

School-based asthma programs

Jean-Marie Bruzzese, PhD,^a David Evans, PhD,^b and Meyer Kattan, MD^b New York, NY

Asthma is prevalent in school-age children and contributes to school absenteeism and limitation of activity. There is a sizable literature on school-based interventions for asthma that attempt to identify children with asthma and improve outcomes. The purpose of this review is to describe and discuss limitations of screening tools and school-based asthma interventions. Identification of children with asthma may be appropriate in schools located in districts with a high prevalence of children experiencing significant morbidity and a high prevalence of undiagnosed asthma, provided there is access to high-quality asthma care. We review strategies for improving access to care, for teaching self-management skills in schools, and for improving school personnel management skills. Although studies indicate that school-based programs have the potential to improve outcomes, competing priorities in the educational system present challenges to their implementation and emphasize the need for practical, targeted, and cost-effective strategies. (J Allergy Clin Immunol 2009;■■■:■■■-■■■.)

Key words: Inner-city asthma, school-based programs, asthma education

Asthma is one of the most common chronic diseases in children. It is the leading cause of hospitalization in childhood and a major cause of school absenteeism. In 2006 in the United States, 14% of children under 18 had been diagnosed with asthma, and 9% (6.8 million) currently have asthma. In 2003, children with at least 1 asthma attack in the previous year missed a cumulative total of 12.8 million school days because of asthma.¹ The burden of asthma is not distributed evenly among the population. Minority children of low socioeconomic status living in urban areas have higher morbidity.² In addition, they have less access to optimal care³ and may be undiagnosed.⁴⁻⁶ A survey of Chicago public schools reported that the percentage of children with diagnosed asthma and with signs of possible asthma was 26.8% and highlighted racial and ethnic disparities.⁷

Asthma may negatively affect children's education. Data from the US National Interview Survey found that children with asthma

Abbreviation used

ED: Emergency department

missed 3 times more school days and had 1.7 times the risk of learning disability compared with well children. Other studies have found associations between poorly controlled asthma and school readiness or academic performance.⁸

The high prevalence in school-age children and the economic impact of asthma attest to its importance as a public health problem, particularly in inner cities. Many investigators have targeted schools as the setting for asthma interventions because schools provide reliable access to large numbers of children. In addition, schools are often the only setting of affordable health care for low-income and ethnic minority youth because of limited access to medical care. The school setting could play a wide role in the spectrum that ranges from identifying students with asthma, supervising medication, managing cases, and educating and teaching appropriate management skills to students, parents, and school personnel, to delivering asthma care in a school-based health clinic. In this review, we describe screening tools and school-based asthma programs, discuss the benefits and limitations of screening and educational programs, and identify challenges and issues that need to be addressed.

CASE IDENTIFICATION OF ASTHMA IN SCHOOLS

A recent report from the American Thoracic Society has provided a comprehensive review of issues in screening for asthma in children both in the general population and in schools.⁹ Screening has the theoretical advantage of identifying undiagnosed and undertreated children. Questionnaires to identify students with undiagnosed asthma have been developed and validated across racial, ethnic, and socioeconomic groups. For example, Redline et al¹⁰ validated a 7-item screening tool to identify undiagnosed asthma for use in elementary schools in high-income and low-income communities. Self-report data from both students and caregivers were validated against clinical examination. The parent and child forms were comparable, although the student version in general provided greater sensitivity. Gerald et al¹¹ developed a 2-item questionnaire for determining probable asthma in low-income school children, which has 66% sensitivity and 96% specificity when validated against spirometry and evaluation by a physician. Galant et al¹² developed a 3-item questionnaire and reported 86% predictability for identifying children with persistent asthma in a multicultural population. Bonner et al¹³ developed a 4-item questionnaire for Head Start personnel to use with parents of preschool children to determine probable asthma. This case detection form had 73% sensitivity, 96% specificity, and 97% positive predictive value to identify preschool children with

From ^athe New York University Child Study Center, New York University School of Medicine; and ^bthe Department of Pediatrics, Columbia University College of Physicians and Surgeons, New York.

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Reprint requests: Meyer Kattan, MD, Columbia University Medical Center, 3959 Broadway, CHC 7-701, New York, NY 10032. E-mail: mk2833@columbia.edu.
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asthma when validated by physician review of a detailed history of symptoms and health care use. The modest sensitivity and high specificity of these questionnaires are advantageous when resources are limited because they limit the number of children with milder or no asthma. Nevertheless, the benefits of population-based screening are unproven.^{14,15}

Given the many pressing priorities in educational systems unrelated to health, school-based screening programs need to be cost-effective. As pointed out in the American Thoracic Society document, for case detection to be cost-effective, asthma should cause considerable morbidity in the population being examined, and the population should contain a sufficiently large number of individuals whose asthma is undiagnosed or poorly controlled.⁹ Because there are considerable disparities in asthma morbidity, it would be most cost-effective to target children in low socioeconomic urban areas.

Once children with asthma are identified, facilities should be available for appropriate evaluation and treatment. The lack of personnel and programs can present a major barrier to implementation of school-based programs. Some studies indicate that the presence of a school nurse can make a difference.¹⁶ The School Health Policies and Programs Study of the Centers for Disease Control and Prevention, a national survey periodically conducted to assess school health policies and programs at the state, district, school, and classroom levels, provides sobering statistics in this regard.¹⁷ The survey found that only 36% of schools had a full-time (≥ 30 hours per week) registered nurse or licensed practical nurse. Furthermore, the median percentage among states of schools in which the lead health coordinator received staff development on asthma awareness was only 19%. School-based health clinics can provide health care for children living in areas that are underserved.^{18,19} However, there are only about 1500 such clinics in the United States. These clinics see children for well-child care as well as deal with acute health issues including asthma. Given the health care demands, it is not surprising that provider adherence to the National Heart, Lung, and Blood Institute asthma guidelines in school-based health centers was found to be inadequate.²⁰ The clinics may be appropriate for treating milder cases of asthma but would likely need an affiliation with specialty care to deal with those children in whom the impact of asthma is greatest. In summary, individual schools have different capabilities to deal with school health in general and asthma in particular. Therefore, different strategies are required depending on the resources available.

STRATEGIES TO IMPROVE ACCESS TO CARE

One strategy for improving control of asthma in school children is to ensure that the students have access to medical care, either in the school or in the community. A variety of approaches have been tried, all of which involve some degree of partnership among school personnel, health care providers in the community, and parents. Access to rescue care at school is perhaps the most widespread approach. In the majority of the public schools in the United States, students or their parents can work with school personnel to establish a procedure for providing bronchodilator treatment for emergent symptoms.^{21,22} These treatments are administered by a school nurse or other staff member with special training, or, with permission from the parents and physician, by the student. Many programs are based on a written asthma treatment plan sent to the school by the student's parents and/or

community physician.^{21,23-25} The aim is to treat symptoms quickly so the student can return to class and avoid having to leave school for treatment at home, their physician's office, or the emergency department (ED). Although there are no controlled trials documenting the effectiveness of this approach, 1 program that provided a consulting physician one-half day per week to work with school nurses found increases in albuterol treatments given at school and reductions in students being sent home or requiring a 911 call for treatment.²⁶ Although the health impact of these efforts has not been well documented, there are many potential benefits and no apparent drawbacks to providing for first-line rescue therapy in the schools.

Another approach is ensuring that students with asthma have a community health care provider who manages their asthma. Examples of this approach usually involve 2 steps. First, schools carry out case detection efforts (health record review, surveys for parents, and so forth) to find all students diagnosed with asthma and to encourage students and/or families who do not have an identified community provider to obtain one. Second, school health staff attempt to obtain written asthma treatment plans for each student's overall asthma management from the provider and family, thus both ensuring the development of such a plan and establishing some degree of partnership among the school, the family, and the provider.²⁶⁻²⁹ Most efforts to establish or improve access to continuing care for asthma in the community by school nurses or other health personnel have not been very successful.²⁷ Although case detection efforts have been shown to increase awareness of asthma cases by school staff, most schools have found it difficult to influence the relationship between family and health care providers beyond providing instructions for rescue care during the school day. One program in which the principal sent a letter home requiring the family to obtain a written asthma treatment plan from the student's physician was successful in obtaining plans from more than two thirds of students with asthma, and this program, which in addition provided asthma education for students at school, also showed reduced rescue treatments in school.³⁰ In a controlled trial, Yawn et al³¹ reported that sending letters to parents recommending medical follow-up of symptomatic children increased physician visits and resulted in medication changes.

In another approach, the school establishes a partnership with a group of health care providers to provide comprehensive medical care for students at school, including, or in some cases, limited to asthma. School-based health centers provide daily on-site care by physicians, physician assistants, or nurse practitioners in more than 1500 public schools in the United States. Two studies have shown that treatment for asthma in school-based health centers was associated with improved outcomes, including fewer hospitalizations,^{18,32} ED visits,¹⁸ and school absences.³² An alternative strategy has been to provide a mobile medical van that on a regular schedule brings health care providers, examination space, and medical supplies to the school so that students may receive diagnostic and treatment services with scheduled follow-up visits. Two studies have shown that comprehensive asthma care provided through mobile vans reduced hospitalizations and ED visits,^{33,34} symptoms and rescue inhaler use,³³ and school absences.³⁴ Another strategy involves a partnership among school staff, health care providers, and parents to identify students who need daily therapy and have shown or are at risk for poor compliance, and provide supervised daily controller therapy at the school. Because adherence to asthma treatment regimens is

typically below 50%, it is an important factor in morbidity. Several small studies of supervised daily controller therapy at school have shown improvements in adherence and health outcomes.³⁵⁻³⁷

A larger controlled trial has shown marginally significant improvements among students new to controller therapy when treated at school compared with home.³⁸ However, in that study, the medical regimen was determined by the study physicians. Unless children are treated by physicians giving guideline-recommended care, supervising medications in schools may not have the desired benefit if the treatment plan is suboptimal.

There are several major challenges to the success of these efforts to provide access to medical care through the schools. One is to document better the effectiveness of these programs in improving health outcomes or school attendance and performance, through either controlled randomized trials, or carefully designed single group designs where randomized trials are not practical. An added challenge is to find ways to ensure that successful programs are adopted and maintained by the schools. Many programs have had trouble fully implementing their plans because school staff, health care providers, and parents all find it difficult to commit sufficient time and effort to establish new patterns of cooperation. Even the New York City plan involving automated health records and a simple, well established plan for getting a written treatment plan for rescue care to the schools has not yet reached a majority of students with asthma.²³ Such efforts require time and financial support to become established and achieve full implementation.

STRATEGIES TO TEACH STUDENTS SELF-TREATMENT SKILLS

School-based interventions have effectively improved asthma knowledge, self-treatment skills, and self-efficacy; reduced asthma morbidity, including reductions in symptoms, ED visits, and hospitalizations; and improved quality of life, including reductions in school absences and improved grades.³⁹⁻⁴⁷ The recently revised National Heart, Lung, and Blood Institute Expert Panel guidelines for diagnosis and management of asthma⁴⁸ and a recent review by Clark et al⁴⁹ provide additional evidence of the effectiveness of school-based programs to improve self-treatment among youth. We know of only 1 study that reviewed results in terms of reduced health care costs relative to cost of the intervention.⁴⁴ Cost-effectiveness studies would be of interest.

Most school-based programs have typically focused on building self-treatment skills in elementary school-age children. However, recent efforts have targeted preschool children⁴⁷ and adolescents.^{42,44-46} Comprehensive programs are also beginning to emerge, which include parents, school teachers and administrators, school custodial staff, and/or medical providers (see examples^{40,42,46,50,51}). However, results are mixed. For example, Bartholomew et al⁵¹ linked school nurses, parents, and students' clinicians; offered a computer-based tailored educational program to the children; and conducted a school environment assessment-based intervention. Intervention children had better asthma knowledge, self-efficacy, management skills, and school performance and fewer absences relative to a comparison group, but asthma morbidity was not affected. In a pilot study, Bruzzese et al⁴⁶ taught parents and middle school students asthma management skills; the parents also received parent training, learning strategies to improve parent-child relations and develop a supportive home environment for asthma care. Relative to controls,

intervention students were more responsible for carrying their medication, took more steps to prevent asthma symptoms, and had fewer nights woken from asthma symptoms. Given the costs of comprehensive programs, studies that determine the efficacy of each of these components independent of the others are warranted.

The delivery method for most school-based programs has been group workshops for the students with asthma, which reach the most children with the least effort. However, recent successful efforts have included computerized games,⁵² web-based programs,⁴⁴ peer education,⁴⁵ and the inclusion of 1-on-1 sessions to allow tailoring of educational messages.⁴² Comparative effectiveness trials are required to determine whether similar benefits are achieved with these different delivery modalities.

Reaching parents has been a challenge in school-based interventions. Given the competing demands for parents' time, parent attendance in asthma interventions is often poor, resulting in many investigators excluding parents. However, others have tried novel approaches to affect parent behaviors. For example, Evans et al⁵³ gave elementary school students participating in a self-treatment program health education activities to take home and complete with their parents; this intervention resulted in improved asthma management on the part of parents. Because parents are the gatekeepers of medical care, there is increasing interest in educating parents. Our team is currently testing 2 novel approaches to including parents in school-based programs. A middle school trial in which parents attend training sessions to learn about asthma and general parenting strategies designed to improve their family functioning is showing promising results.⁴⁶ In a trial for high school students with undiagnosed asthma, parents are receiving educational booklets mailed home followed by a telephone consultation with a trained health educator.

Sustainability of school-based interventions beyond investigator-driven trials presents a challenge. Schools often lack the resources to deliver the interventions without assistance from outside agencies. Two promising models include partnering with local lung associations and using college and medical students to deliver the intervention. The American Lung Association has made asthma a priority and uses Open Airways for Schools, a program for third through fifth grade students with asthma found to be effective in the late 1980s,³⁹ as a major component of this campaign by widely implementing it throughout the United States with ongoing success. For example, Open Airways for Schools was delivered in New York State in 40 schools from 8 school districts throughout the state and resulted in reduced symptoms, decreased use of health care services (ED visits, hospital stays, and doctor visits) and parents' missed work days, and improved feelings about asthma.⁵⁴

Open Airways for Schools has also been sustained through the use of undergraduate-level health education students. These college students, who received intensive but limited training, effectively delivered the program to inner-city children with asthma enrolled in school-based clinics.⁴¹ Using a similar model with medical students, Triple A, an effective peer-based intervention for high school students, has reached more than 12,000 high school students in Australia since its inception in the mid-1990s.⁵⁵ First and second year medical students at the University of Sydney are offered training in delivering the intervention as an elective.⁵⁵ In addition to sustaining Triple A, this model has also proven beneficial to the medical students: participation reinforced their asthma knowledge and confidence in teaching adolescent

patients about health issues, enhanced communication and leadership skills, and assisted in developing an appreciation of social responsibility. A further benefit to this model is that the medical students have served as role models, inspiring the high school students to continue their education. Using pharmacy students has also proven beneficial.

STRATEGIES TO TEACH SCHOOL FACULTY AND PERSONNEL MANAGEMENT SKILLS

Given the significant amount of time children spend in school during the academic year, it is important for school faculty and staff to be educated about asthma and to have skills to prevent and to manage asthma. Although school nurses are the most common provider of school health services, only about one third of schools nationwide have full-time nurses, and one third have full-time health aides.²² In the absence of having a full-time medical staff, medication administration and asthma exacerbations are handled by school administrators, faculty, and staff who often send children home early or to an ED.³⁰ Deaths from asthma exacerbations in school may be attributed, in part, to hesitation and/or delay by school staff to provide medical assistance.⁵⁶

Inadequate asthma management at schools may be a result of poor knowledge of asthma by school personnel.⁵⁷⁻⁶⁰ School staff sometimes describe themselves as very confident in how to respond to an asthma attack, yet their descriptions of what they would do include ineffective and sometimes dangerous steps.⁶⁰ In a recent study of 320 Kindergarten through fifth grade New York City public school teachers, Bruzzese et al (unpublished observation) found that most teachers correctly identified potential triggers, but few knew that exercise need not be avoided in those with asthma and that exercise-induced symptoms could be prevented by taking medication before exercising.

Poor communication between school personnel and parents may also contribute to the inadequate asthma management at schools. For example, school personnel are often not aware of which students are diagnosed with asthma⁶¹ and often learn about a student's asthma diagnosis through informal conversations with the student or parent.⁵⁸ Furthermore, students often do not have asthma management plans on file at school.^{62,63}

Although studies document inadequate asthma knowledge and management skills by school staff and poor communication at schools regarding asthma, little is known about staff who work with low-income, ethnic minority students, the population most affected by asthma and thus in need of good quality asthma management in schools. Therefore, such school personnel should be targeted for further investigation.

Despite the importance of intervening with school personnel, few interventions have been conducted with school personnel. A statewide case study in Minnesota that trained medical personnel, secretaries, teachers, coaches, principals, and other administrators about asthma produced significant increases in asthma knowledge and empowered school personnel to practice behavior and organizational changes.⁶⁴ However, there are no known controlled trials testing an intervention designed specifically for school personnel, and the studies that have included a teacher education component as part of a comprehensive intervention are mixed. Clark et al⁴⁰ found that an inner-city school-based program that provided education to ethnic minority students with asthma, their classmates, their parents, and school personnel resulted in a significant reduction in symptoms, fewer school

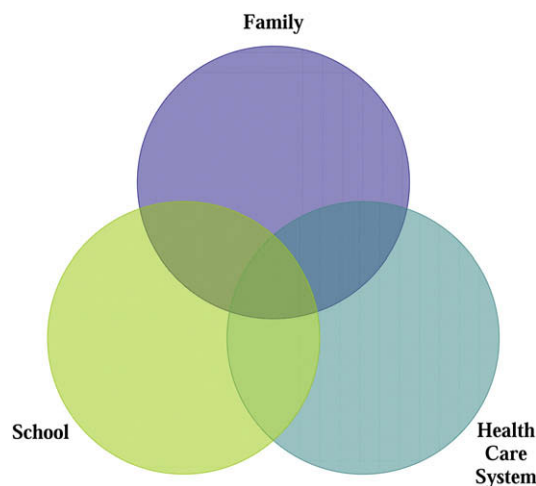


FIG 1. School-based programs depend on a partnership with families and the health care system. The relative contribution of each component is a key determinant of the strategy that will be effective in improving asthma outcomes.

absences, and better grades for students with persistent asthma. In contrast, few improvements in health outcomes were found in ethnic minority New York City students whose schools participated in a comprehensive intervention that included training students' primary care doctors, asthma education for school personnel, and the establishment of a preventive network of care for students with asthma by school nurses who coordinated communications and fostered relationships between families, primary care providers, and school personnel.²⁷ Together, these results suggest that there is potential for a novel intervention targeting school personnel; studies determining the effectiveness of such an intervention would be of interest.

FUTURE DIRECTIONS

Several studies suggest that school-based asthma interventions can improve health outcomes and quality of life in children who have persistent asthma. However, the partnership of the educational and public health systems requires clearer delineation. Screening instruments need to be refined to identify those children who would benefit most from further assessment and treatment. A notable goal of school-based asthma programs is to have nurses present in the school. School nurses have important roles in implementing programs related to immunizations or education of students regarding health behaviors such as drug use and sexually transmitted diseases. There are few data on integration of an asthma educational curriculum for school nurses with education for other health issues. Information on the cost-effectiveness of school-based interventions is limited, and this requires further study. School-based interventions are generally issue-specific or disease-specific. Innovative approaches that combine topics should be considered. For example, in inner cities, both obesity and asthma are prevalent. Because there is an association between asthma and obesity, strategies targeting both problems may be more cost-effective.

In summary, the success of school-based programs for asthma is dependent on a partnership with families and the health care system (Fig 1). Individual schools have different capabilities to deal with school health in general and with asthma in particular.

The strategy to improve asthma outcomes that is most likely to succeed in a particular school will be dependent on the resources that each component of the partnership can contribute.

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