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School Functioning of Children with Asthma:
A Study of the Elementary and Middle School Years

by

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A thesis submitted in partial fulfillment
of the requirements for the degree of
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ABSTRACT

This study examined the school functioning of children with asthma compared to the school functioning of children without asthma over a 9-year time span. The present study was a secondary analysis of data from one large school district in a southeastern state. Information was gathered from multiple sources, including student records and parent and teacher surveys. Variables related to academics, behavior, and teacher perception were examined. A total of 646 participants were initially included in the study. These participants included 296 students identified as having asthma and 350 students identified as not having asthma. Participants were matched on gender, race, and socioeconomic status.

Results of this study indicated significant differences for various years and subjects on a standardized achievement test. However, computed effect sizes were quite low, suggesting no practical difference between the groups. Additionally, rates of special education placement differed for the groups for one school year. All other years and variables indicated no significant differences between the groups. These findings suggest that educational experience of children with asthma may not differ significantly from that of their peers without asthma. However, future research should attempt to

measure variables in different ways and possibly examine cases in a more qualitative manner.

Chapter 1

Introduction

The physical and emotional stressors that are caused by chronic illness can affect all aspects of a person's life. One of the most important experiences of childhood is education. While this is typically a positive experience for most children, students battling chronic illnesses often have many factors to deal with that could possibly have a negative effect on their education. It is important to consider the educational experiences of children with chronic illnesses and how these findings can lead to successful interventions.

Asthma is the most common chronic illness affecting children in the United States (Butz, Malveaux, Eggleston, Thompson, Huss, Kolodner, & Rand, 1995). Currently, the occurrence of this illness is rising, especially among inner-city, African-American children (National Institutes of Health, 2000). Asthma is a markedly variable condition, with symptoms ranging from mild to very severe. Numerous studies examining school-age (ages 5-18) children have found that asthma significantly affects psychological functioning. Many studies examining the psychological functioning of children with asthma have used assessment tools found to be both valid and reliable, such as the Child Behavior Checklist and the Piers-Harris Children's Self-Concept Scale. Additionally, many of these studies were well-designed and included matched control groups who did not have any chronic illnesses. Overall, the results of these studies suggest that children with asthma often exhibit high levels of depression, anxiety, phobias, and social

withdrawal, along with lower levels of self-esteem (Bennett, 1994; Kashani, Konig, Shepperd, Wilfley, & Morris, 1988; MacLean, Perrin, Gortmaker, & Pierre, 1992; Mrazek, Schuman, & Klinnert, 1998; Nelms, 1989; Padur, Rapoff, Houston, Barnard, Danovsky, Olson, Moore, Vats, & Lieberman, 1995). Consequently, it can be assumed that children with asthma may experience an increased number of difficulties at school. Further information about this population of students is needed to ensure that the needs of these children are being fully met.

Rationale

While numerous studies have focused on the psychological and social functioning of children with asthma, very few studies have examined the impact of asthma on the educational experience of children. The lack of research on this topic may be due to the recent advances in medical technology and health care that have made more children with asthma able to participate in the many activities related to childhood, such as school. The few studies that have explored this topic have examined absentee rates (Bender, 1999; Celano & Geller, 1993; Folwer, Davenport, & Barg, 1992; Gutstadt, Gillette, Mrazek, Fukuhara, LaBrecque, & Strunk, 1989), peer acceptance (Graetz & Shute, 1995; Nassau & Drotar, 1995), learning problems in school (Fowler, Davenport, & Garg, 1992; Tonnessen, 1994), and parental perceptions of children's educational experiences (Fowler, Davenport, & Garg, 1992; Nassau & Drotar, 1995; Tonnesson, 1994). However, more research is needed on the overall impact of asthma on the educational experience. Although some studies have examined the educational experience of children with asthma at a specific point in their educational career, no known studies have followed children with asthma throughout their entire educational experience.

Collecting longitudinal data on this population of students will help parents, teachers, and other education professionals to understand the overall school functioning of children with asthma across the school age years. The current study utilized longitudinal data to analyze variables related to academics, behavior, and teacher perception. Achievement, special education placement, number of grade retentions, placement in drop-out prevention programs, disciplinary referrals, and suspensions was analyzed. Teacher perception of students' (a) ability to pay attention, (b) behavior in school, and (c) overall success in school was analyzed within the teacher perception domain.

Purpose

This study examined the school functioning of children with asthma compared to the school functioning of their same-age peers without asthma over a 9-year time span. The study determined if there was a significant difference between these two groups in the areas of academics, behavior, and/or teacher perception domains. The present study was a secondary analysis of data from one large school district in a southeastern state. These longitudinal data included information related to the educational experience of students over a 9-year time span, following participants from kindergarten through eighth grade.

Through the comparison between the groups, attention was directed to the following research questions:

1. Do children with asthma have significantly lower standardized achievement scores in the areas of reading, math, and language arts compared to children without asthma at the elementary and middle school levels? Additionally, are total battery scores on a standardized achievement test significantly lower for

children with asthma compared to children without asthma at the elementary and middle school levels?

2. Are children with asthma placed in special education significantly more than children without asthma at the elementary and middle school levels?
3. Are children with asthma retained significantly more than children without asthma at the elementary and middle school levels?
4. Are children with asthma placed in drop-out prevention programs significantly more than children without asthma at the elementary and middle school levels?
5. Do children with asthma receive disciplinary referrals significantly more than children without asthma at the elementary and middle school levels?
6. Are children with asthma suspended significantly more than children without asthma at the elementary and middle school levels?
7. Do teachers' perceptions of students' ability to pay attention at school, students' overall behavior in school, and students' potential for an overall successful school experience differ significantly for children with asthma compared to children without asthma at the elementary and middle school levels?

Chapter II

Review of Literature

Recent advances in the fields of medical technology and health care have significantly improved the lives of children with chronic illnesses. Not only have these advances prolonged the lives of many children, but those living with chronic illness have experienced an improved quality of life. Consequently, more children who are chronically ill are able to attend school, play sports, and enjoy the many aspects of childhood (Power, McGoey, Heathfield, & Blum, 1999). However, since these advances are fairly recent, research that informs the question of how children with chronic illnesses fare in settings such as public schools is still relatively new. Although the physical effects of chronic illness can be devastating, the educational effects can be equally overwhelming. As a result, it is essential for parents, teachers, and other professionals within the field of education to understand the impact of chronic illness on school-age children and the overall outcome this can have on children's functioning within the educational setting.

Asthma is the most common illness affecting children in the United States (Butz et al., 1995). Numerous studies have focused on the impact of asthma on the psychological and social functioning of children. For example, research exploring the psychological effects of asthma has found that children with asthma are at an increased risk for internalizing behaviors, such as depression, somatic complaints, and social withdrawal (Bennett, 1994; Kashani, Konig, Shepperd, Wilfley, & Morris, 1988;

MacLean, Perrin, Gortmaker, & Pierre, 1992; Mrazek et al., 1998; Nelms, 1989). Research also has investigated the effects of asthma on the self-esteem of children, concluding that children with asthma typically score lower than healthy children on scales of self-esteem. Missing significant amounts of school, being limited in certain activities, and feelings of helplessness may lead to these types of internalizing behaviors (Padur et al., 1995). The social functioning of children with asthma, although frequently researched, has not been found to be significantly different from the social functioning of healthy children. Although children with asthma are viewed by their classmates as having greater levels of illness, being hospitalized more, and being a less preferred playmate, these children have not been found to have poorer peer relationships, fewer friendships, or feel lonelier than their healthy peers (Graetz & Shute, 1995). Additionally, scales completed by parents and teachers also support the assertion that children with asthma do not experience difficulties in the area of social competence (Nassau & Drotar, 1995).

While a substantial amount of research has focused on the psychological and social outcomes of childhood asthma, few investigations have concentrated on looking specifically at the educational experience of these children. This chapter reviews the existing literature investigating the school functioning of children with asthma. This chapter has been divided into five sections: (a) prevalence and definition, (b) symptoms and treatment, (c) academics, (d) behavior, and (e) teacher perception.

Prevalence and Definition

According to the Centers for Disease Control and Prevention (CDC), in 2001 asthma occurred at a rate of 126 per 1,000 children between the ages of 0 and 17. The

rate of asthma among adults occurred at a rate of 109 per 1,000, indicating that the rate of asthma in children is quite high (CDC, 2001). Since 1980, the prevalence rate of asthma among children between the ages of 5 and 14 years increased by 74%, indicating that this is a growing epidemic. Additionally, rates of asthma are found to be higher among African-American children and females (NIH, 2000).

Since asthma is the most common chronic illness experienced by children under the age of 18 years, it is important to consider the educational impact it can have on those living with this illness. According to researchers, asthma is defined as a chronic inflammation disorder that causes airflow obstruction and bronchial hyperresponsiveness to a variety of stimuli (Brown, 1999). Specifically, three physiological changes characterize an asthma attack. First, the lining of the bronchial tubes becomes inflamed, leading to a constricted condition. Second, the small muscles surrounding the bronchi become hypersensitive, reducing airflow further. Finally, glands produce excess mucus secretions further clogging narrowing airways (Phelps, 1998).

There are several characteristics that aid in depicting the course of this illness. First, asthma is intermittent, meaning that its attacks generally occur on an aperiodic basis. Second, asthma is variable in that its attacks can range from mild to quite severe. Third, asthma is reversible, meaning that the airways return to their previous condition spontaneously or following treatment (Thompson & Gustafson, 1996).

The age of onset of asthma can be somewhat earlier for boys than girls. However, nearly two-thirds of boys and half of girls experience their first asthma attack by the age of 3 years. Furthermore, by the age of 10 years, more than 90% of all children with

asthma have had their first asthmatic attack (Mrazek, Schuman, & Klinnert, 1998).

Symptoms and Treatments

The symptoms associated with asthma can be devastating for children and adults alike. The most common symptoms of asthma include coughing, wheezing, tightness of the chest, and allergic reactions of the eyes, nose, or skin (Thompson & Gustafson, 1996). Additionally, children with asthma may experience diminished stamina for vigorous exercise and labored breathing. In severe cases, children with asthma may experience cyanosis, which consists of a lack of oxygen that causes the skin to turn blue (Brown, 1999). Asthma may be precipitated by a variety of factors, such as changes in air temperature or humidity, exposure to environmental allergens, exercise, upper respiratory infection, or emotional expressions such as crying or laughing (Thompson & Gustafson, 1996).

Treatments for asthma include a variety of methods, including environmental control, pharmacologic management, behavioral interventions, and self-management (Bender, 1995; Thompson & Gustafson, 1996). By controlling the environment in which the child lives, many asthmatic attacks can be prevented. These methods include installing air-filters, limiting exposure to animals, and limiting exposure to dust through cleaning. Additionally, depending on the nature of the child's symptoms, medications can be used to prevent and manage attacks. Pharmacologic treatment typically includes the use of bronchodilators, anti-inflammatory agents, and mast-cell stabilizer medications (Bender, 1995). Behavioral interventions typically include relaxation techniques, contingency management, and decreasing hospital overuse by decreasing the reinforcing qualities of the hospital. Finally, self-management includes teaching parents and children

how to appropriately deal with asthma attacks and work with physicians to improve the overall quality of life (Thompson & Gustafson, 1996).

Achievement

Several investigations have asserted that learning problems occur frequently among children with asthma (Tonnessen, 1994). Studies relying on parent questionnaire data typically have concluded that children with asthma experience academic difficulties in school, specifically with reading. Additionally, a study conducted in Sweden investigated the reading achievement of children with asthma. The study included 28 participants, ages 8 through 15, attending a special school for children diagnosed with severe asthma. Reading achievement was assessed by the administration of a computer-based test battery containing a word recognition test and a non-word reading test. Additionally, the parents of the students completed questionnaires designed to assess the prevalence of immune disorders and reading difficulties among the other family members. Results indicated that the proportion of students with reading problems was much higher than would be expected in the normal population. This was particularly true for phonological problems. Additionally, there was found to be an elevated incidence of both reading problems and immune disorders among family members. (Tonnessen, 1994).

In contrast, several studies that have assessed academic achievement in children with asthma by using the results of objective, standardized tests do not typically support the conclusion that this group of children is at risk for academic problems. For example, one study including 99 hospitalized children with moderately severe to severe asthma found that average scores on the Slosson Intelligence Test, Woodcock Johnson Reading

Mastery Test, Woodcock Johnson Psychoeducational Battery (Part II), and Key Math Diagnostic Arithmetic Test fell above the 50th percentile relative to age-based norms (Gutstadt et al., 1989). Similarly, in a study of children with less severe asthma, it was found that the school administered, standardized achievement test scores of these children did not significantly differ from healthy children (Bender, 1995). In the largest study of children with asthma (1,041 patients in eight cities), mean IQ, cognitive, and achievement scores were normally distributed (Annett, Aylward, Lapidus, Bender, & DuHamel, 2000). These conflicting results may be due to a variety of factors that have been shown to affect the academic achievement of children with asthma. For example, the use of certain medications, such as oral steroids, have been found to impede fine motor skills, be related to lower scores on tests of verbal and visual memory, and increase drowsiness and hyperactivity in children (Bender, 1999; Bender, Lerner, & Polland, 1991; Celano & Geller, 1993). Similarly, some studies have found that the severity of asthma is significantly related to the academic achievement of children with asthma, with children having severe asthma scoring lower on standardized achievement tests compared to children with less severe asthma (Bender, 1995).

Special Education Placement

Special education placement is an important component of the educational experience for many children. Special education placement related to academic concerns can include placement for specific learning disabilities and mental handicaps. Special education placement related to behavior may include placement for an emotional handicap, ranging in severity from moderate to severe. Numerous studies have assessed the rates of special education placement among children with asthma in a variety of ways.

For example, a comprehensive study of school functioning of children with asthma in the United States found that families reported that 9% of children with asthma had learning disabilities compared to 5% of healthy children (Fowler, Davenport, & Garg, 1992). Similarly, one study examining children with chronic illnesses, including children with asthma, assessed the likelihood of these children being placed in special education. This study found that children with chronic illness had substantially higher odds of being placed in special education than healthy children (odds ratio 2.65; $p < .0001$) (Gortmaker, Walker, Weitzman, & Sobol, 1990). However, special education placement was assessed by parents answering the following Yes or No item: “Does _____ go to a special class or get special help in school because of a disability or health problem?” This does not assess the specific special education placement or service, which could range from a self-contained class to a pull-out class for reading or a drop out prevention program.

Some researchers also have sought to understand if an asthma-specific learning disability exists. However, there is not clear evidence of this. Most studies that have supported this assumption have relied on data that informally measured students’ learning problems, often by the use of parent interviews (Bender, 1995). Relatively few studies have examined rates of specific placement in special education programs, leaving findings inconclusive.

Additionally, although there are some studies that have examined behavior problems of children with asthma, virtually no known studies have examined the behavior of this population of children at school. Most studies concluding that children with asthma have an increased rate of behavior problems have used data from parents,

while few have examined school records and actual placement in special education placement related to behavioral concerns.

Retention

Research on the topic of grade retention of children with asthma is sparse, possibly due to the few studies that have longitudinally examined the educational experience of children with asthma. In a study that examined data from the 1988 U.S. National Health Interview Survey on Child Health, it was found that children with asthma had higher rates of grade failure (18% vs 15%). Results of this study also concluded that children with asthma from lower income families had a doubled risk for grade failure compared with healthy children from families of similar income (Fowler et al., 1992). However, there were limitations to this research. For example, the information was based on family reports of health conditions and school outcomes. Additionally, the children identified as having asthma may also have had other illnesses that could have played a role in their functioning. The reasons for retention also were not explored. Although there were limitations to this study, it is one of the few studies that has used a representative national sample in order to calculate prevalence estimates. A review of the literature revealed no other studies that have examined this phenomenon to date. This may be due to the fact that many studies utilize participants in elementary school without examining the overall educational experience. Therefore, more data need to be collected in order to better understand the relationship between asthma and retention.

Placement in Drop-Out Prevention Programs

Placement in drop-out prevention programs for academic concerns is typically related to many of the previously mentioned variables. Students often are placed in these

types of programs in order to promote educational success despite adverse academic experiences in the past. Although many studies have examined variables related to possible future placement in drop-out prevention programs, no known studies have examined the rate of children with asthma being placed in drop-out prevention programs for academic concerns.

Drop-out prevention programs also frequently serve children who may be exhibiting risk-taking behavior, such as substance abuse and sexual activity. Despite the higher rates of behavioral problems in children with asthma that some studies have shown, a review of the literature revealed no known studies examining placement of children with asthma in drop-out prevention programs related to behavioral concerns.

Absenteeism

One major factor that is associated with the educational experience of children who experience chronic illness is school attendance. Research has shown that frequent school absences interrupt the process of learning and interfere with children's social interactions and participation in extracurricular activities (Padur et al., 1995). Several studies have shown that children with asthma miss school more often than their healthy peers (Bender, 1999; Celano & Geller, 1993; Gutstadt et al., 1989). For example, one study found that children with asthma in one school district missed 7% of the days, while children without asthma missed 2% of the days (Bender, 1999). Data from the 1988 U.S. National Health Interview Survey on Child Health found that children with asthma averaged 7.6 school days absent compared with 2.5 days for the healthy children during the previous 12 month period (Fowler, Davenport, & Garg, 1992). A similar study

revealed that the percentage of days absent for asthmatic children was 7%, compared to 2% for healthy children (Bender, 1999).

While it is commonly found that children with asthma tend to miss more school than their healthy peers, research exploring the impact of increased absenteeism has revealed conflicting results. Many studies have found that higher absentee rates among children with asthma adversely affect school grades but do not affect academic achievement as measured by standardized tests (Gutstadt et al., 1989). For example, one Connecticut-based study found that among students with asthma, absentee rates were higher and were significantly associated with lower grades but not decreased achievement scores. However, the grades of children with asthma remained above average, indicating that school absence may temporarily interrupt the acquisition of new skills and knowledge without permanently impeding academic progress (Bender, 1999).

Additionally, in a study of 99 moderately severe to severe asthmatic children, Gutstadt and his colleagues (1989) found no statistical correlation between academic performance and school absenteeism. Further, the mean achievement score of the asthmatic group was average or above average despite the children having been absent from school 20% of the days in the semester prior to testing (Gutstadt et al., 1989).

Discipline

There is limited information related to children with asthma and their behavior at school. Some studies have examined the behavior of children with asthma and any problematic concerns that may be apparent (Gortkaker et al., 1990; Mrazek et al., 1998; Nelms, 1989), but no studies have examined the number of referrals to the office children with asthma receive compared to healthy children. However, due to research indicating

that children with asthma often tend to exhibit more internalizing and externalizing behaviors compared to their healthy counterparts, it can be hypothesized that children with asthma may have a higher rate of referrals for behavior concerns as compared to healthy children (Mrazek, Schuman, & Klinner, 1998). For example, in a study conducted by Gortmaker et al. (1990) it was found that, among 4- to 11-year-old children, there was an average of 1.7 more behavior problems indicated among children with a chronic health condition than among healthy children. This study included children with asthma. Additionally, among adolescents with chronic health conditions, behavior problems were 0.9 times more likely to occur in comparison with children without chronic health conditions.

Similarly, limited information exists related to children with asthma and suspension. Data from the 1988 U.S. National Health Interview Survey found that rates of suspension and expulsion were nearly similar for children with asthma compared to healthy children (5% vs 6%) (Fowler et al., 1992). However, several studies have found that children with asthma have higher rates of behavior problems compared to healthy children. For example, one study found that an increased number of school-age children with asthma (11.5%) obtained scores above the 98th percentile on the behavior problems portion of the Child Behavior Checklist (CBCL). This rate is twice that found in the general population (Butz et al., 1995). A similar study concluded that children with asthma were at a greater risk for behavior problems than healthy children (Kashani et al., 1988).

Teacher Perception

Numerous studies have assessed teachers' ratings of the psychological and social functioning of children with asthma. However, no known studies to date have examined teachers' perceptions of children with asthma and their ability to pay attention, although several studies have indicated that children with asthma show increased signs of difficulty paying attention. For example, a study conducted by Butz et al. (1995) found that parents of children with asthma reported that several problem behaviors related to attention occurred "often." Some of these behaviors included being unable to sit still, being easily distracted, and having trouble paying attention. Parents of children with asthma were significantly more likely to rate their children with these problem behaviors compared to parents of healthy children.

There also are no known studies that have examined teachers' ratings of the overall behavior of children with asthma and their overall potential for success in school. The majority of studies examining the behavior of children with asthma have utilized parent ratings. However, the confidence teachers have in their students and the way they view these children also may be an important factor related to the overall school functioning of children with asthma. This study addresses this gap in literature by examining teachers' perceptions of children with asthma.

Summary

Although numerous studies have examined the impact of asthma on the psychological and social functioning of children, few have studied the educational experiences of these children. This may be due to the fact that recent advances in medical technology and health care have increased the quality of life for these children

and allowed them to become more involved in the normal activities associated with childhood, such as school.

Numerous studies have found conflicting results when examining the academic achievement of children with asthma in comparison to healthy children. This may be due to the various ways in which academic achievement has been defined and assessed. Similarly, while some studies have informally interviewed parents in an effort to determine the rates children with asthma are placed in special education for both academic and behavioral concerns, few have assessed this by examining actual placement in educational programs. Additionally, a review of the literature revealed no known studies have examined the rate of children with asthma being placed in drop-out prevention programs due to academic and behavioral concerns. These are areas that need to be further explored in order to better understand the needs of this population.

Numerous studies have confirmed that children with asthma tend to have higher rates of absenteeism compared to healthy children. This is important because research has found that frequent school absences interrupt the process of learning and interfere with children's social interactions and participation in extracurricular activities. Additionally, few studies have examined the difference between children with asthma and healthy children on rates of grade retention, disciplinary referrals, and suspensions. Finally, teacher perception of students with asthma has rarely been assessed and is an area that may be very helpful in understanding more about the educational experience of children with asthma.

This study addressed the gap in the research on children with asthma in several ways. First, virtually no studies have examined the educational experience of children

with asthma compared to children without asthma from a longitudinal perspective. This study followed students from kindergarten through 8th grade, examining numerous variables related to school functioning. Second, this study clearly defined eligibility for special education services by utilizing the state of Florida eligibility standards. Other studies often have defined disabilities such as learning disability by subjective means, such as parent opinion of their child's academic functioning. Third, this study examined school outcome variables that have rarely been examined in this population, such as grade retention and rates of suspension. Finally, this study determined if there was a difference between teachers' perceptions of children with asthma compared to children without asthma.

Chapter III

Method

This causal comparative study examined differences between children with asthma and children without asthma on variables related to academics, behavior, and teacher perception. A description of participants, measures, procedures, and data analyses involved in this study is provided below.

Participants

Participants for this study were drawn from students who were included in the database of a large longitudinal study that was begun in 1989. Data collection was conducted at a large urban school district in the southeastern United States. Each year, data were collected from the cohort that began kindergarten in the fall of 1989, a group initially consisting of 8,734 students. These children were followed from kindergarten through 12th grade. These data were gathered from multiple sources, including students, parents, and teachers. A variety of measures were used to gather the information, which explores academic, behavioral, and family domains. Typically, these measures consisted of scales and surveys examining specific variables determined to be of interest that year. The committee who determined these variables, although different from year to year, was typically comprised of school personnel and academic researchers. Additionally, annual data from each student's school file were available in the database. Information from these files include grades, absences, grade levels retained, discipline referrals, special education placement, and standardized achievement scores. The distributions of the

original sample and the original sample diagnosed with asthma are presented in Table 1 by gender, race, and SES. Six-hundred and forty-six total participants were initially included in this study.

Table 1

Distribution of Original Sample by Gender, Race, and SES

	Original Cohort		Original Cohort with Asthma Diagnosis (of the 6,043 returned parent surveys)	
	<i>n</i>	%	<i>n</i>	%
Gender				
Male	4238	49	221	62
Female	4496	51	135	38
Race				
Black	1630	19	100	28
White	6820	78	220	62
Other	284	3	36	10
SES (Free and Reduced Lunch)				
No	5172	59	206	58
Yes	3562	41	150	42

For the purpose of this study, participants whose parents answered true to the statement “Your child has asthma” on the kindergarten (1989-90) parent survey were selected as the initial asthmatic group. Next, all participants within the initial asthmatic group whose parents indicated on the kindergarten parent survey that their child had ever been hospitalized for any of the following reasons were excluded: allergies, tumor, diabetes, or a heart condition. This decreases the possibility of conditions other than asthma playing a role in various effects. The remaining participants constitute the asthmatic group for this study.

The comparison group for this study was selected by first excluding any participants whose parents answered true to the statement “Your child has asthma.” Next, participants whose parents indicated on the kindergarten parent survey that their child had ever been hospitalized for any of the following reasons: allergies, tumor, diabetes, or a heart condition were excluded. Remaining participants were used to construct the comparison group for the study. Participants within the asthmatic group and the comparison group were matched for gender, grade, race, and socioeconomic status (as measured by eligibility for the Free and Reduced Lunch program). This procedure was completed by first determining the gender, grade, race, and socioeconomic status of each participant in the asthma sample. These participants were then matched one-to-one with participants in the comparison group on the variables of gender, grade, race, school, and socioeconomic status. Due to factors such as students moving to other school districts, more participants were selected for the comparison group to ensure each participant in the asthma group always had a matched participant without asthma. A total of 76 different schools were represented among the participants.

Variables

In this study, the independent variable was health status (asthma or no asthma). Asthma was defined as a diagnosis of asthma according to parent endorsement of the item “Your child has asthma” on the kindergarten parent survey. Additionally, asthma was defined as not having been hospitalized for any of the following reasons: allergies, tumor, diabetes, or a heart condition. No asthma was defined as no diagnosis of asthma and not having a diagnosis of any other chronic health conditions, such as allergies, tumor, diabetes, or a heart condition, as indicated on the parent survey. The dependent

variables were academic achievement, special education placement, grade retentions, placement in drop-out prevention programs, disciplinary referrals, days suspended, and teacher perception of students' (a) ability to pay attention, (b) overall behavior, and (c) potential for overall success in school.

Academic achievement was measured by the test results of administration of the Comprehensive Test of Basic Skills (CTBS) at the elementary school level (grades 3-5) and the middle school level (grades 6-8). The CTBS is a norm-referenced test that assesses individual achievement in the areas of reading, language arts, math, science and social studies. For the purpose of this study, normal curve equivalent (NCE) and scale scores in the areas of reading, math, language arts, and the battery composite score were used to measure achievement. NCE scores can range from 1 through 99 and a score of 50 is considered average or "on grade level." Scale scores range from 0 to 999 and are the same for each grade level. Scale scores can be compared at each grade level within the same content area. The CTBS has been found to have strong content and predictive validity and strong reliability (Schell, 1984).

Special education placement was determined by school records and was defined by Florida eligibility criteria for placement in the Specific Learning Disabilities, Visually Impaired, Speech Impaired, Language Impaired, Emotionally Handicapped, Gifted, Profound Mentally Handicapped, and Severely Emotionally Disturbed programs during the elementary (grades 1-5) and middle (grades 6-8) school levels. Students may have been placed in one or more of these programs at a given time. Eligibility for services from these programs vary by the type of program. Eligibility was typically determined by evaluation results including psychological testing or medical evaluations.

Grade retention was determined by school records and was defined as repeating a complete grade level of school. Students promoted included those who were promoted both through academic and administrative promotions.

Placement in drop-out prevention programs was determined by school records and defined as placement in (a) Educational Alternative Programs, (b) Teenage Parent Programs, (c) Substance Abuse Programs, (d) Disciplinary Programs, (e) Department of Juvenile Justice Programs, and (f) Department of Children and Family Services. Eligibility for these programs typically included resistance to previously implemented interventions and either a school-based team or administrative recommendation for placement in the specific program. These various programs addressed issues ranging from academic remedial instruction to risk-taking behaviors such as substance abuse.

Disciplinary referrals were measured by school records and were defined as any type of disciplinary referral that did not result in suspension, expulsion, or reassignment to an alternative program. The number of disciplinary referrals was totaled for the elementary (grades K-5) and middle (grades 6-8) school levels. Behaviors such as disturbing the classroom or noncompliance of a less severe nature typically resulted in disciplinary referrals.

Suspension was measured by student records, with suspensions including in-school and out-of-school suspensions. The number of days suspended was totaled for the elementary (grades K-5) and middle (grades 6-8) school levels. Behaviors such as physical aggression toward others typically resulted in either an in-school or out-of-school suspension. The number of days suspended varied depending on the type of behavioral infraction.

Finally, teacher perception of children with asthma included several components. Teacher perception of the students' overall ability to pay attention was measured by the Omnibus Project Teacher Survey administered each year during grades 1 through 6. Specifically, this item asked "Does this student have difficulty paying attention?" Choices included (1) yes, (2) no, and (3) undecided. Teacher perception of the students' overall behavior in school was also measured by the Omnibus Project Teacher Survey administered in grades 1 through 6. Specifically, this item asked "Choose the one answer that best describes this student's behavior in school." Answer choices included (1) excellent, (2) satisfactory, (3) needs improvement, (4) unsatisfactory. Teacher perception of the student's overall potential for success was measured by the Omnibus Project Teacher Survey administered in grades 1 through 6. Specifically, this item asked "To what extent do you agree with the statement, 'This student will have a successful overall school experience?'" Answer choices included (1) strongly agree, (2) agree, (3) undecided, (4) disagree, (5) strongly disagree. All data in the teacher perception domain were assessed by computing a mean score across the elementary (grades 1-5) and middle (grade 6) school grade levels for each variable. All data in the teacher perception domain were recoded for the data analysis. Specifically, responses were recoded such that a teacher endorsement of descriptions of positive student behavior received codes of small numerical values (0, 1) while the values became increasingly larger (4, 5) as the behaviors became more negative or inappropriate.

Procedure

This study was a secondary analysis of data collected from a longitudinal research project conducted in a large school district in the southeastern United States. As

described above, each year, data were collected on the cohort of students who entered kindergarten in 1989. These students completed 12th grade during the 2001-2002 school year, although this varies due to drop out and retention. Each year, parent, teacher, and student surveys were completed. The parent surveys were handed out to the students at school who then took them home, had the parents fill them out, then returned them to school through the students. Some schools offered small incentives for students to return the surveys, such as pencils, bookmarks, or magnets. Of the 8,734 parent surveys that were distributed to the original cohort of students, 6,043 were returned. The teacher surveys were sent out to the schools by the school district's internal mail system and completed on the teachers' own time or when students were completing their surveys. Once completed and returned, all surveys were returned to the main research administrative office through the internal mail system. Additionally, students' school records were available for analysis each year.

Permission for the research reported in this paper was obtained from the school district that has collected and maintained the longitudinal data. This was obtained by providing the project manager with a summary of the proposed topic of research, the purpose of the study, specific questions and hypotheses, the sampling method, the statistical procedures that would be utilized, the anticipated results, the time frame for the study, the services that would be requested, and the benefits to the district or educational community. Once permission from the project manager was obtained, the necessary data was requested. The project manager first selected the asthmatic and comparison groups. The project manager then matched these participants one-to-one on the variables of gender, grade, race, and socioeconomic status. The project manager then compiled the

data for each participant on the following variables: reading achievement, math achievement, language achievement, overall achievement, special education placement, grade retention, placement in drop-out prevention programs, disciplinary referrals, days suspended, and teacher perception of students' (a) ability to pay attention, (b) overall behavior, and (c) overall potential for a successful school experience. The project manager then compiled this information onto floppy disks, which was given to the researcher for data analysis.

Data Analysis

First, frequency distributions were examined for all participants on the following variables: school attended, gender, race, socioeconomic status, promotion status for grades Kindergarten through 8 (data are missing for grade 7), special education placement in grades Kindergarten through 8, drop-out prevention program placement in grades Kindergarten through 8 (data are missing for grade 7), number of disciplinary referrals for grades 1 through 8, number of suspensions for grades 1 through 8, and teacher perception scores on teacher completed surveys related to attention, overall behavior, and potential for success for grades 1 through 5. As mentioned above, data were not available for the 1996-97 (grade 7) school year due to an error in the initial data input.

Next, the teacher perception items were recoded in order to ensure that they would be scaled consistently. The three individual teacher perception items were combined to form the teacher perception domain. These individual items included the questions included on the teacher surveys administered each year that related to students' ability to pay attention, students' overall behavior, and students' overall potential for a

successful school experience. Next, reliability analyses were computed for the combined teacher perception domains for each year ranging from 1990 through 1995.

Chapter IV

Results

The participants in this study are presented in Table 2 by gender, race, and SES. Two-hundred and ninety-six students were identified as having asthma during the 1989-1990 school year, while 350 students were selected as the comparison group and identified as not having asthma. There were significantly more males (61%) identified as having asthma compared to females (39%). The majority of participants were White (71%), while African-Americans made up 26% and Asians, Hispanics, and Indians made up the remaining 3% of the participants. Socioeconomic status was measured by eligibility for Free and Reduced Lunch. The majority of students (55%) did not apply for the program, while 38% qualified for reduced lunch and 7% qualified for free lunch.

Table 2

Distribution of Selected Participants by Gender, Race, and SES

	No Asthma		Asthma	
	<i>n</i>	%	<i>n</i>	%
Gender				
Male	182	52	180	61
Female	168	48	116	39
Race				
Black	81	23	87	29
White	261	75	199	67
Asian	4	1	4	1
Hispanic	4	1	5	2
Indian	0	0	1	<1
SES (Free and Reduced Lunch)				
Did not apply	195	56	162	55
Reduced lunch	130	37	116	39
Free lunch	25	7	18	6

Question I: Do children with asthma have significantly lower standardized achievement scores in reading, math, and language arts compared to children without asthma at the elementary and middle school levels? Are total battery scores on a standardized achievement test significantly lower for children with asthma compared to children without asthma at the elementary and middle school levels?

Independent *t* tests were conducted to test differences in the mean NCE scores in the areas of reading, math, language arts, and the total battery for children with and without asthma. NCE scores can range from 1 through 99. A score of 50 is considered average or “on grade level.” Due to an error in the original set of data, math scores were not available for this analysis. Specifically, it appeared that math stanine scores were inputted into the original database rather than NCE scores. As seen in Tables 3 and 4,

scores for children with and without asthma were typically within the average range and usually did not differ significantly. However, there were several instances in which these groups did demonstrate statistically significant difference in mean scores. The formula utilized to compute the standardized effect size was as follows:

$$\frac{\text{Mean nonasthma} - \text{Mean asthma}}{\text{pooled standard deviations}}$$

Cohen's general guidelines regarding effect sizes indicate small effect sizes as being below 0.2, moderate effect sizes being between 0.2 and 0.5, and large effect sizes being between 0.5 and 0.8. For the purpose of this study, significant differences with moderate to large effect sizes will be considered practical differences.

During the 1993-94 school year, children with asthma ($M = 48.63$, $SD = 23.31$) had significantly lower NCE reading scores than children without asthma ($M = 53.87$, $SD = 21.62$), $t(455) = 2.49$, $p = .01$. The degree of difference was calculated using the standardized effect size, $es = .23$, which was relatively low. During the 1993-94 school year, children with asthma ($M = 48.70$, $SD = 24.45$) had significantly lower NCE language arts scores than the children without asthma ($M = 55.39$, $SD = 21.15$), $t(451) = 3.10$, $p = .002$. Again, the degree of difference was calculated using the standardized effect size, $es = .29$, which was also relatively low. Similarly, during the 1994-95 school year, children with asthma ($M = 53.18$, $SD = 22.17$) had significantly lower NCE language arts scores than the children without asthma ($M = 57.52$, $SD = 20.22$), $t(418) = 2.10$, $p = .037$. This standardized effect size, $es = .20$, was also relatively low. During the 1992-93 school year, the total battery NCE scores were significantly lower for children with asthma ($M = 53.54$, $SD = 23.94$) compared to children without asthma ($M = 57.95$, $SD = 23.38$), $t(469) = 2.02$, $p = .044$. A relatively low standardized effect size, es

= .19, was again calculated. Finally, the 1993-94 total battery NCE scores were significantly lower for children with asthma ($M = 49.91$, $SD = 23.78$) compared to children without asthma ($M = 55.38$, $SD = 22.19$), $t(448) = 2.52$, $p = .012$. The standardized effect size for this difference, $es = .24$, was relatively low.

Similarly, when analyzing scale scores, several differences were found. The 1992-93 math scale score was significantly lower for children with asthma ($M = 681.03$, $SD = 61.62$) compared to children without asthma ($M = 692.25$, $SD = 58.51$), $t(469) = 2.03$, $p = .043$. The standardized effect size for this difference was relatively low, $es = .19$. Additionally, the 1992-93 total battery scale scores were found to be lower for children with asthma ($M = 685.35$, $SD = 50.62$) compared to children without asthma ($M = 695.10$, $SD = 48.83$), $t(467) = 2.12$, $p = .034$. This standardized effect size of .20 was also low. The 1993-94 reading scale scores were found to be significantly lower for children with asthma ($M = 687.04$, $SD = 59.24$) compared to children without asthma ($M = 700.44$, $SD = 51.71$), $t(440) = 2.57$, $p = .011$. This standardized effect size was also low, $es = .24$. Additionally, the 1993-94 language arts scale scores were found to be significantly lower for children with asthma ($M = 697.92$, $SD = 54.70$) compared to children without asthma ($M = 714.32$, $SD = 44.85$), $t(429) = 3.48$, $p = 0.01$. Again, the standardized effect size of .33 was low. The 1993-94 total battery scale scores were found to be significantly lower for children with asthma ($M = 694.31$, $SD = 50.06$) compared to children without asthma ($M = 705.93$, $SD = 44.57$), $t(446) = 2.60$, $p = .010$. This standardized effect size was also low, $es = .24$. Finally, the 1994-95 language arts scale scores were found to be significantly lower for children with asthma ($M = 723.85$, $SD = 47.98$) compared to children without asthma ($M = 734.08$, $SD = 42.04$), $t(416) =$

2.33, $p = .021$. Again, the standardized effect size of .23 was low. Due to an error in the original input of data, scores were not obtained for the 1998-98 school year. All effect sizes are summarized in Table 5.

As seen in Table 6, the skewness and kurtosis of the NCE scores indicate approximately normal distributions of CTBS scores across both the asthma and non-asthma groups. Again, math NCE scores were unavailable.

Additionally, a 2 (asthma) x 5 (year) repeated measures analysis of variance (asthma x year) was computed for the reading, math, language arts, and total battery scale scores to determine the difference between the asthma and no asthma groups and their change in scores over time. As seen in Figures 1, 2 and 3, and Tables 4 and 7, scores increased each year, but there was no significant difference between groups in the area of academic achievement or between the groups in academic achievement by year.

Table 3

Means and Standard Deviations for Reading, Math, Language Arts, and Total Battery

CTBS NCE Scores for the 1992-93 through 1997-98 School Years

	No Asthma		Asthma		<i>t</i>	<i>p</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Reading 1992-93 (n = 472)	55.90	21.12	52.47	22.59	1.71	.089
Reading 1993-94 (n = 455)	53.87	21.62	48.63	23.31	2.49	.013
Reading 1994-95 (n = 419)	53.78	20.86	50.62	21.69	1.52	.129
Reading 1995-96 (n = 369)	53.40	20.79	53.75	19.38	-0.16	.870
Reading 1996-97 (n = 375)	55.69	21.98	54.79	21.05	0.40	.686
Reading 1997-98 (n = 368)	56.41	23.19	56.73	23.74	-0.13	.895
Math 1992-93 (n = 460)	--	--	--	--	--	--
Math 1993-94 (n = 437)	--	--	--	--	--	--
Math 1994-95 (n = 410)	--	--	--	--	--	--
Math 1995-96 (n = 371)	--	--	--	--	--	--
Math 1996-97 (n = 365)	--	--	--	--	--	--
Math 1997-98 (n = 367)	--	--	--	--	--	--
L. Arts 1992-93 (n = 470)	56.49	24.31	52.51	23.66	1.80	.073
L. Arts 1993-94 (n = 451)	55.39	21.15	48.70	24.45	3.10	.002
L. Arts 1994-95 (n = 418)	57.52	20.22	53.18	22.17	2.10	.037
L. Arts 1995-96 (n = 369)	52.81	22.97	50.84	22.55	0.83	.407
L. Arts 1996-97 (n = 375)	54.18	25.08	51.13	22.04	1.25	.211
L. Arts 1997-98 (n = 364)	54.47	23.59	53.11	22.76	0.56	.577
Battery 1992-93 (n = 469)	57.95	23.38	53.54	23.94	2.02	.044
Battery 1993-94 (n = 448)	55.38	22.19	49.91	23.78	2.52	.012
Battery 1994-95 (n = 417)	56.47	20.69	52.68	22.31	1.80	.073
Battery 1995-96 (n = 365)	54.48	22.58	52.53	21.64	0.84	.403
Battery 1996-97 (n = 372)	55.72	23.38	53.32	22.08	1.02	.310
Battery 1997-98 (n = 359)	56.29	23.55	55.93	22.90	0.15	.883

Note. Dashes indicate that data were not obtained.

Table 4

*Means and Standard Deviations for Reading, Math, Language Arts, and Total Battery**CTBS Scale Scores for the 1992-93 through 1997-98 School Years*

	No Asthma		Asthma		<i>t</i>	<i>p</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Reading 1992-93 (n = 472)	688.21	49.42	679.25	56.13	1.84	.066
Reading 1993-94 (n = 455)	700.44	51.71	687.05	59.24	2.57	.011
Reading 1994-95 (n = 419)	723.58	44.91	715.53	50.49	1.73	.085
Reading 1995-96 (n = 369)	743.86	42.36	744.60	37.53	- 0.18	.861
Reading 1996-97 (n = 375)	754.90	46.02	753.12	41.94	0.39	.697
Reading 1997-98	--	--	--	--	--	--
Math 1992-93 (n = 471)	692.25	58.51	681.03	61.62	2.03	.043
Math 1993-94 (n = 452)	704.48	51.53	695.81	50.49	1.81	.071
Math 1994-95 (n = 418)	734.25	43.07	727.98	45.38	1.45	.148
Math 1995-96 (n = 371)	754.61	48.63	746.11	51.93	1.63	.104
Math 1996-97 (n = 376)	768.97	53.08	765.09	53.78	0.70	.483
Math 1997-98	--	--	--	--	--	--
L. Arts 1992-93 (n = 470)	704.75	51.23	696.17	49.70	1.84	.066
L. Arts 1993-94 (n = 451)	714.32	44.85	697.92	54.70	3.48	.001
L. Arts 1994-95 (n = 418)	734.08	42.02	723.85	47.98	2.33	.021
L. Arts 1995-96 (n = 369)	740.02	48.81	736.44	47.64	0.71	.478
L. Arts 1996-97 (n = 375)	751.45	54.58	745.81	47.40	1.06	.289
L. Arts 1997-98 Battery	--	--	--	--	--	--
1992-93 (n = 469) Battery	695.10	48.83	685.35	50.62	2.12	.034
1993-94 (n = 448) Battery	705.93	44.57	694.31	50.06	2.60	.010
1994-95 (n = 417)	730.50	39.58	722.33	43.37	2.00	.046
Battery 1995-96 (n = 365)	746.15	41.79	742.90	39.90	0.76	.448
Battery 1996-97 (n = 372)	758.38	45.29	754.07	42.19	0.95	.345
Battery 1997-98	--	--	--	--	--	--

Note. Dashes indicate that data were not obtained.

Table 5

Effect Sizes for Statistically Significant Differences Among CTBS Scores

Subject Area and School Year	Effect Size
Math NCE 1992-93	.21
Total Battery NCE 1992-93	.19
Reading NCE 1993-94	.23
Language Arts NCE 1993-94	.29
Math NCE 1993-94	.21
Total Battery NCE 1993-94	.24
Language Arts NCE 1994-95	.20
Math Scale Score 1992-93	.19
Total Battery Scale Score 1992-93	.20
Reading Scale Score 1993-94	.24
Language Arts Scale Score 1993-94	.33
Total Battery Scale Score 1993-94	.24
Language Arts Scale Score 1994-95	.23
Total Battery Scale Score 1994-95	.20

Table 6

Skewness and Kurtosis of CTBS NCE Scores

	No Asthma	No Asthma
<hr/>		
Reading NCE 1992-93		
<i>n</i>	236	236
Skewness	.058	-.009
Kurtosis	-.470	-.399
Language Arts NCE 1992-93		
<i>n</i>	234	236
Skewness	-.013	.013
Kurtosis	-.852	-.864
Total Battery NCE 1992-93		
<i>n</i>	233	236
Skewness	-.082	.006
Kurtosis	-.729	-.814
Reading NCE 1993-94		
<i>n</i>	231	224
Skewness	-.220	.003
Kurtosis	-.276	-.308
Language Arts NCE 1993-94		
<i>n</i>	228	223
Skewness	.147	.079
Kurtosis	-.267	-.611
Total Battery NCE 1993-94		
<i>n</i>	228	220
Skewness	-.057	.001
Kurtosis	-.586	-.576
Reading NCE 1994-95		
<i>n</i>	219	200
Skewness	.047	-.199
Kurtosis	-.396	-.362
Language Arts NCE 1994-95		
<i>n</i>	218	200
Skewness	.042	-.166
Kurtosis	-.216	-.372
Total Battery NCE 1994-95		
<i>n</i>	217	200
Skewness	.016	-.078
Kurtosis	-.314	-.424
<hr/>		

Continued on the next page

Table 6 (Continued)

	No Asthma	No Asthma
<hr/>		
Reading NCE 1995-96		
<i>n</i>	192	177
Skewness	.149	.069
Kurtosis	-.265	-.162
Language Arts NCE 1995-96		
<i>n</i>	191	178
Skewness	-.237	-.045
Kurtosis	-.338	-.240
Total Battery NCE 1995-96		
<i>n</i>	189	176
Skewness	-.013	.037
Kurtosis	-.531	-.294
Reading NCE 1996-97		
<i>n</i>	198	177
Skewness	-.056	-.051
Kurtosis	-.383	-.399
Language Arts NCE 1996-97		
<i>n</i>	198	177
Skewness	-.006	-.079
Kurtosis	-.620	-.436
Total Battery NCE 1996-97		
<i>n</i>	198	174
Skewness	.024	.066
Kurtosis	-.627	-.491
Reading NCE 1997-98		
<i>n</i>	196	172
Skewness	.042	-.132
Kurtosis	-.481	-.486
Language Arts NCE 1997-98		
<i>n</i>	195	169
Skewness	-.173	-.118
Kurtosis	-.304	-.399
Total Battery NCE 1997-98		
<i>n</i>	192	167
Skewness	.027	.099
Kurtosis	-.595	-.731
<hr/>		

Table 7

Results of the 2 (Asthma) x 5 (Year) Repeated Measures ANOVA for Reading, Math, Language Arts, and Total Battery Achievement Scaled Scores

	Reading		Math		Language Arts		Total Battery	
	<i>F</i>	<i>p</i>	<i>F</i>	<i>p</i>	<i>F</i>	<i>p</i>	<i>F</i>	<i>p</i>
Asthma	0.00	.984	0.43	.514	0.81	.368	0.34	.559
Year	436.98	.000	456.83	.000	184.20	.000	716.20	.000
Asthma x Year	0.37	.831	0.20	.941	1.12	.346	.59	.672

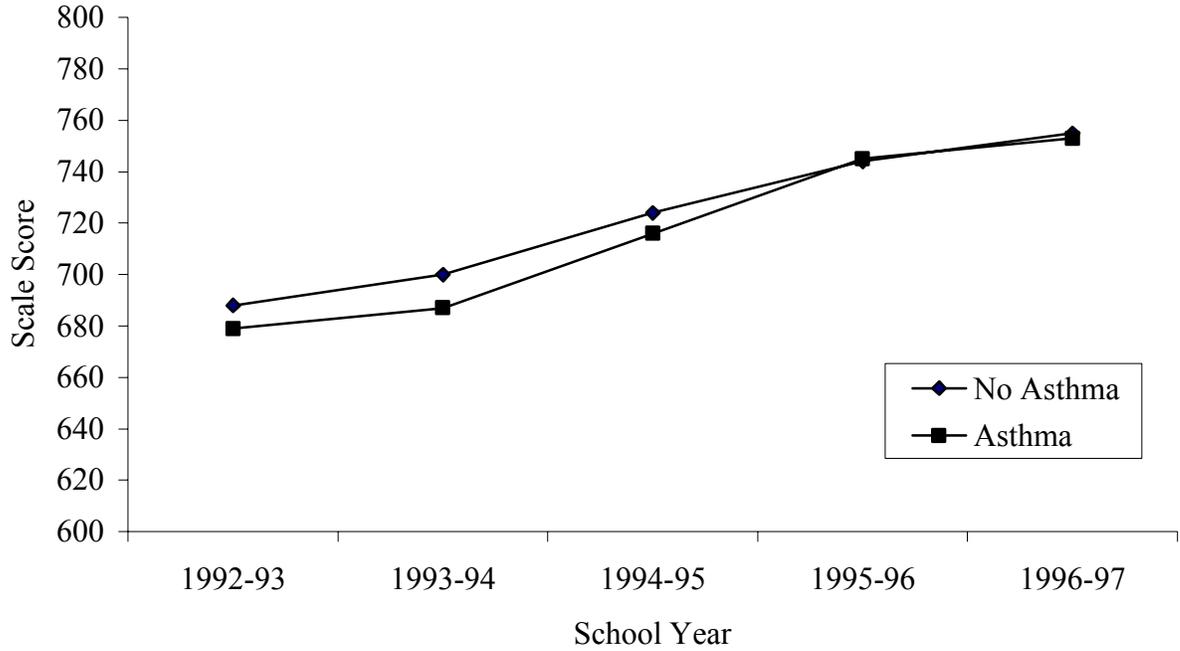


Figure 1. Reading Achievement Scale Scores for the 1992-93 through 1996-97 School Years

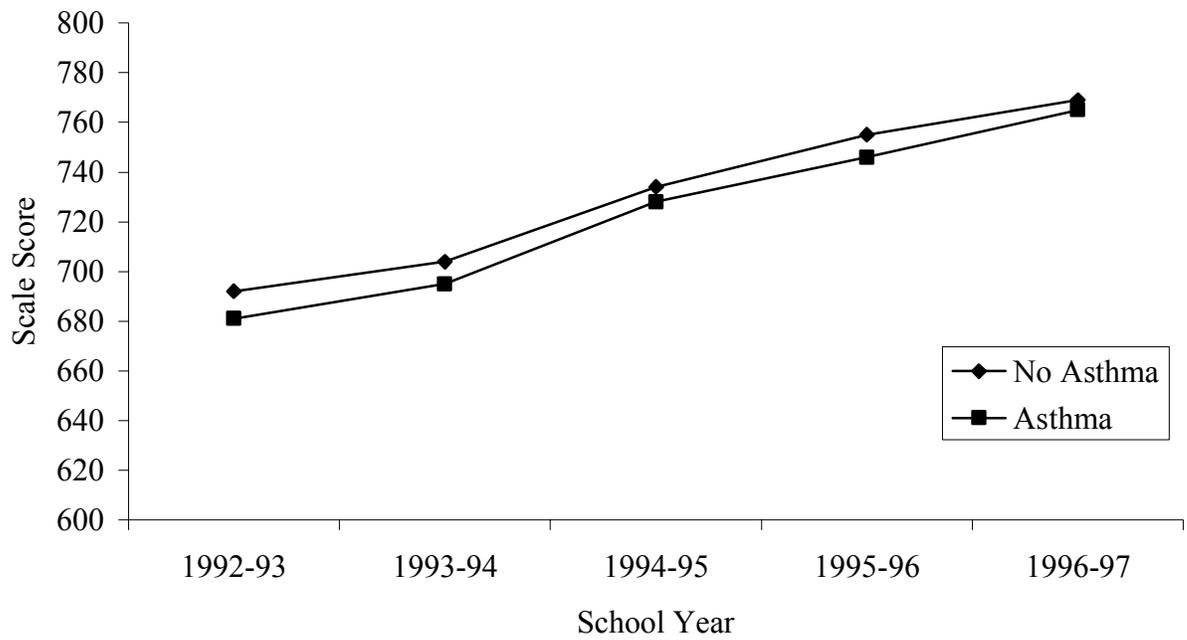


Figure 2. Math Achievement Scale Scores for the 1992-93 through 1996-97 School Years

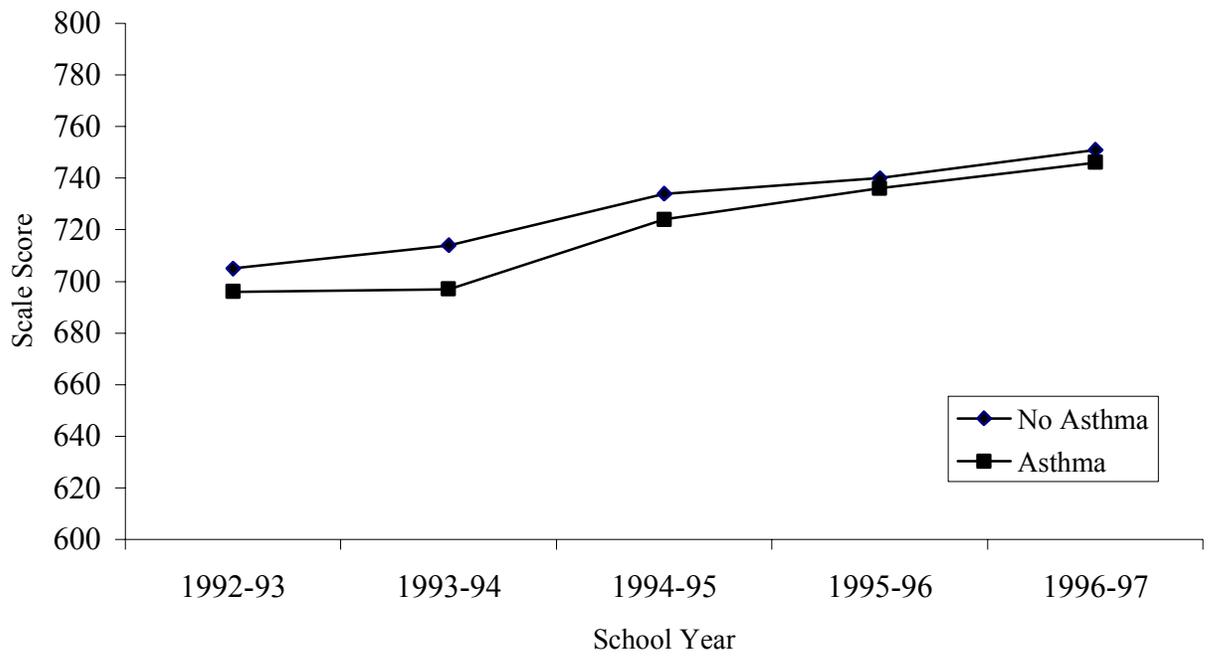
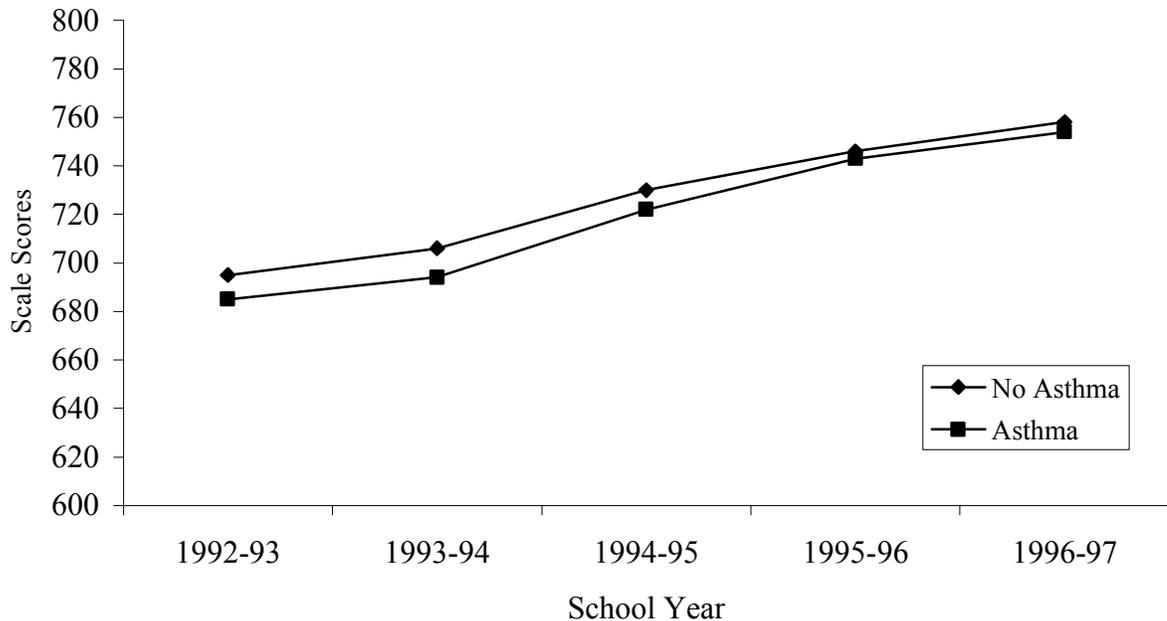


Figure 3. Language Arts Achievement Scale Scores for the 1992-93 through 1996-97 School Years

Figure 4. Total Battery Scale Scores for the 1992-93 through 1996-97 School Years



Question II: Are children with asthma placed in special education significantly more than children without asthma at the elementary and middle school levels?

Chi-square analyses revealed that children with and without asthma typically did not differ in special education placement (see Tables 8 and 9). However, a difference was noted during the 1994-95 school year. During the 1994-95 school year, children with asthma were placed in special education programs significantly more than children without asthma, $\chi^2 = 20.30$, $p = .03$. One-hundred and two (34.5%) of the 296 children with asthma received services through a special education program, while 94 (26.9%) of the children without asthma received services through a special education program. Overall, across the elementary and middle school years, the highest percentage of children were placed in the Specific Learning Disabilities, Speech Impaired, Language Impaired, and Gifted Programs, while the smallest percentages were placed in the

Visually Impaired, Severely Emotionally Disturbed, and the Profound Mentally Handicapped.

Table 8

Total Number of Students Placed in Special Education Programs for the 1990-91 through 1997-98 School Years

	Asthma		No Asthma	
	Special ed. <i>N (%)</i>	No special ed. <i>N (%)</i>	Special ed. <i>N (%)</i>	No special ed. <i>N (%)</i>
1990-91	66 (22.3)	230 (77.7)	73 (20.9)	277 (79.1)
1991-92	85 (28.7)	211 (71.3)	93 (26.6)	257 (73.4)
1992-93	94 (31.8)	202 (68.2)	90 (25.7)	260 (74.3)
1993-94	96 (32.4)	200 (67.6)	88 (25.1)	262 (74.9)
1994-95	102 (34.5)	194 (65.5)	94 (26.9)	256 (73.1)
1995-96	94 (20.1)	269 (76.9)	94 (31.8)	202 (68.2)
1996-97	91 (30.7)	205 (69.3)	85 (24.3)	265 (75.7)

Table 9

Results of Chi-Square Analyses for Placement in Special Education Programs for the 1990-91 through 1997-98 School Years

	χ^2	<i>df</i>	<i>p</i>
1990-91	9.62	8	.293
1991-92	11.85	9	.222
1992-93	16.13	10	.096
1993-94	18.24	10	.051
1994-95	20.30	10	.027
1995-96	14.08	9	.119
1996-97	12.39	9	.192
1997-98	9.09	8	.335

Question III: Are children with asthma retained significantly more than children without asthma during the elementary and middle school levels?

Chi-square analyses revealed that children with and without asthma typically did not differ in the number of times retained in grades 1 through 8. The number of students promoted versus the number of students retained each year is presented in Tables 10 and 11. No data were available for the 1996-97 school year. These data may have been inputted incorrectly when first compiled or unavailable at the time of data collection. Data analysis indicated that most students were academically promoted, while a small percentage were either administratively promoted or retained.

Table 10

Total Number of Students Promoted and Retained for the 1990-91 through 1997-98

School Years

	No Asthma		Asthma	
	Promoted <i>N (%)</i>	Retained <i>N (%)</i>	Promoted <i>N (%)</i>	Retained <i>N (%)</i>
1990-91	341 (97.4)	9 (2.6)	285 (96.2)	11 (3.7)
1991-92	348 (99.4)	2 (0.6)	294 (99.3)	2 (0.7)
1992-93	349 (99.8)	1 (0.2)	294 (99.3)	2 (0.7)
1993-94	349 (99.7)	1 (0.3)	296 (100)	0 (0.0)
1994-95	350 (100)	0 (0.0)	296 (100)	0 (0.0)
1995-96	340 (97.2)	10 (2.9)	287 (97.0)	9 (3.0)
1996-97	--	--	--	--
1997-98	325 (92.8)	25 (7.1)	270 (91.3)	26 (8.8)

Note. Dashes indicate that data were not obtained.

Table 11

Results of Chi-Square Analyses for Promotion Status for the 1990-91 through 1997-98

School Years

	χ^2	<i>df</i>	<i>p</i>
1990-91	3.24	4	.52
1991-92	1.67	3	.64
1992-93	2.74	3	.43
1993-94	2.64	3	.45
1994-95	3.76	2	.15
1995-96	4.33	2	.11
1996-97	--	--	--
1997-98	1.77	3	.62

Note. Dashes indicate that data were not obtained.

Question IV: Are children with asthma placed in drop-out prevention programs significantly more than children without asthma during the elementary and middle school levels?

After analyzing the data related to placement in drop-out prevention programs during the kindergarten through 2nd grade academic levels, it was decided to exclude these years from the data analysis and interpretation due to the fact that drop-out prevention programs were not available to these age groups at that time. As seen in Tables 12 and 13, there was no difference between children with and without asthma in the frequency of placement in drop-out prevention programs. These services varied and included programs such as educational alternative programs and disciplinary programs. The majority of students placed in drop-out prevention programs received services related to academic support, while services related to discipline or at-risk behaviors increased as students were promoted to upper grades (i.e., middle school).

Table 12

Total Number of Students Placed in Drop-Out Prevention Programs for the 1990-91 through 1997-98 School Years

	No Asthma		Asthma	
	Placed <i>N (%)</i>	Not placed <i>N (%)</i>	Placed <i>N (%)</i>	Not placed <i>N (%)</i>
1992-93	4 (1.20)	346 (98.8)	29 (9.70)	267 (90.3)
1993-94	24 (6.80)	326 (93.2)	23 (7.70)	273 (92.3)
1994-95	29 (8.30)	321 (91.7)	36 (12.2)	260 (87.8)
1995-96	41 (11.9)	318 (90.9)	29 (9.70)	267 (90.3)
1996-97	--	--	--	--
1997-98	41 (11.8)	309 (88.2)	24 (8.10)	272 (91.9)

Note. Dashes indicate that data were not obtained.

Table 13

Results of Chi-Square Analyses for Placement in Drop-Out Prevention Programs for the 1992-93 through 1997-98 School Years

	χ^2	<i>df</i>	<i>p</i>
1992-93	5.06	4	.28
1993-94	2.83	4	.59
1994-95	7.35	5	.19
1995-96	7.96	8	.44
1996-97	--	--	--
1997-98	11.44	9	.25

Note. Dashes indicate that data were not obtained.

Question V: Do children with asthma receive disciplinary referrals significantly more than children without asthma during the elementary and middle school levels?

Independent *t*-tests were conducted to test differences in the number of disciplinary referrals for children with and without asthma. As seen in Table 14, there

were no significant differences between children with and without asthma in the total number of disciplinary referrals received.

Table 14

Means and Standard Deviations for Number of Disciplinary Referrals Received During the 1989-90 through 1997-98 School Years

	No Asthma		Asthma		<i>t</i>	<i>p</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
1989-90 (n = 38)	2.78	3.38	1.67	1.11	1.23	.227
1990-91 (n = 43)	2.10	2.38	1.69	1.55	0.67	.508
1991-92 (n = 48)	2.13	1.90	2.08	1.59	0.08	.935
1992-93 (n = 60)	2.14	1.85	2.56	2.22	-0.79	.431
1993-94 (n = 62)	2.41	1.78	2.30	1.75	0.24	.813
1994-95 (n = 67)	2.55	2.20	2.39	1.99	0.31	.761
1995-96 (n = 252)	5.73	6.71	5.21	5.58	0.67	.501
1996-97 (n = 245)	6.46	6.79	5.60	7.03	1.04	.297
1997-98 (n = 299)	7.11	9.10	6.70	7.94	0.42	.678

Question VI: Are children with asthma suspended significantly more days than children without asthma during the elementary and middle school levels?

Independent *t*-tests were conducted to test differences in the number of total days suspended per year for children with and without asthma. An independent *t*-test could not be completed for the 1989-90 school year because no variability was present due to the small number of cases ($N = 7$). As seen in Table 15, no significant differences were found between the two groups on the number of days suspended each year.

Table 15

Means and Standard Deviations for Number of Days Suspended During the 1990-91 through 1997-98 School Years

	No Asthma		Asthma		<i>t</i>	<i>p</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
1990-91 (n = 12)	2.00	1.00	1.60	.894	0.71	.493
1991-92 (n = 21)	2.00	1.84	1.70	.823	0.47	.642
1992-93 (n = 29)	1.69	1.19	1.62	1.66	0.14	.893
1993-94 (n = 32)	1.82	1.02	1.87	1.19	-0.11	.912
1994-95 (n = 25)	1.50	.905	1.85	1.35	-0.75	.462
1995-96 (n = 174)	3.78	4.21	3.87	4.07	-0.13	.895
1996-97 (n = 212)	5.03	4.63	3.91	3.93	1.89	.061
1997-98 (n = 192)	3.69	3.35	3.40	3.04	0.64	.521

Question VII: Do teachers' perceptions of students differ significantly for children with asthma compared to children without asthma during the elementary and middle school levels?

The teacher perception items were first recoded in order to ensure that they would be scaled consistently. The three individual teacher perception items were combined to form the teacher perception domain for each year. Next, reliability analyses were computed for the combined teacher perception domains for each year ranging from 1990-91 through 1994-95. The standardized alpha was utilized when interpreting the reliability of these domains. As seen in Table 16, the reliability coefficients for the teacher perception domains for each year were relatively high. Next, independent *t*-tests were run first including all participants and then only including participants who had data for all years within the teacher perception domain. As seen in Table 17, no significant differences were found between the two groups within the teacher perception domain

when analyzing participants with data for each year and scores were within the average range.

Table 16

Values of Cronbach's Alpha for Combinations of Teacher Perception Items for the 1990-91 through 1995-96 School Years

Year	α
1990-91	.797
1991-92	.851
1992-93	.840
1993-94	.828
1994-95	.877
1995-96	.876

Table 17

Means and Standard Deviations for Teacher Perception Domain During the 1990-91 through 1995-96 School Years

	No Asthma		Asthma		<i>t</i>	<i>p</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
1990-91	-.197	.806	-.222	.773	0.25	.801
1991-92	-.189	.871	-.208	.772	0.18	.854
1992-93	-.156	.854	-.138	.837	-0.17	.866
1993-94	-.103	.826	-.097	.828	-0.06	.953
1994-95	-.046	.911	-.015	.900	-0.27	.789
1995-96	-.065	.852	-.209	.879	1.31	.190

Chapter V

Discussion

The present study utilized longitudinal data to determine the differences between the school functioning of children with asthma compared to the school functioning of children without asthma. Additionally, this study was a secondary analysis of data gathered by a large school district. Consequently, these factors made this study both unique and challenging. This study was unique in the sense that a vast amount of information was available to the researcher to analyze. Additionally, variables were able to be examined over a 9-year time span. Few studies are able to follow children this long throughout the educational experience, which made this study a positive contribution to the literature. However, many challenges arose throughout this study. For example, due to the longitudinal nature of this study, the number of participants decreased as children entered middle school. Additionally, due to the nature of a secondary analysis of data, the researcher was unable to assess some important variables or confidently conclude that other factors (such as the diagnosis of another illness) did not play a major role in the results. Nevertheless, the results of this study offer interesting and important findings and guide future research in this vital area.

This study found several significant differences between the two groups in the area of achievement. These differences typically occurred during the beginning elementary school years. However, computed standardized effect sizes were quite low, suggesting a practical difference was not apparent. One explanation for this is the

various methods in which variables have been examined in the past. For example, while some studies have assessed academic achievement by grades or parent input, this study and others that have utilized standardized test scores have found that there is not a strong difference between these groups. This is an important finding because it suggests that the manner in which achievement is assessed can often play a role in the results. For example, it would be helpful to explore other ways to assess academic achievement, such as Curriculum-Based Measurement. Standardized achievement measures are only one way to assess whether children are learning and while these findings were positive for children with asthma, it would be beneficial to assess achievement in other ways.

The other area in which a significant difference was found between the two groups was in the area of special education placement for the 1994-95 school year. It is interesting to consider why there was a significant difference for only one year. It can be hypothesized that services to children with illnesses may have differed that year compared to other years, possibly affecting their success in school and need for special services. It is also important to note that eligibility criteria for special education can change from year to year, which also may have played a role in the difference. Additionally, it should be mentioned that Gifted was included in special education placement. While all other areas within special education placement indicate a need for services due to academic, behavioral, or physical needs, Gifted indicates a need for accelerated instruction. Consequently, it cannot be assumed that special education placement only represents difficulty in school because many of these students were also receiving services through Gifted.

Additionally, no significant difference was found between children with asthma and children without asthma on the variable of grade retention. Again, past studies have often asked parents whether their child was ever retained, while this study utilized student records.

Several areas were examined that have previously not received a great deal of attention from researchers. Placement in drop-out prevention programs, the number of disciplinary referrals and suspensions, and teacher perception were not found to differ for children with asthma when compared to children without asthma. While previous studies have suggested that children with asthma may demonstrate more negative behaviors than their healthy peers, this study did not find a significant difference within the educational setting. These are very positive findings for children with asthma and their families and suggest that children with asthma have the capability to have an overall successful educational experience.

Limitations

When interpreting the results of this study, it will be important to consider the limitations of this research. First, this study is a secondary analysis of existing data. Consequently, the researcher did not have control over the sampling strategy, instrument selection, or the data collection process. Consequently, although it was possible to identify children whose parents identified them as having asthma in kindergarten, it was difficult to clearly define the asthma group and comparison group for the overall study. For example, it was not possible to identify any students who may have developed asthma later in childhood. Additionally, it was not possible to determine if children in either of the groups later developed any chronic illnesses, although it was possible to

determine if they had been hospitalized for various illnesses prior to kindergarten. Not knowing whether other illnesses developed in participants later in the study made the differentiation between the asthma group and the comparison group less clear.

Second, the number of participants in this study decreased as the students entered the middle school level. This was likely due to students moving to another school district. Additionally, some students had missing data related to the dependent variables. For example, a student may have been absent the day the reading portion of the CTBS, resulting in a missing score for that particular participant. These participants were excluded from the analyses examining the variables they were missing.

Third, participants in this study were from one large school district in a southeastern state. Consequently, the results of this study are limited to this specific population and cannot be generalized to the general population. One reason for this is that many counties, school districts, and states differ in the services provided to children with chronic illnesses. Consequently, students with chronic illnesses in other school districts may receive more or less support and opportunities to succeed compared to students within the school district used for this study. Additionally, eligibility for special education services is often defined differently depending on location. For example, the criteria to meet a diagnosis for a Specific Learning Disability differ from state to state. Consequently, a child who qualifies for services in Florida may not qualify for these services in another state, causing the results of this study to only be specific to children in this location.

A fourth major limitation of this study is the inability to assess the number of days absent for each participant. While it was the plan of the researcher to analyze the

difference between the number of days absent for children with asthma and children without asthma, more detailed examination of the data did not allow for this. Due to the lack of absenteeism data, a very crucial variable was excluded from this study. While this may have been more detrimental if significant differences were found between the groups (and analyses would have been conducted to determine if the number of days absent negatively affected these variables), this is still considered a major limitation of the study.

Similarly, a fifth major limitation of this study is the inability to assess the severity level of each child with asthma involved in the study. Many past studies have assessed severity by a combination of the number of school absences, number of hospitalizations for asthma, type and dosage of medication, and parent ratings. For example, Huberty, Austin, Huster, and Dunn (2000) explored changes in asthmatic condition severity in relation to numerous variables. Results showed that change in condition severity was significantly related to changes in overall academic performance, how well the child was learning, appropriate behavior, and total adaptive functioning. Similarly, in a study examining behavior problems and asthma severity, it was found that children classified with a high level of asthma symptoms were more than twice as likely to experience behavior problems than children classified with a low level of asthma symptoms (Butz et al., 1995). The information available in the database used in this study did not permit accurate measurement of severity. Consequently, children with very mild asthma to very severe asthma were included in the asthma group.

A sixth major limitation of this study is the inability to assess the exact age of onset of asthma. The age of asthma onset has been found to significantly affect

behavioral adjustment in children. For example, past research has shown that children who had an early onset of asthma (by 3 years of age) had significantly more behavior problems at age 4 than children who developed asthma later (between 3 and 6 years of age) (Mrazek, Schuman, & Klinnert, 1998). Some of the behavior problems children with early asthma onset experienced included waking at night, depressed mood, and some indication of increased fearfulness (Mrazek, Schuman, & Klinnert, 1998). Due to the nature of this secondary analysis, age of onset was not explored.

Finally, the type of treatment participants were receiving for their asthma also was not assessed due to this being a secondary analysis of data. This is a limitation because various studies have shown that some medications used to treat asthma may have negative side effects related to the educational experience. For example, beta-agonists, one of the most commonly used treatments for children with asthma, have been shown to slightly impede fine motor skills, such as writing and drawing, immediately after being inhaled. However, this side effect often diminishes within 30 minutes for most children (Bender, 1999). Corticosteroids, the single most powerful agent used to fight bronchial inflammation, have been reported to increase anxiety and depressive feelings in children. Additionally, subtle neurocognitive changes also have been detected in children with asthma receiving steroids. For example, scores on tests of verbal and visual memory have been found to drop significantly during periods of high dose steroid treatment (Bender, Lerner, & Polland, 1991). However, these effects were absent one day after the cessation of steroid treatment (Seuss, Stump, Chai, & Kalisker, 1986). Other medications used to treat asthma, such as antihistamines and theophylline, have also been found to

have some negative side effects on school performance, such as drowsiness and hyperactivity (Celano & Geller, 1993).

Contributions to the Literature

Due to the recent advances in the fields of medical technology and health care, students with chronic illnesses such as asthma have been given the opportunity to participate in an increased number of activities related to childhood, such as school. This is a very positive advancement for children who often struggle to have their medical needs met. However, a gap in the research related to children with chronic illnesses currently exists. While there are a significant amount of studies examining the psychological and social functioning of children with asthma, very few explore the educational experiences of these children. Additionally, no known studies have examined the educational experiences of this population of students longitudinally. This study addresses the gap in the research by examining the educational experience of children with asthma through multiple methods, such as standardized test results, review of student records, and surveys. This study also utilized multiple sources, such as teachers and parents. The longitudinal nature of the study allowed for examination of the entire educational experience of these students and how they compare to children without any diagnosed chronic illnesses.

This study is not only a contribution to the field of school psychology, but it will also aid parents, teachers, students, and educational professionals in understanding the possible educational outcomes for students with asthma and the areas where interventions need to be implemented. While this study found that the functioning of children with asthma appears to be commensurate to that of children without asthma, additional

research is needed in other areas related to the educational experience, such as peer interactions, participation in extracurricular activities, and leadership skills. Additionally, future research is needed to examine children at other grade levels, such as pre-kindergarten and high school. It would also be highly beneficial to examine children with illnesses in a more qualitative manner, due to the variability of this illness, and assess achievement in other manners, such as Curriculum-Based Measurement. Each child who enters school is entitled to a positive educational experience and researchers must continue to examine the possible effects not only asthma, but other chronic illness can have on this experience.

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