

Developing, Implementing, and Evaluating a School-Centered Asthma Program: Step-Up Asthma Program



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What is already known about this topic? Asthma is a problem in school-aged children and contributes to poor school performance.

What does this article add to our knowledge? Developing a successful school-centered asthma program involves collaboration between school nurses, school administration, and local providers. This report describes a school-centered asthma program that reduced asthma morbidity and is being disseminated to additional school districts, demonstrating sustainability.

How does this study impact current management guidelines? The Step-Up Asthma Program applies National Asthma Education and Prevention Program-National Heart, Lung, and Blood Institute guidelines for evidence-based programs for children with asthma.

BACKGROUND: Asthma is a significant health problem among children: 9.3% of children in the United States suffer from asthma. Children with persistent asthma in inner cities have increased health care utilization, worse health care outcomes, increased school absences, and worse academic performance.

OBJECTIVE: We sought to create and evaluate a school-centered asthma program to reduce asthma morbidity and create asthma-friendly schools.

METHODS: We developed, implemented, and evaluated the Step-Up Asthma Program, a multidisciplinary school-centered asthma program. The program was designed as an outreach

program with asthma counselors as a bridge between subspecialty asthma care, primary care providers, school nurses, and children with asthma. The core components of the program involve identifying children with asthma, providing evidence-based asthma education, and case management. Students' asthma knowledge, inhaler technique, and number of asthma exacerbations were evaluated over a 2-year period (2010-2012) as a pre-post study.

RESULTS: A total of 252 students enrolled in the Step-Up Asthma Program over a 2-year period. Significant improvements were noted in number of asthma action plans, rescue

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Abbreviations used

DPS- Denver Public Schools

HRA- Health Risk Assessment

KA- Kickin' Asthma

OAS- Open Airways for Schools

medications at school, and asthma controllers. Program participants had significant improvements in asthma knowledge scores ($P < .001$) and inhaler technique ($P < .0001$). There were significant reductions in *asthma exacerbations* defined as oral steroid courses, urgent care visits, and missed school days ($P < .05$) that persisted over time.

CONCLUSIONS: A guideline-based school-centered asthma program can significantly reduce asthma morbidity. The asthma counselor is the cornerstone of the program, providing asthma education and care coordination. The Step-Up Asthma Program is in its 10th year, and we believe the key elements of this program can be implemented in other school systems. © 2016 American Academy of Allergy, Asthma & Immunology (J Allergy Clin Immunol Pract 2016;4:972-9)

Key words: Asthma; Schools; School nursing; Case Management

Asthma is a prevalent chronic disease that affects 9.3% of all children in the United States (6.8 million).¹ Asthma carries an annual cost of \$56 billion in the United States in direct costs, lost school/work, and premature deaths (185 deaths in children).² Every day, 36,000 students miss school because of their asthma.¹ Inner-city and minority children are more likely to have worse health care outcomes, including increased emergency department visits, hospitalizations, and death from asthma.^{3,4} Students with persistent asthma demonstrate increased absences and worse performance on standardized testing.⁵ The Denver Public Schools (DPS) estimated that asthma prevalence rates range between 4% and 30% (district average, 11.8%), depending on the school (Donna Shocks, MSN, RN, CNS, unpublished data, June 2012). DPS is a large urban school district with 155 schools serving 84,424 students (2012 October count). Most DPS students are from ethnic/racial minorities (58% Hispanic, 15% black) and low socioeconomic backgrounds (72% of students qualify for free or reduced lunch). Neighborhoods in Denver's inner-city have high absence rates and high hospital discharge rates correlating with high rates of uncontrolled asthma.⁶

The Expert Panel Report 3 from the National Asthma Education and Prevention Program-National Heart, Lung, and Blood Institute guidelines recommend evidence-based programs for children with asthma.⁷ Because of a recognized need by DPS nursing, we developed a multidisciplinary school-centered asthma program called the Step-Up Asthma Program. We modeled the Step-Up Asthma Program on various successful programs.⁸⁻¹¹ The initial intent of the program was as a guidelines-based outreach program involving asthma subspecialists, DPS, students, parents, and primary care providers, all linked through the asthma counselors. The goals of the Step-Up Asthma Program included assessing DPS asthma prevalence, encouraging an asthma-friendly school environment, reducing asthma-related school absences, helping families find providers, and establishing systems for sustainability. The Colorado

Department of Public Health and Environment provided financial support to develop a program to improve asthma control and reduce absences for children in DPS; a secondary aim was to evaluate this under the auspices of an institutional review board. We hypothesized that implementation of the Step-Up Asthma Program in DPS would improve asthma control, decrease asthma exacerbations, and improve asthma knowledge.

METHODS

We collaborated with DPS to form an asthma partnership eventually known as the Step-Up Asthma Program, and this program was evaluated as a preintervention and postintervention study. The Step-Up Asthma Program was reviewed and approved by the National Jewish Health Institutional Review Board, the Colorado Multiple Institutional Review Board, and the DPS Student Health and Research Committee. Parents gave informed consent to participate in the program at the time of enrollment.

Program development

We formed a partnership with DPS nursing leadership who assigned a school nurse liaison as the link between DPS and the Step-Up Asthma Program team. In 2006-2007, we performed a survey of school nurses to better understand asthma needs in the schools. A pilot program was introduced for the academic year 2007-2008, followed by a trial of Open Airways for Schools (OAS) in 2008-2009. The Step-Up Asthma Program was piloted in 3 schools in 2009. The subsequent analyses include students enrolled in the Step-Up Asthma Program during the 2010-2011 or 2011-2012 school years and who were followed through the end of the 2011-2012 school year. The Step-Up Asthma Program is a comprehensive, school-centered, care coordination, and asthma educational program for elementary and middle-school age children (Figure 1). The Step-Up Asthma Program uses lay individuals (asthma counselors) trained to provide asthma education and implement care coordination based on the Inner-City Asthma Model of asthma counselors.⁸ The program has 7 primary components: (1) case identification; (2) asthma risk and control assessment using validated instruments (Health Risk Assessment [HRA]; and asthma control tests) with feedback to families and health care providers; (3) care coordination engaging the student, family, school nurse, and health care provider; (4) asthma self-management skills training; (5) evidence-based asthma educational curriculum: OAS and Kickin' Asthma (KA); (6) asthma education and skills training for school nurses and ancillary staff; and (7) a safety net (provision of controller medication) for children needing services while medical homes are established.

The core staff during this time period included 3 asthma counselors from the Denver community, modeled after the National Cooperative Inner-City Asthma Study.⁸ The asthma counselors received extensive asthma education and management training, including the American Lung Association's OAS and Colorado Asthma Coalition's Reach the Peak asthma educator course. Each asthma counselor provided care coordination and education at 5 schools, covering 75 to 100 children. A medical advisory committee composed of asthma specialists and community pediatricians provided medical oversight.

Enrollment

School selection was based on socioeconomic need (percentage of students receiving free and reduced lunch), asthma prevalence, and percentage of minority students. We recruited students at school events such as registration and asthma and back-to-school

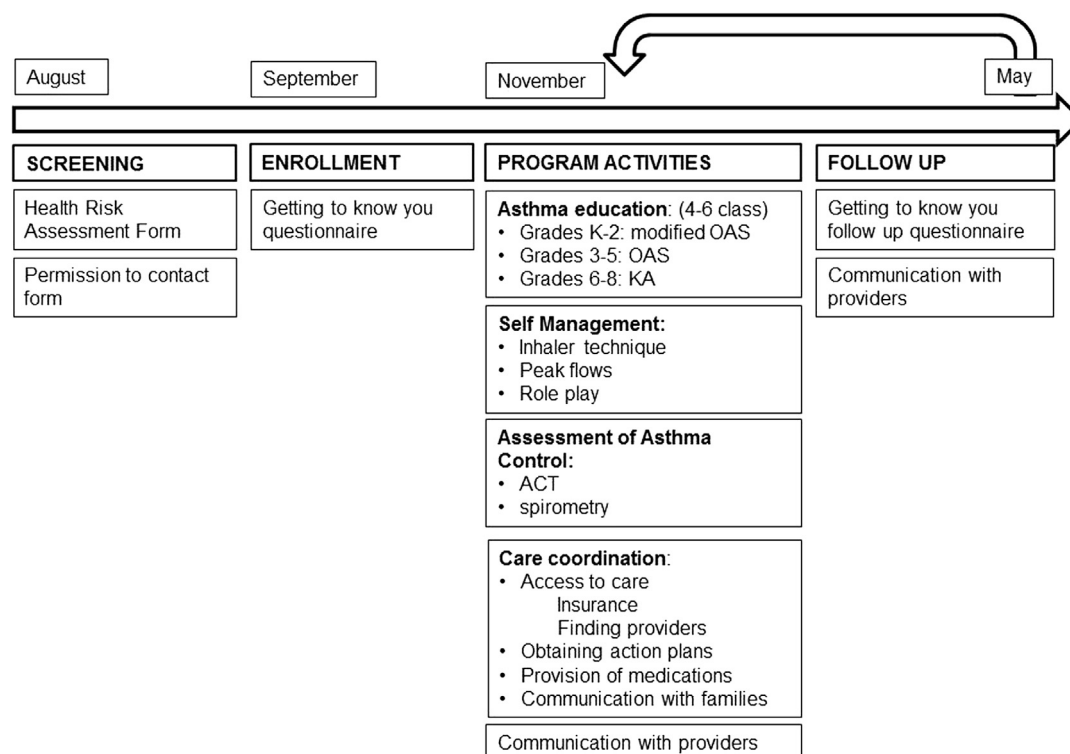


FIGURE 1. Components and timeline of the Step-Up Asthma Program. Students were screened for asthma in the early fall, were enrolled into the Step-Up Asthma Program in October-November, and completed program activities through the winter/spring. Students who continued into the second year of the program repeated all program activities except for the didactic asthma education (KA or Open Airways). ACT, Asthma Control Test.

nights and through flyers, letters from school nurses, and direct referral. Students with asthma were identified via parent/guardian report and subsequently screened with an HRA survey and a permission to contact form. We used a customized HRA, a validated tool created for the Breathmobile program in Los Angeles.⁹ HRA scores ranged from 0 (“no asthma”) to 5 (“uncontrolled asthma-moderate to severe”). Asthma counselors established contact with families of children who scored a 3 (active asthma) or higher on the HRA or students who were otherwise referred to the program, described the Step-Up Asthma Program, and obtained informed consent to participate. Enrollment was limited on the basis of the number of asthma counselors, and asthma counselor caseloads were capped at 75 to 100 students. Once enrolled, students participated in the comprehensive asthma education program during the school day and additional care coordination visits (minimum of 4) with the student and communication to the family and, when appropriate, the physician took place. The current analysis evaluates only the first 2 years of participation during the academic school years 2010-2012.

Program implementation

After enrollment, we sent the primary care provider a brief letter describing the Step-Up Asthma Program and a request for a school asthma action plan. Students classified as possible asthma or poorly controlled asthma prompted referral to the primary care provider for evaluation and management. If a student lacked health care coverage, the Step-Up Asthma Program team guided families through the

enrollment process. If a student lacked an identified health care provider, the Step-Up Asthma Program medical staff provided guideline-based asthma treatment including provision of a controller medication while assisting the family in locating a medical home. Families were empowered to advocate for their children at asthma visits. We used the newly developed Colorado School Asthma Care Plan and revised it with feedback from DPS nurses and local providers (see Supplement 1 in this article's Online Repository at www.jaci-inpractice.org). Midsummer back-to-school reminders with the Colorado School Asthma Care Plan facilitated timely completion of forms.

To assess current asthma control, we used validated tools: the Asthma Control Test¹² for children 12 years and older and the Childhood Asthma Control Test¹³ for children aged 5 years to 11 years. Parents and/or students performed the test at enrollment and every 3 months during the school year. Scores of 19 or lower prompted additional steps to improve control. We also created the Getting to Know You Questionnaire, adapted from previous work,¹⁴ to obtain additional asthma history, including demographic characteristics, asthma management, asthma exacerbations, and asthma triggers. This questionnaire was obtained at baseline, and the Getting to Know You Follow-Up was administered at the end of each year for the duration of the program.

Asthma counselors provided 2 evidence-based educational programs shown to improve asthma outcomes: OAS (grades 3-5; 6 sessions) and KA (grades 6-8; 4 sessions).¹⁵⁻¹⁷ The asthma counselors presented age-adapted concepts from OAS to students in kindergarten to second grade. A preasthma and postasthma

education questionnaire was administered to evaluate effectiveness. OAS scores can range from 0 to 40 (40 being the best possible score), and the evaluation covers questions that assess asthma self-management skills and recognizing asthma triggers. We used a modified KA score system at baseline and at follow-up (3 months) evaluating symptom frequency, health care utilization, activity limitation, and medication use, with lower scores indicating better control. The asthma education and self-management lessons were supported with asthma toolkits (peak flowmeter, holding chamber for inhaled medication, and written educational material in English and/or Spanish) for each student. Students were graded on inhaler technique using an inhaler device assessment tool at the beginning and end of the program, with scores ranging from 0 (completely inaccurate technique) to 5 (completely accurate technique). The asthma counselors trained the students on proper self-management skills and periodically reassessed and retrained important skills throughout the program.

Professional development

The Step-Up Asthma Program promoted school nurse attendance at annual professional development opportunities about asthma: (1) National Jewish Health's Annual Allied Health Update on Asthma and Allergies; (2) DPS' nurses training and workshop meetings; (3) Colorado American Lung Association's Reach the Peak Asthma Educator Course; and (4) "Train the Trainer" school-centered workshops.

Statistical methods

This was a preintervention/postintervention study design with implementation of the Step-Up Asthma Program as the intervention. Paired *t* tests were used to compare pre to post OAS and KA scores and to compare pre to post inhaler technique scores. Linear regressions were used to adjust score differences for sex, ethnicity (black, Hispanic, white, or other), insurance (Children's Health Program +, Medicaid, Private, Other, or None), HRA score (3, 4, or 5), and number of controller medications used per week (0, 1-5, >5).

Three outcome variables (number of steroid bursts, number of urgent care visits, and number of missed school days) were modeled with a Poisson distribution using generalized estimating equations in SAS (PROC GENMOD). The baseline characteristics were included in the generalized estimating equations. Number of hospitalizations was similarly modeled using generalized estimating equations with a binary distribution. Outcome data were collected at baseline, at 1-year follow-up, and at 2-year follow-up. To account for repeated measures in these data, a compound symmetric covariance structure was used. Different covariance structures were also considered, but did not lead to better model fit. The predictor of interest was visit (baseline, 1-year follow-up, 2-year follow-up). Visit was modeled as a class variable. Covariates included in the models were child sex, child ethnicity, insurance, HRA score, and number of times controller medications were used per week. School was considered in the models, but either did not allow the models to converge or was insignificant. Missed school days were categorized as follows: 0 = none, 1 = less than 5, 2 = between 5 and 10, 3 = more than 10. This categorization was necessary due to differences in how data were collected across the years. Subjects were required to have a baseline visit as well as at least 1 follow-up visit in order to be included in the models.

Log linear model estimates are reported as geometric means and percent relative changes. Logistic model estimates are reported as

TABLE I. Demographic characteristics and baseline data for 252 children enrolled in the Step-Up Asthma Program with baseline and at least 1 follow-up visit

Characteristic	n (%)		
	Step-Up Asthma Program participants	Step-Up Asthma Schools	DPS
Sex			
Male	146 (58)		27,567 (51)
Female	106 (42)		26,427 (49)
Ethnicity			
Other	24 (9.5)	656 (8)	3,845 (7)
Black/African American	80 (32)	1822 (21)	6,639 (12)
Hispanic/Latino	134 (53)	4737 (56)	31,759 (59)
White (not Hispanic)	14 (5.5)	1281 (15)	11,751 (22)
Insurance status			
Medicaid	148 (59)		
CHP+/CICP/CHS	13 (5)		
Private	66 (26)		
Other	10 (4)		
No health insurance	15 (6)		
HRA scores (scores can range from 0 to 5; 4 and 5 indicated uncontrolled asthma)			
<3	3 (1)		
3	140 (56)		
4	19 (8)		
5	89 (35)		
Missing	1		
Prescribed a controller			
Yes	115 (46)		
No	137 (54)		
Used oral steroids last year			
Yes	78 (31)		
No	174 (69)		
If used oral steroids, how many times?			
1-2	63 (81)		
3-5	15 (19)		
Emergency department/urgent care visits in last year			
Yes	70 (28)		
No	182 (72)		
If went to urgent care/emergency department, how many times?			
1	40 (57)		
2-4	27 (39)		
5-7	3 (4)		
Hospital admission in last year			
Yes	17 (7)		
No	234 (93)		
Missing	1		
If admitted last year, how many times?			
1	13 (76)		
2	2 (12)		
3	2 (12)		

CHP, Children's Health Program; CHS, Community Health Service; CICP, Colorado Indigent Care Program.

Demographic data for the Step-Up Asthma Schools and all of DPS (grades K-8) are included for comparison. "Missing" indicates the number of students who did not have a result for this variable.

TABLE II. Knowledge scores summarized as mean $\pm$ SD before and after intervention with the Step-Up Asthma Program

Knowledge Score	n	Baseline	Post Step-Up Asthma Program	Difference	P value*
Inhaler technique	233	1.88 $\pm$ 1.14	4.64 $\pm$ 0.79	+2.76 $\pm$ 1.18	<.0001
OAS scores	89	27.11 $\pm$ 3.64	34.22 $\pm$ 3.57	+7.11 $\pm$ 4.49	<.0001
KA scores	66	21.44 $\pm$ 6.33	18.47 $\pm$ 6.75	-2.97 $\pm$ 7.42	.0005

Inhaler technique scores presented for all students and range from 0 to 5 (perfect skills). OAS scores (for students in grades 3-5) can range from 0 to 40 (40 is best). KA scores (for students in grades 6-8) ranged from 9 to 37 before intervention and 10 to 33 postintervention.

*P value from paired *t* test.

predicted probabilities and odds ratios. All analyses were performed with SAS version 9.4. A 2-tailed *P* value of .05 was considered significant in all analyses.

RESULTS

Needs assessment and implementation

More than 85% of school nurses responded to a district-wide survey completed in 2006-2007. They noted a gap in continuity of asthma care for school-aged children, especially at the elementary school level where school nursing resources are limited. Health care resources varied between schools: some schools had access to school-based health clinics, whereas others had a school nurse on campus only 2 to 3 days per week. Other challenges to successful asthma management included (1) inconsistent reporting and tracking of students with asthma; (2) lack of access to preexercise and rescue medication; (3) exclusion from physical activities; (4) lack of efficient communication systems between the school, the family, and the health care provider; (5) ancillary staff ill-prepared to manage asthma symptoms; and (6) lack of school asthma treatment plans.

Demographic and baseline data

In 2010-2012, the Step-Up Asthma Program reached more than 8000 students in 15 schools. Parents reported a history of asthma in 996 students (prevalence of 12.4%) over the 2-year period, and 252 students enrolled in the program and were included in this analysis. Demographic and baseline data of participants are summarized in Table I and are compared with the Step-Up Asthma Schools as a whole and to all of DPS. Most children were male (58%), minorities (94.5%), and had public insurance (64%). Of the students enrolled, 123 (49%) had uncontrolled asthma (HRA scores of 4 or 5; scores can range from 0 to 5). Parents reported that 38% of children missed more than 10 days of school because of asthma in the preceding 12 months. Upon enrollment in the program, 46% of children reported using controller medication. In the preceding 12 months, 78 children (31%) needed at least 1 course of oral corticosteroids, 70 (28%) had emergency department or urgent care visits for asthma, and 17 (7%) were hospitalized for asthma.

Evaluation of intervention

There was a significant increase in the number of school asthma action plans and rescue medications at school and increase in controller medications prescribed. Inhaler technique, OAS scores, and modified KA scores improved significantly from baseline to the 1-year follow-up (Table II).

Students who participated in the Step-Up Asthma Program experienced decreased asthma exacerbations (Figure 2). Emergency department and urgent care visits, use of systemic corticosteroids, and missed school days all decreased significantly from baseline (Figure 2). A subset analysis of subjects with baseline and 2 follow-up years found similar results. Hospital admissions decreased significantly from baseline to the 1-year follow-up (*P* = .002), but baseline to 2-year follow-up was not significant (*P* = .2).

School-community outreach

More than 90 school staff members received asthma education annually, and 5 school nurses obtained Certified Asthma Educator status. Regional events with local sports personalities drew more than 300 participants.

DISCUSSION

The DPS Step-Up Asthma Program, a school-centered asthma program supported by an academic medical center, aimed to assess asthma prevalence, create asthma-friendly schools, reduce asthma exacerbations, and establish sustainability. The Step-Up Asthma Program started as an outreach program assessing school nursing needs around asthma, evolved into pilot programs to meet those needs, and ultimately became the current Step-Up Asthma Program with case identification, enrollment, asthma education, case management, and care coordination (Figure 1). We selected elementary and middle-school age students because they have less access to care and nursing support compared with the high school students who are supported by school-based health clinics in DPS.

Students had improved asthma knowledge scores and inhaler techniques (thereby improving medication delivery). Students enrolled in the Step-Up Asthma Program had fewer exacerbations (steroid courses, emergency department and urgent care visits, and missed school days), and this drop in exacerbations was sustained over the year following program enrollment. A nurse-centered program called Building Bridges also saw a significant, but smaller, decrease in school absences with streamlined asthma forms and asthma management.¹⁸ There was a significant decrease in asthma-related hospitalizations within the Step-Up Asthma Program, although this was not noted to be significant from baseline through year 2; this lack of significance is most likely due to the rare nature of hospitalizations (only 17 preintervention). As an outreach project, the study was not powered adequately to truly assess for significant differences in hospitalizations. Using parental report for exacerbations presents inherent problems and is a limitation of this study.¹⁹

We believe that the asthma counselors are the cornerstone of the Step-Up Asthma Program in that they provide education and culturally sensitive care coordination that links families, schools, and providers. Because of the nature of the funding agency, we focused on creating a school-centered program rather than conducting a controlled clinical trial. The current study used each student as his or her own control. Subsequently, eligible students could enroll in the program (up to 75-100 per asthma counselor), and it is possible that students' asthma may have improved over time irrespective of any intervention.²⁰ The pre-post design and lack of a control group are major limitations of this study.

Many studies describe successful school-centered interventions, including education for students and parents,^{15,16,21-28} case management,^{25,27} enhanced communication with

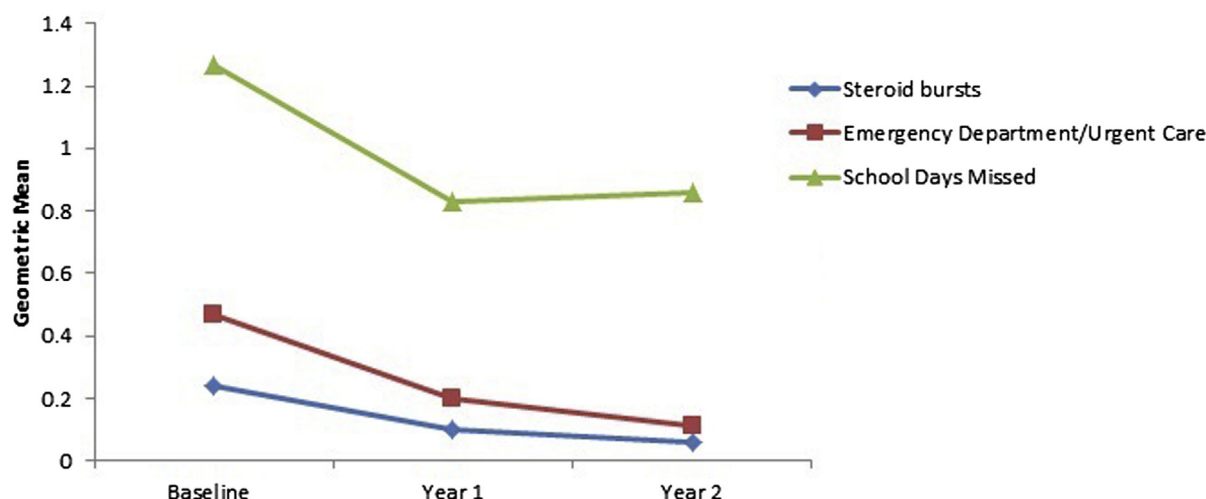


FIGURE 2. Geometric means of asthma exacerbations (steroid bursts, urgent care/emergency department visits, school days missed) in the Step-Up Asthma Program: baseline, year 1 follow-up, and year 2 follow-up. Geometric means (y-axis) correspond to estimates from generalized estimating equations model. Estimates correspond to black boys on Medicaid with an average health risk assessment score of 3. 95% CIs at baseline/year 1 follow-up/year 2 follow-up are as follows: steroid bursts 0.12-0.5/0.05-0.22/0.02-0.18; urgent care visits 0.20-1.11/0.09-0.43/0.03-0.42; school days missed 0.83-1.95/0.53-1.28/0.54-1.28. Percent changes from baseline to year 1 and baseline to year 2 were significant for steroid bursts, urgent care visits, and missed school days, with *P* values all <.007. School days missed were coded as 0 for no missed school days secondary to asthma exacerbations, 1 for 1-5 missed school days secondary to asthma, 2 for 5-10 missed school days secondary to asthma, and 3 for more than 10 missed school days.

providers,^{15,21,26,27} access to providers in school-based health centers^{27,29,30} or as consultants,^{31,32} provision of asthma action plans,^{15,23} directly observed therapy,^{32,33} and home visits.²⁷ These programs have shown improvements in asthma control and have different strengths, but many have small numbers and lack sustainability mechanisms. The Step-Up Asthma Program brings together multiple elements from these previous successful programs, including evidence-based evaluation tools, guidelines-based therapy, education for students, enhanced communication, provision of asthma action plans, access to providers, and case management by bilingual asthma counselors. Asthma counselors are invested community leaders familiar with the language, culture, and socioeconomic backgrounds of their families. By drawing on their community ties, they established improved communication and trust between parents, school personnel, and health care providers. Providing case management and care coordination at school eliminated the barrier of parents making and keeping provider appointments, which has been problematic in other school- and provider-based programs.⁸ Although we believe that asthma counselors are critically important to the success of the program, their involvement is resource intense. During this study period, the Step-Up Asthma Program supported 3 full-time asthma counselors covering approximately 75 students over 5 schools as well as administrative and supervisory support. The Step-Up Asthma Program also provided education for school nurse asthma education. Charges to Medicaid for pediatric emergency department visits are more than \$1000 per visit³⁴; the cost of Medicaid/Children's Health Insurance Plan emergency department visits is more than \$4 million a year.³⁵ Based on the number of exacerbations in the year before entry in the program, 46 emergency department visits were prevented by participation in the program, a cost savings of \$46,000. The costs of personnel are offset by the additional

benefits of reducing school absences, school nurses with improved asthma knowledge, and enhanced communication between schools, families, and providers for asthma, and, by extension, other chronic diseases.

There are various ways to adapt core material from the Step-Up Asthma Program, for example, providing additional training for nurse extenders (ie, health techs) to serve as asthma counselor. These adaptations would provide some of the benefits of the program with a lower cost. Public policy can support school-centered asthma programs to provide sustainability.³⁶ We have support from DPS administration and nursing, and we are disseminating the program into other school districts that have asked for our help. Therefore, although the Step-Up Asthma Program is labor and cost-intensive, the program has been successful in both reducing asthma morbidity and in being accepted and disseminated through DPS and to Colorado more generally.

Key lessons learned from the development of the Step-Up Asthma Program include the following: uncontrolled asthma contributes to poor school attendance and lower academic achievement; school nurses are eager to help students improve asthma control, but have limited time; cooperation and input from school nurses is imperative to form a successful school-centered asthma program; asthma education for ancillary staff in schools is crucial as they provide asthma care when school nurses are not available; asthma counselors provide a critical link between students, school nurses, and providers; and standardization of forms (asthma action plan, permission to carry medications, asthma intake forms, and asthma assessment forms) streamlines asthma care and minimizes burden on school staff, and facilitates effective communication between schools, parents, and providers to improve asthma care.

The Step-Up Asthma Program, developed as a school-centered program to improve asthma control and reduce asthma-related

absences for children with asthma in DPS, has successfully reduced asthma morbidity and has continued to expand to additional schools in DPS. Our next step will be dissemination and implementation of this school-centered asthma program both within and outside of DPS. Program sustainability and expansion is possible only with resources (ie, personnel and funding) and support from the schools (ie, time for nurses to participate). There is no direct cost for the school to participate in the program. DPS benefited from this intervention in multiple ways: educational workshops for all nurses, decreased asthma morbidity, and increased efficiency with standardization of forms. They subsequently organized their resources and personnel to continue the program and expand.

The Step-Up Asthma Model helps students improve asthma control and prevents exacerbations by improved technique, knowledge, and care coordination. We believe that the first year of the program is needed to reduce exacerbations, while the subsequent years reinforce improved asthma control. Asthma counselors provide care coordination for a unified approach to moderate to severe asthma by improving communication between the student, the school nurse, and the primary asthma provider. Improved communication can lead to earlier recognition of asthma exacerbations, preventing emergency department visits and hospitalizations. In addition, the Hospital Readmission Reduction Program has increased awareness and interest in readmission as an end point and even a factor in reimbursement.³⁷ Readmission rate for pediatric asthma is estimated at 17%,³⁸ and therefore, preventing readmissions has financial implications as well as impacting quality of life and academic success. Other interventions have shown that improved asthma case management with asthma educators reduces readmission rates.³⁹ By facilitating communication between families, schools, and providers through the Step-Up Asthma Program, post-exacerbation follow-up can also be improved, thereby preventing asthma readmissions, although the present study did not evaluate this component.

CONCLUSIONS

The DPS Step-Up Asthma Program demonstrated the impact of a sustainable school-centered asthma program that brings together families, school nurses, primary care providers, asthma counselors, and asthma specialists. This program improved asthma care and reduced exacerbations. There is a need for ongoing review of critical steps to further improve communication, education, and case management, and ongoing development of support personnel, especially as the program is disseminated to additional school districts.

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COLORADO SCHOOL ASTHMA CARE PLAN & MEDICATION AUTHORIZATION



PARENT/GUARDIAN please complete this portion and sign completed form		PHOTO OF CHILD
Student Name:	Birth Date: Grade:	
Parent/Guardian:	Home Phone:	
Cell Phone:	Work Phone:	
Other Contact:	Phone:	
Health Care Provider:	Fax:	
ASTHMA TRIGGERS: ☐ Exercise ☐ Illness ☐ Pollen ☐ Smoke ☐ Dust ☐ Air Pollution ☐ Dog/Cat ☐ Weather (cold air) ☐ Mold ☐ Foods (list) Other:		

I give permission for school personnel to share this information, follow this plan, administer medication and care for my child and, if necessary, contact our physician. I assume full responsibility for providing the school with prescribed medication and delivery/monitoring devices. I approve this Asthma Care Plan for my child.

PARENT/GUARDIAN SIGNATURE DATE SCHOOL NURSE SIGNATURE DATE ☐ 504 PLAN OR IEP

HEALTH CARE PROVIDER please complete ALL items in this box, SIGN AND DATE. Thank you!
ASTHMA MEDICATION TO BE GIVEN AT SCHOOL:

Exercise Pretreatment ☐ Not required ☐ As Needed: (state conditions: i.e. cold, seasonal) _____ ☐ Routinely
 Give _____ puffs of _____ 10-15 minutes before physical activity ☐ Via spacer if available
How much Name of medication
 Repeat pretreatment after _____ hours as needed for additional or ongoing activity up to a maximum of _____ puffs/day.

QUICK RELIEF/RESCUE MEDICINE (AS NEEDED MEDICINE TO RELIEVE ASTHMA SYMPTOMS)

Give _____ puffs of _____ as directed below for Yellow or Red Zone asthma symptoms. ☐ Via spacer if available
How much Name of medication
 OR, _____ solution _____ by nebulizer every _____ hours as needed.
Name of medication How much How often

GREEN ZONE Asthma Well Controlled	YELLOW ZONE Breakthrough symptoms Asthma Not Well Controlled	RED ZONE EMERGENCY SITUATION Severe Asthma Symptoms
Peak Flow: _____/N/A ☐ OR Breathing is good. No coughing, wheezing or difficulty breathing. Student can do usual activities but should avoid triggers and pre-treat if ordered.	Peak Flow: _____/N/A ☐ OR IF YOU SEE THIS: Difficulty breathing, wheezing Frequent cough Complaints of chest tightness Unable to tolerate regular activities but still talking in complete sentences DO THIS: • Stop physical activity • GIVE QUICK RELIEF MEDICINE NOW! • If no improvement in 10-15 minutes repeat quick relief medicine • If symptoms do not improve or worsen follow RED ZONE plan • Call parent and school nurse If there is no Quick Relief medicine at school: Call parent to pick up student or bring medicine to school. Inform them that if they cannot get to school, 911 may be called.	Peak Flow: _____/N/A ☐ OR IF YOU SEE THIS: Coughs constantly Struggles or gasps for breath Trouble talking Skin of chest/neck pull in with breathing Lips or fingernails are gray or blue Decreased level of consciousness DO THIS IMMEDIATELY: • GIVE QUICK RELIEF MEDICINE NOW • Call 911 & continue to give Quick Relief Medicine every 10-15 minutes until EMS arrives! • Stay with student • Call parent and school nurse
* HEALTH CARE PROVIDER * Student understands the proper use of his/her asthma medications, & in my opinion, can carry & use his/her inhaler at school independently as per school contract ☐ Yes ☐ No DATE _____ PROVIDER SIGNATURE _____ PROVIDER PRINTED NAME _____ PROVIDER PHONE _____ PROVIDER FAX _____ PROVIDER EMAIL _____		

FIGURE E1. Colorado Asthma Care Plan. A state-wide Colorado Asthma Care Plan was created to standardize school forms within the state.

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