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Research Article

Adherence to National Asthma Education and Prevention Program's "How Asthma-Friendly Is Your School?" Recommendations

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School health policies and programs provide the framework for a safe and supportive environment for students with asthma. School Health Policies and Programs Study 2006 data were examined to assess whether schools nationwide have policies and programs consistent with the "How Asthma-Friendly Is Your School?" checklist from the National Asthma Education and Prevention Program. Adherence to some of the recommendations on the checklist was high. For example, 80% or more of schools allowed students to carry and self-administer asthma medications, and obtained and kept asthma action plans. For other recommendations, however, far fewer schools had the recommended policies or programs; most notably, less than one third of schools had a full-time Registered Nurse. Improvements in many school policies and programs are needed so that students have a safe and supportive school environment to help them control their asthma while away from home.

Keywords: asthma; schools; environment

INTRODUCTION

Asthma is a leading chronic health condition among children and adolescents. More than 6 million children younger than 18 years of age have asthma (Centers for Disease Control and Prevention [CDC], 2006a). Asthma accounts for an estimated 13 million lost school days annually (Akinbami, 2006) and is a leading cause of hospitalization among children younger than 15 years of age (DeFrances, Cullen, & Kozak, 2007). Treatment costs among those younger than 18 years of age are estimated at \$3.2 billion per year (Weiss, Sullivan, & Lytle, 2000).

Although asthma cannot be cured, it can be controlled through medication and avoidance of environmental triggers for asthma, such as cockroaches, dust mites, fur-bearing pets, mold,

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tobacco smoke, and certain chemicals (CDC, 2008a; Moorman et al., 2007). School health policies are the foundation for programs that lead to a safe and supportive environment for students with asthma and can help students control their asthma while away from home (CDC, 2006b).

The "How Asthma-Friendly is Your School?" checklist from the National Asthma Education and Prevention Program (NAEPP) provides a series of eight recommendations, presented in the form of questions, that can be used to determine how well a school serves students with asthma.

The checklist addresses issues such as environmental tobacco smoke, self-medication with asthma medications, emergency plans for asthma episodes, asthma education, and indoor air quality (NAEPP, 2008a).

CDC's School Health Policies and Programs Study (SHPPS) provides national in-depth assessment of eight school health program components at state, district, and school levels (Kyle et al., 2007). SHPPS 2006 examined many school health policies and programs that support students with asthma. The purpose of this secondary analysis of SHPPS 2006 data was to examine the degree to which elementary, middle, and high schools in the United States have policies and programs consistent with recommendations found in the "How Asthma-Friendly is Your School?" checklist.

METHOD

SHPPS 2006 study methods and the psychometric properties of the questionnaires have been described in detail elsewhere (Brenner, Kann, & Smith, 2003; Kyle et al., 2007). Briefly, SHPPS 2006 assessed eight school health program components: health education, physical education and activity, health services, mental health and social services, nutrition services, healthy and safe school environment, faculty and staff health promotion, and family and community involvement. Using 23 questionnaires developed for this study, all eight components were assessed at state, district, and school levels, and health education and

physical education and activity were assessed at the classroom level. Questionnaires that took longer than 20–30 min to complete or covered such a wide range of topics that a single respondent might not have sufficient knowledge to complete it were divided into modules.

DATA COLLECTION AND RESPONDENTS

For this analysis of SHPPS 2006 data, school level data were utilized. The school sample was selected in 2 stages. In the first stage, a sample of primary sampling units (PSUs) was drawn using systematic sampling with the probability of selection proportional to the number of schools in each PSU. In the second stage, schools were selected with stratified random sampling within each sampled PSU. Strata were based on school level (elementary, middle, and high school) and school size (small vs. large). This sampling strategy resulted in a nationally representative sample of public and private elementary, middle, and high schools (Kyle, 2007, Brenner, Kann, & Smith, 2003). Slightly more than one half of sampled schools were elementary schools (52.0%), 29.3% were middle schools, and 18.3% were high schools. Most schools were public (72.8%) and the remaining were Catholic or other private schools (27.1%). One-half of schools were suburban (51.2%), 29.3% were urban, and 19.4% were rural.

School-level data were collected through computer-assisted personal interviews. For each school-level questionnaire or module, the principal or another school-level contact designated a faculty or staff respondent who had primary responsibility for or was the most knowledgeable about the particular component. Classroom-level data were collected in sampled schools through computer-assisted personal interviews with teachers of randomly selected classes covering required health instruction and required physical education in elementary schools and randomly selected required health and physical education courses in middle and high schools. The data were collected between January and June 2006. The CDC's Institutional Review Board determined that SHPPS 2006 was exempt from review because it did not collect individual information from human subjects; that is, respondents reported on the policies and practices of the state

education agency, local education agency, or school that they represented.

RESPONSE RATES

“How Asthma-Friendly is Your School?” was designed for self-assessment at the school level; therefore, the current analysis used only school-level and classroom-level data from SHPPS 2006. Five school health program components (health education, physical education, health services, nutrition services, and healthy and safe school environment) included data relevant to the “How Asthma-Friendly is Your School?” checklist. Response rates for the interviews and the number of schools completing interviews varied depending on the school health program component. For each component, the response rate was calculated by dividing the number of schools that completed at least one module in that component by the number of eligible schools for that component. For health education, the response rate was 69% (920 of 1338 eligible schools); health services, 74% (1029 of 1397 eligible schools); nutrition services, 71% (944 of 1338 eligible schools); and healthy and safe school environment, 72% (1025 of 1416 eligible schools). At the classroom level, 967 classes or courses were eligible for the health education interview; a teacher completed the interview for 912 (94%) of these. Similarly, 1260 classes or courses were eligible for the physical education interview; a teacher completed the interview for 1194 (95%) of these.

DATA ANALYSIS

Asthma-friendly schools are defined as those that have taken steps to create safe and supportive learning environments for students with asthma.

They have policies and procedures in place that allow students to successfully manage their asthma (CDC, 2006b). The “How Asthma-Friendly is Your School?” checklist comprises eight sets of recommendations that are presented

in the form of questions schools can use to self-assess their asthma-related school policies and programs (NAEPP, 2008a; Table 1). For this analysis, SHPPS questions were identified which most closely matched the recommendations in “How Asthma-Friendly is Your School?” SUDAAN[®] statistical software, which takes into account the complex sampling design of SHPPS, was used to generate point estimates and to conduct *t*-tests to compare rates across elementary, middle, and high schools. Results are based on weighted data. Contrasts were considered statistically significant if alpha was $<.05$.

Two composite variables were created to summarize closely related policies or practices. First, to address environmental tobacco smoke, a “smoke-free school policy” variable was created. Schools were considered to have such a policy if they prohibited students, faculty, staff, and visitors from smoking cigarettes in school buildings; on school grounds, including parking lots and playing fields; in school buses or other vehicles used to transport students; and at off-campus, school-sponsored events; and if they prohibited students, faculty, staff, and visitors from smoking cigars or pipes (location not specified).

Second, in the SHPPS 2006 questionnaire, hazardous materials were defined as materials that may be harmful to people or the environment, such as paint, chemicals used for science experiments, cleaning products, and medical waste. Schools were considered to have a hazardous materials plan if they had a plan for each of the following: how to use hazardous materials, how to label them, how to store them, and how to dispose of them.

RESULTS

Results are presented by responding to each of the eight recommendations/questions of the NAEPP.

1. Are the school buildings and grounds free of tobacco smoke at all times? Are all school buses, vans, and trucks free of tobacco smoke? Are all school events, like field trips and team games (both “at-home” and “away”), free from tobacco smoke?

Although one might expect that students with asthma would be less likely than those without asthma to use cigarettes, given that smoking may

TABLE 1. Percentage of Schools With Policies and Practices Consistent With "How Asthma-Friendly is Your School?" Recommendations, by School Level—SHPPS 2006.

<i>"How Asthma-Friendly is Your School?" Question and Associated SHPPS 2006 Items</i>	<i>Total (%)</i>	<i>Elementary Schools (%)</i>	<i>Middle Schools (%)</i>	<i>High Schools (%)</i>
1. Are the school buildings and grounds free of tobacco smoke at all times? Are all school buses, vans, and trucks free of tobacco smoke? Are all school events, like field trips and team games (both "at-home" and "away"), free from tobacco smoke? School had a smoke-free school policy ^a	65.9	67.1	61.2	69.6
2. Does your school have a policy or rule that allows students to carry and use their own asthma medicines? If some students do not carry their asthma medicines, do they have quick and easy access to their medicines? Students were permitted to carry and self-administer a prescription quick-relief inhaler	81.6	76.9	83.3	92.0
3. Does your school have a written emergency plan for teachers and staff to follow to take care of a student who has an asthma attack? In an emergency, such as a fire, weather, or lock-down, or if a student forgets his or her medicine, does your school have standing orders and quick-relief medicines for students to use? Health services facilities and equipment were available at the school for health services staff (available not just for a specific student's use): Peak flow meter Nebulizer Albuterol inhaler	35.7 30.9 11.9	35.7 31.4 11.0	33.5 27.6 10.9	38.7 34.5 15.6
4. Do all students with asthma have updated asthma action plans on file at the school? An asthma action plan is a written plan from the student's doctor to help manage asthma and prevent asthma attacks. School obtained and kept asthma action plans	91.6	91.8	92.6	89.5
5. Is there a school nurse in your school building during all school hours? Does a nurse identify, assess, and monitor students with asthma at your school? Does he or she help students with their medicines, and help them be active in physical education, sports, recess, and field trips? If a school nurse is not full-time in your school, is a nurse regularly available to write plans and give the school guidance on these issues? School had full-time school nurse School had full-time school nurse who was a registered nurse (RN) A school nurse administered medication as needed as a part of standard health services A school nurse identified or provided school-based management of chronic health conditions such as asthma or diabetes as needed as a part of standard health services A school nurse tracked students with chronic health conditions as needed as a part of standard health services A school nurse provided case management for students with chronic health conditions such as asthma or diabetes as needed as a part of standard health services	35.7 31.5 75.8 73.3 69.0 66.7	30.3 26.8 74.0 72.7 67.8 67.5	39.7 33.5 78.0 74.0 69.8 65.4	44.1 41.1 77.3 73.8 70.9 66.5
6. Does the school nurse or other asthma education expert teach school staff about asthma, asthma action plans, and asthma medicines? Does someone teach all students about asthma and how to help a classmate who has asthma? Health services staff provided instruction on self-management of chronic health conditions, such as asthma or diabetes to students when needed Students were required to receive instruction on asthma awareness School had a teacher who received staff development on asthma awareness ^b	78.7 47.2 23.6	78.1 44.9 23.0	77.6 47.0 26.7	82.0 53.8 21.8
7. Can students with asthma fully and safely join physical education, sports, recess, and field trips? Are students' medicines nearby, before and after they exercise? Can students with asthma choose a physical activity that is different from others in the class when it is medically necessary? Can they choose another activity without fear of being ridiculed or receiving reduced grades? School required that physical education classes or courses had a teacher who received staff development on chronic health conditions, for example asthma or diabetes, including recognizing and responding to severe symptoms or reducing triggers	43.6	45.6	37.9	35.3
8. Does the school have good indoor air quality? Does the school help to reduce or prevent students' contact with allergens or irritants, indoors and outdoors, that can make their asthma worse? Allergens and irritants include tobacco smoke, pollens, animal dander, mold, dust mites, cockroaches, and strong odors or fumes from things like bug spray, paint, perfumes, and cleaners. Does the school exclude animals with fur?				

(Continued)

TABLE 1. (continued)

<i>"How Asthma-Friendly is Your School?" Question and Associated SHPPS 2006 Items</i>	<i>Total (%)</i>	<i>Elementary Schools (%)</i>	<i>Middle Schools (%)</i>	<i>High Schools (%)</i>
School had an indoor air quality management program	51.4	52.7	47.5	54.1
School had policy to purchase low-emitting products	56.5	57.5	55.5	55.2
School maintained ASHRAE ^c standards for ventilation ^d	50.3	50.7	46.6	54.9
School kept relative indoor humidity below 60% ^d	55.3	53.6	54.8	60.8
School conducted periodic inspections of heating, ventilation, and air-conditioning system	96.0	96.8	95.5	94.5
School had a plan for how to address mold problems	67.0	70.4	62.5	64.2
School had a plan for how to use, label, store, and dispose of hazardous materials	85.9	83.7	86.8	90.5
School used the following integrated pest management strategies:				
Monitoring strategies				
Conducted periodic inspections for pests ^c	94.2	94.4	94.5	93.0
Exposure reduction strategies				
Spot treatments and baiting used rather than widespread applications of pesticides ^d	57.9	59.2	57.4	54.3
Indoor and outdoor areas that had been treated with pesticides clearly marked ^d	56.2	59.8	46.5	60.1
Staff and students informed prior to the application of pesticide ^d	65.4	68.1	60.6	63.3
Sanitation strategies				
Food stored in plastic, glass, or metal containers with tight lids so that it was inaccessible to pests ^d	82.6	78.8	83.4	88.8
Food preparation equipment cleaned promptly ^d	97.5	97.0	99.6	98.0
Surfaces contaminated by food cleaned promptly ^d	97.7	97.5	99.2	95.9
Eating allowed only in designated areas to control pests ^d	59.5	59.1	64.9	54.0
Lockers cleaned to remove any food remains ^d	39.8	37.4	40.3	38.2
Desks cleaned to remove any food remains ^d	70.2	72.6	66.8	70.1
Trash containers cleaned with a disinfectant ^d	57.6	53.2	65.2	56.1
Exclusion strategies				
Waste stored in plastic, glass, or metal containers with tight lids so that it was inaccessible to pests ^d	73.8	72.8	79.4	70.4
Openings in walls, floors, doors, and windows sealed with caulk or weather stripping ^d	49.8	50.5	47.9	51.7
Vegetation, shrubs, and wood mulch kept at least 1 foot away from buildings to control pests ^d	63.0	63.7	62.2	62.4

- a. Smoke-free policies are defined as those that (a) prohibit students, faculty, staff, and visitors from smoking cigarettes in school buildings; on school grounds, including parking lots and playing fields; in school buses or other vehicles used to transport students; and at off-campus, school-sponsored events, and (b) prohibit students, faculty, staff, and visitors from smoking cigars or pipes (location not specified).
- b. Elementary school classes covering required health instruction and required health education courses in middle school or high school had a teacher who received staff development on asthma awareness during the 2 years preceding the study.
- c. American Society of Heating, Refrigerating, and Air Conditioning Engineers.
- d. Almost always or always, during the 12 months preceding the study.
- e. During the 12 months preceding the study.

cause asthma symptoms, a national study of high school students found that students with self-reported asthma were as likely or more likely to use cigarettes than students without asthma (Everett Jones, Merkle, Wheeler, Mannino, & Crossett, 2006). (CDC, 1994; Clark, Brown, Parker, Robins, Remick, & Philbert, 1999; Epps, Manley, & Glynn, 1995; Everett Jones et al., 2006; Morkjaroenpong et al., 2002; U.S. Department of Health and Human Services, 1994). SHPPS 2006 found that overall 65.9% of schools had a smoke-free school

policy. Significantly more high schools (69.6%) than middle schools (61.2%; $t = 2.1, p < .05$) had a smoke-free school policy.

To provide support for students choosing not to smoke, and to protect students, staff, and visitors from secondhand smoke, school policies should prohibit tobacco use by all students, staff, and visitors on all school property, in any form of school transportation, and at any school-sponsored event on and off school property

2. Does your school have a policy or rule that allows students to carry and use their own asthma medicines? If some students do not carry their asthma medicines, do they have quick and easy access to their medicines?

Students with asthma should have immediate access to their medications throughout the school day and on their way to and from school. When parents or guardians, the asthma care clinician, and school personnel, particularly the school nurse, deem it appropriate, students should be allowed to carry and self-administer their asthma medications as a means of preventing or reducing the severity of asthma episodes (Everett Jones & Wheeler, 2004; NAEPP, 2005a). Such determinations should be made on a case-by-case basis based on a child's abilities, interest, and maturity (Everett Jones & Wheeler, 2004; NAEPP, 2005a).

SHPPS 2006 found that overall 81.6% of schools permitted students to carry and self-administer a prescription quick-relief inhaler.

Significantly more high schools (92.0%) than elementary schools (76.9%; $t = 5.0, p < .001$) and middle schools (83.3%; $t = 2.9, p < .01$) permitted students to do so.

3. Does your school have a written emergency plan for teachers and staff to follow to take care of a student who has an asthma attack? In an emergency, such as a fire, weather, or lockdown, or if a student forgets his/her medicine, does your school have standing orders and quick-relief medicines for students to use?

School staff should understand asthma symptoms and should be able to identify when a student requires emergency attention. NAEPP has developed suggested emergency protocols for students with asthma symptoms who do not have a personal asthma action plan. These emergency protocols include symptoms to watch for and actions to be taken in response (NAEPP, 2008b, 2008c). Schools should be prepared for situations in which school-wide emergencies occur or when students who need their medications do not have them.

SHPPS 2006 did not assess emergency plans specific to students with asthma or the extent to

which schools have standing orders for quick-relief medicines for students. However, SHPPS 2006 queried schools about health services and facilities or equipment that were available at the school for in-school health services staff to use. Schools demonstrated readiness to implement emergency plans by providing asthma equipment and stock medications. When asked about equipment and medication "not just for a specific student's use," about one third of schools (35.7%) had a peak flow meter, 30.9% had a nebulizer, and 11.9% had an albuterol inhaler, none of which significantly varied by school level.

4. Do all students with asthma have updated asthma action plans on file at the school? An asthma action plan is a written plan from the student's doctor to help manage asthma and prevent asthma attacks.

The NAEPP Expert Panel Report 3 recommends clinicians provide to all patients who have asthma a written asthma action plan that includes instructions for daily management and for recognizing and addressing worsening asthma. Daily management plans address (a) what medicine to take daily, including the specific names of the medications, and (b) what actions to take to control environmental factors that worsen the patient's asthma. Recognizing and handling worsening asthma includes identifying (a) what signs, symptoms, and peak expiratory flow (PEF) measurements indicate worsening asthma; (b) what medications to take (or how to adjust dosages) in response to these signs; (c) what symptoms and PEF measurements indicate the need for urgent medical attention; and (d) emergency telephone numbers of the physician, emergency department, and person or service to transport the patient rapidly for medical care (National Heart, Lung, and Blood Institute [NHLBI] NAEPP, 2007). One small study of school nurses in a metropolitan school district found that asthma action plans increased the nurse's confidence in caring for children with asthma, and that the asthma action plans provided guidance and direction needed for the "provision of safe asthma care" (Borgmeyer, Jamerson, Gyr, Westhus, & Glynn, 2005, p. 27).

Although SHPPS does not assess the contents of asthma action plans, SHPPS 2006 found that nearly all schools (91.6%) obtain and keep asthma action plans "in any type of student record."

5. Is there a school nurse in your school building during all school hours? Does a nurse identify, assess, and monitor students with asthma at your school? Does he or she help students with their medicines, and help them be active in physical education, sports, recess, and field trips? If the school nurse is not full-time in your school, is a nurse regularly available to write plans and give the school guidance on these issues?

The American Academy of Pediatrics recommends having a full-time school nurse in every school (American Academy of Pediatrics, 2008). According to the National Association of School Nurses (NASN), "school nurses facilitate positive student responses to normal development; promote health and safety; intervene with actual and potential health problems; provide case management services; and actively collaborate with others to build student and family capacity for adaptation, self-management, self-advocacy, and learning" (NASN, 2002a). School nurses play an important role in helping students with asthma manage their asthma at school and are an important link between the student's school, home, and health care provider (NASN, 2002b; Telljohann, Dake, & Price, 2004).

Using the criterion that a school had a full-time nurse, if either a registered nurse (RN) or a licensed practical nurse (LPN) was present in the school for at least 30 hr per week during the 30 days preceding the study, 35.7% of all schools had a full-time school nurse. Significantly more middle schools (39.7%; $t = 2.4$, $p = .02$) and high schools (44.1%; $t = 3.7$, $p < .001$) than elementary schools (30.3%) had a full-time school nurse. Less than one third (31.5%) of all schools had a full-time school nurse who was an RN. Significantly more high schools (41.1%) than elementary schools (26.8%) had a full-time school nurse who was an RN ($t = 3.7$, $p < .001$).

SHPPS also asked about health services that may be provided to students when needed as a part of standard health services at the school, and asked respondents to identify who provided the services. Nearly all schools (98.1%) provided administration of medications, with significantly more elementary schools (98.6%; $t = 2.1$, $p = .04$) and middle schools (98.6%; $t = 2.1$, $p = .04$) providing administration of medication than high schools (95.8%). In 75.8% of all schools, a school nurse administered medications. Most schools (81.9%) provided identification or

school-based management of chronic health conditions such as asthma or diabetes; in 73.3% of all schools, a school nurse was identified as providing this service. Most schools (79.0%) provided tracking of students with chronic health conditions; in 69.0% of schools, a school nurse was identified as providing the tracking. Nearly three fourths (74.1%) of schools provided case management services for students with chronic health conditions such as asthma or diabetes; in 66.7% of schools, a school nurse was identified as providing case management services.

6. Does the school nurse or other asthma education expert teach school staff about asthma, asthma action plans, and asthma medicines? Does someone teach all students about asthma and how to help a classmate who has asthma?

One of the six strategies identified by CDC to address asthma within a coordinated school health program is to provide asthma education and awareness programs for all students and school staff (CDC, 2006b). For students with asthma, education can reinforce the knowledge, attitudes, and skills they need to control their asthma. Asthma awareness should be promoted among all other students by incorporating asthma education into the health education curricula. School staff need education on asthma basics, asthma management, and emergency response to ensure that they can provide proper care for students with asthma at school (CDC, 2006b).

SHPPS 2006 found that in 78.7% of schools, health services staff provided instruction on the self-management of chronic health conditions, such as asthma or diabetes when needed as part of standard health services. In 47.2% of schools, students were required to receive instruction on asthma awareness. Significantly, more high schools (53.8%) than elementary schools (44.9%) had this requirement ($t = 2.1$, $p = .04$). Nationwide, 23.6% of elementary school classes covering required health instruction and required health education courses in middle school or high school had a teacher who received staff development on asthma awareness during the 2 years preceding the study.

7. Can students with asthma fully and safely join physical education, sports, recess, and field trips? Are students'

medicines nearby, before and after they exercise? Can students with asthma choose a physical activity that is different from others in the class when it is medically necessary? Can they choose another activity without fear of being ridiculed or receiving reduced grades?

Without preexercise treatment, exercise will cause asthma symptoms for most students with asthma, particularly if their asthma is not well controlled (NHLBI, 1995; Weiler et al., 2007). Current treatments, however, can successfully control asthma and allow students in school to engage in physical activity with little or no restriction (NHLBI, 1995; Weiler et al., 2007). In fact, physical activity may reduce asthma symptoms by improving lung function (Fitch, Blitvich, & Morton, 1986; Matsumoto et al., 1999; Welsh, Kemp, & Roberts, 2005; Welsh, Roberts, & Kemp, 2004). Physical education teachers and coaches must understand what asthma is and what students with asthma may need to safely engage in physical activity, such as preexercise medication, a longer warm up, or modification of the activity (NHLBI, 1995; Weiler et al., 2007).

SHPPS 2006 found that 43.6% of required physical education classes or courses had a teacher who received staff development during the 2 years preceding the study on chronic health conditions (e.g., asthma or diabetes), including information on recognizing and responding to severe symptoms or minimizing triggers. This kind of staff development for teachers of physical education was significantly more common in elementary schools (45.6%) than in high schools (35.3%; $t = 2.1, p = .04$).

8. Does the school have good indoor air quality? Does the school help to reduce or prevent students' contact with allergens or irritants, indoors and outdoors, that can make their asthma worse? Allergens and irritants include tobacco smoke, pollens, animal dander, mold, dust mites, cockroaches, and strong odors or fumes from things like bug spray, paint, perfumes, and cleaners. Does the school exclude animals with fur?

Poor indoor air quality not only can trigger asthma episodes in susceptible children, who may then miss school, but also can cause drowsiness; fatigue; lethargy; headache; eye, nose, throat, and skin irritation; and inability to concentrate—all of which compromise learning (American Academy of Pediatrics Committee on Environmental Health, 2003; Lyons, 2001;

Tranter, 2005). A recent meta-analysis of the associations between respiratory health effects and dampness and mold in homes found that building dampness and mold were associated with 30% to 50% increases in many respiratory and asthma-related adverse health outcomes (Fisk, Lei-Gomez, & Mendell, 2007).

SHPPS 2006 assessed several indicators of good indoor air quality. More than one half (51.4%) of schools had an indoor air quality management program (i.e., a set of specific activities for preventing or resolving indoor air quality problems); 56.5% had a policy of purchasing low-emitting products (i.e., products designed to give off low levels of fumes or vapors) for use in and around the school and school grounds (including art classes, industrial art classes, and science laboratories); 50.3% almost always or always maintained American Society of Heating, Refrigerating, and Air Conditioning Engineers standards for ventilation; and 55.3% almost always or always kept relative indoor humidity below 60%. Nearly all schools (96.0%) conducted periodic inspections of heating, ventilation, and air-conditioning systems, and 67.0% of schools had a plan for addressing mold problems.

SHPPS 2006 also asked about hazardous materials in the school, that is, materials that may be harmful to people or the environment, such as paint, chemicals used for science experiments, cleaning products, and medical waste. Most schools (85.9%) had a plan for how to use, label, store, and dispose of hazardous materials. Significantly more high schools (90.5%) than elementary schools (83.7%) had such plans ($t = 2.6, p < .01$).

Schools are particularly vulnerable to pest problems because of the large size of school structures; the numbers of occupants; the availability of food on the premises; and the abundance of books, supplies, and equipment that provide potential habitats for various types of pests (American Academy of Pediatrics Committee on Environmental Health, 2003). Controlling pests is important for reducing asthma triggers, but pesticides themselves can be asthma triggers. Students can be exposed to pesticides at school when pest control chemicals are applied, a practice that is particularly problematic when schools conduct "routine" spraying (i.e., applying pesticides based on routine schedules rather than on evaluation of need) (American Academy of Pediatrics Committee

on Environmental Health, 2003). Integrated pest management is an approach to pest control that seeks to reduce the use of toxic pesticides as much as possible by relying on nontoxic methods of pest control such as physical exclusion and by limiting pesticide use, when essential, to the least toxic available substances (U.S. Environmental Protection Agency [EPA], 2008a).

In SHPPS 2006, schools were not asked whether they had an integrated pest management program, but were instead asked whether they used individual strategies recommended as part of such a program. During the 12 months before the study, only 6.7% of schools almost always or always followed *all* of the recommended strategies applicable to their school. The percentage of schools engaging in some of the strategies varied across school level. Significantly more high schools (88.8%) than elementary schools (78.8%) stored food in plastic, glass, or metal containers with tight lids so that it was inaccessible to pests ($t = 2.6, p = .01$); significantly more middle schools (99.6%) than elementary schools (97.0%) promptly cleaned food preparation equipment ($t = 2.1, p < .05$); significantly more middle schools (99.2%) than high schools (95.9%) promptly cleaned surfaces contaminated by food ($t = 2.1, p < .05$); significantly more middle schools (64.9%) than high schools (54.0%) allowed eating only in designated areas to control pests ($t = 2.8, p < .01$); significantly more middle schools (79.4%) than high schools (70.4%) stored waste in plastic, glass, or metal containers with tight lids so that it was inaccessible to pests ($t = 2.5, p < .05$); significantly more middle schools (65.2%) than elementary schools (53.2%; $t = 3.0, p < .01$) and high schools (56.1%; $t = 2.1, p < .05$) cleaned trash containers with a disinfectant; and significantly more elementary schools (59.8%, $t = 3.2, p < .01$) and high schools (60.1%; $t = 3.1, p < .01$) than middle schools (46.5%) clearly marked indoor and outdoor areas that had been treated with pesticides.

DISCUSSION

The U.S. Healthy People 2010 initiative has identified asthma as a national priority area and has set eight national asthma-related goals, including reduction of asthma-related deaths,

hospitalizations, activity limitations, and school or work days lost (U.S. Department of Health and Human Services, 2000). Schools can play an important role in reaching those goals by establishing policies and programs that create a safe and supportive environment for students with asthma.

NAEPP put forth the policy and program recommendations in the "How Asthma-Friendly is Your School?" checklist to help schools provide an environment in which students can successfully manage their asthma. An analysis of SHPPS 2006 data found that 80% or more of schools had policies or programs consistent with NAEPP recommendations, including allowing students to carry and self-administer asthma medications; obtaining and keeping asthma action plans; administering medications; identifying or managing chronic health conditions as part of standard health services; periodically inspecting heating, ventilation, and air-conditioning systems; and having plans in place to manage hazardous materials. Notably, 91.6% of schools obtained and kept asthma action plans; however, this figure is higher than reported elsewhere in the literature (Hillemeier, Gusic, & Bai, 2006; Sapien, 2007) and may represent, in part, the collection of medication orders, not complete asthma action plans. Likewise, SHPPS did not specify whether such asthma action plans are kept for every student with asthma, only that such information is kept in student records.

For most of the "How Asthma-Friendly is Your School?" recommendations, considerable improvement could be made in school programs and policies that would benefit students with asthma. Of particular concern is that less than one third of schools had a full-time RN. In addition to serving as a liaison between the school and child's home and between the school and health care providers, school nurses can contribute in numerous ways to the effective management of students with asthma while at schools by working with students, parents, staff, and the community (NASN, 2002b). Minimal educational requirements for nurses are not consistent nationally. NASN recommends a baccalaureate for entry into school nursing practice (NASN, 2002c). LPNs or Licensed Vocational Nurses (LVN) do not have the academic preparation to perform case management, coordination activities and health promotion or maintenance

services (NASN, 2002c). In addition, only 47.2% of schools required students to receive instruction on asthma awareness and only 23.6% of elementary school classes covering required health instruction and required health education courses in middle school or high school had a teacher who received staff development on asthma awareness during the 2 years preceding the study. These data suggest that many students and staff may not know how to identify a student having an acute asthma episode, what to do for a student with asthma who needs assistance, and how to support students with asthma so they can better control their asthma at school.

Another area for improvement includes indoor air quality management programs. While just over half of the schools reported having indoor air quality management programs, the pest management activities that are a central component of an indoor air quality management plan varied considerably. Pest management methods in schools are important not only because pests themselves can be problematic for students with asthma, but also because pesticides used to control pests can trigger asthma symptoms in sensitive students. SHPPS 2006 found that few schools engaged in all of the recommended pest management practices examined in the study; however, some practices were very common, such as promptly cleaning food preparation equipment and surfaces and storing food in containers inaccessible to pests. The prevalence of several pest management strategies (e.g., allowing eating only in designated areas to control pests, storing waste in containers inaccessible to pests, and clearly marking indoor and outdoor areas that had been treated with pesticides, to name a few) varied by school level. More research is warranted to understand why pest management practices vary so widely.

To help school districts evaluate and manage their school facilities for key environmental, safety, and health issues, including pest management, the EPA developed the HealthySEAT software tool (EPA, 2008b). In addition to recommending the implementation of an integrated pest management plan, the tool addresses inspection for evidence of pests, policies on methods of pesticide application, and posting and prenotification to parents and school employees of pesticide applications. More than one half of schools reported using integrated pest management

strategies consistent with the HealthySEAT priorities: 94% of schools conducted periodic inspections for pests, 58% used spot treatments and baiting rather than widespread applications of pesticides, 56% clearly marked indoor and outdoor areas that had been treated with pesticides, and 65% informed staff and students prior to the application of pesticides (Everett Jones, Axelrad, & Wattigney, 2007).

LIMITATIONS

This study is subject to at least two limitations. First, data are based on self-report and the extent to which respondents underreported or overreported is not known. Second, SHPPS 2006 was not designed to evaluate the extent to which schools were implementing the recommendations in "How Asthma-Friendly is Your School?" As a result, some of the SHPPS 2006 questions are only approximate matches for the concepts found under the recommendations.

The number of schools that have reviewed the recommendations found in "How Asthma-Friendly is Your School?" is not known. "How Asthma-Friendly is Your School?" was first published in 1997 and was disseminated to the school health community by NAEPP member organizations, including the U.S. Department of Education, the American Association of School Administrators, the National Education Association-Health Information Network, the National Association of State Boards of Education, and the National School Boards Association. Awareness of the recommendations may not be enough to foster implementation of each of the components, because effective implementation requires time, expertise, and resources that schools may not have. For example, hiring a full-time school nurse or providing in-service training for all staff requires financial resources and expertise.

IMPLICATIONS FOR SCHOOL NURSING PRACTICE

A careful review of both the recommendations provided in "How Asthma-Friendly Is Your School?" and the extent to which schools have implemented those recommendations provides

additional support for a full-time school nurse in every school. Not only do the recommendations directly identify the need for a school nurse in the school building during all school hours, but the expertise of a school nurse is implicated in all of the recommendations.

In addition to recommendations provided in "How Asthma-Friendly is Your School?," a variety of other resources are available to help schools ensure that they provide an asthma-friendly school environment. For example, NAEPP developed "Managing Asthma: A Guide for Schools," which includes action steps for principals, school nurses, teachers, custodians, and others (NAEPP, 2003). The EPA provides additional guidance through its "Indoor Air Quality Tools for Schools Program," including "Managing Asthma in the School Environment" (EPA, 2008c, 2008d). Further, EPA's Children's Health Protection website (<http://yosemite.epa.gov/ochnp/ochpweb.nsf/content/homepage.htm>) and Healthy School Environments website (<http://www.epa.gov/schools>) provide links to numerous resources addressing environmental exposures where children live, learn, and play. CDC's "Strategies for Addressing Asthma within a Coordinated School Health Program" identifies six strategies that schools and districts can use to address asthma within a coordinated school health program (CDC, 2006b). CDC also developed "Initiating Change: Creating an Asthma-Friendly School," a toolkit to "help advocates at the district and school levels persuade people in their schools and communities of the importance of asthma-friendly schools" (CDC, 2008b).

At least one state (New Jersey; The Pediatric/Adult Asthma Coalition of New Jersey, 2008) and two cities (Chicago and New York; Chicago Asthma Consortium's School Task Force, 2007; New York City Department of Health and Mental Hygiene, 2008) are working to improve the implementation of asthma-friendly policies by presenting Asthma-Friendly School Awards. Each award program is tailored to community laws and goals. All three programs have established criteria similar to "How Asthma-Friendly is Your School?" and annually provide awards to schools that meet the criteria. In New Jersey, more than 400 schools (approximately 10%) have received an Asthma-Friendly School Award (The Pediatric/Adult Asthma Coalition of New Jersey, 2008).

CONCLUSION

Data from SHPPS 2006 suggest that adherence to some of the recommendations found in NAEPP's "How Asthma-Friendly is Your School?" was high. For most recommendations, however, adherence was much lower. Notably, less than one-third of schools had a full-time registered nurse. Significant improvements in many school policies and programs are needed to ensure that students have safe and supportive school environments to help them control their asthma while away from home. To assess progress in this area, this analysis should be repeated periodically, beginning with the next wave of SHPPS, which is planned for 2012. Application of the many resources that provide guidance to schools and replication of Asthma-Friendly School Awards in additional states and cities may improve the extent to which schools provide an asthma-friendly environment.

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