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A missed primary care appointment correlates with a subsequent emergency department visit among children with asthma

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Abstract

Objective: Since the Affordable Care Act's implementation, emergency department (ED) visits have increased. Poor asthma control increases the risk of acute exacerbations and preventable ED visits. The Centers for Medicare and Medicaid Services support the reduction of preventable ED visits to reduce healthcare spending. Implementation of interventions to avoid preventable ED visits has become a priority for many healthcare systems yet little data exist examining children's missed asthma management primary care (PC) appointments and subsequent ED visits.

Methods: Longitudinal, retrospective review at a children's hospital was conducted for children with diagnosed asthma (ICD-9 493.xx), ages 2–18 years, scheduled for a PC visit between January 1, 2010, and June 30, 2012 ($N = 3895$). Records were cross-referenced with all asthma-related ED visits from January 1, 2010 to December 31, 2012. Logistic regression with maximum likelihood estimation was conducted.

Results: None of the children who completed a PC appointment experienced an ED visit in the subsequent 6 months whereas 2.7% of those with missed PC appointments had an ED visit ($\chi^2 = 64.28$, $p < .0001$). Males were significantly more likely to have an ED visit following a missed PC appointment than females ($\chi^2 = 34.37$, $p < .0001$). There was a statistically significant interaction of sex $\times$ age. Younger children (<12 years) made more visits than older children.

Conclusions: The importance of adherence to PC appointments for children with asthma as one mechanism for preventing ED visits was demonstrated. Interventions targeting missed visits could decrease asthma-related morbidity, preventable ED visits, and healthcare costs.

Keywords

Asthma exacerbation; emergency department utilization; missed appointments; pediatric asthma; primary care

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Declaration of interest

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Introduction

With the Affordable Care Act signed into law in 2009, the frequency of overall emergency department (ED) visits has increased and patients are reportedly sicker upon arrival [1–5,33,34]. Various factors could contribute to this including an increase in the number of people with access to care coupled with limited capacity of primary care (PC) providers which may increase wait times for appointments [2,4–6]. Previous studies have shown that not having a PC provider, feeling as though one's needs are not being met by the provider, lower continuity of care and missing PC appointments can lead to an increased risk of preventable ED visits [7–11]. For those with asthma, missing PC appointments may contribute to increased morbidity [12].

In the United States, asthma currently affects 7.1 million children and is the leading chronic health condition affecting the pediatric population [35]. Previous studies indicate that males and younger children are at a higher risk for ED visits [13–16]. While there is no cure for asthma, improved control of persistent symptoms can be achieved for many patients through proper diagnosis, adherence with daily controller medications and prompt recognition and treatment of symptoms [17]. There are many barriers that families face in achieving good asthma control including ongoing exposure to environmental triggers, non-adherence to recommended treatment, lack of regular care and healthcare provider compliance with recommended treatment guidelines for asthma [13,18]. Poor control of persistent asthma symptoms increases the risk of acute exacerbations and preventable ED visits [19]. Implementation of interventions to avoid preventable ED visits and hospital admissions has become a priority for many healthcare systems [20,21].

There is a paucity of data specifically examining the relationship between missed PC appointments for asthma management and subsequent ED visits. A review of the literature found no studies focused on the likelihood of an ED visit within six months of a missed PC appointment, although a study by Smith, Wakefield and Cloutier found an inverse relationship between the number of PC appointments and ED visits [15]. An inverse relationship was also found for prescriptions filled for asthma controller medications and ED visits [15]. Continuity of care, defined as seeing the same practitioner over time, was found to be a significant factor for decreasing ED visits across various ethnic groups [36,37]. Given the heterogeneity of asthma symptoms and level of control over time, longitudinal routine follow-up visits with the same PC provider are vital for providing optimal individualized asthma management. Interventions targeted to the population that misses these important routine visits could decrease morbidity related to pediatric asthma and could yield formidable cost savings.

Purpose

The purpose of this study was to examine ED visit data for children with asthma at Nationwide Children's Hospital (NCH) in Columbus, Ohio and investigate whether missed PC appointments were associated with subsequent ED visits. Aligned with the national objective to decrease asthma-related ED visits, NCH seeks to reduce preventable ED visits,

particularly those which can be eliminated by increased PC management [22,23]. The guiding question for this study was: Among children with asthma, is a missed pediatric PC appointment associated with an asthma-related ED visit within the subsequent 6 months? Findings from this study could prompt the development of interventions implemented *at the time a scheduled PC appointment is missed*, to assist these children in getting into the office for maintenance and/or follow-up care with the goal of avoiding an ED visit. Most importantly, this could reduce the morbidity and mortality of childhood asthma while also acting as a healthcare cost saving measure.

Methods

Ethics

Institutional review board approval was granted for this study by NCH.

Design, setting and sample

Design—We performed a retrospective, longitudinal, cohort review of the electronic medical records for all children, ages 2 – 18 years, with a primary or secondary diagnosis of asthma (ICD-9 code 493.xxx). Children included were scheduled for a PC visit in the Primary Care Network at NCH in Columbus, Ohio, between January 1, 2010 and June 30, 2012. The time interval was chosen to account for the seasonality of asthma [24,25]. PC visits were selected because patients with asthma as documented in the electronic medical record have a standardized template that promotes assessment of control and discussion of asthma at every PC appointment for these children regardless of the reason for the visit.

Setting—NCH is the first freestanding pediatric hospital in Ohio to achieve the Magnet status and is the largest provider of pediatric care in the state, with approximately 1 million patient visits per year (<http://www.nationwidechildrens.org/fast-facts>) across all inpatient and outpatient facilities. The NCH PC network has received recognition as a Patient-Centered Medical Home by the National Committee for Quality Assurance (NCQA). The NCQA Patient-Centered Medical Home standards emphasize the use of systematic, patient-centered, coordinated care that supports access, communication and patient involvement. NCH's hospital-owned PC network is one of the largest in any children's hospital with 11 community clinics.

Sample—The cohort consisted of 3895 children who made 7511 visits during the study period. Children younger than 2 years were not included due to the challenge of diagnosis (i.e., other causes of wheezing in this age group that are not later diagnosed with asthma) [26].

Methods

Data extraction occurred initially through a request to the NCH Electronic Data Warehouse to generate two separate Excel databases for patients meeting eligibility criteria: (1) Patients scheduled for a PC visit during our study timeframe and (2) Patients with any ED visit between January 1, 2010 and December 31, 2012. These databases were combined based on medical record number and verified by the PI to ensure that cases met the eligibility criteria

and PC and ED visit dates were within the specified study periods. Once data cleaning was completed, the final database was converted to a Statistical Analytics Software dataset for analyses.

Variables

Variables for this study included age in years on January 1, 2010, sex, PC appointment, missed PC appointment and ED visit dates. Age in years was calculated by subtracting the child's date of birth from January 1, 2010 and dividing by 365.25. We classified age into three categories: 2–4, 5–11 and 12–18 years and also examined it as a continuous variable. Missed appointments were counted if a scheduled PC appointment (during the review period) was not attended by the patient. For the purpose of our study, only asthma-related ED visits that occurred between January 1, 2010 and December 31, 2012 were included. Only the first asthma-related ED visit was included; multiple ED visits were not counted in the analysis.

Variables were created representing any missed appointment (0 = *no*, 1 = *yes*), any asthma-related ED visit (0 = *no*, 1 = *yes*) and any asthma-related ED visit within six months of a missed appointment (0 = *no*, 1 = *yes*). Within the total study timeframe, a patient could be classified as follows: –missed PC appointment/–asthma-related ED visit; –missed PC appointment/+asthma-related ED visit; +missed PC appointment/–asthma-related visit; +missed PC appointment/+asthma-related ED visit. This same classification structure was used for the analyses restricting the timeframe to ED visits 6 months post missed PC appointment. Insurance was coded as 1 = *Medicaid/Medicare*, 2 *Commercial* and 3 *Self-Pay*. As illustrated in Table 2, the coding for race and ethnicity did not allow us to differentiate between the two and thus, we could not examine ED visits by race or ethnicity.

Statistical analyses

Descriptive statistics were completed for all variables to examine the distribution (SAS v9.2). Chi-square analyses examined the relationship between any missed PC appointments and any asthma-related ED visits over the entire study period and then restricted to any ED visits within 6 months following a missed PC appointment. Logistic regression using maximum likelihood estimation controlling for age and sex estimated the probability of having an ED visit within 6 months of a missed PC appointment. Wald odds ratios (ORs) and 95% confidence intervals were specified. Three separate logistic regression analyses were conducted: The first model denoted age as a continuous variable (Model 1) and male sex and no missed appointments as the reference groups; the second model used the categorical age variable as a classification factor (Model 2) with the same reference groups as Model 1; and the third model included the interaction of sex by age category (Model 3). There was a quasi-separation of the data (zero in one of the cells because none of the children who kept their scheduled PC appointment incurred an asthma-related ED visit in the subsequent 6 months), thus, because maximum likelihood estimation could yield biased estimates of the regression parameters, Firth's bias correction was utilized [27].

Results

Table 1 presents the sample sociodemographic characteristics. A total of 3894 children between 2 and 18 years of age and diagnosed with asthma were scheduled for 7511 PC visits from January 1, 2010 to June 30, 2012. There were 460 asthma-related ED visits from January 1, 2010 to December 31, 2012. Sixty-three percent of the sample was male; the mean age was 7.33 years ($SD = 4.03$) and the majority (82%) was insured by Medicaid/Medicare.

Seventy-one percent of scheduled visits (5326/7511) were missed. Of those who had a missed appointment *at any time during the review period*, 7% ($n = 416$) had an asthma-related ED visit compared to 2% ($n = 44$) of completed PC appointments ($\chi^2 = 53.24$, $p < .0001$). Table 2 displays the results for asthma-related ED visits when the review period is narrowed to 6 months following a missed PC appointment. Remarkably, among the children who kept their scheduled PC appointments, none of them had an asthma-related ED visit in the subsequent 6 months compared to 2.7% ED visit prevalence among those who missed a PC visit ($\chi^2 = 64.28$, $p < .0001$).

The results of analyses for Model 1 (age as a continuous co-variate) revealed that male sex ($OR = 3.20$, 95% CI 2.20, 4.65, $p = .0001$) was associated with increased odds and not missing a PC appointment ($OR = 0.008$, 95% CI $<.0001$, 0.12, $p = .0006$) and decreased odds of an ED visit. Child's age was not statistically significant. The results from Model 2 (age as a categorical co-variate) yielded equivalent results: male sex ($OR = 3.23$, 95% CI 2.22, 4.69, $p = .0001$); no missed PC appointment ($OR = 0.008$, 95% CI $<.0001$, 0.12, $p = .0001$); and age category (2–4 years $OR = 1.17$, 95% CI 0.77, 1.76, $p = .18$; 5–11 years $OR = 0.90$, 95% CI 0.61, 1.34, $p = .21$). Table 3 presents the results for Model 3 (sex $\times$ age interaction added). These findings showed statistically significant main effects for child sex ($\chi^2 = 34.37$, $p = .0001$), missed appointment ($\chi^2 = 12.04$, $p = .0005$) and sex $\times$ age interaction ($\chi^2 = 6.66$, $p = .04$). Examination of the age sub-groups revealed that the older males (12–18 years) had significantly greater odds of an ED visit compared to the 5–11 years old males. There was no sex $\times$ age interaction for females.

Discussion

The findings from this study revealed a highly significant relationship between missed PC appointments for asthma management and the likelihood of a subsequent ED visit for asthma exacerbations. Our hypothesis that missed PC appointments were associated with subsequent ED visits was confirmed. Even more compelling is the finding that when PC appointments were completed, *no asthma-related ED visits occurred in the subsequent 6 months*. In an effort to reduce the likelihood of a preventable ED visit and unnecessary healthcare spending, interventions in the PC setting could immediately target these missed appointments and attempt to get the child in the office for care. It is possible that a substantial proportion of the 460 ED visits which followed a missed PC appointment could have been avoided. On average, if even 80% of those ED visits were avoided, this could have saved \$976.25 for each ED visit at NCH, totaling \$359,260 [28].

Data from the Agency for Healthcare Research and Quality (AHRQ) showed that boys have slightly more ED visits than girls [29] but data from other studies are inconsistent relative to sex or age [13,15,16]. Our findings supported the AHRQ data regarding sex. Our study indicated that boys had greater odds of asthma-related ED visits but older boys had the highest risk. The reasons for this could be varied. One potential explanation for the age risk factor could be that the developmental stage of adolescents establishing independence and peer relationships may contribute to a lack of controller medication adherence. Diligence in the use of evidence based practices by healthcare providers along with improved self-management through adherence to treatment regimens on the part of those with asthma can contribute to improved outcomes [30].

Limitations

This study had several limitations. Our study included a single Midwestern hospital's PC network, so generalizability is limited. We did not obtain visit data from specialty clinics so future studies should examine all asthma management visits and their relationship to subsequent ED visits. Retrospective studies are at risk of confounding factors that were not measured. For example, our data did not include whether any of the children had other chronic, co-morbid conditions. Additionally, we did not have information about the severity of presentation for those with an asthma-related ED visit, length of asthma diagnosis, or other social issues and barriers contributing to missed appointments (e.g., lack of transportation). Other data that could have strengthened this study include information about controller medication adherence and healthcare practitioner adherence to recommended asthma management guidelines [13,26,27]. Finally, patients could have presented to other area EDs in the subsequent 6 months that we were not able to capture. These data were beyond the scope of this study and are worthy of future studies. This study elucidates, however, the need to target interventions to children with asthma that miss PC appointments. Socioeconomic status and race/ethnicity were not included in our analytical models. As stated above, the coding for race and ethnicity were co-mingled yielding numerous categories which could not reliably be collapsed. The insurance status data related to Medicaid from our sample indicate a similar racial and ethnic composition to national data [21,31]. The overwhelming majority of children were insured by Medicaid so there was not enough variance to yield stable estimates for the three insurance categories. Thus, a decision was made to omit this variable from the model. The inability to conduct sub-group analyses based on insurance status and race/ethnicity somewhat limits generalizability.

Implications and future directions

The findings from this study demonstrate the importance of adherence to PC visits for pediatric patients with asthma. Current National Heart, Lung, and Blood Institute [32] national asthma guidelines recommend routine follow-up visits for all children with asthma, with increasing frequency based upon the level of asthma severity and control. While lack of attendance at routine follow-up visits may decrease the ability for clinicians to provide current assessment of asthma control, adjust therapy as necessary, and provide education/anticipatory guidance, it is also possible that missed PC visits are a surrogate for families that have psychosocial stressors, financial constraints, and other factors influencing their ability to provide optimal asthma care within the home. Better understanding of these

relationships will provide even more useful information for designing interventions and providing outreach to these families.

Future studies in this area could focus on children with high ED utilization (more than two visits per year) and identify characteristics among this group, specifically missed asthma management appointments, which could inform targeted interventions to get children into primary or specialist care to avert preventable ED visits. Approximately 21% of the children in this study had 2 or more ED visits during the review period (data not shown); thus there is an opportunity to significantly reduce potentially preventable ED utilization through early intervention when an appointment is missed. Future research should examine all missed visits for asthma management, not just PC, and the relationship to subsequent ED visits; test intervention strategies to get children into care quickly after a missed appointment; and determine the cost-effectiveness of these interventions to identify the most promising strategies for improving children's asthma management and reducing preventable ED visits, costs to families and healthcare systems.

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Table 1.Sample sociodemographic characteristics ($N = 3895$).

Variable	Mean (SD)
Age (years)	7.33 (4.03)
	<i>N</i> (%)
Age category	
2–4 years	1195 (30.68)
5–11 years	2007(51.53)
12–18 years	693 (17.79)
Child sex	
Male	2430 (62.39)
Female	1465 (37.61)
Ethnicity	
American/European American	3171 (81.41)
Middle Eastern	10 (0.26)
Puerto Rican	7 (0.18)
Mexican	146 (3.75)
Dominican	6 (0.15)
Central American/South American	22 (0.57)
African American/Black Caribbean/West Indian	9 (0.23)
Asian/Southeast Asian/Native Hawaiian/Pacific Islander	27(0.69)
African	295 (7.57)
Spanish/Hispanic	98 (2.52)
Missing	104 (2.67)
Payor	
Medicaid/Medicare	3183 (81.72)
Commercial	488 (12.53)
Self-pay	224 (5.75)

Table 2.

Chi-square results for any ED visits in the 6 months following a missed PC appointment ($N_{\text{appointments}} = 7511$).

Any missed PC appointment	ED visit w/in 6 months of a missed PC appointment		χ^2 (df)	<i>p</i> -value
	No <i>N</i> (%)	Yes <i>N</i> (%)		
No	1769 (23.55)	0 (0)	64.28 (1)	<.0001
Yes	5539 (73.75)	203 (2.7)		

Table 3.

Model 3 logistic regression for ED visit following a missed PC appointment.

Variable	B(SE)	Wald χ^2	p-value	OR [95% CI]
Missed Appointment *	-2.44 (0.70)	12.04	.0005	.008 [<.0001,0.12]
Sex *	-.70 (.12)	34.37	<.0001	
Age (categorical) *				
2-4 yrs	0.10 (0.16)	0.36	.55	
5-11 yrs	0.11 (0.14)	0.63	.43	
12-18 yrs	REF			
Sex				
Male vs. Female (2-4 yrs)	0.07 (0.16)	0.17	.68	4.65 [2.26,9.56]
Male vs. Female (5-11 yrs)	-0.36 (0.14)	6.62	.01	1.99 [1.24,3.21]
Male vs. Female (12-18 yrs)	REF			7.28 [2.40,22.12]
Age $\times$ Sex				
2-4 yrs vs. 12-18 yrs (Male)				1.08 [0.70,1.67]
5-11 yrs vs. 12-18 yrs (Male)				0.72 [0.47,1.10]
2-4 yrs vs. 12-18 yrs (Female)				1.69 [0.48,5.91]
5-11 yrs vs. 12-18 yrs (Female)				2.62 [0.85,8.12]

NOTE: Firth's Maximum Likelihood Estimation used due to quasi-separation of data.

* Reference groups: No missed appointment; 12-18 year olds; and male sex.