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Parental Knowledge and Use of Preventive Asthma Care Measures in Two Pediatric Emergency Departments

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Abstract

Objectives—Parents of children who visit the pediatric emergency department (PED) for asthma exacerbations may not receive adequate instruction in preventive asthma care. Our primary objective was to assess knowledge and use of preventive asthma care measures among parents of children with asthma who present to the PED with asthma exacerbations. Our secondary objective was to identify variables that predict adherence to four key preventive care measures.

Methods—We administered a 38-item questionnaire to 229 parents of children ages 2 to 18 years with asthma exacerbations who presented to two, urban PEDs, one in the southeast and one in the northwest U.S. Descriptive statistics were calculated to assess parental knowledge of preventive care. Multivariable logistic regression was used to identify variables associated with the use of four key preventive care measures.

Results—Thirty-two percent of the children had an action plan, 29% of children 5 years of age had a peak flow meter, and 52% received the influenza vaccine within the preceding year. Sixty-six percent of the children had persistent asthma by NIH criteria. Of these, 51% received daily inhaled corticosteroids (ICS). When parents were asked how an ICS medicine worked, 29% (64/221) responded “immediately opens the airway”, and 24% (53/221) responded “I do not know.” Daily use of ICS in these children was significantly associated with parent education level beyond high school (OR=2.81; 95% CI: 1.26, 6.24; P=0.01). Non-African Americans were more likely to have received an action plan than African Americans (OR=2.18; 95% CI: 1.17, 4.06; P=0.01). A secondary analysis of the parent's perception of his/her ability to provide care during an asthma exacerbation was significantly associated with receipt of an action plan in a multivariable proportional odds model (OR=3.63; 95% CI: 1.99, 6.62; P<0.001).

Conclusions—Parents of children with persistent asthma presenting to urban tertiary care PEDs with asthma exacerbations frequently have inadequate understanding of appropriate ICS use. Parents with less than a high school education, in particular, may benefit from focused educational interventions which address the importance of daily ICS use in asthma control. Parents who receive a written action plan are more confident in their ability to provide care for their child during an asthma exacerbation.

Keywords

pediatric asthma; prevention; self-management; parental knowledge; racial disparity

INTRODUCTION

Asthma is the most common, chronic, serious disease of childhood and a significant public health concern.^{1–3} The disease affects over 6 million children in the United States and over 300 million people worldwide.^{3,4} National and international guidelines emphasize asthma education and preventive measures to minimize exacerbations and maximize control of asthma symptoms.^{5,6} Nonetheless, asthma is the most frequent reason for hospitalization of children in North America¹, and it accounts for over 600,000 visits to the emergency department (ED) each year in children 14 years of age in the United States.⁴

Prior studies have shown that the level of preventive asthma care and self-management in children in the outpatient setting is often inadequate and that adherence to preventive strategies recommended in the National Heart Lung and Blood Institute (NHLBI) guidelines is less than optimal.^{7–10} Many children with asthma do not have action plans or peak flow meters, and many children with persistent asthma do not use long-term controller medications on a daily basis.^{9,10} While prior studies have identified deficits in preventive care among children who present to the ED with acute asthma exacerbations,^{8,10} we are not aware of studies investigating whether parents of these children have sufficient knowledge of preventive care measures to prevent these exacerbations.

We hypothesized that parents of children who visit the pediatric emergency department (PED) for asthma exacerbations may not receive adequate instruction in preventive asthma care. Our primary objective in this study was to assess parental knowledge and use of preventive asthma care measures. Our secondary objective was to identify predictor variables associated with the use of key preventive care measures in this population.

METHODS

Study Design and Enrollment

The study was conducted in the pediatric emergency departments (PEDs) of two large, urban, tertiary care centers, one in the southeast and one in the northwest United States. We prospectively enrolled a convenience sample of *parents* of children with asthma ages 2 to 18 years who visited the PED for treatment of an acute asthma exacerbation between September, 2007 and March, 2009. Parents were eligible for inclusion if their child had doctor-diagnosed asthma and presented with signs and symptoms consistent with an acute asthma exacerbation (i.e. wheezing, cough, chest tightness, shortness of breath).¹¹ We excluded parents if it was the child's first episode of wheezing, the child had a reason for wheezing unrelated to an asthma exacerbation (i.e. anaphylaxis, foreign body), or if the child had a significant chronic medical co-morbidity including cystic fibrosis, chronic lung disease, immunodeficiency, or tracheostomy. We performed enrollment and data collection at both sites across a wide range of days of the week and times of the day in order to minimize spectrum bias. At the southeast site, enrollment and data collection were

performed by three investigators (JD, DA, TB) and 4 research assistants who worked in the PED. Two research assistants worked day shifts, one worked evening shifts, and one worked night shifts. At the northwest site, enrollment and data collection were performed by one investigator (DS) and student research volunteers who performed data collection from 7am to 11pm every day during the study period. Prior to participation, each member of the research team received study protocol instruction and a question key to clarify each questionnaire item.

We invited eligible parents to participate in the research project while the child was receiving treatment for an acute asthma exacerbation in the PED. We provided a document that explained the study to the subject and obtained verbal assent for research participation. The study was approved by the institutional review boards at Vanderbilt University Medical Center and Oregon Health and Science University.

Data Collection

We administered a 38-item, in-person questionnaire to eligible parents during the child's PED visit. The questionnaire was administered in either English or Spanish, as appropriate, and took approximately 15 minutes to complete. The questionnaire was written at a sixth grade reading level, and each question was read to the parent by research staff in order to ensure parental understanding of the question. Research staff recorded all answers. We recorded demographic information as well as information on the child's symptom frequency, number of ED visits during the preceding 12 months, and prior hospitalizations.

We asked if the child had scheduled visits with a primary care provider for preventive asthma care and if the child received care from a pediatric pulmonologist or allergist. We asked parents about the child's current asthma medications, use of inhaled corticosteroids (ICS), receipt of an action plan, and receipt of the influenza vaccination within the preceeding year. We also asked parents about the child's use of a peak flow meter (PFM) and use of a spacer device. Parents were also asked focused questions to assess their understanding of quick-relief medications and long-term controller medications as well as the differences between them. Additionally, we asked parents how confident they were in caring for their child during an acute asthma exacerbation.

Definition of Variables

We classified each child's underlying asthma severity as intermittent or persistent using criteria derived from the NHLBI guidelines.⁵ Persistent asthma was defined based on parent report of the child having daytime symptoms > 2 times per week or night time symptoms > 2 times per month during the six month period preceding the emergency department visit. We used this definition for persistent asthma irrespective of whether the child was on controller medications at the time of the ED visit. As the NHLBI guidelines do not clearly specify how persistent asthma is defined once a child is on controller medications, we used this definition in order to have a consistent classification scheme for the subject's current asthma severity.

Parent education level was defined as the highest level of education completed. This item was based on parent self-report and was collapsed into high school graduate or less and college graduate or more. Race was also collapsed into a two-level variable with African American set as the reference group for the analysis.

We defined an action plan as any written plan of care provided by the child's physician which provided instructions for administration of asthma medications including the name of the medication, dose, and circumstances in which to take the medication.

For our outcomes of interest, we selected four key preventive measures based on preventive care recommendations in the NHLBI guidelines⁵ in place at the time of this study. These key measures were: daily use of inhaled corticosteroids (ICS) in children with persistent asthma, receipt of an action plan, scheduled asthma visits with a PCP for preventive asthma care, and receipt of the influenza vaccination within the preceding year.

Data Management and Statistical Analyses

Data from the questionnaires were entered into an online database by two investigators (JD, TB). Multivariable analyses were conducted to identify variables associated with the four key preventive care measures. Model covariates were selected a priori allowing no more than 1 covariate per 10 events for a given model to avoid overfitting. Distributional and variance assumptions were evaluated and were met for the multivariable methods used. For completeness in the analysis, we also performed bivariate analyses to assess the unadjusted associations of parental knowledge and use of preventive asthma care. Additionally, we used a multivariable proportional odds model to assess the associations of a priori selected covariates with the parent's perceived ability to provide care for their child during an asthma exacerbation. Statistical significance was defined as a two-sided *P* value ≤ 0.05 . All analyses were performed using the statistical programming language R, Version 2.8.1 (R Foundation for Statistical Computing, Vienna, Austria).

RESULTS

Baseline demographic characteristics of the patients and parents enrolled at each site are presented in Table 1. Of the 229 total subjects, 131 (57%) were enrolled at the southeast site and 98 (43%) were enrolled at the northwest site. Overall, 66% percent of the children had persistent asthma by NHLBI criteria. There was no statistically significant difference in the level of asthma severity between the two sites ($P=0.39$).

Urgent Asthma Care

Almost two thirds (63%, 144/228) of the children had visited the ED for an asthma exacerbation within the 12 month period preceding the current visit. Over half of the children (55%) had previously been hospitalized for more than 24 hours for asthma.

Preventive Asthma Care Visits

Ninety-three percent (212/227) of the children had a primary care provider (PCP). Of these, 62% had attended a preventive asthma care visit with their PCP during the 12 month period preceding the ED visit. Twenty-two percent (51/228) of the children received asthma care from an asthma specialist.

Preventive Asthma Care and Self-Management

Use of preventive asthma care measures and self-management tools is presented in Table 2. Of those children with persistent asthma, 51% (55/108) used ICS on a daily basis. Thirty-two percent of the children had received a written action plan. Fifty-two percent (116/224) of the children received the influenza vaccination within the preceding year. Twenty-nine percent of the children ≥ 5 years of age had a PFM. Of these, the majority (57%, 27/47) either never used the device or only used it during asthma exacerbations.

Parental Knowledge of Preventive Care

When parents were asked about the most important medicine to give to their child during an asthma exacerbation, 90% correctly selected the response, "albuterol or xopenex." In response to the query, 'how does an inhaled corticosteroid medicine work', 29% (64/221) of

parents selected the response, “immediately opens the airways” and 24% (53/221) selected the response, “I do not know.” When parents were asked about asthma education information that might be useful to them in caring for their child with asthma, 58% (101/175) reported that they would like more information about the differences between quick-relief medicines, like albuterol, and ICS. Sixty-two percent (108/175) reported that they would like more information on common triggers of asthma exacerbations.

Parental Perception of Ability to Provide Asthma Care

Parents were asked how confident they were in caring for their child during an acute asthma exacerbation. Forty-six percent (104/227) reported that they were very confident and would know exactly what to do, 29% reported that they were confident and would know most things to do, 19% reported that they were somewhat confident, and 6% reported that they would not know what to do.

Multivariable Analysis

We performed multivariable logistic regression analyses to predict the four key preventive measures of interest: daily ICS use in children with persistent asthma, receipt of an action plan, scheduled preventive asthma care visits with a PCP, and receipt of the influenza vaccination. The covariates used in each analysis are shown in Table 3. Children with persistent asthma whose parents had education beyond high school were more likely to use ICS daily than those whose parents had less education (OR=2.81; 95% CI: 1.26, 6.24; P=0.01). Non-African Americans were more likely to have received an action plan than African Americans (OR=2.18; 95% CI: 1.17, 4.06; P=0.01), and were also more likely to have a scheduled preventive asthma care visit with their PCP (OR 1.75; 95% CI: 0.99, 3.07; P = 0.053). Additionally, children with persistent asthma were significantly less likely to receive the influenza vaccination than children with intermittent asthma (OR 0.45; 95% CI: 0.25, 0.82; P = 0.008).

In a secondary multivariable proportional odds model to assess the association of the 3-level parental perception outcome with various covariates, receipt of an action plan was significantly associated with the parent’s perception of his/her ability to provide care during an asthma exacerbation (OR=3.63; 95% CI: 1.99, 6.62; P<0.001). The covariates used in the secondary models are shown in Table 4.

DISCUSSION

The results of our study suggest that parents of children with asthma presenting to urban tertiary care PEDs with asthma exacerbations frequently have inadequate knowledge of preventive care measures, and many of their children lack important self-management tools, including action plans and peak flow meters.

We found that many parents have an inadequate understanding of the differences between ICS and rescue medications. Twenty-nine percent of the parents in our sample thought that ICS immediately opened the airways, and 24% reported that they did not know how ICS worked. Additionally, over half of the parents reported that they would like more information on the differences between rescue medications and ICS.

The inadequate understanding of appropriate ICS use in parents of children who present to PEDs with asthma exacerbations may contribute to poor compliance with preventive medication use in this population. Sixty-six percent of the children in our study had persistent asthma based on NHLBI criteria.⁵ However, only 51% of these children used an ICS on a daily basis. These findings are consistent with those of other ED-based studies,

some of which have shown even lower use of ICS among children presenting to the ED for asthma related care.^{9,10,12,13}

We noted other important deficiencies in preventive asthma care. Overall, 68% of the children did not have a written action plan, and 71% of the children 5 years of age did not have a PFM. These results are in accordance with findings in other ED-based studies.^{8,9} We also found that a large proportion of children (38%) were exposed to second-hand smoke within the home. Interestingly, when parents were asked about asthma education information that might be useful to them in helping them care for their child with asthma, 62% reported that they would like more information on common triggers of asthma exacerbations. These two findings point to a need for focused public health education interventions to promote smoking cessation and second-hand smoke avoidance.

We are not aware of other studies investigating receipt of the influenza vaccine in a similar population of children. Based on parent report, 48% of the children had not received the influenza vaccination during the past 12 months. In multivariable analysis, children with persistent asthma were significantly less likely to receive the influenza vaccination than children with intermittent asthma. The CDC recommends influenza vaccination of all persons with asthma because of the higher risk of complications from influenza in these individuals.^{14–16} Low rates of influenza vaccination among children in our study are consistent with low rates of coverage reported in a recent national survey¹⁶. These findings emphasize the continued need to promote routine influenza vaccination of all children with asthma during health-care visits.

In addition, we found that identifiable parental characteristics predict adherence to four key preventive care measures recommended by national and international guidelines.^{5,6} First, children with persistent asthma whose parents had education beyond high school are more likely to use ICS daily than those whose parents had less education. This finding suggests that parents with no more than a high school education, in particular, may benefit from focused educational interventions which address the important role of daily ICS use in asthma control.

Second, we found that non-African Americans are more likely to receive a written action plan than African Americans. This finding is consistent with findings in a large adult study by Krishnan and colleagues¹⁷ which noted significant differences in receipt of action plans between African Americans and whites. However, two studies evaluating the effect of race/ethnicity on asthma management in children showed no significant differences in the receipt of action plans between racial groups.^{18,19} Of note, socioeconomic status and household income were not collected in our study and may confound the relationship between race and receipt of an action plan. This may explain the difference in our findings from other published studies.

In another recent study by Cabana and colleagues,²⁰ the authors reported that children were more likely to receive an action plan if the parent had only completed high school. In contrast to this study, we did not identify a significant association between receipt of an action plan and parental education level. However, this study was a cross-sectional study of parents of children with asthma in the primary care setting. Our study specifically targeted parents of children with asthma who present to the PED for asthma related care.

Third, non-African Americans are more likely to have scheduled preventive asthma care visits with their PCP than African Americans. In our model, there was a strong trend toward statistical significance (OR 1.75; 95% CI: 0.99, 3.07; $P = 0.053$). This finding further highlights important racial disparities in preventive asthma care. Finally, we are surprised to

find that children with persistent asthma are less likely to receive the flu vaccine (OR 0.45; 95% CI: 0.25, 0.82; P=0.008).

We also evaluated parental perceptions of their ability to provide care for their child during an asthma exacerbation. In our sample, forty-six percent of the parents were very confident in their ability to provide care and reported that they would know exactly what to do. Not surprisingly, the longer the parents have been caring for the child's asthma, the more confident they were in their ability to manage an exacerbation. We also found that parents who received a written action plan were significantly more confident in their ability to provide care in a multivariable proportional odds model which controlled for race, parental education level, and number of years the parent had cared for the child's asthma. Interestingly, parental education level was not significantly associated with parental confidence in ability to provide asthma care in this multivariable model.

Limitations

Our study has several limitations. The findings in our study pertain to parents of children with asthma who present to the PED for asthma related care. As such, some of these findings may not be generalizable to other populations. We attempted to increase the generalizability of our study by enrolling subjects at two geographically distinct sites. In addition, although we enrolled subjects across a wide range of days of the week and times of the day, the data collected still represent a convenience sample of all PED visits during the study period. Furthermore, our questionnaire has not been validated, but it does follow the precepts of the NHLBI guidelines. We did not obtain information on socioeconomic status, insurance status, and access to care. These factors may each play a role in preventive asthma care practices. Another limitation was that the information obtained for data analyses was based on parent report and subject to recall bias. It is also possible that social desirability influenced the responses. Finally, sample size was relatively small leading to less precise estimates.

CONCLUSIONS

Our findings point to the continued need to improve asthma education at multiple levels of care including schools, primary care clinics, urgent care centers, and the emergency department. Areas of focus should include appropriate use of ICS, individualized action plans, second-hand smoke avoidance, and receipt of the influenza vaccination. This study suggests that parents with no more than a high school education, in particular, may benefit from educational interventions which focus on the differences between rescue medications and long-term controller medications. Our findings also indicate a need to recognize and address potential racial disparities in preventive asthma care.

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Abbreviations

NIH	National Institutes of Health
NHLBI	National Heart Lung and Blood Institute
PED	Pediatric Emergency Department

ICS	Inhaled corticosteroids
PFM	Peak flow meter
OR	Odds ratio
CI	Confidence interval

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Table 1

Patient and Parent Characteristics (n = 229)

Characteristic	Data % (N)
Age (y)	
2–4	27 (59)
5–9	48 (108)
10–14	17 (38)
15–18	8 (18)
Race	
Caucasian	34 (76)
African American	44 (97)
Hispanic	16 (36)
Other	5 (13)
Parent education level	
Middle school	5 (11)
1–3 years high school	8 (18)
High school graduate	28 (63)
1–3 years of college	32 (72)
College graduate	19 (43)
Masters degree or doctorate	7 (15)
Smoker in the home	
Yes	38 (85)
No	62 (137)
Persistent asthma	66 (152)

Table 2**Asthma Care and Self-management Characteristics**

Preventive Measure	N	Data n (%)
Daily use of ICS *	108	55 (51)
Receipt of action plan	225	72 (32)
Scheduled visits with PCP	227	141 (62)
Receipt of flu vaccine	224	116 (52)
Use of spacer device	200	141 (71)
Have PFM **	168	48 (29)
Use PFM	47	
Daily		5 (11)
1x per week		4 (9)
1x per month		11 (23)
Only during exacerbation		20 (43)
Never		7 (23)

N is number of non-missing values

* Daily ICS use among children with persistent asthma

** Peak flow meter among subjects ≥ 5 years of age

Table 3

Prediction of Preventive Care

Outcome	Covariate	OR	95% CI	P
Daily ICS use *	> High school	2.81	(1.26, 6.24)	0.011
	non-African American	1.40	(0.61, 3.23)	0.423
	Sub-specialist care	0.98	(0.4, 2.4)	0.967
	# years with asthma	1.09	(0.97, 1.22)	0.134
Receipt of an action plan	> High school	1.66	(0.89, 3.08)	0.108
	Persistent asthma	1.44	(0.75, 2.75)	0.274
	non-African American	2.18	(1.17, 4.06)	0.014
	Sub-specialist care	1.83	(0.92, 3.62)	0.083
	# years with asthma	0.99	(0.91, 1.07)	0.722
Scheduled asthma visits with PCP	> High school	0.82	(0.46, 1.47)	0.512
	Persistent asthma	1.60	(0.89, 2.91)	0.119
	non-African American	1.75	(0.99, 3.07)	0.053
	Sub-specialist care	2.32	(1.1, 4.9)	0.028
Receipt of flu vaccine	> High school	0.93	(0.54, 1.61)	0.797
	Persistent asthma	0.45	(0.25, 0.82)	0.008
	non-African American	1.32	(0.77, 2.29)	0.316
	Sub-specialist care	1.40	(0.72, 2.72)	0.316

* Daily use of ICS in children with persistent asthma

Table 4 Parental Perception of Ability to Provide Care^{*}

Covariate	OR	CI	P
# years with diagnosed asthma	1.14	(1.06, 1.22)	0.0003
non-African American	0.81	(0.48, 1.38)	0.4385
Receipt of an action plan	3.63	(1.99, 6.62)	0.0000
> High school education	0.95	(0.56, 1.62)	0.8595

^{*} Results from a secondary multivariable proportional odds model investigating the associations of covariates with the parent's perceived ability to provide care for their child during an asthma exacerbation