Availability of Asthma Quick Relief Medication in Five Alabama School Systems

Joe K. Gerald, M.D., Ph.D.,¹ Nancy Stroupe, M.P.H., M.A.,² Leslie A. McClure, Ph.D.,³
Lani Wheeler, M.D., FAAP, FASHA, and Lynn B. Gerald, Ph.D., MSPH^{2,4}

Objectives: This paper documents individual asthma action plan presence and quick relief medication (albuterol) availability for elementary students enrolled in five Alabama school systems.

Patients and Methods: Data were obtained during baseline data collection (fall 2005) of a school-based supervised asthma medication trial. All students attended 1 of 36 participating elementary schools across five school systems in Jefferson County, Alabama. In addition, they had to have physician-diagnosed asthma requiring daily controller medication. Each school system had its own superintendent and elected school board. Asthma action plan presence and albuterol availability was confirmed by study personnel. Asthma action plans had to contain daily and acute asthma management instructions. Predictors of asthma action plan presence and albuterol availability were also investigated. Associations between albuterol availability and self-reported characteristics including health care utilization prior to study enrollment and outcomes during the study baseline period were also investigated.

Results: Enrolled students had a mean (SD) age of 11.0 (2.1) years, 91% were African American, and 79% had moderate persistent asthma. No student had a complete asthma action plan on file and only 14% had albuterol physically available at school. Albuterol availability was not predicted by gender, race, insurance status, second-hand smoke exposure, need for pre-exercise albuterol, asthma severity, or self-reported health care utilization prior to study enrollment. Albuterol availability did not predict school absences, red/yellow peak flow recordings, or medication adherence during the study's baseline period.

Conclusion: Despite policies permitting students to possess albuterol, few elementary students across five independent school systems in Alabama actually had it readily available at school.

Introduction

ASTHMA IS ONE OF THE most common chronic health conditions in schools, affecting approximately 7 million children under the age of 18.¹ Because asthma accounts for more than 14 million school absences each year, it is also a leading cause of absence due to chronic illness.² Schools serving underrepresented students living in urban areas bear an even greater burden because these populations have higher than average asthma prevalence and asthma-related morbidity.^{1,3-8}

Students with asthma are absent about 2 days more than students without asthma and some miss much more.^{9,10} In contrast, students in schools with considerable health resources (e.g., full-time nurses, asthma continuing education programs, and asthma action plans) may miss no more school than students without asthma.¹¹ Therefore, schools have a vested interest in policies that promote an asthma-friendly environment.

Several national organizations have developed policy recommendations to help schools optimize the well-being of students with asthma.¹²⁻¹⁶ These recommendations emphasize the importance of having written asthma action plans on file and quick-relief medication (albuterol) readily available for all students with asthma. The National Asthma Education and Prevention Program (NAEPP) guidelines recommend that schools have a written medication policy that allows safe, reliable, and prompt access to medications in the least restrictive way during all school-related activities.¹⁴ Students should also have the ability to possess and self-administer their asthma medications when appropriate.

Asthma action plans provide schools with specific instructions that describe the student's daily medication regimen, outline how to recognize worsening asthma, and how to manage it safely when it occurs. Specifically, asthma action plans should list the names, dosages, and administration frequency of all daily medications; describe what steps to

¹Division of Community, Environment and Policy and ²Division of Health Promotion Sciences, Mel and Enid Zuckerman College of Public Health, University of Arizona, Tucson, Arizona.

³Department of Biostatistics, School of Public Health, University of Alabama at Birmingham, Birmingham, Alabama.

⁴Arizona Respiratory Center, University of Arizona, Tucson, Arizona.

take to avoid environmental triggers; indicate the symptoms and signs of worsening asthma; list what medications should be taken when the student has difficulty breathing; explain when urgent medical attention is needed; and provide important emergency contact information.¹⁴

To be effective, a well-documented asthma action plan requires that albuterol be readily available to students while at school. In 2010, all 50 states had policies permitting students to possess and self-administer albuterol.¹⁷ In 2003, these abilities were granted to Alabama students (setting of our study) as long as parents provided schools with written authorization, indemnification against future liability, and a signed physician medication order form.¹⁸

We recently completed a school-based supervised asthma therapy clinical trial in five urban schools systems in Jefferson County, Alabama.¹⁹ Alabama state law requires every school to have a completed health form for every enrolled student and an asthma emergency action plan on file for each student with asthma. To accomplish this, schools distribute health forms to parents during fall registration by mail or in person. Parents of children with asthma are also required to provide the school with a pre-printed, standardized emergency asthma action plan signed by the parent and the child's physician. This emergency asthma action plan allows school nurses or other qualified personnel to administer medication. In these school systems, there is approximately one school nurse for every four to five schools. This report documents individual asthma action plan presence and albuterol availability for elementary students enrolled in the participating schools at the beginning of the clinical trial.

Methods

Data were obtained during baseline data collection (fall 2005) of a recently completed school-based supervised asthma medication trial.¹⁹ The methods of the original trial have been described in detail elsewhere.^{19,20} Eligibility requirements included physician-diagnosed asthma requiring daily controller medication and attendance at 1 of 36 participating elementary schools across five school systems in Jefferson County, Alabama. These schools systems served predominately African-American, urban, low-income students. Each school system had its own administrative structure including a superintendent and elected school board. Parents provided written consent; children provided assent. The Institutional Review Board at the University of Alabama at Birmingham and an independent Data Safety and Monitoring Board approved and monitored the study.

At enrollment, the study personnel documented the presence of an asthma action plan, as well as the physical availability of albuterol for each student, including albuterol that was stored in the school office or carried by the student. Self-reported data including health care utilization, health insurance status, overall health status, and second-hand smoke exposure were collected at baseline via telephone interviews with a parent. Data on daily peak flow, symptoms, and absences were collected via a web-based, electronic monitoring system developed specifically for the study. Asthma severity and the need for pre-exercise albuterol were assessed clinically by either the child's primary asthma physician or the study physician.

Statistical analysis

Data were described as means (SDs) and counts (%) as appropriate. The following factors thought to be related to asthma action plan presence and albuterol availability were investigated: age, gender, race, school system, insurance status, asthma severity, overall health status, need for pre-exercise albuterol, second-hand smoke exposure, and asthma-related emergency department visits and hospitalizations in the 8 months prior to study enrollment. The associations between albuterol availability at enrollment and outcomes during the study's baseline period (October–December 2005) were also investigated. These outcomes included the number of respiratory absences, the number of red or yellow peak flow meter readings (monitored daily at school), and the proportion of expected controller medication refills that were obtained. Continuous variables were examined for normality. *T*-tests were used to examine associations with continuous variables and chi-square tests were used to examine the associations with categorical variables.

Results

A total of 290 students participated in this trial. The mean age, gender, race, health insurance status, asthma severity, self-reported health status, second-hand smoke exposure status, need for pre-exercise albuterol, prior health care utilization, and school system enrollment are described in Table 1. While all students who had albuterol at school had one of the school's emergency asthma action plans on file, none of these plans contained all of the elements recommended by the NAEPP guidelines. For example, these pre-printed, standardized forms did not contain information regarding the student's daily asthma medication regimen or their known asthma triggers. The guidance for administration of albuterol was limited to "Use as ordered."

Only 14% ($n=41$) of students were found to have albuterol while at school. No student with a diagnosis of severe asthma ($n=14$) had albuterol. Of those with albuterol, very few self-carried; most albuterol was maintained in the school's health room or front office.

Overall, approximately 80% of students had a diagnosis of moderate asthma, and 90% were deemed to need pre-exercise albuterol. In the 8 months prior to study enrollment, 41% of caregivers reported one or more asthma-related emergency department visits, and 10% reported one or more asthma-related hospitalizations. There were no statistically significant differences between students who did and did not have albuterol readily available by age, gender, race, school system, insurance status, second-hand smoke exposure, need for pre-exercise albuterol, asthma severity, or reported asthma-related emergency department visits and hospitalizations.

Overall, 36% of children had at least one asthma-related school absence, and 65% had at least one red/yellow peak flow meter reading during the study's baseline period. When a student's daily controller regimen during the baseline period required one or more refills, 47% of those refills were actually obtained. There were no significant differences observed between albuterol availability at study enrollment and the number of asthma-related absences, red/yellow peak flow readings, or controller medication refills during the baseline period (Table 2). Although not statistically

TABLE 1. DEMOGRAPHIC CHARACTERISTICS OF STUDY PARTICIPANTS AND ASSOCIATION WITH ALBUTEROL ACCESS AT STUDY ENROLLMENT

	Overall (N=290) %	Medication at school (n=41) %	No medication at school (n=241) %	<i>p</i> ^a
Age (years), mean ± SD	11.0 ± 2.1	11.0 ± 2.0	11.0 ± 2.0	0.79
Gender (male)	57	59	57	0.82
Race (black)	91	85	92	0.23
Health insurance				
None	4	3	4	0.90
Private	27	28	27	
Public	69	69	69	
Asthma severity				
Mild	16	20	16	0.10
Moderate	79	80	81	
Severe	5	0	6	
Self-reported health status				
Excellent/very good/good	76	82	75	0.42
Fair/poor	24	18	25	
Second-hand smoke exposure	29	31	29	0.80
Need pre-exercise albuterol	89	85	89	0.41
≥ 1 ED admission (baseline)	41	33	42	0.31
≥ 1 hospitalization (baseline)	10	8	10	0.59
School system				
System 1	25	22	26	0.76
System 2	38	34	39	
System 3	21	22	21	
System 4	6	10	5	
System 5	10	12	10	

^a*p* values were based on *t* or chi-square tests, as appropriate; ED, emergency department.

significant, there was a trend toward fewer respiratory absences during the baseline period for students who had albuterol (*p*=0.06).

Discussion

Despite policies requiring students with asthma to have albuterol readily available at school, only 14% of elementary-age students with persistent asthma actually had it available in this large school-based study. Albuterol availability was not associated with any of the measured variables; however, students who had albuterol at study enrollment did seem to have fewer asthma-related absences during the study's

baseline period (*p*=0.06). Because albuterol was provided at enrollment for all study participants for use at school during the baseline period, it is not clear why albuterol availability at enrollment would have predicted absences during the baseline period. It is possible that albuterol availability was a marker for some other behavior associated with exacerbation risk (e.g., trigger avoidance) or school attendance.

While all students who had albuterol also had a standardized emergency action plan on file, these forms were not "true" asthma action plans, as they lacked key elements recommended by the NAEPP guidelines. Key elements that were missing included the student's daily medication regimen and known asthma triggers.¹⁴ More importantly, the

TABLE 2. ASSOCIATION BETWEEN ALBUTEROL AVAILABILITY AT ENROLLMENT AND SCHOOL ABSENCES, PEAK FLOW METER READINGS, AND MEDICATION REFILLS DURING THE BASELINE PERIOD

	Overall (N=290) %	Medication at school (n=41) %	No medication at school (n=241) %	<i>p</i> ^a
Respiratory absences				
0	64	78	62	0.06
1–3	27	20	28	
> 3	9	2	10	
Yellow/red peak flow				
0	55	54	55	0.94
1–3	34	34	34	
> 3	11	12	10	
Proportion of refills completed (mean, SD)	0.47 (0.29)	0.52 (0.28)	0.46 (0.29)	0.29

^a*p* values were based on *t*- or chi-square tests, as appropriate.

forms lacked detailed instructions on how much and how frequently albuterol should be administered during an emergency. Instead, the form instructed school personnel to use albuterol as “ordered.” In most instances, these orders were found on the medication label and included the instruction to “take two puffs as needed every 4–6 hours for symptoms.” This phrasing prevented school personnel from giving additional doses when students’ symptoms persisted or when the student had recently used their inhaler prior to exercise. If the initial two puffs did not provide relief, the next recommended treatment escalation was paramedic notification. Thoughtful rephrasing could have provided greater flexibility for school personnel when responding to a student’s respiratory difficulty.

The simplicity of the schools’ emergency action plans was likely intended to increase the return rate for completed forms. Even with study resources, we had difficulty obtaining medication order forms as part of our trial. To improve customizability while maintaining the ease of standardized forms, the schools could have substituted one of the customizable asthma action plans available from the NAEPP guidelines,¹⁴ from many state asthma program Web sites, or from other reputable online sources.^{21–23} Use of these forms has been shown to increase physician response and improve the quality of the order.²⁴

Another commonly encountered obstacle was the fact that many students did not have a usual source of care from which to obtain a physician signature. While our study physician could provide medication orders for these students during the trial, schools did not have a similar option.

Surprisingly, many students came forward during study recruitment who were not previously known by the school to have asthma. Some may have come forward to obtain study medication at no cost, but most students were already covered by public or private health insurance and should have had access to asthma medication. Even so, our provision of a second corticosteroid and albuterol inhaler just for school use may have been an unusual incentive. The fact that many students did not have a usual source of asthma care may have been an indication that the barriers to care (e.g., transportation difficulty, hourly wage employment without paid time off, and single-parent families) outweighed the perceived benefits of completing the medication order form and obtaining a second inhaler for school use. The schools faced similar challenges as they had even fewer resources and options to ensure that each student with asthma had an albuterol inhaler for school use. Many schools were aware that some students with asthma did not have an albuterol inhaler on hand, but it was simply too difficult for them to obtain the completed medication order forms and inhalers from parents.

The barriers faced by our schools are consistent with those identified in the literature.^{25–27} For example, many schools with appropriate policies in place often fail to implement them fully.^{28–33} Others face similar challenges obtaining asthma action plans from physicians and parents,^{29,34–37} securing physician time to complete personalized asthma action plans,²⁹ ensuring that school personnel have the knowledge needed to manage asthma at school,³² and obtaining access to asthma specialists.⁸ These reports and our experience suggest that school policies, while necessary, are not sufficient to ensure student access to albuterol while at school.

One approach to ensure that students have access to albuterol while at school is for the schools to maintain albuterol inhalers with disposable chambers. This approach has been endorsed by several national medical and school organizations since 2002 and eliminates the need for each student to bring their own inhaler.³⁸ National survey data provide indirect evidence regarding the availability of albuterol as part of a school’s emergency equipment supply. The 2006 School Health Policies and Programs Study reported that 12% of schools had a stock inhaler, 30% had a nebulizer, and 35% had a peak flow meter.³⁹ A survey of the National Association of School Nurses indicated that 78% of nurses reported their school had an albuterol inhaler as part of their emergency equipment supply.⁴⁰ While not a substitute for each student having their own asthma action plan and quick-relief medication, stock inhalers would help address situations when albuterol is needed but a student’s personal inhaler is not available.

These data in the paragraph above do not provide direct evidence on the availability of albuterol for individual students. To our knowledge, this report is one the first to assess individual student access to albuterol while at school. While our sample of schools is geographically limited to Alabama and the data are now 7 years old, it is also important to note that we were in 36 elementary schools across five independent school systems. Until more data are provided on individual student access to albuterol in elementary schools, the working assumption should be that these students likely have limited access to albuterol while at school.

Several important limitations should be noted. First, the trial was not specifically designed to identify barriers to albuterol access. Because of this, we may have failed to ask pertinent questions that would have shed more light on both barriers to and predictors of access to albuterol. Second, our results may not be widely generalizable, since our schools were from a single geographic area representing a rather homogenous population. Perhaps other school systems across the nation are doing better than the ones on which we report. It is also possible that our data may underestimate albuterol availability, as schools may have improved access since 2005 by either obtaining more inhalers from individual students or by adopting stock inhalers. Nevertheless, our results point out the very real possibility that some school systems may not be doing as well as expected. Third, this trial involved elementary schools exclusively and may not reflect circumstances and/or barriers to albuterol faced by older students in middle and high school. Fourth, the trial enrolled only a small number of students with severe asthma. It is possible that those who did participate were the students with the least resources and who could have only obtained an albuterol inhaler for school use by participating in the study.

In conclusion, we found few elementary students to have access to albuterol while at school despite state and local policies permitting students to possess albuterol. While geographically isolated, this finding was consistent across five independent school systems in Alabama. There are numerous potential barriers that likely contributed to this lack of access, but further research is needed to identify the most important of them. The schools were supportive of students having albuterol on hand, but seemed to lack the resources to make it happen for all students. The lack of albuterol availability potentially places students at unnecessary risk

should an asthma attack occur at school. Additional effort is needed to ensure that albuterol is readily available to all students with asthma while at school.

Acknowledgments

We would like to thank our school system partners without whom this study could not have been performed. These partners included Birmingham City Schools, Bessemer City Schools, Jefferson County Schools, Midfield City Schools, and Tarrant City Schools. This trial was sponsored by the National Institutes of Health, National Heart, Lung, and Blood Institute (R01HL075043). Blue Cross and Blue Shield of Alabama provided support for the Internet-based "Asthma Agents" monitoring system. Pulmicort Turbuhalers[®] were provided by AstraZeneca Pharmaceuticals.

Author Disclosure Statement

No competing financial interests exist.

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Address correspondence to:

Joe K. Gerald, M.D., Ph.D.

Division of Community, Environment and Policy

Mel and Enid Zuckerman College of Public Health

University of Arizona

1295 North Martin Avenue

P.O. Box 245210

Tucson, AZ 85724

E-mail: geraldj@email.arizona.edu

Received for publication September 19, 2011; accepted after revision November 28, 2011.