SUPPLEMENT ARTICLE

Delivering Tailored Asthma Family Education in a Pediatric Emergency Department Setting: A Pilot Study

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ABSTRACT

OBJECTIVE. Many children are brought to the pediatric emergency department (ED) with acute asthma symptoms. Emergency asthma care is costly, and many ED visits may be preventable. Families often do not have written asthma action plans and lack asthma self-managment skills. This study tests a tailored self-managment intervention delivered in the ED for families of children with asthma. The primary hypotheses were that the intervention group would have greater confidence to manage asthma 14 days postintervention and more well-asthma visits and fewer urgent care/ED visits at 9 and 12 months.

METHODS. This randomized intervention/usual-care study was part of a larger ED asthma surveillance project in 4 urban pediatric ED sites. Asthma educators used a computer-based resource to tailor the intervention messages and provide a customized asthma action plan and educational summary. Children with acute asthma were enrolled during an ED visit, and follow-up telephone interviews were conducted during the next 9 months. The ED clinician classified the child's acute and chronic severity.

RESULTS. To date, 464 subjects aged 1 to 18 years have been enrolled. The ED clinicians reported that 46% had intermittent and 54% had persistent chronic severity with 51% having mild acute severity episodes. The confidence level to prevent asthma episodes and keep them from getting worse was significantly higher in the intervention group at 14 days postintervention. More subjects in the intervention group reported well-asthma visits by 9 months. Return ED visits were significantly lower in the intervention group in those with intermittent asthma. Twelve-month follow-up is in process.

CONCLUSIONS. The tailored ED self-management intervention demonstrates significant effects on caregiver self-confidence and well-visit follow-up. Additional evaluation is needed to determine what impact this intervention has long-term.

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Key Words
pediatric asthma, self-management, patient education, emergency care

Abbreviations
ED— emergency department
TEDAS—Texas Emergency Department Asthma Surveillance
QoL— quality of life
ITG-CASF—Integrated Therapeutics Group Child Asthma Short Form
OR— odds ratio
CI— confidence interval

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An estimated 9 million (12.5%) children <18 years of age in the United States have had asthma diagnosed at some time in their lives.[1] Asthma morbidity and mortality have increased dramatically in the United States in the last 2 decades. The economic burden of asthma is increasing, with hospitalizations accounting for 46% to 50% of costs and emergency department (ED) visits accounting for ~8%.[2] Emergency care visits cost 5 times more than primary care visits.[3] Every year, 1 of 3 children with asthma visit an ED because of an asthma-related event.[3] These ED visits and hospitalizations may be preventable through either better chronic asthma control or early recognition of acute symptoms and intervention in the primary care setting.

Children with asthma may lack a primary medical provider and may depend on ED services for their care. Routine primary medical care is hampered by a lack of medical insurance and by other barriers such as access to transportation. There are disparities in asthma severity and access to care with respect to ethnicity and socioeconomic status, and minority children and those with low socioeconomic status are impacted by a variety of factors including exposure to environmental triggers and potentially poor access to medical care and controller therapy.[4–7] Failure to prescribe antiinflammatory therapies for patients with persistent disease or to provide written management plans suggests that the medical care provided is often inadequate.[7–11]

National asthma-management guidelines recommend the development of an asthma action plan for each patient and encourage regular communication between patients and health care providers.[12–14] A systematic review of educational interventions for self-management of asthma has documented positive effects of such interventions on asthma morbidity and health care utilization, but issues remain concerning how to reach high-risk populations and sustain self-management over time.[15] Ideally, children with asthma and their families receive self-management training from their primary care provider; however, it is clear that many families in our study have not had access to such education and that many do not have a written asthma action plan. Although the ED is a challenging and busy setting in which to provide education, an acute asthma episode may serve as a "teachable moment." An ED visit may provide an opportunity to motivate a family to accept asthma as a chronic recurring condition and promote new efforts to assure optimal control and ongoing medical care.[3] For those patients who practice good asthma self-management and are in the ED with an episode that could not be managed at home, appropriate reinforcement of their efforts is needed as well. Few studies have evaluated self-management educational interventions in the ED setting. A review of controlled clinical trials of asthma education for children who had been in the ED for asthma revealed mixed results and suggests a need for more research in this area.[16]

This study describes the development and pilot evaluation of an ED-based asthma education intervention for children presenting with an acute asthma episode. Asthma educators used a computer-based resource to provide tailored individual instruction including a written asthma action plan and printed summary. The intervention emphasized linkage back to the patient's primary asthma care provider, identification of barriers to care, and tailoring management to disease severity and individual triggers. As hypothesized, early analysis of the results suggests that our ED education intervention has an impact on patients' self-management and increases their follow-up with their primary health care providers.

METHODS

Study Design and Recruitment

This intervention study is a substudy of a larger asthma surveillance project, the Texas Emergency Department Asthma Surveillance (TEDAS), which is a collaborative effort among Baylor College of Medicine, the University of Texas-Houston Health Sciences Center, the Harris County Hospital District, and the University of Texas Medical Branch (Galveston). The project network serves a 13-county region in southeast Texas (the Texas Department of Health's region 6), with Houston as its largest city. Beginning in January 2002, the TEDAS team established a surveillance network consisting of 4 EDs. Together, these EDs serve almost 70% of the estimated 76 453 children with asthma in the greater Houston-Galveston area. All children >1 year of age with a diagnosis of asthma who presented for ED care with an asthma episode were included in the surveillance.

The TEDAS ED Intervention Study was set up as a randomized, prospective clinical trial. Subjects were enrolled during an ED visit for acute asthma, and staff were available to screen and recruit subjects on weekdays at all sites as well as during selected shifts on weekends and weeknights. Subjects were randomly assigned to receive the educational intervention or usual care. The primary hypotheses were that subjects in the intervention group would report increased confidence in their ability to self-manage asthma 14 days postintervention and lower ED utilization in the subsequent 9- and 12-month follow-up. We also hypothesized that the subjects in the intervention group would have more well-asthma visits than the subjects in the usual-care group.

Study Population

At each of the 4 participating sites, children were recruited during ED visits for an acute asthma episode. The sites serve a multiethnic population, and asthma educators were scheduled at various times to allow for sampling of children presenting during night shifts and

weekends in addition to weekdays. Inclusion criteria included: age of 1 to 18 years; previous physician diagnosis of asthma (any severity level); the ability of the caregiver who is present at the ED visit to speak English or Spanish; and presentation to a participating ED with asthma symptoms. Exclusion criteria included having a diagnosis of another chronic lung or cardiovascular disease.

Asthma educators obtained informed consent from the parent/guardian of each subject and, for children >12 years of age, the child's assent to participate. The study was approved by the institutional review board for human subjects research of each of the partnering institutions.

TEDAS ED-Based Pediatric Asthma Education Intervention

The TEDAS pediatric asthma ED self-management intervention is based on theoretical and behavioral principles of disease self-management, social cognitive theory, and tailored communication.[17–19] Individualization of the intervention is important, given the range of asthma severity, variability of individual triggers, and personalized asthma therapy regimens. Principles of education included self-efficacy (confidence), outcome expectations, self-regulation, and role modeling. To address tobacco smoke exposure, the intervention incorporated the stages-of-change transtheoretical model for behavior change to facilitate educators' identification of counseling strategies most likely to be effective for parents who smoke.[20] The computer-based intervention used was adapted in part from the "Stop Asthma" program developed by several of the co-authors as a tool to promote guideline-congruent outpatient asthma care.[21]

The TEDAS self-management intervention is delivered in the ED, with a follow-up telephone call 1 to 2 weeks after the visit. The intervention includes both universal and tailored content, and the educator has the flexibility to navigate the content based on the individual child/family's needs and questions (Table 1). To assist in tailoring the intervention, the educator accesses patient information from the family and patient, the ED clinician, the prospective TEDAS surveillance data sheets, and the child's ED chart. The educator builds a tailored written action plan and an education summary; the printed summary reinforces information covered by the educator. The educator can also provide elementary school children with their own version of the written action plan that includes when to ask an adult for help. All materials are available in English and Spanish.

TEDAS Asthma Educator Computer Resource

The TEDAS education intervention was created in Microsoft Access (Microsoft Corp, Redmond, WA) on a Microsoft Windows platform. The data are stored in a

TABLE 1 TEDAS Pediatric Asthma Educational Intervention Overview

Universal Content	Tailored Content	Tailored Output
Communication	Primary care access	Communication
Child's asthma care team: family, friends, health care providers, day care/school	Problem-solving	Chronic severity
Irritant trigger avoidance	Social services referral	Decision-making
Ozone air pollution	Financial counseling referral	Written asthma action plan
Passive tobacco smoke	Specialist referral	Preventive therapy
Symptom monitoring	Through primary care	Rescue therapy
Early recognition	Moderate to severe asthma	Emergency care
Self-regulation	Asthma-control goals	Peak flow if indicated
Link to action plan decision-making	Relation to outcome expectations	Asthma trigger avoidance
Emergency medical care	Link to adherence with asthma care and therapy	Follow-up medical care plan
Defining a medical emergency	Written asthma action plan	Preventive/controller therapy
Link to action plan red zone	Preventive therapy	Goals and expectations
Medication delivery skill	Rescue therapy	
Follow-up medical care	Emergency care	
"Well-asthma visits"	Peak flow if indicated	
Information to bring	Asthma trigger avoidance	
Other resources	Self-regulation/self-management skills	
Print materials	Self-efficacy (confidence)	
Internet Web sites	Decision-making	
Organizations	Reinforcement of positive actions	
Telephone help line	Controller therapies	
For asthma questions	Antiinflammatory	
	Risk/benefit	
	Link to asthma severity	
	Parental concerns	
	Reinforcement of positive actions	
	Decision-making	
	Self-regulation	

relational database with tables for patient data as well as the intervention components of educator prompts and tailored letter text. The video segments are executed from within the system using Microsoft's Windows Media Player. The system is designed as a "point-and-click" system: a minimum amount of patient demographic information is typed into the system, and the rest of the patient information is selected from a series of screens using radio buttons, check-boxes, and drop-down lists. Resources available for use with patients and families included simple figures and graphics about asthma, video clips showing other parents and children as role models providing motivational messages regarding use of an asthma action plan, and skill training. Counseling prompts and probes are provided to guide the educator in a specific field for each content area. The use of mandatory screens assures that a complete written action plan is provided. At the completion of each ED educational intervention session in our study, the educator generated a report that was sent to the child's primary care provider (if known) to communicate any immediate needs with respect to a family's questions or need for clarification in plans for therapy.

The educators initially used laptop computers in the ED setting and later switched to a tablet-style portable computer, which provided greater portability and visibility of video clips for patients and families.

Asthma Educator Training

Individuals recruited to serve as asthma educators in the TEDAS program included a physician, nurses, respiratory care practitioners, and a layperson. They all were provided with a review of core principles relating to the intervention and received training in the use of the computer resource to provide tailored education and generate individualized materials.

TEDAS Pediatric Asthma Education Intervention Follow-up Telephone Call

At 1 to 2 weeks after the ED visit, the asthma educator made follow-up telephone contact with the child/family. During the call, the educator asked about the child's symptom status, follow-up with an asthma specialist or primary care physician, and need for ED reevaluation. The educator also asked about and reinforced use of the asthma action plan, provided a referral for any identified obstacles, tried to help the family set goals to assure follow-up, and addressed any new concerns or questions as appropriate.

Asthma Education Hot Line

A toll-free telephone hot line was set up to provide subjects in the intervention group with a source for general asthma questions. The telephone line was accessible 24 hours per day, 7 days per week. Subjects in the intervention group were given a magnet with the telephone number and TEDAS logo. The hot line was not intended to substitute for medical care and did not provide advice for acute symptoms. If subjects called to report symptoms, they were instructed to call their primary asthma care provider or the 911 emergency operator for assistance if symptoms were severe. Project physicians answered the calls. A palmtop program was developed to allow documentation of caller requests and guide the responding clinician during the call.

Demographics and Outcome Measures

Demographic information was gathered for each subject including age, gender, ethnicity, primary language, residential zip code, education level of the child and caregiver at the ED visit, and ED center. Prospective data included information on the chronic and acute severity of the child's asthma and whether the family contacted the child's primary care provider before coming to the ED. Asthma severity was assessed by either the attending ED physician or an upper-level resident or fellow. Acute severity was classified as mild, moderate, severe, or respiratory arrest using a scale modified from national guidelines.[12] Chronic severity was classified using the national guideline categories of mild intermittent, mild persistent, moderate persistent, and severe persistent.[13]

Outcome measures were administered at baseline and by follow-up telephone calls 14 days and 3, 6, 9, and 12 months postintervention. If a subject could not be contacted at the designated time point, staff attempted to contact the subject for subsequent time points (therefore, sample size varies by time point). Not all measures were collected at each time point, as indicated herein.

Health Care Utilization/Medication Use

Each subject's family was asked whether they had a written asthma action plan. Current asthma medication use was determined at baseline and at 12-month follow-up (but for purposes of this study, medication use was analyzed only for baseline, because 12-month follow-up is ongoing). Any history of hospitalization or ED visits for asthma in the previous 12 months was recorded at baseline. Follow-up measures of health care utilization included urgent care or ED visits, hospitalizations for asthma, and well-asthma visits during the previous 3 months. The number of school and/or day care days missed in the previous 3 months was also recorded. The amount of health care utilization and school/day care absences were asked at each time point.

Parent/Caregiver Confidence

Table 2 shows the 4 items that were used to measure the parent/caregiver's confidence in managing the child's asthma. The 5-point response scale ranges from "not at all sure" to "very sure." Respondents were asked to rate their confidence in the preceding 3 days. Confidence was

TABLE 2 **TEDAS Educational Intervention Study Mean Baseline and Change at 14-Day Follow-up Confidence and Acute Asthma Behavioral Capability Variables**

Confidence Variable	*N*	Baseline, Mean (SD)	*N*	14-d Postintervention, Mean Change (SD)	*t*[a]	*P*[b]
Prevent child from getting symptoms					1.93	.05[a]
Intervention group	248	3.04 (1.36)	197	0.77 (1.65)		
Control group	189	3.18 (1.36)	154	0.45 (1.44)		
Prevent child from getting worse					2.19	.03[b]
Intervention group	247	3.44 (1.29)[b]	197	0.48 (1.56)		
Control group	189	3.78 (1.22)	152	0.13 (1.38)		
Stop symptoms without doctor visit					−0.35	.73
Intervention group	249	2.84 (1.28)	200	0.50 (1.57)		
Control group	190	2.87 (1.36)	153	0.56 (1.66)		
Take care of child's asthma in general					1.30	.19
Intervention group	255	4.08 (1.09)	202	0.19 (1.30)		
Control group	192	4.33 (0.96)	157	0.03 (1.06)		

Confidence is based on a 0- to 5-point scale (5 = very sure).
[a] Analyzed using Student's *t* test.
[b] Significant at $P < .05$.

determined at baseline and during the 14-day follow-up telephone call.

Asthma Symptoms/Quality of Life

Quality of life (QoL) was assessed by the Integrated Therapeutics Group Child Asthma Short Form (ITG-CASF), which includes both symptom- and health-related QoL items.[22,23] The recall period used in this study was the past 3 days at 14 days after the baseline ED visit and the past 4 weeks for the other follow-up interviews. The response options for each item used a 5-point scale ranging from "all of the time" to "none of the time." Two additional items were included from the ITG-CASF regarding adjustments to family life because of the child's asthma and whether inhaler use or other treatments interfered with the child's life.[22] Items within scales were summed and linearly transformed from 0 to 100, with higher scores indicating better functioning. The QoL measure was taken at all data-collection time points.

Other Measures

Each subject's family was also asked to complete an environmental control survey and the Acute Asthma Behavioral Capability Questionnaire. The latter measure tests practical knowledge applying an asthma action plan in the event of acute symptoms and was adapted from a similar measure that was reported for adult asthma.[24] Both measures were assessed at baseline and 3 months postintervention and will be assessed at 12 months. Results will not be available until the 12-month assessments are complete.

Analysis

Analyses were run by using SPSS 13.0 (SPSS Inc, Chicago, IL). χ^2 analysis was used to compare the intervention and control groups on baseline demographics. Insurance status was divided into uninsured versus insured (which included traditional indemnity, managed care, and state Medicaid). Moderate and severe acute severity categories were combined because of their low frequency and greater likelihood that ED care was required. Chronic severity categories were reduced to intermittent versus persistent, given that guidelines recommend that all patients with persistent asthma be on at least 1 controller medication. Subject age was divided into 3 groups (1–4, 5–14, and >14 years).

Outcome analyses were performed comparing the intervention and control (usual-care) groups, and exploratory analyses were performed for the intermittent and persistent-asthma subgroups within each of the 2 randomized groups. A change in score from the baseline measure was calculated for all confidence items. Because the change score calculated for the confidence items already controlled for baseline differences, a Student's *t* test was used to test for between-group differences. The urgent care/ED-visits, hospitalizations, and well-visit variables were dichotomized into 0 or ≥1 visits because the data were skewed. These outcomes were analyzed by using logistic regression, where the baseline value of the outcome was included in the model to adjust for any preintervention differences. QoL symptom scores were kept as continuous outcomes and analyzed by using linear-regression models, where the baseline measure was included to adjust for any differences present before the intervention. Day care and/or school days missed had very skewed nonnormal distributions; therefore, these outcomes were analyzed by using the Mann-Whitney test.

An a priori sample-size estimate was made on the basis of data from a study by Wasilewski et al,[25] which reported a mean number of ED visits in the previous year of 3.4 ± 3.84. To detect a difference of 1.0 at 80% power required a total sample size of 474. To detect a difference of 1.5 at 80% power required a total sample of

212. They also reported mean ED visits for a group not previously hospitalized as 1.70 ± 2.18. Using this estimate, the sample size required to detect a difference of 1.0 with 80% power was 156. The target goal for recruitment was also planned on the basis of an anticipated attrition rate of ~40% from loss to follow-up.

A posthoc power analysis based on the sample size available for this report found that at 14-day follow-up with 375 subjects and a rate of 12% return ED visits, the minimum detectable difference between the intervention and control groups is 11%. At 9 months with 218 subjects and a 23% return ED-visit rate, the minimum detectable difference is 17.5%.

RESULTS

Demographics

To date, 464 subjects have been enrolled and randomly assigned in the TEDAS Education Intervention study. Demographic variables are shown in Table 3; there are no significant differences between groups for the demographic variables shown or by ED center. Based on ED clinician judgment, 46% of the subjects had intermittent asthma and 54% had persistent asthma; 51% of the presenting acute episodes were mild, and 49% were moderate or severe acute episodes. The mean age of the subjects was 6.56 years (SD: 4.28; range: 1–18 years); 40% were ≤4 years.

Follow-up data are available for 214 (46%) of 464 subjects 14 days postintervention and 218 (47%) of 464 subjects 9 months postintervention, and the follow-up rate was the same in both groups. Preliminary results are reported up to 9 months.

TABLE 3 **TEDAS Educational Intervention Study Baseline Intervention and Control (Usual-Care) Group Characteristics ($n = 464$)**

Characteristic	Intervention Group, *n* (%)	Control Group, *n* (%)	Total, *N* (%)	*P*[a]
ED site number				.47
1	212 (80.6)	162 (80.6)	374 (80.6)	
2	19 (7.2)	21 (10.4)	40 (8.6)	
3	8 (3.0)	5 (2.5)	13 (2.8)	
4	24 (9.1)	13 (6.5)	37 (8.0)	
Age, y				.52
1–4	104 (39.5)	88 (43.8)	192 (41.4)	
5–14	144 (54.8)	105 (52.2)	249 (53.7)	
15–18	15 (5.7)	8 (4.0)	23 (5.0)	
Gender				.61
Female	99 (37.6)	71 (35.3)	170 (36.6)	
Male	164 (62.4)	130 (64.7)	294 (63.4)	
Ethnicity				.89
White	39 (14.8)	31 (15.4)	70 (15.1)	
Black	147 (55.9)	107 (53.2)	254 (54.7)	
Hispanic	74 (28.1)	59 (29.4)	133 (28.7)	
Other	2 (0.8)	4 (2.0)	6 (1.3)	
Primary language				.27
English	235 (90.4)	175 (87.5)	410 (89.1)	
Spanish	24 (9.2)	25 (12.5)	49 (10.7)	
Other	1 (0.4)	0 (0)	1 (0.2)	
Chronic severity				.88
Intermittent	119 (45.9)	90 (45.2)	209 (45.6)	
Persistent	140 (54.1)	109 (54.8)	249 (54.4)	
Acute severity				.34
Mild	128 (51.0)	105 (55.6)	233 (53.0)	
Moderate/severe arrest	123 (49.0)	84 (44.4)	207 (47.0)	
Insurance				.16
Uninsured	44 (16.7)	24 (12.1)	68 (14.7)	
Insured	219 (83.3)	175 (87.9)	394 (85.3)	
Previous ED visits				
No previous visits	72 (59)	67 (69)		

[a] χ^2 test for differences between the intervention and control groups.

Health Care Utilization

At baseline, the 2 groups showed no differences in the number of ED visits or hospitalizations in the previous year. Urgent care/ED visits and hospitalizations were not significantly different between the groups 14 days or 9 months postintervention. Among those for whom we have data at both baseline and 9 months, 72 (59%) of 122 subjects in the intervention group and 67 (70%) of 96 subjects in the control group had no prior ED visits at baseline. At 9 months' follow-up, 4% of subjects in the intervention group and 9% of subjects in the control group had ≥2 ED visits, and 15.3% of subjects in the intervention group and 22.4% of subjects in the control group had ≥1 visit. Those whose chronic asthma severity was classified as mild intermittent had significantly fewer ED/urgent care visits 9 months postintervention than those in the control group (odds ratio [OR]: 0.32; 95% confidence interval [CI]: 0.12–0.88). Similar differences were not found in the persistent-asthma group.

A greater proportion of subjects in the control group reported having well-asthma visits at baseline. Nine months postintervention, a significantly greater proportion of subjects in the intervention group reported having well-asthma visits (OR: 1.85; 95% CI: 1.05–3.39) (Table 4).

School and/or day care days missed did not differ significantly between the groups or at any of the follow-up time points. The mean at baseline for school days missed was 2.98 days (SD: 5.31 days; $n = 180$) for the intervention group and 2.83 days (SD: 3.67 days; $n = 131$) for the control group.

There were only 5 calls to the telephone hot line during the whole study period, including one that was a medication-refill request.

Parent/Caregiver Confidence

Although parents/caregivers rated their confidence as high in general in managing their child's asthma at baseline, they had lower confidence in controlling or preventing acute symptoms and managing acute episodes without visiting a physician (Table 2). At the 14-day follow-up, caregivers for the intervention group reported significant improvements in confidence in preventing asthma symp-

TABLE 4 **TEDAS Educational Intervention Study Health Care Utilization: Intervention and Control Groups at Baseline and 9-Month Follow-up**

Variable	Baseline (Past Year), % (95% CI)	9 mo (Past 3 mo), % (95% CI)	OR (95% CI)
Total No. of ED visits (all severities)			0.68 (0.34–1.33)
Intervention	69 (63–75)	17 (12–22)	
Control	65 (58–72)	23 (17–29)	
ED visits for intermittent asthma			0.32 (0.12–0.88)[a]
Intervention group		14 (10–18)	
Control group		34 (27–41)	
ED visits for persistent asthma			1.35 (0.51–3.58)
Intervention group		20 (15–25)	
Control group		15 (10–20)	
Urgent doctor visits			1.60 (0.91–2.81)
Intervention group		46 (37–55)	
Control group		49 (28–48)	
Hospitalizations, asthma			1.50 (0.50–4.49)
Intervention group	9 (6–13)	9 (6–13)	
Control group	6 (3–9)	6 (3–9)	
Well-asthma visits			1.85 (1.05–3.39)[a]
Intervention group	42 (36–48)	46 (40–52)[a]	
Control group	53 (46–60)[a]	34 (27–41)	

[a] Significant.

toms and keeping symptoms from getting worse versus the control-group caregivers. Both groups had some increase in their confidence to stop an acute episode without visiting a physician, and there was no significant difference between groups for this item. Mean scores for confidence items reported at 14 days were 3.59 (SD: 1.35) for preventing the child from getting symptoms, 3.88 (SD: 1.13) for preventing symptoms from getting worse, 3.38 (SD: 1.26) for stopping symptoms without seeing a physician, and 4.33 (SD .97) for overall confidence in caring for the child's asthma.

Symptoms/QoL

At baseline the 2 groups had similar ITG-CASF scores with the exception of significantly lower functional limitation scores for the intervention group. The scores indicate that both groups had recently experienced inadequate asthma control. The intervention group had significantly lower family-adjustment scores at 14 days ($z = 2.82$; $P < .005$), suggesting that families in this group have had to make more adjustments as a result of the child's asthma compared with those in the control group. The 2 groups did not differ significantly in any of the other ITG scales (daytime or nighttime symptoms, functional limitations, or interference from therapy) 14 days or 9 months postintervention (Table 5).

TABLE 5 **TEDAS Educational Intervention Study Baseline and 14-Day and 9-Month Follow-up ITG-CASF Item Responses**

Variable	Baseline, Mean (SD)	14 d, Mean (SD)	9 mo, Mean (SD)
Daytime symptoms			
Intervention group	52.9 (29.3)	81.6 (26.4)	75.1 (27.4)
Control group	57.9 (29.3)	80.7 (23.8)	73.7 (27.9)
Nighttime symptoms			
Intervention group	33.2 (25.6)	74.5 (29.2)	67.9 (28.7)
Control group	38.2 (28.9)	74.8 (28.3)	67.5 (29.8)
Functional limitation			
Intervention group	56.3 (26.6)	78.3 (27.6)	80.6 (22.6)
Control group	62.7 (26.9)[a]	82.1 (21.7)	75.1 (26.4)
Inhaler/treatment interference			
Intervention group	59.2 (36.6)	73.5 (34.5)	73.1 (34.5)
Control group	57.1 (35.6)	76.9 (31.5)	76.6 (31.1)
Family adjustment			
Intervention group	70.9 (33.7)	82.5 (28.5)	84.8 (24.1)
Control group	66.4 (35.3)	87.8 (25.1)[b]	83.7 (26.7)
Total ITG-CASF score			
Intervention group	54.8 (22.3)	78.8 (23.7)	77.1 (21.8)
Control group	57.1 (23.6)	80.4 (20.4)	74.9 (23.4)

[a] $P = .03$

[b] $t = -2.82$; $P = .005$.

DISCUSSION

Here we have described the development and ongoing pilot evaluation of an ED-based asthma self-management intervention for children with asthma and their families. The intervention was tailored on the basis of a number of characteristics of the child's asthma and provided in English or Spanish. Tailored communications have been used increasingly in educational and behavioral interventions, and there is growing evidence of their increased effectiveness.[26,27] More research is needed regarding what characteristics are most important to use to individualize interventions. In this study, asthma educators typically spent ~30 minutes with each child and caregiver delivering the intervention in the ED. The printed summary and asthma action plan were provided at the time of the ED visit to help assure retention of the messages, particularly given the stress and fatigue likely experienced by many families of these ill children. The

use of a laptop and tablet computer permitted portability of the intervention in the busy ED setting. The semi-structured content with tailoring on the basis of category ratings allowed standardization of the intervention across various educators.

Self-efficacy, or confidence, is a judgment of a person's capability to accomplish a certain level of performance and is considered a determinant of self-management behavior according to social cognitive theory.[17] Self-efficacy has been shown to relate to asthma morbidity and is amenable to intervention.[15,28–30] At the 14-day follow-up, confidence to prevent and keep asthma symptoms from getting worse improved more in the intervention group than in the control group. Although a significant increase in confidence levels for 2 items was observed in the intervention group at the 14-day follow-up, both groups reported overall confidence in managing asthma exacerbations, and neither group expressed high levels of confidence regarding stopping an attack without seeing a doctor.

This educational intervention study shows insignificant differences in asthma symptom control or QoL in a heterogeneous population of children with asthma seen during an acute ED visit. It is important to note that the majority of subjects were judged to have intermittent or mild asthma, and more than one third were very young children (<5 years of age). Both the intervention and control groups showed significant improvement in QoL and symptom scores 14 days after the ED visit (likely reflecting the resolution of the acute episode), and this improvement was sustained in both groups at 9 months. Just over half of the acute episodes were mild and potentially could have been handled in the primary care office or at home. It is possible that the intervention may be most appropriate in a more selected age or chronic severity group. However, it is difficult even in a large pediatric ED network to access adequate numbers of subjects to evaluate such subgroups. A small study of 61 pediatric asthma patients with multiple ED visits revealed that providing education and linking patients to trained primary care providers resulted in improved asthma care and economic outcomes.[31]

Although a written rescue plan is recommended for all asthma patients, many patients continue to report not receiving an action plan or not being given guidance about handling acute episodes.[13,14,32,33] Little work has been done to evaluate how well families use such plans and their reasons for nonuse. Some evidence supports patients' deficits in knowledge and decision-making skills to handle acute asthma.[24] Our experience (as well as published literature) indicates that many families bring children in for emergency asthma care because of a delayed response to early warning signs or a failure to use guideline-based written asthma action plans and intervene accordingly.[34–36]

In the TEDAS surveillance portion of the study, only 15% of the families reported having a written asthma action plan on presentation to the ED. A few studies suggested a positive perceived value of written asthma action plans and impact on asthma self-management behavior for children and their families.[33,37,38] The role of the action plan in facilitating physician-patient communication needs additional study.

Overall, rates of all health care utilization in the 9 months after the initial ED visit were similar in both the intervention and control groups, although there were fewer ED visits among subjects in the intervention group who had mild intermittent asthma. Although a greater proportion of subjects in the intervention group reported well-asthma visits than subjects in the control group, it was still <50%. The ability to link children with ED visits back to primary care for well-asthma care remains a challenge, and even when follow-up occurs, the impact on subsequent asthma control remains uncertain. Cabana et al[39] observed that 17% of a cohort of 561 children had a repeat ED visit for asthma within 1 year of an initial visit for asthma. Almost two thirds of the children (66%) did not receive outpatient follow-up for asthma within 30 days of an ED visit for asthma. However, outpatient visits for asthma within 30 days of the ED visit were found to be associated with an increased likelihood of repeated ED visits within 1 year. Grossman et al[40] reported a reduction in ED visits over 6 months after an intervention during an ED visit to help link Medicaid-recipient children with asthma to a primary care provider, but that intervention was not accompanied by any difference in the number of primary care visits. Similarly, Petersen et al[41] found that only 6% of children made a follow-up visit to their primary care physician after an ED visit despite an ED intervention that provided follow-up guidance. Several studies reported higher rates of keeping a follow-up appointment after an ED visit if an appointment with the primary care provider was made during the ED visit.[42,43] Appointments for primary care follow-up were not provided in the ED in this study.

It is also unclear how successful it is to have ED clinicians prescribe asthma-controller medication. Rates of adherence have been low, with the National Cooperative Inner-City Asthma Study finding a self-reported adherence rate to the prescribed home regimen of only 34% at follow-up.[42]

Study Limitations

The study sample was representative of the total ED asthma population based on our surveillance database; however, the sample size is still somewhat limited because of improvement in symptom scores among both groups, relatively low rates of morbidity, and significant loss to follow-up over the course of the study.[44] Many subjects were unable to be contacted despite obtaining multiple contact numbers and making multiple attempts

to reach them. Follow-up is continuing for subjects who have been enrolled in the last 9 months and includes additional secondary outcome measures.

Medical chart reviews of health care utilization were unavailable from community hospitals not participating in the network, and therefore it was not possible to discern possible underreporting by caregivers. Information regarding the continuation of controller-medication use among those with persistent asthma is not available at this time but will be collected at the 12-month follow-up. The community includes a large number of primary care providers, and it is unclear whether all are following national asthma guidelines or providing positive reinforcement for well-asthma visits. Intervention staff mailed copies of action plans and tailored summaries to the primary care physicians; however, these clinicians received no training regarding the use of these materials to reinforce family education.

CONCLUSIONS

This ED-based educational intervention had a significant impact on the level of parent/guardian confidence to manage the child's asthma in the first 14 days after the ED encounter and resulted in increased well-child visits at 9 months as compared with a control group. We expect to continue follow-up for subjects currently enrolled in the intervention study. Future studies should compare the impact of ED-based intervention with minority subjects compared with white subjects, because we had a limited sample of white subjects in this study. Future studies will compare whether there are baseline differences between those who receive the intervention in English and those who receive it in Spanish.

Although differences in ED-revisit rates were observed in this study when the cohort was stratified by asthma severity (improved within the intermittent group), the impact of the intervention on a heterogeneous group of children of all severities will require a larger sample size to make adequately powered comparisons. Similarly, differences may be observed among children at different age levels but will also require adequate sample sizes to make comparisons. We have expanded our measure to include more questions regarding the families' decision to come to the ED rather than contact the primary care provider. Other areas to be investigated further are the value of the written asthma action plan, reasons that families prefer clinician evaluation with mild acute episodes, and the role of the primary care provider in reinforcing self-management over time.

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REFERENCES

1. Dey AN, Bloom B. Summary health statistics for U.S. children: National Health Interview Survey, 2003. *Vital Health Stat 10.* 2005;(223):1–78.
2. Gergen PJ. Understanding the economic burden of asthma. *J Allergy Clin Immunol.* 2001;107(5 suppl):S445–S448
3. Kennedy S, Stone A, Rachelefsky G. Factors associated with emergency department use in asthma: acute care interventions improving chronic disease outcomes. *Ann Allergy Asthma Immunol.* 2003;90:45–50
4. Akinbami LJ, Schoendorf KC. Trends in childhood asthma: prevalence, health care utilization, and mortality. *Pediatrics.* 2002;110:315–322
5. Aligne CA, Auinger P, Byrd RS, Weitzman M. Risk factors for pediatric asthma: contributions of poverty, race, and urban residence. *Am J Respir Crit Care Med.* 2000;162:873–877
6. Boudreaux ED, Emond SD, Clark S, Camargo CA. Race/ethnicity and asthma among children presenting to the emergency department: differences in disease severity and management. *Pediatrics.* 2003;111(5). Available at: www.pediatrics.org/cgi/content/full/111/5/e615
7. Lieu TA, Lozano P, Finkelstein JA, et al. Racial/ethnic variation in asthma status and management practices among children in managed Medicaid. *Pediatrics.* 2002;109:857–865
8. Silver EJ, Crain EF, Weiss KB. Burden of wheezing illness among U.S. children reported by parents not to have asthma. *J Asthma.* 1998;35:437–443
9. Eggleston PA, Malveaux FJ, Butz AM, et al. Medications used by children with asthma living in the inner city. *Pediatrics.* 1998;101:349–354
10. Homer CJ, Szilagyi P, Rodewald L, et al. Does quality of care affect rates of hospitalization for childhood asthma? *Pediatrics.* 1996;98:18–23
11. Riekert KA, Butz AM, Eggleston PA, Huss K, Winkelstein M, Rand CS. Caregiver-physician medication concordance and undertreatment of asthma among inner-city children. *Pediatrics.* 2003;111(3). Available at: www.pediatrics.org/cgi/content/full/111/3/e214
12. National Heart, Blood, and Lung Institute; National Asthma Education and Prevention Program. *Expert Panel Report 2: Guidelines for the Diagnosis and Management of Asthma*. Bethesda, MD: National Institutes of Health; 1997. NIH publication No. 97-4051
13. National Asthma Education and Prevention Program. Expert panel report: guidelines for the diagnosis and management of asthma update on selected topics—2002 [published correction appears in *J Allergy Clin Immunol*. 2003;111:466]. *J Allergy Clin Immunol.* 2002;110(5 suppl):S141–S219
14. Pediatric Asthma Committee. *Pediatric Asthma: Promoting Best Practice Guide for Management of Asthma in Children*. Milwaukee, WI: American Academy of Allergy, Asthma and Immunology; 1999
15. Guevara JP, Wolf FM, Grum CM, Clark NM. Effects of educational interventions for self management of asthma in children and adolescents: systematic review and meta-analysis. *BMJ.* 2003;326:1308–1309
16. Haby MM, Water E, Robertson CF, Gibson PG, Ducharme FM. Interventions for educating children who have attended the emergency room for asthma. *Cochrane Database Syst Rev.* 2001;(1):CD001290

17. Bandura A. *Self-Efficacy: The Exercise of Control*. New York, NY: W.H. Freeman; 1997
18. Clark NM, Valerio MA. The role of behavioural theories in educational interventions for paediatric asthma. *Paediatr Respir Rev.* 2003;4:325–333
19. Clark NM, Partridge MR. Strengthening asthma education to enhance disease control. *Chest.* 2002;121:1661–1669
20. Prochaska JO, Velicer WF. The transtheoretical model of health behavior change. *Am J Health Promot.* 1997;12:38–48
21. Shegog R, Bartholomew LK, Craver J, et al. Development of an expert system knowledge base: a novel approach to promote guideline congruent asthma care. *J Asthma.* 2004;41:385–402
22. Bukstein DA, Mcgrath MM, Buchner DA, Landgraf J, Goss TF. Evaluation of a short form for measuring health-related quality of life among pediatric asthma patients. *J Allergy Clin Immunol.* 2000;105:245–251
23. Gorelick MH, Brousseau DC, Stevens MW. Validity and responsiveness of a brief, asthma-specific quality-of-life instrument in children with acute asthma. *Ann Allergy Asthma Immunol.* 2004;92:47–51
24. Kolbe J, Vamos M, James F, Elkind G, Garrett J. Assessment of practical knowledge of self-management of acute asthma. *Chest.* 1996;109:86–90
25. Wasilewski Y, Clark NM, Evans D, Levison MJ, Levin B, Mellins RB. Factors associated with emergency department visits by children with asthma: implications for health education. *Am J Public Health.* 1996;86:1410–1415
26. Bartholomew LK, Parcel GS, Kok G, Gottlieb NH. Intervention mapping step 3: producing program components and materials. In: *Intervention Mapping: Designing Theory and Evidence-Based Health Promotion Programs*. Mountain View, CA: Mayfield Publishing Company; 2001
27. Skinner CS, Campbell MK, Rimer BK, Curry S, Prochaska JO. How effective is tailored print communication? *Ann Behav Med.* 1999;21:290–298
28. Bursch B, Schwankovsky L, Gilbert J, Zeiger R. Construction and validation of four childhood asthma self-management scales: parent barriers, child and parent self-efficacy, and parent belief in treatment efficacy. *J Asthma.* 1999;36:115–128
29. Grus CL, Lopez-Hernandez C, Delamater A, et al. Parental self-efficacy and morbidity in pediatric asthma. *J Asthma.* 2001; 38:99–106
30. Hanson J. Parental self-efficacy and asthma self-management skills. *J Soc Pediatr Nurs.* 1998;3:146–154
31. Higgins JC, Kiser WR, McClenathan S, Tynan NL. Influence of an interventional program on resource use and cost in pediatric asthma. *Am J Manag Care.* 1998;4:1465–1469
32. Farber HJ, Johnson C, Beckerman RC. Young inner-city children visiting the emergency room (ER) for asthma: risk factors and chronic care behaviors. *J Asthma.* 1998;35:547–552
33. Lieu TA, Quesenberry CP Jr, Capra MA, Sorel ME, Martin KE, Mendoza GR. Outpatient management practices associated with reduced risk of pediatric asthma hospitalization and emergency department visits. *Pediatrics.* 1997;100:334–341
34. Wilson SR, Mitchell JH, Rolnick S, Fish L. Effective and ineffective management behaviors of parents of infants and young children with asthma. *J Pediatr Psychol.* 1993;18:63–81
35. Munro JF, Haire-Joshu D, Fisher EB, Wedner HJ. Articulation of asthma and its care among low-income emergency care recipients. *J Asthma.* 1996;33:313–325
36. Mansour ME, Lanphear BP, Dwitt TG. Barriers to asthma care in urban children: parent perspectives. *Pediatrics.* 2000;106: 512–519
37. Gillies J, Barry D, Crane J, et al. A community trial of a written self management plan for children with asthma. Asthma Foundation of NZ Children's Action. *N Z Med J.* 1996;109:30–33
38. Dinakar C, Van Osdol TJ, Wible K. How frequent are asthma exacerbations in a pediatric primary care setting and do written asthma action plans help in their management? *J Asthma.* 2004;41:807–812
39. Cabana MD, Bruckman D, Bratton SL, Kemper AF, Clark NM. Association between outpatient follow-up and pediatric emergency department asthma visits. *J Asthma.* 2003;40:741–749
40. Grossman LK, Rich LN, Johnson C. Decreasing nonurgent emergency department utilization by Medicaid children. *Pediatrics.* 1998;102:20–24
41. Petersen DL, Murphy DE, Jaffe DM, et al. A tool to organize instructions at discharge after treatment of asthmatic children in an emergency department. *J Asthma.* 1999;36:597–603
42. Leickly FE, Wade SL, Crain E, Kruszon-Moran D, Wright EC, Evans R 3rd. Self-reported adherence, management behavior, and barriers to care after an emergency department visit by inner city children with asthma. *Pediatrics.* 1998;101(5). Available at: www.pediatrics.org/cgi/content/full/101/5/e8
43. Zorc JJ, Scarfone RJ, Li Y, et al. Scheduled follow-up after a pediatric emergency department visit for asthma: a randomized trial. *Pediatrics.* 2003;111:495–502
44. Macias CG, Caviness AC, Sockrider MM, et al. The effect of acute and chronic asthma severity on pediatric emergency department utilization. *Pediatrics.* 2006;117(4 suppl):S86–S95

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