



Predictors of prior asthma specialist care among pediatric patients seen in the emergency department for asthma

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ABSTRACT

Background: Asthma guidelines recommend specialist care for patients experiencing poor asthma outcomes during emergency department (ED) visits. The prevalence and

predictors of asthma specialist care among an ED population seeking pediatric asthma care are unknown.

Objective: To examine, in an ED population, factors associated with prior asthma specialist use based on parental reports of prior asthma morbidity and asthma care.

Methods: Parents of children ages 0 to 17 years seeking ED asthma care were surveyed regarding socio-demographics, asthma morbidity, asthma management, and current asthma specialist care status. We compared prior asthma care and morbidity between those currently cared for by an asthma specialist versus not. Multivariable logistic regression models to predict factors associated with asthma specialist use were adjusted for parent education and insurance type.

Results: Of 150 children (62% boys, mean age 4.7 years, 69% Hispanic), 22% reported asthma specialist care, 75% did not see a specialist, and for 3% specialist status was unknown. Care was worse for those not seeing a specialist, including under-use of controller medications (24% vs 64%, $p < 0.001$) and asthma action plans (20% vs 62%, $p < 0.001$). Multivariable logistic regression revealed that lack of recommendation by the primary care physician reduced the odds of specialist care (OR 0.01, 95% CI <0.01, 0.05, $p < 0.001$).

Conclusions: Asthma specialist care was infrequent among this pediatric ED population, consistent with the sub-optimal chronic asthma care we observed.

Prospective trials should further investigate if systematic referral to asthma specialists during/ after an ED encounter would improve asthma outcomes.

INTRODUCTION

Asthma guidelines from the National Institutes of Health (NIH) recommend asthma specialist care for children experiencing poor asthma outcomes, including moderate to severe persistent asthma, exacerbations requiring emergency department (ED) visits and/or hospitalization, or multiple uses of systemic corticosteroids in one year¹. Studies have shown pediatric asthma care to be more consistent with practice guidelines when specialists, such as allergists or pulmonologists, are involved, even after adjustment for asthma severity, race, and educational status²⁻⁴. Furthermore, direct referral of patients from the ED to asthma specialists has been shown to reduce subsequent asthma morbidity and acute health care use in both adult and pediatric populations⁵⁻⁸. Nonetheless, pediatric asthma specialist services may be frequently underutilized^{2,9,10}.

Despite widespread initiatives to improve asthma care, the rate of ED visits for an asthma complaint has remained stable¹¹. Questionnaires have been developed to improve pediatric asthma morbidity assessment in the ED¹², but studies have not fully quantified the prevalence of asthma specialist care among pediatric patients seen for asthma in the ED setting. One study in Ontario showed less than five percent of high-risk children accessing the ED were referred to asthma specialist services¹³, but this study did not examine factors associated with absence or receipt of specialist care. Another study observed a follow up rate of one-third in asthma specialty clinics within three months after an ED visit, but there is limited characterization of the factors driving these ED visits¹⁴. There are few such studies in adults as well, but it appears that the prevalence of asthma specialist use is likewise low¹⁵. As literature review has shown that nearly one in five children seeking asthma care in the ED relapse within a month, an ED

visit for asthma has been characterized as a commonly experienced marker of poorly controlled and/or inadequately treated disease; it is also an indicator of increased risk for future poor outcomes¹⁶⁻²⁰. Furthermore, many patients, often uninsured or those with public insurance, frequent the ED as a primary site for acute and chronic asthma treatment, for a variety of reasons, including inadequate access to high quality asthma care^{2,21-25}. Various studies have correlated asthma specialist care with increased controller medication use, specialized testing, and less asthma ED visits^{2,3,7}. Therefore, it may be that many of the patients seen in the ED for asthma would benefit from asthma specialist care to improve asthma management and reduce the future risk for poor outcomes⁴. However, the factors associated with asthma specialist care among an ED population seeking asthma care are unknown.

The purpose of this study was to examine parent-reported clinical and socio-demographic factors that may predict asthma specialist use among a population of children seeking ED asthma treatment. We hypothesized that we would observe greater morbidity among children seeing an asthma specialist, but that children not followed by a specialist would have significant prior asthma morbidity.

METHODS

Study population and recruitment procedures

The study was conducted at an urban tertiary children's hospital ED among parents of children seeking asthma care. A bilingual research assistant (RA) identified potential participants based on the presence of a respiratory chief complaint. Eligibility criteria included English or Spanish-speaking parents with a child age 0 to 17 years of age, carrying a diagnosis of asthma or reactive airway disease, or screened positive for study participation using a validated algorithm that queried about the presence of coughing, wheezing, chest tightness, or trouble breathing in the recent and more distant past²⁶⁻²⁸. Children that had been diagnosed with cystic fibrosis, lung cancer, bronchopulmonary dysplasia, currently used a mechanical ventilator at home, and parents who had previously taken the survey or who did not understand English or Spanish were excluded.

Parents were administered a survey by the RA once the patient had been placed in a private room. The survey included questions regarding socio-demographics, morbidity, acute health care use, asthma management by healthcare providers, and status of current asthma specialist care. Parents of eligible participants received twenty dollars cash for completion of the survey. Recruitment occurred from September 2015 to March 2017, based on RA availability. The hospital's Institutional Review Board approved the study protocol.

Survey and Data Collection

Parents completed an interviewer-administered written survey that assessed the following: (a) acute health care utilization (ED visits, hospitalizations) and oral steroid use for asthma over the past 12 months (using the Pediatric Asthma Control and Communication Instrument (PACCI)-ED version, a 12-item questionnaire that assesses disease trajectory, disease burden risk, adherence, and asthma control^{29,30}), and over lifetime; (b) prior asthma care, which included presence or absence of asthma specialist care, receipt of an asthma action plan, use of daily controller asthma medications, and prior use of a validated asthma questionnaire; (c) missed school days; and (d) socio-demographics. The psychometric properties of the PACCI questionnaire has been reported previously amongst similar patient populations^{12,29-31}.

Demographic information about the child and the child's parents were obtained, including age, race/ethnicity, gender, insurance type, educational level, marital status, and income.

Analyses

Indicators of prior asthma care, prior asthma morbidity, and need for referral to an asthma specialist (independent variables) were compared by parent-reported specialist care status (dependent variable). Continuous variables (age, missed school days) were summarized using means and standard deviations and were compared between groups (those reporting ongoing specialist care versus those not reporting ongoing specialist care) using two sample t-tests. Categorical variables (ethnicity, gender, educational level, insurance, income, marital status, specialist care status, indicators of asthma

morbidity, asthma management by health care providers) were summarized using frequencies and percentages and were compared between the two groups using chi-squared or Fisher's exact tests as appropriate. Multivariable analyses to examine factors associated with receipt of an asthma specialist were conducted using logistic regression models adjusted for parent education and insurance type, as these factors have been associated with receipt of specialist care^{2,32}. All odds ratios (OR) are presented with 95% confidence intervals. P-values are 2-sided and $p \leq 0.05$ is considered statistically significant. All analyses were performed using R v. 3.3.2 software (<http://www.r-project.org/>).

RESULTS

Demographics

A total of 150 patients were enrolled. The mean age of children in this study was 4.7 years, while a majority were boys (62%) and identified as Hispanic (69%) (Table 1). More than half of the parents were living with a significant other, reported an educational level of high school graduate or less, and had a household income less than \$20,000. Over three-fourths of patients had public health insurance. Twenty-two percent of parents reported current asthma specialist care for their child ($n = 34$). Parents of Hispanic patients were less likely to report asthma specialist care ($p = 0.03$), while married parents were more likely to report asthma specialist care ($p = 0.01$). There was no additional significant difference in asthma specialist care status relative to age, gender, educational level, insurance, and income.

Prior Asthma Care by Specialist Status

Twenty-four percent of children not followed by a specialist reported use of a daily controller medication compared to 64% of those followed by specialists ($p < 0.001$). Similarly, children who did not have a specialist involved in their care were less likely than children seeing a specialist to receive an asthma action plan (20% vs 62%, $p < 0.001$). Likewise, we observed a trend that these children were also less likely than those seeing a specialist to have previously completed a validated asthma questionnaire (1% vs 3%, $p = 0.3$).

Prior Asthma Morbidity by Specialist Status and Indicators for Specialist Care

When examining evidence of asthma exacerbations or acute health care use, there were significant differences between those not currently seeing an asthma specialist and those seeing an asthma specialist over the prior 12 months and over the lifetime of patients in each respective group (Table 2). Specifically, in terms of asthma morbidity over the prior 12 months, there were significant differences for: two or more oral steroid courses (29% vs. 50%, $p = 0.04$), and one or more hospital stays (22% vs. 59%, $p = 0.001$). There was not a significant difference in ED visits for asthma during the same time-frame. In terms of prior lifetime asthma morbidity, there were significant differences for hospitalization (29% vs. 73%, $p < 0.001$) and ICU admission/intubation for asthma (9% vs. 32%, $p = 0.001$). Notably, there were no differences in terms of two or more oral steroid uses (61% vs 65%, $p = 0.8$) and prior ED visits (63% vs 79%, $p = 0.1$) for asthma. Consistent with this pattern, more school or day care days were missed due to asthma on average among those already under specialist care than those who were not (14.2 vs 5.9, $p < 0.001$) and a higher proportion missed at least one school or day care day due to asthma (65% vs 43%, $p = 0.03$).

Multivariable Analysis of Associated Factors of Specialist Care (Table 3)

In a multivariable analysis, after adjustment for parental education and insurance type, the strongest factors associated with current asthma specialist care were: oral steroid use in the last 12 months (OR 2.35, 95% CI 1.06, 5.21), prior receipt of an asthma action plan (OR 8.56, 95% CI 3.16, 23.16), prior exacerbations including any prior lifetime hospitalization (OR 6.72, 95% CI 2.80, 16.13) or hospitalization in the last 12 months (OR 3.37, 95% CI 1.51, 7.49), and prior ED visits in the last 12 months (OR

30.07, 95% CI 1.00, 9.45). Those without any acute health care use in the prior 12 months were significantly less likely to report asthma specialist care (OR 0.20, 95% CI 0.05, 0.90). Moreover, if primary care physicians (PCPs) did not suggest specialist care, patients were particularly less likely to see a specialist (OR 0.01, 95% CI <0.01, 0.05).

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DISCUSSION

In this cross-sectional study of pediatric patients seeking ED treatment for asthma, parent-reported ongoing asthma specialist use was low (22%) given the large percentage of children not seeing a specialist who had required multiple courses of oral steroids (61%), multiple ED visits (63%), or who had been hospitalized for asthma (29%). Furthermore, under-referral to asthma specialists appears to be a specific problem for this population of patients given the morbidity levels we observed, including missed school days and prior acute health care use for asthma. The most important apparent contributing factor to this under-referral was lack of recommendation by the PCP. We observed a 99% reduction in the odds of reporting specialist care when it was not recommended by the PCP. As we did not interview the PCPs or review the PCPs' charts of these patients, we do not know what criteria were used to make that determination. Based on the non-use of validated questionnaires by the PCPs (1% usage as reported by the parents of these children), there may be under-recognition of the patient's asthma morbidity and need for specialist referral. The combination of high patient morbidity and low PCP use of validated asthma questionnaires suggests that one area to focus on to improve appropriate specialist referral is improving PCP recognition of those children in need of such referral.

Most concerning for lack of specialist care amongst our study population were the children who experienced ICU admissions (9%), hospitalizations (22%), and/or repeated ED visits (54%) for asthma within a single year but were still not cared for by an asthma specialist. These children are the highest risk for future morbidity (recurrent ED visits

and hospitalizations) and/or mortality yet have not been appropriately followed by a specialist. Given the inadequate prior asthma care reported by these families, there is a need to improve overall quality of asthma care, as well as the process of identification of children requiring specialist care. This may include implementing facilitated referral protocols using patient data on acute health care use or frequency of rescue medication dispensations in settings like the ED to identify those eligible for specialist referral, using interventions such as decision support tools, clinical pharmacy support, or feedback and audit³³. We also do recognize that there was high morbidity among children already seeing an asthma specialist, but we do not know the timing or frequency of the specialist care relative to the morbidity episodes.

Our study supports current literature that children who are not under asthma specialist care are less likely to receive the care recommended in NIH asthma guidelines, including receipt of an asthma action plan and use of daily controller medications^{2,4,34,35}. In our study, those with an action plan were eight times more likely to be associated with specialist use. Action plans or written instructions on asthma management have been shown to improve outcomes among diverse patient populations^{3,35-37}. Use of asthma action plans are opportunities to provide asthma education, such as enhancing parental understanding of their child's asthma, the proper use of controller and rescue medications, and when to seek emergency care.

Our study also found that specialist care is correlated with increased controller medication use. Other studies support these findings, as specialists may have a better

understanding of symptom severity, enhanced familiarity with asthma guidelines, or more comfort with prescribing controller medications^{3,35,37-39}. Taking into consideration the increased morbidity of patients followed by a specialist, there also seems to be a notable gap of individuals who may require a daily controller medication that are not on one. Daily controller medication use has significant benefits on improved chronic asthma morbidity including the potential to reduce mortality⁴⁰. Given that PCPs believe that the ED visit can be a setting to initiate controller medications per guideline-based criteria⁴¹, there may be an opportunity for ED physicians to facilitate initiation of inhaled corticosteroids.

This study has several limitations. First, recall bias may be present as parents may not have accurately recalled specialist care, medications, or other reported indications for specialist care. Second, this study was conducted at a tertiary care academic medical center in an urban setting which may limit its generalizability to other types of centers, settings (e.g. rural areas), and/or patient populations. However, the study population included mostly those from minority groups and those with public health insurance, which is representative of the pediatric population at increased risk for asthma morbidity.^{9,32} Third, our study population was comprised primarily of young children, so our findings may not be representative of adolescents and other older patients with asthma. We did not adjust for age in our models, but prior research does not suggest an age effect in asthma specialist referral or use^{2,9,10,32,42}. Lastly, our findings may not be representative of patients without health care access, although ED settings are well-known to provide care for uninsured patients.

CONCLUSION

Among this ED population with significant asthma morbidity, few children received specialist care, although the majority met NIH criteria for such care. Prior asthma care was sub-optimal for many children, particularly those not followed by an asthma specialist. Overall this study demonstrates the necessity of specialist referral among the population of children who seek asthma care in an ED setting. Prospective trials should be continued to further assess the long-term implications of barriers to accessing asthma specialist care for patients seen in the ED setting, and to learn if systematic referral to asthma specialists during or after an ED encounter would improve asthma care and outcomes.

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Declaration of Interest and Acknowledgements

The authors of this manuscript have no conflict of interest nor any financial interests to declare.

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Table 1: Association of Socio-demographics by Asthma Specialist Care Status

Demographic Factors				
	Total	Does not see Asthma Specialist (n=112)	Currently Sees Asthma Specialist (n=34)	p-value
Mean age in years (SD)	4.7 (4.2)	4.6 (4.3)	5.2 (3.9)	0.6
Child Gender, Male	62%	64%	50%	0.09
Married or Single and living with significant other	68%	68%	77%	0.01
Education (less than or equal to high school)	65%	63%	68%	0.9
Income (less than \$20,000)	56%	55%	53%	0.4
Insurance, public (e.g. Medicaid)	91%	89%	94%	0.7
Ethnicity (row percentage)				
Hispanic	69%	72%	27%	0.03
Black	11%	75%	13%	0.06

White/Caucasian	6%	89%	11%	0.8
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Table 2: Asthma Morbidity by Asthma Specialist Status

Asthma Morbidity Indicator	Does not see Asthma Specialist (n=112)	Currently Sees Asthma Specialist (n=34)	p-value
≥2 oral steroid courses in prior 12 months	29%	50%	0.04
≥2 ED visits for asthma in prior 12 months	54%	65%	0.1
≥1 hospital stay in prior 12 months	22%	59%	0.001
≥2 lifetime oral steroid courses	61%	65%	0.8
≥2 lifetime ED visits	63%	79%	0.1
Ever hospitalized for asthma	29%	73%	<0.001
Ever admitted to ICU or intubated for asthma	9%	32%	0.001
Missed school/ day care due to asthma in prior 12 months	43%	65%	0.03
Mean days of school/ day care missed due to asthma in prior 12 months (SD)	5.9 (5.7)	14.2 (5.7)	<0.001

Table 3: Factors associated with asthma specialist care*

Effect	OR (95% CI)	P value
Child's Gender (Female)	1.77 (0.81, 3.85)	0.1
Child's Age (+1y)	1.04 (0.95, 1.13)	0.4
Prior Use of Asthma Survey	0.31 (0.02, 5.16)	0.4
Receipt of Asthma Action Plan	8.56 (3.16, 23.16)	<0.001
Inhaled Corticosteroid Use	1.84 (0.77, 4.39)	0.2
Short-Acting Beta Agonist Use	1.81 (0.77, 4.24)	0.2
Chronic Asthma: Controlled	0.20 (0.05, 0.90)	0.04
Oral Steroid		
Any Lifetime Oral Steroid Use	1.50 (0.44, 5.06)	0.5
Oral Steroid Use in the Prior 12 months	2.35 (1.06, 5.21)	0.04
Prior Emergency Department Visits		
Any Lifetime ED Visits	2.45 (0.68, 8.81)	0.2
ED Visits in the Prior 12 months	3.07 (1.00, 9.45)	0.05
Prior Hospitalizations		
Any Lifetime Hospitalization	6.72 (2.80, 16.13)	<0.001
Hospitalization in the Prior 12 months	3.37 (1.51, 7.49)	0.003
Primary care physician did not suggest specialist	0.01 (<0.01, 0.05)	<0.001

* logistic regression models adjusted for parental education and insurance status

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