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Asthma medications in schools: a cross-sectional analysis of the Asthma Call-back Survey 2017-2018

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Abstract

Context: Asthma is the most common chronic disease affecting children in the United States. Goals for asthma management include symptom control, the ability to maintain a normal activity level, and minimizing adverse events.

Objectives: The objective of this study is to analyze the number of children with asthma that are permitted to carry medications at school and without an asthma action plan.

Methods: In this study, we analyzed the Center for Disease Control and Prevention (CDC) Asthma Call-back Survey (ACBS) to assess the prevalence of children in school allowed to carry medication and with asthma action plans. Utilizing the sampling weights provided, we estimated population prevalence by age group and urbanicity.

Results: Results showed that, overall, 34.8% of students reported they were not allowed to carry asthma medications in school. Specifically, nearly 51% of children ages 5 to 9 and 33% of children ages 10 to 14 were reported not to be allowed to carry medications at school. Further, 58.2% of children did not have a written asthma action plan.

Reported urbanicity was not significantly associated with access to medication at school ($p=0.46$) or having an asthma action plan ($p=0.57$).

Conclusions: In our study, more than one-third of students were not permitted to carry asthma medications and nearly three-fifths did not have a written asthma action plan. Therefore, we recommend partnerships between schools, healthcare professionals, students, and osteopathic family physicians to increase access to asthma action plans and medication in schools.

Keywords: asthma action plan; asthma medications; schools.

Asthma is the most common chronic childhood disease in the United States, with over 6.1 million children diagnosed as of 2018 [1]. Among these children, nearly 40% have uncontrolled asthma symptoms [2, 3]. Quality treatment of asthma warrants appropriate patient screening and education [4, 5]. Evidence-based recommendations for managing asthma are implemented through medication administration [5] and the incorporation of an asthma action plan [6]. Asthma action plans are utilized to successfully control a patient's asthma with guidance from a healthcare provider by implementing a color-coded chart that breaks down asthma symptoms into three zones—green, yellow, and red, as available from the Asthma and Allergy Foundation of America (AAFA, <https://www.aafa.org/asthma-treatment-action-plan/>). Each zone provides information on how to handle different levels of asthma exacerbation. The goal of an asthma action plan is to decrease the frequency of symptom onset, prevent the number of times a patient seeks emergency care, and guide adults in the process of caring for children with asthma, [7] such as in school settings.

The American College of Allergy, Asthma, and Immunology (ACAAI) states that the risk of an allergen trigger occurring at school is greater than the risk in a child's own home [8]. Common allergens—pollen, mold, and dust—can induce allergic airway hyperresponsiveness ranging from mild to severe symptoms [9]. In addition to allergic asthma

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triggers, exercise performed at school can exacerbate symptoms [10]. The physical education teacher is usually the only adult in the room, yet a study in New York showed that the majority of these teachers are unprepared for managing a child experiencing acute asthmatic symptoms, such as an asthma attack, and require the school nurse's assistance [11]. Children with asthma frequently experience exercise-induced bronchospasm, and many asthma action plans include pretreatment with albuterol prior to the onset of physical activity [12]. Greiling et al. [13] performed a study looking at the number of asthma-related deaths within US school systems from 1990 to 2003, with the results showing 16 students deaths that occurred while participating in physical activity, and 12 of those deaths occurred while the student was waiting to be treated for their exacerbation.

Through the use of asthma action plans and appropriate medication, following the CDC's recommendations utilizing the National Asthma Education Prevention Program (NAEPP) requirements, [14] we believe that schools and their students can meet the long-term goals of asthma management including achieving symptom control, maintaining a normal activity level, and minimizing the risk of asthma-related mortality, exacerbations, persistent airflow limitations, and side effects of treatment [4, 15, 16]. Given the necessity of having access to medication and an asthma action plan, our primary objective aimed to analyze the prevalence of school children having access to asthma medications and written asthma action plans in schools. Our secondary objective aimed to see if there were differences between urban and rural populations.

Methods

We analyzed the Behavioral Risk Factor Surveillance System (BRFSS) Asthma Call-back Survey [17] (ACBS) for children (ages 0–17 years). The CDC releases yearly ACBS data reports consisting of data in every state collected directly from individuals regarding multiple fields and topics, including health risk factors [18]. Based on the BRFSS survey, the Asthma and Community Health Branch in the National Center for Environmental Health (NCEH) conducts an ACBS asking more detailed health questions to those who reported to have a child with a diagnosis of asthma [19]. The ACBS collects information about the child's history of asthma, healthcare utilization, knowledge of an asthma management plan, environmental factors, medications, cost of care, school-related asthma symptoms, and alternative or complementary therapies.

Inclusion criteria

Only children who were reported as currently in school and currently having asthma were included. Children were considered to currently

have asthma if they answered “yes” to both questions, “Have you ever been told by a doctor, nurse, or other health professional that you had asthma?” and “Do you still have asthma?” Participants with responses of ‘refused’ or ‘unknown’ were excluded from the analyses.

Variables

To identify whether students were allowed to carry asthma medicine in school, ACBS asks the questions: “Does the school {he/she} goes to allow children with asthma to carry their medication with them while at school?” and “Does {child's name} have a written asthma action plan or asthma management plan on file at school?” Additional variables utilized within this analysis include whether the student was located in a rural or metropolitan area based on the National Center for Health Statistics (NHS) rural/urban classification.

Statistical analysis

The 2017 and 2018 ACBS cycles datasets were combined and the sampling weights were adjusted accordingly. Assessments included the prevalence (sample, *n*) and population estimates (*N*) of children in school who were allowed to carry asthma medication. Next, we estimated the prevalence of children who were reported to have an asthma action plan in place. Multiple regression analyses were then conducted utilizing both variables—ability to carry medication and having an asthma action plan in place—to evaluate for any associations existing between a child living in an urban or rural setting. Statistical analyses were performed in December 2021 utilizing Stata 16.1 (StataCorp, LLC, College Station, TX). This study was submitted to an institutional review board for ethics review and was determined not to meet the criteria of human subjects research.

Results

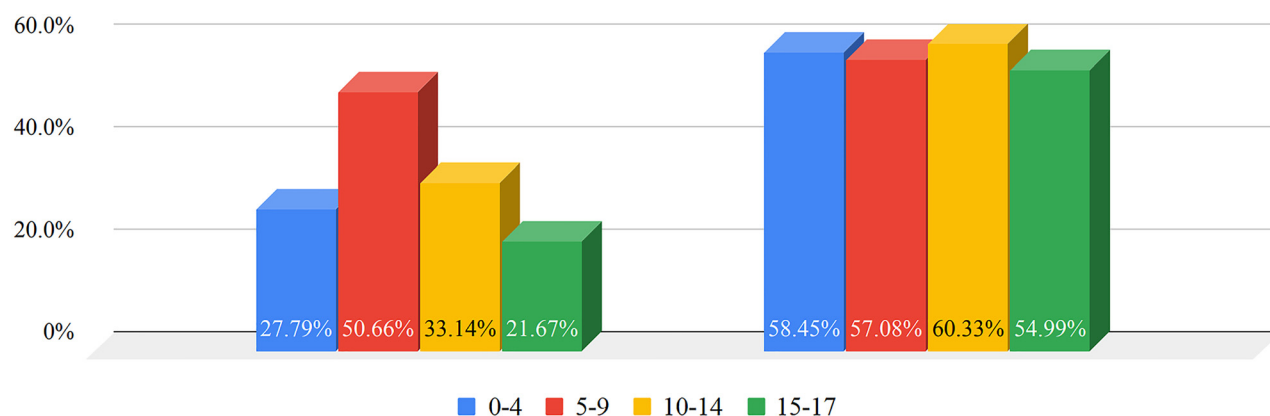
The median ACBS response rates during 2017 through 2018 for children (via adult proxies) ranged from 91.00% to 91.12%, and the rates for adults ranged from 92.15% to 93.00%. As a result of the ACBS in 2017, 32 geographic regions had an adult response rate of 93%, while 26 geographic regions had a child response rate of 91.00%; and in 2018, the adult response rate was 92.15%, while the child response rate was 91.12%.

Sample size and population size

The number of participants included in our study was 1399, which when ACBS weighting was applied represents 1,333,045 children in the United States. Among the students, 12.82% (95% CI: 11.18–14.66) lived in rural settings, and 87.18% (95% CI: 85.34–88.82) were from metropolitan areas.

Table 1: Prevalence of children having access to asthma medications or having an asthma action plan at school or daycare.

	Rural n, N, %	Urban n, N, %	Total n, N, %	Chi-square test
Asthma medications allowed in school or daycare				
Yes	114, 56687 (7.87%)	357, 413168 (57.36%)	471, 469855 (65.22%)	F(1, 471) = 0.54, 0.46
No	69, 25170 (3.49%)	206, 225342 (31.28%)	275, 250511 (34.78%)	
Total	183, 81857 (11.36%)	563, 638509 (88.64%)	746, 720366 (100.00%)	
Written asthma action plan in school or daycare				
Yes	92, 38367 (4.77%)	304, 299482 (37.25%)	396, 337849 (42.02%)	F(1, 548) = 0.32, 0.57
No	120, 59666 (7.42%)	318, 406496 (50.56%)	438, 466162 (57.98%)	
Total	212, 98033 (12.19%)	622, 705978 (87.81%)	834, 804011 (100.00%)	

**Figure 1:** The weighted prevalence of students not allowed to carry medications (left) or have an asthma action plan in place at school (right) by age group.

The percentage of children from ages 0 to 4 was 12.03% (95% CI: 8.86–16.13), from ages 5 to 9 was 28.19% (95% CI: 23.33–33.63), from ages 10 to 14 was 34.87% (95% CI: 29.70–40.41), and from ages 15 to 17 was 24.91% (95% CI: 21.37–28.82).

We found that among the 746 (n=720,366) participants answering the question regarding the allowance of medication in schools, 34.78% (n=275, n=250,511) reported that they were not allowed to carry them (Table 1). Of the 834 responding to the question regarding asthma action plans, 58.20% (n=438, n = 466,162) did not have a written action plan. Design-based chi-square tests showed that urbanicity showed no significant association with either medication access at school ($F(1, 471)=0.54, p=0.46$) or having an action plan ($F(1, 548)=0.32, p=0.57$).

Regarding age groups, we found that children ages 5–9 years were the age group most often reporting to not be allowed to carry medication at 50.66% (95% CI: 40.31–60.94) followed by 33.14% (95% CI: 25.19–41.81) of children ages 10–14 years, and 27.79% (95% CI: 16.19–43.39) of children ages 0–4 years, with the lowest percentage being older children ages 15–17 years (21.67%; 95% CI: 13.69–32.54; Figure 1). This distribution showed a statistically

significant association given the disparity among children ages 5–9 years compared to the other groups ($F(2.84, 1336.73)=5.10, p=0.002$). Regarding students having an asthma action plan in place at school, more than half of the respondents for children of all age groups reported not having one in place. The percentage of children not having an asthma action plan was the highest among children ages 10–14 years (60.33%; 95% CI: 52.97–67.26) and lowest among children ages 15–17 years (54.99%; 95% CI: 46.97–62.76)—a nonstatistically significant association ($F(2.22, 1215)=0.16; p=0.87$).

Discussion

Our findings showed more than one-third of students diagnosed with asthma were not permitted to carry asthma medications and that nearly three out of five students did not have a written asthma action plan. Our results add to a previously published smaller study assessing the ease of obtaining albuterol and the need for an asthma action plan within the state of Alabama [20]. Alabama found that

among 290 students with asthma who had asthma action plans required from a previous study, (Gerald et al. 2009), none of the plans contained the child's medication regimen or known asthma triggers which are recommended by the NAEPP requirements. Among the students who needed to have albuterol on-site as part of their planned treatment, only 14.14% of these students actually did [20]. Our results add statistical strength and expand the reach of the existing literature by utilizing a national dataset to support the need for access to asthma medications and asthma action plans within the school setting.

Although all children who are having an asthma exacerbation or are experiencing symptoms of "respiratory distress" have a crucial need for albuterol, [21] not all of them are ready to carry and safely administer their own medication. The American Lung Association published a questionnaire that parents can utilize to assess whether a child is prepared to carry his or her own medication [22]. Because not every child is considered self-sufficient, the best standardized recommendation is for schools to carry stock asthma medication, such as albuterol, for fast-acting symptom management of those children with an asthma diagnosis. According to the policies from the American Thoracic Society (ATS), Allergy & Asthma Network Mothers of Asthmatics (AANMA), Association of Legal Administrators (ALA), and the National Association of School Nurses (NASN), implementing protocols for stock albuterol in schools increases access to medication for children with asthma who are not permitted to carry it [21]. All 50 states have passed legislation allowing students to carry and administer their own medication; however, as of August 2021, only 13 states have passed legislation that schools must supply medication on-site for students [23].

A Cochrane review of school-based asthma self-management interventions showed that the interventions were likely to reduce hospitalizations, emergency department visits, and improve students' health-related quality of life [24]. One proposed program implemented in St. Louis public schools, Breathe Your Best for School Success, attempted to combine reminders and incentives to increase asthma action plan utilization for students [25]. The school district sent reminders throughout the summer and offered prizes for those who correctly turned in the materials and medication needed for their asthma action plan, which they referred to as an "Asthma Passport." Although this program did not reach its ultimate goal of increasing the number of asthma action plans for students with asthma, 92% (22 of 24) of parents said that the experience was informative and that they were reminded of the importance of staying up to date with their child's asthma management regimen [25]. Educating parents and their children about

the signs and symptoms of an asthma exacerbation and how to manage it is one of the key components for long-term asthma control [26].

Establishing relationships between school faculty and physicians is essential for effective asthma management plan implementation, especially in the school setting [27, 28]. A survey of stakeholders in the Southeast Minnesota Beacon Stakeholder group, a group that spotlights several "best practice" approaches to improve healthcare delivery and health in the United States, stated that the most commonly reported theme was that there were no uniform guidelines for communication between schools and health professionals [29]. Further, starting young children with proper asthma education can have an earlier and potentially more impactful improvement in quality of life [30, 31]. Thus, healthcare professionals should actively engage school systems to provide guidance for the roles of education professionals in asthma management programs and communication strategies. Physicians should also incorporate screening and education for children and parents on safe and effective asthma mitigation, advocate for asthma action plans in school, and advocate for the child's personal safety. Future research may also investigate the cost-benefit of having albuterol on the school premises for asthma emergencies.

Limitations

Limitations include the potential for selection bias because the BRFSS and ACBS are both phone-based surveys that rely on self-report [17, 18]. As phone-based surveys, the surveys are restricted to only individuals with phone lines. Each question is also based on the individual's response to questions about past events, introducing recall bias due to accidental or purposeful release of incorrect information from the interviewee to the survey conductor. These limitations are mitigated by the large sample size and the complex survey design implemented through BRFSS.

Conclusions

Assessing the 2017–2018 ACBS, we found that a majority of students did not have an asthma action plan in place at school nor were they able to carry asthma medication with them. These results illustrate a need for a change in the approach to the way that healthcare providers and schools systems address asthma management. Thus, healthcare providers should be engaged with the educational systems within their communities to help implement policies to

ensure that appropriate asthma action plans and medication protocols are in place.

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