

# Rural and Urban Children With Asthma: Are School Health Services Meeting Their Needs?

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## ABSTRACT

**OBJECTIVE.** Children with asthma spend a large portion of their day in school, and the extent to which public schools are prepared to meet their health needs is an important issue. The objective of this study was to identify asthma policies and practices in rural and urban school settings and to compare them with current National Heart, Lung, and Blood Institute recommendations.

**METHODS.** A stratified random sample of school nurses who represented each of the 500 active Pennsylvania school districts were surveyed in 2004 concerning nurse staffing patterns, availability of asthma monitoring and treatment-related equipment, emergency preparedness, availability of asthma-related support and case management services, school-specific procedures including identification of children with asthma and accessibility of inhaler medication during school hours, presence and content of written asthma management plans, and perceived obstacles to asthma management in the school setting. Sampling weights were incorporated into the analyses to take the survey design into account.

**RESULTS.** The overall response rate was 76%, with a total of 757 surveys analyzed. In more than half of secondary schools and three quarters of elementary schools, nurses were present <40 hours per week. Nearly 1 in 5 schools reported that staff who know what to do for a severe asthma attack were not always available. In 72% of rural schools, children were allowed to self-carry rescue inhalers, as compared with 47% of urban schools. Asthma management plans were on file for only 1 quarter of children with asthma, and important information often was omitted. Approximately half of the schools were equipped with peak flow meters and nebulizers, and spacers were available in 1 third of schools.

**CONCLUSIONS.** Improvements are needed to bring schools into compliance with current recommendations, including more consistent availability of knowledgeable staff, improved access to asthma monitoring and treatment-related equipment, more universal use of asthma management plans, and greater access to inhalers while at school, including increasing the proportion of children who are allowed to carry and self-administer inhaler medication.

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### Key Words

asthma, school health services, rural, urban, disparities, special health care needs

### Abbreviation

NHLBI—National Heart, Lung, and Blood Institute

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**C**HILDREN WITH ASTHMA spend a large portion of their day in school settings, often participating in before- and after-school activities in addition to scheduled classes. The extent to which public schools are prepared to meet the health needs of these children is an important issue, especially in view of the magnitude of the current childhood asthma burden. More than 9 million US children who are younger than 18 years have received a diagnosis of asthma at some point during their childhood,<sup>1</sup> and asthma is the single most prevalent cause of disability among children.<sup>2</sup> Each year, children with asthma experience 14.5 million missed school days, and these lost school days along with medical expenditures and lost productivity have been estimated to cost society close to \$2 billion annually.<sup>3</sup>

Research in the school setting suggests that multiple factors may impede effective asthma management.<sup>4</sup> Equipment that is necessary to monitor respiratory functioning and facilitate medication administration is unavailable in many schools.<sup>5</sup> Policies that promote ready access to rescue inhaler medications, including provisions for self-carrying by students, have been suggested to facilitate prompt symptom treatment and reduce the risk for more serious asthma exacerbations.<sup>6</sup> Such policies, however, are absent in a number of school settings.<sup>7,8</sup> Studies of school teachers and other staff have identified lack of sufficient knowledge about asthma and the appropriate actions to be taken in the event of asthma symptoms as a common problem.<sup>9,10</sup> In addition, lack of consistent communication among staff about children with asthma and asthma-related policies has been identified as an important barrier to optimal disease management.<sup>11,12</sup>

In 2002, the National Heart, Lung, and Blood Institute (NHLBI) sponsored the Resolution on Asthma Management at School to encourage adoption of policies that “encourage the active participation of students in the self-management of their condition and allow for the most consistent, active participation in all school activities” (p. 1).<sup>6</sup> The resolution included a series of specific policy recommendations, including the following:

1. A smoke-free environment for all school activities
2. Access to health services that are supervised by a school nurse. These services should include identification of students with asthma; a written asthma management plan for each student with asthma; appropriate medical equipment; and the support of an adult, as appropriate, to evaluate, monitor, and report on the administration of medication to the parent/guardian and/or health provider.
3. A written medication policy that allows safe, reliable, and prompt access to medications in the least restrictive way during all school-related activities and self-managed administration of medication (including

consideration of allowing students to carry and self-administer medications) consistent with the needs of the individual child and the safety of others.

4. A school-wide emergency plan for handling severe exacerbations of asthma.
5. Staff development for all school personnel on school medication policies, emergency procedures, and procedures for communicating health concerns about students.
6. Development of a supportive and healthy environment that respects the abilities and needs of each student with asthma.

Although the NHLBI resolution has been promoted by numerous professional and advocacy organizations, little is known about the extent to which the recommendations actually are implemented in public school settings. The 1 study that was found on this topic in a recent search of the empirical literature was by Snow et al,<sup>11</sup> who investigated asthma management policies and protocols in 5 Bronx elementary schools in relation to the NHLBI resolution. In their survey of principals, teachers, counselors, and school nurses, they found poor adherence to the recommendations and a lack of consistent strategies for communication and management of children’s asthma.

The objective of the present study was to survey public school nurses throughout Pennsylvania about asthma policies and practices in their school settings. In 2000, Pennsylvania joined a number of other states<sup>13</sup> in ensuring a smoke-free environment by passing Act 128, which prohibits the use or possession of tobacco by students or any other individuals in school buildings, on buses, or on any other property that is under the control of a school district.<sup>14</sup> Conformance with other NHLBI recommendations by schools throughout the state, however, has not been previously assessed.

The prevalence of asthma among school children in Pennsylvania is 9.3%, according to statistics gathered from school districts by the Pennsylvania Department of Health.<sup>15</sup> This rate is slightly higher than the overall rate of 8.7% that was found recently in the New England region.<sup>16</sup> The asthma rate among urban Pennsylvania children is modestly higher than the rural rate (9.5 vs 8.5).<sup>15</sup> Results from the National Survey of Children’s Health indicate that asthma poses a significant burden among Pennsylvania families, with 12.5% of those who have a child with asthma reporting that the condition has a great or medium impact on their family.<sup>17</sup>

Approximately half of all Pennsylvania school districts are located in rural areas, and a particular focus of the present study was the comparison of rural and urban districts to determine whether disparities in asthma policies and procedures are present. Although this issue has not been well studied, there is some evidence to suggest

that rural schools may face additional hurdles to appropriate asthma management. A study in New Mexico, for example, found that fewer than half of the state's rural elementary schools allowed children to carry needed medication as compared with 80% of urban schools. In addition, significantly fewer of the rural schools studied had staff who knew what to do for a severe asthma attack.<sup>18</sup> More generally, rural school nurses often are responsible for schools that are miles away from 1 another and may be more likely to find it necessary to delegate nursing functions to other school staff members.<sup>19</sup> As in many other states, rural schools in Pennsylvania also have relatively fewer economic resources available for student services, including health-related activities. In the 2000 school year, for example, the state's rural schools spent an average of \$7777 per student, as compared with \$8474 per student in urban districts.<sup>20</sup> In view of limited funding and other constraints, it was hypothesized in the present study that schools in rural districts would be less likely to have implemented NHLBI recommendations for optimal asthma management.

## METHODS

A stratified random sample of 996 public schools was drawn from the universe of all public elementary, middle, and high schools in Pennsylvania. The sampling design consisted of randomly selecting 2 schools from each of the Pennsylvania school districts. Although there are 501 school districts in the Commonwealth, in 2004, only 500 of these districts were active, yielding a theoretical maximum sample size of 1000. Because 3 of these districts contained only 1 school, the final sample size was 997 schools. Roughly half of Pennsylvania school districts ( $n = 243$ ) were classified as rural according to the definition used by the Center for Rural Pennsylvania; that is, the number of people per square mile within the district is  $<274$ .<sup>20</sup> Statistics gathered by the Pennsylvania Department of Health indicate that 86.3% of all children in the Commonwealth attend public school.

The nurse survey instrument drew on question formats that previously were used in asthma<sup>21,22</sup> and emergency preparedness research,<sup>23</sup> as well as content that reflects recommendations from the NHLBI Resolution on Asthma Management at School as discussed above. Questionnaire items covered nurse staffing patterns, availability of asthma monitoring and treatment-related equipment, emergency preparedness, availability of asthma-related support and case management services, school-specific procedures including identification of children with asthma and accessibility of inhaler medication during school hours, presence and content of written asthma management plans, and perceived obstacles to asthma management in the school setting.

An introductory letter was mailed to the attention of the school nurse in each of the schools in the sample,

along with the survey form and postage-paid return envelope. The option of an Internet-based response also was provided. The introductory letter included detailed information about all aspects of the study and also contained a statement notifying participants that informed consent was implied by return of a completed survey. The study protocol and procedures were reviewed and approved by the Pennsylvania State University Office of Research Protections (IRB 16438).

In the rare cases in which a nurse whose practice involved multiple schools received surveys at 2 schools, she or he was instructed to answer each questionnaire pertaining only to the school to which it was addressed. A \$2 monetary incentive was included with each survey to encourage participation.

Survey administration and data entry were coordinated by staff in the Pennsylvania State University Survey Research Center. Sampling weights were used to take the stratified survey design into account and produce representative estimates, and design-based F statistics were calculated to determine the significance of differences in categorical study variables among rural and urban school settings. All analyses were conducted with Stata version 8.2 statistical software.<sup>24</sup>

## RESULTS

A total of 365 surveys were received from nurses in rural schools and 392 from those in urban schools, for a total of 757 completed surveys. The overall response rate was 76%, and response rates did not differ significantly among rural (75.4%; 95% confidence interval: 71.6–79.2) and urban (76.6%; 95% confidence interval: 72.9–80.3) schools. The vast majority of questionnaires were received by postage-paid return mail, with only 11 questionnaires submitted electronically via the Internet Web site.

Table 1 shows the number of hours per week that either an registered nurse or a licensed practical nurse was reported to be physically present in the elementary and secondary schools surveyed, stratified by rural/urban location. Approximately 1 quarter of rural and urban elementary schools have nursing coverage for 40 or

**TABLE 1** Hours of Nurse Availability in Pennsylvania Elementary and Secondary Public Schools by Rural/Urban Location, 2004

	<8 h, %	8–23 h, %	24–39 h, %	≥40 h, %	<i>P</i> <sup>a</sup>
Elementary schools					
Rural	10	26	43	22	
Urban	4	16	53	27	.03
Secondary schools					
Rural	5	4	49	41	
Urban	2	11	57	30	.20

Nurse indicates registered nurse or licensed practical nurse.

<sup>a</sup>Statistical significance associated with design-based F statistic.

more hours per week. Nurse staffing was found to be significantly less comprehensive in rural relative to urban elementary schools ( $P = .03$ ). A nurse was present <8 hours per week in 10% of rural schools, and in an additional 26% of schools, nurses were present 8 to 23 hours, as compared with 4% and 16% coverage, respectively, in urban schools.

Nursing coverage tended to be somewhat more extensive in secondary schools; however, it remained the case that more than half of all schools combined had nurses on site for <40 hours per week. No significant rural–urban differences were seen among secondary schools. Nurse staffing of 40 or more hours per week was found in 41% of rural and 30% of urban secondary schools. Nine percent of rural schools and 13% of urban schools had nurses on site for <24 hours per week.

Table 2 presents comparisons of rural and urban schools in the availability of asthma-related equipment, aspects of emergency preparedness, and services and procedures related to asthma. The availability of 3 types of equipment was assessed: peak flow meters to monitor respiratory function and nebulizers and spacers for effective and efficient administration of asthma medication. Peak flow meters were available for student use in 61% of rural schools and in 49% of urban schools. Similarly, approximately half of schools in both rural and urban settings had nebulizers on site for medication administration, and approximately 1 third had spacers available to students.

Several aspects of emergency preparedness were eval-

uated. Nurses were asked whether staff who know what to do for a severe asthma attack before help arrives were always available during school hours. This was the case in just more than 80% of both rural and urban schools, indicating that knowledge about emergency asthma management among staff is an important issue in both types of school settings. An emergency response plan for medical emergencies was present in 91% of rural and 94% of urban schools, and a rapid response system linking the school campus to emergency medical services was available in approximately two thirds of schools in both settings. A notable difference was seen in the availability of automated defibrillation equipment, with rural schools significantly more likely to have this equipment on site (83% vs 59% in urban schools).

Nurses also were asked about specific services and procedures related to asthma. Support services for children with asthma and their families, including 1-to-1 counseling and support groups, were available in relatively few schools (19% in rural schools and 26% in urban schools). Likewise, case management services for children with frequent asthma-related problems were provided in approximately one third of schools in each setting. The primary ways in which school nurses learn which students have asthma also were similar, including parental notification, medical history and examination form from a physician, and medication order form. It is sometimes the case, however, that the school nurses' first indication that a child has asthma is when that child presents in the health office with asthma symptoms. This

**TABLE 2 Rural/Urban Comparisons of Asthma-Related Equipment, Emergency Preparedness, and Procedures and Services in Pennsylvania Public Schools, 2004**

	Rural, %	Urban, %	<i>P</i> <sup>a</sup>
Asthma-related equipment available at school			
Peak flow meters	61	49	.08
Nebulizers	54	52	.53
Spacers	32	34	.36
Emergency preparedness			
Staff who know about treating asthma attacks are always available	81	84	.59
Emergency response plan is in place for medical emergencies	91	94	.43
Rapid communication system links all parts of campus to EMS	65	61	.19
Automated external defibrillation equipment is available	83	59	<.001
Asthma-related services and procedures			
Support services available for children with asthma and their families	19	26	.47
Case management for children with frequent asthma-related problems	33	35	.79
Ways school nurses learn which students have asthma			
Parental notification	98	98	.69
Medical history and examination form signed by physician	83	89	.04
Medication form or doctor's medication order	87	88	.70
When student visits health office for asthma symptoms	62	81	<.001
Where students with asthma have access to inhalers while at school			
At the health office	91	93	.62
In their own possession	72	47	<.001
Other place	9	12	.44
Students do not have access to inhalers while at school	0.2	0.8	.23
Students who have asthma and have asthma management plans on file at school	22	29	.33

EMS indicates emergency medical services.

<sup>a</sup> Statistical significance associated with design-based F statistic.

situation was reported significantly more often in urban schools (81%) relative to rural schools (62%).

Nurses were instructed to identify each of the places where students have access to their inhalers while at school. The health office was the location most often cited, with >90% of all school nurses reporting that medications were available there. A significant difference was found in the proportion of schools that allowed children to carry their own inhalers while at school, with rural schools more often permitting self-carried medications than urban schools (72% vs 47%). Notably, 3 school nurses (2 urban and 1 rural) reported that students had no access to inhalers at their schools.

The NHLBI recommends that a written asthma management plan be available for every child with asthma. In all schools in the study sample, fewer than one third of children with asthma had asthma management plans on file. Moreover, plans that were available often lacked important information for optimal care of asthma in the school setting, as shown in Fig 1. For example, an emergency protocol for handling severe asthma attacks was present in fewer than three quarters of the management plans, and even fewer of the plans included emergency contact information for the child's physician. Contact information for parents was the recommended component that was most likely to be included but still was missing in >20% of the management plans. Other recommended components of management plans were less likely to be present, including peak flow monitoring procedures, plans for physical education participation, a list of specific asthma triggers, and procedures for storing and administering medications. Asthma management plans in urban schools were significantly more likely than those in rural schools to include several of the informational components.

Nurses also were asked about obstacles to asthma management in their school settings (Table 3). Lack of time was a commonly identified problem, noted by 46% of rural nurses as compared with 40% of urban nurses. Rural nurses were significantly more likely to cite lack of clear policies about asthma management as an important obstacle. Lack of funding for supplies was men-

**TABLE 3 Perceived Obstacles to Asthma Management in Rural and Urban Pennsylvania Public Schools, 2004**

	Rural, %	Urban, %	P <sup>a</sup>
Lack of time	46	40	.42
Lack of clear policies about asthma management	28	16	.003
Lack of staffing	30	25	.50
Lack of funding for supplies	25	36	.14
Lack of administrative support	8	7	.51

<sup>a</sup> Statistical significance associated with design-based F statistic.

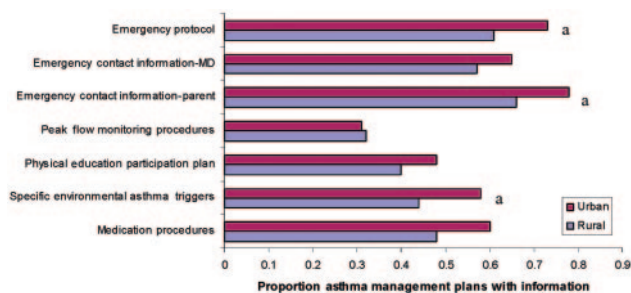
tioned by 36% of urban nurses and by 25% of rural nurses. Lack of administrative support seldom was viewed as an issue in either setting. In total, 85% of nurses reported 1 or more obstacles to asthma management, 68% reported 2 or more, and 44% reported 3 or more.

## DISCUSSION

Findings from this study indicate that many aspects of the NHLBI Resolution on Asthma Management at School have not been implemented fully in Pennsylvania schools. A key component of the recommendations, supervision of health services by a school nurse, is compromised by limited nurse staffing levels. Full coverage of school and extracurricular activities would require nursing availability for at least 40 hours per week in most cases, and this level of coverage was found in fewer than one third of elementary schools and fewer than half of secondary schools. In the absence of full nursing coverage, health services often are delegated to other school staff, who may have limited understanding of asthma and its management.<sup>10,25</sup> In addition, schools with less comprehensive nurse staffing tend to provide fewer services to children with asthma.<sup>26</sup> Present survey findings indicate that with current staffing levels, fewer than one quarter of schools provide support services for children with asthma and their families, such as counseling and peer support groups. Case management services, which have been found to be beneficial for children with asthma-related problems,<sup>4,27</sup> are available in just one third of schools.

These findings are consistent with nurses' perceptions of barriers to asthma management in their practice settings, with lack of time the issue most often mentioned. Statutory requirements for school nurse staffing in Pennsylvania stipulate a ratio of 1 school nurse for every 1500 students.<sup>28</sup> This staffing level is consistent with that found in a number of other states<sup>29</sup>; however, it is less comprehensive than the 1:750 ratio recommended in the *Healthy People 2010* national public health objectives<sup>30</sup> and the recommendations of professional nursing organizations.<sup>31</sup>

Increasing the number of nurses who are available would allow more time to provide support services for



**FIGURE 1**

Information included in asthma management plans in rural and urban Pennsylvania schools. <sup>a</sup> Differences between rural and urban schools statistically significant ( $P < .05$ ).

children with asthma, as well as promote more coordination in asthma care. In view of the finding that staff who know what to do for a severe asthma attack before help arrives are not always available in 1 of every 5 schools surveyed, more nursing coverage also would increase the likelihood that such situations consistently are managed appropriately. Given that schools face significant funding constraints that limit their ability to increase nursing staffing immediately, it may be reasonable to pursue a dual strategy of phasing in greater nursing staff coverage while at the same time increasing education and training about asthma for other school personnel who may be called on to treat children's asthma symptoms when a nurse is not present.

Other structural gaps in preparedness were identified in the present study. Some types of equipment that are relevant to asthma, such as nebulizers and spacers for optimal medication administration, are not uniformly available; neither are peak flow meters for monitoring respiratory function. Regarding emergency preparedness more generally, a response plan for medical emergencies is not in place in all schools, and only two thirds have a rapid communication system linking all parts of the campus to emergency medical services and automated external defibrillation equipment. Schools were more likely, however, to have elements of emergency preparedness in place than to have preventive and support services available, such as counseling and case management.

Communication about asthma and symptom management was reported to be problematic by many survey respondents. More than two thirds of nurses indicated that, in some instances, they are not aware that a child has asthma until that child comes to the health office with symptoms. This situation was reported significantly more often in urban schools, suggesting that routine channels of communication among school nurses, physicians, and parents about children's asthma may be less well-established in these settings. Alternatively, given that asthma is somewhat more prevalent in urban schools in Pennsylvania, it may be that school nurses in those settings are more likely to be the first medical professional to assess and recognize symptoms of asthma in some children.

Communication about asthma management also is known to be facilitated by the presence of written asthma plans<sup>6,32</sup> as recommended in the NHLBI resolution; however, only approximately one quarter of children with asthma currently have such a plan on file at their school. The plans that are available often lack important components, including emergency contact information for physicians and parents and the recommended procedures to follow in the event of severe symptom exacerbations. More collaboration is needed between school nurses and pediatric primary care providers to ensure that accurate and complete asthma

management plans are available in the school setting for each child with asthma.

The proportion of schools in Pennsylvania that allow self-carrying rescue inhaler medication is roughly comparable to schools nationally, 68% of which allow students to self-medicate with prescription inhalers.<sup>5</sup> Schools may limit self-carrying asthma medication as part of drug use prevention efforts or in hopes of reducing liability claims.<sup>7</sup> Because lack of ready access to inhalers may cause delay in treating mild symptoms and thereby increases the risk for more serious exacerbations and attendant medical costs and school absences,<sup>7,8</sup> however, more widespread adoption of such policies is warranted. Although almost all schools provide access to inhalers at either the health office or other place, many students are embarrassed about taking medications and may resist going to another part of the school building to gain access to their inhaler.<sup>7</sup>

Contrary to expectations, the significant rural–urban differences that were present in asthma preparedness did not consistently favor 1 setting over the other. On the one hand, nurses in rural schools were more likely to mention lack of clear policies about asthma management as a barrier to asthma management in their practice settings and had less favorable staffing patterns at the elementary school level. On the other hand, they were less likely than urban school nurses to experience some communication issues and also were relatively more advantaged in terms of having emergency external defibrillation equipment available and allowing students to self-carry their inhalers. These differences suggest that some rural school districts may be attempting to compensate for less optimal nursing staff availability by providing equipment and policy options to address potential emergency situations.

It should be borne in mind that findings from the present study pertain to rural and urban schools in Pennsylvania, which may or may not be similar to other rural and urban schools throughout the United States. Nonresponse bias also is a potential consideration in interpreting survey data, although the 76% response rate achieved in this study is considered to be adequate in the survey research field,<sup>33</sup> and it is reassuring that the response rates among urban and rural school nurses were not significantly different.

## CONCLUSION

The study findings point to several suggestions for improving asthma management in the school setting. More consistent availability of staff who are knowledgeable about asthma and symptom management is required, which could be accomplished by establishing more favorable nurse staffing standards in combination with more widespread provision of asthma education for school teachers, administrators, and other staff members. There is a need for more universal use of asthma

management plans, which would improve communication among school personnel and ultimately lead to more optimal care for all children with asthma. Finally, access to inhalers while at school should be maximized, including increasing the proportion of children who are allowed to self-carry and self-administer inhaler medications.

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