

Parental Asthma Education and Risks for Nonadherence to Pediatric Asthma Treatments

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Objectives: Targeted parental education reduces acute visits for pediatric asthma. Whether the use of education sources readily available to parents relates to nonadherence to asthma treatments is uncertain. This study describes asthma education sources and assesses for a relationship to risks for nonadherence.

Methods: Caregivers of children with asthma completed a cross-sectional survey at 2 sites: a pediatric emergency department (ED) and an asthma clinic (AC). Measured items included the use of 7 education sources (primary care, ED, AC, friends/family, TV, internet, and printed materials), scores of child asthma morbidity, parental asthma knowledge, and risks for nonadherence, the primary outcome. Recruitment site, preferred language (English/Spanish), and demographics were recorded. Descriptive statistics, bivariate analyses, and multivariate regressions were performed.

Results: A total of 260 participants, 158 from ED and 102 from AC, used a variety of education sources. They reported 4.1 (2.0) of 13 risk factors for nonadherence, with more risks in ED parents than AC parents (4.8 vs 3.9, $P < 0.001$). The ED parents worried more about medications and had worse access to primary care. The regression did not show a significant relationship between education sources and risks for nonadherence, but ED recruitment, Spanish language, and worse morbidity contributed to higher risks.

Conclusions: The use of more asthma education sources was not associated with reduced risks for nonadherence. Of the education sources, a primary care provider may benefit ED parents, who also need refills and education about medications. Spanish-speaking parents report more risks for nonadherence, warranting further study of Spanish-language asthma education.

Key Words: asthma, medication nonadherence, minority health, education (*Pediatr Emer Care* 2014;30: 782–787)

Pediatric asthma is among the most common, chronic pediatric illnesses: in 2010 its prevalence reached just more than 7 million.¹ In addition, pediatric asthma was responsible for

640,000 emergency department (ED) visits, 6.7 million private office visits, and 157,000 hospital admissions in 2007.¹ Medication regimens designed to control this disease and reduce the need for acute care visits exist, yet nonadherence rates to treatments are reportedly as high as 60% to 80%.^{2,3} Some of the factors that put families at risk for nonadherence include managing several prescribed medications and concern about medication adverse effects.² Risks for nonadherence, which have been shown to be better measures of true behavior than parental admissions of nonadherence, are associated with worse disease.^{2,4}

Lack of asthma education also relates to worse morbidity. Parents who score lower on health and asthma-related literacy scales are more likely to have children with more severe asthma.⁵ The National Heart, Lung, and Blood Institute guidelines for asthma treatment strongly recommend a focus on education for this reason. In response, asthma management programs have been developed, with success reported in several studies as measured by reduction of ED visits, cost, and other markers of morbidity.^{6–9}

Absent from these programs are patients without access to regular outpatient asthma care, such as those who frequently present to the ED. It is this population that is reported to have worse adherence,³ worse access to a primary care physician, and worse morbidity as measured by missed school days and frequent ED visits.⁶ Little is known about where the parents of ED patients feel they are learning about asthma, how these education sources might impact morbidity and risks for nonadherence, and how all of these might differ from the experience of patients presenting to a dedicated asthma clinic (AC).

This study surveyed parents of children with asthma in an urban pediatric ED and AC to describe their perspective of and experience with various sources of asthma education. Previous studies have shown that the use of multiple sources of asthma education is reported by parents with greater health literacy, who also tend to have healthier children.^{5,10} At present, the role of adherence in these relationships is unclear. This study assessed for a potential association between the asthma education sources queried, other factors (demographic and asthma-related patient characteristics), and the outcome of a high number of reported risks for nonadherence with the child's medication regimen.

METHODS

Design

This study was a cross-sectional written survey of parents/guardians presenting with their children for asthma care between March 2011 and March 2012. This study was exempt by the institutional review board at Children's Hospital and Research Center Oakland.

Sample Recruitment and Procedures

We surveyed a convenience sample of families presenting to the ED or AC at Children's Hospital and Research Center Oakland for asthma care. The ED, with approximately 50,000 visits annually, is a dedicated pediatric ED in a free-standing,

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tertiary care children's hospital. Asthma is among the most common diagnoses treated in this urban ED, and education about asthma is conducted by treating physicians, nurses, and respiratory therapists. Each child's asthma action plan is reviewed before discharge. The AC is a federally qualified health center that is staffed by pediatricians, nurse practitioners, and trained asthma educators who review the pathophysiology of the disease, how treatments work, and how to use inhaled medications. It operates once per week, with an average of 500 visits per year. Patients in AC are referred from the primary care clinic or are recruited by AC staff after a hospital admission or ED visit.

Recruitment of the ED portion of this convenience sample occurred at a variety of hours and days intended to reflect the 24-hour 7-day availability of emergency care. Recruitment from AC occurred during its weekly session. Participants were English or Spanish literate parents/guardians of patients aged 2 to 17 years with either a previous diagnosis of asthma by a physician or previous receipt of a prescription for asthma medications. Those excluded were patients with their first presentation of wheezing or respiratory distress as well as children with significant medical comorbidities affecting pulmonary function and those who were considered to be in danger of impending respiratory failure by the treating provider. Patients meeting the exclusion criteria were identified by a review of the electronic medical record or discussion with the treating provider, and they were not approached. Parents/guardians who previously participated or who reported that another caregiver participated in the survey during the recruitment period were also deemed ineligible. Five parents declined to participate.

Participants in this study completed questionnaires while waiting for their child's appointment in AC or while waiting for the completion of their child's respiratory treatment during a visit to the ED. The data from the completed questionnaires were entered into REDCap (CTSA Award UL1RR025744 NIH/NCRR at Stanford University).

Measurements

A 56-item questionnaire was developed to investigate (1) the primary variable of interest—parental asthma education source; (2) the outcome variable—risk factors for nonadherence; and (3) several other variables such as recruitment site, language of survey completed, child asthma morbidity, demographics, and parental asthma knowledge (Appendix, <http://links.lww.com/PEC/A50>). The education sources included primary care clinic, AC, ED, friends and family with experience caring for children with asthma, TV, Internet, and printed materials. Parents were asked which education sources they used within the last 6 months as well as which education sources they felt they could turn to for help with any questions or concerns. A 13-item risk for nonadherence scale was developed based on a previously studied measurement tool.² The risk factors for nonadherence include barriers to care such as difficulty obtaining a doctor's appointment and child refusal of medication.^{2,4} Asthma morbidity was measured via questions derived from the National Asthma Education and Prevention Program guidelines for measuring asthma control and severity¹¹ and several published surveys to create a summary score with a maximum morbidity of 7-total items.^{4,12} Morbidity factors included frequent wheeze or cough, waking from sleep, and missing school or planned activities. Parental asthma knowledge was evaluated using 8 questions adapted from studies of health literacy and asthma care.^{5,13,14} Parents were also asked about previous visits to the ED or AC to characterize their access and use of the recruitment sites.

The wording and structure of the survey questions was reviewed and modified in consultation with an expert in survey design. After its initial development, the survey was revised 4 times in response to suggestions from 5 physicians as well as 5 sample parents with no medical background who tested the survey for face validity. Pilot testing was conducted with an additional 5 English-speaking families presenting to the ED for asthma care. These parents reported that the questions were understandable and clear. The survey was then translated into Spanish by a certified hospital interpreter and a native Spanish-speaking physician with specialty training in allergy and immunology.

Statistical Analysis

Data were analyzed using SAS version 9.3 (SAS Institute, Cary NC, 2011). We tabulated parental education sources, risk for nonadherence scores, child asthma morbidity scores, and asthma knowledge scores. We used descriptive statistics to compare recruitment sites (AC vs ED) using a *t* test for continuous and χ^2 test for categorical measures. We used multivariate logistic regression to determine the association between total number of parental education sources used for help and high risk for nonadherence, our measure of the primary outcome, which we planned to define as total number of risks above the median number reported by the sample. In addition to education sources, we also adjusted for 8 other variables of presumed clinical significance established a priori to the analysis: recruitment site, language of survey completed, child age and sex, child asthma morbidity, parental income (known and unknown), and parental asthma knowledge. When determining goal sample size, previous studies have shown that a minimum of 10 outcome events per variable is necessary to avoid bias in a logistic regression analysis.¹⁵ Our regression incorporated 9 total variables, so for each to generate 10 events of high risks for nonadherence, we needed at least 90 participants to report some number of risks above the median, making our goal sample size at least 180. Additional regression models were developed to determine the effect of individual education sources on total risks for nonadherence. Separate regression models were also created for each recruitment site because bivariate testing revealed a significant difference in risks for nonadherence between parents recruited from the ED and those recruited from AC. A significance level of 0.05 was used for all statistical tests.

RESULTS

During the 12-month study period, a total of 260 parents/guardians participated in the survey. A total of 158 were recruited from the ED and 102 from AC. Mean (SD) age at asthma onset was 2 (2.8) years, mean (SD) age at the time of recruitment was 7 (4.0) years, and more parents reported that their asthmatic children were male (63%) and African American (44%). The majority of participants identified English as their preferred language (79%). Most parents completed secondary school or some portion of a college/technical degree, and the majority earn less than \$20,000 per year. In the year preceding recruitment, 58% of the parents reported a visit to the ED for asthma care and 42% reported a visit to AC. Table 1 demonstrates these demographic characteristics by recruitment site.

On average, the participants reported use of 2.6 (1.6) of 7 different education sources within the last 6 months and identified 3.2 (1.4) different sources they could turn to for help. There was not a significant difference in mean number of education sources used by parents recruited from the ED compared with those from AC (Table 2). Participants reported learning from a variety of people and places: all of the 7 sources queried in the survey were

TABLE 1. Demographic Characteristics

	Total, 260	ED, 158	AC, 102	P
Child age in years, mean (SD)	7.1 (4.0)	6.5 (4)	8.1 (4.0)	0.002
Child age at diagnosis in years, mean (SD)	2.2 (2.8)	2.2 (2.9)	2.1 (2.8)	0.81
Child sex, male, n (%)	163 (63)	100 (63.3)	37 (63)	0.96
Child race and ethnicity				
African American, n (%)	114 (44)	64 (41)	50 (49)	0.10
Hispanic, n (%)	86 (33)	60 (38)	26 (25)	
White, n (%)	13 (5)	10 (6.4)	3 (3)	
Other, n (%)	46 (18)	23 (14.6)	23 (23)	
Language of survey, Spanish, n (%)	55 (21)	41 (26)	14 (14)	0.02
Highest parent education level				
Lower than/some high school, n (%)	56 (23)	37 (25)	19 (19)	0.85
High school graduate, n (%)	58 (24)	31 (21)	27 (27.5)	
Some college/technical school, n (%)	77 (31)	46 (31)	31 (31.5)	
More advanced degrees, n (%)	55 (22)	33 (23)	22 (22)	
Parent income level				
<\$20,000 per year, n (%)	125 (50)	66 (43)	59 (60)	0.03
>\$20,000 per year, n (%)	76 (30)	54 (36)	22 (23)	
Unsure, n (%)	49 (20)	32 (21)	17 (17)	
Use of ED in past year, n (%)	148 (57.6)	98 (62.8)	50 (49.5)	0.06
Use of AC in past year, n (%)	106 (41.6)	48 (31)	58 (57)	<0.001

Variables in bold, $P < 0.05$.

used by some percentage of participants. Most participants, 92.3%, viewed an outpatient clinic as a helpful educational source (primary care provider's [PCP] office or AC). Many parents also noted that the ED was a source of asthma education, as 51% reported learning during a recent ED visit. The least used education sources were the Internet (23%) and TV (11%). The

frequency of all potential asthma education sources used during the last 6 months by study participants is depicted in Figure 1.

The mean (SD) number of risk factors for nonadherence was 4.1 (2.0) on the 13 item scale. Some of the most frequently reported risks for nonadherence included a complex asthma care regimen with more than 1 prescribed medication for asthma (70%), concerns about adverse effects (67%), and the involvement of several different caregivers in a child's asthma care (51%). Mean (SD) morbidity score was 3.6 (2.4) with an even distribution of lower scores (less sick) to higher scores (more sick) throughout the sample. Bivariate analyses by recruitment site found no difference in the mean child asthma morbidity score or mean parental asthma knowledge score by site. However, there was a difference in the mean number of risk factors with 3.5 (1.7) reported by the AC participants and 4.6 (2.0) reported by the ED participants ($P < 0.0001$) (Table 2). More parents recruited from the ED worried that they do not give the medications

TABLE 2. Reported Knowledge, Morbidity, and Risks for Nonadherence

	Total, 260	ED, 158	AC, 102	P
Education sources				
Total sources used for help, mean (SD)	3.2 (1.4)	3.2 (1.4)	3.2 (1.3)	0.9
Accessed in last 6 mo, mean (SD)	2.6 (1.6)	2.5 (1.6)	2.8 (1.7)	0.1
Child morbidity score, mean (SD)	3.6 (2.4)	3.7 (2.3)	3.4 (2.5)	0.25
Parent asthma knowledge score, mean (SD)	5.9 (1.7)	5.9 (1.7)	5.9 (1.6)	0.9
Risks for nonadherence, mean (SD)	4.11 (2)	4.53 (2)	3.5 (1.7)	<0.0001

Variables in bold = $P < 0.05$. P values are based on t test results.

Education sources include primary care clinic, ED, AC, friends/family, TV, internet, and printed materials. Child's morbidity score is a 7-item scale measuring asthma severity by reports of frequent wheeze/cough, waking from sleep, missing school/planned activities, and/or increased need for rescue medication. Parent's knowledge score is an 8-item scale measuring parental knowledge of asthma and asthma care by assessing understanding of asthma symptoms, indications for treatment with medication, and indications for medical evaluation. Risks for nonadherence scale is a 13-item tool measuring barriers to adherence and asthma care such as lack of medication refills in the home, lack of access to a PCP, and concern that the medications will not help.

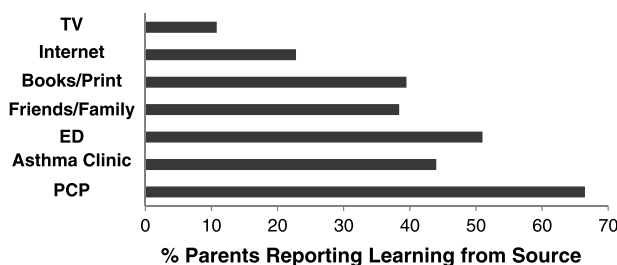
Where Parents Learn About Asthma

FIGURE 1. Distribution of education sources used by parents for asthma learning. Education sources queried included TV, Internet, books/printed material, friends/family of children with asthma, the ED, AC, and the PCP. Most parents reported learning about asthma from their PCP, and more than half reported learning from the ED or AC.

properly or on time, reported that they do not have medication in the house, and doubted that the medications would help with asthma symptoms. In addition, ED participants noted more difficulty securing a doctor's appointment and more lacked a regular doctor for their child's asthma. Figure 2 shows the risk factors for nonadherence that were significantly different by recruitment site. Only 3% of the participants (3 from AC and 5 from ED) reported no risk factors for nonadherence.

The results of the regression analysis examining the association between high total risks for nonadherence and total education sources while adjusting for recruitment site, child age, child sex, language, parental income, child morbidity score, and parental asthma knowledge score are listed in Table 3. The model stratified risks for nonadherence into low risk (<4 risk factors) and high risk (≥ 4 risk factors) because the median and mean number of risks was closest to 4. After excluding 14 from analysis due to missing data, 95 parents reported fewer than 4 risks for nonadherence, with 151 reporting the high-risk outcome of 4 or more risks. Total number of education sources was not significantly associated with high risks for nonadherence nor were any of the individual education sources. However, recruitment from the ED, Spanish language, and higher morbidity score all showed a significant association with high risk for nonadherence.

After adjusting for all other variables, the mean number of risks for nonadherence for ED participants remained significantly greater than for AC participants (4.75 vs. 3.87, respectively; $P < 0.001$), confirming the relationship initially noted in the binary analysis. The regression was then repeated by site to evaluate for relationships between the previously tested variables and the outcome that might be unique to each group (Table 4). Of note, Spanish language remained significantly associated with more risks for nonadherence in both settings (ED odds ratio [OR], 4.4; 95% confidence interval [CI], 1.4–14; $P = 0.01$ vs AC OR, 5.98; 95% CI, 1.2–29.2; $P = 0.03$). Increasing age was associated with a reduction in risks for nonadherence among the ED cohort, whereas worse morbidity was associated with more risks for nonadherence in both groups. A look at education sources showed that the ED participants who identified their PCP as a

TABLE 3. Factors Associated With High Risk for Nonadherence

Variable Measured	Adjusted OR (95% CI)	P
Site		
ED	2.2 (1.21–3.91)	0.01
AC, reference	1	
Age, y	0.94 (0.88–1.01)	0.10
Sex		
Female	0.93 (0.52–1.67)	0.81
Male, reference	1	
Income		
<\$20,000 per year	0.87 (0.45–1.67)	0.91
Not sure	0.90 (0.38–2.13)	
>\$20,000 per year, reference	1	
Language		
Spanish	4.26 (1.79–10.14)	0.001
English, reference	1	
Child's morbidity score	1.24 (1.09–1.41)	0.001
Total education sources used for help	0.89 (0.72–1.1)	0.28
Parent's knowledge score	0.99 (0.81–1.2)	0.89

Variables in bold, $P < 0.05$.

Results are based on a multivariate logistic regression that evaluated the association between patient-level factors and high risks for nonadherence. High risk is defined as 4 or more risks on a 13-item scale because the mean number of risks in the population was 4.

source of helpful information had a trend toward fewer risks for nonadherence (OR, 0.11; 95% CI, 0.01–1.1; $P = 0.06$).

DISCUSSION

This study reaffirms that parents use several different education sources to learn about asthma. Unlike previous studies of asthma education, this study compared the experiences of parents presenting to the ED with those of parents presenting to an AC. Although the results showed no difference in the number of education sources used by each recruitment group, those recruited from the ED reported more risks for nonadherence. Using more education sources did not show a relationship to the outcome of high risk for nonadherence, but trends were noted between individual education sources and total risks (Table 4). This suggests that it might be the type of education source and not the number of sources that is more associated with adherence.

Parents surveyed in this study reported the use of a PCP for asthma education more than any other source. Whether the education provided by a PCP can cause a reduction in risks for nonadherence is not clear from this study, but ED parents who reported having a PCP available for help with asthma education had a trend toward fewer risks for nonadherence. Previous studies have shown that follow-up with a PCP can improve understanding of discharge instructions, which can improve adherence.¹⁶ Unfortunately, many parents presenting to the ED lack access to a PCP and appropriate medication for asthma. It may not be possible for ED providers to arrange appointments and guarantee PCP follow-up after ED discharge, yet they may be able to help by identifying families in need of a PCP and/or medication refills as a regular part of the discharge process.

The ED itself can also be a potential source of asthma education, as evidenced by the fact that 51% of the parents surveyed in our study reported learning about asthma during an ED visit. We

Significant Risks for Non-Adherence by Survey Site

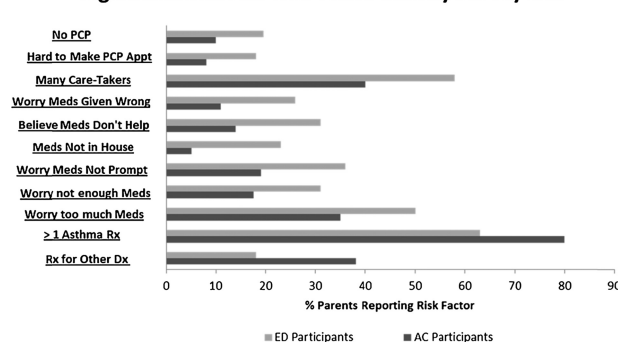


FIGURE 2. Distributions of reported risks for nonadherence compared by survey site. Risks for nonadherence are listed on the y axis. Appt indicates appointment, Meds, medications, Rx, prescription. More than 1 asthma prescription, the presence of many asthma caretakers, and worry that the child takes too many asthma medications were among the most common risk factors reported. Parents surveyed in the ED were much more likely to report lack of available medication in the house and to worry that they give the medications incorrectly. Bivariate analysis of risks by site with $P < 0.05$.

TABLE 4. Factors Associated With High Risk for Nonadherence Stratified by Recruitment Site

Variable Measured	ED (n = 158)	P	AC (n = 102)	P
	Adjusted OR (95% CI)		Adjusted OR (95% CI)	
Age, y	0.90 (0.81–1.0)	0.05	0.96 (.85–1.1)	0.48
Sex				
Female	1.5 (0.64–3.4)	0.35	0.47 (0.17–1.3)	0.14
Male, reference	1		1	
Income				
<\$20,000 per year	0.94 (0.38–2.4)	0.98	0.86 (0.26–2.8)	0.93
Not sure	1.03 (0.32–3.2)		0.72 (0.14–3.9)	
>\$20,000 per year, reference	1		1	
Language				
Spanish	4.4 (1.4–13.8)	0.01	5.98 (1.2–29.2)	0.03
English, reference	1		1	
Child's morbidity score	1.3 (1.1–1.6)	0.01	1.3 (1.03–1.55)	0.03
Specific education sources used for help				
PCP	0.11 (0.01)	0.06	0.79 (0.23)	0.71
AC	0.62 (0.26)	0.28	0.65 (0.17)	0.52
ED	1.2 (0.47)	0.74	0.57 (0.21)	0.28
Friends and family	1.5 (0.66)	0.34	0.39 (0.14)	0.09
Internet	1.5 (0.51)	0.48	2.3 (0.60)	0.23
Printed materials	0.90 (0.34)	0.82	0.68 (0.23)	0.50
Parent's knowledge score	1 (0.75–1.3)	0.96	1 (0.73–1.4)	0.96

Variables in bold = $P < 0.05$.

Child's morbidity score is a 7-item scale measuring asthma severity. Parent's knowledge score is an 8-item scale measuring parental knowledge of asthma and asthma care.

did not find that ED as an education source was associated with either increased or decreased risks for nonadherence, but there might be specific educational interventions that could help target the risks more often reported by ED parents. When compared with AC parents, ED parents reported less belief in asthma treatments and more concerns about how and when to give them, so teaching in the ED should address how asthma medication works, when it is indicated, and how to deliver it effectively. This is supported by previous research showing that teaching efforts during an ED visit, specifically assisting parents with the use of a metered dose inhaler for asthma care, improves medication adherence.¹⁷

The educational experience of parents presenting to the ED versus AC for asthma care is different largely because of the time constraints and lack of follow-up inherent in emergency care. However, the use of ED or AC as education sources by parents at these different sites did not explain the discrepancy in risks for nonadherence noted. In a subgroup analysis by site, the relationships found to have a significant association with the outcome were mostly the same, as both worse morbidity and Spanish language again contributed to high risk for nonadherence. Apart from the trend toward a reduction in risks noted in ED participants with access to a PCP, the only other variable that revealed a difference between recruitment sites was age. Parents of older children recruited from the ED were found to have lower risks for nonadherence, likely for the same reasons reported in previous studies: longer duration of experience with a child's asthma increases parental confidence in the ability to manage an exacerbation.¹⁴ On average, children from AC were older, likely reducing the effect of age on risks for nonadherence in that group.

Among the variables associated with high risks for nonadherence across all analyses in this study was Spanish language. This disparity is something not previously described in pediatric

literature. Although previous studies of pediatric risks for nonadherence with asthma treatments were conducted in both English and Spanish, they did not seek out a potential difference in morbidity, risks, or other variables between those groups.² These findings corroborate a study of elderly patients with asthma that found that Spanish-speaking patients had lower adherence to asthma treatments as well as worse asthma control, worse quality of life, and a higher likelihood of needing hospital admission for their exacerbations compared with their English-speaking counterparts.¹⁸ The reason for this discrepancy seems to be related to failed communication especially because studies of parents with limited English proficiency have shown that they are less likely to understand ED discharge instructions.¹⁶ It is unknown how often formal interpreter services are used when parents are instructed about asthma care. According to one study, 87% of Spanish-speaking patients who did not have an interpreter for help with their ED visit felt that one should have been used.¹⁹ Availability of formal interpreter services in the ED should be encouraged not only as a potential intervention to reduce risks for nonadherence but also because it improves patient and provider satisfaction with communication.²⁰

Limitations

The main limitations to this study are related to its design as a cross-sectional study with a convenience sample drawn from one single institution. It is possible that participants' responses were affected by selection and recall bias. Social desirability bias should have been mitigated by the fact that participants were explicitly told that the surveys were anonymous. Although the study was limited to a single institution, Children's Hospital and Research Center Oakland is an urban, free-standing children's

hospital emergency department, and the results may be generalizable to similar hospitals.

By recruiting patients from 2 different sites, ED and AC, this study attempted to account for variations in access to care to further improve generalizability to a broader population of parents. The study was limited, however, by the inevitable overlap that occurs between these groups, as some parents from each site reported a visit to the other site in the year preceding recruitment. Yet when the variables that were similar between the 2 groups (child morbidity score, parent knowledge score, etc) were accounted for in the regression, a significant difference in mean risks for nonadherence between sites emerged.

This study is also limited by the use of a survey tool not previously validated. In an effort to address this reality, several components of the survey were derived from existing, validated measurement tools. Future studies using the same tool would help to establish internal consistency, reliability, and construct validity.

The survey was conducted in 2 languages, English and Spanish, and it was only offered in written form with no option for verbal administration of the survey. Although it is true that this limits these results to those literate in the languages surveyed, a previous study using the same risks for nonadherence scale among parents of children with asthma presenting to an urban pediatric ED demonstrated similar results when their surveys were administered in both written and verbal form.⁴

Lastly, because this is a survey study conducted on a convenience sample, it was not possible to recruit equal Spanish and English populations to allow for better comparison of these groups. As a result, the data provided by the Spanish parents is limited in accuracy as illustrated by the wide CIs. A future study design that is dedicated to comparing English with Spanish parents as 2 discrete groups would better address this limitation.

CONCLUSIONS

This study found that parents rely on several sources for education about asthma. Medical providers should offer parents a variety of asthma education opportunities after an acute visit for asthma care. Compared with AC participants, ED participants reported more risks for nonadherence, specifically risks suggesting that education in the ED should target parental concerns about medication efficacy, timing, and delivery. Parents presenting to the ED are also more likely to need refills and referral to a PCP to further reduce barriers to care. This is the first pediatric study to show many more risks for nonadherence among Spanish-speaking parents. This population likely warrants careful education in their native language. The findings reported here offer guidance to providers seeking improved pediatric asthma control through improved adherence. Prospective and multicenter studies of these interventions are necessary to validate these conclusions.

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