

Childhood Asthma in Rural Pennsylvania:
Building Schools' Capacity to Optimize Health



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*Childhood Asthma in Rural Pennsylvania:
Building Schools' Capacity to Optimize Health*

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Project Summary

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Asthma is a chronic lung disease that poses an increasingly serious threat to the health of rural Pennsylvania children. The goals of this research were to: 1) quantify the prevalence of asthma and the burden of asthma-related morbidity among rural children in Pennsylvania and identify factors that influence the severity of children's asthma burden; 2) describe the current policies and practices related to asthma management in rural Pennsylvania schools and the services available to children with asthma and their families; 3) ascertain the level of preparedness among school health personnel to care for children with asthma and their perceived needs for additional education and policy change; and 4) identify interventions that have proven to be effective in rural school settings in other states and make policy recommendations that will lead to more optimal symptom management and improved quality of life for rural children with asthma.

These goals were accomplished through a survey of school nurses throughout Pennsylvania, a review of relevant literature on asthma in schools, and analyses of discharge data for asthma-related hospital stays among Pennsylvania children.

Research findings included: 1) the asthma burden among rural Pennsylvania children is substantial and increasing over time; 2) asthma hospitalizations among rural children are costly and tend to be prolonged among lower income children; 3) asthma management in rural schools is hampered by limited registered nurse availability and lack of other knowledgeable staff; 4) rural children are not always assured of quick access to asthma rescue medications during school hours; 5) communication about asthma is a problem in rural schools; 6) recommended asthma-related equipment and services are often not available in rural schools; and 7) rural school nurses desire additional education about asthma.

Policy considerations for the state government include: 1) ensure that all Pennsylvania children with asthma have prompt access to rescue medications by overseeing universal adoption of legislation passed at the end of 2004 requiring school districts to develop policies allowing students to possess and self-administer asthma inhalers; 2) enhance outreach and enrollment of children with asthma, particularly rural children, in public medical care coverage programs, including Medicaid and the state Children's Health Insurance Program (CHIP); 3) increase the availability of registered nurses in rural schools; and 4) establish a state asthma plan that establishes reduction of asthma burden as a high-priority policy goal and includes strategies for optimizing management of asthma in the school setting.

Policy considerations for the Pennsylvania Department of Health include: 1) increase the availability of asthma educational opportunities, comprehensive reference materials, and sample curricula for school nurses, teachers, coaches, and other staff, to use in school educational programs at the elementary, middle and high school levels; and 2) encourage health care providers to improve communication with school nurses about children's asthma management.

Introduction

Background

Asthma is a chronic inflammatory disorder of the lungs characterized by episodes of wheezing, shortness of breath, chest tightness, and coughing. Medical information provided to schools by families during the 2002-2003 school year indicates that 45,316 rural¹ Pennsylvania children have been diagnosed with asthma,² and prevalence rates calculated from these reports have increased in rural school districts by more than 20 percent in just five years, jumping from an overall prevalence of 6.8 percent to 8.5 percent. Asthma prevalence is increasing nationally as well (Akinbami and Schoendorf, 2002), and represents a significant burden on affected children and their families. Nationally, asthma is the single most prevalent cause of childhood disability (Newacheck and Halfon, 2000) and, in rare cases, can lead to premature death (Mannino et al., 2002). It is responsible for an estimated 14 million missed school days each year (American Lung Association, 2003) and is one of the most common causes of hospitalization in childhood (Wood, 2002). The monetary costs of childhood asthma are staggering, totaling \$6.6 billion annually in medical care expenditures, lost school days, and lost productivity (Landrigan et al., 2002).

While asthma among urban children has received considerable attention, there is evidence to suggest that rural children with asthma face unique disadvantages in achieving adequate management of their disease. Recent research has found urban children to be twice as likely as those in rural areas to have the advantage of access to an asthma specialist in managing their disease. Moreover, young rural children were hospitalized more often for asthma symptoms than corresponding urban children, which suggests a lack of appropriate staff and observational facilities in rural emergency rooms to manage acute asthma episodes on an outpatient basis (Yawn et al., 2001).

The frequency of the most serious outcomes of childhood asthma, including hospitalization and mortality, can be modified, at least in part, by careful monitoring of symptoms and prompt administration of appropriate medication when indicated. Since children spend a large portion of their time at school, it is crucial that school personnel be highly knowledgeable about asthma and that the capability exist for swift response when a child experiences asthma-related symptoms. Unfortunately,

evidence suggests that rural schools often fail to provide for appropriate asthma management. A study in New Mexico, for example, found that less than half of the state's rural elementary schools allowed children to carry needed medication compared to 80 percent of urban schools. In addition, significantly fewer of the rural schools studied had staff who knew what to do for a severe asthma attack before help arrives (Marshik et al., 2001).

Very little is known about the capacity of schools in rural Pennsylvania to meet the health needs of their students with asthma. This research addresses critical gaps in the understanding of current asthma policies and practices in rural schools and identifies barriers to optimal asthma management in these settings.

Goals and Objectives

The first goal of this research, which was conducted in 2004, was to both quantify the prevalence of asthma and the burden of asthma-related morbidity³ among rural children in Pennsylvania and to identify factors that influence the severity of children's asthma burden. This quantification included:

- an analysis of prevalence rates by geographic location,
- a description of the nature and severity of asthma-related morbidity among rural children,
- identification of individual, school and community factors that influence asthma morbidity and hospitalization among rural children,
- a determination of the degree to which disparities in asthma prevalence and morbidity burden exist among children living in economically disadvantaged areas relative to others, and
- a determination of the degree to which disparities in asthma prevalence and morbidity burden exist among children living in rural areas relative to urban areas.

Additionally, the research describes the current policies and practices related to asthma management in rural Pennsylvania schools and the services available to children with asthma and their families. This goal focused on ascertaining the availability of school nurses and other school personnel to care for children with asthma in rural schools, identifying the presence or absence of recommended asthma-related policies and procedures in schools, describing communication between school nurses, other personnel and families about asthma management, and determining the availability of asthma-related educational and support services for students and their families.

¹Rural school districts are defined using the Center for Rural Pennsylvania's 2000 definition except where otherwise noted; a school district is rural when its population per square land mile is less than 274 persons.

²Schools are asked to identify students who have a medical diagnosis of asthma; this information can be provided by a parent reporting to the school district.

³Morbidity is the proportion of sickness or of a specific disease in a geographical locality.

The third goal of this research was to ascertain the level of preparedness among school health personnel to care for children with asthma and their perceived needs for additional education and policy change.

Finally, the study identified interventions that have

proven effective in rural school settings in other states and identified policy considerations that will lead to more optimal symptoms management and improved quality of life for rural children with asthma.

Research Methodology

School Nurse Survey

A sample of 996 public schools was drawn from the total 3,022 public elementary, middle, and high schools in Pennsylvania. The sampling design consisted of randomly selecting two schools from each of Pennsylvania's 501 school districts. Since only 500 of these districts are active, the maximum possible sample size was 1,000. Four districts had only one school, so the final sample size was 996 schools.

Surveys concerning the prevalence of asthma and asthma-related morbidity, school policies and procedures related to asthma, the preparedness of school staff for appropriate asthma management in the school setting, and perceived needs for continuing education about asthma and improvements in current school asthma policies were sent to each of the selected schools to the attention of the school nurse. Because in a few cases, the same school nurse served two schools in the sample, there were slightly fewer than 996 individual nurses surveyed.⁴ In cases where one nurse received surveys at two schools, she was instructed to answer each questionnaire pertaining only to the school to which it was originally sent. As records kept by the Pennsylvania Department of Education list a total of 2,035 school nurses in the commonwealth, the survey reached close to half of all school nurses.

There were 757 surveys completed for a response rate of 76 percent, which the literature search suggests to be relatively high and more than adequate for purposes of data analysis. The response rate was not significantly different among rural (75.4 percent) and urban (76.6 percent) school nurses.

Analysis of Hospitalization Data

The researchers analyzed discharge records for children aged 0-19 who were hospitalized in Pennsylvania in 2001 with an admitting diagnosis of asthma. The source of these hospitalization records was the Pennsylvania Health Care Cost Containment Council. The Council collects statewide discharge data annually that include patient information (sex, race/ethnicity, age, residential zip code, residential

county); admission data (admission source, admitting diagnosis); discharge data (discharge status, length of stay); diagnosis codes; payor type; and a summary dollar amount for charges associated with the hospitalization.

There were 8,002 children hospitalized with an admitting diagnosis of asthma in 2001. A second set of data was used from the Pennsylvania Department of Education and the National Center for Educational Statistics (demographic information, including Census data, for the commonwealth's 501 public school districts). A third source of data was from the 2001 Area Resource File indicating the number of pediatricians in office-based practice and the number of pediatric beds in short-term care hospitals in the county. These three data sets were merged by resident zip code of each child. Because not all residential zip codes in the hospitalization data set could be matched to a specific Pennsylvania public school district, the final number of asthma-related child hospital discharge records with school district-related demographic attached that were available for analysis was 7,734. Finally, a variable indicating whether the school district was rural or urban was attached to each record.

Analyses of this merged data set included: 1) determination of the number of hospitalizations in 2001 among children with asthma in rural and urban school districts; 2) quantification of the total dollar amount of asthma-related hospitalization charges and the average charge per asthma-related hospitalization; 3) identification of the percentage of asthma-related hospitalizations among rural children that were not covered by insurance; 4) analysis of the correlation of selected individual, school district, and community characteristics with length of asthma-related hospital stay, an indicator of asthma burden; and 5) statistical analysis that explored the extent to which socioeconomic and rural-urban disparities in this measure of asthma burden exist when other factors are controlled.

Literature Review

A review of the literature related to childhood asthma with emphasis on rural children identified successful models in other states that have been implemented in rural school districts where emergency and specialty medical services may not be readily available. Information from this review is discussed in the Results section.

⁴ This was known to have happened at least twice, because the school nurses who received surveys in two different schools telephoned the investigators for guidance. There may have been other similar cases, but the investigators were not able to determine the precise number from the anonymous questionnaire forms.

Results

Prevalence of Asthma and Burden of Asthma-Related Morbidity

Asthma Prevalence

In 2002-2003, there were 45,316 rural Pennsylvania children with asthma, a prevalence rate of 8.5 percent, as shown in Figure 1. The asthma rate among urban Pennsylvania children was modestly higher at 9.5 percent. National data were not strictly comparable, as the National Health Interview Survey does not ask about current asthma but rather whether a child has had an asthma attack in the previous 12 months. Not surprisingly, this “asthma attack rate” for the nation was somewhat lower at 4.2 percent (Dey et al., 2004).

Asthma-Related Morbidity

Each year, public schools report health information from student medical information forms to the Division of School Health within the Pennsylvania Department of Health. From this information, it is possible to determine not only how many students have asthma, but also how many of those with asthma have a medication order on file at the school and how many medication doses were given in total for that group of students. Figure 2 presents this information for rural and urban children with asthma. In both geographic groups, just over one-third of children with asthma have a medication order on file. Rural children with asthma, however, appear to require more doses of medication during school hours on average than do urban children (11.8 doses per rural child vs. 10.8 doses per urban child over the school year). This difference, however, is not statistically significant.

Figure 3 displays results of the school nurse survey and provides further details regarding morbidity among rural and urban Pennsylvania children.

About 15 percent of rural children with asthma were limited in their physical activity secondary to their symptoms, and 5 percent were reported to have been seen in an emergency room for their asthma. Rural children were somewhat more likely than urban children to have missed one or more days of school due to asthma symptoms (19 percent vs. 17 percent). No statistically significant rural-urban disparities were seen in these measures of morbidity.

Asthma-Related Hospitalizations in Children

Analyses of hospitalization data for 2001 from the Pennsylvania Health Care Cost Containment Council revealed that there were 858 hospitalizations among rural Pennsylvania children with asthma, ages 0-19. This represents 12 percent of all child hospitalizations for

Figure 1. Prevalence of Asthma Among Rural and Urban Public School Children in Pennsylvania, 2002-2003 School Year

	Total Children	Total Children With Asthma	Prevalence Rate
Rural	535,924	45,316	8.5%
Urban	1,481,587	141,351	9.5%
Total	2,017,511	186,667	9.3%

*Data Source: PA Department of Health, Division of School Health

Figure 2. Asthma Medication Orders at School Among Rural and Urban Pennsylvania Public School Children, 2002-2003 School Year

	Total Children With Asthma	Asthmatic Children With Medication Order At School	Percent With Medication Order	Average Doses Administered Per Child With Medication Order
Rural	45,316	16,324	36%	11.8
Urban	141,351	49,258	35%	10.8
Total	186,667	65,582	35%	11.0

*Data Source: PA Department of Health, Division of School Health

Figure 3. Asthma Morbidity At School Among Rural and Urban Pennsylvania Children

	Total Number of Children With Asthma	Percent Having Limited Physical Activity	Percent Having ER Visit For Asthma Symptoms	Percent Missing 1 or More School Days Due to Asthma
Rural (n=341)	10,551	15%	5%	19%
Urban (n=360)	14,717	15%	5%	17%
Total (n=701)	25,268	15%	5%	18%

*Data Source: School Nurse Survey, 2004

asthma analyzed in that year. Since rural children make up about one-fourth of all children reported to have asthma, according to school records, it appears they were disproportionately less likely than their urban counterparts to be hospitalized. The average length of hospital stay among rural children was 2.3 days, the same mean length of stay seen among urban children. The total costs for all asthma-related hospitalizations among rural children in 2001 was \$5,249,442. The average cost per hospitalization among rural children was \$6,118, which was considerably less than the corresponding average cost of \$9,546 among urban children. This may reflect the greater likelihood of urban children being admitted to teaching hospitals, which tend to have higher costs per patient day and are located in urban areas. Among rural children hospitalized for asthma, 4.4 percent were uninsured, almost twice the urban rate of 2.3 percent.

Asthma burden was operationalized in the present study as length of asthma-related hospital stay, which is known to be associated with poorer pre-hospitalization asthma control. Correlations were examined between length of asthma-related hospitalization and the individual, school district, and community factors listed in Figure 4. These factors were selected because they have been linked, either conceptually or empirically, to asthma burden in the existing asthma literature.

Older children were more likely to have a longer length of stay than younger children. Children living in school

districts with higher median family incomes had shorter hospital stays than those living in lower income districts. Similarly, the greater the percent of district families living in poverty, the longer the average length of child asthma hospitalization. Greater percentages of adults having less than a high school diploma was associated with longer hospitalization stays. No significant correlations were observed for school district tax revenues per pupil or percent of minority population.

Because school district boundaries do not always correspond directly with the areas in which children reside, characteristics of the zip code were also examined. Similar to the pattern seen for school district characteristics, lower income, higher poverty levels, and lower educational attainment in the residential area were associated with longer asthma-related hospitalizations. No significant associations were seen between hospitalization length and percent of minority population, number of pediatricians in office-based practice, or number of pediatric hospital beds available in short-term hospitals in the residential area.

In the correlations described above, each variable was considered individually without regard to the possible effects of other factors. A second analysis examined relationships between these same factors and the length of asthma-related hospitalization considering groups of factors together in one model. Additional factors considered in these models included sex and race of the child, as well as rural or urban residence.

In the latter analyses, longer length of asthma hospitalization continued to be significantly associated with older children and was also more common among girls than boys. No differences in length of stay were seen according to child race. Economic characteristics of the residential environment continued to be significantly associated with length of hospitalization. Lower median family incomes, whether measured at the school district or zip code level, were associated with longer length of hospitalization. This suggests that there are socioeconomic disparities in the severity of asthma symptoms at admission, with children living in lower income areas more likely to

Figure 4. Correlations Between Individual, School District, and Community Level Characteristics and Length of Asthma-Related Hospital Stay (n=858 hospital stays)

Variables	As Variable Increases, Asthma Burden:
Individual	
Age	Increases
School District	
Median family income	Decreases
% of families in poverty	Increases
% adults 25+ years who are not high school graduates	Increases
Community	
Median family income	Decreases
% families in poverty	Increases
% adults 25+ years who are not high school graduates	Increases

be in poor control of their asthma. With income included in the models, education was no longer significantly associated with length of stay, suggesting that the material resources available to families, such as the ability to access high-quality health care, may be more important in managing children's asthma than educational levels. Other characteristics of the zip code or school district were not found to be significantly related to length of hospitalization, including rural/urban location, percent of minority residents, tax revenues per pupil, and number of pediatricians. Having more pediatric hospital beds available was associated with longer length of stay in one of the models, but this effect was not a consistent finding in all models.

Current Policies and Practices Related to Asthma Management

Staff Availability

The nurse survey included the question: "How many hours per week is a registered nurse or licensed practical nurse present at this school?" This question pertains to the school building itself, rather than the district as a whole. In 5 percent of rural schools surveyed, registered nurses were available for less than eight hours per week, and another 15 percent had registered nurse coverage for less than 24 hours per week. Rural schools were more likely than urban schools to be in the lower categories of registered nurse coverage, but the differences were not statistically significant. There were, however, significant differences in the availability of nurses between elementary and secondary schools. Among elementary schools, 7 percent reported nurses were available less than eight hours per week, and in 17 percent nurses were present eight to 23 hours. In contrast, the percentages in secondary schools were only 4 percent present less than eight hours and 7 percent available eight to 23 hours. These differences between elementary and secondary schools were statistically significant.

When registered nurses are not present, other personnel are authorized to give out medications; however, they often do not possess the professional background desirable for knowledgeable administration of medications. Only 81 percent of school nurses in rural schools stated that a staff member who knows what to do for a severe

asthma attack was always available. A similar percentage of urban school nurses also gave this answer, indicating that one in five Pennsylvania public schools do not always have knowledgeable staff present in the event of a severe asthma attack.

Presence of Recommended Asthma-Related Policies and Procedures

Experts in asthma management have recommended that every school have written care plans for each child with asthma (National Asthma Education and Prevention Program, 2002). This is not the case in rural Pennsylvania schools, where only 22 percent reported having plans on file. Even among those plans that are on file, few are completed according to professional recommendations. For example, only 60 percent contain an emergency protocol, only 48 percent include procedures for storing and administering asthma medications, and only 54 percent have emergency contact information for the child's physician.

It is also recommended that children with frequent asthma-related problems have case management services provided to coordinate care. Case management services would include: frequent communication with the child's primary care provider to ensure that the child is regularly seeing that provider for health care; communication with any asthma specialists the child sees to be sure that all health care providers involved in the child's care are informed of the medication regimen and provider visit schedule that has been recommended; and communication with the child and his or her family to identify any barriers to carrying out the recommended asthma regimen. Survey results suggest that case management services are available in less than one third of rural schools.

One of the most prominent issues in asthma management in schools concerns access to inhalers⁵ and other asthma medications during school hours. Rural school nurses report that only 73 percent of their schools had policies allowing children to carry their own inhalers. Most other schools had medications available in the health office or similar place. One rural school nurse did report, however, that children at her school had no access to inhalers or other medications during the school day.

Figure 5. Hours Per Week of Nurse Availability in Rural and Urban Pennsylvania Public Schools

	< 8 Hours	8-23 Hours	24-39 Hours	40 or More Hours
Rural (n=357)	5%	15%	43%	37%
Urban (n=383)	2%	14%	46%	38%

*Data Source: School Nurse Survey, 2004

⁵ An inhaler is a hand-held portable device that allows medication to be delivered into the lungs as the child inhales.

This was also the case for two urban schools in the study sample.

Access to equipment for asthma management and treatment is also important for asthma management during school. Only about one-half of rural nurses reported their schools had nebulizers⁶ available for medication administration and peak flow meters⁷ for monitoring. Less than one-third had spacers⁸, which are also used for asthma medication.

Communication about Asthma

Good communication among school nurses, physicians, families, and school staff is essential for coordinated, consistent management of children’s asthma symptoms.

Unfortunately, results of the school nurse survey indicate this communication is far from optimal. For example, only 4 percent of rural school nurses rated their communication with children’s physicians as “excellent,” and 25 percent rate their communication as “good.” However, 33 percent of rural nurses stated this communication was “poor” or “very poor.” While rural nurses reported that provider communication was a problem, their ratings were significantly better than the ratings by urban nurses. Among nurses in urban settings, 40 percent considered communication with providers to be “poor,” or “very poor.”

School nurses tended to rate communication with parents somewhat more favorably, but still far from ideal. Twelve percent of rural nurses rated their communications with parents as “excellent” and 49 percent as “good,” with only 7 percent reporting “poor” or “very poor” communication with parents. These ratings did not differ significantly from those reported by urban school nurses.

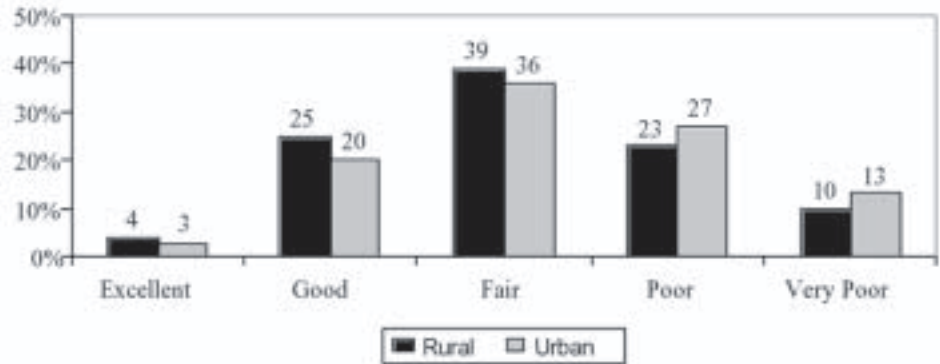
⁶ A nebulizer delivers medication to the lungs by using an air compressor that creates a mist of medication solution that can be inhaled.

⁷ A peak flow meter is a hand-held device that measures the speed with which a child can breathe out. The peak expiratory flow rate can be used by medical providers to monitor a child’s lung function.

⁸ A spacer is a tube that attaches to an inhaler to help improve the delivery of medication to the lungs by preventing it from escaping to the surrounding air.

Figure 6. Rural and Urban School Nurse Communication with Physicians of Children with Asthma

(Rural, n=363; Urban, n=386)



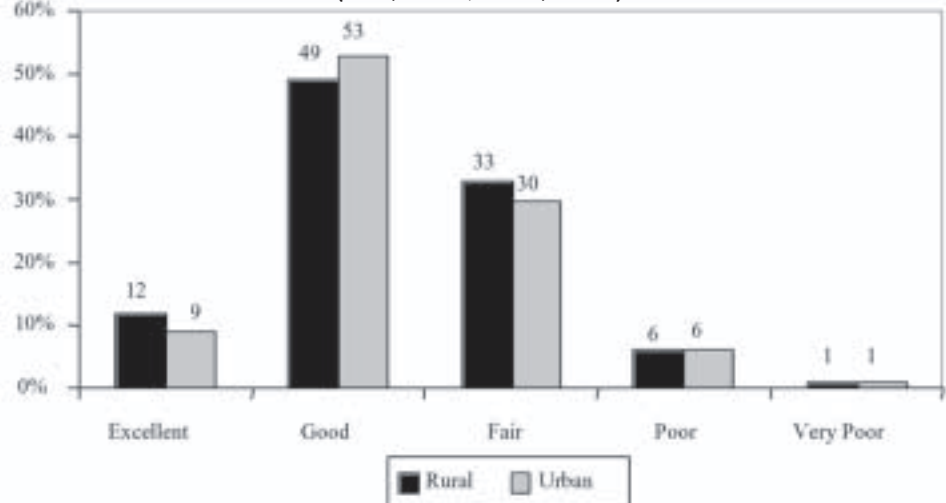
Only about half of school nurses reported that classroom teachers are routinely taught about asthma, and 10 percent reported that there is no policy for notifying teachers when they have a child with asthma in their classroom. Educating the student body about asthma was not routine, with less than half of schools providing this education.

School Health Personnel Level of Preparedness and Perceived Needs Frequency and Adequacy of Asthma-Related Education

Although about 40 percent of rural school nurses reported attending some type of asthma education program in the previous year, there was considerable support for adding more educational offerings, with 85 percent expressing interest in attending such programs.

Figure 7. Rural and Urban School Nurse Communication with Parents about Asthma

(Rural, n=365; Urban, n=392)



Nurses were asked to choose among the educational topics shown in Figure 8, and could choose as many as desired. All topics were desired by at least one-third of nurses; however the most frequently selected topics included update on asthma medications (85 percent) and current best practices and guidelines (84 percent).

The most popular formats for these educational offerings were formal class offerings with continuing education credits and provision of written materials, such as pamphlets.

Figure 8. Asthma Education Topics Desired by School Nurses (n=757)

Topic	Percent of Nurses Desiring Further Education on Topic
Update on asthma medications	85%
Current best practices/guidelines	84%
Emergency care for child with an asthma attack	71%
Teaching tools for families and school staff	69%
Asthma triggers	38%
General asthma facts	34%

Perceived Barriers to Optimal School Asthma Management

The most commonly mentioned barriers for nurses to managing asthma in schools were lack of time, lack of communication with health care providers, and lack of communication with parents, which were each mentioned by close to half of all rural school nurses. (See Figure 9) Rural nurses tended to report more barriers to appropriate asthma management than did nurses working in urban school settings. Rural nurses were significantly more likely than urban nurses to mention lack of time, lack of clear policies about asthma management, and lack of staffing as important issues that impeded asthma management. This is consistent with results presented earlier

indicating that there is relatively less availability of registered nurses in rural school settings.

Interventions in Rural School Settings in Other States

While there have been studies of asthma in rural children and schools in a number of states, an extensive literature and internet-based review revealed only one study testing a school-based asthma intervention specifically for rural schools. This project, the A+ Asthma Rural Study, looked at five rural Maryland counties and evaluated the effectiveness of an intensive educational intervention on quality of life, asthma knowledge, and asthma management practices among elementary students

with asthma along with their families and health personnel in their schools. The intervention included educational programs and workshops, newsletters, provision of peak flow meters and spacer devices, home visits by rural community health workers, and nurse consultants working to instruct school health personnel about asthma management (Huss et al., 2004).

Huss et al. (2001b) have also written about unique aspects of asthma education and management in rural settings that can be addressed by school nurses. For example, they stressed the importance of advising children with asthma about avoiding aeroallergens from hay, smoke,

Figure 9. Perceived Barriers to Asthma Management by Rural and Urban School Nurses

	Rural (n=364)	Urban (n=392)
Lack of time	49%	38%
Lack of communication with health care providers	47%	50%
Lack of communication with parents	44%	46%
Lack of clear policies about asthma management	29%	22%
Lack of staffing	28%	22%
Lack of funding for supplies	25%	25%
Lack of administrative support	8%	8%
Lack of training	8%	9%

dust, grain in silos, and animal dander from cattle and sheep. They pointed out that parents in rural settings may not realize the importance of routine preventive health care for asthma. They also emphasized the need to adapt existing asthma strategies to fit the needs of children in rural school settings.

State Asthma Plans

In this vein, it is helpful to identify states' strategies that are targeted at asthma more broadly but have relevance to children in rural school settings. Several states with significant rural populations, such as Iowa, Maryland, Texas, and Oregon, have formal asthma plans in place. While these plans generally do not address rural issues specifically, they focus attention on asthma among children and touch on schools and other places like childcare settings where children spend a large portion of their day.

For example, in 2002, the Maryland State Legislature established the Maryland Asthma Control Program to "prevent asthma and to maximize the health and well being of children, adolescents, and adults living with asthma." A statewide taskforce sponsored through this program convened work groups, focus groups, regional meetings, and an Asthma Summit, culminating in the development of the Maryland Asthma Plan cited above. This plan is intended to provide a comprehensive framework for local and statewide action against asthma. It established two long-term goals to be attained over a 10-year time frame. The first is to decrease the prevalence of asthma and the occurrence of its complications in Maryland through focusing on surveillance and tracking, provider issues, patient issues, environment, schools, childcare, collaboration and coordination, communication, and research. The second goal is to decrease disparity in health outcomes related to asthma in all parts of the state.

The process through which the Maryland Asthma Plan was formulated could be replicated in Pennsylvania by bringing together interested stakeholders to establish a high profile plan with long-range goals related to reducing asthma burden. Establishing these goals as a priority in this manner would have beneficial effects including raising public awareness about asthma and mobilizing resources to support needed services, such as enhanced asthma surveillance and provider education.

Resources and Training Materials for School Personnel

Some states have created standardized educational materials about childhood asthma tailored for school personnel who deal with school children. One of the most comprehensive was produced by the Minnesota Department of Health, in collaboration with the Centers for Disease Control and Prevention. This manual includes comprehensive chapters geared specifically for each of the following types of school personnel: RNs, LPNs, health assistants, secretaries and administrative assistants, teachers, counselors, coaches, custodial staff, nutrition services staff, playground assistants, and bus drivers. The material covered in each chapter is tailored to the needs of the targeted school staff members.

The Pennsylvania Departments of Education and Health could work together to adopt this training strategy, making comprehensive asthma materials similar to those in the Minnesota manual available to school staff members throughout the commonwealth.

Child-Centered School Curricula about Asthma

A third strategy adopted in some states involves the development of educational curricula about asthma for school children. Minnesota provides an elementary-school-level asthma teaching unit integrating math, science, vocabulary, and other curricular elements that provides specific lesson plans and camera-ready worksheets for use in grade-school classrooms. For example, the math lessons include asthma content and examples in making fractions, figuring averages, making bar graphs and other graphic representations of data, and compiling group data. Related Language Arts lessons include topics such as "Feelings and How to Express Yourself," "Asthma Vocabulary and Spelling," and "Friends Helping Friends." Science lessons include making several different types of lung models. Making curriculum materials such as these available to Pennsylvania teachers and encouraging their use could be a valuable step toward raising asthma awareness and improving the level of knowledge about asthma throughout the commonwealth.

Conclusions

Taken as a whole, the project findings and analyses support the following conclusions:

- *The asthma burden among rural Pennsylvania children is substantial and is increasing over time*

The prevalence of asthma among children in rural school districts is 8.5 for every 100 children, a rate that has increased by more than 20 percent over the past five years. During the 2002-2003 school year, 15 percent of public school students with asthma were limited in their level of physical activity due to asthma symptoms, 5 percent required medical attention in an emergency room, and nearly one in five had health-related school absences.

- *Asthma hospitalizations among rural children are costly and tend to be prolonged among lower income children*

In 2001, there were 858 asthma-related hospitalizations of rural Pennsylvania children. The average hospital stay was slightly over two days in length and resulted in an average total charge of \$6,118. Aggregate charges for all hospitalizations among rural children with asthma totaled \$5,249,442 for the year. Prolonged hospital stays, which tend to be associated with more severe asthma symptoms at admission, were more likely among older children than younger children and among children who lived in lower-income areas. Rural children with asthma were twice as likely as urban children with asthma to be uninsured, suggesting that the high costs of hospitalization are of particular concern for their families.

- *Asthma management in rural schools is hampered by limited registered nurse availability and lack of other knowledgeable staff*

Five percent of the rural nurses surveyed reported that registered nurses were available in their school setting for less than eight hours per week, and in another 15 percent of cases, registered nurse availability totaled eight to 24 hours per week. Even more troubling, one in five nurses reported that their schools did not always have a staff member available who knows what to do in the event of a severe asthma attack. Rural nurses were more likely than urban nurses to cite lack of staffing and lack of time as obstacles to managing asthma in their school.

- *Rural children are not always assured of quick access to asthma rescue medications during school hours*

Only 73 percent of rural nurses reported that children were allowed to carry their own medication inhalers at

school, which is the preference of professional asthma organizations, such as the National Asthma Education and Prevention Program (NAEPP, 2002). Most other schools required students to go to the health office or another area to gain access to their medication. However, a nurse in one rural school reported that students had no access at all to rescue medication while at school.

- *Communication about asthma is a problem in rural schools*

Written asthma action plans, which could provide important information about a child's asthma symptoms and treatment regimen, are not routinely in place in rural schools, and those that are in place lack fundamental elements including an emergency protocol, procedures for storing and administering medications, and emergency contact information. In addition, only 29 percent of rural school nurses rate their level of communication with children's physicians as "excellent" or "good" and 33 percent said it was "poor" or "very poor." Communication with parents and school staff was rated as somewhat higher; however only about two-thirds of rural nurses rated their communications with these two groups as "excellent" or "good." Lack of communication with health care providers and with parents were among the barriers to asthma management most often selected by rural school nurses from a set of barriers. Communication with teachers is also an important issue in that only half of rural school nurses reported that teachers in their schools were taught about asthma symptoms and treatment.

- *Recommended asthma-related equipment and services are often not available in rural schools*

Only about 50 percent of rural nurses reported their schools had nebulizers and peak flow meters available for asthma management, and less than one-third had spacers for medication administration. While case management to coordinate care is recommended for children who have frequent asthma-related problems, these services were unavailable in more than two-thirds of rural schools.

- *Rural school nurses desire additional education about asthma*

About 40 percent of rural school nurses had attended some type of asthma education program in the previous year, and the vast majority (85 percent) expressed interest in further asthma education. The topics most often requested included current best practices and guidelines, updates on asthma medications, and emergency care for children during asthma attacks.

Policy Considerations

State Government

- *Ensure that all Pennsylvania children with asthma have prompt access to rescue medications by overseeing universal adherence to legislation passed at the end of 2004 requiring school districts to develop policies allowing students to possess and self-administer asthma inhalers*

Pennsylvania Act 187 amended section 1401 of the Public School Code to read that, effective immediately, school districts should develop policies allowing school students to carry and administer asthma inhaler medications. A safety precaution imbedded in this law stipulates that children must first demonstrate that they know how to properly use the inhaler before being allowed to carry it with them during the school day. Findings from the school nurse survey suggest that students are currently not allowed to carry their inhalers in more than one-quarter of rural schools. Implementation of this recommendation will reduce the asthma burden, including costly hospitalization, among children in Pennsylvania.

- *Enhance outreach and enrollment of children with asthma, particularly rural children, in public medical care coverage programs, including Medicaid and the state Children's Health Insurance Program (CHIP)*

More than 4 percent of rural children with asthma do not have health insurance, making them twice as likely as other children to be uninsured. The high costs associated with children's asthma treatment represent a significant burden for families, particularly those living in lower-resource areas.

- *Increase the availability of registered nurses in rural schools*

Results of the school nurse survey indicate that registered nurses are not present in many schools for a significant percentage of weekly in-school hours. Moreover, lack of time and lack of staffing were frequently cited by rural school nurses as important barriers to asthma management in their schools.

Pennsylvania Department of Health

- *Establish a state asthma plan that sets reduction of asthma burden as a high-priority policy goal and includes strategies for optimizing management of asthma in the school setting*

Building on ideas from other state asthma plans, such as the Maryland Asthma Plan, Pennsylvania could establish policy objectives including but not limited to: 1) enhancing asthma surveillance; 2) increasing provider use of nationally recognized asthma management guidelines as well as improving provider communication with school nurses about children's asthma management; 3) improving public awareness and education about asthma and its management; 4) decreasing environmental factors that negatively influence asthma incidence and severity; 5) maximizing asthma management in the school setting including provision of recommended equipment, such as nebulizers, spacers, and peak flow meters; and 6) supporting ongoing research on causes, triggers and management of asthma in school and community settings.

- *Increase the availability of asthma educational opportunities, comprehensive reference materials, and sample curricula for school nurses, teachers, coaches, and other staff; and for integration into school educational programs at elementary, middle and high school levels*

The research shows that school nurses perceived the need to improve their level of knowledge about asthma and recent developments in symptom management and prevention. The nurses were also highly motivated to make use of opportunities for learning. This combination of factors argues for enhanced continuing education programs about asthma that is accessible to rural school nurses throughout the state. Additionally, it suggests the importance of making asthma resource materials available for school nurses to use in working with school staff, classroom teachers and school children.

- *Encourage health care providers to improve communication with school nurses about children's asthma management*

Some asthma hospitalizations among children could likely be prevented or reduced in length with more effective control of symptoms that occur during the school day. Approximately half of all school nurses viewed the lack of communication with health care providers as a barrier to optimal asthma management, and many considered the level of such communication to be poor. Implementing policies, such as mandating asthma action plans signed by the health care provider for all students with asthma, could greatly improve communication and enhance the chances that asthma symptoms will be treated promptly and appropriately.

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