ASTHMA AND SCHOOL FUNCTIONING

by

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(Under the Direction of A. Michele Lease and Stacey Neuharth-Pritchett)

ABSTRACT

The goal of this dissertation was to better understand factors contributing to the school functioning of students with asthma. Study 1 examined teacher-reported aspects of asthma management at school in reference to federal policy guidelines available for schools in assisting students with asthma. Results indicated that adherence to one recommendation, the presence of school-wide medication policy statements, was high. In contrast, teacher-reported adherence to other recommendations including the provision of school-based services in the form of IEPs or 504 plans, providing asthma-related professional development to teachers, limiting exposure to asthma triggers at school, and coordinating management efforts between home and school were low. Provision of professional development to teachers regarding asthma, teachers' own history of chronic illness, and information-seeking behaviors served as significant predictors of whether students with asthma were receiving formalized services. Study 2 examined the ways in which a diagnosis of asthma can affect the academic achievement of students in a sample of former Head Start children. Results of this study first indicated students with asthma perform worse than students without this diagnosis on standardized measures of both reading and math achievement. In reference to reading abilities among students with asthma, indicators of socioeconomic status, gender, and level of school absences were found to be predictive of reading scores. Both

socioeconomic status and school absences were significant in predicting the math scores of students with asthma. Finally, family environmental variables (e.g., access to community resources and regular family routines) were not significant contributors to explaining the asthma-academic achievement relationship.

INDEX WORDS: Asthma; Schools; Federal Law and Policy; Individualized Education Plans; 504 Plans; Academic Achievement; Head Start

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TABLE OF CONTENTS

Page

LIST OF TABLES

Page

CHAPTER 1

DISSERTATION INTRODUCTION

Students with chronic health problems represent a rapidly growing population in the United States as it has been estimated that nearly twenty percent of school-age children are diagnosed with a chronic illness at some point during their elementary and secondary education (Sexson & Madan-Swain, 1995). Within this group, students with asthma are among the most highly represented (National Asthma Education and Prevention Program [NAEPP], 2003). Recent population health data from the Centers for Disease Control and Prevention estimate that 7.1 million, or 1 in 10 American children are currently living with asthma in this country (Bloom, Cohen, & Freeman, 2010). Furthermore, previous research has shown that students with asthma are at a greater risk for a range of adverse health, developmental, and school-related outcomes when compared to healthy peers. Potential difficulties experienced by these students include worse general health outcomes (Collins et al., 2008), sleep deprivation due to nighttime asthma symptoms (Fiese, Everhart, & Wildenger, 2009), greater mental health difficulties such as anxiety and depression (Röder, Kroonenberg, & Boekaerts, 2003), and increased school absences (Moonie, Sterling, Figgs, & Castro, 2008). Although it is apparent how each of these resulting difficulties might in turn affect the school functioning of students with asthma, the complexities of these relationships within the school environment are not well understood.

Overview of Asthma

Asthma is a disease characterized by chronic inflammation of the lungs resulting in symptoms including labored breathing, wheezing, coughing and general feelings of fatigue (National Heart, Lung, and Blood Institute, 2009). As a result, individuals with asthma are often restricted in the performance of everyday activities, including those undertaken at school. While effective treatments for the control of asthma symptoms, namely the regular use of quick-relief and long-acting bronchodilator medications as well as the avoidance of environmental triggers, have been identified (Environmental Protection Agency, 2010; Wang, Zhong, & Wheeler, 2006), adherence to asthma treatment regimens among school-age children is often low (McQuaid, Kopel, Klein, & Fritz, 2003; Wang et al., 2006). Given that children spend a significant portion of their time in school, it is vital that schools understand the role that they can play in encouraging the effective management of asthma.

Asthma Management at School

As asthma represents a significant public health concern with treatment costs estimated at $3.2 billion annually (Weiss, Sullivan, & Lytle, 2000), it is perhaps not surprising that many related federal laws and guidelines exist for schools in effectively addressing the needs of students with asthma. First, the Individuals with Disabilities Education Improvement Act (IDEIA, 2004) and section 504 of the Rehabilitation Act (Rehabilitation Act, 1973) serve as federal statutes guiding schools in the provision of services to students with special needs, of which students with asthma are included. Various other federal agencies including the National Asthma Education and Prevention Program under the guidance of the National Heart, Lung and Blood Institute (NAEPP,

2005), Centers for Disease Control and Prevention (CDC, 2006), and Environmental Protection Agency (EPA, 2010) have also offered strategies for schools regarding the management of asthma within the school environment.

These guidelines consist of a series of overarching principles of effective asthma management such as reducing exposure to potential asthma triggers (i.e., smoke, pet dander, dust, mold) and ensuring adequate air quality at school (CDC, 2006; EPA, 2010; NAEPP, 2005), providing professional development opportunities regarding asthma and effective management strategies to teachers and other school staff involved in the care of students with asthma (CDC, 2006; NAEPP, 2005), the presence of school-wide mediation policies allowing for the provision of necessary asthma medications to students at school (EPA, 2010; NAEPP, 2005), and coordinated efforts between family, school, and community in addressing the needs of children with asthma (CDC, 2006). Despite the existence of policy statements such as these in addressing the problem of asthma in schools, the extent to which schools are compliant with these guidelines is not clear.

Asthma and Academic Achievement

In addition to understanding their role in the successful management of asthma, it is imperative that schools also understand the ways in which asthma can affect the academic functioning of students afflicted with the disease. Previous studies examining the relationship between asthma and academic achievement have resulted in conflicting findings. Whereas some researchers have found that children with asthma tend to perform more poorly on standardized measures of academic achievement, particularly reading (Kohen, 2010; Liberty, Pattemore, Reid, & Tarren-Sweeney, 2010), results from other studies have indicated no significant differences between the academic performance

of students with asthma and their healthy peers (Milton, Whitehead, Holland, & Hamilton, 2004; Moonie et al., 2008). It is then important to recognize those intervening variables that might play a role in contributing to discrepant results.

Factors identified in the literature as contributing to the asthma-academic achievement relationship have included disease-related factors such as symptom severity and medication side effects (Taras & Potts-Datema, 2005), individual demographic factors including gender (Koinis-Mitchell, Murdock, & Berz, 2004), ethnicity (Koinis-Mitchell et al., 2010), and socioeconomic status (Aikens & Barbarin, 2008; Milton et al., 2004; Perera et al., 2009), and an increased incidence of school absences among students with asthma (Koinis-Mitchell et al., 2005; Moonie et al., 2006). Beyond the role of these variables, few researchers have examined the potential contribution of other environmental variables affecting the academic achievement of students with asthma, including aspects of the family environment (Taras & Potts-Datema, 2005). Family-related variables in particular, including access to community resources and regular family routines might serve a protective role in contributing to higher levels of academic achievement among students with asthma. Given the established role of these variables in contributing to more positive academic outcomes in the general student population (Leventhal & Brooks-Gunn, 2005), it is reasonable to believe that similar relationships might hold for students with asthma. Indeed, as students with asthma often experience more obstacles to school success than those without asthma (i.e., in higher levels of school absences, symptoms and treatment regimens potentially getting in the way of academic productivity), moderating factors such as these could be particularly relevant in

contributing to academic success for this group. However, this relationship has not yet been adequately explored.

Overview of Two Studies

The following two studies examine the current school functioning of students with asthma. As the academic success of all students is often contingent on individual student as well as school-related factors, these studies examine the role of both in leading to better outcomes among students with asthma. In study 1, the focus is on identifying the current nature of asthma management in schools as reported by teachers with particular attention to the degree to which schools are compliant with current federal laws and guidelines for addressing the needs of students with asthma. Furthermore, this study identifies those school-related variables that are most predictive of the provision of formalized school services to students with asthma. In study 2, the focus is on exploring the relationship between asthma and academic achievement and identifying those individual and family-related variables playing a role in this relationship. That is, the following questions were asked: 1) Do students with asthma perform differently than students without asthma on standardized measures of academic achievement?, 2) Is this relationship moderated by student and family characteristics including gender, SES, level of school absences, and disease severity?, and 3) Do family-related variables in the form of access to resources and regular family routines also help to account for the level of academic achievement experienced by student with asthma? Taken together, these studies will help to further an understanding of the unique experience and needs of students with asthma in schools.

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CHAPTER 2

MANAGING ASTHMA IN ELEMENTARY AND MIDDLE SCHOOLS: ADHERENCE TO FEDERAL LAWS AND NATIONAL GUIDELINES[1]

[1] Schiling, E.J., Neuharth-Pritchett, S., Getch, Y.Q., & Lease, A.M. To be submitted to *Journal of Asthma.*

Abstract

Objective. The current study examined teacher-reported aspects of asthma management at school with the purpose of identifying whether Georgia schools are following available federal policy guidelines in assisting students with asthma.

Methods. Data were collected from a sample of 593 kindergarten to eighth grade teachers who completed a survey as part of the Georgia Healthy Schools Asthma Study. Demographics along with data regarding teachers' compliance with federal laws and policies, information-seeking behavior, asthma-related professional development received, and asthma management practices were collected. Using logistic regression analyses, the study examined if asthma services varied as a function of adherence to federal policy statements or other teacher characteristics.

Results. A small percentage of teachers reported that students with asthma were being served by an Individualized Education Plan (IEP) or a 504 plan with a greater percentage of middle school teachers than elementary school teachers reporting the implementation of both these services. Teachers reported that medication policies were in place for students with asthma, consistent with guidelines from the NAEPP (1), CDC (2), and EPA (3), but a limited number of students with asthma were reportedly allowed to self-administer medications. Teachers generally reported low compliance to asthma-related federal policies. Provision of professional development to teachers regarding asthma, teachers' own history of chronic illness, and information-seeking behaviors were significant predictors of whether students with asthma were served by an IEP or 504 plan.

Conclusions. Additional work is needed to assist schools in Georgia to adhere to federal policies regarding asthma management.

Introduction

Asthma management continues to be a pressing concern for American schools with limited resources available to meet the needs of children and adolescents who present with the condition. Prevalence data from the Centers for Disease Control and Prevention's National Health Interview Survey indicate 7.1 million American children and adolescents, or 9.6% of the population aged 17 and under, have an asthma diagnosis (4). As children with asthma are found in almost every classroom in the nation (5, 6), it is imperative that schools are responsive to the health needs of these students so that they can access equal opportunities for learning (7).

With the reauthorization of the Individuals with Disabilities Education Improvement Act [IDEIA] (8), the educational rights of children and adolescents with chronic illness to equal access to services within schools were reinforced. Moreover, the ability of these students to receive special education services and/or accommodations when their educational achievement is compromised as a result of their illness was strengthened. Despite the abundance of guidelines addressing asthma management in schools both in federal laws, such as IDEIA, and other federal policies, the degree to which schools comply with mandated policies and guidelines is not well understood (9).

As in other environments, poor asthma management in schools might result in lack of immediate intervention resulting in exacerbations including asthma attacks, the use of emergency medication, and need for emergency care or other medical intervention (10). As a result, schools become increasingly responsible for ensuring that these more intensive services are delivered. Furthermore, as treatment costs of asthma are estimated

at $3.2 billion annually (11), control and prevention of asthma, including in schools, is essential to lessening the strain of associated health care costs (1, 12, 13, 14).

Students with chronic health problems frequently face challenges at school stemming from the cognitive, social, emotional, and behavioral sequelae of the disease process itself (20, 21). Subsequently, those who support the education of these students, including administrators, teachers, school nurses, and other school staff, must be aware of potential barriers to academic functioning that exist in this population.

Furthermore, asthma has been found to be a risk factor for a range of adverse educational outcomes, including increased absenteeism (22, 23, 24, 25, 26, 27), poor psychosocial functioning at school (22, 23, 28), and decreased levels of academic achievement (24, 29, 30, 31). However, the mechanisms by which asthma exerts its influence on such variables are not well understood. Whereas some researchers have found asthma independently predicts the presence of less positive school outcomes (30), others have identified intervening variables accounting for this relationship. Identified variables have included asthma severity (31), persistent nighttime asthma symptoms (23), socioeconomic status (25), and self-esteem and self-efficacy in one's beliefs regarding disease management (32, 33, 34). Thus, it is important to recognize the role schools can play in promoting the health and ultimate school success of students with asthma.

Asthma Management

Treatment of childhood asthma incorporates both the medical management of the disease and avoidance of environmental triggers, which can exacerbate disease symptoms (3). Asthma management is enhanced when triggers in the school environment to which students are sensitive (e.g., dust, strong chemicals) are minimized. Additionally, medical

management of asthma at school is often accomplished through quick-relief inhaled bronchodilators, which target the treatment of sudden respiratory symptoms (14). Students often also use long-acting bronchodilator medications in conjunction with quick-relief medications, but this intervention does not typically take place in the school setting (14). Despite the proven effectiveness of medications in controlling asthma symptoms, researchers have documented the underuse of long-acting preventative medications as well as the overuse of quick-relief medications in school-age children (14, 15, 16).

A barrier to ensuring adequate management of asthma exists in the degree to which students are permitted access to their quick-relief asthma medications while at school. Although all 50 states currently protect the rights of students with asthma to carry and self-administer asthma medications, including inhalers, laws vary by state and individual school districts may have their own specific policies regarding medication administration (17). Most states require written documentation of an asthma diagnosis from the child's health care provider along with a statement in the form of an asthma action plan that the use of asthma medication at school is necessary for the purposes of disease management (17). The asthma action plan then exists as a document for teachers and schools to refer to when addressing asthma management of students. Written consent from the child's guardian(s) is also required (a) to allow the school to supervise and directly administer medication, and (b) to release the school from liability for claims that may arise relating to concerns about the administration of approved medications (17).

Whereas all states currently allow students with asthma to carry reliever medications on their person at all times, some states (e.g., Arkansas, Delaware) also

require that medications be kept in their original containers along with original prescription labels (18). Other states (e.g., Arkansas, California, Colorado) require that asthma inhalers be kept in the school nurse's office should the student forget medication at home. As well, some states require students with asthma to demonstrate adequate skills in and responsibility for the self-administration of asthma medications (18) before they are allowed to carry medications on their person at school (e.g., Alaska, Colorado, Hawaii).

The National Asthma Education and Prevention Program (19) also provides guidelines for health care providers to decide whether a child with asthma is mature enough to carry and to self-administer quick-relief medications at school. These guidelines stipulate that individuals making these decisions should consider child, parent/caregiver, and school-related factors (19). Student-related variables include the desire to carry and self-administer medication, developmental/maturity level, ability to self-identify asthma symptoms, particularly those of an asthma attack, and an ability to use correct medication administration procedures. Parent/guardian factors center on desire for their child to self-carry and self-administer medication, awareness of parental responsibility in the process, and commitment to making sure medications are provided for the child. Finally, school-related factors include presence of a full-time school nurse, adequate training of staff, provision of safe storage and easy access to medication, and the presence of an emergency action plan for addressing escalating symptoms. Despite the existence of clear federal policies for effective asthma management in schools, previous research has not adequately addressed the degree to which schools follow these policy statements. Similarly, it is not clear whether adherence to such policies vary as a

function of school setting (e.g., elementary vs. middle school). Given that previous research has demonstrated a higher incidence of medication use in older children with asthma as well as more complicated treatment regimens in this group (14), it is reasonable to believe that compliance with policies might be higher in middle or high school. However, this finding has not been evidenced in the literature.

What Asthma Policies Are Available for Schools?

Federal Education Statutes.

Individuals with Disabilities Education Improvement Act.

The federal Individuals with Disabilities Education Improvement Act (IDEIA) (8) mandates the free and appropriate education of all students with disabilities within the least restrictive school environment. An understanding of the term "disability" is integral in determining which students are eligible for school-based services under the law. Under IDEIA, a "child with a disability" is defined as a student

> with mental retardation, hearing impairments (including deafness), speech or language impairments, visual impairments (including blindness), serious emotional disturbance (referred to in this title as `emotional disturbance'), orthopedic impairments, autism, traumatic brain injury, other health impairments, or specific learning disabilities…who by reason thereof, needs special education and related services (8).

Other Health Impairment, the category under which asthma is subsumed, is further defined as any condition causing

> limited strength, vitality, or alertness including a heightened alertness to environmental stimuli, that results in limited alertness with respect to the

> educational environment that (i) is due to chronic or acute health problems such as asthma, attention deficit disorder or attention deficit hyperactivity disorder, diabetes, epilepsy, a heart condition, hemophilia, lead poisoning, leukemia, nephritis, rheumatic fever, sickle cell anemia, and Tourette syndrome; and (ii) adversely affects a child's educational performance (8).

For a student with asthma to be served under the IDEIA classification of Other Health Impairment, he/she must meet this definition of disability and require special education services as a result of his/her medical condition (35). For example, the educational performance of students with asthma might be adversely affected by time away from school due to absences, difficulties concentrating as a result of breathing problems, or more direct cognitive effects of the disease.

An understanding of the term, "appropriate education" is also necessary in determining what types of services children with asthma are entitled to under the law. As this term is rather vague as defined by IDEIA and includes any special education or related services provided to students within the education setting (8), some have attempted to clarify this definition as including those services that allow for meaningful progress made by the student with a disability in comparison to typically-developing peers (36). That is, as previous research has shown that the educational achievement of students with asthma is often similar to that of students without asthma (24), it is important to recognize when the disease is having a significant negative effect on school performance. In making a determination of what services are appropriate for students with asthma in encouraging educational progress, IDEIA also mandates that Individualized Education Plans (IEPs) be written and revised accordingly for students

with disabilities served under the law (8). According to IDEIA guidelines, specific factors that should be addressed in the development of an IEP include the child's strengths, concerns of parents, results of any recent psychoeducational evaluations, and the overall academic, functional, and developmental needs of the child (8).

For students whose asthma impedes their access to learning or an appropriate education, the development of an asthma management/action plan is often a necessary part of the IEP process (35). The asthma management plan should consist of instructions from healthcare providers regarding how best to treat the student's asthma during the school day, medication schedules, appropriate use of self-administered medication, typical symptoms, and perhaps most importantly, guidelines designed for school staff for dealing with the exacerbation of asthma symptoms at school (10, 35). In theory, schools should be following these guidelines in serving students with asthma at school. However, recent research suggests school officials lack sufficient knowledge of the implications of chronic illness, which can serve as a barrier to identifying appropriate accommodations for this group (37). Furthermore, although students with asthma may be eligible for services under IDEIA, including the implementation of an IEP addressing their needs at school, this is not typical practice (38). That is, if students with asthma are receiving services in accordance with IDEIA, this is often due either to the presence of a co-occurring condition affecting school functioning (i.e., ADHD) or to direct effects of the student's asthma on educational performance, which is less common. As such, the needs of students with asthma are more often addressed with 504 plans (38).

Section 504 of the Rehabilitation Act.

Section 504 of the Rehabilitation Act of 1973 exists as another federal statute that

guides schools in addressing the needs of students with asthma (39). This law prohibits discrimination against otherwise qualified individuals on the basis of disability alone (40). The definition of disability under Section 504 is much broader than the IDEIA definition and subsumes any person who "(i) has a physical or mental impairment which substantially limits one or more major life activities, (ii) has a record of such impairment, or (iii) is regarded as having such an impairment" (40).

As Section 504 recognizes that any major life activity, and not just educational functioning as in IDEIA, might be affected by a disability such as asthma, the law is particularly useful in providing access to non-academic accommodations (i.e., to medication access) within the school setting (35). Furthermore, this law, in serving as an anti-discrimination statute, holds schools to rigorous standards in ensuring appropriate and adequate accommodations are made for students with disabilities in placing them on an even playing field with their typically-developing peers (40). Despite the high prevalence rate of students with chronic health difficulties, including asthma, in schools, results of a recent national survey indicate that only 1.2% of the public school population are served under section 504 alone (i.e., in the absence of an IEP plan) (41). This finding may be due to a misunderstanding of 504 eligibility standards by schools, thus resulting in the under-identification of students for services (41). Finally, Section 504 is an unfunded mandate and schools are often hesitant to offer 504 as a solution as the schools themselves would incur costs associated with any accommodations afforded the child (e.g., use of specialized filters to address environmental triggers in classrooms). It is therefore important to understand the level to which students with asthma are included among students with 504 plans.

Other Federal Policy Statements for Asthma Management at School

A number of federal agencies have provided extensive guidance on the management of asthma in schools. Although these policies and suggested procedures are not legislation, they do provide useful tools for schools by informing schools about how they can ensure access to students whose asthma conditions necessitate intervention in school settings.

NAEPP Resolution on Asthma Management at School.

In 2005, the National Asthma Education and Prevention Program (NAEPP) released a position statement encouraging schools to adopt specific asthma management policies with the goals of ensuring the safety of students with asthma, allowing for the active participation of students with asthma in all school activities, and encouraging greater self-management of asthma by students (19). The core policy recommendations put forth in this statement are (i) the existence of a smoke-free environment for all student activities, (ii) the presence of an asthma emergency plan guiding staff in the treatment of asthma episodes, (iii) the provision of professional development for all staff regarding medication policies, steps for communicating about health concerns of students, and emergency procedures, and (iv) a written medication policy that allows for safe and easy access to asthma medications as needed (19). Regarding this last recommendation, NAEPP encourages all schools to allow students with asthma to carry and self-administer quick-relief medications when possible given that the ability and willingness of all involved parties to take this action is established.

The NAEPP guidelines also state that schools should provide access to regular health services at school, including monitoring and treatment of asthma symptoms,

school nurse support, and the construction of an individualized asthma action plan for all students with asthma (19). The NAEPP recommendations also suggest that all schools should provide appropriate physical education options for students with asthma that promote as much safe physical activity as possible. Finally, the development of healthy environments is encouraged via the implementation of indoor air quality management plans, pest management activities, and reduction of exposure to common school-based asthma triggers such as bus exhaust (19).

One recent study examined adherence to NAEPP recommendations by schools and found that, although a large percentage (80% or more) of schools nationwide allowed students to carry and self-administer quick-relief asthma medications and kept asthma action plans on file for students, adherence to other recommendations was not as high (9). For example, Jones and colleagues (9) found that less than one-third of schools employed a full-time school nurse. Therefore, it is vitally important to continue to understand what schools are doing to serve the needs of students with asthma in reference to such guidelines.

Centers for Disease Control and Prevention: Strategies for addressing asthma within a coordinated school health program.

The Centers for Disease Control and Prevention (CDC) (2) also provides written policy guidelines for schools on best practices in asthma management. While fairly consistent with NAEPP guidelines in emphasizing the need for management and support systems, access to health services within the school setting, the provision of healthy school environments, including ensuring high air quality, and the importance of asthma education, CDC policy guidelines add a further provision (2). Namely, the CDC (2) recommends that coordinated family, school, and community efforts are needed to

improve asthma symptoms and reduce school absences of students with asthma (2). Whereas CDC guidelines regarding the usefulness of coordinated efforts in managing asthma can certainly be helpful to schools in addressing the needs of students with asthma, like other federal guidelines, not much is known regarding their implementation.

Environmental Protection Agency: Managing Asthma in the School Environment.

The Environmental Protection Agency (EPA) (3) has developed materials for school administrators and staff on the successful management of asthma at school. The EPA offers three overarching guidelines for schools. Their first two guidelines, in contrast to NAEPP and CDC statements, focus more on optimal school environments for students with asthma. First, the establishment of adequate indoor air quality is encouraged (3). According to the EPA (3), healthy air quality is facilitated by the presence of quality HVAC systems, control of mold/moisture, effective cleaning and maintenance activities, strong pest management, and the selection of breathe-friendly materials. Second, the EPA advocates for the reduction of student exposure to asthma triggers within the school environment, such as animal allergens, pests, dust mites, and other indoor air pollutants (3). Finally, the EPA, in agreement with NAEPP and CDC statements, encourages the development of a school-wide asthma management plan, the implementation of individualized asthma action plans, allowing easy access to medications as needed, and clear emergency procedures for dealing with students' asthma attacks (3).

The Current Study

The purpose of the current study was to examine elementary and middle-school teacher-reported efforts in asthma management at school to better understand whether

schools in Georgia are adequately following available policy guidelines in addressing the needs of students with asthma. More specifically, the first aim of the study was to determine the degree to which teachers report that schools are compliant with policy recommendations regarding asthma management at school as put forth by federal agencies including the National Asthma Education and Prevention Program, Centers for Disease Control, and Environmental Protection Agency. Specific recommendations were examined including reducing exposure to environmental asthma triggers as measured by the number of reported irritants present in classrooms, the presence of formalized medication policy statements, encouraging coordinated family, school, and community efforts regarding asthma management as evidenced by teachers' information-seeking behavior, and providing asthma-related professional development opportunities to school staff. The second aim of the study was to determine the degree to which students with asthma in Georgia are currently served under appropriate federal statutes, including section 504 of the Rehabilitation Act and IDEIA as reported by teachers. The third aim of the study was to describe the nature of current teacher-reported asthma management practices in Georgia classrooms, particularly related to medication administration (i.e., in accordance with self-carry of asthma medication laws). Finally, the fourth aim of the study was to discover whether the provision of services (e.g., in the presence of a 504 plan or IEP in accordance with IDEIA) varies as a function of teacher-reported adherence to federal policy statements, namely the provision of professional development regarding asthma to teachers, the presence of a school-wide medication policy statement, reduction of asthma triggers in the classroom, and coordinated family, school, and community efforts regarding asthma management.

It was hypothesized that, although teachers reported that the needs of students with asthma were addressed under the guidance of federal statutes such as section 504 and IDEIA, the level to which these services were provided would vary greatly. As previous research has demonstrated (9), it was also expected that although schools might be proficient in allowing children access to quick-relief asthma medications, adherence to other guidelines for effective asthma management, including reducing exposure to environmental asthma triggers, coordinating efforts between all involved parties, and the provision of asthma-related professional development opportunities to school staff, would lag behind. Last, it was believed that those teachers who reported: (a) receipt of greater professional development and training regarding asthma, (b) more teaching experience, (c) a personal experience with chronic illness or asthma, (d) the presence of a formal medication policy, (e) lesser exposure to asthma triggers in the classroom, (f) higher levels of confidence in their school's capability to address the needs of students with asthma, and (g) coordinated family, school, and community efforts regarding asthma management would be more likely to also report that the needs of these students were addressed under IDEIA/section 504.

Method

Participants

Study participants consisted of 593 teachers who completed a survey as part of the Georgia Healthy Schools Asthma Study (6). The study was approved by the Institutional Review Board with surveys returned by teachers indicating consent to participate. Data were collected on 291 elementary school teachers in 1999 and 302 middle school teachers in early 2001. The sample represented an equally balanced

distribution across the nine grade levels. Teachers from elementary schools taught kindergarten (7.4%), first grade (9.8%), second grade (7.9%), third grade (8.3%), fourth grade (5.2%), fifth grade (5.1%), special education (.7%) and other classrooms (5.2%). Middle school teachers taught in sixth grade (17.7%), seventh grade (13.3%), eighth grade (14.3%), and special education classrooms (1.7%). Survey respondents were representative of all the metropolitan statistical areas of the state of Georgia. Further, 60% of counties across the state were represented in the sample, as areas ranging from major metropolitan to very rural were included. Gender of the teachers was reported as 89% female and 11% male. The ethnic breakdown of the teacher respondents was 85% Caucasian and 12.5% African American, with less than 1% identifying themselves as Hispanic/Latino, Native American, or other. Most teachers reported an age of 30 or older (90%). All teachers reported having earned a minimum of a bachelor's degree and two thirds reported the attainment of a graduate degree. Teaching experience reported by teachers ranged from 1 year to 36 years (M = 15.45 years, SD = 8.66). Few teachers reported teaching in schools with less than 250 students (1.5%). The remainder of teachers taught in more populated schools with 251 – 500 students (21.6%), 501-750 students (33.4%), and 750 or more students (42.5%).

Procedure

From 1999 to 2001, as part of the Georgia Healthy Schools Asthma Study (6), a survey was sent to a random sample of 2000 kindergarten through eighth grade teachers across the state of Georgia. 593 teachers completed and returned the survey, representing a 30% return rate that is consistent with the response rate of Georgians to other medical surveys. For example, the response rate of Georgians to the U.S. Center for Disease

Control's Behavioral Risk Factor Surveillance Survey was 39.8% (2). Data collected included information regarding teachers' levels of training and professional development in issues around students with chronic health conditions including asthma, classroom environments, teacher knowledge regarding asthma, level of comfort in the school's current asthma management activities, and school policies regarding meeting the needs of students with asthma.

Measures

Official School Policies.

Information regarding the presence (or absence) of formal school policies addressing the needs of students with asthma was assessed by the following three questions:

1. Do children with asthma in your school have a 504 plan?
2. Do children with asthma in your school have an IEP?
3. My school has an official policy about medication administration.

Respondents were asked to respond "yes" or "no" to each of these questions. A further question was posed to teachers regarding who dispenses medication to students with asthma while at school. Response options from which participants could choose all that applied included the child him/herself, the school nurse, teachers, and parents.

Asthma Management by Teachers.

Teachers' confidence in their own abilities to manage asthma in the classroom and to seek out information when needed was assessed using the Teacher Asthma Management and Information Seeking Scale (42). The scale consists of 13 items for which teachers were asked to identify how certain they were that they could engage in each behavior presented (1 = not sure, 10 = very sure). Construct validity of the scale is

indicated by a strong two-factor structure resulting in the identification of two subscales (42). The Teacher Asthma Management subscale consists of items addressing the ability to recognize the signs of asthma, determine when medications are not working, to identify side effects of asthma medication, to recognize the early warning signs of an asthma attack, to differentiate between asthma medications, and to identify asthma triggers in the classroom. The Information Seeking subscale includes two items regarding the teacher's confidence in communicating with school administrators and with parents about issues around students' asthma management at school. Internal consistency for both subscales is also adequate with Cronbach's alpha values of .90 and .71, respectively. Reliability of both subscales is also indicated by a solid two-factor structure and associated items. Both subscales were examined in the current study for the purposes of determining adherence to federal guidelines.

A further question concerning asthma management was asked of teachers as part of data collection for the Georgia Healthy Schools Asthma Study (6). This item, referred to as Level of Exposure to Classroom Asthma Triggers, addresses the presence of potential asthma triggers in the classroom (i.e., carpeting, chalkboards, cleaning supplies, plants). That is, teachers were asked to indicate all those potential triggers that were currently present in their classrooms. Teacher responses to this item serve as a further indicator of adherence to federal guidelines.

Training and Professional Development.

Teachers' current levels of training and professional development around issues of asthma in schools were assessed by the following item: During your professional preparation, did you have specific course work on asthma? Participants were asked to

specify whether such training was received at the (i) undergraduate, (ii) graduate, or (iii) in-service level. Participants also responded to a question asking them to estimate the percentage of teachers in their school who have received staff development around the presence of students with asthma in the classroom. These items were examined in the current study and will serve as a marker for adherence to federal guidelines regarding the provision of asthma-related professional development to teachers.

School Resources.

The Teacher Capability and School Resource Scale for Asthma Management (43) was used to determine teachers' levels of confidence in their school's asthma management capabilities. This 10-item measure asked teachers how capable they were in managing stressful asthma-related episodes in the classroom and identifying any concerns regarding current school policies, regulations, and liabilities regarding management practices (43). Construct validity of the Teacher Capability and School Resource was indicated by the identification of two factors/subscales, Teacher Capability in Social and Emotional Aspects of Asthma Management and School Resources/Institutional Capability for Asthma Management (43). Further validity evidence for the scale exists in adequate internal consistency for both scales with Cronbach's alpha values of .83 and .86, respectively. Reliability of both subscales is also indicated by a solid two-factor structure and associated items. For the purposes of the current study, items from the School Resources/Institutional Capability subscale of this measure were examined. Items on this subscale include:

1. Your school district's adequacy of resources to assist with children with asthma
2. Your school's adequacy of resources to assist with children with asthma
3. School facilities to deal with asthma exacerbations

4. The availability of a school nurse to assist with the child's management of their asthma

For each item, teachers were asked to rate their level of comfort on a five point scale ranging from 1 = very uncomfortable to 5 = very comfortable.

Results

Of note, missing data was present across surveys and respondents. In such cases, listwise deletion was employed before running statistical analyses. The first set of analyses addressed whether students with asthma were currently being served under appropriate federal statutes (IDEIA or 504). Frequency counts were examined for the questions asking teachers whether children in their school had an individualized education plan (IEP), or whether children in their school had a 504 plan. The data for the questions on the use of an IEP or a 504 plan suggested that some teachers were unaware of the presence of these policies for students with asthma. Regarding the use of an IEP, 12.1% (n = 72) of teachers reported that their schools employed IEPs for children with asthma while 72% of teachers indicated that their school did not use an IEP to assist children with asthma. It should be noted that 94 teachers (15.9%) did not respond to the question suggesting that they might have been naive of this fact. The same pattern held for the use of 504 plans for children with asthma. Specifically, 102 teachers (17.2%) reported that students with asthma in their schools had a 504 plan while 346 (58.3%) indicated that 504 plans were not used for students with asthma. In response to this question, 145 teachers (24.5%) did not respond to the item perhaps indicating either their unawareness of the use of 504 plans or perhaps their lack of knowledge of what a 504 plan provides. Phi analyses were conducted to examine potential differences in response

patterns between elementary and middle-school teachers on the same two questions. Significant differences were found regarding the use of IEPs and 504 plans in the different schooling environments. That is, middle-school teachers were more likely to report the use of IEPs (φ (499) = -.14, p = .00) and 504 plans (φ (448) = -.15, p = .00) to assist children with asthma.

The second set of analyses addressed the question of whether schools were currently following available federal policy statements regarding asthma management at school. On the presence of a medication policy, 97.6% of teachers responded that their schools did have medication administration policies in place. A chi square analysis revealed no differences between elementary and middle-school teachers' responses to this question.

Frequency counts were also conducted to examine the number of triggers present in elementary and middle-school classrooms as reported by teachers in this sample, a further indicator of adherence to policy statements. The total number of triggers in each classroom was calculated. Across all classrooms, the modal number of triggers present was three (21.6%). Of the 13 triggers present, 59.8% of classrooms had four or more triggers present. Of these 13 triggers, the mean number was also calculated and a comparison made between elementary and middle-school classrooms. Elementary school classrooms were found to have more triggers present [$F(1,588) = 151.67$, $p < .00$]. Table 1.1 presents the frequencies for each of 13 triggers indicated as present or absent by the teachers who completed the survey. In all cases where a significant difference was found between school settings, there were a greater proportion of triggers present in elementary than in middle-school classrooms.

An additional six trigger items were posed to middle-school teachers given the diversity and specialization in the curriculum covered in middle school. Specifically, middle-school teachers were questioned about the presence of chemicals for science experiments, art supplies, materials for agricultural or technical training, materials for family and consumer science, storage facilities for student belongings, and carpentry supplies. Of these six triggers, two were found to be relatively prevalent in middle-school classrooms. Of the middle-school teachers who reported the presence of these triggers, chemicals for science experiments (16.1%) and art supplies (45.3%) were indicated most often.

Teachers were also asked to respond to three items that focused on their professional development on asthma management at the undergraduate, graduate, or in-service level. Of the 593 teachers, 15.9% (n = 94) indicated some professional development on the topic. No significant differences were found in the reporting of professional development experiences between elementary and middle-school teachers [$F(1,592) = 2.65$, $p = .104$].

To examine the extent of coordinated efforts in asthma management at school, teachers' responses on the Information Seeking (IS) subscale of the Teacher Asthma Management and Information Seeking Scale were examined. The mean score for the total sample of teachers on the IS subscale was 7.34 (SD = 2.25). No significant difference was found among elementary and middle-school teachers on their skills in seeking information to assist students with asthma ($F(1,586) = 1.12$, $p = .29$). It should be noted that the mean score for both elementary and middle-school teachers representing

their skills in seeking information fall below a scale score of 7.5, indicating that these teachers have mixed capability in seeking information to support students with asthma.

A third set of analyses was undertaken to address the question of the current nature of asthma management in Georgia classrooms, particularly in regard to compliance with self-carry laws. The Teachers completed the Asthma Management Factor (AMF) subscale of the Teacher Asthma Management and Information Seeking Scale as an indicator of current asthma management practices. On the AMF, the total sample had a mean score of 4.69 (SD = 2.13), indicating mixed skill capabilities in managing asthma in the classroom. No statistically significant difference was found on the mean score between the elementary and middle-school teachers ($F(1,587) = .04$, $p = .85$). Teachers also completed the School Resources/Institutional Capability subscale of the Teacher Capability and School Resources Scale For Asthma Management as a measure of school-wide asthma management practices. On this subscale, the total sample had a mean score of 3.06 (SD = 1.12), with scores of 3.5 or higher denoting feelings that schools are capable in meeting the needs of children with asthma. On average, middle school teachers reported greater resources for students with asthma than elementary school teachers, although both groups' scores were below this cutoff ($F(1,585) = 23.08$, $p < .00$).

Teachers also responded to an item questioning them about a student with asthma's ability to self-carry their rescue medication and administer such medication. The number of elementary and middle-school teachers who reported that children were able to self-administer medication was 36 (6.1%). No significant difference was found between elementary and middle-school teachers on this item (φ (587) = -.03, $p = .49$).

Finally, a logistic regression analysis was employed to answer the question of whether adherence to federal policy statements is a significant predictor of whether students with asthma are served under IEPs or 504 plans in schools. Separate models were tested for each of these questions. In the first model, an analysis was conducted to predict the presence of IEPs for students with asthma using teachers' past professional development regarding asthma, level of information seeking behavior, number of years of teaching experience, teachers' reported diagnosis of a chronic illness or asthma, their school's presence of a formal medication policy, and level of reported school resources for students with asthma as predictors. Results of this logistic regression can be found in Table 1.2. A test of the full model indicated that these predictors as a set reliably distinguished between whether or not students with asthma were reportedly being served by an IEP ($\chi^2(7) = 23.04$, $p = .00$). Furthermore, the Hosmer and Lemeshow test indicated good model fit for included variables ($\chi^2(8) = 7.32$, $p = .50$). The Wald criterion indicated that only past professional development regarding asthma accounted for significant unique variance in the model beyond the contribution of other variables ($\chi^2(1) = 19.39$, $p < .00$). The odds ratio for this predictor portrayed that those teachers who reported having received some previous professional development regarding asthma were 3.64 times more likely to report that students in their schools were currently being served under an IEP.

In the second model, an analysis was conducted to predict the presence of 504 plans for students with asthma using these same variables as predictors. Results of this logistic regression can be found in Table 1.3. A test of the full model indicated that this set of variables reliably distinguished between whether or not students with asthma were

currently being served by 504 plan as reported by teachers ($\chi^2(7) = 22.58$, $p = .00$). Furthermore, the Hosmer and Lemeshow test indicated good model fit for included variables ($\chi^2(8) = 1.76$, $p = .99$). The Wald criterion again indicated that past professional development regarding asthma accounted for significant unique variance in this model ($\chi^2(1) = 9.72$, $p = .00$) with those having received professional development around this issue 2.46 times more likely to report that students with asthma in their schools were being served by 504 plans. Additionally, teachers who reported having a diagnosis of a chronic illness were .45 times more likely to report the presence of 504 plans for students with asthma as this variable also made a significant contribution to prediction ($\chi^2(1) = 5.66$, $p = .02$). Finally, results demonstrated that those teachers who reported engaging in less information-seeking behavior were 0.88 times more likely to report that students with asthma are served by 504 plans in their schools ($\chi^2(1) = 4.33$, $p = .04$). This result might indicate a feeling among teachers that the medical treatment of students' asthma is under control and, thus, there is no need to seek additional information from others regarding the condition.

Discussion

The purpose of the current study was to examine teacher-reported aspects of asthma management at school with the purpose of identifying whether schools in Georgia are adequately following available federal statutes and policy statements in addressing the needs of students with asthma. Specifically, it was hypothesized that teachers would report compliance with certain policies, namely the provision of services through an IEP or 504 plan and the presence of medication policy statements allowing students to self-carry and administer asthma medications at school. It was also expected that compliance

with other guidelines, including reducing exposure to asthma triggers in the classroom, coordinating efforts between all those involved in the care of students with asthma, and the provision of professional development to teachers regarding asthma would not be as high. Finally, it was hypothesized that those teachers who reported having more teaching experience, a personal experience with chronic illness or asthma, the presence of a formal medication policy in their school, higher levels of confidence in their school's capability to address the needs of students with asthma and coordinated family, school, and community efforts regarding asthma management will be more likely to also report that the needs of students with asthma are currently being addressed by an IEP or 504 plan. Hypotheses were partially supported.

First, only 12% and 17% of teachers respectively reported that students with asthma in their schools were being served by an IEP or 504 plan. Results indicated that teachers more often reported that these students had 504 plans instead of IEPs in place. These results are consistent with previous research indicating that students with asthma more often receive services under 504 plans as they often don't meet the stipulation under IDEIA that their condition adversely affects educational performance (38). The finding that middle-school teachers were more likely to report the presence of formalized services in the form of an IEP or 504 plan might further suggest either that older students with asthma are in greater need of formalized school services as they progress in their schooling or that the middle-school teachers in this sample were more knowledgeable regarding the provision of formalized services to students with asthma than their elementary school counterparts. Additionally, as expected, most teachers (98%) reported that their schools did have medication policies in place for students with asthma, as is

consistent with guidelines from NAEPP (5), the CDC (2), and the EPA (3). However, it should also be noted that only 6% of teachers responded that students with asthma in their schools were allowed to self-administer medication, more often noting that medications were administered by the school nurse, teachers, or other school staff. As this question did not delineate between rescue and maintenance medication, it is not clear whether this finding is due to a misunderstanding of the question by teachers or truly that students in their schools were not allowed to self-administer medication. If the latter is true, it appears that schools in this sample are not compliant with NAEPP guidelines and other federal mandates regarding self-administration of asthma medication at school.

Also as expected, teachers reported lower compliance to other federal policy guidelines regarding asthma management at school. First, regarding reducing the number of potential asthma triggers in the classroom, results indicated that nearly 60% of teachers reported that more than four asthma triggers were typically present in classrooms surveyed. As policy recommendations from NAEPP, CDC and EPA all stipulate that exposure to such triggers should greatly be limited and indoor air quality ensured, classrooms in this sample are again at odds with this guideline. Second, only 16% of teachers surveyed reported having received some professional development regarding asthma throughout their training, again indicating incongruence with policy recommendations. Additionally, teachers' reports regarding current asthma management practices as well their own abilities to seek out information and help coordinate services for students with asthma denoted less than adequate abilities in these areas. Generally, these findings are consistent with the literature regarding schools' compliance with asthma guidelines including a 2009 study conducted by Jones and colleagues (9) in which

compliance with NAEPP guidelines was found to be low with the exception of the implementation of medication policies.

Finally, in examining what factors might play a role in determining whether a student with asthma receives formalized services (i.e., in the form of an IEP or 504 plan), hypotheses were again partially supported. That is, it was found that the provision of professional development to teachers regarding asthma is a reliable predictor of whether students with asthma are served by an IEP, at least as reported by teachers. This finding supports the importance of continued professional development for teachers as emphasized by NAEPP and the CDC in helping to ensure that the needs of students with asthma are adequately addressing at school. Furthermore, this same variable as well as a teacher's own diagnosis of a chronic illness were found to serve as viable predictors for the presence of a 504 plan for students with asthma. It is therefore reasonable to believe that a teacher's own experience with chronic illness might make him/her more likely to advocate for or at least be aware of the educational needs of students with asthma. The finding that teachers' information-seeking behavior around asthma management was negatively predictive of teacher-reported provision of 504 services is somewhat surprising. Namely, it might be expected that teachers who are more confident in their own abilities to seek out information about asthma management when needed would be more likely to report that the educational needs of students with asthma are being addressed by a 504 plan. Alternatively, this finding could represent a lack of understanding by teachers of section 504 in general as noted in the literature (41).

Conclusion

This study helped illuminate the asthma management practices in one state's

elementary and middle-schools. Findings suggest that teachers and school administrators need support in implementing best practices associated with asthma management. Despite an increased understanding of how federal policies and guidelines for asthma management are implemented in schools, several limitations of the current study exist. First, it must be noted that variables regarding the current nature of asthma management in schools were measured solely by teacher report. For example, although a majority of teachers reported that students with asthma in their schools were not currently being served by an IEP or 504 plan, it is feasible to believe that actual student records might point to the contrary. Thus, future research investigating the provision of services to students with asthma could benefit from examining student records in corroborating any teacher reports.

Another limitation of the current study is the potential difficulty in generalizing study results to other areas of the United States. As data were collected from teachers across a large southeastern state and from a variety of both metropolitan and rural areas, it is evident that results are representative of teacher viewpoints and school policies within that geographical region. However, it is less clear whether similar results might be found within schools throughout other areas of the country. Future research could continue to examine these issues at more of a national level in gaining a clearer picture of nationwide school policies related to students with asthma.

Despite its limitations, this study adds to the understanding of how schools are functioning in addressing asthma management and how teachers view this process. Although best practices and related policy guidelines for serving the needs of students with asthma have been developed, this is one of the first studies examining the question

of actual implementation of these standards. In particular, results suggest that whereas teachers view schools as adequately meeting policy recommendations in some areas (i.e., in the implementation of medication policy statements, providing services to students with asthma), compliance with other guidelines is not as high. That is, teachers recognize a failure to limit exposure to potential asthma irritants in classrooms, lower levels of coordinated asthma efforts, inadequate confidence in schools' capabilities for asthma management, and a lack of professional development around asthma. However, it was also noted that the presence of potentially protective factors such as these, particularly the provision of professional develop to teachers, can play a role in determining whether students with asthma ultimately obtain access to needed services within the school setting. Therefore, future investigations into similar factors ensuring the successful implementation of asthma-related policies by schools are warranted.

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Table 1.1.

Summary of specific asthma triggers present across classrooms with tests for differences in the presence of specific triggers between elementary and middle schools

Trigger	Elementary	Middle-School	Phi	Significance
Carpeting	236 (81)[a]	168 (56)	-.25	.00
Furry animals	24 (8)	12 (4)	-.09	.04
Chalkboard	167 (28)	129 (43)	-.13	.00
Eraser board	221 (76)	197 (65)	-.10	.02
Cloth Furniture	38 (13)	37 (11)	-.01	.87
Cleaning Chemicals	96 (33)	104 (34)	.03	.54
Plants	128 (44)	110 (36)	-.07	.11
Fish bowl	47 (16)	23 (8)	-.13	.00
Cockroaches	78 (27)	54 (18)	-.10	.02
Strong smells	38 (13)	44 (15)	.03	.51
In-class storage of personal items	240 (82)	97 (32)	-.50	.00
Pillows for reading	78 (27)	17 (6)	-.29	.00
Toys	132 (45)	7 (2)	-.50	.00

[a]Percentages of classrooms reporting the presence of a given trigger are presented in parentheses

Table 1.2.

Summary of logistic regression predicting presence of an IEP for students with asthma

Variable	β	SE β	Wald's X^2	p	OR
Professional Development	1.29	.30	19.05	.00*	3.64
Information Seeking	-.09	.30	1.86	.17	.91
Teaching Experience	.01	.02	.56	.45	1.01
Teacher's Illness	.01	.42	.00	.99	1.01
Teacher's Asthma	-.38	.48	.62	.43	.69
Medication Policy	.82	.92	.79	.37	2.27
School Resources	-.08	.13	.37	.54	2.15

Note. $df = 1$
*$p < .01$

Table 1.3.

Summary of logistic regression predicting presence of a 504 plan for students with asthma

Variable	β	SE β	Wald's X^2	p	OR
Professional Development	.90	.29	9.72	.00**	2.46
Information Seeking	-.12	.06	4.33	.04*	.88
Teaching Experience	.01	.01	.50	.48	1.01
Teacher's Illness	-.81	.34	5.66	.02*	.45
Teacher's Asthma	.37	.44	.70	.40	1.45
Medication Policy	.47	.99	.22	.64	.95
School Resources	-.05	.11	.94	.33	2.93

Note. $df = 1$
*$p < .05$, **$p < .01$

CHAPTER 3

THE EFFECTS OF ASTHMA ON ACADEMIC ACHIEVEMENT IN A SAMPLE OF FORMER HEAD START CHILDREN[2]

[2] Schilling, E.J., Neuharth-Pritchett, S., & Lease, A.M. To be submitted to *NHSA Dialog*.

Abstract

The ways in which a diagnosis of asthma can affect the academic achievement of students were examined in a sample of 5,711 former Head Start children, 788 of which were identified as having asthma. Results indicated statistically significant group differences in standardized reading and mathematics scores, with students with asthma performing worse than students without this diagnosis in both academic areas. In reference to reading abilities among students with asthma, indicators of socioeconomic status, gender, and level of school absences were found to be predictive of reading scores. Regarding mathematics abilities, results indicated the significant contribution of both socioeconomic status and level of school absences in predicting the math scores of students with asthma. Variables regarding the family environment did not make a significant contribution to explaining the asthma-academic achievement relationship beyond the effects of these variables.

KEY WORDS: Asthma, Academic Achievement, Head Start

Introduction

Asthma is the most prevalent respiratory chronic illness for American school-aged children, with an estimated 7.1 million children (9.6%) diagnosed with the condition (Bloom, Cohen, & Freeman, 2010). Of this group, children under the age of five are diagnosed with the condition at higher rates than any other age group (Akibani & Schoendorf, 2002; Sly, 1999). Therefore, it is important not only to address the successful management of the disease in young children but also to understand the influence of the condition on children's school outcomes.

Research suggests children with asthma are at greater risk for negative life outcomes when compared to their healthy peers in areas such as physical and mental health difficulties. These difficulties include poorer general health outcomes (Collins, Gill, Chittleborough, Martin, Taylor, & Winefield, 2008), more frequent nighttime waking and subsequent sleep deprivation from asthma symptoms (Fiese, Everhart, and Wildenger, 2009), and a higher incidence of internalizing behavior problems, including anxiety and depression (Fiese et al., 2009; Röder, Kroonenberg, & Boekaerts, 2003). Whereas studies have documented higher school absenteeism for children with asthma (Dean, Calimlim, Kindermann, Khandker, & Tinkelman, 2009; Moonie, Sterling, Figgs, & Castro, 2006; Silverstein, Mair, Katusic, Wollan, O'Connell, & Yunginger, 2007), other aspects of school functioning, particularly academic achievement, are less clear. Therefore, the current study aims to examine the academic achievement of young children with asthma, with a particular emphasis on the role that family factors, including access to resources and regular family routines, might play in potentially moderating this relationship.

Asthma and Academic Achievement

Research regarding the effects of asthma on academic achievement is largely inconclusive. Some studies indicate children with asthma perform more poorly than their healthy peers on measures of academic functioning, particularly reading (DeFries, Olson, Pennington, & Smith, 1991; Kohen, 2010; Liberty, Pattemore, Reid, & Tarren-Sweeney, 2010), whereas others have found that these children perform just as well or even better on measures of reading and math achievement when compared to healthy peers (Milton, Whitehead, Holland, & Hamilton, 2004; Moonie et al., 2008) or to children with other chronic health conditions (Austin, Huberty, Huster, & Dunn, 1998; McNelis, Dunn, Johnson, Austin, & Perkins, 2007). Kohen (2010) suggests these discrepant findings might result from inconsistencies in both the operational definitions of asthma used (e.g., severity level, physician versus parent-reported diagnosis, etc.) and the measure(s) of academic achievement employed. For example, some studies have employed standardized achievement measures in assessing current levels of academic achievement (Liberty et al., 1999; Kohen, 2010), whereas other studies have incorporated parental reports of children's academic strengths and weaknesses (Diette, Markson, Skinner, Nguyen, Algatt-Bergstrom, & Wu, 2000).

Fowler and colleagues warn that relying on parent report alone might result in identification of greater academic difficulties in students with asthma when compared to reviews of school records for these same children (Fowler, Davenport, & Garg, 1992). That is, parents might already view a child with asthma as compromised in daily functioning. Parents could then be predisposed to over-report the existence of academic deficits in their children in measuring this performance against healthy peers. Teachers,

however, likely have a more objective accounting of a child's performance, resulting in a refined view of the condition's influence on achievement.

Factors Contributing to the Asthma-Academic Achievement Relationship

Disease-Related Variables.

One mechanism by which asthma could adversely affect the academic achievement of children exists in the disease process itself. It is well established that many children with chronic health difficulties face challenges in academic functioning at least partially as a result of cognitive deficits. In particular, many researchers have recognized an increased rate of academic problems in children with health difficulties directly impacting the central nervous system or some aspect of brain functioning (Armstrong & Horn, 1995; Mukherjee, Lightfoot & Sloper, 2000; Sexson & Madan-Swain, 1995; Shiu, 2001; Wodrich & Cunningham, 2008). For example, children and adolescents diagnosed with brain tumors are often adversely affected academically from concomitant deleterious effects in brain regions associated with memory and learning (Armstrong & Horn).

Although direct cognitive effects are perhaps not as apparent in students with asthma, a disease primarily affecting respiratory functioning, some researchers argue that such effects might still occur. Bender (1995) argues that neurological damage can occur in those with more severe, less-controlled forms of asthma as a result of chronic episodes of respiratory distress and subsequent cerebral hypoxia. Albeit possible, clear evidence for the existence of hypoxia-induced brain effects in children with asthma is lacking (Annett & Bender, 1994).

Other researchers have argued that a more plausible link between asthma and

impaired cognitive functioning could be due to the negative side effects of asthma medications, namely inhaled corticosteroids. Side effects of long-term corticosteroid use can include mood disturbance in the form of depression (Gift, Wood, & Cahill, 1989), mania/hypomania (Cerullo, 2006), as well as increased behavior problems (e.g., agitation, aggressiveness, and oppositional behavior). Each of these concerns can adversely affect academic performance at school (Taras & Potts-Datema, 2005). Studies examining more direct cognitive effects of inhaled corticosteroid use have found prolonged use of these medications to be associated with neurocognitive deficits related to verbal memory (Bender, Learner, & Kollasch, 1988; Brown, Rush, & Mcewen, 1999), declarative memory (Newcomer, Craft, Hershey, Askins, & Bardgett, 1994), and attention deficits (Naudé & Pretorius, 2003).

Although it appears possible that the disease process itself might exert a direct influence on the academic functioning of students with asthma via concomitant cognitive effects, previous research results do not consistently support the existence of an asthma-specific learning disability, as deficits appear to vary widely between individuals (Bender, 1995). Similarly, Biederman and colleagues (1994) found no clear evidence for a relationship between asthma and other disorders of neuropsychological functioning, namely attention-deficit hyperactivity disorder. Despite this lack of evidence, it should also be emphasized that asthma-related symptoms (difficulty breathing) as well as long-term corticosteroid use can both exist as general risk factors for the development of cognitive deficits; however, little is known regarding the mechanisms by which these effects occur (Kirkham & Datta, 2006). Some have suggested that the relationship between asthma and academic achievement is perhaps best explained by individual

differences among students with asthma, as has largely been borne out in the literature.

Demographic Factors.

The relationship between asthma and important outcome variables, including school performance, is often moderated by individual demographic factors including gender, ethnicity, and socioeconomic status (SES). In examining these relationships, it is first necessary to understand the population of children diagnosed with asthma in the United States. Results of the most recent National Health Interview Survey conducted by the Centers for Disease Control and Prevention indicate that children with certain characteristics are differentially diagnosed with asthma in this country (Bloom et al., 2010). Regarding gender, more boys (16%) than girls (12%) receive a lifetime diagnosis of asthma (Bloom et al.). In reference to ethnicity, non-Hispanic African American children (21%) are more likely to have asthma than Hispanic children (13%) and non-Hispanic White children (12%) (Bloom et al.). Finally, results of this survey denote that children from families with more limited economic resources (17%) experience higher rates of asthma than children coming from families who are not living in poverty (12%) (Bloom et al.). It is then important to identify which, if any, of these characteristics might play a contributory role in the association between asthma and academic achievement.

Gender.

Results from studies regarding the effects of gender on academic achievement are mixed. Whereas some researchers have found that boys experience higher levels of academic success than girls (Garden, 1989) or vice versa (Mullis, Martin, Gonzalez, & Kennedy, 2003), others have argued that the gender gap related to academic achievement

has radically closed over recent years (Ma, 2008). Regarding asthma, Koinis-Mitchell, Murdock, and Berz (2004) found that gender differences are apparent in the emotional response to the disease. That is, perceptions of low self-competence in girls with asthma were associated with depressed mood, while this relationship did not similarly hold for boys with the disease (Koinis-Mitchell et al., 2004). Moreover, social-emotional difficulties such as these are recognized to place school-age children at risk for the development of academic difficulties, including the development of learning disorders (Horn & Packard, 1985). Despite this fact, the direct role that gender might play in the association between asthma and academic achievement is less clear. Some researchers examining this relationship have controlled for the presence of basic demographic characteristics, including gender, to adequately address research questions of interest (Kohen, 2010). Others have found no relationship between gender and outcome variables related to achievement among students with asthma (Koinis-Mitchell, Adams, & Murdock, 2005).

Ethnicity.

It is understood that children from diverse ethnic backgrounds, particularly those living in urban areas, are at a greater risk for asthma as well as worse asthma-related outcomes (Bloom et al., 2010). Factors accounting for this disparity have included lower medication adherence rates (Rand, Butz, Huss, Eggleton, Thompson, & Malveax, 1994), different beliefs regarding medication use (Koinis-Mitchell et al., 2005), higher exposure to environmental irritants (Kattan et al., 2005), greater perceptions of community violence (Wright et al., 2004), and less access to/poorer quality of care for presenting symptoms (Ortega et al., 2002). Therefore, it is often difficult to separate the effects of

minority status from such related factors. Accordingly, it is perhaps most appropriate to think of factors such as minority status and SES as broader markers for the presence of higher-risk family environments.

In a recent study of asthma-related outcomes in a sample of urban children, researchers found that the presence of a greater number of risk factors (e.g., poverty status, neighborhood disadvantage) was associated with greater asthma-related morbidity and that this relationship held for all groups regardless of ethnic background (Koinis-Mitchell et al., 2010). In contrast, this same study also demonstrated that African American and Hispanic families experienced greater functional limitations as well as higher levels of poverty resulting from asthma when compared to their non-Hispanic White counterparts, potentially pointing to a more direct effect of ethnicity (Koinis-Mitchell et al., 2010). Most studies attempt to control for ethnicity variables when examining asthma effects on academic achievement, as few have looked beyond the role of such variables as potential markers for achievement (Liberty et al., 2010). Furthermore, some still argue that any effects of minority status observed are largely still a function of related variables, namely issues of socioeconomic status (SES) (Taras & Potts-Datema, 2005).

Socioeconomic Status (SES).

Research consistently demonstrates that students coming from economically disadvantaged families are at a greater risk for poorer school outcomes and that these effects are particularly apparent when the child begins school (Arnold & Doctoroff, 2003). Associated characteristics of low-SES families, which have been demonstrated to contribute to this phenomenon, include greater parent distress resulting from economic

strain, less access to educational materials (e.g., books) in the home, and less overall importance placed on education by parents (Aikens & Barbarin, 2008). As a result, children coming from lower-SES families sometimes do not achieve the same level of early academic success as those children from higher-SES families, who are more likely to have received a greater level of early academic preparedness at home (Dornbusch, Ritter, & Steinberg, 1991).

Whereas many researchers have controlled for SES in examining the relationship between asthma and academic achievement, some have found that SES still plays an important role in moderating observed deleterious effects. In a synthesis of studies examining social and economic consequences of asthma, Milton and colleagues (2004) concluded that children with asthma living in lower income households are at greater risk for poorer academic outcomes, namely grades. Another mechanism by which living in high-poverty, urban environments might adversely affect the school functioning and healthy development of children with asthma lies in the presence of poor air quality in such environments. Compromised outdoor air quality (e.g., due to traffic-related air pollution and exposure to industrial-related pollution) (Brauer, 2010) as well as poor indoor air quality as evidenced by higher concentrations of environmental toxins, including secondhand smoke in the home (Butz et al., 2011; Hullin, Caillaud, & Alessi-Maesano, 2010; Rodriguez et al., 2010), have all been shown to lead to an exacerbation of asthma symptoms among children living in such areas. Additionally, research has demonstrated that indoor air quality in urban schools is often characterized by a greater presence of environmental irritants including dust, lead, and asbestos (Yoon, Li, & Park, 2011). Early exposure (i.e., prenatally) to airborne toxins often present in low-SES,

urban environments can have lasting effects on cognitive functioning as measured by standardized intelligence tests (Perera et al., 2009). Despite the potential negative consequences that limited economic resources and associated environmental conditions might have on the academic outcomes of students, the family environment in the form of positive parenting practices and access to neighborhood resources, have been identified as important mediators in overcoming the negative effects of poverty (Kiernan & Mensah, 2011). However, family-related variables such as these have not received much attention in the asthma-academic achievement literature.

Absences and Asthma Severity.

The role that school absences play in contributing to poor school outcomes in children with chronic health problems has been studied widely. In general, the school environment offers an opportunity for students to experience both academic and personal success, to practice and master new skills, to foster a developing sense of self and growing self-efficacy, and to develop those social relationships necessary for future successful functioning at school and beyond (Shiu, 2001). Unfortunately, students experiencing chronic health difficulties are at a greater risk for school absenteeism resulting from prolonged hospitalizations, doctor visits, and an overall greater incidence of poor health days (Shiu, 2001). As a result, these students might regularly miss out on the important normative experiences that the school environment might offer in aiding healthy development. Research suggests that increased absenteeism among students is associated with negative school-related outcomes including the disruption of the learning process, strained peer relationships, and reduced involvement in physical activities, including extracurricular activities (Bender, 1995; Newacheck & Halfron, 1998). As

children with asthma experience the highest absenteeism rate of all students with chronic health difficulties (Doull, Williams, Freezer, & Holgate, 1996), it is important to understand how absences might adversely influence school functioning in this population.

Students with asthma, particularly those with less well-controlled forms of the disease, tend to miss more school days than healthy peers and more than peers with better-controlled asthma (Moonie et al., 2006). As reported in the literature, estimates of the difference in average days absent annually range anywhere from 1.3 (Moonie et al., 2006) to 22 (Lodha, Puranik, Kattal, & Kabra, 2003) more days missed by these students. Students with asthma miss more school days for a number of reasons that include doctors appointments, increased severity of asthma symptoms (e.g., labored breathing, fatigue), and proactive avoidance of potential contact with asthma triggers at school (Taras & Potts-Datema, 2005). In addition, parents of students with asthma often report keeping their children home from school because of a lack of trust in the school's ability to manage their child's condition, as a precautionary measure to avoid escalating symptoms, or because of feelings that their children are too vulnerable to participate in regular school activities (Celano & Geller, 1993). Moreover, some studies have demonstrated that relationships between asthma and lower levels of school achievement are partially moderated by the incidence of more missed school days (Koinis-Mitchell et al., 2005; Moonie et al., 2008). Research suggests school absences in students with asthma are associated with multiple indicators of poor academic achievement including poorer mathematics performance (Kohen, 2010) and word reading scores (Liberty et al., 2010) as measured by standardized achievement tests.

The Family Environment.

Taras and Potts-Datema (2005), in a review of studies examining the link between asthma and school-related outcomes, acknowledge that few researchers have addressed the role that other contributory factors could play in this relationship. These authors recognize that family-related factors in particular such as the home environment, level of access to community health care, and family resources have received minimal attention from asthma researchers (Taras & Potts-Datema, 2005).

Exposure to adverse sociodemographic events could place children with asthma at risk for a host of negative outcomes including low self-competence (Brooks-Gunn & Duncan, 1997), poor disease control and exacerbations of symptoms (Eggleston, Buckley, Breysse, Wills-Karp, Kleeberger, & Jaackkola, 1999), less access to quality health care (Eggleston et al., 1999), and fewer opportunities to participate in developmentally appropriate activities (Eggleston et al., 1999). Furthermore, more recent evidence indicates that family-related variables may serve an important role in moderating the effects of SES in the form of lower family income on the educational success of children living in these environments (Aikens & Barbarin, 2008). Additionally, Kazak, Simms, & Rourke (2002) have emphasized the usefulness of a systems-level framework in pediatric psychology. These authors state that in order to adequately address the needs of students with chronic health problems, schools should join all involved parties together through a culture of mutual respect, use a competence-based approach in identifying needed supports, and collaborate with the child's family and medical team together and not in isolation. Therefore, it is clear that a consideration of the family environment is certainly relevant to an examination of the school

functioning of students with asthma. However, these effects are not yet clear.

Family Resources and Family Routines.

Two aspects of the home environment that appear to be integral to children's development, including the promotion of positive educational outcomes, are access to community resources and the existence of regular family routines. First, families living in higher-quality environments often have greater opportunities to provide their children with potentially enriching community experiences that can aid in healthy development (e.g., parks, youth programs, libraries, well-performing schools) (Leventhal & Brooks-Gunn, 2005). Furthermore, studies have shown that less access to such resources is associated with a range of variables often identified as correlates of poor school functioning, namely high poverty rates (Leventhal & Brooks-Gunn, 2000), greater family stress and hardship (Conger, Ge, Elder, Lorenz, & Simons, 1994), negative parenting practices (Simons et al., 2002), and a diminished sense of community organization and cohesion (Sampson, Raudenbush, & Earls, 1997). Furthermore, greater access to community resources is often associated with potentially moderating environmental variables including better air quality and access to health care (Eggleston et al., 1999).

The presence of family routines in daily activities such as mealtimes, nighttime curfews, and homework is also accepted as an integral element to promoting a sense of cohesion in the family, while also serving a protective role in the health and well-being of children (Boyce, Jensen, James, & Peacock, 1983). Although consistent family routines can have great effects on encouraging healthy child development, particularly social development, studies have demonstrated that such routines are not as prevalent in families living in poorer neighborhoods. Characteristics of low SES neighborhoods that

might contribute to a lack of consistent family routines include less social organization and economic constraints (e.g., parents working long hours to support the family; Leventhal & Brooks-Gunn, 2005). It is therefore apparent how aspects of more advantageous home environments in the form of higher access to community resources and the existence of family routines might play a role in contributing to the positive educational outcomes of students. However, the role of such variables in moderating this relationship among students with asthma is not clear.

The Current Study

The purpose of the current study was to better understand the mechanisms by which asthma can affect the academic achievement of children with this disease. Although past studies have begun to explore the role of potentially intervening variables in this relationship, much of this focus has been on identifying common covariates of low achievement in isolation, including school absences (Moonie et al., 2006; Moonie et al., 2008), disease severity and associated limitations (Kohen, 2010; Moonie et al., 2006), and other demographic variables, namely SES (Liberty et al., 2010). In contrast, studies have not examined the contributory role that other variables might play above and beyond these effects. Therefore, in addition to examining potential covariates including gender, ethnicity, SES (in the form of household income), and number of school absences, the focus of the current investigation was also on exploring whether aspects of the family environment, including access to resources and family routines might further represent an important aspect of this relationship. Additionally, few studies have examined the asthma-academic achievement relationship at the national level as most previous research has focused on aspects of this relationship in more localized samples.

As such, the current study extends an understanding of potential asthma effects in examining this issue in a nationwide sample of students formerly enrolled in the federal Head Start program. The following research questions were posed:

1. Do students with asthma exhibit different academic profiles than those without asthma as measured by standardized tests of academic achievement?
2. Among students with asthma, are levels of academic achievement contingent upon student and family characteristics including gender, ethnicity, SES in the form of household income, number of school absences, and disease severity?
3. Do family-related variables also help to account for the level of academic achievement experienced by students with asthma? That is, do those families of children with asthma who report greater access to resources and more regular family routines tend to have higher achieving children?

First, it was hypothesized that students with and without asthma would perform similarly on measures of reading and math achievement as most past research fails to support the existence of asthma-specific learning difficulties (Bender, 1995).

Regarding potential moderators of the asthma-academic achievement relationship in this study, it was first hypothesized that basic demographic variables, particularly gender and ethnicity, would not contribute significantly to the variance in academic achievement scores among students with asthma. In addition, as results of previous studies have demonstrated that differential academic functioning is often attributed to differences in SES among individuals (Taras & Potts-Datema, 2005), it was similarly expected that academic achievement outcomes among students with asthma will be

moderated by differences in household income. It was also hypothesized that differences in academic achievement among students with asthma would be partially moderated by indicators of asthma severity and level of school absences. That is, some more recent studies have demonstrated that individuals experiencing more severe forms of the disease and resulting higher levels of school absences have lower levels of school achievement (Moonie et al., 2008). Finally, regarding family-related variables, it was hypothesized that those families of children with asthma reporting greater access to resources and the presence of regular family routines will have children with higher levels of academic achievement. These results were expected given the potential positive effects that such variables can have on fostering successful academic outcomes for all students. In identifying those factors that do and do not significantly contribute to the academic achievement of students with asthma, the conversation can then shift to identifying effective means of intervening with this group with the ultimate goal of improving academic outcomes.

Method

Procedures

Study participants were drawn from the National Head Start/Public School Early Childhood Transition Demonstration Study (Ramey et al., 2000) conducted from 1991 to 1999. The study was completed to provide information regarding the nationwide implementation of the Head Start program and to provide data regarding the impact of the program on children, families, communities, and schools as children transitioned into the first four years of public school. More than 7,500 former Head Start children and families were enrolled in the national study. Outcome data were collected from families,

teachers, school administrators, and children annually from kindergarten to third grade. Data collection occurred in the Fall and Spring of children's kindergarten year and then in the Spring of first, second, and third grade. Data collected included information regarding basic demographic information, family and community characteristics, child health, school climate, and individual child attributes, including measures of academic functioning. Although the original data were collected in the 1990s, asthma diagnosis is a relatively robust measure and along with a common standardized achievement measure, we believe that the findings from this study are relevant today.

Participants

For the purposes of the current study, data from a group of former Head Start children enrolled in the National Head Start/Public School Early Childhood Transition/Demonstration Study (Ramey et al., 2000) whose parents/caregivers completed the question of whether or not they had received a doctor's diagnosis of asthma were examined ($N = 5711$). Of this group, 788 were identified by their parents as having an asthma diagnosis (14% of the sample). Specifically, caregivers were asked if a doctor has told them that their child had asthma. If the parent responded yes, three follow-up questions were posed that include the age at which the diagnosis was made, if the child still has the condition, and if the child ever received treatment for the condition. Although the asthma diagnosis was not pulled from medical records, there is reasonable certainty of the presence of the condition from these parental report data given consistency of responding on this question across years of the study. Data on covariates (e.g., gender, ethnicity, SES) were inspected within the sample of students with asthma to determine the role that each might play in the asthma-academic achievement relationship.

To adequately address research questions, outcome data from the end of the third grade school year were examined. This third-grade subset of data was chosen as it is thought that a greater variety in outcome variables, namely academic achievement variables, is more likely to be observed as students reach later grades in school.

Of those children enrolled in the study, 45% were White, 32% were African American, 13% were Hispanic/Latino, 2% were Asian, and a further 7% were identified as American Indian, Eskimo/Alaskan Native, or Other ethnicities. 52% were male and 48% were female. Respondents to surveys were mostly mothers (87%). Other respondents included fathers (6%), grandmothers (4%), and other relatives (3%), which included stepparents, siblings, grandfathers, and foster parents. Regarding socioeconomic status, 4,499 respondents (79%) reported a monthly family income below the federal poverty line, whereas 989 respondents (18%) reported an income above this level.

Measures

Demographic/Family Background Measures.

Family Background Interview.

Parents/caregivers were interviewed regarding basic family characteristics and child demographics on the Family Background Interview, a structured interview developed by the authors of the National Head Start/Public School Early Childhood Transition Study. Information collected in this interview and used in this study included the child's gender, race/ethnicity, number of school absences, and monthly family income.

Your Child's Health and Safety.

Parents/caregivers also reported information regarding children's current health

status as well as any past history of health difficulties in response to interview items created by researchers of the original study. Two items from this interview were inspected for the purposes of informing the current investigation. First, the item, "Would you say your child's health, in general, is excellent, very good, good, fair, or poor?", referred to as "Child Health" was examined as an indicator of children's current health as well as a potential marker for asthma severity. The second item, referred to as "Asthma Status" asked parents/caregivers if they were ever told by a doctor that their child had asthma and was used to differentiate between the two groups of interest (i.e., students with and without asthma) in the current study.

Measures of Family Characteristics.

Family Resource Scale.

The Family Resource Scale (Leet & Dunst, 1985) provides a measure of families' level of access to resources within their community and is based on those resources that have been identified as integral to the support and wellbeing of families (Dunst & Leet, 1987). That is, the scale consists of 30 items addressing level of access to health/necessities, growth/support, physical shelter, nutrition/protection, communication/employment, intrafamily support, income, and childcare (Leet & Dunst, 1985).

Psychometric properties of the Family Resource Scale have been deemed adequate (Dunst & Leet, 1987). Regarding internal consistency, coefficient alpha as measured by the average correlation among all 30 items included in the scale is .97 (Dunst & Leet, 1987). Validity evidence for the Family Resource Sale exists in the identified factor structure of the measure and the alignment of this structure with well-

established conceptions of family supports and needs (Bronfenbrenner, 1979; Maslow, 1954). Criterion-related validity also exists for the measure in the prediction of scores on other measures of both health and well-being (i.e., Health and Well-Being Index) and parental commitment to providing for their children (i.e., Personal Allocation Scale) from Family Resource Scale total scores (Dunst & Leet, 1987). Four of the subscales have also been found to correlate highly with other measures of well-being and parental commitment to child-based interventions (Dunst & Leet, 1987).

Family Routines Inventory.

The Family Routines Inventory (Boyce, Jensen, James, & Peacock, 1983) was also completed by parents/caregivers and served as a further measure of current family functioning. This 28-item measure serves as an indication of predictability/routinization in the family's daily life (Boyce et al., 1983). The measure operates under the assumption that family routines are observable events involving multiple family members and that these events occur at predictable intervals (Boyce et al., 1983). Domains of family routines are assessed (n = 10): workday, weekend and leisure time, children's routines, parents' routines, bedtime, meals, extended family, leaving and homecoming, disciplinary routines, and household chores (Boyce et al., 1983). For each family activity (e.g., whole family eats dinner together), participants were asked to rate how often that activity occurs per week on a 4 point scale ranging from occurs "almost never" to occurs "every day." The scale yields an overall frequency score serving as an indication of the level to which the family engages in regular routines.

Psychometric properties of the Family Routines Inventory were acceptable. That is, the 30-day test-retest reliability coefficient for the overall frequency score was .79.

(Jensen, James, Boyce, & Hartnett, 1983). Moreover, the overall frequency score was positively correlated with family cohesion, family organization, and family control and negatively correlated with family conflict as measured by the Family Environment Scale, another scale measuring family functioning with known acceptable psychometric properties (Jensen et al., 1983).

Standardized Measures of Academic Achievement.

Woodcock-Johnson Psychoeducational Battery - Revised.

The Woodcock-Johnson Psychoeducational Battery – Revised (WJ-R) (Woodcock & Johnson, 1990) consists of a set of tests assessing a variety of academic and cognitive skills. Those tests measuring reading and math skills were administered to all children enrolled in the original study at the end of the third grade school year as these skills are regarded to be integral to children's academic success.

The reading cluster of the WJ-R administered to participants included 2 subtests: Letter-Word Identification, requiring the child to identify and read a series of letters and words presented to them and Passage Comprehension, a task examining the child's ability to understand and identify missing words and pictures from a series of passages when given context clues. Internal consistency reliabilities for these two subtests were .96 for letter-word identification and .95 for passage comprehension (Woodcock & Mather, 1990). The Mathematics cluster administered to participants was comprised of a Calculation subtest, which required the child to solve a series of increasingly complex mathematical computations and an Applied Problems subtest, in which the child had to determine the correct procedure for solving problems, identify necessary information, and provide a solution. Reported internal consistency reliabilities for these two subtests were

.93 for Calculation and .84 for Applied Problems. Sampling and re-norming procedures for the WJ-R have been judged to meet high standards as its technical adequacy is well supported (Cummings, 1995).

Results

Regarding sample characteristics of students with (n = 788) and without asthma (n = 4923), demographic variables were examined across groups. Of students with an asthma diagnosis, 59% were male and 41% were female. Of students without asthma, 51% were male whereas 49% were female. In reference to ethnicity, sample characteristics were fairly similar between groups (44% Caucasian, 37% African American, 12% Hispanic, and 7% other ethnicities among students with asthma; 45% Caucasian, 32% African American, 14% Hispanic, and 9% other ethnicities among students without an asthma diagnosis). Regarding SES, characteristics were again comparable between groups with 82% and 84% of families of students with and without asthma, respectively reporting an income below the federal poverty line. Of note, missing data was present across surveys and respondents. In such cases, listwise deletion was employed before running statistical analyses.

To address the question of whether students with asthma exhibit different academic profiles than students without asthma, t-tests were conducted examining mean differences between groups across reading and math composites on the WJ-R. Results of this analysis are presented in Table 2.1. Regarding reading abilities, a significant difference was observed between reading scores on the WJ-R for students without asthma (M = 97.98, SD = 16.47) and students with an asthma diagnosis (M = 94.86, SD = 18.35); $t(3724) = 3.88$, $p = .00$). In reference to mathematics abilities, there was also a

significant difference between the mathematics scores on the WJ-R between students without asthma (M = 100.68, SD = 18.15) and students with asthma (M = 98.91, SD = 20.09); $t(3721) = 2.00$, $p = .045$). The effect sizes for both these analyses (d = .18 and .09, respectively) were found to fall below Cohen's (1988) convention for a small effect (d = .20).

The remaining research questions were addressed by examining the sample of students with an asthma diagnosis only (n = 788) using hierarchical multiple regression. To examine the potential role of demographic factors, school absences and asthma severity, as well as the unique contribution of family-related variables to the academic achievement of students with asthma, variables that might explain this relationship were entered in three steps. In step one, academic achievement (WJ-R) scores were the dependent variables and demographic variables (e.g., gender, race/ethnicity and SES) were the independent variables. In step two, Child Health and school absences were entered into the step one equation. Finally, family-related variables in the form of family routines and access to resources including health services/necessities were entered to determine their contribution to a model of asthma and academic achievement. This process of analysis was completed in examining the contributory relationship of these variables on both reading and mathematics abilities. Before the hierarchical multiple regression analysis was performed, variables were tested for collinearity. Results of the variance inflation factor (all less than 2.0), and collinearity tolerance (all greater than .89) suggest that the estimated β's are well established in the following regression models.

In examining relationships between study variables, post hoc analyses revealed several findings relevant to an interpretation of study results. First, differences were

evident in the number of school absences experienced by students with asthma from different ethnic groups [$F_{(3, 522)} = 5.88$, $p < .01$) with African American and Native American students missing an average of 3.4 and 7.4 more days of school, respectively than Caucasian students with asthma. SES in the form of monthly income was also found to be related to the Child Health variable [$t(755) = 2.19$, $p = .03$)] with families with monthly incomes above the federal poverty line on average also reporting better overall health in their children. The remaining observed significant relationships between study variables were related to the level of access to health/necessities and family routines variables, which were significantly related to one another [$r(711) = .31$, $p < .01$]. First, both variables were related to SES in the form of monthly income with those families reporting monthly incomes above the poverty line reporting greater access to community resources [$t(731) = 7.17$, $p < .01$] and a higher level of family routines [$t(708) = 3.55$, $p < .01$)]. Finally, both variables were also related to the Child Health variable with families who rated their children as healthier indicating greater access to community health/necessities ($F_{(4, 755)} = 9.54$, $p < .01$) and a higher level of family routines ($F_{(4, 730)} = 3.11$, $p < .01$).

Reading Achievement

In reference to reading scores, the results of step one indicated that the variance accounted for (R^2) with the first three independent variables (gender, race/ethnicity, and SES) equaled .05 (adjusted $R^2 = .05$), which was significantly different from zero ($F_{(3, 379)} = 3.08$, $p < .01$). Gender ($\beta = .16$, $p < .01$) and SES ($\beta = .15$, $p < .01$) represented significant predictors of reading achievement for students with asthma in this step, with boys and students from those families with monthly incomes above the federal poverty

level exhibiting higher reading scores. In step two, after adding Child Health and school absences into the regression equation, the change in variance accounted for (ΔR^2) was equal to .24, which was significantly different from zero ($F_{(5, 377)} = 6.30$, $p < .01$). In this step, number of school absences was the only significant predictor adding to the model ($\beta = -.16$, $p < .01$), indicating those students with asthma experiencing less days missed from school demonstrated higher reading scores. In step three, family-related variables including level of family routines and access to resources in the form of health services/necessities were entered into the equation. The change in variance accounted for (ΔR^2) by this final step was .003, which was also significantly different from zero ($F_{(7, 375)} = 4.63$, $p < .01$). It should be noted that neither variable in isolation entered in step three served as a significant predictor in the full model of reading achievement for students with asthma. Together, all predictors in the final model accounted for 8% of the variance in reading achievement scores for students with asthma. The standardized (B) and unstandardized (β) regression coefficients for variables in the full model are reported in Table 2.2.

Mathematics Achievement

Regarding mathematics scores, the results of step one demonstrated that the variance accounted for (R^2) with the first three independent variables (gender, race/ethnicity, and SES) was equal to .03 (adjusted $R^2 = .02$), which was significantly different from zero ($F_{(3, 379)} = 3.30$, $p = .02$). Only SES ($\beta = .16$, $p < .01$) served as a significant predictor of math achievement for students with asthma in this step. As with reading results, the trend observed here was for students with families reporting monthly incomes above the federal poverty level to have higher math achievement. After adding

Child Health and school absence variables in step two, the change in variance accounted for (ΔR^2) was equal to .22, which was significantly different from zero ($F_{(5, 377)} = 3.74$, $p < .01$). In this step, number of days absent was again the only significant predictor adding to the model of math achievement ($\beta = -.15$, $p < .01$), indicating students with asthma who are, on average, absent for fewer days during the year are more likely to have higher math achievement. In step three, when family-related variables were entered into the regression equation, the change in variance accounted for (ΔR^2) by this final step was .001. This final model was again significantly different from zero in predicting math scores for students with asthma ($F_{(7, 375)} = 2.70$, $p < .01$). Similar to results observed regarding the last step of asthma-reading achievement prediction, neither of the family-related variables taken in isolation served as a significant independent variable in explaining math achievement. All predictors in this final model accounted for 4.8% of the variance in mathematics achievement scores for students with asthma. The standardized (B) and unstandardized (β) regression coefficients for variables in the full model are reported in Table 2.3.

Discussion

The purpose of the current study was to determine what variables are most relevant in contributing to the academic achievement of students with asthma. More specifically, in addition to determining whether students with asthma exhibit different academic profiles than students without asthma, the main focus was on identifying factors contributing to differential academic success among children with asthma. First, it was hypothesized that differences observed in academic achievement scores between students with and without asthma would not be statistically significant. Regarding basic

demographic variables, it was expected that gender and race/ethnicity would not serve as significant explanatory variables in the asthma-academic achievement relationship, whereas a further demographic variable, SES would. Third, it was hypothesized that indicators of both asthma severity and level of school absences would also serve as moderators in this relationship. Finally, it was believed that those families of students with asthma reporting higher levels of regular family routines as well as greater access to community resources in the form of health care and necessities would also have higher achieving children. Hypotheses were partially supported.

First, regarding academic achievement scores of students with and without an asthma diagnosis, results demonstrated that statistically significant differences exist in both math and reading outcomes for these two groups. That is, on average, students with asthma were found to have lower math and reading abilities at the end of third grade as measured by the WJ-R. Although contrary to hypotheses, these results are partially consistent with some past findings that, when compared to healthy peers, students with asthma perform worse on measures of standardized reading abilities (Liberty et al., 2010). However, it must also be noted that although observed differences in this study were statistically significant, effects were found to be small.

In examining the school functioning of students with asthma, it was then important to determine those factors that play a role in determining why some students with asthma perform worse than healthy peers on measures of reading and math abilities, whereas others do not. First, in reference to the role of demographic variables, it was found that whereas race/ethnicity did not explain a significant proportion of variance in academic outcomes, SES and gender did serve as significant predictors in this

relationship. These findings are consistent with expectations as well as previous research results pointing to the significant role that various indicators of SES (i.e., access to educational opportunities, enriching community experiences) can play in promoting the academic success of all students (Aikens & Barbarin, 2008). The finding that significant gender effects are apparent in predicting reading scores of students with asthma, with boys performing better in this area, might be indicative of previous research showing that girls with asthma tend to struggle more in their emotional response to the disease, which can then affect their performance at school (Koinis-Mitchell et al., 2004). However, the fact that similar gender effects were not evidenced in predicting math scores among students with asthma also appears to support increased parity between the genders in school achievement as has been the trend in more recent years.

Regarding the role of the associated variables of disease severity and school absences in predicting academic achievement in students with asthma, hypotheses were again partially supported. That is, students with asthma experiencing a greater number of absences during the school year tended to perform more poorly on measures of both reading and math achievement. This result is perhaps not surprising given that students who experience more time away from school often miss out on quality instructional time and presentation of foundational concepts promoting greater school success (Kohen, 2010; Liberty et al., 2010). The finding that students with asthma from minority ethnic backgrounds (i.e., African American, Native American) tend to miss more days on average than their Caucasian counterparts might portray that these students could be particularly vulnerable to the detrimental effects of time away from school.

Finally, hypotheses were partially supported when examining the role of family-

related variables in predicting the academic achievement of students with asthma. That is, although the full model including these variables was statistically significant in predicting both math and reading scores, neither level of family routines nor access to community resources in isolation helped to explain the variance in these scores above and beyond the influence of SES, gender and school absences. It could be that there was not enough variability in participants' scores on these measures to detect these effects given the population studied (i.e., students formerly enrolled in the Head Start program) It might also be that many family-related variables such as these are already captured to a certain degree in a broad definition of SES. That is, families of children with asthma from lower SES backgrounds might experience fewer routines in daily living at home as well as lower access to health care and necessities, which in turn can affect the academic performance of their children. Indeed, when examining the relationships among these variables, all were found to highly correlated with one another.

Conclusion

This study helped to identify those factors that play a contributory role in the academic achievement of students with asthma. Further, in examining this relationship in a nationwide sample of former Head Start students, a group already at a greater risk for a range of adverse school outcomes, it is hoped that results might help point to those variables most relevant in leading to more positive outcomes in Head Start students with asthma. Findings first suggest that although differences can be observed in the reading and math abilities of students with asthma and their healthy peers, these abilities are not largely discrepant. Moreover, when examining achievement among students with asthma, results of the current study point to the importance of examining other factors

beyond solely an asthma diagnosis in determining disease effects. Despite the importance of these findings, several limitations to the current study exist.

First, study participants consisted of children formerly enrolled in the federal Head Start program. It is less clear whether these same results would be found in other student populations. Another limitation exists in that further information regarding students' asthma conditions beyond the presence of an asthma diagnosis was not examined. Although a rating of overall child health was taken as an indicator of asthma severity among participants, other aspects of asthma including level of control over current asthma symptoms and medication use, factors that could also play a role in the asthma-academic achievement relationship was not collected. Future studies further examining this relationship might benefit from taking such variables into account.

Although limitations exist, this study adds to the growing body of knowledge regarding how chronic health conditions including asthma can affect the ultimate school success of children. In addition, this is one of the first studies to examine such effects in former Head Start children, a population already vulnerable to negative school outcomes. The results of the current study suggest that variables including SES, school absences, and gender all contribute to an explanation of academic achievement in this group. The fact that family-related variables were not significant in contributing to the prediction of achievement scores among students with asthma might portray that such variables are already captured in a consideration of SES and thus do not contribute to an explanation of further unique variance to the model. However, this determination is beyond the scope of the current study. Of note, these are all variables that have been shown to contribute to overall school success in the general school population as a whole, suggesting that

students with asthma are perhaps not so different. In recognizing the role of such variables, future research should turn to examining potentially efficacious interventions for ensuring the educational success of all students with asthma.

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Table 2.1

Results of T tests examining differences in reading and math scores between students with and without asthma

WJ-R Composite	*t*	*df*	*Sig. (2 tailed)*	*Mean Difference*
Reading	3.878	3724	.000**	3.12
Mathematics	2.001	3721	.045*	1.77

Note. *$p < .05$, **$p < .01$

Table 2.2

Summary of hierarchical regression predicting reading achievement in students with asthma

Variable	*B*	SE *B*	*β*	ΔR^2
Step 1				.05*
Race/Ethnicity	-1.00	.78	.78	
SES	5.84	2.50	.12*	
Gender	6.04	1.89	.16*	
Step 2				.24*
Child Health	-.23	.99	-.01	
School Absences	-.33	.11	-.16*	
Step 3				.003*
Resources	.10	.11	.05	
Family Routines	-.05	.10	-.03	

Note. *$p < .01$

Table 2.3

Summary of hierarchical regression predicting math achievement in students with asthma

Variable	*B*	SE *B*	*β*	ΔR^2
Step 1				.02*
Race/Ethnicity	.25	.88	.02	
SES	7.01	2.81	.13*	
Gender	1.76	2.12	.04	
Step 2				.22*
Child Health	.25	1.11	.01	
School Absences	-.35	.12	-.15*	
Step 3				.001*
Resources	-.00	.12	-.00	
Family Routines	.06	.11	.03	

Note. *$p < .01$

CHAPTER 4

DISSERTATION CONCLUSION

Summary of Findings

The goal of the two studies presented in this dissertation was to better understand factors affecting the school functioning of students with asthma. That is, although results of previous studies have shown that children with asthma are often at a greater risk for adverse outcomes including physical health (Collins, Gill, Chittleborough, Martin, Taylor, & Winefield, 2008) and mental health problems (Fiese, Everhart, & Wildenger, 2009) as well as academic difficulties (Kohen, 2010), few studies have examined these relationships in depth. As a result, the current dissertation took a two-pronged approach in examining functioning both from the standpoint of the school as well as students with asthma themselves.

In study 1, the task was first to identify those federal policy recommendations currently available for schools regarding effective asthma management practices. The question was then asked, how compliant are schools in following these guidelines to ensure the needs of students with asthma are adequately met? To explore this question, elementary and middle school teachers' responses to survey questions regarding current asthma management practices in schools across the state of Georgia were examined. Adherence to current recommendations was also examined in reference to the subsequent provision of formalized services (i.e., through an IEP or 504 plan). That is, do higher levels of teacher-reported adherence to asthma-related policies help to predict the

delivery of services? First, results indicated that only a small percentage of teachers reported students with asthma in their schools were currently being served by an IEP or 504 plan. Second, whereas adherence to some recommendations, namely the presence of formal medication policy statements, was high as reported by teachers, teachers indicated that adherence to the remaining guidelines including limiting exposure to potential asthma triggers, providing professional development to teachers and staff regarding asthma, coordinating efforts with all involved in the care of students with asthma, and allowing students to self-carry medication, was low. Finally, logistic regression analyses revealed the provision of asthma-related professional development, teachers' information-seeking behavior, and a teacher's own diagnosis of a chronic illness were all predictive of the provision of formalized services to students with asthma. In sum, results of this study imply that schools can be doing a more effective job at meeting the needs of students with asthma. Moreover, regression results indicate that increasing the knowledge base of teachers regarding asthma might be an effective means of increasing access to services for these students.

In study 2, the focus was on how a diagnosis of asthma might affect a student's level of academic achievement. Moreover, this study examined a national sample of elementary school students formally enrolled in the federal Head Start program, a population relatively neglected in the previous literature regarding the asthma-academic achievement relationship. The question was first asked whether students with asthma exhibit different academic profiles than students without this diagnosis as measured by standardized measures of achievement. Subsequently, the goal of this study was to identify those factors playing a role in the asthma-academic achievement relationship.

The question was asked, do variables including gender, ethnicity, SES, number of school absences, disease severity and other family-related variables help to account for differential levels of achievement among students with asthma? Results of this study first revealed that students with asthma demonstrate significantly lower standardized achievement scores in both math and reading when compared to those scores of healthy peers. Second, hierarchical regression analyses revealed that indicators of SES as well as level of school absences were predictive of both reading and math scores among students with asthma, with kids from families reporting higher monthly incomes and experiencing fewer days absent having higher achievement scores. Gender also served as a significant predictor of reading scores in this group, with boys with asthma exhibiting higher scores than girls on average. In sum, results of this study indicate that whereas students with asthma do perform worse on measures of academic achievement in relation to healthy peers, several common covariates of lower achievement in the general school population (i.e., SES, school absences, and gender) are also applicable to a consideration of academic functioning within this group.

Future Directions

Taking the results of both studies together, several common conclusions can be drawn. Perhaps most importantly, whereas both have identified some apparent weaknesses in the current school functioning of students with asthma, the strengths of both studies lie in the identification of potential areas for intervention in the future for addressing these weaknesses. For example, in the first study, whereas teachers reported that schools are largely not compliant with current federal asthma management policy recommendations, the important role that the provision of professional development

regarding asthma to teachers can play in improving access to formalized school services was also indicated. Likewise, whereas results of the second study point to worse academic functioning in students with asthma, several moderating variables, particularly SES and school absences, have also been identified as potential protective factors in this relationship.

In addition to a continuing focus on the role of such variables in enhancing the school experience and performance of students with asthma, future studies should continue to explore potentially effective interventions for meeting the particular needs of students with asthma. For example, whereas many previous studies have examined the role of professional development interventions provided to teachers for enhancing student outcomes (e.g., Powell, Diamond, Burchinal, & Koehler, 2010), the effects of similar interventions have not yet been examined in reference to students with asthma. Further, given the results of these studies supporting that students with asthma appear to be affected by many of the same variables factoring into the school functioning of all students in general, future studies should continue to explore the issue of providing students with asthma with as normalized a school experience as is possible.

Finally, future research regarding the school functioning of students with asthma, including a consideration of school-wide asthma management practices as well as individual factors affecting the school performance of these students should focus on exploring these issues in a broad range of diverse populations. That is, the current studies examined these questions in samples of teachers in the State of Georgia (study 1) and in former Head Start students (study 2). As such, new studies will benefit from a consideration of broadening implications.

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