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Physical activity, restrictions in activity, and body mass index among urban children with persistent asthma

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ABSTRACT

Background: Asthma and obesity are public health problems that disproportionately affect underserved children. Urban children with asthma may be limited in their participation in physical activity, further increasing their risk for overweight.

Objective: To determine the prevalence of overweight and obesity among high-risk children with persistent asthma, to assess physical activity and activity restrictions by level of asthma control, and to evaluate whether activity is associated with weight status.

Methods: We analyzed baseline data from 324 urban children with poorly controlled asthma (3–10 years old) enrolled in the School-Based Telemedicine Enhanced Asthma Management program in Rochester, New York. Caregivers reported their child's asthma symptoms, physical activity, and activity limitation, and height and weight were measured.

Results: Most children were black (59%), and 69% had Medicaid. Almost half (47%) of children had symptoms that indicated poorly controlled asthma, 15% were overweight, and 31% were obese. Few children (39%) participated in 1 or more hour of physical activity per day. In addition, most (85%) did not walk to and from school, 38% did not have any recess in school, and 35% reported no safe place to exercise. More children with very poorly controlled asthma symptoms, compared with children with more mild symptoms, reported limitation in gym class (58% vs 43%, $P = .01$) and even in mild activities (28% vs 14%, $P = .004$). Children with activity limitation were at significantly greater odds of being overweight or obese (odds ratio, 2.1; 95% confidence interval, 1.2–3.8).

Conclusion: Many children with persistent asthma are overweight or obese, have limited opportunity for activity, and experience activity limitations. Efforts are needed to optimize asthma control and provide opportunity for increased physical activity in and outside school.

Trial Registration: clinicaltrials.gov Identifier: NCT01650844.

Introduction

Asthma is a chronic condition that affects more than 6 million children nationwide. Along with morbidity from the disease itself, asthma carries a strong social and economic impact and disproportionately affects underserved, poor children.[1] Furthermore, urban and minority children with asthma are more likely to receive insufficient preventive care,[2–5] leading to preventable morbidity.

Previous studies have found that children with asthma are more likely to be overweight or obese than nonasthmatic children[6,7] and are less likely to be physically active.[7–9] Obesity is an increasing epidemic in the United States, affecting roughly 12.7 million children and adolescents aged 2 to 19 years.[10] Furthermore, obesity is related to a number of health conditions, including heart disease, stroke, and type 2 diabetes, many of which are preventable.[11] Although overall national rates of childhood obesity are concerning, these rates are disproportionately high in low-income and minority populations. The prevalence of obesity is greater among Hispanic (22.4%) and non-Hispanic black children (20.2%) than among non-Hispanic white (14.1%) children.[10] Furthermore, children from low-income households have more than 2 times higher

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odds of being obese than children from higher-income households.[12]

Although guidelines from the National Heart, Lung, and Blood Institute (NHLBI)[13] encourage the maintenance of normal physical activity for children with asthma, people with asthma in general and specifically urban children with asthma tend to be less physically active.[14] In fact, inactivity itself may exacerbate asthma symptoms.[15] Poor asthma control can then interfere with normal activity and lead to a sedentary lifestyle and subsequent overweight status.[15] Unfortunately, this may be particularly true for high-risk urban children with asthma, who have suboptimal medication adherence, ongoing asthma symptoms, and a higher risk of obesity.[5,10,12,16,17] However, there is limited research on the barriers to activity that children with asthma from disadvantaged homes may face.

This study aims to determine the prevalence of overweight and obesity among a sample of high-risk children with asthma; assess physical activity, activity limitations, and barriers to activity by level of asthma control; and evaluate whether physical activity is associated with weight status in this population. A better understanding of barriers and limitations these children face to physical activity may help to ultimately promote the optimization of asthma control and healthy weight.

Methods

Study Population

Data were obtained from a larger study, the School-Based Telemedicine Enhanced Asthma Management (SB-TEAM) program in Rochester, New York.[5,16,17] Caregivers of children aged 3 to 10 years with asthma were interviewed to assess eligibility. Eligibility requirements for the study included the child having a physician diagnosis of asthma, poorly controlled symptoms at the time of screening based on NHLBI criteria,[18] ability to communicate in English, and not having other chronic conditions that could alter accurate reporting of asthma symptoms (including cystic fibrosis, heart disease, and sickle cell disease). Caregivers provided informed written consent, and oral assent was obtained from children 7 years and older. The study protocol was approved by the institutional review board at the University of Rochester.

The SB-TEAM program intervention includes 2 main components: the delivery of prescribed preventive medication in schools under the supervision of the school nurse and telemedicine visits at the school to provide ongoing assessment and adjustment of therapy as needed. Data for this analysis were drawn from a total of 324 baseline assessments conducted during 3 years (2012–2014) (78% participation rate) and obtained during in-home, interviewer-administered surveys with primary caregivers.

Assessment of Asthma Symptoms and Severity

We obtained information about the child's asthma symptoms from standardized interviewer-administered questionnaires completed with the child's primary caregiver (the caregiver who spends the most time with the child). Caregivers were asked to report how often in a 14-day period their child experienced daytime and nighttime symptoms and days requiring rescue medication use.[5] Because most children included in this study (65%) were prescribed a preventive medication at the time of the screening assessment, we matched the caregiver's report of symptom frequency to an assessment of asthma control (rather than a severity assessment) for this analysis. Level of asthma control was estimated based on NHLBI criteria,[13] with children classified as having not well controlled or very poorly controlled asthma, depending on the frequency of symptoms reported. Children with well-controlled symptoms were not included based on eligibility criteria for the SB-TEAM study.

Assessment of Weight Status

During the baseline assessment, the child's height and weight were measured using a stadiometer and standardized scale, respectively. Child age was also collected at the time of the baseline interview. The body mass index (BMI) for the child was calculated using Centers for Disease Control and Prevention standards for height and weight using the BMI-for-age growth chart based on sex.[19] Children's BMI was categorized as normal weight (BMI $<$85th percentile), overweight (BMI $\geq$85th and $<$95th percentile) or obese (BMI $\geq$95th percentile).

Assessment of Physical Activity and Barriers to Activity

Physical activity was assessed at the baseline interview, which occurred during the fall to early winter months. Caregivers were asked to report on their child's physical activity and barriers and limitations their child experienced to being physically active.

Caregivers were also asked to report the amount of physical activity their child participated in throughout the period of an average week. Questions included the number of minutes and days their child participated in physical activity. Minutes of physical activity were dichotomized based on national recommendations for 60 minutes per day or more.[20]

Caregivers reported their child's physical activity limitations using questions from the Children's Health Survey for Asthma scale, a standardized, 5-point Likert scale ranging from 1 (totally limited) to 5 (not limited).[21] Caregivers were asked to rate how much their child was limited in the last 2 weeks from participating in activities because of their asthma. Activities included sports or running outside; very strenuous activities, such as running fast or playing hard; and mild activities, such as walking. We dichotomized responses for any limitation vs not limited.

We assessed barriers to physical activity from questions regarding the social and built environment in which the child lived. Items included whether the child walked to and from school, whether there was recess at the child's school, if the child lived within walking distance to an outdoor play area, and whether there was a safe place for the child to play outdoors. We also explored minutes of screen time, including television viewing and computer use, and dichotomized responses to more than 2 hours per day based on national recommendations for maximum daily screen time.[22]

We included several child and caregiver demographics, including child age (continuous, and dichotomized at $<$5 years vs $\geq$ 6 years), sex, race (white, black, other), ethnicity (Hispanic vs non-Hispanic), insurance type (Medicaid or public insurance vs other), smoker in the home (yes vs no), and prescribed a preventive medication (yes vs no). We also included caregiver age (continuous) and education level (less than high school vs high school or more).

Statistical Analysis

We performed analyses using SPSS statistical software, version 22 (SPSS Inc, Chicago, Illinois). Frequency analyses were used to provide descriptive data on the population and to determine the prevalence of overweight and obese children within the sample.

We used χ^2 and t tests to compare levels of asthma symptom control with demographics and overweight or obese status. Bivariate and multivariate analyses were conducted to compare physical activity, limitations, and barriers to activity of children with not well-controlled symptoms to children with very poorly controlled symptoms. In multivariate analyses, we controlled for race, ethnicity, insurance, age, and sex (determined a priori).