2013

Using Structural Equation Modeling

Lara Jane Kaplan Goodrich
University of Rhode Island, larajane@comcast.net

USING STRUCTURAL EQUATION MODELING

TO UNDERSTAND ACCULTURATIVE STRESS AND PEDIATRIC ASTHMA

IN A LATINO SAMPLE

BY

LARA JANE KAPLAN GOODRICH

A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE

REQUIREMENTS FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

IN

CLINICAL PSYCHOLOGY

UNIVERSITY OF RHODE ISLAND

2013

DOCTOR OF PHILOSOPHY DISSERTATION

OF

LARA JANE KAPLAN GOODRICH

APPROVED:

Dissertation Committee:

Major Professor	Ellen Flannery-Schroeder
	Andrea Paiva
	Leslie Mahler
	Nasser H. Zawia DEAN OF THE GRADUATE SCHOOL

UNIVERSITY OF RHODE ISLAND

2013

Abstract

The present study aimed to further explore the established relationship between acculturative stress and diminished pediatric asthma outcomes in Latino populations. Three psychosocial variables related to pediatric asthma outcomes were predicted to mediate this relationship. Secondary data on pediatric asthma outcomes were analyzed using Structural Equation Modeling path analyses. Study results did not support the hypothesized mediating effect of the psychosocial variables. Rather, post hoc analyses indicated that the psychosocial variables moderated the relationship between acculturative stress and pediatric asthma outcomes. The significance of these findings in relation to pediatric asthma vulnerability and pediatric asthma interventions is discussed, and methodological recommendations are suggested for future research.

Acknowledgements

I am incredibly thankful to several people for contributing their intellect and support throughout my entire dissertation experience.

Ellen Flannery-Schroeder, Ph.D., Leslie Mahler, Ph.D.,

Andrea Paiva, Ph.D., and Elizabeth McQuaid, Ph.D.:

For generously providing their time, insight, and moral support as dissertation committee members, professional colleagues, and mentors.

Leslie Brick:

For helping me tackle SEM with clarity and humor.

My Family:

For always cheering me on.

My Husband, Danny:

For traveling this journey with me, and for being incredible while doing so.

This document is dedicated to:

Elizabeth McQuaid, Ph.D., and the Childhood Asthma Research Program

At Rhode Island Hospital's Bradley Hasbro Research Center

Providence, Rhode Island

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Introduction

Statement of the Problem

Over 10 million children living in the United States have been diagnosed with asthma, a lifelong disease characterized by chronic inflammation in the lungs resulting in wheezing, coughing, shortness of breath and chest tightness (Centers for Disease Control, 2010). A startling reality is that poor children, urban children, and children of racial and ethnic minority status disproportionately struggle with symptoms of asthma, medication adherence, and asthma care (Please see Appendix A; CDC, 2005; Halfon & Newacheck, 1993; Koinis-Mitchell et al. 2007; McQuaid, Kopel, Klein, & Fritz, 2003; MMWR, 2000). Specifically, Latino children are at high risk for developing asthma due to poverty (e.g., Canino, Koinis-Mitchell, Ortega, McQuaid, Fritz, & Alegria, 2006), environmental exposures (e.g., Findley, Lawler, Bindra, Maggio, Penachio, & Maylahn, 2003), and cultural factors (e.g., Lara, Morgenstern, Duan, & Brook, 2005). Since Latino children and adolescents are among the fastest growing populations in the United States (US Census Bureau, 2000, 2003 & 2004; Vega, Rodriguez, & Gruskin, 2009), there is a great need to increase knowledge about factors that impact the development and course of asthma in Latino children.

Justification for and Significance of the Study

Pediatric asthma has been a growing health concern in the United States for several decades and has been identified as a leading chronic childhood disease in the United States (Akinbami, 2006). A 2009 United States National Health Survey reported that over 10 million children under the age of 17, or approximately 14% of the nation's population, had been diagnosed with asthma at some point in their lives (Centers for Disease Control, 2010). Studies have shown that children with asthma may experience physical, psychological and social effects of the disease. Asthmatic lungs and lung airways are overly responsive to irritants and allergens, are exceptionally sensitive to inflammation and muscle constriction, and are prone to mucous production and blocked airflow (National Asthma Education and Prevention Program, 2007). These complications cause various symptoms such as coughing, wheezing, shortness of breath or difficulty breathing, and chest discomfort (Centers for Disease Control, 2010). The term "asthma attack" describes the onset of several asthma symptoms at once, and severe asthma attacks may result in respiratory arrests, seizures, and intubation. Triggers for asthma symptoms include allergens (e.g., dust, food, pollen, pets, cockroach waste), irritants (e.g., cigarette smoke, perfumes, pollutions, cleaners), and other stimuli (e.g., respiratory infections or colds, seasonal changes, strong emotions, stress, exercise) (National Asthma Education and Prevention Program, 2007).

While many children diagnosed with asthma adjust to and manage their disease well, some studies have suggested that asthma puts some children at greater psychosocial risk. For example, asthma appears to put children at greater risk for internalizing symptoms (Feldman, Ortega, McQuaid, & Canino, 2006; Goodwin, Fergusson, & Horwood, 2004; Katon, Lazano, Russo, McCauley, Richardson, & Bush, 2007). Furthermore, early studies have noted that self-esteem and other psychological adjustment variables (Pless, 1974; Pless & Pinkerton, 1975) as well as sleep patterns (Freudenberg, Feldman, Clark, Millman, Velle, & Wasilewski, 1980; Parcel, Gilman, Nader, & Bunce, 1979; Wasilewski, Clark, & Evans, 1988) may be negatively affected by pediatric asthma. Pediatric asthma may also be a source of stress for parents, siblings, and other family members related to the affected child (Wasilewski, Clark, & Evans, 1988; Yawn, 2003). Pediatric asthma has been shown to adversely affect school attendance and performance (Freudenberg, Feldman, Clark, Millman, Velle, & Wasilewski, 1980; Parcel, Gilman, Nader, & Bunce, 1979; Pless, 1974; Pless & Pinkerton, 1975; Wasilewski, Clark, &

Evans, 1988) and some asthma triggers such as strong emotions, exercise and other physical activity may cause difficulties in certain social situations (e.g., playing sports, running, and other lively peer interactions).

Factors affecting pediatric asthma. Although asthma outcomes vary somewhat by age and gender (please see Appendix B), literature has focused primarily on asthma outcomes related to physical, psychological, and social well-being which are influenced by health care, familial factors, asthma management and self-efficacy, poverty, ethnicity, and culture. Such factors include having limited access to preventive asthma care and asthma specialists, limited health literacy (Canino, McQuaid, & Rand, 2009), and limited access to sources for asthma education (Evans, 1992). Familial factors also contribute to pediatric asthma outcomes including maternal asthma (Litonjua, Carey, Burge, Weiss, & Gold, 1998; Martinez, Wright, Taussig, Holbert, Halonen, & Morgan, 1995), young maternal age, poor prenatal care and low birth-weight (Oliveti, Kercsmar, & Redline, 1996; Sears, Holdaway, Flannery, Herbison, & Silva, 1996; Weitzman & Gortmaker, 1990). Additionally, several studies have found that parental stress is associated with increased asthma diagnoses and overall asthma prevalence, and may also effect child asthma management (Busse, Kiecolt-Glazer, Coe, Martin, Weiss, & Parker, 1995; Kozyrskyj, Mai, McEwen & Stellar, 1993; McGrath, Hayglass, Becker, & Macneil, 2008; Sandberg, Paton, & Ahola, 2000; Shalowitz, Berry, Quinn, & Wolf, 2001).

Effective asthma management strategies, and self-efficacy to manage symptoms, also contribute to pediatric asthma outcomes. Asthma management includes partnering and communicating effectively with a physician (Clark et al., 1999), adhering to medication, avoiding environmental triggers, monitoring asthma symptoms, and having control of asthma (National Heart Lung and Blood Institute, 2002; Thoonan et al, 2003). Effective asthma management is important for having fewer episodes of asthma symptoms and less health service utilization (Clark & Nothwehr, 1997). Self-efficacy, or an individual's personal belief that he or she can successfully complete tasks in certain situations (Clark & Zimmerman, 1990), is also documented as a strong predictor of asthma outcomes. It has been suggested that low-income individuals who are depressed also have lower levels of self-efficacy, which may result in less capability to cope with asthma, lower medication adherence, more reliance on health services, more functional impairment, more prevalent asthma episodes, and less use of preventive health care (Brinke, Ouwerkerk, Zwinderman, Spinhoven, & Bel, 2001; McCauley, Katon, Russo, Richardson, & Lozano, 2007; Opolski & Wilson, 2005).

Furthermore, studies suggest that low socio-economic standing and minority status also contribute to undesirable asthma outcomes. A recent report released by the Center for Disease Control reported that children of poor economic standing experience more frequent symptoms of asthma (Zahran, Bailey, & Garbe, 2011). Additionally, children living in urban, low-income communities are at higher risk for asthma morbidity and hospitalizations (Aligne, Auinger, Byrd, & Weitzman, 2002; Nelson, Johnson, Divine, Strauchman, Joseph, & Ownby, 1997; Kattan et al., 1997), for being exposed to multiple indoor and environmental triggers (Crain et al., 2002; Kattan et al., 1997; Nelson, Johnson, Divine, Strauchman, Joseph, & Ownby, 1997; Morgan et al., 2004), and for having more exposure to urban-living stressors such as violence, high crime rates, and poverty (Cabana et al., 2004; Koinis-Mitchell, Murdock, & McQuaid, 2004; Wright et al., 2004). Furthermore, ethnic minority children who live in urban environments demonstrate higher rates of non-preventive, emergency care utilization (Celano, Gellar, Phillips, & Ziman, 1998; Diaz et al., 2000; Rand, Butz, Kolodner, Huss, Eggleston, & Malveaux, 2000). Minority status has also been found to be negatively associated with asthma medication adherence, even when controlling for socio-economic status (McQuaid, Kopel, Klein, & Fritz, 2003).

Pediatric Asthma Among Latinos. Increasing research on pediatric asthma has focused on health outcomes in Latino populations, given the high prevalence rates and disproportionate morbidity (Lara, Akinbami, Flores, & Morgenstern, 2006). Latino subgroups include, but are not limited to, those of Mexican, Puerto Rican, Cuban, or Dominican descent. Among Latinos, asthma prevalence varies by ethnic subgroup. As a population, Puerto Rican children experience the highest rate of childhood asthma (19.2%), more so than any other population based on race and ethnicity (CDC Data Report #381, 2006). Latino children are among the fastest growing populations in the United States (US Census Bureau, 2000, 2003 & 2004; Vega, Rodriguez, & Gruskin, 2009), and Latino health is affected by unique factors that may contribute to asthma outcomes.

Factors affecting Latino pediatric asthma. One factor that may contribute to the varying rates of pediatric asthma across Latino populations may be genetic predisposition. Over one-hundred genes have been identified as associated with asthma (Drake, Galanter, & Burchard, 2009), and studies have shown that genetic predisposition may contribute to the high prevalence of asthma in Puerto Ricans (Lara, Morgenstern, Duan, & Brooke, 1999). This evidence may play a role in disparities in prevalence between Latino and non-Latino White populations as well as disparities between Latino subgroups, such as those documented between Puerto Rican and Mexican children with asthma (Canino, Koinis-Mitchell, Ortega, McQuaid, Fritz, & Alegria, 2006). For example, an early study by Ledogar et al. (2000) found that Puerto Ricans living in specific areas of Brooklyn, New York, had more asthma diagnoses than Dominicans and other Latino subgroups living in the same homes and on the same streets in Brooklyn. Furthermore, a study by Burchard et al. (2003) investigated asthma disparities between Puerto Ricans and Mexicans by recruiting participants from New York, San Francisco, Puerto Rico, and Mexico and measuring their asthma symptoms and functioning and physiological response to bronchodilators. The results of this study found that Puerto Ricans had more severe asthma symptoms and more impaired lung function compared to Mexicans. The study also indicated that bronchodilators, the most commonly used quick-relief medication for asthma, were less effective in Puerto Rican populations compared to Mexican populations (Burchard et al., 2003). A later study by Choudhry et al. (2004) also indicated that there may be a genetic basis for differences in asthma severity and physiological responses to bronchodilator medications between Puerto Ricans and Mexicans with asthma.

Environmental factors may also contribute to pediatric asthma in the Latino population. Approximately 22% of Latinos live in poverty compared to 10% of non-Latino Whites (Ramirez, 2004). Poverty is especially detrimental to health outcomes because it is characterized by simultaneous exposure to multiple physical and psychological stressors, and possibly repeated over time (Evans & English, 2002; Lengua, 2002). Furthermore, poor neighborhoods are more susceptible to indoor and outdoor pollutants and stressors related to impoverished living (Canino, Koinis-Mitchell, Ortega, McQuaid, Fritz, & Alegria, 2006). A large study focusing on Puerto Rican children living in New York (Findley, Lawler, Bindra, Maggio, Penachio, & Maylahn, 2003) found that they were more likely to be exposed to environmental triggers in their home than other children. Puerto Ricans have been documented as having the second highest rate of cigarette smoking (CDC, 1998), and Puerto Rican children are more sensitized to outdoor allergens than other groups (Celedon, Sredl, Weiss, Pisarski, Wakefield, & Cloutier, 2004). Additionally, asthma among Latino children is associated with higher rates of morbidity, less use of preventive medications, more hospital and urgent care visits (Boudreaux, Emond, Clark, & Camargo, 2003; Carter-Pokras & Gergen, 1993; Finkelstein et al., 1995; Lieu et al., 2002; Ortega, Gergen, Paltiel, Bauchner, Belanger, & Leaderer, 2002), and more absent days from school or work (Canino, Koinis- Mitchell, Ortega, McQuaid, Fritz, & Alegria, 2006; Haselkorn, Lee, Mink, & Weiss, 2008; Lieu et al., 2002). Furthermore, it has been suggested that Latinos are more likely to live in areas with levels of toxic pollutants that exceed federal standards (Wernette & Nieves, 1992).

Asthma management may also play an influential role in asthma outcomes in Latino children. Generally, studies show that minority populations are less adherent to using controller medications, which are taken daily to prevent symptoms, (Apter, Reisine, Affleck, Barrows, & ZuWallack, 1998; Bender et al., 2000; McQuaid, Kopel, Klein, & Fritz, 2003). Specifically, Latinos' negative beliefs about medication, such as inhaled steroids, may prevent use or decrease use of prescribed asthma medications (Canino, McQuaid, & Rand, 2009), and medications may be used in a less timely fashion due to cultural beliefs and home remedies (Canino, Koinis-Mitchell, Ortega, McQuaid, Fritz, & Alegria, 2006). Such beliefs may impede knowledge acquisition about asthma and negatively affect relationships with health care providers. (Flores, 2000).

A study by Lavoie et al. (2008) found that higher levels of asthma self-efficacy, or confidence in one's ability to control asthma symptoms, were associated with higher levels of asthma control and enhanced quality of life in adults living with asthma. As stated earlier, self-efficacy is documented as a strong predictor of many preferred health outcomes (Clark et al., 1988; Strecher, DeVellis, Becker, & Rosenstock, 1986), and studies have suggested that self-efficacy may be a contributor to asthma outcomes in Latino children. A study of 139 low-income, minority children with asthma found that low levels of parental self-efficacy were associated with undesirable asthma outcomes, such as missing days of school (Grus et al., 2001).

Another factor that may contribute to pediatric asthma morbidity in the Latino population is acculturative stress. The term "acculturative stress" recognizes that the experience of adapting to a foreign society, or "acculturation," can either cause or exacerbate mental health (Fennelly, 2006; Lara et al., 2005) and physical health problems (Feldman, Ortega, Koinis-Mitchell, Kuo, & Canino, 2010; Klinnert, Price, Liu, & Robinson, 2002; Koinis-Mitchell et al., 2010; Lara et al., 2005). Acculturation has been documented to have a negative impact on Latino health in the United States (Lara et al., 2005) perhaps due to the "distress that is associated with pressure to assimilate and accept new cultural values and beliefs" (Feldman, Ortega, Koinis-Mitchell, Kuo, & Canino, 2010). Examples of such stress may include, but are not limited to, depression, job loss, unemployment or underemployment, social or geographic isolation, language barriers or changes in language use, discrimination, and possible changes in attitude, cognitive style, personality, and identity (Martin, Shalowitz, Mijanovich, Clark-Kauffman, Perez, & Berry, 2007).

Acculturative stress, Latinos, and pediatric asthma. Acculturation is closely linked to overall health outcomes in the United States, and is related to Latino health including pediatric asthma. An individual's level of acculturation can be measured in various ways. For example, one's proficiency in the English language, country of origin, and time spent living in the U.S.A. are particular measures of acculturation that have been used (Fennelly, 2006). Characteristics of low acculturation may include speaking English as a second language, being born outside the United States, and living in the United States for a short period of time (Martin, Shalowitz, Mijanovich, Clark-Kauffman, Perez, & Berry, 2007). In contrast, characteristics of high acculturation may include English fluency and extended residency within the United States. Understanding that acculturative stress may accompany the acculturation process clarifies why low-acculturated Latinos (i.e., those who are less integrated with American society and presumably experience less acculturative stress) demonstrate more desirable health outcomes such as lower infant mortality and higher life expectancy, more regular immunizations, lower mortality from cardiovascular disease and cancer, and less drug use (Anderson, Wood, & Sherbourne, 1997; Balcazar & Krull, 1999; Collins & Martin, 1998; Flores & Brotanek, 2005; Markides & Coreil, 1986; Martin, Shalowitz, Mijanovich, Clark-Kauffman, Perez, & Berry, 2007; Prislen, Suarez, Simpson, & Dyer, 1998). It has been suggested that the experience of acculturation may also be linked to the risk of poor asthma outcomes in the United States (Drake, Galanter, & Burchard, 2009; Solis, Marks, Garcia, & Shelton, 1990). Families who are not acculturated to American culture or American healthcare may experience acculturative stress for several reasons when seeking care for their child's asthma. For example, these families may have to navigate an entirely new healthcare system, communicate with new doctors, and learn new healthcare practices such as the importance of taking prescription medications. Many of these tasks are closely related to effective asthma management, and thus the experience of acculturation during these tasks may compromise the acquisition of asthma management skills and later outcomes.

Linking acculturative stress, asthma management and efficacy, and asthma outcomes. Research suggests that acculturative stress may have a negative impact on pediatric asthma in Latino populations. Genetic predispositions, poverty, environmental exposures, and low levels of asthma management and efficacy are factors that contribute to the high rates of pediatric asthma in Latino populations. Existing literature, however, has not yet investigated whether the relationship between acculturative stress and poor asthma outcomes is direct and uninfluenced by factors such as genetics, poverty, environment, and asthma management and efficacy, or if the relationship between acculturative stress and asthma outcomes is mitigated by some or all of these factors. Although it is known that these factors may contribute to high rates of pediatric asthma in Latino populations, factors such as genetics and impoverished living are likely unchangeable or difficult to modify when attempting to improve asthma outcomes. Asthma management and self efficacy, though, have been successfully modified through interventions over the past two decades to yield improved asthma outcomes (e.g., Bryce, Neville, Crombie, Clark, & McKenzie, 1995; Krieger, Takaro, Song & Weaver, 2005; Lieberman, 2000; Mayo, Richman, & Harris, 1990; Rubin et al., 1986).

The present study aimed to evaluate self efficacy and asthma management as mediators of acculturative stress and asthma outcomes in Latino children. Additionally, the present study considered the mediating influence of other factors related to asthma management and efficacy, such as knowledge about asthma and beliefs about asthma medicine, to further understand the mechanisms that underlie the relationship between acculturative stress and asthma outcomes. The study also considered the influence of relevant demographic factors such as annual income, parent origin, the child gender, child age, and child grade in school. Gaining a better methodological understanding of these relationships may provide health care professionals with useful data that inform effective, targeted intervention strategies to improve asthma outcomes in the face of acculturative stress. The following hypotheses were made:

- The relationship between acculturative stress and asthma outcomes is not simply direct and linear, but is instead mediated by additional variables that account for asthma outcomes.

- A mediation path model will acceptably "fit" the data and describe the indirect relationship between these variables. This tested model will provide a better "fit" for the data than the independence model (e.g., the algorithm created by the statistical software which assumes that each variable is independent from the other).
- Self efficacy and management of asthma symptoms will mediate the relationship between acculturative stress and asthma outcomes.
- Having knowledge about asthma and having a positive perception of asthma medication will also mediate the relationship between acculturative stress and asthma.

Methods

The present study was a secondary analysis using data collected from Project ACE (Asthma Controlled Effectively) asthma education intervention (R01 NR08524, E. McQuaid, PI). Project ACE was a randomized, controlled trial aimed at improving medication adherence among Latino and African American children with persistent asthma. Project ACE was conducted by the Childhood Asthma Research Program at the Bradley/Hasbro Children's Research Center of Rhode Island Hospital. For additional information on Project ACE, please see Appendix C.

Participants

Parents in Project ACE (N=230) were of African American or Latino ethnicity, spoke English and/or Spanish, and had a child (infant through age 18) diagnosed with asthma. For more information on participant ethnicity and multicultural considerations in research, please see Appendix D. Each parent/child pair was counted as one participant (n=1). The present study limited analyses to data reported by Latino parents (N=205). Of these parents, 6.8% reported that they were born in the United States (n=14); 22% reported being born in Puerto Rico (n=45); 36.6% reported being born in the Dominican Republic (n=75); 33% reported "other" (n=68); and 1.5% did not report their birth origin (missing data; n=3). The majority of parents (61%; n=125) reported their race as "other," 23.4% reported their race as White Latino (n=48), 6.8% reported their race as Black Latino (n=14), 2.9% reported their race as Mulatto[1] (n=6), 2.9% reported their race as Criollo[2] (n=6), and 0.5% reported their race as African American (n=1). The mean annual income reported (N = 187) was $18,231 with a reported range of $224 to $69,999. All parent participants also reported their primary language, with the majority of parents (84.4%;

[1] **Mulatto** is a term used to refer to a person who is born from one white parent and one black parent, or more broadly, a person of mixed black and white ancestry.
[2] In some Latin American countries, the term **Criollo** is used to describe people from particular regions, such as the countryside or mountain areas.

n=173) citing Spanish as their primary language. The remaining parents reported English as their primary language.

The percentage of racial variation across Latino child participants, according to parent report, was almost identical to the racial variation across Latino parent participants listed above. The majority of child participants (57.6%; n=118) were male; one participant (missing data; n=1) did not report his/her gender. The majority of child participants (52%; n=107) were between the ages of 8 and 18. Specifically, 65 children were ages five years-old or under, 81 children were between the ages of six and 10 years-old, 51 children were between the ages of 11 and 15 years-old, and 8 children were between the ages of 16 and 18 years-old. For more information on pediatric asthma variations by age and gender, please see Appendix B. According to Physician Ratings of Asthma Severity (which were collected from chart reviews), 6.3% (n=13) of children were classified as having intermittent asthma, 58% (n=119) were classified as having persistent mild asthma, 25.9% (n=53) were classified as having persistent moderate asthma, and 2.9% (n=6) were classified as having persistent severe asthma. Physician Ratings of Asthma Severity were unreported or missing for 6.8% (n=14) of the participating Latino children.

Procedure

Recruitment. Recruitment for Project ACE took place between August, 2005 and April, 2009. Families who were potentially eligible for Project ACE were identified through IRB-approved recruitment strategies at five local, federally-qualified, Providence Community Health Centers (PCHC). The Childhood Asthma Research Program or PCHC staff contacted these families by phone or in person during a clinic visit, and parents voluntarily completed a screening form to determine their eligibility for Project ACE. Participant eligibility was based on ethnicity (parents of Latino or African American ethnicity were eligible), primary language (parents who spoke English and/or Spanish were eligible), and child asthma diagnosis (parents with a child diagnosed with asthma by a physician were eligible). Project ACE was a randomized, controlled trial to improve medication adherence, thus it was necessary that eligible children were also prescribed a daily medication to control asthma symptoms.

Baseline session. All families that were enrolled in Project ACE completed a baseline session. During the baseline session families were informed of study policies and procedures under Rhode Island Hospital and HIPAA regulations, and provided informed consent and child assent. They completed questionnaires on family demographics, family functioning, and asthma to evaluate pre-intervention effects. These included measures of asthma management, self efficacy, environmental factors, cultural stress, and beliefs about medicine. Parents were the primary informants in Project ACE and provided data on their child's asthma if the child was younger than 8-years-old. Children 8-years-old or older provided data about their asthma on selected measures. These measures were read to the participants in English or Spanish, based on language preference, by a Project ACE research assistant during the baseline session. Each participant was assigned a research code for tracking and recording data throughout Project ACE. These codes de-identified participant data and information and eliminated the potential for participant identification. Participants received $25 for their participation in the baseline session.

The Project ACE baseline sessions were followed by three intervention sessions that provided participants with asthma education and, for those randomized to active treatment, a behavioral intervention to increase medication adherence. Data were collected again at the end of treatment and during follow-up sessions at three, six, nine, and twelve months post-treatment to evaluate post-intervention effects. These post-treatment data were not analyzed in the present study.

Measures. The present study analyzed Project ACE baseline data collected from parent participants (for more information on the decision to use parent data, see Appendix E). Data were gathered from the following demographic questionnaire, physician rating measure, and self-report measures. Measures are described here and summarized in Table 1.

*Demographic Questionnaire***.** This self-report questionnaire collected information on parent and child demographics such as race, ethnicity, primary language, and age. It was administered during the baseline sessions of Project ACE.

*Physician Ratings of Asthma Severity***.** Physician ratings of asthma severity were obtained through chart reviews of medical files belonging to the child participants. The National Heart, Lung and Blood Institute (National Asthma Education and Prevention Program, 2007) defines severity as the intrinsic intensity of a disease, and the Expert Panel Report 3 (National Asthma Education and Prevention Program, 2007) advises physicians to classify asthma severity from 1-4, specified as intermittent, mild persistent, moderate persistent, or severe persistent. A patient's asthma severity is classified as such based on spirometry data and patient report of symptoms during the previous two to four weeks (NHLBI EPR-3, 2007). The physician ratings used in the Project ACE chart review follow these standards put forth by NHLBI Expert Panel Report 3 (2007) guidelines.

SAFE Acculturative Stress Scale. The SAFE Acculturative Stress Scale (SAFE; Fuertes & Westbrook, 1996) is a 26-item, Likert-scale measure used to assess parent levels of perceived acculturative stress in social, attitudinal, familial, and environmental contexts, as well as perceived discrimination toward immigrant populations. Each item was scaled ranging from 1 (Not stressful) to 5 (Extremely stressful). Items that were "not applicable" were skipped and scored as 0 and individual total scores were prorated to reflect possible skipped items. Possible total scores for the SAFE ranged from 0 to 130, in which higher scores represented higher levels of perceived acculturative stress. This scale was deemed a reliable measure of acculturative stress with a heterogeneous group of Hispanic Americans (alpha=0.89; Fuertes and Westbrook, 1996). This scale was administered during the baseline session.

Asthma Self Efficacy Scale. The Asthma Self Efficacy Scale (Bursch, et al., 1999), which includes Attack Management and Attack Prevention subscales, is a 13-item, Likert-scale measure used to assess perceived parent management and self-efficacy surrounding child asthma care in various domains such as medication use, physician relationship, avoidance of triggers, and prevention. Items were scored ranging from 1 (Not at all sure) to 5 (Completely sure). A summary score was calculated by taking a mean of all items, with total scores ranging 1-5. Higher scores reflected greater perceived self-efficacy. This measure showed reliability and consistency (Cronbach alpha of .87; Bursch, et al., 1999). In relation to the Project ACE Latino data, both the Attack Management subscale (alpha=.60), Attack Prevention subscale (alpha=.71), and Total Score (alpha=.77) had fair internal consistency with data provided by Spanish-speaking participants (who comprised the majority of participants). Similar alphas were found for English-speaking Latino participants (Attack Management, .77; Attack Prevention, .70; Total Score, .84). This scale was administered during the baseline session.

Asthma Knowledge Scale. A 10-item self-report measure was used to assess the parent's basic factual knowledge regarding asthma. The measure is a combination of true/false questions and free response items. Points were given for each correct response, and a total percentage correct score was derived ranging from 0-10. This scale was adapted from another measure that had been used extensively in prior studies (Fitzclarence and Henry, 1990). This Asthma Knowledge Scale showed moderate reliability across both English and Spanish speaking parents enrolled in Project ACE (English alpha=.53; Spanish alpha=.51). This scale was administered during the second session of Project ACE. Fewer participants completed this scale compared to measures that were administered during the baseline session due to participant attrition.

Beliefs About Medicine Questionnaire. A 10-item Likert-scale self-report measure was used to assess parental concerns and beliefs about the necessity of asthma medications. The measure comprised two five-item scales assessing beliefs about the necessity of medication for controlling illness and concerns about taking the medication. The differential score of these two scales was used in the present study, with differential scores ranging from -26 to 14. Positive scores suggested a perception that the benefits of taking medication outweighed the risks of taking medication, and vice versa. This measure has been previously used in studies of parents of children with asthma (Horne and Weinman, 1999). This scale showed moderate reliability across both English and Spanish speaking parents enrolled in Project ACE, and reliability analyses were run for both subscales (English necessity score alpha=.74, English concerns score alpha=.64; Spanish necessity score alpha=.70, Spanish concerns score alpha=.70). This scale was administered during the second sessions of Project ACE. Fewer participants completed this scale compared to measures that were administered during the baseline session due to participant attrition.

Asthma Quality of Life Questionnaire. The Parent Asthma Quality of Life Questionnaire (PAQLQ; Juniper et al., 1998) is a 13-item, Likert-scale measure used to assess the physical, emotional, and social problems that were troublesome to a child with asthma within the past two weeks. Mean scores from four, equally weighed domains (activity limitation, symptoms, emotional function, and exposure to environmental stimuli) are used to generate an overall quality of life score. Overall scores range from 1-7, in which lower overall scores represent higher quality of life and higher overall scores represent lower quality of life (e.g., this variable was reverse-coded). This scale was found to have strong reliability (intraclass correlation coefficients=.95, .96) and comparably strong validity (Juniper et al., 1999). This scale was administered during the baseline session.

Asthma Functional Severity Scale. Six Likert-scale items were used from the Asthma Functional Severity Scale (AFSS; Rosier et al., 1994) to assess asthma functional severity, or asthma control, of participants within a four week time-frame. Four components of pediatric asthma morbidity were measured including frequency of episodes, frequency of symptoms between episodes, intensity of impairment during an episode, and intensity of impairment during the intervals between episodes. The functional morbidity index score (total score) was calculated by computing a mean across all completed items, with values ranging from 0-4. Higher values represented higher levels of functional severity or morbidity, or less control. This assessment was validated with a sample of over 10,000 children who had asthma (Rosier et al., 1994). This scale also showed strong reliability across both English and Spanish speaking participants enrolled in Project ACE (English alpha=.86; Spanish alpha=.80) and moderate levels of validity (range r=.22-.35; Rosier et al., 1994). This scale was administered during the baseline sessions of Project ACE.

Results

The present study sought to better understand the functional relationship between Acculturative Stress and Physician Ratings of Asthma Severity (independent constructs) and asthma outcomes (dependent constructs). Asthma outcomes were evaluated by measuring asthma functional severity and asthma quality of life. Structural Equation Modeling (SEM) path analyses. The total score of each construct was used in all analyses. Preliminary analyses were completed prior to structural equation modeling.

Descriptive Statistics. Table 2 summarizes the descriptive statistics of each construct used in the models (see page 64).

Independent Constructs. Physician Ratings of Asthma Severity were provided for most of the study participants (PhysRating; n = 191). Ratings ranged from 1 to 4 (1Intermittent, 2 Mild/Persistent, 3 Moderate/Persistent, 4 Severe/Persistent). Acculturative Stress was analyzed using total scores (AccStress; n = 204) with values ranging from 0 to 123. Higher total scores indicated higher levels of acculturative stress, and the average Acculturative Stress total score was 36.9.

Mediating Constructs. Asthma Self Efficacy was analyzed using total scores (SelfEff; n = 205) with values ranging from 1.0 to 5.0. Higher total scores indicated higher levels of self efficacy and asthma management. The mean total score was 4.2. Asthma Knowledge was analyzed using total scores (Know; n = 129) with values ranging from 2.0 to 10.0. Higher total scores indicated higher levels of asthma knowledge, and the average Asthma Knowledge total score was 5.1. Beliefs About Asthma Medicine was analyzed using total scores (MBeliefs; n = 128) with values ranging from -0.9 to 2.8. Higher total scores indicated more positive beliefs about asthma medicine, and the average Beliefs About Asthma Medicine total score was 0.7.

Dependent Constructs. The dependent constructs in the present study measured asthma outcomes. Asthma Quality of Life was analyzed using total scores (AQOL; n = 205) with values ranging from 1.0 to 5.6. Lower total scores indicated higher levels of asthma quality of life, and the average Asthma Quality of Life total score was 2.8. Asthma Functional Severity (FunctSev; n = 205) was analyzed using a Functional Morbidity Index Score with values ranging from 0.0 to 3.3. Higher total scores indicated higher levels of morbidity or functional severity, and less asthma control. The average Functional Severity total score was 0.9.

Missing Data. Substantial data were missing from the Physician Ratings of Asthma Severity construct (6.8%) and the Asthma Knowledge and Beliefs About Asthma Medicine constructs (37.1%, 37.6%). This was due to the run-in period prior to intervention, and failure to complete the second session. Little's MCAR test reported a non-significant chi-square value, indicating that these missing data were missing at random (X^2=104, df=99, p=0.3). For further information on evaluating patterns of missing data, please see Appendix F.

Normality. The skewness and kurtosis of each construct were analyzed to ensure that each variable would meet the assumption of normality in SEM path analyses. A normally distributed construct typically displays a skewness statistic between -1.0 and 1.0 and a kurtosis statistic between -1.5 and 2.0. Self Efficacy had a slightly negatively skewed distribution and slightly leptokurtic kurtosis (skewness statistic = -1.2, kurtosis statistic = 3.1). To normalize the variable score distribution, Self Efficacy scores were transformed in SPSS 19.0 using reflect and logarithm transformations. The Asthma Self Efficacy transformed scores had values ranging from 0.0 to 0.7, with a transformed mean total score of 0.23. The transformed Self Efficacy construct was retained for the remaining analyses to meet the normality assumption of structural modeling. The skewness and kurtosis values of all other constructs fell within normal limits.

A Pearson correlation analysis was conducted to analyze the bivariate relationships between each construct used in structural analyses. Demographic variables of interest (e.g., annual income, parent origin, child age, child gender, and child grade) were also included in this Pearson analysis. In all correlation analyses, the research assumed an alpha level of 0.05 and conducted two-tailed tests. In consideration of missing data, Little's MCAR chi-square statistic (See Appendix G for more information; Little, 1988) was conducted to test whether values were missing completely at random.

Bivariate Correlations. Pearson correlations were conducted to assess the bivariate relationships between the constructs being used in the structural models. The correlations are reported in Table 3 and structurally depicted in Figures 1 and 2.

Results indicated no significant relationship ($p = .47$) between Acculturative Stress and Physician Ratings of Asthma Severity, the two independent constructs of the proposed structural model. There was a significant, positive correlation ($r = .50$, $p < .01$) between Functional Severity and Asthma Quality of Life, the two outcome constructs of the proposed structural model. There was no significant relationship between Physician Ratings of Asthma Severity and Functional Severity, Physician Ratings of Asthma Severity and Asthma Quality of Life, or Acculturative Stress and Functional Severity, although there was a significant, positive correlation between Acculturative Stress and Asthma Quality of Life ($r = .20$, $p < .01$). Overall, with the exception of Acculturative Stress and Asthma Quality of Life, none of the independent constructs of the proposed structural model were correlated with the dependent constructs.

The Pearson correlation analysis also yielded important results about the bivariate relationships between other variables (see Figure 1). The transformed Self Efficacy construct was not significantly correlated to any other variable included in the correlation analysis. Beliefs

About Asthma Medicine and Asthma Knowledge were positively correlated ($r = .22$, $p < .05$), and Asthma Knowledge was negatively correlated with Functional Severity (e.g., an increase in asthma knowledge yielded a lower Functional Morbidity Index score, signifying less functional severity and more asthma control; $r = -.22$, $p < .05$).

Several demographic variables were correlated to the construct variables (see Figure 2). Parent Origin was correlated with Functional Severity ($r = -.20$) and Annual Income ($r = .25$). Child grade was correlated with Beliefs About Asthma Medication ($r = -.29$) and Child Age ($r = .96$). Annual income was correlated with Functional Severity ($r = -.22$), Asthma Knowledge ($r = .24$), and Asthma Quality of Life ($r = -.19$). Child Age was correlated with Physician Ratings of Asthma Severity ($r = .16$), Acculturative Stress ($r = .14$), and Functional Severity ($r = -.28$).

Path Analyses. Path analyses were conducted in EQS (EQuationS; Bentler, 1985-2010) to investigate the fit of the proposed mediation path model. The present study tested a complex, simultaneous structural equation model that hypothesized specific paths of influence among independent and dependent constructs related to childhood asthma. The statistical software compared this tested model against a generated independence model which assumed that each construct was independent from the other. For additional information on path analyses, please see Appendix H. The present study completed analyses using Maximum Likelihood (ML) method rather than List-wise Deletion method to handle missing data. For additional information on handling missing data in structural equation modeling, please see Appendix F.

The full path model that was used for the present study is shown in Figure 3. The model illustrates the hypothesis that each of the independent constructs (X1 Physician Ratings of Asthma Severity, X2 Acculturative Stress) would influence childhood asthma outcomes (Y4

Asthma Quality of Life, Y5 Functional Severity) by way of psychosocial factors affecting childhood asthma (the proposed mediators shown in the center of the figure; Y1 Self Efficacy, Y2 Asthma Knowledge, Y3 Beliefs about Asthma Medicine). Figure 3 has paths showing all predicted relationships (all hypotheses) between these independent and dependent constructs.

Using this full path model, each individual path was programmed as "fixed" or "free" to explore specific hypotheses and conduct direct and mediation path analyses. Paths that were to be estimated in an analysis were programmed as "free" and paths that were to be ignored in an analysis were "fixed" at zero. Specifically, a direct path analysis was conducted (Figure 4), in which mediating paths were fixed to zero and the direct paths were fixed as free; this model only estimated the direct relationship between the independent and dependent constructs. Subsequent to the direct path analysis, mediation path analyses were completed by fixing direct paths to zero and programming indirect paths as free. Three mediation path analyses were conducted to estimate the effect of each individual mediator (Figure 5), and a fourth path analysis estimated the combined effect of all three mediators (Figure 6).

Model estimates were evaluated upon the completion of each path analysis. The present study analyzed several statistics and fit indices to assess model fit. For more information on these fit indicators, please see Appendix I.

Fit indices for the full, direct, and mediation path models are displayed in Table 4. The direct model provided a poor fit for the data, as suggested by a significant and large likelihood ratio chi-square (X^2 = 781.02, df=21, N=205, p=0.00). Similar patterns of poor fit were found in each of the mediation models (SelfEff X^2 = 906.96, df=21, N=205, p=0.00; MBeliefs X^2 = 1044.452, df=21, N=205, p=0.00; Know X^2 = 811.51, df=21, N=205, p=0.00), the combined mediation model (X^2 = 324.85, df=13, N=205, p=0.00), and the full model (X^2 = 204.80, df=9, N=205, p=0.00). These chi-square values indicated that the difference between the independence and tested model was most likely not due to chance or error. The CFI values (0.00) of these models also indicated very poor model fit, and the SRMR values (ranging 0.31-1.94) indicated that large amounts of data variance were not explained by the model. The large RMSEA values (ranging 0.42-0.54) further supported the poor fit of these models. Comparatively, these models were not statistically stronger than the independence model (X^2 = 105.00, df=21).

The GLS Tests of Homogeneity were non-significant (p>0.01), and thus the null hypothesis of homogeneous means and covariances was not rejected. This supported the results of Little's MCAR test and further verified that the missing data handled with ML method were missing completely at random.

Post Hoc Questions

In consideration of the mediation path analysis results, post hoc analyses were conducted to better understand the following research questions:

1. Can a different structural model be used to explain the correlation between Asthma Knowledge and Functional Severity ($r = -0.22$), and Acculturative Stress and Asthma Quality of Life ($r = 0.20$)?
2. If Asthma Knowledge, Beliefs about Asthma Medicine, and Self Efficacy are not the factors that directly bridge the relationship between Acculturative Stress and asthma outcomes, then does the presence of each variable instead moderate the amount of influence that Acculturative Stress has on asthma outcomes? For example, acculturative stress does not appear to directly diminish asthma knowledge and thus impact asthma outcomes. Rather, perhaps one's level of asthma knowledge interacts with one's level of acculturative stress, and the interaction of these two factors diminishes or improves asthma outcomes. If so, do certain factors have a greater moderating influence than others (e.g., may some moderating variables be conceptualized as protective factors for asthma outcomes in the face of acculturative stress?), and does the moderation effect account for a notable amount of variability in asthma outcomes?

Note: The Physician Ratings of Asthma Severity variable was excluded from the post hoc analyses since it was not significantly correlated with Acculturative Stress, and thus did not serve as a related independent construct.

Post Hoc Results

Question 1. Despite the poor fit of the tested mediation path models, Pearson correlations suggested that a significant relationship exists between Asthma Knowledge and Functional Severity (r= -0.22), and Acculturative Stress and Asthma Quality of Life (r= 0.20). A direct path model (see Figure 7) was tested to further explore this relationship. Missing data were once again handled using ML Method.

Despite the Pearson correlations between these constructs, the post hoc direct path model provided a poor fit for the data (X^2= 328.56, df=5, N=205, p=0.00). The CFI (0.00) also indicated very poor model fit, and the SRMR value (1.18) specified that large amounts of data variance were not explained by the model. The large RMSEA value (0.68) further supported the poor fit of this model. Comparatively, this model was not statistically stronger than the independence model (X^2 =77.41, df=6).

Question 2. Asthma Knowledge, Self Efficacy, and Beliefs About Asthma Medicine were tested as moderators in an interaction path model (see Figure 8) to better understand their influence on the relationship between Acculturative Stress and asthma outcomes. Using these variables as moderators in the post hoc analyses was a logical decision since moderator variables are typically introduced in the presence of unexpectedly weak or inconsistent relationships between independent and dependent variables (please see Appendix J for more information on moderators in path analyses; Baron and Kenny, 1986). These independent relationships are desirable so that the effect of the interaction term is clear (Baron and Kenny, 1986). The data in the present study adhered to this guideline, with the exception of the mild correlation between Asthma Knowledge and Functional Severity (r = -.22). Additionally, it was productive to investigate the influence of moderating psychosocial variables on pediatric asthma outcomes because moderation path analyses are used in current social science research to investigate a variety of health outcomes. For example, recent publications in pediatric health research have used moderation analyses to better understand the influence of psychosocial moderators on pediatric epilepsy (Ferro, Avison, Campbell, and Speechley, 2010), pediatric immune function (Caserta, Wyman, Wang, Moynihan, and O'Connor, 2011), pediatric diabetes (Jaser, et al., 2012), and other pediatric chronic health conditions (Odar, Cantor, and Roberts, 2013).

In order to conduct moderation analyses and graph interaction effects, the continuous scores for Acculturative Stress, Asthma Knowledge, Asthma Self Efficacy, and Beliefs About Asthma Medicine were transformed into categorical variables. Acculturative Stress total scores were grouped into four categories (0-30, Minimal; 31-60, Mild; 61-90, Moderate; 91-130, Severe), Asthma Knowledge total scores were grouped into three categories (0 - 3, Low; 4 - 7, Medium; 8 - 10, High), Asthma Self Efficacy total scores were grouped into three categories (0 - .2, Low; .3 - .4, Medium; .5 - .7, High), and Beliefs About Asthma Medicine differential scores were grouped into two categories (-26 – 0, Risks Outweigh Benefits; 0 – 14, Benefits Outweigh Risks).

Three new variables known as "interaction variables," labeled SelfEff*AccStress, Know*AccStress, and Beliefs*AccStress, were created. These variables represented the combined effect of Acculturative Stress and the selected moderator variable. The skewness and kurtosis of each interaction variable was analyzed to ensure multi-normal distribution. A descriptive analysis showed that SelfEff*AccStress and Know*AccStress were positively skewed. These interaction variables were transformed using Square Root transformations. The transformed interaction variables were retained for the remaining analyses to meet the normality assumption of structural modeling. Missing data was handled using List-wise Deletion or ML Method, depending on the amount of missing data in each model.

Figure 8 depicts the interaction path model used to test the interaction effect of the moderating variable. The model was first run to test the main (e.g., non interaction) effects of the predictor and moderator variables. To test the main effects, the paths leading from the Interaction Variable were fixed to zero and the other paths were fixed as free. Next, the model was run to test the main effects of the predictor and moderator variable in the presence of the interaction variable, during which all paths were fixed as free.

Results of the interaction path analyses suggested that all three interaction variables had a significant effect on the relationship between Acculturative Stress and asthma outcomes. This signifies that, overall, the role of Self Efficacy, Asthma Knowledge, and Beliefs About Medicine are best described as having a moderating effect, rather than a direct or main effect, on the relationship between Acculturative Stress and asthma outcomes. Tables 5, 6, and 7 report the significant main (Model 1) and interaction (Model 2) effects of Acculturative Stress, Self Efficacy, Asthma Knowledge, and Beliefs About Asthma Medicine on Asthma Quality of Life and Functional Severity. Additionally, Figures 9 through 14 are provided to illustrate the impact of interacting variables on outcome means. This illustrative method was recommended by West and Aiken (1991) and Jaccard and Becker (1990).

Model 1 of Table 5 indicated that Acculturative Stress was a significant but weak predictor of Asthma Quality of Life ($p < .05$, $R^2 = .03$) and was not a significant predictor of Functional Severity. Self Efficacy had no significant main effect on predicting Asthma Quality of Life or Functional Severity. Model 2 of Table 5 indicated that the main effect of Acculturative Stress on Asthma Quality of Life was strengthened by the presence of the interaction term ($R^2 = .03$ to $R^2 = .12$). The main effect of Self Efficacy was also strengthened by the presence of the interaction term in that it too became a significant predictor of Asthma Quality of Life ($p < .05$, $R^2 = .12$). The interaction term was a significant, albeit weak, predictor of both Asthma Quality of Life ($p < .05$, $R^2 = .12$) and Functional Severity ($p < .05$, $R^2 = .05$). The test statistic (-.16) indicated a negative relationship between the interaction term and Asthma Quality of Life. Figure 9 and 10 illustrate the interaction of Acculturative Stress and Self Efficacy on each asthma outcome.

Model 1 of Table 6 indicated that Acculturative Stress and Asthma Knowledge were significant predictors of Asthma Quality of Life ($p < .05$, $R^2 = .26$) and Functional Severity ($p < .05$, $R^2 = .08$). Model 2 of Table 6 indicated that the main effects of Acculturative Stress and Asthma Knowledge on Asthma Quality of life were minimally strengthened by the presence of the interaction term ($R^2 = .26$ to $R^2 = .29$). However, the main effects of Acculturative Stress and Asthma Knowledge on Functional Severity were greatly strengthened by the presence of the interaction term ($R^2 = .08$ to $R^2 = .43$). Although the interaction term was not a significant predictor of Asthma Quality of Life, it was moderately influential in predicting Functional Severity ($p < .05$, $R^2 = .43$). Specifically, the test statistic (beta = -.37) indicated a negative relationship between the interaction term and Functional Severity. Figures 11 and 12 illustrate the interaction of Acculturative Stress and Asthma Knowledge on each asthma outcome.

Model 1 of Table 7 indicated that Acculturative Stress and Beliefs About Asthma Medicine were significant predictors of Asthma Quality of Life ($p < .05$, $R^2 = .39$) and Functional Severity ($p < .05$, $R^2 = .17$). Model 2 of Table 7 indicated that the main effects of Acculturative Stress and Beliefs About Asthma Medicine on Asthma Quality of life and Functional Severity were strengthened by the presence of the interaction term ($R^2 = .39$ to $R^2 = .60$; $R^2 = .17$ to $R^2 = .29$). The interaction term was also an equally strong and significant predictor of Asthma Quality of Life and Functional Severity ($R^2 = .60$; $R^2 = .29$), but instead indicated a negative relationship (-.32, -.20). Figures 13 and 14 illustrate the interaction of Acculturative Stress and Beliefs About Asthma Medicine on each asthma outcome.

Discussion

This study represents a recruited population of Latino parents and their children with asthma between the ages of 0-18 (N=205) living in Rhode Island. Most of the parents reported their primary language as Spanish. About half of the children were under age 8, and slightly more than half of the children were male. With exception of the Physician Ratings of Asthma Severity (collected via chart reviews), all data were collected from self-report measures and were thus subject to variations in the perceptions and opinions of the participants. Descriptive analyses indicated that a majority (58%) of the children had persistent mild asthma as indicated by physician asthma severity ratings. On average, parent scores suggested low levels of acculturative stress, high levels of asthma self efficacy, moderate levels of asthma knowledge, moderate asthma quality of life, and low levels of functional severity (e.g., indicating high levels of asthma control and low levels of asthma morbidity). This reflects that, overall, the participants in this study were not severely affected by acculturative stress or poor asthma outcomes. The average differential score of parent medication beliefs was close to zero and suggested that the parent sample had competing views on whether or not asthma medication benefits outweighed asthma medication risks.

Preliminary Analyses. Preliminary descriptive and correlation analyses indicated that several demographic variables were related to the independent and dependent constructs used in this study. Annual income, parent origin (e.g., country of birth), child age, and child grade were influential demographic variables in this sample. Annual income was positively correlated with Asthma Knowledge ($r = .24$) and negatively correlated with Functional Severity ($r = -.22$). This suggests that families with higher income may have more cost-related health care resources (e.g., better insurance coverage, more frequent doctor's visits, etc.) to help increase their knowledge about asthma and manage their child's asthma. Furthermore, annual income was negatively correlated (r = -.19) with Asthma Quality of Life. Due to the reverse coding of Asthma Quality of Life, this suggests that higher income also increases the likelihood of having a better asthma quality of life. These correlations are generally supported by pediatric asthma literature.

Furthermore, annual income was correlated with parent origin in this sample (r = .25). Parent origin was also negatively correlated with Functional Severity (r = -.20), which relates to existing literature that suggests cultural values and background can influence pediatric asthma care. Child grade was negatively correlated with Beliefs About Asthma Medicine (r = -.29), and may suggest that factors such as age and maturity level influence a parent's feelings about his/her child taking asthma medication. Parent origin was not correlated with Beliefs About Asthma Medication. Although literature suggests that medication beliefs differ according to country of origin, there was only a small sub-sample of US born participants (n=14) which may have diminished this effect within the data. Child age was correlated with Functional Severity (r = -.28), Physician Rating of Asthma Severity (r = .16), and Acculturative Stress (r = .14). This indicates that, in this sample, parents with older children appeared to show increased control of asthma compared to parents with younger children, despite physician reports of more asthma severity in older children. It is unclear whether this increase in asthma control is actually reflective of a child's age (e.g., older children are in better control of their asthma), or if it is reflective of the amount of time that has elapsed since a child's initial asthma diagnosis (e.g., families that have cared for an asthmatic child over a long period of time are more adept at asthma management). The correlation between child age and acculturative stress in this sample may suggest that parents' immersion in a new culture could be influenced by factors related to their child's age, such as school attendance, and community activities, which often increase in frequency as a child ages.

Preliminary analyses revealed several correlations between the model constructs that are generally supported by pediatric asthma literature. Significant correlations found between Asthma Knowledge and Functional Severity, as well as Asthma Knowledge and Beliefs About Asthma Medicine were not surprising since existing pediatric asthma literature emphasizes the important relationship between asthma education, medicine adherence, and asthma management. Asthma Knowledge and Functional Severity were negatively correlated ($r = -.22$), indicating that higher levels of asthma knowledge were associated with lower levels of asthma severity (and thus more asthma control) in this sample. Asthma Knowledge and Beliefs About Medicine were positively correlated ($r = .22$), indicating that sample participants who were more knowledgeable about asthma likely believed that the benefits of asthma medications outweighed their concerns about the medicine.

The preliminary analyses also indicated correlations related to asthma quality of life that are supported by pediatric asthma literature. Asthma Quality of Life and Functional Severity were positively correlated in this sample ($r = .50$), indicating that functional severity was generally lower in participants who reported high asthma quality of life. This moderately strong correlation indicates that parents who have children with less asthma morbidity generally report less daily asthma interruptions, less worry, and a better mood. Acculturative Stress and Asthma Quality of Life were also positively correlated in this sample ($r = .18$). Existing literature suggests that acculturative stress generally has a negative impact on pediatric asthma outcomes, and these data also indicated that parents who reported more acculturative stress also reported diminished asthma quality of life.

Finally, preliminary analyses indicated a null relationship between variables that, based on pediatric asthma literature, would be expected to correlate in the present study's sample. No correlation was found between the following variables: Acculturative Stress and Physician Ratings of Asthma Severity; Acculturative Stress and Asthma Control; Physician Ratings of Asthma Severity and Asthma Control; and Physician Ratings of Asthma Severity and Asthma Quality of Life. The hypothesis that a mediation path model would best explain the relationship between the independent constructs (e.g., Acculturative Stress and Physician Rating of Asthma Severity) and the dependent constructs (e.g., Asthma Severity and Asthma Quality of Life) was based on the expectation that these variables would be correlated to support the framework of a mediation path model. It was also notable that Self Efficacy was not correlated with any variable. This may be due to the restricted range of this variable, since this sample scored high on self efficacy with little variability across participants. Nonetheless, this was an important and unexpected finding since Self Efficacy was predicted to be a mediating variable in the path model. Thus, it was expected that Self Efficacy would be related to the predictor and outcome variables. Unfortunately, the independence of these variables was an early indicator that the proposed mediation path model would not provide an appropriate fit for the data.

Path Model Analyses. All fit indices clearly indicated that the tested path models (full, direct, and mediation) did not acceptably fit the data, nor did these models provide fit that was superior to the independence model. This indicated that Self Efficacy, Asthma Knowledge, and Beliefs About Asthma Medicine did not significantly mediate the relationship between Acculturative Stress, Physician Ratings of Asthma Severity, and asthma outcomes. Although these models provided poor fit for the data, the theory supporting the present study indicated that perhaps another type of relationship linked these variables.

Post Hoc Analyses. Overall, the presence of the interaction term in each moderation analysis increased the amount of variability that was accounted for in childhood asthma outcomes. This suggests that the ability to predict pediatric asthma outcomes is strengthened when looking at the combined effect of acculturative stress and psychosocial variables on asthma outcomes, rather than at the independent effects of each variable on asthma outcomes. The moderation figures illustrated the direction of change that was influenced by these interaction effects, but the influential strength of each moderating variable was best understood by considering the R-squared values of each interaction term. Broadly, these results indicated that asthma self efficacy as a moderating variable explained the least amount of variance in child asthma outcomes, while asthma knowledge and beliefs about asthma medicine appeared to be more influential moderators of child asthma outcomes.

Figures 13 and 14 illustrated that parent beliefs about asthma medicines moderated the relationship between parent acculturative stress and child asthma quality of life. The R-squared values suggested that the interaction between medication beliefs and acculturative stress accounts for a large proportion of variance in asthma outcomes (Asthma Quality of Life, $R^2 = 0.6$; Functional Severity, $R^2 = 0.3$). Parents who believed asthma medicines were mostly beneficial reported that their children had a lower asthma quality of life compared to parents who believed asthma medicines were mostly risky, even in the presence of high acculturative stress. These results may suggest that parents whose children have poorer asthma quality of life may be more likely to see the benefits of asthma medication. Interestingly, parents who thought asthma medicines were mostly risky reported their highest level of acculturative stress as "moderate," whereas parents who thought asthma medicines were mostly beneficial reported their highest level of acculturative stress as "severe." This may indicate that the processes associated with understanding and believing asthma medicine to be beneficial may require immersion in our Americanized healthcare system. Parent beliefs about asthma medicines also appeared to moderate child asthma functional severity. Yet, asthma functional severity scores did not vary greatly (ranging from 1.0 to 2.0) across different levels of acculturative stress even when parents believed asthma medicines were mostly beneficial.

Figures 11 and 12 illustrated that parents with high asthma knowledge and low acculturative stress reported that their children had better asthma outcomes than children of parents with low asthma knowledge. However, these asthma outcomes became poorer when parents with high asthma knowledge reported higher levels of acculturative stress. It should be noted, though, that the interaction of these two variables only had a significant influence on asthma functional severity ($R^2 = 0.4$) and not on asthma quality of life. This indicates that the protective influence of parent asthma knowledge on asthma functional severity diminishes as acculturative stress increases. This finding is extremely important since many asthma interventions are created to increase asthma knowledge. Although this approach may be effective in populations that are not experiencing acculturative stress, it is important that interventions created for acculturating populations provide other protective methods. Although parents with a high level of asthma knowledge reported a decrease of asthma control in the presence of more acculturative stress, parents who reported a medium level of asthma knowledge reported lower levels of asthma control that remained stable across all levels of acculturative stress. Also surprising was that parents who had low asthma knowledge experienced an increase in control in the presence of increased acculturative stress. Perhaps parents with low asthma knowledge and higher levels of acculturative stress had additional resources or interventions in place to help manage their child's asthma, while parents with high knowledge and higher levels of acculturative stress did not have additional resources or were less sought out by asthma interventions.

Figures 9 and 10 illustrated that parents who reported the highest levels of asthma self efficacy also reported the lowest levels of acculturative stress. It was interesting that this pattern emerged, since the preliminary analyses indicated that Self Efficacy was not correlated with any of the other variables. As one would expect, the moderation figures indicate that parents who reported high asthma self efficacy and low acculturative stress also reported that their children had the highest levels of asthma control (as indicated by low scores of asthma functional severity). In comparison, parents who reported lower levels of asthma self efficacy also reported slightly less asthma control across all levels of acculturative stress (as indicated by slightly higher asthma functional severity scores). The small R-squared value of this relationship, though, indicates that only a very small percentage of the variability in child asthma control is due to the interaction between a parent's acculturative stress and asthma self efficacy ($R^2 = .05$). Rather, the interaction between a parent's acculturative stress and asthma self efficacy has a stronger effect on a child's asthma quality of life ($R^2 = .12$). Parents who reported high levels of asthma self efficacy and low acculturative stress also reported that their children had the highest asthma quality of life. Parents who reported medium levels of asthma self efficacy across all levels of acculturative stress reported that their children had consistently moderate asthma quality of life, and not surprisingly, parents who reported low levels of asthma self efficacy and high levels of acculturative stress reported lower levels of their child's asthma quality of life. This indicates that the combination of a parent's high acculturative stress and low asthma self efficacy is a potential risk factor that may diminishes a child's asthma quality of life although, overall, a parent's asthma self efficacy is the least influential factor in a child's asthma outcomes compared to asthma knowledge and asthma medication beliefs.

Lastly, correlations between the model constructs and demographic variables may imply that the demographic variables are also influencing the effects of the moderator variables. For example, correlations suggest that higher income is related to better asthma quality of life (i.e., lower AQOL scores), increased asthma knowledge, and less functional severity. Pediatric asthma literature has emphasized the influential role of culture, socioeconomic status, and child age on asthma outcomes, and the present study further reinforces the influential role of these factors. Functional Severity was the most frequently correlated demographic variable, indicating that functional severity and control may be more influenced by demographic factors than other asthma outcomes, such as Asthma Quality of Life, which was only correlated with one demographic factor.

Limitations. Limitations of the present study include missing data and sample size issues, mild asthma morbidity among participants, the use of limited measures to identify constructs, and participant response bias.

Two variables used in the present study had large amounts of missing data (e.g., over 30%) due to participant attrition between the Project ACE baseline sessions and second sessions. To handle these large amounts of missing data, the researcher followed the recommendation generally supported by experts in the field of structural equation modeling: to use Maximum Likelihood Method to ensure the best estimates. This more recent method was preferred over the traditional List-wise Deletion Method because ML methods have been shown to produce unbiased parameter estimates and standard errors even when large amounts of data are missing. The present study appropriately employed listwise deletion when only small amounts of data were missing. Although ML Method is considered acceptable and is recommended, it should be considered that, for certain variables within the present study, almost a third of the data was generated using estimates from non-missing data.

The power and general application of the completed SEM analyses may be improved if the study were replicated using a larger sample size (minimum of $N \geq 200$). Although it is always ideal to gather the largest sample possible, the sample size used in the present study was likely sufficient for the number of constructs and parameters used in the tested models and should not be considered as a major limitation.

Another potential limitation of this study was that, overall, the sample did not have severe asthma. The majority of the child participants (58%) were reported as having mild persistent asthma, and less than 3% were reported as having severe persistent asthma. The benefit of this distribution is that many children have asthma that is mild to moderate, and not severe, and so the results of this study may generalize to this broad population. The limitation of this distribution, however, is that children with severe asthma are also most at-risk, and the findings of this study may not generalize to their experiences with acculturative stress, psychosocial influences, and asthma outcomes. The present study may have also benefited from using additional measures to quantify the identified constructs (e.g., two or three measures to assess Acculturative Stress, Asthma Knowledge, Asthma Severity, etc). Last, as with any study that uses self-report measures, the data were subject to participant response inaccuracies and bias. This issue may be particularly salient to the current study because parent reporters may not have been fully aware of their child's asthma severity during school and other activities away from home, and thus may have underreported severity.

Future moderation studies in asthma research may benefit from conducting preliminary analyses to determine the best categorization of moderating variable values. The present study categorized the continuous variables by grouping scores across the full range of measured values to illustrate the lowest and highest possible scores that could have been reported by each participant. This approach illustrates the range of possible values measured by the construct even if no participants scored the lowest or highest possible score. Another approach is to categorize the values of continuous variables by splitting the scores into groups based on the range of participant reported scores. This approach would provide a more exact illustration of reported participant scores, but may not capture the true range of a measured construct. In addition, the values of a continuous variable could be categorized based on establishing an even distribution of participant scores in each category of scoring (e.g., in a sample of thirty participants the top scoring 10 participant scores would be labeled "high", the middle scoring 10 participant scores would be labeled "medium", and the lowest scoring 10 participant scores would be labeled "low"). This approach may have an even distribution of participant scores in each category, but may also skew the score range of each category.

Future studies should also consider the type of measure that was utilized when categorizing scores on a continuous measure. For example, the questionnaire that was used in the present study to measure asthma knowledge was a 10-item questionnaire made of true/false statements. Given the fifty-percent odds of a participant answering each question correctly combined with the likelihood that a participant had at least minimal knowledge of asthma, it was unlikely that a participant would answer more than half of the questions wrong. In considering this, future research that considers asthma knowledge as a mediating variable may benefit from using a categorization technique that accounts for this possible distribution of total scores.

Implications for Future Research. Although the results of the present study did not support the initial mediation hypotheses, important findings emerged during the post hoc analyses. The data from this sample provided a better understanding of the role that psychosocial factors may play in mitigating the relationship between acculturative stress and asthma outcomes. The mediation results of these data suggest that asthma knowledge, beliefs about asthma medicines, and asthma self efficacy do not explain how or why asthma outcomes occur in relation to acculturative stress (e.g., acculturative stress does not better predict asthma outcomes in the presence of asthma knowledge), but rather the moderation results indicate that psychosocial factors predict when outcomes are likely to occur (e.g., the influence of acculturative stress on asthma outcomes is likely to increase or decrease when asthma knowledge is present and may depend on the level of asthma knowledge).

Although the current study did not yield significant findings from the mediation analyses, those non-significant findings should not be interpreted to mean that mediation analyses are useless to the study of pediatric asthma. Future research may choose to focus on additional factors that are known to be directly correlated to acculturative stress and asthma outcomes in order to gain a better understanding of mediating influences in this relationship. For example, acculturative stress could be described as a construct rooted in culture and socialization, while asthma knowledge, beliefs about asthma medicine, and asthma self efficacy could be differently described as constructs rooted in cognitions. Perhaps acculturative stress is more likely to be mediated by a factor that is also related to socialization, such as the quality of communication between a parent and child. Family communication and acculturative stress, as social constructs, may be directly related to each other and poor family communication may inhibit practices that are necessary for healthy asthma outcomes. The current study analyzed only some of the many psychosocial factors that influence asthma outcomes, and mediation analyses should be utilized in future research to help understand relationships that have not yet been explored using path analysis.

The distinction between mediating and moderating effects is well documented and of great interest in psychological science. The present study clearly indicated that structural equation modeling and path analyses (whether mediating or moderating) can be effective in helping researchers and health professionals better understand the function and influence of factors affecting pediatric asthma outcomes. These results suggested that asthma knowledge, self efficacy, and beliefs about asthma medicine are worthy of further investigation in pediatric asthma populations that are affected by acculturative stress. The structural framework used in the present study could be replicated in future studies to test other psychosocial factors as well. Future pediatric asthma studies employing structural equation modeling should strive for large sample sizes so that researchers can build detailed, multi-factor equation models. Additionally, future studies could build upon the present study by recruiting participants from a larger, different geographic area, collecting data on children with more severe asthma, recruiting newly acculturated families, and increasing the number of Latinos representing each ethnic origin (e.g., Mexican, Puerto Rican, Dominican, etc.). Doing so may enable health care professionals to better identify which acculturating families are most at risk for poor asthma outcomes, tailor asthma interventions based on relevant cultural factors, and promote behavioral and knowledge-based changes that are most likely to be effective in the face of acculturative stress.

APPENDICES

Appendix A: Justification for the Use of a Latino Sample

Children of low economic standing, urban living, and racial and ethnic minorities disproportionately struggle with symptoms of asthma, medication adherence, and asthma care (MMWR, 2000; CDC, 2005; Halfon & Newacheck, 1993; McQuaid et al., 2003; Koinis-Mitchell et al., 2007). Specifically, a 2006 Advanced Data report from the Center for Disease Control (CDC Data Report #381, 2006) states that, of the racial/ethnic groups identified by the CDC, Puerto Rican children and non-Hispanic Black children have disproportionately high rates of childhood asthma. As a population, Puerto Rican children experience the highest rate of childhood asthma (19.2%) compared 12.7% childhood asthma in non-Hispanic Black populations, 8.0% in non-Hispanic White populations, 7.8% in Hispanic populations, and 6.4% in Mexican populations. The proposed study has chosen to analyze asthma outcomes within a Latino population in order to better understand Latino pediatric asthma overall, and further investigate the high rates of asthma in Puerto Rican children compared to other Latino children. This will be done by considering acculturative stress as an influential variable that may be mediated by other factors pertinent to childhood asthma.

Appendix B: Pediatric Asthma Variations by Age and Gender

According to the Center for Disease Control (CDC Data Report #381, 2006), health care for asthma is most utilized by families with young children with asthma. The CDC has also specified that asthma prevalence increases with age, and that boys have a higher prevalence of asthma and death rates from asthma compared to girls throughout childhood.

Appendix C: Resources Required

The dataset needed for this study was collected as a part of an IRB-approved clinical research study (R01 NR08524; RI Hospital IRB Committee # 222-04) through Bradley/Hasbro Children's Research Center at Rhode Island Hospital. All identifying participant information has been removed from the research data. Elizabeth McQuaid, Ph.D., of the Alpert Medical School at Brown University, has granted me access to these data. I have downloaded EQS 6.1 (Bentler, 1985-2010) to complete my analyses. Further resources, if needed, will be found through reputable online libraries.

Appendix D: Multicultural Considerations

The proposed study acknowledges the importance of multiculturalism in research. Specifically, the population sample in the proposed study is of Latino background and was extracted from a larger study that recruited participants of African American or Latino descent. The introduction of this dissertation proposal has outlined the importance of advancing research in pediatric Latino asthma, and will use measures shown to appropriately represent unique factors facing this population (i.e., the SAFE Acculturative Stress Scale). Although the proposed study focuses on a specific population, the author will show caution when interpreting the results of the study and will not generalize the results to all Latino families. Although the term "Latino" classifies a group of people, Latinos themselves can be culturally diverse from one another.

Appendix E: Using Adult Participant Data

While the original Project ACE dataset also included data provided by child participants, these data constituted a smaller sample size (n=107), given that data were only collected from child participants eight and older. These data were not analyzed in the present study. The researcher acknowledged that child data on acculturative stress and asthma management and efficacy are worthy of analysis in future studies, but the present study instead focused on the mediating constructs affecting parent data.

Appendix F: Handling Missing Data in Structural Equation Modeling

A traditional method of dealing with missing data in SEM is list-wise deletion, in which the entire participant case is deleted for having missing data. List-wise deletion, until recently, has been the most favored way of dealing with missing data in applied psychology (Graham, 2009). It was thought to yield little bias and change in true scores, albeit minimizing power, yet newer studies have shown that the listwise deletion method with large amounts of missing data may diminish precision in estimation, such as showing biased parameters and standard errors (Graham, 2009).

Empirical support has amounted for dealing with missing data in SEM through other methods, primarily Maximum Likelihood (ML) methods. ML methods are particularly advantageous when larger amounts of data (e.g., 20% or more) are missing (Enders, 2001). The terminologies “direct ML”, “full information ML (FIML)”, and “case-based ML” are generally interchangeable when discussing ML methods (Bentler, 2006). These methods are not to be confused with the less desirable “limited information” ML estimations, which are not computed in EQS programs (Bentler, 2006). ML methods been shown to produce unbiased parameter estimates and standard errors in the presence of MAR or MCAR. ML methods utilize all available data by collecting model fit information from each participant and estimating a likelihood function for each participant profile (Enders, 2006).

In order to use ML method in the present study, a constant independent variable (e.g., V999) with a variance fixed at zero was added to each structural model. This addition instructs the statistical software to run a mean structure model (e.g., in the syntax this is specified as

ANALYSIS=MOMENT) to analyze means and covariances. The present study used a Fisher information matrix to compute standard errors.

Appendix G: Evaluating Patterns of Missing Data

Roderick J. A. Little's chi-square statistic tests whether values are missing completely at random (Little, 1988). For this test, the null hypothesis states that the data are missing completely at random with a significance level of 0.05; a p-value less than 0.05 indicates that the data are not MCAR, but rather MAR (missing at random) or NMAR (not missing at random), and thus further analysis would be needed to determine if there is a pattern to the missing data.

Appendix H: Path Analysis

The purpose of conducting path analyses is to determine a single concise, parsimonious model that best "fits" a set of data by explaining the linear relationships between independent and dependent constructs. Mediation has been documented as being successful when a strong relationship between the independent and dependent constructs exists (Sergi et al., 2006). To determine which path model best fits the data, a proposed model, or "tested model", is statistically compared against an "independence model" which assumes that all of the constructs are independent of one another and not correlated. This is done by first proposing a full path model that depicts both the hypothesized direct and indirect relationships between the independent and dependent constructs, and then estimating and evaluating several individual path models (known as direct and mediating models) nested within the full path model to determine which model best fits the data.

Appendix I: Path Analysis "Fit" Statistics and Indices

The *standardized root mean-square residual index (SRMR)* is one fit index that is important to consider. SRMR is equal to the square-root of the average squared element of the residual correlation matrix; thus, indicating the amount of residual present (e.g., variance not explained by the model). A popular cutoff value for this index is 0.05 or less, or less than 5% SRMR present. Raw residuals of each construct pairing can also be examined.

The *Likelihood Ratio Chi-Square Statistic* (X^2) is an important test statistic that compares the fit of the tested model and independence model. A non-significant X^2 value ($p>0.05$) that is close in value to the degrees of freedom is desirable. A non-significant X^2 statistic retains the null hypothesis (which is desirable in SEM) that there is no significant difference between the tested model and the data. The X^2 statistic is based on normality assumptions of the measured variables and indicates if the standardized residuals, as described above, are likely due to sampling error or poor model fit. Thus, a significant X^2 typically indicates a poor overall model fit.

The *Goodness of Fit Index (GFI)* and *Adjusted Goodness of Fit Index (AGFI)* indicate the proportion of variance explained by a tested model. GFI and AGFI values range from 0 to 1, with values exceeding 0.90 (90% variance explained by the tested model) acceptable.

Other indications of an overall well-fitting model include the *comparative fit index (CFI)* and *root mean square error of approximation (RMSEA)*. The CFI is a measure of noncentrality between the tested model and the independence model, and is ideally close to 1.0 (CFI>0.9). The root mean square error of approximation (RMSEA) measures the average amount of misfit in the model per degree of freedom. Favorable RMSEA values are small and close to zero, ideally less than 0.1.

Appendix J: Moderators

Moderating effects are tested by adding moderator variables, or interaction variables, to a path model. Moderators are most commonly categorical variables, but can also be continuous variables (Sergi, Rassovsky, Nuechterlein, and Green, 2006). Moderators specify when, or under what conditions, an independent construct affects a dependent construct, and are most commonly investigated when there is no relationship (or an unexpectedly weak relationship) between independent and dependent constructs so that the researcher can clearly interpret the interaction effect of the moderator (Sergi, Rassovsky, Nuechterlein, and Green, 2006).. These models should include the interaction effects and the main effects of the variables that were used to compute the interaction terms, even if the main effects are not significant (Sergi, Rassovsky, Nuechterlein, and Green, 2006). If the main effects are not included, the main effects and interaction effects can get confounded. Specifically, a moderating effect is significant when the interaction between a moderator variable and an independent construct reduces, enhances, or changes the direction of the relationship between independent and dependent constructs (Lindley & Walker, 1993).

TABLES AND FIGURES

(Ordered as presented in manuscript)

Table 1.
Summary of Measures

Name of Measure	Measure Type	Construct Label	Construct Type	Total Score Range
Physician Rating of Asthma Severity	Ordinal	PhysRating	Independent	1-4 (Intermittent – Severe Persistent)
SAFE Acculturative Stress Scale	Scale	AccStress	Independent	0-130 (Less Stress – More Stress)
Asthma Self Efficacy Scale and Asthma Management Subscale	Scale	SelfEff	Mediating	1-5 (Low SE/Man – High SE/Man)
Asthma Knowledge Scale	Scale	Know	Mediating	0-10 (Less Knowledge – More Knowledge)
Beliefs About Medicine Questionnaire	Scale	MBeliefs	Mediating	-26-14 (Risky – Beneficial)
Asthma Quality of Life Questionnaire	Scale	AQOL	Dependent	1-7 (High AQOL – Low AQOL)
Asthma Functional Severity Scale	Scale	FunctSev	Dependent	0-4 (Less Morbidity – More Morbidity)

Table 2.
Descriptive Data of Physician Asthma Severity Ratings and
Psychosocial Measures of Childhood Asthma in a Latino Sample

	n	Min	Max	Mean	Std. Dev.	Skewness		Kurtosis	
							SE		SE
PhysRating	191	1.0	4.0	-	-	0.5	0.2	0.5	0.3
AccStress	204	0.0	123.0	36.9	27.0	0.7	0.2	-0.1	0.3
SelfEff	205	1.0	5.0	4.2	0.6	-1.2	0.2	3.1	0.3
SelfEff (T)	205	0.0	0.7	0.2	0.1	0.2	0.2	-0.4	0.3
Know	129	2.0	10.0	5.1	1.9	0.5	0.2	-0.3	0.4
MBeliefs	128	-.9	2.8	0.7	0.8	0.2	0.2	-0.2	0.4
AQOL	205	1.0	5.6	2.8	1.1	0.4	0.2	-0.4	0.3
FunctSev	205	0.0	3.3	0.9	0.9	0.6	0.2	-0.7	0.3

Note: The mean and standard deviation of Physician Rating of Asthma Severity were not listed in this table since it is a nominal variable.

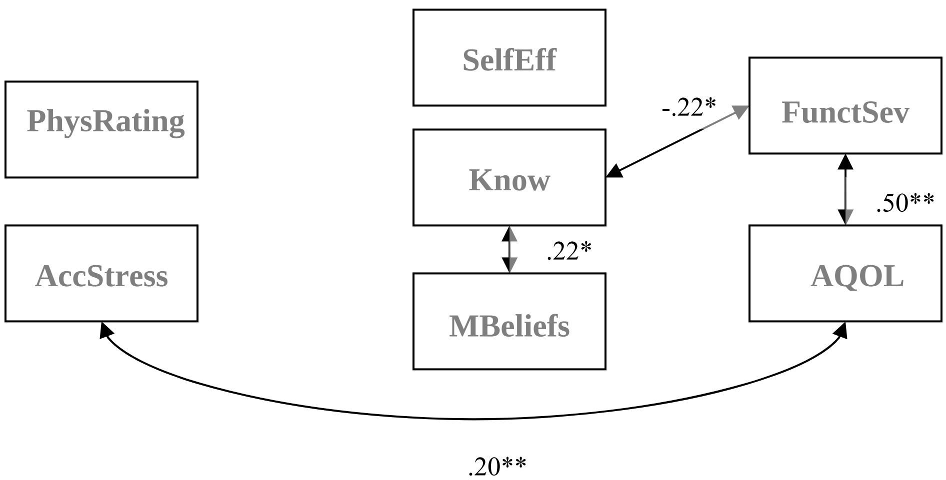
Table 3.

Zero-Order Correlations of Demographic Data, Physician Asthma Severity Ratings, and Psychosocial Measures of Childhood Asthma in a Latino Sample

		1	2	3	4	5	6	7	8	9	10	11	12
1. Origin (p)	*r*	1											
	n	202											
2. Gender (c)	*r*	-.11	1										
	n	202	205										
3. Age (c)	*r*	.01	.05	1									
	n	202	204	204									
4. PhysRating	*r*	.09	.06	.16*	1								
	n	188	191	190	191								
5. AccStress	*r*	-.02	.07	.14*	-.05	1							
	n	201	204	203	190	204							
6. AQOL	*r*	-.07	.01	-.10	.09	.20**	1						
	n	202	205	204	191	204	205						
7. Know	*r*	.07	.15	.12	.11	.07	-.15	1					
	n	126	129	128	124	128	129	129					
8. MBeliefs	*r*	-.13	.00	-.12	-.13	-.10	-.00	.22*	1				
	n	125	128	127	123	127	128	128	128				
9. SelfEff	*r*	.11	.11	.12	-.03	.01	.04	.11	-.11	1			
	n	202	205	204	191	204	205	129	128	205			
10. FunctSev	*r*	-.20*	.01	-.28*	-.01	.00	.50**	-.22*	.04	-.04	1		
	n	202	205	204	191	204	205	129	128	205	205		
11. Income	*r*	.25*	-.08	-.05	-.07	-.11	-.19**	.24**	-.17	.12	-.22**	1	
	n	184	187	186	176	186	187	119	118	187	187	187	
12. Grade (c)	*r*	.08	-.05	.96*	.12	-.06	-.12	-.14	-.29*	.07	-.14	-.05	1
	n	133	136	135	128	136	136	87	87	136	136	186	136

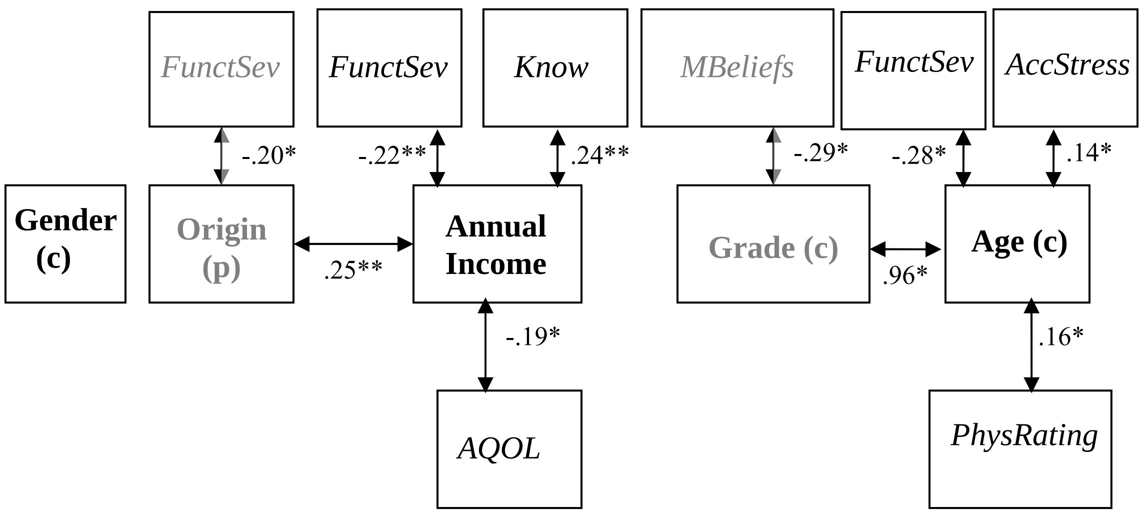
**p<0.05. **p<0.01. (p) of parent. (c) of child.*

Figure 1.
Bivariate Pearson Correlations between Constructs



** p < .05; ** p < .01*

Figure 2.
Bivariate Pearson Correlations between Demographic Variables



* $p < .05$; ** $p < .01$

Figure 3.
Full Path Model

Key:
X1 PhysRating
X2 AccStress
Y1 SelfEff
Y2 Know
Y3 MBeliefs
Y4 FunctSev
Y5 AQOL

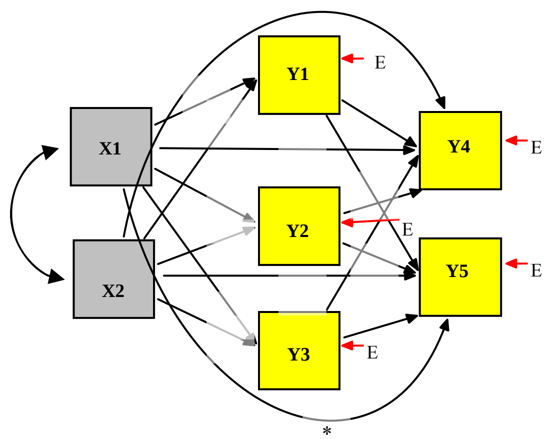


Figure 4.
Direct Path Model

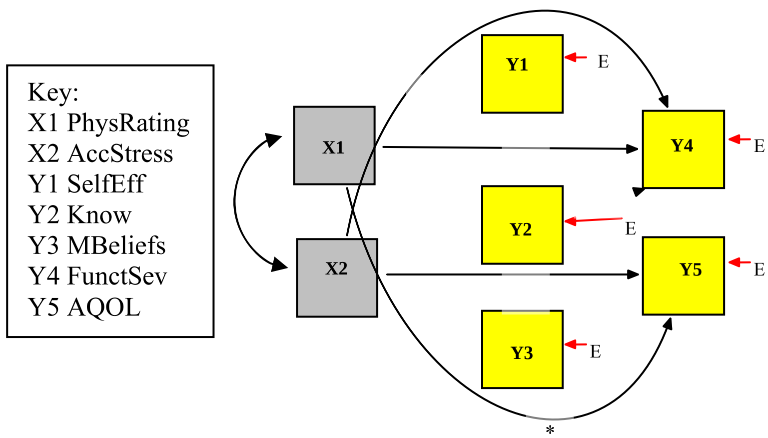
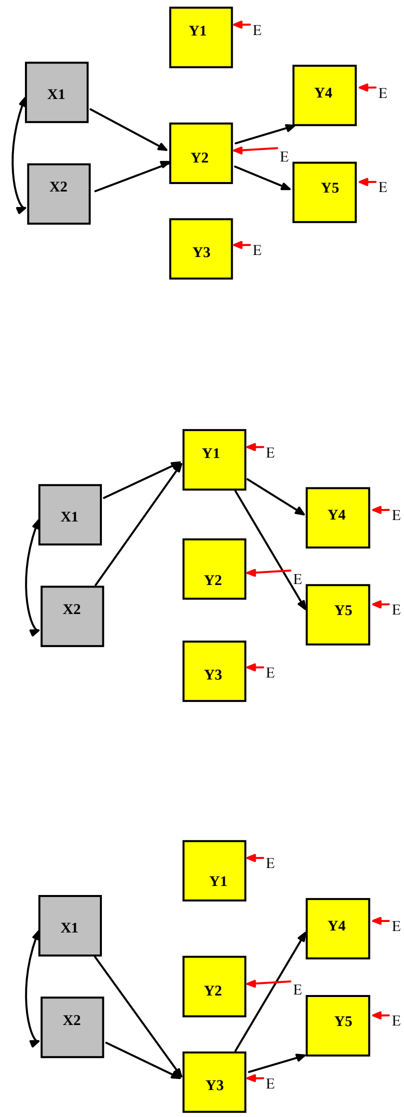


Figure 5.
Mediation Path Models



Key:
X1 PhysRating
X2 AccStress
Y1 SelfEff
Y2 Know
Y3 MBeliefs
Y4 FunctSev
Y5 AQOL

Figure 6.
Mediation Path Model (combined effect)

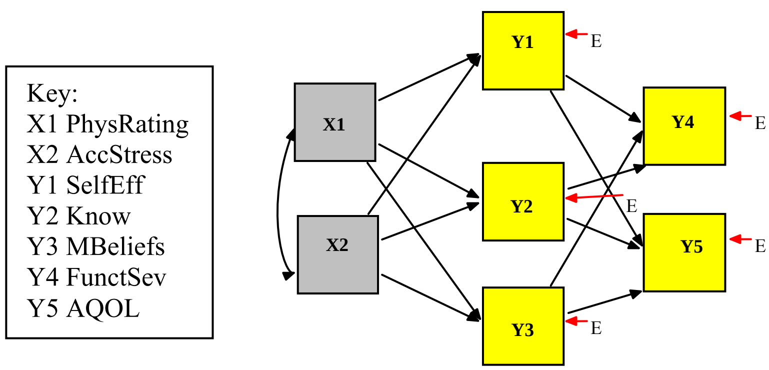


Table 4.
Direct, Mediation, and Full Path Model Fit Indices

Model	SRMR	X^2	CFI	RMSEA [90% CI]
Direct	1.54	81.02**	0.00	0.42 [0.39, 0.44]
Mediation (SelfEff)	1.94	906.96**	0.00	0.51 [0.48, 0.54]
Mediation (MBelief)	1.86	1044.45**	0.00	0.49 [0.46, 0.52]
Mediation (Know)	1.32	811.51**	0.00	0.46 [0.43, 0.48]
Mediation (combined)	0.49	324.85**	0.00	0.47 [0.42, 0.51]
Full	0.31	204.80**	0.00	0.54 [0.48, 0.59]

** $p < 0.01$

Figure 7.
Direct Path Model (post hoc)

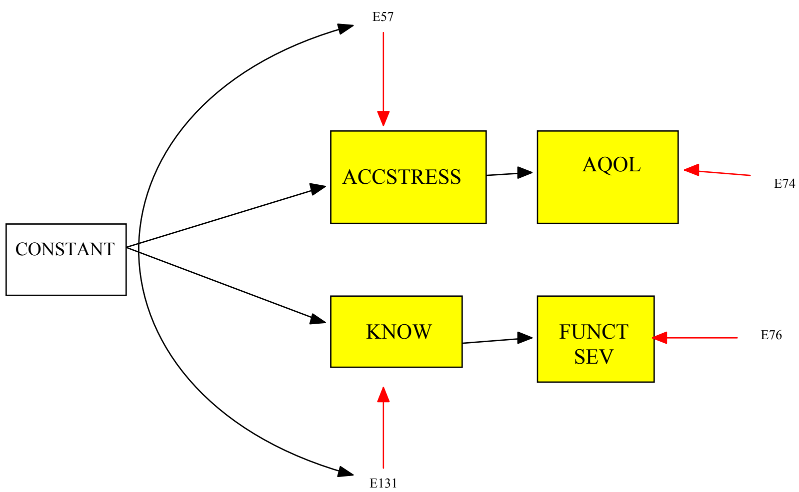
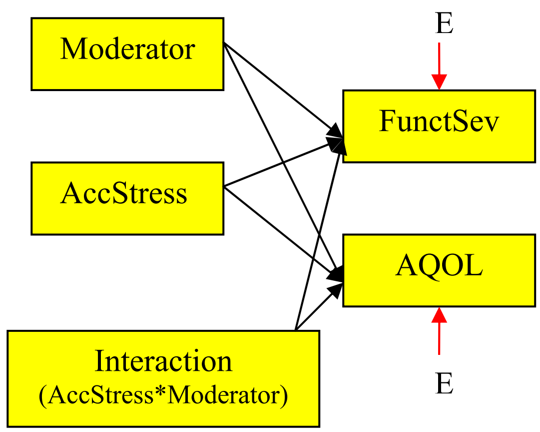


Figure 8.
Moderation Path Models

Interaction Effects



Main Effects

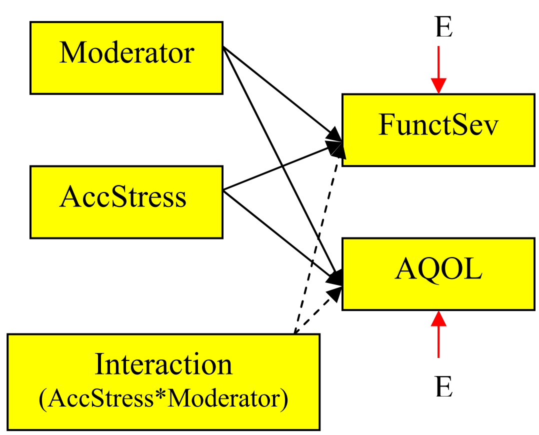
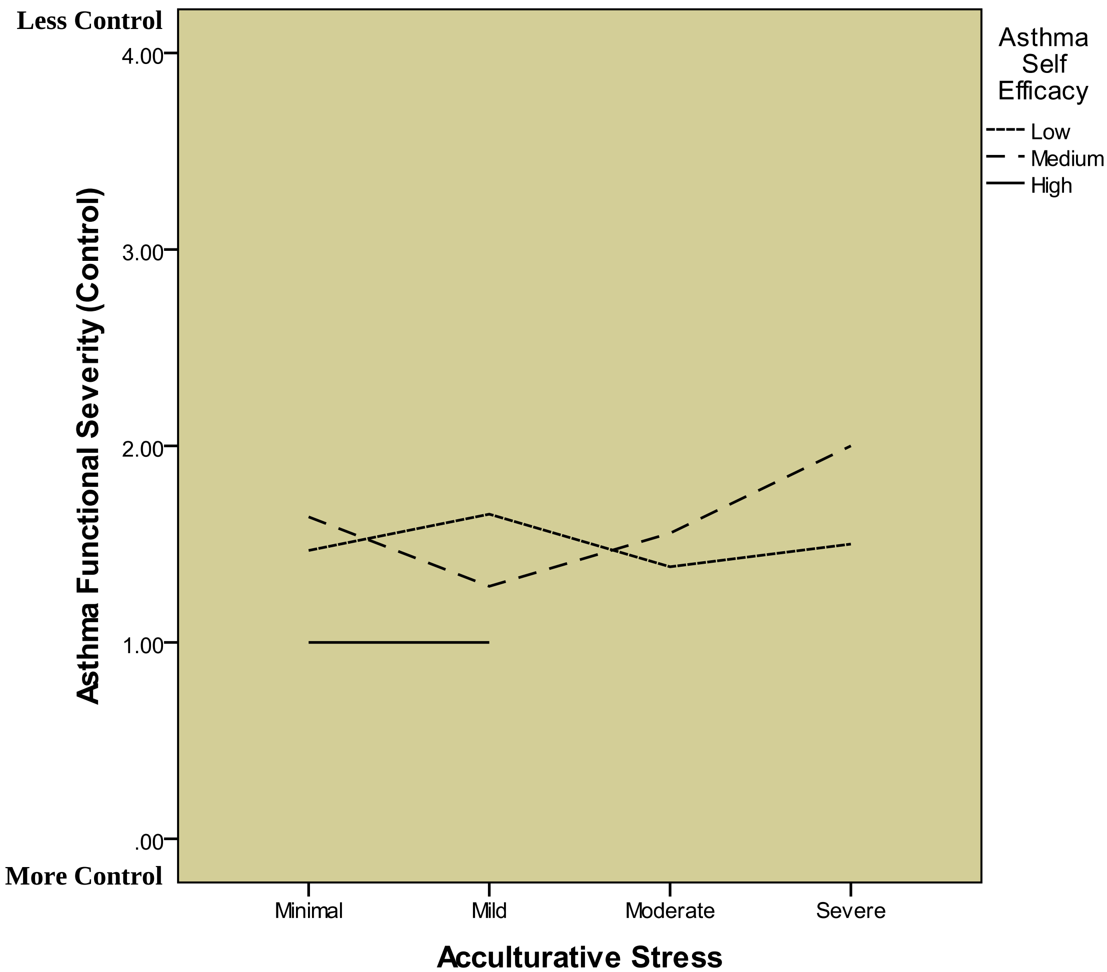


Table 5.
Main and Interaction Effects of Acculturative Stress and Self Efficacy on Asthma Quality of Life and Functional Severity

		Asthma Quality of Life		**Functional Severity**	
		Beta	R^2	*beta*	R^2
Model 1	AccStress	.18	.03	ns	ns
	SelfEff	Ns	ns	ns	ns
Model 2	AccStress	.27	.12	ns	ns
	SelfEff	.12	.12	ns	ns
	AccStress*SelfEff	- .16	.12	.15	.05

Note: Reported statistics are significant at the 0.05 level

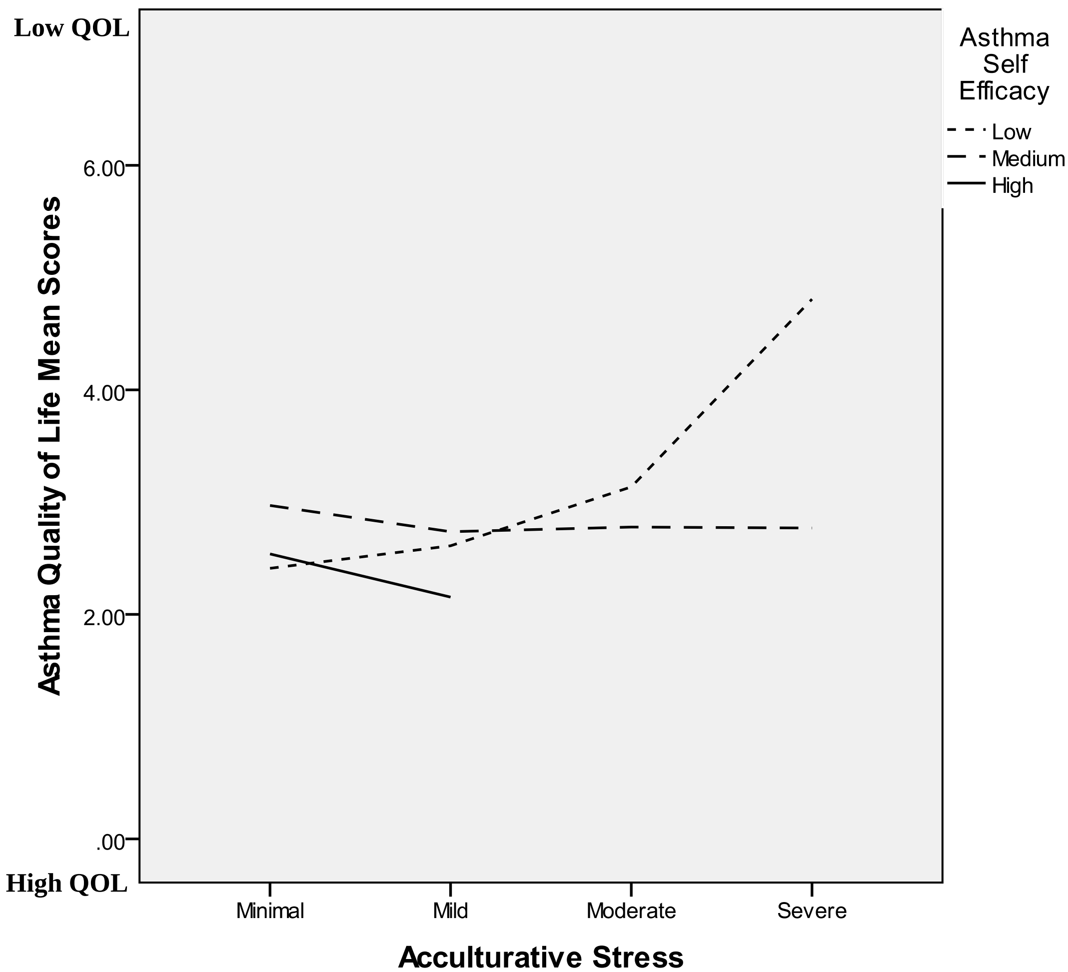
Figure 9.
Two-Way Interaction Effect of Acculturative Stress and Self Efficacy on Functional Severity (N=204)



Acculturative Stress Legend

Minimal: n = 105, Total Scores 0-30
Mild: n = 61, Total Scores 31-60
Moderate: n = 35, Total Scores 61-90
Severe: n = 3, Total Scores 91-130

Figure 10.
Two-Way Interaction Effect of Acculturative Stress and
Self Efficacy on Asthma Quality of Life (N=204)



Acculturative Stress Legend

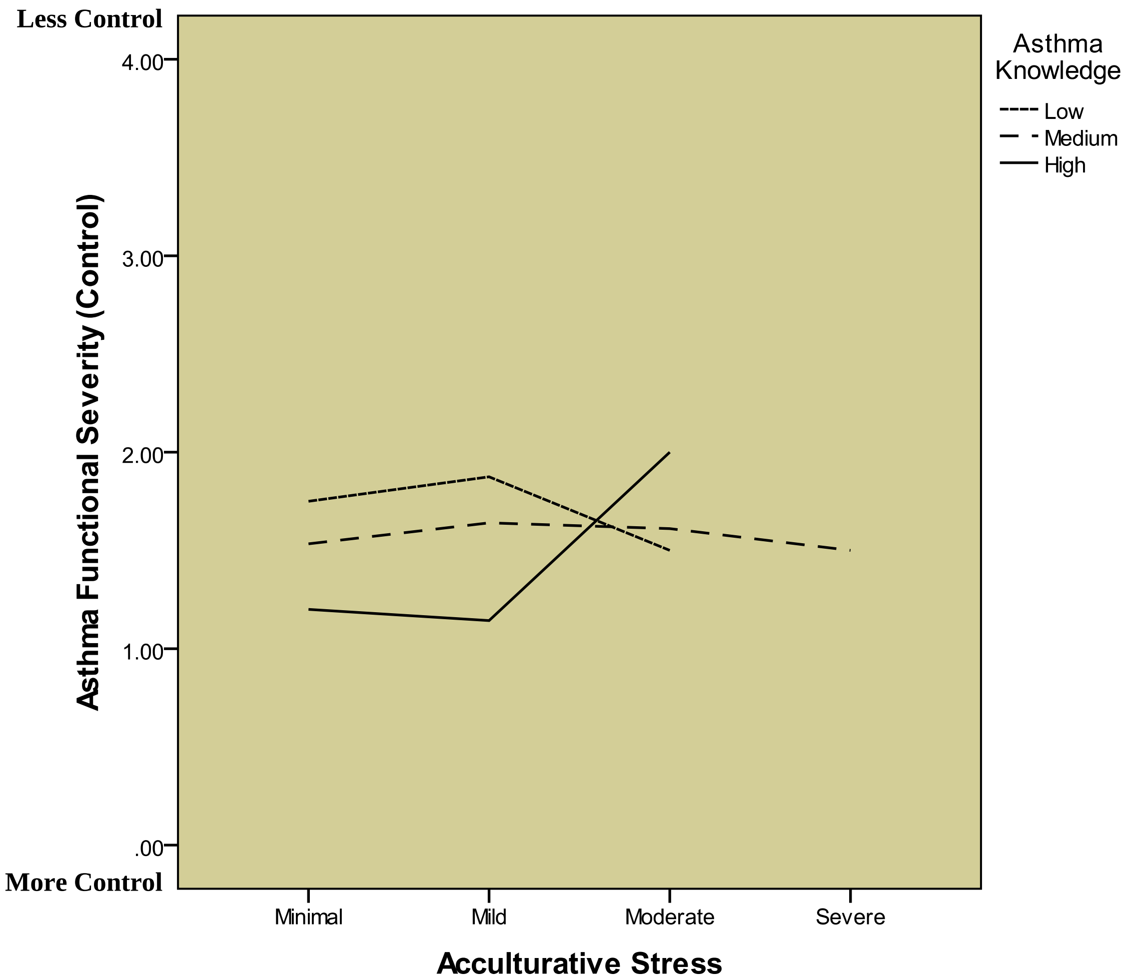
Minimal: n = 105, Total Scores 0-30
Mild: n = 61, Total Scores 31-60
Moderate: n = 35, Total Scores 61-90
Severe: n = 3, Total Scores 91-130

Table 6.
Main and Interaction Effects of Acculturative Stress and Asthma Knowledge on Asthma Quality of Life and Functional Severity

		Asthma Quality of Life		**Functional Severity**	
		beta	R^2	*beta*	R^2
Model 1	AccStress	.34	.26	.18	.08
	Know	.34	.26	.20	.08
Model 2	AccStress	.36	.29	.46	.43
	Know	.38	.29	.29	.43
	AccStress*Know	ns	ns	- .37	.43

Note: Reported statistics are significant at the 0.05 level

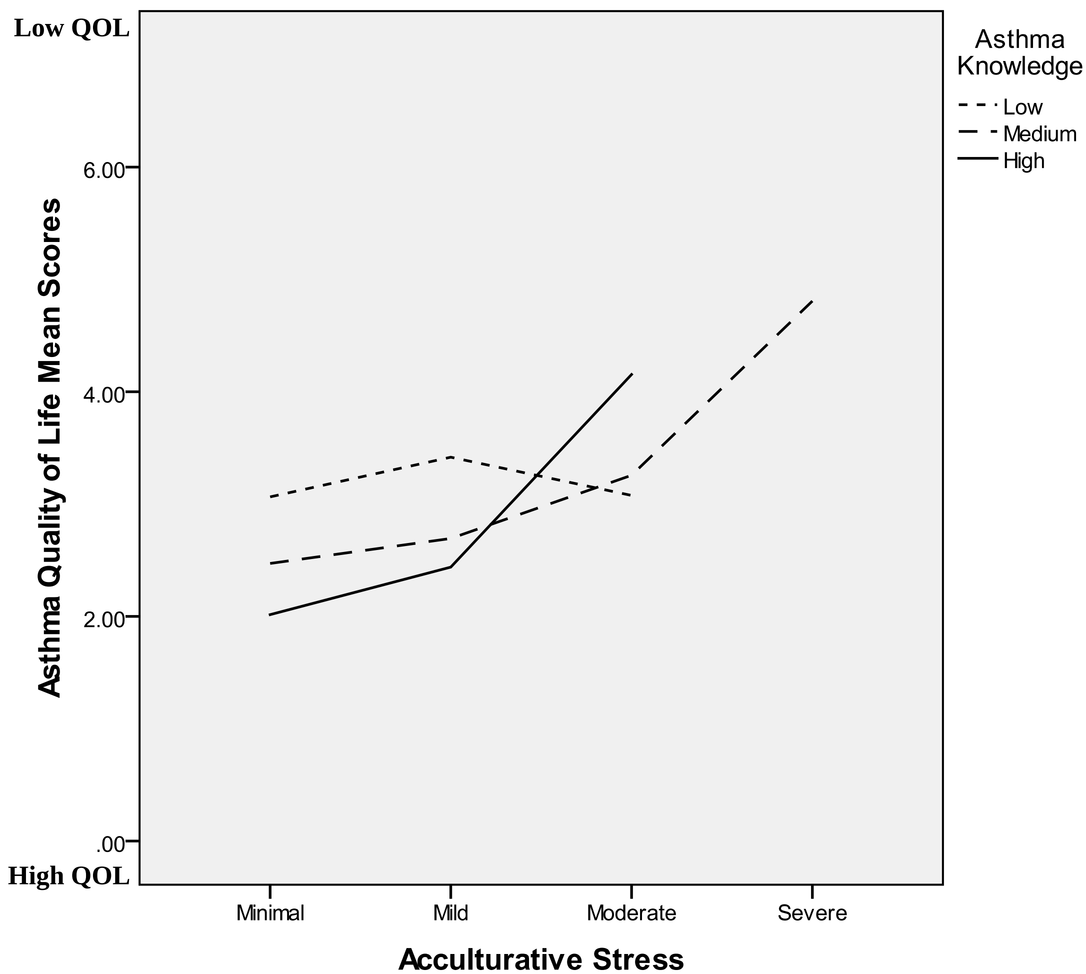
Figure 11.
Two-Way Interaction Effect of Acculturative Stress and
Asthma Knowledge on Functional Severity (N=129)



Acculturative Stress Legend

Minimal: n = 105, Total Scores 0-30
Mild: n = 61, Total Scores 31-60
Moderate: n = 35, Total Scores 61-90
Severe: n = 3, Total Scores 91-130

Figure 12.
Two-Way Interaction Effect of Acculturative Stress and Asthma Knowledge on Asthma Quality of Life (N=129)



Acculturative Stress Legend

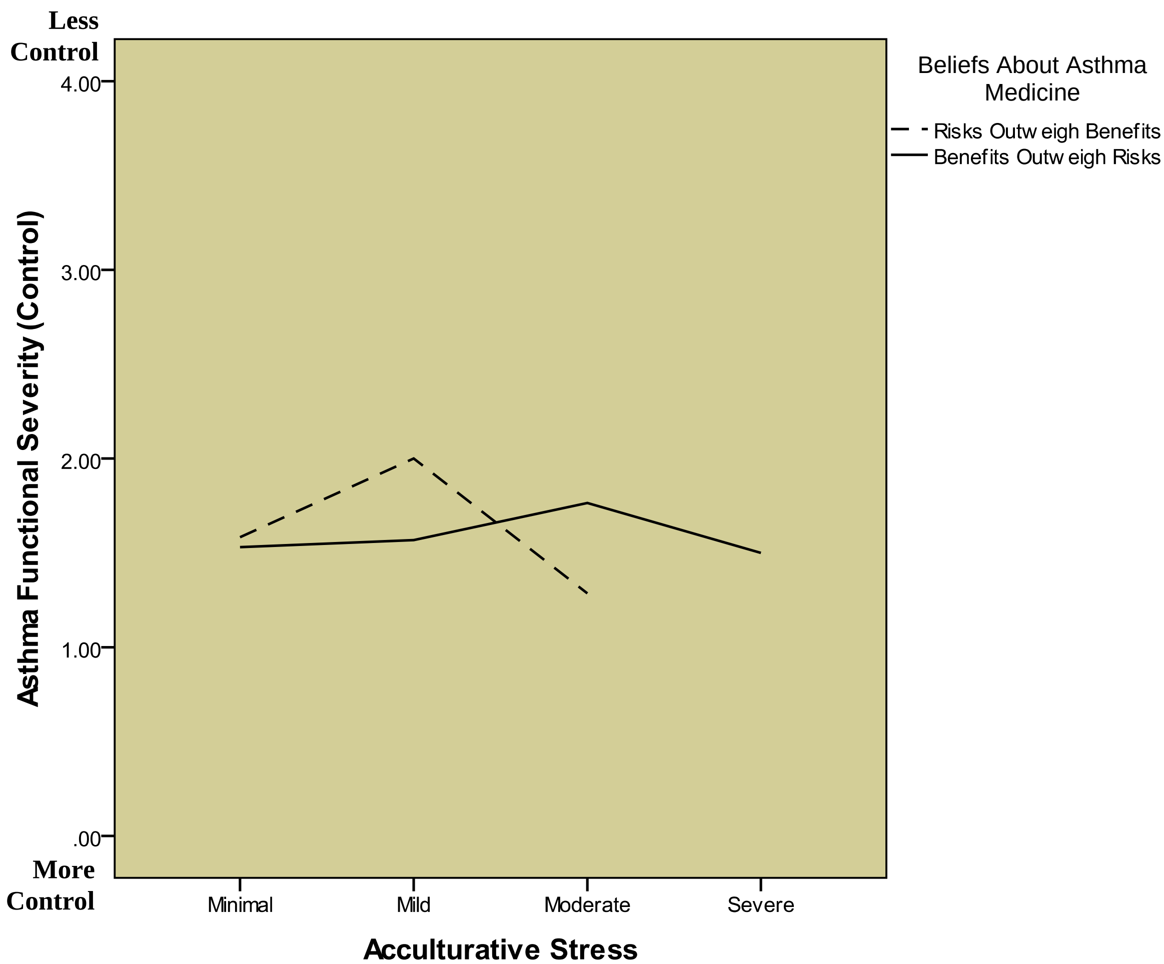
Minimal: n = 105, Total Scores 0-30
Mild: n = 61, Total Scores 31-60
Moderate: n = 35, Total Scores 61-90
Severe: n = 3, Total Scores 91-130

Table 7.
Direct and Interaction Effects of Acculturative Stress and Beliefs About Asthma Medicine on Asthma Quality of Life and Functional Severity

		Asthma Quality of Life		**Functional Severity**	
		beta	R^2	*beta*	R^2
Model 1	AccStress	.53	.39	.32	.17
	Beliefs	.33	.39	.27	.17
Model 2	AccStress	.52	.60	.34	.29
	Beliefs	.47	.60	.37	.29
	AccStress*Beliefs	- .32	.60	- .20	.29

Note: Reported statistics are significant at the 0.05 level

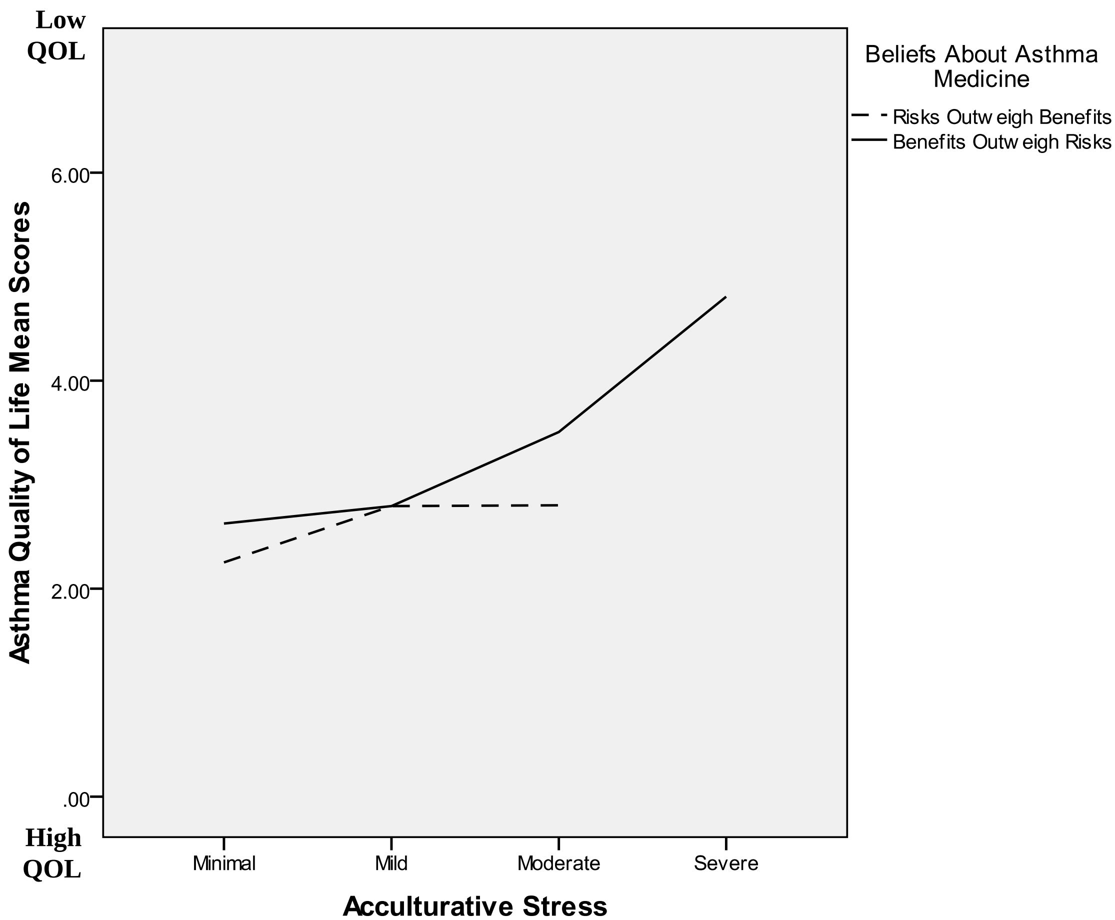
Figure 13.
Two-Way Interaction Effect of Acculturative Stress and
Beliefs About Asthma Medicine on Functional Severity (N=128)



Acculturative Stress Legend

Minimal: n = 105, Total Scores 0-30
Mild: n = 61, Total Scores 31-60
Moderate: n = 35, Total Scores 61-90
Severe: n = 3, Total Scores 91-130

Figure 14.
Two-Way Interaction Effect of Acculturative Stress and
Beliefs About Medicine on Asthma Quality of Life (N=128)



Acculturative Stress Legend

Minimal: n = 105, Total Scores 0-30
Mild: n = 61, Total Scores 31-60
Moderate: n = 35, Total Scores 61-90
Severe: n = 3, Total Scores 91-130

Bibliography

Akinbami, L. (2006). The state of childhood asthma, United States, 1980-2005. *Advanced Data 381,* 1-24.

Aligne, C.A., Auinger, P., Byrd, R.S. and Weitzman, M. (2002) Risk factors for pediatric asthma. Contributions to poverty, race, and urban residence. *American Journal of Respiratory and Critical Care Medicine, 162,* 873-877.

Anderson, L.M., Wood, D.L., and Sherbourne, C.D. (1997). Maternal acculturation and childhood immunization levels among children in Latino families in Los Angeles. *American Journal of Public Health, 87,* 2018-2021.

Apter, A., Reisine, S., Affleck, G., Barrows, E., & ZuWallack, R. (1998). Adherence with twice-daily dosing of inhaled steroids. Socioeconomic and health belief differences. *American Journal of Respiratory and Critical Care Medicine, 157*(6 Pt 1), 1810 –1817.

Balcazar, H., Krull, J.L. (1999). Determinants of birth-weight outocomes among Mexican-American women: Examining conflicting results about acculturation. *Ethnic Disparities, 9,* 411-422.

Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of personality and social psychology*, *51(6),* 1173.

Bartholomew, L.K., Sockrider, M.M., Abramson, S.L., Swank, P.R., Czyzewski, D.I., Tortolero, S.R., Markham, C.M., Fernandez, M.E., Shegog, R., and Tyrrell, S. (2006). Partners in school asthma management: Evaluation of a self-management program for children with asthma. *Journal of School Health, 76(6),* 283-290.

Bender, B., Wamboldt, F. S., O'Connor, S. L., Rand, C., Szefler, S., Milgrom, H., et al. (2000). Measurement of children's asthma medication adherence by self report, mother report, canister weight, and Doser CT. *Annals of Allergy, Asthma, & Immunology, 85,* 416– 421.

Bentler, P.M. (1985-2010). EQS Version 6.1. *Multivariate Software, Inc.*

Bentler, P.M. (2006). *EQS 6 Structural Equations Program Manual.* Encino, CA: Multivariate Software, Inc.

Boudreaux, E.D., Emond, S.D., Clark, S., Camargo, C.A., Jr. (2003). Race/ethnicity and asthma among children presenting to the emergency department: differences in disease severity and management. *Pediatrics 111(pt 1).*

Brinke, A., Ouwerkerk, M.E., Zwinderman, A.H., Spinhoven, P., and Bel, E.H. (2001). Psychopathology in patients with severe asthma is associated with increased health care utilization. *American Journal of Respiratory Critical Care Medicine, 163,* 1093-1096.

Bryce, F.P., Neville, R.G., Crombie, I.K., Clark, R.A., and McKenzie, P. (1995). Controlled trial of an audit facilitator in diagnosis and treatment of childhood asthma in general practice. *BMJ, 310,* 838-842.

Burchard, E.G., Avila, P.C., Nazario, S., Casal, J., Torres, A., et al. (2004). Lower bronchodilator responsiveness in Puerto Rican than in Mexican subjects with asthma. *American Journal of Respiratory and Critical Care Medicine, 169,* 386-392.

Bursch, B., Schwankovsky, L., Gilbert, J., and Zeiger, R. (1999). Construction and validation of four childhood asthma self-management scales: Parent barriers, child and parent self-efficacy, and parent belief in treatment efficacy. *Journal of Asthma, 36(1),* 115-128.

Busse, W.W., Kiecolt-Glazer, J.K., Coe, C., Martin, R.J., Weiss, S.T., and Parker, S.R. (1995). NHLBI Workshop Summary. Stress and Asthma. *American Journal of Respiratory and Critical Care Medicine, 151,* 249-252.

Cabana, M.D., Slish, K.K., Lewish, T.C., Brown., R.W., Nan, B., Lin, X., et al. (2004). Parental management of asthma triggers within a child's environment. *Journal of Allergy and Clinical Immunology, 114,* 352-357.

Canino, G., Koinis-Mitchell, D., Ortega, A.N., McQuaid, E.L., Fritz, G.K., and Alegria, M. (2006). Asthma disparities in the prevalence, morbidity, and treatment of Latino children. *Social Science Medicine, 63,* 2926-2937.

Canino, G., McQuaid, E.L., Rand, C.S. (2009). Addressing asthma health disparities: A multilevel challenge. *American Academy of Allergy, Asthma & Immunology, 123(6),* 1209-1217.

Carter-Pokras OD, Gergen PJ. (1993). Reported asthma among Puerto Rican, Mexican-American, and Cuban children, 1982 through 1984. *Am J Public Health*. *83*:580-582.

Celano, M., Geller, R.J., Phillips, K.M., and Ziman, R. (1998). Treatment adherence among low-income children with asthma. *Journal of Pediatric Psychology, 23,* 345-349.

Celedon, J.C., Sredl, D., Weiss, S.T., Pisarski, M., Wakefield, D., and Cloutier, M. (2004). Ethnicity and skin test reactivity to aeroallergens among asthmatic children in Connecticut. *Chest, 125(1),* 85-92.

Centers for Disease Control and Prevention. (2010). www.cdc.gov. Accessed May 2012.

Centers for Disease Control and Prevention. (2006). Advanced Data From Vital and Health Statistics, Number 381: The State of Childhood Asthma, United States, 1980-2005.

Centers for Disease Control and Prevention. (2005). *Asthma – United States, 2003*: Centers for Disease Control.

Centers for Disease Control and Prevention. (2007). National Health Interview Survey, National Center for Health Statistics. 2003 population estimates and prevalence tables.

Centers for Disease Control. (1998). Tobacco use among US racial/ethnic minority groups – African Americans, American Indians and Alaska Natives, Asian Americans and Pacific Islanders, and Hispanics: A report of the surgeon general. *US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health*. Atlanta, GA.

Charlton, I., Antoniou, A.G., Atkinson, J., et al. (1994). Asthma at the interface: Bridging the gap between general practice and a district general hospital. *Arch Dis Child, 70,* 313-318.

Choudhry, S., Ung, N., Avila, P., Ziv, E., et al. (2004). Pharmocogenetic differences in response to Albuterol between Puerto Rican and Mexican asthmatics. *American Journal of Respiratory and Critical Care Medicine, 171(6),* 563-570.

Clark, N.M. and Nothwehr, F. (1997). Self-management of asthma by adult patients. *Patent Educ Couns, 32,* s5-s20.

Clark, N.M., Randal, W.B., Parker, E., Robins, T.G., Remick, D.G. jr., Philber, M.A., Keeler, G.J. and Israel, B.A. (1999). Childhood asthma. *Environmental Health Perspectives, 107(3),* 421-429.

Clark, N.M., Rosenstock, I., Hassan, H., et al. (1988). The effect of health beliefs and feelings of self-efficacy and self management behavior of children with a chronic disease. *Patient Education Council, 11,* 131-139.

Clark, N.M. and Zimmerman, B.J. (1990). A social cognitive view of self-regulated learning about health. *Health Education Research, 5(3),* 371-379.

Cochrane, G.M. (1996). Compliance and outcomes in patients with asthma. *Drugs, 52 suppl:12-9.*

Collins, J.W. and Martin, C.R. (1998). Relation of traditional risk factors to intrauterine growth retardation among US-born and foreign-born Mexican Americans in Chicago. *Ethnic Disparities, 8,* 21-25.

Crain, E.F., Walter, M., O'Connor, G.T., Mitchell, H., Gruchalla, R.S., Kattan, M., et al. (2002). Home and allergic characteristics of children with asthma in seven U.S. urban communities and design of an environmental intervention: The Inner-City Asthma Study. *Environmental Health Perspectives, 110,* 939-945.

Diaz, T., Sturm, T., Matte, T., Bindra, M., Lawler, K., Findley, S., et al. (2000). Medication use among children with asthma in East Harlem. *Pediatrics, 105,* 1188-1193.

Drake, K.A., Galanter, J.M., Burchard, E.G. (2009). Race, ethnicity and social class and the complex etiologies of asthma. *Parmacogenomics, 9(4),* 453-462.

Drummond, N., Abdall, M., Buckingham, J.K., Beattie, J.A., Lindsay, T., Osman, L.M., Ross, S.J., et al. (1994). Integrated care for asthma: A clinical, social, and economic evaluation, Grampian Asthma Study of Integrated Care (GRASSIC). *BMJ, 308,* 559-564.

Duarte, C.S., Bird, H.R., Shrout, P.E., Wu, P., Lewis-Fernandez, R., Shen, S., and Canino, G. (2008). Culture and psychiatric symptoms in Puerto Rican children: Longitudinal results from one ethnic group in two contexts. *Journal Child Pscyhol Psychiatry, 49,* 563-572.

Enders, C. K. (2001). The impact of nonnormality on full information maximum-likelihood estimation for structural equation models with missing data. *Psychological Methods*, *6*(4), 352.

Evans, R. (1992). Asthma among minority children: A growing problem. *Chest, 101,* 368S-371S.

Evans, R. and English, K. (2002). The environment of poverty: Multiple stressor exposure, psychophysiological stress, and socioemotional adjustment. *Child Development, 73,* 1238-1248.

Evans, R., Gergen, P.J., Mitchel, H., Kattan, M., Kercsmar, C., Crain, E., Anderson, J., Eggleston, P., Malveaux, F.J., and Wedner, H.J. (1999). A randomized clinical trial to reduce asthma morbidity among inner-city children: Results of the National Cooperative Inner-City Asthma Study. *The Journal of Pediatrics, 135(3),* 332-338.

Evans, D., Mellins, R., Loback, K., et al. (1997). Improving care for minority children with asthma: Professional education in public health clinics. *Pediatrics, 99,* 157-164.

Fennelly, K. (2006). Health and well-being of immigrants: The health migrant phenomenon. In Walker and Barnett (Editors): *Immigrant Medicine: A Comprehensive Reference for the Care of Refugees and Immigrants*. Elsevier Press, Philadelphia.

Feldman, J.M., Ortega, A.N., Koinis-Mitchell, D., Kuo, A.A., and Canino, G. (2010). Child and family psychiatric and psychological factors associated with child physical health problems: Results from the Boricua Youth Study. *The Journal of Nervous and Mental Disease, 198(4),* 272-279.

Feldman, J.M., Ortega, A.N., McQuaid, E.L., and Canino, G. (2006). Comorbidity between asthma attacks and internalizing disorders among Puerto Rican children at one-year follow-up. *Psychosomatics, 47,* 333-339.

Flores, G. and Brotanek, J. (2005). The healthy immigrant effect: A greater understanding might help us improve the health of all children. *Arch. Pediatric Adolesc. Med., 159,* 295-297.

Flores, G. 2000. Culture and the patient-physician relationship: Achieving cultural competency in health care. *Journal of Pediatrics, 136(1),* 14-23.

Findley S, Lawler K, Bindra M, Maggio L, Penachio MM, Maylahn C. (2003). Elevated asthma and indoor environmental exposures among Puerto Rican children of East Harlem. *J Asthma*; 40:557-569.

Fitzclarence, C. and Henry, R. (1990). Validation of an asthma knowledge questionnaire. *Journal of Pediatric Child Health, 26(4),* 200-204.

Finkelstein JA, Brown RW, Schneider LC, et al. (1995). Quality of care for preschool children with asthma: the role of social factors and practice setting. *Pediatrics*; 95:389-394.

Freudenberg, N., Feldman, C.H., Clark, N.M., Millman, E.J., Velle, I., and Wasilewski, Y. (1980). The impact of bronchial asthma on school attendance and performance. *Journal of School Health, 50,* 522-526.

Fuertes, J.N., and Westbrook, F.D. (1996). Using the social, attitudinal, familial, and environmental (SAFE) acculturative stress scale to assess adjustment needs of Hispanic college students. *Measurement and Evaluation in Counseling and Development, 29,* 67-76.

Garrett, J., Fenwick, J.M., Taylor, G., Mitchell, E., Stewart, J., and Rea, H. (1994). Prospective controlled evaluation of the effect of a community based asthma education centre on a multiracial working class environment. *Thorax, 49,* 976-983.

Goodwin, R.D., Fergusson, D.M. and Horwood, L.J. (2004). Asthma and depressive and anxiety disorders among young persons in the community. *Psychol Med., 34,* 1465-1474.

Graham, J. W. (2009). Missing data analysis: Making it work in the real world. *Annual review of psychology*, *60*, 549-576.

Grus, C.L., Lopez-Hernandez, C., Delamater, A., Applegate, B., Brito, A., Wurm, G., and Wanner, A. (2001). Parental self-efficacy and morbidity in pediatric asthma. *Journal of Asthma, 38(1),* 99-106.

Greineder, D.K., Loane, K.C., and Parks, P. (1999). A randomized controlled trial of a pediatric asthma outreach program. *Journal of Allergy and Clinical Immunology, 103(3) part 1,* 436-440.

Guevara J.P., Wolf F.M., Grum C.M., et al. (2006). Effects of educational interventions for self management of asthma in children and adolescents: Systematic review and meta-analysis. *BMJ, 326,* 1308-1309.

Halfon, N. and Newacheck, P.W. (1993). Childhood asthma and poverty: Differential impacts and utilization of health services. *Pediatrics, 91,* 56-61.

Haselkorn, T., Lee, J.H., Mink, D.R., and Weiss, S.T. (2008). Racial disparities in asthma-related health outcomes in severe or difficult-to-treat asthma. *Annual Allergy and Asthma Immunology, 101,* 256-263.

Homer, C., Susskind, O., Alpert, H.R., Owusu, C., Schneider, L., Rappaport, L.A., and Rubin, D.H. (1999). An evaluation of an innovative multimedia educational software program for asthma management: Report of a randomized, controlled trial. *Pediatrics, 106(1), 210-215.*

Hu, D.J. and Covell, R.M. (1986). Health care usage by Hispanic outpatients as function of primary language. *West. J. Med., 144(4),* 490-493.

Hughes, D.M., McLeoud, M., Garner, B., and Goldbloom, R.B. (1991). Controlled trial of a home and ambulatory program for asthma children. *Pediatrics, 87,* 54-61.

Hunt, L.M. (2005). Health Research: What's culture got to do with it? *Lancet, 366,* 617-618.

Jaccard, J., & Becker, M. A. (1990). *Statistics for the behavioral sciences* (pp. 304-329). Wadsworth Publishing Company.

Joshi, A., Lichenstein, R., Rafei, K., Bakar, A., and Arora, M. (2007). A pilot study to evaluate self initiated computer patient education in children with acute asthma in pediatric emergency department. *Technology and Health Care, 15(6),* 433-444.

Juniper, E.F., Buist, A.S., Cox, F.M., Ferrie, P.J., and King, D. (1998). Development and validation of the standardized Asthma Quality of Life Questionnaire (AQLQ(S)). *Journal of Allergy and Clinical Immunology, 101,* S177.

Juniper, E.F., Buist, A.S., Cox, F.M., Ferrie, P.J., and King, D. (1999). Validation of a standardized version of the Asthma Quality of Life Questionnaire. *Chest, 115(5),* 1265-1270.

Katon, W., Lozano, P., Russo, J., McCauley, E., Richardson, L., Bush, T. (2007). The prevalence of DSM-IV anxiety and depressive disorders in youth with asthma compared with controls. *Journal of Adolescent Health, 41,* 455-463.

Kattan, M., Mitchell, H., Eggleston, P., Gergen, P., Crain, E., Redline, S., et al. (1997). Characteristics of inner-city children with asthma: The National Cooperative Inner-City Asthma Study. *Pediatric Pulmonology, 24,* 253-262.

Kelly, C., Morrow, A., Shults, J., Nakas, N., Strope, G., and Adelman, R. (2000). Outcomes evaluation of a comprehensive intervention program for asthmatic children enrolled in Medicaid. *Pediatrics,105,* 1029-1035.

Klinnert, M.D., Price, M.R., Liu, A.H., and Robinson, J.L. (2002). Unraveling the ecology of risks for early childhood asthma among ethnically diverse families in the southwest. *American Journal of Public Health, 92,* 792-798.

Koinis-Mitchell, D, McQuaid, E.L., Kopel, S.J., Esteban, C.A., Ortega, A.N., Seifer, R., Garcia-Coll, C., Klein, R., Cespedes, E., Canino, G., and Fritz, G.K. (2010). Cultural-related, contextual, and asthma-specific risks associated with asthma morbidity in urban children. *Journal of Clin Psychol Med Settings, 17,* 38-48.

Koinis-Mitchell, D., McQuaid, E.L., Seifer, R., Kopel, S.J., Esteban, C., Canino, G., Garcia-Coll, C., Klein, R., and Fritz, G. (2007). Multiple urban and asthma-related risks and their association with asthma morbidity in children. *Journal of Pediatric Psychology, 32(5),* 682-595.

Koinis-Mitchell, D., Murdock, K.M., and McQuaid, E.M. (2004). Risk and resilience in urban children with asthma: A conceptual model and exploratory study. *Children's Health Care, 33,* 275-298.

Kozyrskyj, A.L., Mai, X.M., McGrath, P., Hayglass, K.T., Becker, A.B., and Macneil, B. (2008). Continued exposure to maternal distress in early life is associated with an increased risk of childhood asthma. *American Journal of Respiratory and Critical Care Medicine, 177,* 142-147.

Krieger, J.W., Takaro, T.K., Song., L., and Weaver, M. (2005). The Seattle-King County Healthy Homes Project: A randomized, controlled trial of a community health worker intervention to decrease exposure to indoor asthma triggers. *American Journal of Public Health, 95(4),* 652-659.

Lara, M., Akinbami, L., Flores, G., Morgenstern, H. (2006). Heterogeneity of childhood asthma among Hispanic children: Puerto Rican children bear a disproportionate burden. *Pediatrics, 117,* 43-53.

Lara, M., Gamboa, c., Kahramanian, M.I., et al. (2005). Acculturation and Latino health in the United States: A review of the literature and the sociopolitical context. *Ann Rev Public Health, 26,* 367-397.

Lara, M., Morgenstern, H., Duan, N., and Brook, R.H. (1999). Elevated asthma morbidity in Puerto Rican children: A review of possible risk and prognostic factors. *Western Journal of Medicine, 170(2),* 75-84.

Lavoie, K.L., Bouchard, A., Joseph, M., Campbell, T.S., Favreau, H., and Bacon, S.L. (2008). Association of asthma self-efficacy to asthma control and quality of life. *Annals of Behavioral Medicine, 36(1),* 100-106.

Ledogar, R.J., Penchaszaden, A., Garden, C.I., and Acosta, L.G. (2000). Asthma and Latino cultures: Different prevalence reported among groups sharing the same environment. *American Journal of Public Health, 90(6),* 929-935.

Lieberman, D.A. (2000). Management of chronic pediatric diseases with interactive health games: Theory and research findings. *Journal of Ambulatory Care Mangemnt, 18(57),* 26-38.

Lieberman DA: Interactive video games for health promotion: Effects on knowledge, self efficacy, social support, and health, in Street RL, Gold WR, Manning T (eds.): *Health Promotion and Interactive Technology: Theoretical Applications and Future Directions*. Hillsdale, NJ, Lawrence Erlbaum, 1997, pp. 103-120.

Lindley, P., and Walker, S.N. (1993). Theoretical and methodological differentiation of moderation and mediation. *Nursing Research, 42(5),* 276-279.

Lengua, L.J. (2002). The contribution of emotionality and self-regulation to the understanding of children's response to multiple risk. *Child Development, 73,* 144-161.

Lieu TA, Lozano P, Finkelstein JA, et al. (2002). Racial/ethnic variation in asthma status and management practices among children in managed Medicaid. *Pediatrics, 109,* 857-865.

Litonjua, A.A., Carey, J.J., Burge, H.A., Weiss, S.T., and Gold, D.R. (1998). Parental history and the risk for childhood asthma: Does mother confer more risk than father. *American Journal of Respiratory and Critical Care Medicine, 158,* 176-181.

Little, R.J. (1988). A test of missing completely at random for multivariate data with missing values. *Journal of the American Statistical Association, 83(404),* 1198-1202.

Lozano, P., Finkelstein, J.A., Carey, V.J., Wagner, E.H., Inui, T.S., Fuhlbrigge, A.L., Soumerai, S.B., Sullivan, S.D., Weiss, S.T., and Weiss, K.B. (2004). A multisite randomized trial of the effects of physician education and organizational change in chronic-asthma care. *Arch Pediatr Adolesc Med, 158,* 875-883.

Mancuso, C.A., Rincon, M., McCulloch, C.E. and Charlson, M.E. (2001). Self-efficacy, depressive symptoms, and patients' expectations predict outcomes in asthma. *Medical Care, 39(12),* 1326-1338.

Markides, K.S. and Coreil, J. (1986). The health of Hispanics in the southwestern United States: An epidemiologic paradox. *Public Health Rep., 101,* 253-265.

Marks, G., Garcia, M., and Solis, J.M. (1990). Health risk behaviors of Hispanics in the United States: Findings from HHANES, 1982-84. *American Journal of Public Health, 80(supp),* 20-26.

Martin, M.A., Shalowitz, M.U., Mijanovich, T., Clark-Kauffman, E., Perez, E., and Berry, C.A. (2007). The effects of acculturation on asthma burden in a community sample of Mexican American schoolchildren. *American Journal of Public Health, 97(7),* 1290-1296.

Martinez, F.D., Wright, A.L., Taussig, L.M., Holbert, C.J., Halonen, M., and Morgan, W.J. (1995). Asthma and wheezing in the first six years of life. *New England Journal of Medicine, 332,* 133-138.

Mayo, P.H., Richman, J., and Harris, H.W. (1990). Results of a program to reduce admissions for adult asthma. *Annual Internal Medicine, 112,* 864-871.

McCauley, E., Katon, W., Russo, J., Richardson, L., and Lozano, P. (2007). Impact of anxiety and depression on functional impairment in adolescents with asthma. *General Hospital Psychiatry, 29,* 214-222.

McEwen, B.S. and Steallar, E. (1993). Stress and the individual. *Arch. Intern. Med., 153,* 2093-2100.

McQuaid, E.L., Kopel, S.J., Klein, R.B., and Fritz, G.K. (2003). Medication adherence in pediatric asthma: Reasoning, responsibility, and behavior. *Journal of Pediatric Psychology, 28(5),* 323-333.

Morgan, W.J., Crain, E.F., Gruchalla, R.S., O'Connor, G.T., Kattan, M., Evans, R., et al. (2004). Results of a home-based environmental intervention among urban children with asthma. *New England Journal of Medicine, 351,* 1068-1080.

Moudgil, H., Marshall, T., and Honeybourne, D. (2000). Asthma education and quality of life in the community: a randomized controlled study to evaluate the impact on white European and Indian subcontinent ethnic groups from socioeconomically deprived areas in Birmingham, UK. *Thorax, 55,* 177-183.

National Asthma Education and Prevention Program. (2007). National Heart Lung and Blood Institute, Expert Panel Report 3: Guidelines for the Diagnosis and Management of Asthma.

National Heart Lung and Blood Institute. (2002). *Asthma statistics, data fact sheet.* Bethesda, MD: National Institute of Health.

Nelson, D.A., Johnson, C.C., Divine, G.W., Strauchman, C., Joseph, C.L., and Ownby, D.R. (1997). Ethnic differences in the prevalence of asthma in middle class children. *Annals of Allergy and Asthma Immunology, 78*, 21-26.

Oliveti, J., Kercsmar, C., and Redline, S. (1996). Pre- and perinatal risk factors for asthma in inner city African-American children. *American Journal of Epidemiology, 143,* 570-577.

Opolski, M. and Wilson, I. (2005). Asthma and depression: A pragmatic review of the literature and recommendations for future research. *Clin Pract Epidem Mental Health, 1,* 18.

Ortega, A.N., Gergen, P.J., Paltiel, A.D., Bauchner, H., Belanger, K.D., Leaderer, B.P. (2002). Impact of site of care, race, and Latino ethnicity on medication use for childhood asthma. *Pediatrics;* 109:e1-e6.

Parcel, G.S., Gilman, S.C., Nader, P.R., and Bunce, H. (1979). A comparison of absentee rates of elementary school children with asthma and non-asthma schoolmates. *Pediatrics, 64,* 878-881.

Pless, I. (1974). *Theoretical and practical considerations in the measurement of outcome*. In: Chronic Childhood Illness: Assessment of Outcome (Greuve, G., Pleass, I., editors). Washington, U.S. Department of Health, Education and Welfare.

Pless, I. and Pinkerton, P. (1975). *Chronic Childhood Disorder Promoting Patterns of Adjustment.* New York: Henry Kempton, Publishing.

Prislen, R., Suarez, L., Simspon, D.M., and Dyer, J.A. (1998). When acculturation hurts: The case of immunization. *Soc. Sci. Med., 47,* 1947-1956.

Ramirez, R.R. (2004). *We the people: Hispanics in the United States.* Census 2000 Special Reports. Washington, DC: Bureau of the Census, US Department of Commerce.

Rand, C.S., Butz, A.M., Kolodner, K., Huss, K., Eggleston, P., and Malveaux, T. (2000). Emergency department visits by urban African American children with asthma. *Journal of Allergy and Clinical Immunology, 105,* 83-90.

Richards, W. (1989). Hospitalizations of children with status asthmaticus: A review. *Pediatrics, 84,* 111-117.

Rosier, M.J., Bishop, J., Nolan, T., Robertson, C.F., Carlin, J.B., and Phelan, P.D. (1994). Measurement of functional severity of asthma in children. *American Journal of Respiratory and Critical Care Medicine, 149,* 1434-1441.

Rubin, D.H., Leventhal, J.M., Sadock, R.T., Letovsky, E., Schottland, P., Clemente, I., and McCarthy, P. (1986). Educational intervention by computer in childhood asthma: A randomized clinical trial testing the use of a new teaching intervention in childhood asthma. *Pediatrics, 77(1), 1-10.*

Rutledge, M.S. and McLaughlin, C.G. (2008). Hispanics and health insurance coverage: The rising disparity. *Med Care, 46(10),* 1086-1092.

Sandberg, S., Paton, J.Y., Ahola, S., et al. (2000). The role of acute and chronic stress in asthma attacks in children. *Lancet, 256,* 982-987.

Sears, M.R., Holdaway, M.D., Flannery, E.M., Herbison, G.P., and Silva, P.A. (1996). Parental and neonatal risk factors for atopy, airway hyper-responsiveness, and asthma. *Arch. Dis. Child., 75,* 392-398.

Sergi, M.J., Rassovsky, Y., Nuechterlein, K.H., and Green, M.F. (2006) Social perception as a mediator of the influence of early visual processing on functional status in schizophrenia. *American Journal of Psychiatry, 163(3),* 448-452.

Shalowitz, M.U., Berry, C.A., Quinn, K.A., and Wolf, R.L. (2001). The relationship of life stressors and maternal depression to pediatric asthma morbidity in a subspecialty practice. *Ambulatory Pediatrics, 1,* 185-193.

Shames, R.S., Share, P., Mayer, M., Robinson, T.N., Hoyt, E.G., Gonzalez-Hensley, F., Bergman, D.A., and Matsu, D.T. (2004). Effectiveness of a multicomponent self-management program in at-risk, school-aged children with asthma. *Annals of Allergy, Asthma and Immunology, 92(6),* 611-618.

Shegog, Rill., Bartholomew, K., Parcel, G.S., Sockrider, M., Masse, L., and Abramson, S. (2001). Impact of a computer-assisted education program on factors related to asthma self-management behavior. *Journal of American Medical Informatics Association, 8(1),* 49-61.

Simon, P.A., Zing, Z., World, C.M., Haddock, W., and Fielding, J.E. (2003). Prevalence of childhood asthma and associated morbidity in Los Angeles County: Impacts of race/ethnicity and income. *Journal of Asthma, 40,* 535-543.

Solis, J., Marks, G., Garcia, M., and Shelton, D. (1990). Acculturation, access to care, and use of preventive services by Hispanics: Findings from HHANES 1982-1984. *American Journal of Public Health, 80(supply),* 11-19.

Strecher, V., DeVellis, B.M., Becker, M., and Rosenstock, I. (1986). The role of self-efficacy in achieving behavior change. *Health Education Quarterly, 13,* 73-91.

Taggart, V.S., Zuckerman, A.E., Sly, R.M., Stein Mueller, C., Newman, G., O'Brien, R.W., Schneider, S., and Bellini, J.A. (1991). You can control asthma: Evaluation of an asthma education program for hospitalized inner-city children. *Patient Education and Counseling, 17(1),* 35-47.

Throne, B.P.A., Schemer, T.R.J., Van den Boom, G., Molina, J., Flowering, H., Ackerman's, R.P., Growl, R., Van Weal, C., and Van Scheck, C.P. (2003). Self-management of asthma in general practice, asthma control and quality of life: a randomized controlled trial. *Thorax, 58,* 30-36.

US Census Bureau. (2004). *US interim projections by age, sex, race, and Hispanic origin*.

US Census Bureau Population Division, Population Projections Program. (2003). *Projections of the total resident population by 5-year age groups, race, and Latino origin with special age categories: middle series, 2006 to 2010*.

US Census Bureau Statistics from 2000, 2003, 2004, and 2008. www.census.gov.

Vega, W.A., Rodriguez, M.A., Gruskin, E. (2009). Health disparities in the Latino population. *Epidemiologic Reviews, 31,* 99-112.

Wasilewski, Y., Clark, N.M., Evans, D., et al. (1988). The effect of paternal social support on maternal disruption caused by childhood asthma. *Journal of Community Health, 13,* 33-42.

Weitzman, M., Gortmaker, S., and Cobol, A. (1990). Racial, social, and environmental risks for childhood asthma. *American Journal of Disorders of Childhood, 144,* 1189-1194.

Wernette, D.R. and Nieves, L.A. (1992). Breathing polluted air. *EPA Journal, 18,* 16-17.

West, S.G., and Aiken, L.S. (1991). *Multiple regression: Testing and interpreting interactions.* Sage Publications, Incorporated.

Wright, R., Cohen, S., Carey, V., Weiss, S., and Gold, N. (2002). Parental stress as a predictor of wheezing in infancy. *American Journal of Respiratory and Critical Care Medicine, 165,* 358-365.

Wright, R.J., Mitchell, H., Vines, C.M., COHE, S., Stout, J., Evans, R., et al. (2004). Community violence and asthma morbidity: The inner-city asthma study. *American Journal of Public Health, 94,* 625-232.

Yawn, B.P., Aglet-Bergstrom, P.J., Yawn, R.A., Wolman, P., Greco, M., Gleason, M., and Mark son, L. (2000) An in-school CD-ROM Asthma Education Program. *Journal of School Health, 70(4),* 153-159.

Yawn, B.P. (2003). The impact of childhood asthma on daily life of the family – A qualitative study using recurrent thematic analysis. *Prim Care Rasp Journal, 12(3),* 82-85.

Zahran, H.S., Bailey, C., and Garbe, P. (2011). Vital signs: Asthma prevalence, disease characteristics, and self-management education. *Morbidity and Mortality Weekly Report, Centers for Disease Control and Prevention, 60(17),* 547-552.