

Building Bridges for Asthma Care Program: A School-Centered Program Connecting Schools, Families, and Community Health-Care Providers

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Abstract

Asthma imposes tremendous burden on children, families, and society. Successful management requires coordinated care among children, families, health providers, and schools. Building Bridges for Asthma Care Program, a school-centered program to coordinate care for successful asthma management, was developed, implemented, and evaluated. The program consists of five steps: (1) identify students with asthma; (2) assess asthma risk/control; (3) engage the family and student at risk; (4) provide case management and care coordination, including engagement of health-care providers; and (5) prepare for next school year. Implementation occurred in 28 schools from two large urban school districts in Colorado and Connecticut. Significant improvements were noted in the proportions of students with completed School Asthma Care Plans, a quick-relief inhaler at school, Home Asthma Action/Treatment Plans and inhaler technique ($p < .01$ for all variables). Building Bridges for Asthma Care was successfully implemented extending asthma care to at-risk children with asthma through engagement of schools, health providers, and families.

Keywords

asthma, care coordination, case management, collaboration/multidisciplinary teams, families, National Association of School Nurses (NASN's) Framework for 21st-century school nursing practice

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Statement of Problem

Approximately 36,000 children and youth miss school due to asthma each school day in the United States (Zahran, Bailey, Damon, Garbe, & Breyesse, 2018). Daily attendance strongly affects standardized test scores as well as the graduation and dropout rates of students (Balfanz & Byrnes, 2012). Poorly controlled asthma, directly and indirectly, affects academic achievement through the causal pathways of high absenteeism, cognition, and school connectedness (Basch, 2011). Students with poorly controlled asthma have poorer sleep quality and are troubled and distracted by their asthma symptoms which impacts cognition and performance. Higher absenteeism resulting from poorly controlled asthma also contributes to poorer school performance and connectedness. A coordinated and partnered approach involving students, their families, health-care providers (HCP), and schools is needed to address poorly controlled asthma and these associated causal pathways (Basch, 2011).

Schools are an ideal setting for reaching children with health-care needs. School nurses and their health team members are often in the best position to monitor and support children with asthma. Strategies directed at improving overall asthma management to reduce asthma-associated morbidity have been evaluated and include asthma screening, case identification, supervised administration of maintenance medication, case management, care coordination among students, families, HCPs and schools, and self-management education programs (Al Aoolo, Naik-Panvelkar, Nissen, & Saini, 2014; Cicutto, Gleason, & Szeffler, 2014; Coffman, Cabana, & Yelin, 2009; Leroy, Wallin, & Lee, 2017). Some of these interventions have led to reduced school absenteeism and health services use and improved quality of life (Al Aoolo et al., 2014; Cicutto, Gleason, et al., 2014; Coffman et al., 2009; Leroy et al., 2017). The effective programs are multifaceted, but they typically do not include engagement of HCPs. The Building Bridges for Asthma Care Program, hence referred to as Building Bridges (BB), was designed to fill the gap of engaging HCPs while integrating evidence-informed best practices for school-based asthma management into a cohesive, easy to follow program that would benefit students with asthma.

This article describes the elements of the BB Program and its uptake by school nurses and school health teams in two urban school districts. It details program elements and implementation approaches to permit future implementation by others, which is identified as a limitation of the literature (Cheung et al., 2015; Engelke, Swanson, & Guttu, 2013). A separate publication describes the program's outcomes for reducing school absenteeism of students with asthma and improving the use of inhaled corticosteroids and asthma control (Szeffler et al., 2018).

Method

Design

A practice improvement project or quality improvement design was used to determine whether the Building Bridges for Asthma Care Program, an evidence-informed practice program for school nurses, could be implemented in two urban school districts and if its implementation led to improvements in indicators of quality asthma care, specifically completed home and school asthma care plans, possession of a quick-relief inhaler at school, and accurate inhaler technique.

Institutional Review Board

Approval to conduct the study was provided by the Colorado Multi-Institutional Review Board, National Jewish Health, Denver Public Schools (DPSs), and Connecticut Children's Medical Center's Institutional Review Boards.

Setting and Implementation Team

BB was developed, implemented, and evaluated in two urban school systems, Denver, CO, and Hartford, CT, Public School Systems. Elementary schools with higher needs and school nurse interest in participation were selected for program implementation by the respective district's head school nurse. Being identified as a higher needs school was based on higher rates of socioeconomically disadvantaged students, established by the percent of students with free and reduced lunch, and higher asthma prevalence rates. Implementation occurred in two phases. The first phase was completed in eight schools for the 2013–2014 school year and permitted piloting and informed learning. Phase II expanded to 28 schools for the 2014–2015 academic year. School nurses led the program with additional support depending on the school district. In DPS, school nurses were typically at an elementary school 2–3 days per week and relied on unlicensed assistive personnel (UAP)/health aides to extend and supplement their work. In contrast, Hartford Public Schools (HPSs) had a full-time school nurse in every school building. Additional members of the implementation team for DPS consisted of a family advocate, a part-time, district-wide, asthma disease management specialist nurse, and a part-time school liaison; the last two roles are certified asthma educators. The HPS implementation team included a part-time certified asthma educator and two part-time research coordinators. Each district identified school nurse asthma champions within their district who were knowledgeable in asthma care, had the respect of the school community and understood the complexity of the school system, to serve as the point of contact and to provide guidance and support for implementers at the individual schools. Many of the champions were certified asthma educators, but all held credibility with their peers and past leadership experience. Some members of the implementation team were bilingual

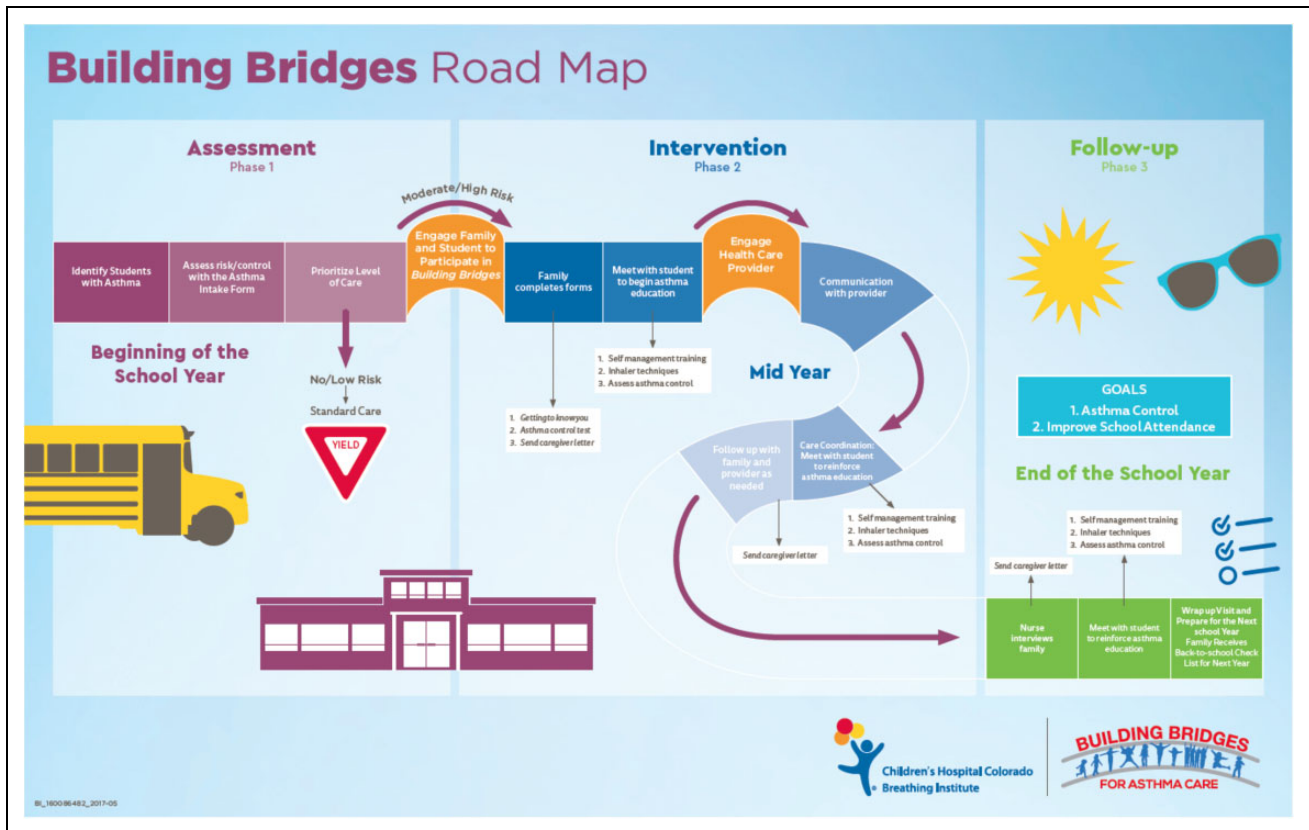


Figure 1. Building Bridges program.

and bicultural to serve and meet the needs of participating Hispanic families and students. Additionally, both districts have translation services for English as a second language for families and students that were accessed when appropriate for spoken and written translation. Families and students who were monolingual or preferred to be engaged in their first language were provided this service. Many of the standard forms used in the program are available in other languages.

Research and asthma consultants from the community worked with school districts and participating schools to build capacity related to asthma care and problem-solving. They provided workshops that included providing effective asthma education, the appropriate use of inhalers, and an overview and implementation of BB. Prior to implementing in DPS, community asthma consultants provided a 6-hr workshop to school nurses and UAPs to reinforce programmatic steps, skills for implementation, and data entry. Additional 2-hr workshops were held quarterly with school nurses to discuss progress and issues with implementation. In HPS, asthma consultants provided 30 min of general asthma education to school nurses and then 45 min of training specific to BB. Additionally, to support implementation and address the readiness of school districts, regular meetings of the core implementation team occurred to identify and address challenges.

Program Description

The BB Program consisted of five steps: (1) identify students with asthma, (2) assess asthma risk/control, (3) engage the family and student-at-risk to participate in BB, (4) provide case management and care coordination, and (5) prepare for the next school year. See Figure 1 for details.

Step 1: Identify students with asthma. In DPS, district health forms completed annually were reviewed and included questions for parents/guardians about whether their child had asthma and used asthma medications/inhalers. In HPS, the Connecticut Health Assessment Record and Medication Authorization forms completed by health providers for the supervised administration of asthma medication during school were reviewed to identify students with asthma. Hartford does not require annual completion of school health forms so nurses are informed of medical conditions and the need for medication administration at school through the completion of the Health Assessment Record and Medication Authorization forms. For both districts, a student's asthma status was documented in the school's electronic academic record.

Step 2: Assess asthma risk/control. For students identified with asthma in Step 1, parents/guardians completed a standardized

Table 1. At-Risk Criteria for Students With Asthma Used to Identify Priority Level of Care.

Indicators of Asthma Risk: Any of the following criteria

- Two or more urgent care/ED visits for asthma in the last 12 months
- Any hospitalization for asthma in the last 12 months
- Two or more courses of prednisone or systemic corticosteroids in the last 12 months
- >5 missed school days due to asthma in the last school year

OR

Current uncontrolled asthma as indicated by one or more of the following:

- Daytime symptoms experienced >2 days per week
- Nighttime awakenings >2 times per month
- Quick relief inhaler used >2 times per week
- Limiting activity level due to asthma “often” or “all of the time”

Asthma Intake Form early in the school year to identify the level of risk for experiencing an asthma exacerbation in the future and potential for increased asthma burden in the upcoming school year. The Asthma Intake Form incorporates the National Asthma Education and Prevention Program (NAEPP, 2007) and the National Association of School Nursing (2014) asthma care guidelines. See Table 1 for criteria used to determine at-risk status. Children identified at risk were targeted for the provision of BB-specific case management and care coordination.

Step 3: Engage the family and student-at-risk to participate in building bridges. Children at-risk and their families were contacted by team members to explain the child’s risk status, the need for closer monitoring and support, and to engage for active collaboration. Informed consent was obtained from a parent/guardian who agreed to work closely with the project team to achieve asthma control and assent was obtained from the student. Consent and assent were obtained by research personnel. Through an interview (15–30 min) with the parent/guardian/family caregiver, a standardized Getting to Know You form (Cicutto, To, & Murphy, 2013; Cicutto et al., 2005) was used to obtain information for coordinating care, identify learning needs and barriers, and planning case management activities. The interview captured contact information on HCP offices (primary care and specialist), health insurance, difficulties in accessing medical care and medications, asthma triggers, prescribed medications, and perceptions of asthma interference with school performance. A program information sheet with Health Insurance Portability and Accountability Act (HIPAA) and Family Educational Rights and Privacy Act (FERPA) permission was signed to allow communication among the child’s parents/guardians, HCPs, and school staff supporting the student.

Step 4: Case management and care coordination. Information from the completed Getting to Know You form was used to

develop a plan for case management activities for each student. At least three face-to-face visits with the student occurred annually at school to assess asthma control, inhaler technique and to provide asthma education. All three of these elements are indicators of evidence-informed quality care (National Asthma Education and Prevention Program, 2007). At least two additional visits with the parent(s)/guardian(s) occurred to assess asthma control and asthma management practices and to provide asthma education, case management, and care coordination. Visits occurred in October, January, and April. Asthma control was assessed using the Childhood Asthma Control Test (cACT) for children 4–11 years and the Asthma Control Test (ACT, Quality Metric Inc.) for those ≥ 12 years (Liu et al., 2007; Nathan et al., 2004). Asthma education provided to parents/guardians and students included short summaries on the management of asthma triggers, medications, asthma control, and working with HCPs. An important activity, consistent with evidence-informed asthma care, was ensuring that the student had a completed School Asthma Care Plan and Home Asthma Action/Treatment Plan. A School Asthma Care Plan was completed by the HCP and guided the school health team in managing the student’s asthma at school. The plan authorized the school to administer medication, served as a communication tool, and granted permission to communicate among HCPs and school personnel working with the student. The school plan was signed by both the HCP and parent/guardian. Additional activities that supported successful asthma management at school included verifying that the student had a reliever inhaler (quick acting bronchodilator/short-acting β_2 agonist) at school and was actively participating in physical education, monitoring student absenteeism to identify issues and the need for follow-up with the family, and ensuring that the student had an HCP and, if necessary, helping to identify an HCP. Use of the Inhaler Technique Assessment Tool permitted a standardized approach to assessing, scoring, and documenting inhaler technique conducted by school nurses (Cicutto, To, et al., 2013; Cicutto et al., 2013; Cicutto, Dingae, & Langmack, 2014). Once copies of the School Asthma Care Plans and Home Asthma Action/Treatment Plans and the reliever inhaler were obtained by school nurses, this information was recorded in the BB electronic program portal.

To enhance communication among the school nurse, parents/guardians, and the student’s HCP(s), three letters were sent to the student’s HCP(s) and the family. Letters to HCPs used a standardized template that provided individualized information about the student’s level of asthma control, school absenteeism, self-reported use of prescribed medications, and presence of an individualized school asthma care plan with an available reliever (quick-acting bronchodilator/short-acting β_2 agonist) inhaler at school. When needed, letters asked the HCP to contact the family to schedule an appointment, to complete and submit a school asthma care plan, and/or to provide an additional

reliever inhaler for school. A copy of the letter was provided to the parent/guardian.

Step 5: Preparation for next school year. To facilitate continuity for the next school year, Back to School Asthma Packets were sent to families of BB participants in May. These packets included documents to administer medication at school (such as the school asthma care plan) and a Back to School with Asthma Checklist. The checklist identified activities to be completed over the summer including making an appointment with the HCP, requesting a reliever inhaler for school use, and completing necessary school forms.

BB Electronic Portal: A Tool for Data Collection, Analytics, Communication, and Coordination

A web-based electronic portal, created by BB researchers and external to the district's electronic academic platform, facilitated data entry, management, communication, and analytics. Data collection and analytics occurred for the Asthma Intake Form, cACT, ACT, Getting to Know You questionnaire, the Inhaler Technique Assessment Tool, possession of reliever inhaler at school, and completion of school asthma care plans and home asthma action/treatment plans. In addition, to support communication with family and HCPs, the portal contained standardized templates for letters to HCPs and families with built-in capability to pull these data to automatically populate the individualized fields of letters.

Measures and Analyses

We monitored and tracked implementation of the five steps of the program and four quality care process outcomes including parental report of a Home Asthma Action/Treatment Plan, the presence of quick-relief medication in school, inhaler technique assessment and score, and the provision of a School Asthma Care Plan to the school nurse. Descriptive statistics were used to describe all variables. A generalized linear mixed model was used to estimate the mean and standard error for continuous data. Inhaler technique scores could range from 0 to 5, with 0 indicating that zero steps were performed correctly and 5, indicating accurate technique. A binomial mixed model was used to examine differences in proportions.

Results

Participating School Districts

Demographic characteristics are described in Table 2 at the school district level for DPS and HPS and for BB participating schools in DPS ($n = 18$) and HPS ($n = 10$). The DPS district had 185 schools and over 90,000 students. Most of the students in the district were of Hispanic descent (56.7%) and 70% of students qualified for free or reduced lunch. The HPS district had 50 schools and over 21,000 students. The

HPS district's student population was 51.7% Hispanic descent (predominantly Puerto Rican) and 85% qualified for free or reduced lunch. Compared to the DPS district, HPS had a larger percentage of African American students (30% vs. 14% for DPS), a higher school nurse to student ratio (1:423 vs. 1:1,000 in DPS), and fewer English as second language learners (18% vs. 38%). Schools participating in the BB program for each district were more likely to have students qualifying for free or reduced lunch programs and English as a second language learners consistent with the decision to recruit higher need elementary schools. Racial/ethnic differences between DPS and HPS were present in the BB participating schools (see Table 2). Students in the BB participating schools in DPS and HPS comprise the study population.

Step 1: Identify students with asthma. For all participating schools in the two districts, DPS and HPS, 15,518 students completed the case identification process, identifying 2,178 students with asthma, representing an asthma prevalence of 14%. All students (100%) in 18 DPS completed annually the school health form that permitted asthma case identification. There were 828 (8.7%) elementary students identified with asthma. In the 10 HPS schools, 74% of students had completed health information on record of whom 1,350 (22.6%) were identified with asthma. In contrast to Denver, HPS students with asthma were identified based on historical records from the health assessment form, which is completed only upon initial registration into the district and during the 6th or 7th and 9th or 10th grade and the yearly Health Assessment and Medication Authorization form, which is completed by HCPs for children who require medication administration at school. See Table 3 for details.

Step 2: Assess asthma risk/control. For DPS and HPS BB schools combined, 56% (781) of students were identified as being at-risk for future asthma exacerbations and higher levels of burden and thus targeted for the provision of extra support by school nurses. Refer to Table 1 for a list of at-risk criteria. The top two reasons for students to be identified as at-risk, overall and for both districts, were having two or more systemic corticosteroid bursts for an asthma exacerbation in the past year (44%) and two or more Emergency Department (ED) visits in the past year (42%; Table 3). Differences were noted in completion rates between DPS and HPS. Ninety-seven percent (800) of DPS students identified as having asthma completed the Asthma Intake Form with 55% (437) of students identified as at-risk. Of the 1,350 students identified with asthma in Hartford's BB schools, 590 completed the Asthma Intake Form during registration or when bringing asthma medications to the school nurse. Of these students, 58% (344) were identified as at-risk. Refer to Table 3 for details.

Step 3: Engage the family and student-at-risk to participate. A total of 781 students identified with asthma and at risk (437

Table 2. District and Participating Schools Characteristics.

Variable	All Denver Schools	BB Denver Schools	All Hartford Schools	BB Hartford Schools
Students (<i>n</i>)	90,150	9,574	21,147	8,028
Schools (<i>n</i>)	Total = 185	Total = 18	Total = 50	Total = 10
ECE-K	3	0	2	1
Elementary (ECE-5)	86	12	3	8
Combined (ECE-8)	20	2	22	1
Combined (K-12)	4	0	3	0
Middle (6-8)	22	4	1	0
Combined (6-12)	19	0	3	0
High (9-12)	31	0	10	0
School nurse:student ratio	1:1,000	1:1,205	1:423	1:524
Race/ethnicity (%)				
Black/African American	14.1	10.6	30.4	26.0
Hispanic/Latino	56.7	76.8	51.7	61.9
White	21.9	7.5	10.2	8.9
Asian	3.3	2.4	3.0	1.7
American Indian	0.6	0.8	0.2	0.3
Other	3.4	1.9	1.7	1.2
Graduation rate (2013-2014; %)	64	N/A	72	N/A
English as a second language (%)	38	49	18	25
Eligible for free/reduced lunch (%)	70	91	77	100
Electronic academic record platform	Infinite campus	Infinite campus	Power school	Power school

Note. BB = building bridge; ECE = early childhood education; NA = not applicable.

from Denver and 344 from Hartford) were invited to participate in the BB program and 463 (240 Denver, 223 Hartford) expressed interest in participating in the program. Participation rates were 55% in DPS and 65% in HPS, with an overall participation rate of 60%. Common reasons provided by parents/guardians for declining participation included their child “really doesn’t have asthma,” the child’s asthma is “not that bad” to merit this program, and the program was too time intensive. Contacting parents/guardians to discuss project participation was difficult at times, as often contact numbers were inaccurate or parents/guardians did not return calls despite multiple attempts. Refer to Tables 3 for details.

Step 4: Case management and care coordination. Participating students and their families in DPS and HPS received Step 4: Case management and care coordination (Table 3). Three or more visits were completed with 93% of students (94% in DPS and 92% in HPS) and assessed asthma control, provided education, and assessed and coached for accurate inhaler technique. Over 90% of students received three or more sessions for inhaler technique. Visits occurred when students attended the health office to use a reliever inhaler or when school nurses requested a visit. Follow-up letters (three or more) were sent to 88% for HCPs, 93% for DPS, and 83% for HPS students (Table 3). Most HCPs (96%) received two or more letters regarding the status of their participating students.

Step 5: Preparation for next school year. All students and their families in the program were provided a Back to School

Asthma Packet at the end of the year. In DPS, this resulted in the return of 15% of School Asthma Care Plans at the start of the next school year. These data were not captured in HPS.

Indicators of improved asthma management. Table 4 summarizes indicators of improved asthma management practices. There were significant increases in the proportions of students with completed School Asthma Care Plans, a quick-relief inhaler at school, and a Home Asthma Action/Treatment Plan following enrolment in the program ($p < .01$ for all variables). Significant improvement ($p < .0001$) in inhaler technique following participation in the program was also observed in response to assessment and coaching sessions provided by school nurses.

Discussion

In response to the growing problem of chronic school absenteeism linked to increases in chronic health conditions, school nurses are ideally positioned to intervene (Jacobsen, Meeder, & Voskuil, 2016; Leroy et al., 2017). Our program demonstrated that it is feasible to implement a school-centered asthma care program to facilitate asthma self-management and strengthen communication and asthma care coordination. Our work supports the impact of school nurse-led health teams to implement established evidence-based asthma care in schools.

The BB Program differs from many school-based programs by using activities that foster communication to

Table 3. Implementation of Building Bridges.

Variable	Denver BB Schools	Hartford BB Schools	Total
Step 1: Identify students with asthma			
• Completion of questions eliciting asthma diagnosis at registration (<i>n</i>)	9,550	8,028	15,518
• Students with asthma (<i>n</i>)	828	1,350	2,178
• Asthma rate (%)	8.7	22.6	14.0
Step 2: Assess and identify asthma risk/control (<i>n</i>, %)			
• Completion of Asthma Intake Form for those with asthma	800 (96.6)	590 (43.7)	1,390 (63.8)
• Students with at-risk asthma	437 (54.9)	344 (58.3)	781 (56.2)
Any of the following risk-factors due to asthma in the past year:			
• ≥2 ED/urgent care visits	155 (35.5)	172 (50.0)	327 (41.9)
• ≥1 Hospitalization	87 (19.9)	61 (17.7)	148 (19.0)
• ≥2 Oral steroid bursts	175 (40.0)	170 (49.4)	345 (44.2)
• >5 School absences	142 (32.5)	83 (24.1)	225 (28.8)
Any of the following asthma control/impairment indicators in past 4 weeks:			
• Quick acting bronchodilator use	143 (32.7)	156 (45.3)	299 (38.3)
• Daytime symptom experience	94 (21.5)	129 (37.5)	223 (28.6)
• Nocturnal awakenings	86 (19.7)	117 (34.0)	203 (26.0)
• Activity interruption	76 (17.4)	85 (24.7)	161 (20.6)
Step 3: Engage the family and student-at-risk to participate			
Participation/enrollment			
• # Participation/enrolled	240 (54.9) ^a	223 (64.8) ^a	463 (59.3) ^a
• # Declined participation	183	109	292
• # Lost to follow-up	14	12	26
Step 4: Case management and care coordination			
Student visits (<i>n</i>, %):			
• 0 Student visits	<i>n</i> = 240 4 (1.7)	<i>n</i> = 223 0 (0)	<i>n</i> = 463 4 (0.86)
• 1 Student visit	5 (2.1)	4 (1.9)	9 (2.0)
• 2 Student visits	5 (2.1)	14 (6.3)	19 (4.1)
• ≥3 Student visits	226 (94.2)	205 (91.9)	431 (93.1)
HCP communication (<i>n</i>, %)			
• 0 Times contacted	4 (1.7)	4 (1.8)	8 (1.7)
• 1 Contact	6 (2.9)	2 (0.9)	8 (1.9)
• 2 Contacts	5 (2.1)	31 (13.9)	36 (7.9)
• ≥ 3 Greater	224 (93.3)	186 (83.4)	410 (88.5)
Inhaler technique assessment and coaching sessions (<i>n</i>, %)			
• 0 Sessions	4 (1.7)	0 (0)	4 (0.86)
• 1 Session	5 (2.1)	4 (1.8)	9 (2.0)
• 2 Sessions	8 (3.3)	17 (7.6)	25 (5.4)
• ≥3 Sessions	223 (92.9)	202 (90.5)	425 (91.8)
Step 5: Preparation for next school year			
Families provided Back to School Asthma Packet (<i>n</i> , %)	240 (100)	223 (100)	463 (100)

Note. BB = Building Bridges; HCP = health-care provider.

^aPercentage of those considered at risk.

Table 4. Process Outcomes—Possession of School Asthma Care Plans, Home Asthma Treatment Plans, Quick Relief Inhaler at School, and Inhaler Technique of Students.

Variable	Denver (<i>N</i> = 228)		Hartford (<i>N</i> = 154)		Total (<i>N</i> = 382)		<i>p</i> Value
	Baseline	Post	Baseline	Post	Baseline	Post	
Asthma action plan/home treatment plan (% [<i>n/N</i>])	40.3 (73/181)	55.6 (95/171)	43.9 (43/98)	71.7 (66/92)	41.6 (116/279)	61.2 (161/263)	<.01
School asthma care plan (% [<i>n/N</i>])	58.0 (105/181)	87.7 (150/171)	69.4 (68/98)	79.3 (73/92)	62.0 (173/279)	84.8 (223/263)	<.01
Quick relief inhaler at school (% [<i>n/N</i>])	53.6 (97/181)	79.5 (136/171)	67.3 (66/98)	77.2 (71/92)	58.4 (163/279)	78.7 (207/263)	<.01
Inhaler technique (mean ± standard error)	2.9 (.13)	4.0 (.13)	2.8 (.20)	3.7 (.19)	2.9 (.11)	3.9 (.11)	<.01

promote clinical care (Wheeler, Merkle, Gerald, & Taggart, 2006). Care coordination engages multiple stakeholders, can occur in a variety of settings, and can lead to reduced asthma symptoms, unscheduled health-care visits, activity limitations, and school absences (Clark et al., 2010; Kelly et al., 2015; Leroy et al., 2017; Szeffler et al., 2018). BB Program activities support case management and care coordination among HCPs, school nurses, and students and families and include assessing asthma control and at-risk status, delivering asthma education, communicating with the clinical team, conducting follow-up visits with students and families, and referring families to medical and social services within their community (Garwick et al., 2015; Mansfield et al., 2011; Maughan & Schantz, 2014; NASN, 2016).

The provision of standardized individualized letters to the student's physician and parents/guardians sent at the beginning, middle, and end of the school year makes the BB Program unique in its approach to engaging, communicating, and coordinating care. Because children spend a significant proportion of their day, during the school year at school, school nurses are often aware of the frequency of daytime symptoms, the need and use of reliever inhalers, level of interference with physical activity, and frequency of school absenteeism, all of which are important indicators of asthma control. This unique position makes them an ideal resource for HCPs in understanding the child's asthma status. To share this information with children's HCPs, letters were sent that included current and historical information about the child's asthma control, school absenteeism, medication use, interruptions with daily activity, and possible actions/steps needed to support asthma control, such as the need for a doctor's visit or an extra reliever inhaler at school. Parameters reported in the letter facilitated effective communication and care coordination among school health teams, families, and clinicians by giving specific and clinically relevant language and messages that clinicians could use to make asthma care decisions. Feedback from clinicians suggested that the letters were helpful as they provided important information about asthma control and associated burden. They explained that they are often disadvantaged by limited information about the child's asthma, as they are reliant on families to attend office visits regularly and to report full and accurate information regarding the child's asthma and daily life interruptions.

Cheung et al. (2015) and Rasberry et al. (2014) also identified students with poorly controlled asthma in schools and had school nurses provide case management and care coordination activities and noted improvements in asthma control and clinical care. These studies and our work identified challenges for care coordination in schools and included difficulty contacting parents/guardians, limited access to health-care records outside of the school setting, and time constraints of school health teams. Annual completion of the Asthma Intake Form is a strategy for overcoming these obstacles. The differences in Asthma Intake Form

completion rates between DPS and HPS are likely due to the integration of this assessment form into DPS's annual school registration process.

An interesting observation was the differing prevalence rates for asthma noted between Hartford (22.6%) and Denver (8.7%). We will highlight four factors, but there are likely several additional reasons. One, the Hispanic population differs between Denver and Hartford. Hartford had more Puerto Rican Hispanic students in the district, and Denver had more Mexican Hispanic children. People of Puerto Rican Hispanic backgrounds are more likely to have asthma, which would account for higher asthma prevalence (Rosas-Salazar et al., 2016). Second, Black children are more likely to have asthma and Hartford had a higher proportion of Black students. Third, exposure to environmental triggers (poor housing stock, gun violence, and allergens associated with the diagnosis of asthma could potentially be higher in the Hartford schools population compared to Denver schools; Rosas-Salazar et al., 2016; Zahran et al., 2018). Fourth, the asthma case identification process is different between Denver and Hartford. Denver had 100% completion of school health forms (so a higher denominator) and self-reported diagnosis of asthma, which can be potentially underreported (so a decrease to the numerator). In contrast, Hartford's case identification rate was lower and used a coordinated system for getting health information from health providers, which may have targeted children with asthma (higher numerator and lower denominator).

Our work contributes to the literature by demonstrating feasibility of program provision in two distinct school districts with differing models and infrastructures and in different regions of the United States. Even school districts and schools with more limited school nurse resources, like DPS, can implement the program. DPS only had a school nurse in elementary schools two days per week. However, they had UAPs in the school building 5 days a week to assist. In DPS, training was held with school nurses and their UAPs to support program activities. In contrast, HPS had a full-time school nurse in every elementary school. Both districts demonstrated very high implementation rates for each of the BB steps and activities.

Limitations

Ideally, participation rates of families with at-risk students with asthma would be higher than 60%. There are likely several reasons: (1) difficulty reaching parents/guardians, such as incorrect phone numbers and numerous phone calls that are not returned, (2) the student's asthma is incorrectly perceived by the family as "not that bad" to warrant intervention, (3) program participation required too much time with three visits, and (4) the process and need for signed informed consent and assent. The issue of lower than desired participation rates is multifaceted and noted by other studies (Cheung et al., 2015; Rasberry et al., 2014). This represents

an important issue because these students are at greatest risk of experiencing increased school absenteeism and urgent health-care service based on their previously demonstrated need for urgent care, systemic steroid use, and school absenteeism the year before (Hoch et al., 2017). Future work is needed to identify effective steps and approaches to engage these students and families.

Our work clearly demonstrates that initial uptake is feasible in large urban school districts over a short-time period. However, our work did not involve rural schools that likely have different cultures, models, infrastructure, and resources. As mentioned, similar to smaller rural school districts, DPS does not have a full-time school nurse in elementary school but was able to successfully and effectively implement the program with the assistance of UAPs and the asthma disease management specialist nurse. Another limitation of our work is that implementation was studied over a relatively short-time frame (2 years). Understanding implementation and sustainability of new practices over the long term is needed to identify key factors for sustained practices and institutionalization of these practices.

In addition, our study did not examine the individual behavior changes of students with asthma and their families, although we did demonstrate improvements in inhaler technique. Instead, our project chose to examine the feasibility of school district uptake of an evidence-informed school-centered asthma program, as evidence existed regarding the effectiveness of interventions targeting students and was used to inform the development of our multifaceted BB Program (Al Aloom et al., 2014; Cicutto, Gleason, et al., 2014; Coffman et al., 2009; Leroy et al., 2017; Maughan & Schantz, 2014; NASN, 2014; Rasberry et al., 2014). Similarly, sustained behaviors of students and families should be explored.

Lessons Learned

Several lessons were learned through our project implementation experience. Initially, implementation requires significant resources, as many challenges and needs exist to initiate new practices and behavior changes. Regular meetings of the core implementation team are necessary to identify and address challenges. Asthma champions who are knowledgeable in asthma care, have the respect of the school community, and understand how the complex school system works are key to successful program implementation. They provide leadership, initiate and support change, and serve as cheerleaders to school nurses and other school health team members through motivation and reinforcement. Professional development is also central so that school nurses are knowledgeable and possess the skills and competencies, including computer skills, to implement the BB Program. HPS demonstrated that 30 min of general asthma education

to school nurses followed by 45 min of training specific to BB was sufficient for program implementation.

In DPS, we noted a 30% reduction in time school nurses spent on implementation activities between Year 1 piloting and Year 2. This is likely due to a couple of factors. An online registration system prompted families to complete the asthma at-risk assessment tool (Asthma Intake Form) when families indicated on the school health form that their child has asthma. This saved time and was a successful strategy that achieved over 90% completion rates for students with asthma. Another time-saver noted in DPS pilot schools was that once students were identified as having asthma and at-risk, it was easier to target activities and to maintain family engagement in the program. Initial program implementation required time but once families were enrolled, maintenance and continued support were more easily sustained.

Before initiating a multifaceted school-based asthma program, it is important to understand the readiness of the school district and the school. Key readiness factors include understanding the skill level of school nurses and other school health team members related to programmatic activities, such as computer skills and leading change, existing senior administrative support for the program and for school nurses implementing the program, and assuring infrastructure exists to support implementation, such as an electronic academic record with a functional health tab, school nursing practice supports, and appropriate policies and procedures (Cicutto et al., 2016). The Asthma Intake Form, school asthma care plans, standardized inhaler technique checklist, and the electronic portal were tools that supported school nursing practice.

Our program offered flexibility in the approaches and tools used to achieve program objectives so that each district's needs, resources, and characteristics could be taken into account. For instance, a core program objective was that students possess asthma care plans. Denver and Hartford approached the achievement of this objective differently. Colorado has a statewide uniform asthma care plan and medication order for schools and childcare centers that is recommended by the Colorado Department of Education for use across the state as a way to standardize the approach in an easy to follow manner for use by nonhealth professionals, ensure that HIPAA and FERPA are addressed, and to assist health-care professionals and families by clarifying and streamlining one form needed to permit asthma medication administer at school. The Colorado Asthma Care Plan for Schools and Child Care Settings is not for home use as it does not include controller medications and management steps completed outside of school. In addition to this form, the Denver student will need a written asthma action plan or home care plan. In contrast, Hartford is more of a closed system of health providers who have a closer relationship with the school district. As a result, the school district and health providers have one form that serves as

Table 5. Alignment of BB Approaches and Activities With NASN's Framework for 21st-Century School Nursing Practice.

Care Coordination	Quality Improvement	Community/Public Health
<ul style="list-style-type: none"> • Case management for at-risk asthma students • Chronic asthma disease management • Collaborative communication and care coordination among students, families, schools, and health providers • School initiated communication with physician who details asthma control level, school absenteeism, and the need for a visit and medication for school use • Direct asthma care: assessing, planning, and revising • Individualized student-centered asthma care based on identified strengths and needs of student and family • Interdisciplinary approach to asthma care • Provision of asthma education to students and families • Use of motivational interviewing and counseling for effective asthma management • Use of School Asthma Care Plans for care coordination among students, families, school, and health provider 	<ul style="list-style-type: none"> • Continuous and standardized data collection of process indicators and outcomes • Capture and monitored meaningful health outcomes (school absenteeism, health services use, and inhaler technique) • Create a uniform data set across schools and districts • Evaluate efforts and overall program implementation • Use data (process and outcomes) to reassess and reinforce evidence-informed asthma management practices 	<ul style="list-style-type: none"> • Support attaining health insurance, if necessary • Ensure student had a primary care provider • Prevent asthma exacerbations • Support successful management of environmental triggers • Assist with and providing follow-up care and referrals • Identify those most at-risk for future asthma exacerbations and excessive burden (surveillance and screening) • Target those at-risk to receive risk reduction strategies • Use population health system wide approach to understanding the needs of students and families with asthma • Promote health equity by working in schools with a student body composed of higher rates of free and reduced lunch rates, underrepresented minority students, and asthma prevalence

Note. NASN = National Association of School Nurses; BB = Building Bridges.

both a school and home asthma care plan. Denver and Hartford had different approaches but both school districts met the goal of attaining completed asthma care plans for students with asthma.

Aligned with having a strong infrastructure is the need for good systems and processes so that all team members are oriented to the uptake of evidence-informed quality practices. Having more personnel or more highly qualified personnel is not the magic bullet if the personnel or team members are not oriented to the system and processes. We noted that when integrated systems are in place and their use institutionalized, the completion of activities was higher. This was most evidenced in the steps of asthma case identification and assessment of at-risk status.

Application to School Nursing Practice

The BB Program aligns with and is supportive of NASN's Framework for 21st-Century School Nursing Practice. Alignment with NASN's Framework is important because it provides the overall structure for and articulates the components of present day, evidence-based school nursing practice. Consistent with the Framework's Principle of Standards of Practice, all steps in the BB Program are informed by evidence-based guidelines for asthma (Al Aloola et al., 2014; Association for Supervision and Curriculum Development & Centers for Disease Control, 2014; Cicutto et al., 2014; Coffman et al., 2009; Leroy et al., 2017; Maughan &

Schantz, 2014; NAEPP, 2007; NASN, 2014) and are within the scope and standards of school nursing practice. Table 5 details activities performed by school nurses implementing the BB Program and how they align with the Framework's elements of Care Coordination, Quality Improvement, and Community/Public Health. Alignment with the Framework is thought to be important for long-term sustainability in DPS and HPS and will likely be a factor considered for future implementation by school nurses.

The BB Program provides an evidence-based and replicable model for other school districts to implement to support students with asthma succeed and to improve their provision of evidence-based asthma care practices. Our implementation experience demonstrates that school nurses can implement the program with a high level of uptake for the various steps and activities. Over 90% of students identified as at-risk participating in the program received the key program elements that engaged the student, families, and HCPs in meaningful ways to coordinate asthma care efforts. The American Academy of Allergy, Asthma and Immunology and the National Association for School Nurses have developed a program to share experience and available resources, such as those developed in BB (Lemanske et al., 2016; Szeffler et al., 2018).

Author's Note

David A. Stempel is with Propeller Health, San Francisco, CA and was formerly with GlaxoSmithKline.

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