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Urban Stressors and Child Asthma: An Examination of Child and Caregiver Models

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URBAN STRESSORS AND CHILD ASTHMA: AN EXAMINATION OF CHILD AND
CAREGIVER MODELS

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of
Philosophy at Virginia Commonwealth University

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Abstract

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The purpose of the present study was to examine how low-income, racial and ethnic

minority, urban families experience and manage their child's asthma. The rationale for this study

stems from existing literature on asthma disparities and documented predictors of increased

asthma morbidity and mortality. In particular, this study considered how specific types of stress

may disproportionately impact low-income, racial and ethnic minority, urban families that have a

child with asthma. This study aimed to determine associations between urban stressors (stressful

life events, perceived discrimination, subjective socioeconomic status) and child asthma

outcomes (emergency department visits, school days missed, asthma control), and considered

depressive symptoms and asthma self-efficacy as mediators in these associations. Analyses were

conducted in a sample of 97 urban caregivers and their children in Richmond, Virginia.

Findings revealed that neighborhood stress was significantly associated with asthma

control. Stressful life events were significantly associated with school days missed. Perceived

discrimination and subjective SES were not significantly related to any child asthma outcomes.

Bootstrapping procedures demonstrated that child depressive symptoms mediated the relation

between neighborhood stress and asthma control. Child asthma self-efficacy did not significantly

mediate associations between neighborhood stress and any child outcomes. Caregiver depressive symptoms and caregiver asthma self-efficacy did not significantly mediate any associations between caregiver-reported urban stressors and child asthma outcomes.

Results from the present study suggest that urban stressors, especially neighborhood stress and stressful life events, are important to consider in the context of child asthma management and subsequent health outcomes. Exposure to urban stressors may further contribute to pediatric asthma disparities because they are disproportionately experienced by low-income, racial and ethnic minority, urban families. Each urban stressor that was related to a child outcome was associated with a particular asthma outcome. Specifically, child-reported neighborhood stress was related to asthma control. Caregiver-reported stressful life events were associated with school days missed. These findings suggest that exposure to specific types of stress may impact asthma management differently. Future research should, therefore, explore the impact and contribution of specific stressors in greater depth. Further, child depressive symptoms significantly mediated the relation between neighborhood stress and asthma control, although caregiver depressive symptoms did not significantly mediate any associations between urban stressors and child asthma outcomes. Additionally, both child and caregiver depressive symptoms were significantly associated with multiple urban stressors and child asthma outcomes. Depressive symptoms may, therefore, be important to target in future research as possible explanatory variables or variables that contribute to stress appraisals and child asthma outcomes.

Keywords: urban families, stress, pediatric asthma, health disparities

Urban Stressors and Child Asthma: An Examination of Child and Caregiver Models

Asthma is the most common pediatric chronic illness. It currently affects nearly seven million children in the United States, which equates to 9.3% of the population under age 18. Overall, 10 million children under the age of 18 (14% of all children) have ever been diagnosed with asthma (Bloom, Jones, & Freeman, 2013). Among children under age 18, asthma prevalence rates are higher among boys (9.3%) than girls (7.3%; CDC, 2015).

Asthma is a chronic lung disease that inflames and narrows airways and subsequently leads to difficulty with breathing. Risk factors for the development of asthma include wheezing, respiratory infections, allergies, eczema, and atopy (e.g., genetic predisposition to develop allergies; NHLBI, 2014). Other factors that place children at risk for the development of asthma include children who have a family history of asthma, particularly a diagnosis in a parent, premature birth, overweight or obesity, being foreign-born, and exposure to second-hand smoke (Eldeirawi & Persky, 2006; Jaakkola, Nafstad, & Magnus, 2001; Vrijlandt, Gerritsen, Boezen, & Duiverman, 2005).

In many cases, there is chronic inflammation of the airways that may not cause detectable symptoms. More severe exacerbations, however, occur when noticeable symptoms are present (McQuaid & Abramson, 2009). Symptoms often include wheezing, chest tightness, shortness of breath, and coughing (NHLBI, 2014). Asthma is a heterogeneous chronic illness, and as such, symptoms and triggers vary from person to person and also vary over the course of the disease. Triggers are things (e.g., pets, dust, smoke, mold), activities (e.g., exercise), or conditions (e.g., respiratory infection) that people with asthma are exposed to that can lead to exacerbations or full-blown attacks (American Lung Association, 2015; Kattan et al., 1997; McQuaid & Abramson, 2009; NHLBI, 2014). The most common triggers include allergens (e.g., animal fur,

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pollen), irritants that affect all individuals with asthma (e.g., air pollution, tobacco smoke, dust), seasonal changes (e.g., cold weather), select medicines, foods and drinks with sulfites, physical activity, and viral upper respiratory infections (e.g., colds; Kattan et al., 1997; McQuaid & Abramson, 2009; NHLBI, 2014).

When exacerbations occur, such as those due to trigger exposure, and there is obstruction of the airways, symptom management in the form of rescue medication can be used to reverse the impact on the airways and lungs. In some cases, however, the impact is not reversible, causing permanent airway "remodeling" and significant depletion in lung function (Bibi, Feigenbaum, Hessen, & Shoseyov, 2006). Due to the impact that exacerbations, especially chronic exacerbations, can have on a child's health, disease management is crucial to prevent or minimize outcomes that may negatively impact a child's development (e.g., school days missed, emergency department [ED] visits, hospitalizations).

Treatment for asthma typically consists of both long-term controller medications and quick-relief or rescue medications. Long-term, preventative medications are often inhaled corticosteroids that are administered daily or twice per day. Controller medications can also be taken in pill form. Quick-relief medications often come in the form of short-acting beta-agonists, and they are used during flare-ups/exacerbations. Importantly, quick-relief inhalers relax the muscles around the airway so that air can flow through them more easily, whereas long-term controller medications are used regularly to reduce chronic inflammation and mucus buildup in the lungs (NHLBI, 2014). Similar to the heterogeneous nature of triggers and symptoms, treatments vary and need to be tailored to the individual needs and disease severity of the child with asthma.

Pediatric Asthma Disparities

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Health disparities are defined by the Department of Health and Human Services as follows:

> A particular type of health difference that is closely linked with social or economic disadvantage. Health disparities adversely affect groups of people who have systematically experienced greater social or economic obstacles to health based on their racial or ethnic group, religion, SES, gender, age, mental health, cognitive, sensory, or physical disability, sexual orientation, geographic location, or other characteristics historically linked to discrimination or exclusion. (The Secretary's Advisory Committee on National Health Promotion and Disease Prevention Objectives for 2020, 2008, p. 28)

Asthma impacts children from racial and ethnic minority families at disproportionate rates, as well as those from families with low-income/socioeconomic status (SES) and who reside in urban settings. Previous research has clearly documented pediatric asthma disparities among children from minority populations compared to non-Latino White children (Canino, McQuaid, & Rand, 2009). Recent prevalence statistics gathered through the 2013 National Health Interview Survey (NHIS) suggest that Puerto Rican (14.6%) and non-Latino Black (9.9%) are most likely to have a current asthma diagnosis. Prevalence rates for other racial and ethnic groups are as follows: non-Latino White (7.4%), Latino (5.9% overall), Mexican/Mexican American (4.7%), and other non-Latino (5.8%; CDC, 2015). In terms of prevalence rates broken down by federal poverty threshold, 10.9% of children below 100% of poverty level currently have an asthma diagnosis, followed by 100% to less than 250% of poverty level (7.0%), 250% to less than 450% of poverty level (6.2%), and 450% of poverty level or higher (6.6%; CDC, 2015). Even after controlling for healthcare variability in low-income, urban populations, however, higher rates of asthma prevalence and asthma-related risks (e.g., increased morbidity) are still

present in low-income, racial and ethnic minority families (Joseph, Ownby, Peterson, & Johnson, 2000; McQuaid & Abramson, 2009).

Racial and ethnic minority children living in low-income populations are impacted substantially more by pediatric asthma morbidity and mortality (Federico & Liu, 2003). Data collected from 1980-2005 demonstrate that African American children are nearly 2.5 times more likely to utilize emergency healthcare services and be admitted to the hospital than White children (Akinbami, 2006). Hospital inpatient discharges from 2010 are higher among African Americans with asthma (29.9%) compared to Whites (8.7%) and others (12.6%) with asthma (CDC, 2015). Conversely, African American children are less likely to have outpatient medical visits. In 2004, African American children had nearly 20% fewer outpatient medical visits for their asthma than White children (Akinbami, 2006). It seems plausible that the decreased rate of outpatient medical visits is related, in part, to higher rates of urgent care utilization. Further, data reported by the Centers for Disease Control and Prevention (CDC) in 2013 demonstrated greater asthma mortality rates among non-Latino African Americans (25.9%) compared to non-Latino Whites (8.4%), other non-Latinos (12.0%), and Latinos (9.0%; CDC, 2015). In fact, African American children are five times more likely to die from asthma than White children (Akinbami, 2006). Some reasons for these differences in healthcare utilization and asthma mortality may include unequal access to and utilization of health care, as well as cultural attitudes and beliefs toward health in general (Weiss, Gergen, & Crain, 1992).

Gold and Wright (2005) suggest that these substantial asthma disparities highlight the presence of multiple interrelated factors that lead to more negative asthma outcomes among racial and ethnic minority children. For example, higher rates of unemployment, lower SES, reduced access to healthcare, insurance status, overcrowding in housing, higher crime rates, and

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racism are examples of stressors more often faced by African Americans than by Whites (Anderson, Myers, Pickering, & Jackson, 1989; Outlaw, 1993). Exposure to chronic stress may, therefore, explain some of the health disparities found among African Americans. In addition, types of family support may impact child asthma outcomes. Specifically, disparities are common in African American populations where caregivers and families have less access to resources (e.g., medical services), and social support from family members may be reduced when they are also managing similar problems and stressors (Bryant-Stephens, 2009).

Household and environmental triggers. Exposure to household and environmental triggers is another type of stressor commonly faced by low-income, racial and ethnic minority, urban families. Data from the National Cooperative Inner-City Asthma Study (NCICAS) found that low-income children residing in urban settings were more likely to be exposed to environmental triggers, such as cockroaches (Gergen et al., 1999). This study also found that among children with asthma, exposure to cockroaches was significantly associated with more symptoms and emergency healthcare utilization (e.g., ED visits). Other triggers present in inner-city, low-income homes and communities include exposure to secondhand smoke (SHS), pets, pests, dust, nitrous oxide, and other irritants (Curtin-Brosnan et al., 2008; Matsui et al., 2005; Simons, Curtin-Brosnan, Buckley, Breysse, & Eggleston, 2007). Further, these triggers have been found to differ by racial and ethnic background (Everhart et al., 2011). Everhart and colleagues (2011) analyzed data from 133 urban, low-income children with asthma (6-13 years of age) and their caregivers. Results showed that non-Latino White and African American families reported more exposure to SHS compared to Latino families. In addition, non-Latino White families reported more exposure to pets than Latino families. Similarly, another study found that among 140 urban families of a child with asthma, there were significantly more areas

of concern related to housing condition (e.g., maintenance issues, home safety) reported in Latino and African American homes compared to non-Latino White homes (Pacheco et al., 2014). These results highlight a constellation of factors related to family SES that are known to negatively impact child asthma outcomes (e.g., increased symptoms, emergency healthcare utilization).

Urban residence. Residing in an urban setting is another factor that can be associated not only with greater asthma prevalence rates, but also with worse child asthma outcomes. The CDC categorizes large metropolitan statistical areas (MSA) as having a population of one million or more people. Small MSAs include fewer than one million residents. Approximately 9.5% of children residing in large MSAs have asthma, whereas 9.3% of children in small MSAs, and 8.8% of children not living in MSAs have asthma (Bloom et al., 2013). In general, caregivers of children with asthma who live in urban areas face more challenges in managing their child's asthma (Strunk, Ford, & Taggart, 2002). Strunk and colleagues (2002) cited a variety of reasons for disparities present in urban communities, including poverty, urban-related stress, lack of support (within family and community), and inadequate knowledge about the disease and associated treatment. Research also shows that racial and ethnic minority children living in urban settings, in particular, are at an even greater risk for deleterious asthma outcomes (Rand et al., 2000). On top of those findings, data from the 2010 United States Census demonstrate that there are increased numbers of minority families living in urban areas compared to previous years (Frey, 2011). Specifically, out of the 100 largest urban areas in the country, non-Whites and Latinos make up more than 50% of the population in 22 of those 100 urban areas, compared to 14 and five out of 100 in 2000 and 1990, respectively. These statistics suggest that because there is an increasing number of families living in urban settings, there is a greater chance that these

families are exposed to a myriad of stressors (e.g., poverty, limited knowledge about asthma, limited access to care) that can impede the family's ability to effectively manage childhood asthma.

Summary of pediatric asthma disparities. It is increasingly evident that asthma disparities are due to a constellation of interrelated factors (Canino et al., 2006). Koinis-Mitchell and colleagues (2012) point out that it is challenging to determine the impact of individual factors (e.g., minority status, SES) on asthma disparities. Even though it may be difficult to determine the impact of individual factors, it is important to learn more about which factors, like urban stressors, may contribute to asthma disparities. Overall, published reports suggest that children from lower-income, urban, and racial and ethnic minority families are more likely to be at-risk for worse asthma morbidity (e.g., being admitted to the hospital for asthma) and mortality. The present study aimed to build off existing literature on asthma disparities and predictors of increased asthma morbidity and mortality by considering how stress (e.g., neighborhood stress, stressful life events, subjective SES, perceived discrimination) may disproportionately impact low-income, racial and ethnic minority, urban families that have a child with asthma.

Theoretical Framework

Bronfenbrenner's Social-Ecological Theory is a widely-used model in developmental psychology that posits that there are reciprocal influences between an individual and multiple levels of factors within a larger system (Bronfenbrenner, 1979). Bronfenbrenner's Theory includes four main "systems" that surround the individual in the middle. In the present study, the individual in the middle is the child with asthma. Examples of individual factors that comprise the center of the system include age, gender, sex, and health status (e.g., asthma diagnosis). The systems then become larger and less proximal as they expand out around the child, in the

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following order: The Microsystem, the Mesosystem, the Exosystem, and the Macrosystem. The Microsystem is the system, or direct context, in which the child lives (e.g., family, school, health services, neighborhood). The next level is the Mesosystem, which is the system that connects different aspects of a child's overall system. Then, the Exosystem includes larger institutions that are not necessarily directed at the individual, but the institutions are known to impact child development (e.g., social services, media, neighbors, friends). Finally, the Macrosystem is the largest system and includes broader aspects of a child's system, like cultural attitudes. In addition to the four main levels, the Chronosystem is another component of Bronfenbrenner's Social-Ecological Theory that includes life transitions (e.g., parental divorce) that may impact child development. Together, there are many transactional processes that occur within and between systems and subsequently impact child development (Bronfenbrenner, 1979).

The premise of the present study was that both child- and caregiver-reported experiences and factors are important to examine given the differing ways in which child and caregiver stress impact child asthma. In an extensive review, Wood, Miller, and Lehman (2015) reported that it is well-established that family and caregiver stress are associated with pediatric asthma outcomes. In the present study, the goal was to examine two separate models. The first model included a child-reported urban stressor, neighborhood stress, and how that variable was associated with child asthma outcomes. The second model included three caregiver-reported urban stressors (stressful life events, perceived discrimination, subjective SES) and how those stressors were each related to child asthma outcomes.

The models highlighted two pathways through which child- and caregiver-reported variables (depressive symptoms and asthma self-efficacy) accounted for the associations between urban stressors and child asthma outcomes. The mechanism at play in the child model was the

physiological impact of stress; the psychological impact of stress and subsequent reduction of available resources (e.g., cognitive, emotional) was the mechanism at play in the caregiver model. The child model was constructed based on the knowledge that stress perceived by a child physiologically impacts the child's airways. Specifically, when a child is exposed to an event that is perceived as stressful, the child's airway may be sensitized (Chen & Miller, 2007). Child depressive symptoms and child asthma self-efficacy were included as possible mediators given their associations with both urban stressors and child asthma outcomes. A different psychological mechanism, however, was considered in the caregiver model. Specifically, caregivers who are managing multiple urban stressors (e.g., perceived discrimination) may have fewer cognitive and emotional resources to dedicate to a child's asthma management. This is consistent with literature that suggests that stress faced by parents may negatively impact the health outcomes of children with chronic health conditions (Cousino & Hazen, 2013; Streisand, Braniecki, Tercyak, & Kazak, 2001). Similar to the child model, in the context of urban stress, caregiver depressive symptoms and asthma self-efficacy and were included as mediator variables that could explain associations between caregiver-reported urban stressors and child asthma outcomes.

The present study's examination of two separate child and caregiver models was novel. The child model was particularly unique, given the dearth of literature collected from children on their experiences of stress as they relate to their disease management and outcomes. Often, stress is reported by caregivers. For instance, a recent study by Tobin and colleagues (2016) examined neighborhood stress among children with asthma, although the neighborhood stress variable was reported by their caregivers. Consistent with limited data reported by children, Koinis-Mitchell and colleagues (2014) support the need for further research on the ways in which child-reported

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stress impacts asthma management. Additionally, depressive symptoms and asthma self-efficacy are variables that were examined as potential mediators in the current study. Including an examination of these mediator variables is consistent with another priority in the field of pediatric asthma research, which is to understand more about various mechanisms that may contribute to or explain child asthma outcomes (Koinis-Mitchell et al., 2014). Among racial and ethnic minority, low-income, urban families, research examining these associations may identify processes by which urban stressors contribute to child asthma disparities.

Overview of Psychological and Neighborhood Stress

General psychological stress. Generally, psychological stress impacts the human body, including the immune system (Segerstrom & Miller, 2004). In the context of asthma, stress can affect airway inflammation in response to physical triggers and subsequently increase asthma expression and exacerbations (Chen & Miller, 2007; NHLBI, 2007; Wright, Cohen, & Cohen, 2005; Wright, 2007). This means that exposure to more negative emotions and stressors may sensitize pathways and lead to airway inflammation. Moreover, when someone is exposed to a trigger (e.g., SHS), the inflammatory response in the lungs is more profound, which leads to more frequent and severe symptoms (Chen & Miller, 2007). This literature is relevant to the present study, as children who experience events that they perceive to be stressful may subsequently experience more frequent and severe asthma symptoms. Similarly, caregivers may experience difficulty managing stressors that are commonly experienced by urban families.

Neighborhood stress. Neighborhood stress is a variable of interest in the present study given the study's focus on pediatric asthma disparities. Neighborhood stress broadly refers to stress that is triggered by exposure to certain events, experiences, and surroundings in the community. In urban areas, it is critical to understand how families manage asthma in the context

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of stressors, particularly stressors within the neighborhood context. Although many types of stressors may be apparent in urban areas, exposure to stress due to neighborhood factors (e.g., crowded housing, lack of safety) is particularly heightened. Compounding the general impact of stress on physical and psychological health, neighborhood stress has the potential to initiate and exacerbate asthma symptoms and challenge families in managing asthma appropriately on a day to day basis (NHLBI, 2007; Wright et al., 2005; Wright, 2007).

Children may perceive certain events in their neighborhoods as stressful, which has the potential to impact their asthma symptoms (Chen & Miller, 2007). In regard to caregivers, those who experience more stress, including within the neighborhood, may have fewer resources to devote to managing a child's asthma care. In these cases, neighborhood stress may have important implications for urban families concurrently managing a child's asthma.

Neighborhood Stress and Child Asthma Outcomes

Research demonstrates that families residing in urban settings generally encounter more barriers (e.g., less access to resources, more exposure to violence) to asthma prevention, management, and treatment, which often negatively impact asthma control (Jandasek et al., 2011). Cabana and colleagues (2004) found higher rates of child asthma hospitalizations and mortality in urban settings comprised of more individuals living in poverty, more neighborhood stressors, and a larger percentage of ethnic minority families. Overall, these factors are disproportionately present in urban neighborhoods and may put urban children with asthma at heightened risk for poorer outcomes.

Safety and violence. Low-income, racial and ethnic minority caregivers living in urban settings who are raising their children with asthma are facing very real challenges. Despite their very best intentions, they may need to devote cognitive and emotional resources toward making

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sure their children are safe in their neighborhoods versus attending to children's asthma symptoms. Data from the National Survey of Children's Health reported in 2009 examined neighborhood safety (Subramanian & Kennedy, 2009). Caregivers responded to one question, "How often do you feel (child) is safe in your community or neighborhood?" to assess perception of neighborhood safety. The findings highlighted higher rates of asthma diagnosis in families who perceived their neighborhoods to be "sometimes safe" or "never safe" compared to families who perceived their neighborhoods to be "always safe" (Subramanian & Kennedy, 2009). Although the focus of their study was to examine asthma prevalence stratified by level of neighborhood safety, it highlights the fact that more families of children with asthma may be living in unsafe neighborhoods as compared to safer neighborhoods. Families living in unsafe neighborhoods may face barriers in trying to provide appropriate asthma care for their children if they are also managing concerns related to their children's safety in their neighborhoods.

Caregiver perception of neighborhood violence can, therefore, impact child asthma symptoms (Warman, Silver, & Wood, 2009; Wright et al., 2004). Caregivers who reported feeling unsafe in their neighborhoods were more likely to have children with higher rates of asthma morbidity (Kopel et al., 2015). Further, exposure to violence has been found to be associated with more daytime asthma symptoms (Wright et al., 2004). Other correlates of exposure to community violence include more symptom days and hospitalizations (Swahn & Bossarte, 2006; Wright et al., 2004). Exposure to increased stress within the community (i.e., crime) may subsequently reduce the number of cognitive and emotional resources available to these caregivers, thus reducing their ability to appropriately manage asthma treatment for their children. When families feel safer, they may be able to contribute and attend more to child

asthma management, which leads to better asthma control (Coutinho, McQuaid, & Koinis-Mitchell, 2013).

One study specifically looked at home and neighborhood safety within a sample of 147 urban, racial and ethnic minority families (Coutinho et al., 2013). Children were between the ages of six and 13 years and from Latino, African American, and non-Latino White families. The authors controlled for poverty level in analyses and found an association between neighborhood safety and better family asthma management among caregivers with higher levels of perceived discrimination. The authors concluded that this study highlights the importance of considering home and neighborhood safety within the context of family asthma management (Coutinho et al., 2013). A lack of home and neighborhood safety may increase the stress placed on caregivers tending to their children with asthma. Wright and Steinbach (2001) posited that consistent exposure to violence may increase psychosocial risk, including general level of stress, and may subsequently intensify asthma symptoms in high-risk urban communities. Increased exposure to stress, therefore, impacts urban children by causing them to be more susceptible to inflammatory responses to triggers that subsequently alter pathways and increase the frequency and severity of asthma symptoms (Chen & Miller, 2007).

Household and caregiver characteristics. Within the family context, family poverty status and caregiver characteristics may also impact neighborhood stress. Specifically, more household stress can subsequently impact child mental health (e.g., increase anxiety, increase depressive symptoms) and trigger a physiological response (e.g., exacerbation of asthma symptoms; Yen, Yelin, Katz, Eisner, & Blanc, 2006). In addition, caregiver characteristics that are thought to impact perceived neighborhood stress include mental health, physical health, efficacy, coping skills, and irritability (Leventhal & Brooks-Gunn, 2000). The household can be

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a more stressful environment when caregiver depression, general caregiver stress, and any stressful life events are part of the context (Koinis-Mitchell et al., 2014; Wright et al., 2004). As previously described, stress has the potential to alter pathways and exacerbate asthma symptoms in response to triggers, which may make it more challenging for families to manage their child's asthma appropriately (Chen & Miller, 2007; NHLBI, 2007; Wright et al., 2005; Wright, 2007).

Relevance to the current study. Urban families frequently experience stress, including related to the neighborhood context, and exposure to these stressors may subsequently increase child asthma morbidity. For instance, a recent study showed that children who demonstrate poorer asthma control report higher levels of neighborhood stress than those with better asthma control (Koinis-Mitchell et al., 2014). In a separate study, Kopel and colleagues (2015) found that urban children whose caregivers reported feeling less safe in their neighborhoods were more likely to report negative asthma outcomes, including worse asthma control, greater likelihood of dyspnea and rescue medication use, increased activity limitation, and higher frequency of nighttime symptoms, compared to children whose families lived in safer neighborhoods. Together, these findings suggest that living in an urban setting can increase exposure to stressors within the neighborhood context. Increased exposure to stressors within the community may subsequently impact the care provided to children with asthma, as caregivers may place other priorities above the care for their children's asthma (e.g., safety) or may have depleted cognitive and emotional resources that prevent them from appropriately managing asthma care. This is consistent with previous pediatric literature that suggests that in the presence of caregiver stress, children may have more negative health outcomes (Cousino & Hazen, 2013; Streisand et al., 2001). For children, these stressful experiences may also increase the frequency and severity of asthma symptoms, leading to greater asthma morbidity (Chen & Miller, 2007).

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Neighborhood stress covers a wide range of stressors that may be present in one's community. In the present study, children reported directly about their experiences with neighborhood stress (e.g., violence), whereas caregivers reported about a myriad of stressful life events, including those within the family and community. Importantly, it is likely that aspects of overall stressful life events may overlap with perceived discrimination and subjective SES, two other variables reported by caregivers in the current study. The present study, therefore, examined the association between each urban stressor (stressful life events [e.g., lack of safety], perceived discrimination, subjective SES) and important child asthma outcomes experienced and reported by caregivers. This study also examined the relation between neighborhood stress experienced and reported by children and child asthma outcomes reported by their caregivers.

Overview of Perceived Discrimination

A substantial amount of literature has documented the association between discrimination and health. Pascoe and Richman (2009) define perceived discrimination as follows: "A behavioral manifestation of a negative attitude, judgment, or unfair treatment toward members of a group" (p. 3). The authors also point out that although discrimination is subjective and reports of discrimination are often not confirmed, the perception of discrimination in and of itself causes stress. Similar to the way in which general stress and other specific types of stressors impact asthma outcomes, perceived discrimination is a stressor that may deplete family resources (e.g., cognitive and emotional coping strategies). In turn, this could decrease the ability of caregivers to care for their children with asthma, and therefore lead to greater asthma morbidity and mortality in urban families.

Discrimination is often unpredictable and uncontrollable, and these types of experiences are often more stressful and consequently more detrimental to physical and psychological health

than in situations when stress may be predictable (Williams & Mohammed, 2009). Responses to stressful discriminatory events can include engaging in fewer healthy behaviors or more unhealthy (risky) behaviors when coping with a situation. It may be that when people experience discrimination, either sporadically or chronically, the increase in stress level subsequently limits available coping resources (Pascoe & Smart Richman, 2009). Other research suggests higher rates of risky behaviors in response to discrimination, including smoking, alcohol and substance abuse, and avoidance of positive health behaviors (e.g., health screenings; Bennett, Wolin, Robinson, Fowler, & Edwards, 2005; Klonoff & Landrine, 1999; Martin, Tuch, & Roman, 2003; Ryan, Gee, & Laflamme, 2006; Yen, Ragland, Greiner, & Fisher, 1999; Yoshikawa, Wilson, Chae, & Cheng, 2004). In the context of pediatric asthma management, it is possible that caregivers who experience discrimination may utilize coping resources that are not only harmful to themselves, but also their children (e.g., smoking, avoidance of health screenings).

In a comprehensive meta-analysis completed by Pascoe and Richman (2009), the authors examined several mental health variables, including symptoms (e.g., depression, post-traumatic stress), distress, and general indicators of wellbeing (e.g., quality of life [QOL], satisfaction with life). Among 110 studies, results suggested that there is an association between perceived discrimination and poorer overall wellbeing, more symptoms of depression, and heightened distress. Recent discrimination had more of an effect on mental health outcomes than lifetime discrimination. Pascoe and Richman (2009) also determined that there was not a significant difference between lifetime and chronic discrimination on mental health outcomes, although trends in data suggested that chronic discrimination had a stronger effect on mental health outcomes compared to lifetime discrimination. Although most studies did not include clinical diagnoses of mental health problems, the authors concluded that identified patterns between

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greater perceived discrimination and more mental health concerns suggest the presence of the association between discrimination and clinically-significant mental health problems (Pascoe & Richman, 2009).

The authors also examined the impact of perceived discrimination on psychological stress, as stress is a general indicator of mental health and physical health. In the meta-analyses, approximately 90% of studies identified a link between perceived discrimination and stress responses. Specifically, the direction of the association was such that more perceived discrimination was associated with more psychological stress (Pascoe & Richman, 2009).

Perceived Discrimination and Child Asthma Outcomes

Previous research on the association between perceived discrimination and asthma outcomes in urban pediatric asthma populations, in particular, is sparse. Few studies have established connections between perceived discrimination in children as a potential risk factor for child asthma morbidity. It is challenging to study perceived discrimination among children due to the cognitive and social development required to take different perspectives and understand discrimination (Bigler & Liben, 1993; Doyle & Aboud, 1995; Eccles, 1999). Previous studies, however, have examined perceived discrimination and child asthma morbidity within the family unit, specifically among racial and ethnic minority families (Koinis-Mitchell et al., 2007, 2010).

Similar to neighborhood stress, stress associated with perceived discrimination may impact the ability of caregivers to manage asthma treatment because they are coping with additional stress. It is also plausible that caregivers who are concerned about exposing their children to discrimination may be more protective of their children and keep them from playing and being active outside, resulting in a possible increase in exposure to triggers in the home.

Although it is likely that some aspects of perceived discrimination overlap with neighborhood stress and subjective SES, the present study sought to determine the specific association between perceived discrimination and child asthma outcomes among urban children with asthma and their families.

A previous study documented the impact of discrimination on higher rates of asthma morbidity (e.g., ED visits) among urban families of children with asthma (Koinis-Mitchell et al., 2007). Koinis-Mitchell and colleagues (2010) built upon their previous work examining risk factors for asthma morbidity among urban children with asthma (Koinis-Mitchell et al., 2007). In the study by Koinis-Mitchell and colleagues (2010), the authors examined cultural, contextual, and asthma-specific risks to determine associations with asthma outcomes. Researchers recruited a sample of 264 children with asthma between the ages of seven and 15 years from an urban population. The children and their primary caregivers self-identified as African American, Latino, and non-Latino White.

Koinis-Mitchell and colleagues (2007) included two primary cultural risk factors in a cumulative risk model: discrimination experiences and levels of acculturative stress. After controlling for race and ethnicity, the presence of more asthma-related risks was associated with greater child functional morbidity. Additionally, contextual and cultural risk factors seemed to have more of an impact on morbidity among African American and Latino children than non-Latino White children. In particular, African American and Latino families endorsed more poverty and asthma-specific functional limitation compared to non-Latino White families. Although this study did not determine how these cultural risk variables directly impact asthma management within urban populations, it is likely that the increased risk is related to a general

increase in stress that limits a family's ability to find and use resources to care for a child with asthma.

Relevance to the current study. The comprehensive meta-analysis conducted by Pascoe and Richman (2009) strongly supports previous research on discrimination and health; the perception of discrimination has been associated with poor mental and physical health outcomes (Brown et al., 2000; Williams & Mohammed, 2009). More specifically, the results suggest that perceived discrimination is associated with increased negative stress responses, both physiologically and psychologically. Results also provided support for the association between perceived discrimination and increased participation in unhealthy behaviors (e.g., alcohol and drug use and abuse) and decreased participation in healthy behaviors (e.g., diet, exercise). In the present study, perceived discrimination was examined as a stressor to determine its association with child asthma outcomes (e.g., ED visits, asthma control). Low-income, racial and ethnic minority families living in urban settings may be susceptible to discrimination, which could subsequently impact a caregiver's ability to effectively care for their children with asthma. The present study aimed to better understand how perceived discrimination was associated with child health outcomes, particularly in an urban pediatric asthma sample.

Overview of Subjective SES and Subjective Social Status

It is well-established in the pediatric asthma literature that poverty is associated with asthma morbidity (Bloom et al., 2013). For example, Strunk and colleagues (2002) indicated in their National Heart, Lung, and Blood Institute (NHLBI) Workshop report that asthma is one of the only diseases in which disparities in treatment and asthma outcomes are present in people living in poverty. What is unknown, however, is the relative impact of the perception of poverty level or SES on child asthma outcomes, not solely the objective SES or income level of urban

families. It may be that assessments of subjective SES add to the overall experience (e.g., what resources a family has or stressors they perceive to be present in relation to their peers) reported by families with a child with asthma, above and beyond objective measures of SES (e.g., income, education level). For this reason, subjective SES was examined in this study to further understand how it may be related to health outcomes among urban families that have a child with asthma.

Subjective SES has previously been defined as, "An individual's perception of his or her place in the socioeconomic structure" (Singh-Manoux, Adler, & Marmot, 2003, p. 1322). Subjective SES and subjective social status (SSS) are two terms that are often used interchangeably and have been examined in several studies with adults and adolescents. The idea is based on the premise that SES and social status both involve many more factors than absolute income or other objective variables (e.g., education, occupation; Kingdon & Knight, 2006). Arguments have also been made that SES can be measured based on individual comparisons to others from the reference group, as these comparisons influence perceptions of poverty (Easterlin, 1995; Runciman, 1966). In fact, more recent research suggests that subjective measures of SES may actually be more relevant to health outcomes than objective measures of SES (Adler, Epel, Castellazzo, & Ickovics, 2000; Lynch, Smith, Kaplan, & House, 2000; Wilkinson, 1999; Wilkinson, 1996).

For instance, previous research points to social constructs such as relative deprivation and social comparison as being related to subjective SES and having possible implications for health outcomes (Clayton & Crosby, 1992; Rosenberg & Pearlin, 1978). Although the present study did not focus on adolescents, among children in that age range, reports of lower subjective SES and lower SSS (including those specific to the school setting) seem to be consistently related to

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worse psychological health and physical health outcomes, including poorer self-rated health, more health complaints, increased distress, more mood disorders, more symptoms of anxiety and disruptive behaviors, and an increase in substance use and abuse (Goodman, Huang, Schafer-Kalkhoff, & Adler, 2007; Karvonen & Rahkonen, 2011; McLaughlin, Costello, Leblanc, Sampson, & Kessler, 2012; Sweeting & Hunt, 2014). These findings have potential implications for younger children living in households with low SES who continue to grow and develop and cope with their asthma throughout adolescence and adulthood.

In addition, Adler and colleagues (2000) suggest that lower subjective SES may be directly associated with more psychological stress or subsequently increase vulnerability to the negative impacts of stress. Given what is known about the effects of stress on the human body, low subjective SES may therefore greatly impact health outcomes, including worse asthma morbidity (Segerstrom & Miller, 2004). Similar to perceived discrimination, subjective SES is a potential psychological stressor that urban families may face when making relative comparisons between themselves and their peers. Therefore, if a caregiver perceives his or her SES to be low compared to those around him or her, this could cause more stress for the caregiver. Subsequently, this stress could negatively impact the child's asthma management (e.g., caregiver negativistic thought patterns, decreased likelihood of purchasing necessary medication) or directly impact the child physiologically. The child could experience more airway inflammation, as exposure to stress associated with low subjective SES may sensitize pathways and lead to more frequent and severe asthma symptoms in response to trigger exposure (Chen & Miller, 2007).

Previous studies have examined the subjective nature of poverty level and social status compared to others. Although some studies term this subjective SES and others SSS, the term

subjective SES will be used in the current study. This is primarily because the measure that was used to assess this variable is labeled as a measure of "subjective SES." Research on adult and adolescent health outcomes is also reviewed to demonstrate the strong link between subjective SES and health outcomes.

Subjective SES, SSS, and adult health outcomes. Subjective SES has been examined in relation to adult outcomes in previous literature (Adler et al., 2000; Ostrove, Adler, Kuppermann, & Washington, 2000). Overall, findings from these studies with adults suggest that subjective SES is associated with multiple mental and physical health outcomes, including sleep latency, heart rate, chronic stress, pessimism, control over life, active coping, passive coping, and self-rated health. The results suggest that subjective SES may be an important indicator of both mental and physical health outcomes among adults (Adler et al., 2000). Ostrove and colleagues (2000) examined subjective SES among racial and ethnic minority populations. Their results indicated that subjective and objective SES may impact groups and populations differently. The authors posited that perhaps resources associated with a higher income were more relevant to health outcomes than simply having a higher income (Ostrove et al., 2000). Examples of resources associated with a higher income could include more medical knowledge, more access to support, and increased access to a variety of care providers and facilities.

Subjective SES, SSS, and adolescent health outcomes. Additional studies examined the association between subjective SES and adolescent health outcomes. Goodman and colleagues (2001) conducted a larger-scale study that included 10,843 reports from adolescents (*M* age = 14.4 years) in the United States. The participants who completed this component of the study were nearly 60% female and 93% were White. The purpose of the study was to analyze a new adolescent version of a SSS scale to determine its association with mental health and

physical health outcomes among this youth population. The MacArthur Scale of Subjective Social Status (Adler et al., 2000) was adapted to determine SSS in a manner appropriate for adolescents (e.g., the adolescents were asked to consider their school contexts instead of income, education, and occupation). The first task required them to place themselves and their families on a rung of a ladder compared to other families within the broader society. The second task required them to place themselves on the ladder compared to those in their school communities. The authors found that higher SSS was significantly associated with fewer depressive symptoms. Interestingly, after controlling for demographics, school ladder rankings were more strongly associated with depressive symptoms than the society ladder rankings. In addition, higher SSS was significantly correlated with a reduced probability of overweight and obesity. In these analyses, community and society ladder rankings did not significantly differ in the strength of their associations with overweight and obesity. In sum, this study provides support for the significant association between adolescent-reported SSS and health outcomes, particularly within the school context (Goodman et al., 2001).

Another recent study by Sweeting and Hunt (2014) examined SSS among 2,503 adolescents (13-15 years of age) from seven schools in urban and semi-rural areas of Scotland. Adolescents were asked to rank themselves compared to the rest of their Scottish society, using the MacArthur Scale of SSS. Sweeting and Hunt (2014) also asked participants to rank themselves compared to their peers at school in a variety of categories (e.g., popularity, doing well at school, attractive or stylish, sporty). The outcomes they examined included physical symptoms (e.g., stomachaches, headaches), psychological distress, and anger. When they controlled for objective SES (family affluence and residential deprivation), higher SSS was

significantly associated with more physical symptoms and increased psychological distress (Sweeting & Hunt, 2014).

Goodman, Adler, Daniels, Morrison, Slap, and Dolan (2003) conducted a study with 1,491 African American and White adolescents (*M* age = 15.2 years) recruited from a suburban area. The authors examined SSS across multiple contexts, including school and society, with the widely-used MacArthur Scale of SSS. Measurements of weight status, demographics, and objective SES (caregiver education, family income) were also collected. The authors found that school SSS was significantly higher among students classified as normal weight compared to those classified as overweight. In fact, lower school SSS had a stronger association with the likelihood of being overweight than did the two objective measures of SES. When the authors examined differences by sex and race, significant findings emerged. Results demonstrated that school SSS was uniquely associated with overweight status in White adolescent girls and boys, was trending toward significance among African American adolescent boys, and did not have an association among African American adolescent girls. The authors did not, however, find any significant differences between societal SSS and weight status in this sample.

The overall findings from the study by Goodman and colleagues (2003) suggested that among adolescents, SSS has a stronger association with overweight status compared to objective SES, particularly within the more immediate social context of school. These findings, however, differed by sex and race. Goodman and colleagues (2003) suggested possible explanations for these findings, including that obesity may mediate the association between objective SES and SSS. Another possibility is that these differences may be due to varying cultural norms and attitudes surrounding health and weight, in particular. The school setting was outside of the scope of the current study, although it is a relevant social context for adolescents.

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Subjective SES, SSS, and Child Asthma Outcomes

      Relevance to the current study. To date, few studies have clearly established a link between subjective SES and health outcomes, particularly in the context of younger populations. Developmentally, research suggests that it is not until middle childhood that children are able to start taking others' perspectives. Further, during adolescence, children are better able to engage in self-reflection related to complicated issues (Eccles, 1999). Due to these developmental changes, it would therefore likely make it difficult to accurately assess subjective SES and SSS among young children, even within the school setting. It seems evident from the reviewed literature, however, that the health of older adolescents and adults is impacted by their perceptions of themselves and how their SES compares to those around them. Based on research to date about the impact of subjective SES and SSS on health outcomes, it seems reasonable that caregiver-reported level of subjective SES may impact the health outcomes of their children with asthma. Level of subjective SES may be another stressor encountered by low-income, racial and ethnic minority families residing in urban areas that could lead to increased psychological distress and subsequently impact asthma management within families. If the caregiver has a limited income, but perceives the family's SES as higher than would be reported by objective measures (e.g., income, education level), that caregiver's positive perception of the family's SES may be protective. This may indicate that despite their objective SES being very low, they perceive their status to be greater, which may indicate that they are coping relatively well and experiencing less stress related to SES. Conversely, a family could have more money than other families in the neighborhood, but if the caregiver reports the family's SES in the other direction (lower subjective than objective SES), it may suggest that the family perceives their situation to be more difficult than others. The latter family may therefore perceive their SES to be more

stressful and subsequently limit the amount and type of cognitive, emotional, and tangible resources available to the families to manage the child's asthma.

Although subjective SES has not yet been studied in pediatric asthma literature, there seems to be enough of a research base to suggest the possible presence of an association between subjective SES and child asthma outcomes. Therefore, subjective SES was a unique variable to consider in the present study as one of the many stressors experienced by urban families. Researchers and healthcare providers may also be able to target caregivers and their families who perceive their situations to be worse off than others around them (lower subjective SES), as that may indicate that those families may be vulnerable to additional stress, regardless of objective SES (e.g., income).

Mediator Variables

In addition to examining the associations between urban stressors and child asthma outcomes, the present study also examined two possible mediator variables (depressive symptoms and asthma self-efficacy) in the associations between urban stressors and child asthma outcomes, in separate child and caregiver models. Previous literature provides a strong link between stress and health outcomes, particularly among children with asthma (Cabana et al., 2004; Chen & Miller, 2007; Cousino & Hazen, 2013; Coutinho et al., 2013; Koinis-Mitchell et al., 2014; Kopel et al., 2015; Streisand et al., 2001; Swahn & Bossarte, 2006; Wright & Steinbach, 2001; Wright, 2007; Wright et al., 2004; Wright et al., 2005). It is unknown, however, whether depressive symptoms and asthma self-efficacy explain the associations between urban stressors and child asthma outcomes in a low-income, racial and ethnic minority, urban population. Each of the mediator variables included in this study is reviewed in turn.

Child mediator variables.

Child asthma self-efficacy. There is minimal literature to date that examines the association between child-reported asthma self-efficacy and child asthma outcomes. Most of the research has previously focused on caregiver asthma-self efficacy, which is likely due to the developmental stage and knowledge level of the child and the degree to which management and adherence often fall on the caregivers of young children, instead of children themselves (McQuaid, Kopel, Klein, & Fritz, 2003). Bursch and colleagues (1999) recruited 110 children with asthma between the ages of seven and 15 years. The purpose of the study was to construct and validate four asthma self-management scales, one of which assessed child-reported self-efficacy. There were two subscales within that domain, including child attack prevention and child attack management. Bursch and colleagues (1999) found that child asthma self-efficacy was significantly and positively correlated with health status such that children who endorsed more self-efficacy in regard to their asthma management and treatment were healthier overall. Further, child-reported asthma self-efficacy was negatively associated with ED use, such that those with worse self-efficacy more frequently utilized the ED for asthma care.

A more recent study by Kaul (2011) examined child asthma self-efficacy in the context of asthma self-management among urban, African American children between the ages of seven and 12 years. A different measure of child self-efficacy, the Asthma Belief Scale (Velsor-Friedrich, Pigott, Srof, & Froman, 2004) was administered. Analyses revealed a positive association between asthma self-efficacy and asthma self-management, such that children who reported more efficacy in their ability to manage their asthma also reported engaging in more asthma management behaviors. The authors concluded that this finding is important given research that shows a link between child asthma self-management and child asthma morbidity (Kaul, 2011).

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Child depressive symptoms. Depression and asthma are well-documented as highly comorbid among children (Peters & Fritz, 2011; van Dyck et al., 2004). Yellowlees and Kalucy (1990) conducted a study in a sample of children receiving outpatient medical services for their asthma. They found that approximately one-third of the children they recruited had a concurrent diagnosis of depression. Similar to experiences of stress and the emotional impact that stress can have on a child's asthma symptoms, depression and depressive symptoms act similarly and have the potential to trigger an asthma exacerbation (Galil, 2000). Further, in a study involving inner-city children with asthma, findings suggested that poor mental health (including depression) in children with asthma or their caregivers was more strongly tied to greater asthma morbidity (Weil et al., 1999). Similar to the impact of stress on the immune system, depression can weaken the immune system, which can then lead to more exacerbations.

The association between asthma and depression is likely bidirectional. In the other direction, the presence of an asthma diagnosis is associated with a greater likelihood of depression (Bennett, 1994; Padur et al., 1995). In addition, greater asthma severity is tied to higher rates of depressive symptoms (Blackman & Gurka, 2007). There are multiple explanations for the increased likelihood of depression among children with asthma, including hospitalizations, physical limitations, poor self-image, and unpredictability of exacerbations (Chaney et al., 1999; Galil, 2000; Gizynski & Shapiro, 1990).

Depression is a noteworthy variable to consider in child asthma management given negative outcomes that have consistently been shown to be associated with depression. For instance, depression is associated with higher rates of noncompliance with asthma medication (Christaanse, Lavigne, & Lerner, 1989). Other asthma-related correlates of depression among

children include increased rates of hospitalization, more wheezing, poorer functional status, more asthma symptoms, and fewer symptom free days (Richardson et al., 2006; Weil et al., 1999).

Caregiver mediator variables.

Caregiver depressive symptoms. Research on caregiver psychological health and child health (e.g., symptoms, disease management, healthcare utilization) is well-documented, particularly in the pediatric asthma population. Caregiver depression can have particularly harmful effects on children's development, behavior, mental health, and physical health (O'Brien, Heycock, Hanna, Jones, & Cox, 2004; Weissman et al., 2004, 2006). In the context of medical care, according to DiMatteo, Lepper, and Croghan (2000), caregivers of children who are depressed are three times more likely to be nonadherent to medical treatment plans.

In general, caregivers of children with asthma report higher rates of depressive symptoms than caregivers of children without asthma (Bartlett et al., 2001; Shalowitz et al., 2006). The effects of caregiver depression on morbidity have also been well-documented in the field of pediatric asthma (Pak & Allen, 2012). A recent literature review by Pak and Allen (2012) reiterated that maternal depression is associated with several deleterious child asthma outcomes, such as poor adherence and inconsistent healthcare utilization (Bartlett et al., 2001; Brown et al., 2006; Leiferman, 2002; Shalowitz, Berry, Quinn, & Wolf, 2001; Weil et al., 1999).

Within a sample of children seen in suburban and inner-city pediatric asthma subspecialty practices, caregiver depression was one of the strongest factors to impact child asthma morbidity, including symptoms and health care utilization (Shalowitz et al., 2001). Shalowitz and colleagues (2001) recruited 123 children with asthma between the ages of 18 months and 12 years of age to participate in their study about life stressors, maternal depression, and child asthma morbidity. They recruited children and their caregivers from three clinics (two urban, one

suburban). A composite measure of asthma morbidity was administered in this study, along with self-report measures of caregiver depressive symptoms. Results from analyses demonstrated that children were more likely to experience greater asthma morbidity if their caregivers reported more depressive symptoms. Specifically, more than two times as many caregivers of children with high asthma morbidity had high depressive symptom scores (45%) compared to those with intermediate morbidity (17% had high depressive symptom scores) or low morbidity (20% had high depressive symptom scores). Further, significant differences in caregiver depressive symptom scores across level of child asthma morbidity were found.

In the context of pediatric asthma, depression may make it challenging to manage a child's asthma regimen (Kaugars, Klinnert, & Bender, 2004). Furthermore, research suggests that caregiver depression may be even more common in urban settings (close to 50%), which has important implications for child asthma management in these areas (Bartlett et al., 2001). For example, the NCICAS recruited 1,528 urban children with asthma between the ages of four and nine years. They found that 50% of caregivers endorsed clinically significant levels of psychological distress. Moreover, poor caregiver mental health was the strongest predictor of hospitalizations due to child asthma (Wade et al., 1997).

Bartlett and colleagues (2001) conducted a study to examine the connection between maternal depression and the use of the ED for child asthma-related visits. Children recruited for the study were in kindergarten through fifth grade. Children with asthma and their families were recruited from urban locations and 98% identified as African American. Further, children needed to have visited the ED at least one time within the past six months for asthma or admitted for a hospitalization at least one time within the past year.

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In the study by Bartlett and colleagues (2001), 47% of the mothers reported depressive symptoms that were clinically significant. The researchers divided the mothers into high and low categories of depressive symptoms. Those who reported high levels of depressive symptoms were more likely to be unemployed, have lower income levels, and report a poorer QOL. Interestingly, aside from demographic differences, few differences between the children and their asthma morbidity were detected. Specifically, there were no differences in lifetime hospitalizations due to asthma, the amount of money spent on asthma medications, or the number of regular appointments with the provider. One significant difference emerged in healthcare utilization following baseline. Mothers with high levels of depressive symptoms were more likely to take their children to the ED in the six months following initial data collection. Similarly, those who were categorized in the highest category for depressive symptoms were most likely to take their children to the ED. In sum, after controlling for related factors, mothers reporting the highest level of depressive symptoms were 30% more likely to take their children to the ED for asthma treatment. The two biggest contributing factors were the age of the mother (mothers between ages 30 and 35 were most likely to use the ED) and the psychological status of the mother (Bartlett et al., 2001).

Another study examined the association between caregiver depressive symptoms and child asthma outcomes among 221 low-income, Puerto Rican children between the ages of five and 12 years living in mainland United States (Martínez, Pérez, Ramírez, Canino, & Rand, 2009). Caregivers and their children with asthma were categorized into two groups based on whether caregivers reported no/few depressive symptoms or high levels of depressive symptoms. Child asthma outcomes included asthma severity, symptom-free days/nights, and healthcare utilization (ED visits, hospitalizations due to asthma). Findings demonstrated that more

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depressive symptoms were associated with fewer symptom-free days/nights for their children with asthma. In addition, they found several connections between more depressive symptoms and other caregiver-level variables. For example, higher levels of depressive symptoms were associated with poorer self-efficacy, less empowerment, and poorer QOL compared to caregivers who reported no or few depressive symptoms. Overall, these data provide further support for the negative impact of caregiver depressive symptoms on child asthma outcomes.

Several explanations for the association between maternal depression and child ED visits have been provided. Frankel and Wamboldt (1998) previously suggested that depressive symptoms prevent caregivers from using appropriate resources and coping strategies to manage their child's asthma. Additionally, they postulated that mothers who are depressed interpret symptoms as being more severe than they truly are, which subsequently leads to an increase in ED utilization. Moreover, depressed caregivers may also perceive that they do not have the skills or resources to manage their child's asthma. It also seems likely that child asthma regimens are overwhelming to caregivers who are depressed. Interestingly, in Bartlett and colleagues (2001), nearly 60% of the children taken to the ED were categorized as having mild-to-moderate asthma. These findings suggest that there may be factors other than asthma severity, such as caregiver depression, that contribute to ED utilization.

A more recent biological study examined whether caregiver depressive symptoms impact inflammatory markers in children with asthma compared to a healthy control group (Wolf, Miller, & Chen, 2008). Fifty children with asthma and 33 healthy children between the ages of nine and 18 years were recruited for this study. Children and their caregivers were assessed twice, the second time point being approximately six months following the baseline session. Caregiver depression was assessed at baseline, along with caregiver perceived stress.

Additionally, two inflammatory markers were tested at baseline and follow-up: eosinophil cationic protein (ECP) and stimulated interleukin-4 (IL-4). Results demonstrated an increase in ECP across time for those children whose caregivers reported greater depressive symptoms. Surprisingly, these patterns were not evident in the IL-4 marker across time. This study highlighted the potential pathway between caregiver depressive symptoms and child asthma morbidity.

Caregiver asthma self-efficacy. Caregiver asthma self-efficacy is another mediator variable that was examined in the caregiver models with urban stressors and child asthma outcomes. In pediatric asthma literature, caregiver self-efficacy specific to child asthma has previously been defined as a caregiver's perception of his or her ability to prevent an asthma attack from happening and manage an attack once it begins (Bursch et al., 1999). Few published studies have examined caregiver self-efficacy in the context of asthma prevention and management. Studies to date, however, have demonstrated that caregiver self-efficacy impacts critical asthma outcomes, including healthcare utilization and disease management and treatment. For example, caregiver self-efficacy to prevent asthma symptoms from worsening and stop an asthma attack once it starts has been associated with more lifetime hospitalizations and school days missed due to asthma, as well as more asthma symptoms and poorer health status (Bursch et al., 1999; Chen, Bloomberg, Fisher, & Strunk, 2003; Grus et al., 2001).

Several factors have been identified in previous research as being positively associated with caregiver self-efficacy for asthma management, including asthma knowledge, health behaviors, health literacy, and social support (Brown, Gallagher, Fowler, & Wales, 2014; Chan, Keeler, Schonlau, Rosen, & Mangione-Smith, 2005; Clark, Gong, & Kaciroti, 2001; Wood, Price, Dake, Telljohann, & Khuder, 2010). Conversely, caregivers with depressive symptoms

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and those who believe that asthma management tasks are difficult to handle are more likely to have poorer self-efficacy for asthma management (Brown et al., 2014; Martínez, Pérez, Ramírez, Canino, & Rand, 2009; Morawska, Stelzer, & Burgess, 2008).

In the original study that constructed and validated the use of the Asthma Self-Efficacy Scale by Bursch and colleagues (1999), one of the subscales included caregiver asthma self-efficacy. In addition to the families initially recruited for the study, 129 caregivers of children with asthma between the ages of three and 15 were also recruited. The Parent Asthma Management Self-Efficacy Scale was broken down into two subscales, including caregiver attack prevention and caregiver attack management. The authors found that the scale demonstrated good reliability and validity. In addition, they determined that greater caregiver self-efficacy was associated with better child health outcomes, fewer asthma symptoms, and less impact on the family due to asthma. The caregiver attack prevention subscale was also related with child age such that as the age of the children increased, as did the self-efficacy of the caregivers to prevent an asthma attack. This study was one of the first to examine caregiver self-efficacy in the context of child asthma and provided initial support for this measure. Findings also suggest that low caregiver self-efficacy may be associated with negative outcomes, including more family strain and more asthma symptoms (Bursch et al., 1999).

Grus and colleagues (2001) recruited 139 low-income, minority caregivers of children with asthma between the ages of five and eight years. Caregivers were administered a 22-item measure of general and health-specific self-efficacy. The self-efficacy measure was broken down into two subscales, including learned helplessness and general self-efficacy. Data were also collected on hospitalizations, missed school days, ED visits, asthma symptoms, and functional status. Results showed that learned helplessness within caregiver self-efficacy was significantly

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associated with several asthma morbidity variables. Specifically, more learned helplessness was associated with more hospitalizations, more school days missed, more ED visits within the past year, more wheezing, more times the child woke up during the night due to asthma symptoms, taking more medications for asthma, and more times the caregiver lost sleep due to the child's asthma. In contrast, higher functional status was associated with less learned helplessness. Few significant findings emerged when the general self-efficacy subscale was examined together with the asthma morbidity variables. Specifically, lower caregiver self-efficacy was associated with more school days missed within the past two months and within the past year. This study supports the notion that caregiver self-efficacy is associated with child asthma morbidity, particularly among low-income, racial and ethnic minority families (Grus et al., 2001).

Summary of mediator variables.

In the present study, child- and caregiver-reported depressive symptoms and asthma self-efficacy were examined as potential mediators in the associations between urban stressors and child asthma outcomes. Previous literature presented above provides support for a significant link between stress and health outcomes, among both children and caregivers (Cabana et al., 2004; Chen & Miller, 2007; Cousino & Hazen, 2013; Coutinho et al., 2013; Koinis-Mitchell et al., 2014; Kopel et al., 2015; Streisand et al., 2001; Swahn & Bossarte, 2006; Wright & Steinbach, 2001; Wright, 2007; Wright et al., 2004; Wright et al., 2005). As a novel addition to previous literature, the present study sought to explore whether child- and caregiver-reported depressive symptoms and asthma self-efficacy provided an explanation for the associations between urban stressors and child asthma outcomes.

In the child models with child depressive symptoms and child asthma self-efficacy, neighborhood stress was the urban stressor. In urban areas where children may experience

violence, they may subsequently report exposure to neighborhood stress. Children who live in the context of neighborhood stress may experience frequent and severe asthma symptoms as a result of the body's physiological response to stress (Chen & Miller, 2007). Children may also endorse depressive symptoms in the context of stress (Evans et al., 2014; Grant, Compas, Thurm, McMahon, & Gipson, 2004; Rudolph et al., 2000), which in turn impacts their health outcomes. Child asthma self-efficacy could also play a role in the association between neighborhood stress and child asthma outcomes. Self-efficacy literature by Bandura (1997) suggests a robust relation between stress reactions and self-efficacy such that individuals with more self-efficacy may be impacted less by stress because they believe themselves to be more capable of managing a particular situation. Therefore, in the context of exposure to neighborhood stress, asthma self-efficacy could be impacted, which may subsequently effect child asthma outcomes.

In the caregiver models with depressive symptoms and asthma self-efficacy, stressful life events, perceived discrimination, and subjective SES were the urban stressors. The theoretical support for the caregiver model is that those who are exposed to more stress may have fewer cognitive and emotional resources to dedicate to their child's asthma management, which may negatively impact asthma outcomes (Cousino & Hazen, 2013; Streisand et al., 2001). Caregiver depressive symptoms may play a role in the association between urban stress and child asthma outcomes such that caregivers who experience stress may endorse symptoms of depression (Hammen, 2005), which in turn may be associated with child health outcomes. Specifically, depressive symptoms may prevent caregivers from effectively managing their children's asthma or prompting caregivers to perceive their children's asthma symptoms as more severe than they are. Further, caregivers may feel burdened by the stress, which impacts their ability to dedicate resources to child asthma management. While caregivers are concurrently managing a myriad of

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stressors, their asthma self-efficacy may be impacted (Bandura, 1997), which in turn could influence the health of their child.

Study Aims

Previous research has clearly documented pediatric asthma disparities (Canino et al., 2009); low-income, racial and ethnic minority children living in urban populations often report higher rates of asthma morbidity (e.g., hospitalizations due to asthma) and mortality (Federico & Liu, 2003). In urban settings, in particular, there are several plausible determinants of asthma disparities, including poverty, urban-related stress, lack of support (within family and community), and inadequate knowledge about the disease and associated treatment (Strunk et al., 2002). Consistent with Bronfenbrenner's Social-Ecological Theory, it is important to recognize the reciprocal influences between a child with asthma and the multiple levels of factors present within a larger system to understand how children and their caregivers experience and manage asthma (Bronfenbrenner, 1979).

In the present study, neighborhood stress, stressful life events, perceived discrimination, and subjective SES were examined as stressors relevant to families living in urban settings (i.e., urban stressors). Two models predicting child asthma outcomes were examined in this study. Child-reported neighborhood stress was examined to determine its association with child asthma outcomes and whether child depressive symptoms and child asthma self-efficacy mediated those associations. In the caregiver model, stressful life events, perceived discrimination, and subjective SES were analyzed to determine significant relations between those variables and child asthma outcomes. Similar to the child model, caregiver depressive symptoms and caregiver asthma self-efficacy were included as potential mediators. Another goal of the current study was, therefore, to determine whether depressive symptoms and asthma self-efficacy mediated the

associations between child- and caregiver-reported urban stressors and child asthma outcomes (e.g., ED visits, asthma control, school days missed). The present study had two specific aims, detailed below.

Specific Aims

Specific Aim 1. The first aim examined associations between urban stressors (reported by children with asthma and by their caregivers) and child asthma outcomes. This aim used both secondary data analysis and original data collection.

Part 1. The first goal of Aim 1 was to determine how neighborhood stress (child-report), stressful life events (caregiver-report), perceived discrimination (caregiver-report), and subjective SES (caregiver-report) were each individually associated with child asthma outcomes (ED visits, asthma control, school days missed) among urban families. I hypothesized that more perceived stress (more neighborhood stress, more stressful life events, greater perceived discrimination, and lower subjective SES) would be associated with worse child asthma outcomes.

Part 2. The second goal of Aim 1 was to determine whether any one urban stressor (child- or caregiver-reported) was more strongly associated with any of the child asthma outcomes, compared to the other urban stressors. I hypothesized that more significant associations would be detected between each of the caregiver-reported predictors (stressful life events, perceived discrimination, subjective SES) and child asthma outcomes compared to child-reported neighborhood stress. I also hypothesized that among the caregiver-reported predictors, when examined together simultaneously in the same model, subjective SES would be most strongly associated with child asthma outcomes compared to stressful life events and perceived discrimination. The support for this hypothesis came from Bronfenbrenner's Social-Ecological

Theory and previous literature about the impact of subjective SES on health outcomes, including asthma symptoms (Adler et al., 2000; Clayton & Crosby, 1992; Rosenberg & Pearlin, 1978; Segerstrom & Miller, 2004). In Bronfenbrenner's model, the socioeconomic status of the family is most proximal to the child compared to potential discriminatory events and a more general list of possible life stressors. Further, the perception of low SES (compared to objective SES) may be directly associated with more psychological stress or subsequently increase vulnerability to the negative impacts of stress, which is likely to interfere with a caregiver's ability to effectively manage a child's asthma (Adler et al., 2000).

Specific Aim 2. The second aim of the study was to examine whether depressive symptoms and asthma self-efficacy mediated the associations between urban stressors and child asthma outcomes in a child model and in a caregiver model. This aim used both secondary data analysis and original data collection.

Part 1. The first part of Aim 2 examined a child model to determine whether child depressive symptoms and child asthma self-efficacy mediated the associations between child-reported neighborhood stress and child asthma outcomes (see Figure 1). Previous literature provides support for the relation between stress and child asthma outcomes among children (Chen & Miller, 2007). Available research on child depressive symptoms and child asthma self-efficacy also suggests that these two variables are important to consider in the context of stress and child asthma outcomes (Bandura, 1997; Bursch et al., 1999; Galil, 2000; Kaul, 2011; Peters & Fritz, 2011; van Dyck et al., 2004; Weil et al., 1999). I hypothesized that child depressive symptoms and child asthma self-efficacy would mediate the associations between neighborhood stress and child asthma outcomes.

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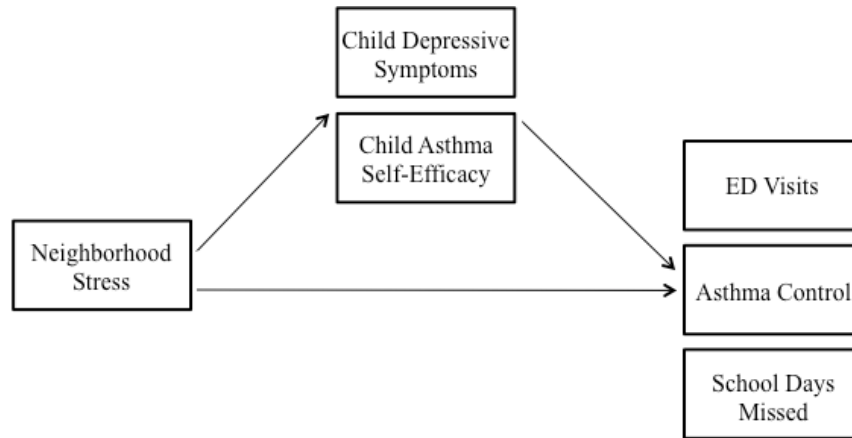
Figure 1. Child model with potential mediation pathways between child-reported neighborhood stress and child asthma outcomes.

Part 2. The second part of Aim 2 was to determine whether caregiver depressive symptoms and caregiver asthma self-efficacy mediated associations between caregiver-reported stressful life events, perceived discrimination, and subjective SES, and child asthma outcomes (see Figure 2). Previous research suggests that caregivers who experience stress may subsequently have fewer cognitive and emotional resources to dedicate to child asthma management (Cousino & Hazen, 2013; Streisand et al., 2001). Available research also supports the important role of caregiver depressive symptoms and caregiver asthma self-efficacy in the context of child asthma outcomes (Bandura, 1997; Bartlett et al., 2001; Brown et al., 2006; Bursch et al., 1999; Chen et al., 2003; Grus et al., 2001; Kaugars et al., 2004; Leiferman, 2002; Martínez et al., 2009; Shalowitz et al., 2001; Wolf et al., 2008). I hypothesized that caregiver depressive symptoms and caregiver asthma self-efficacy would mediate the effects of caregiver-reported urban stressors on child asthma outcomes. The measure of stressful life events was added to the second dataset only. Therefore, analyses between stressful life events and caregiver-reported mediator variables, as well as between stressful life events and child asthma outcomes, were limited to only 40 families.
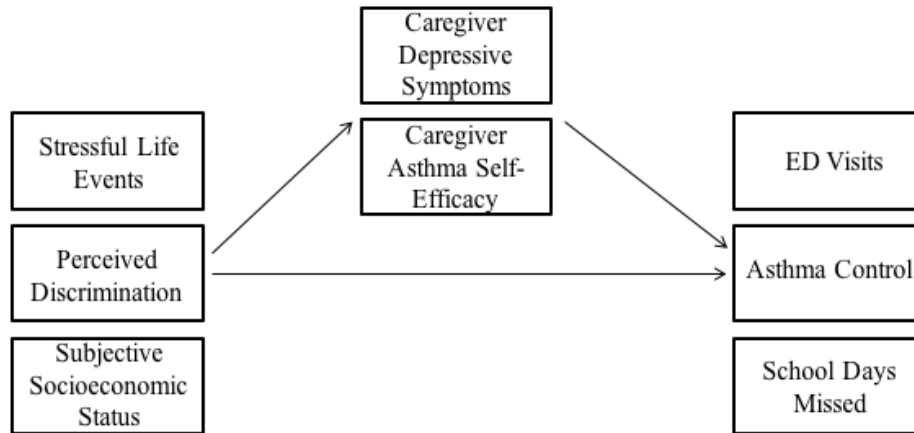
Figure 2. Caregiver model with potential mediation pathways between caregiver-reported urban stressors and child asthma outcomes.

Methods

Overview of the Current Study

The present study included 97 children with asthma and their caregivers. Data from 57 racial and ethnic minority families (African American, Multi-Racial, Other [Moor]) from a previous study (CARE Study; Childhood Asthma in Richmond Families; Targeted Research Grant, Society of Pediatric Psychology, R. Everhart, PI) were combined with original data from 40 families collected for the present study. The larger sample size gained by combining secondary and original data increased the likelihood of detecting significant differences (i.e., more statistical power). The CARE Study, which was used for secondary data analysis, is described below, followed by a description of original data that were collected through the Childhood Asthma in Richmond Families-2 Study (CARE-2 Study).

CARE Study

Participants. Fifty-seven low-income, racial and ethnic minority, urban families of children with persistent asthma between the ages of seven and 12 years were recruited from

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Richmond, Virginia (see Table 1 for participant demographics for both studies) for a larger intervention study. Study inclusion criteria included: children with current persistent asthma (NHLBI, 2007); English-speaking; legal guardians to the children; and having lived with the child for at least six months. Further, current and persistent asthma was determined by: 1) having a current prescription from their physician for a controller medication or 2) showing any of several symptoms within the past four weeks: a) daytime asthma symptoms, including wheezing, chest tightness, or cough at least three days per week, b) nighttime awakenings due to asthma at least three-to-four times per month, 3) use a quick relief/rescue inhaler at least two days per week, 4) activity limitation, or 5) use of oral steroids at least two times per year (NHLBI, 2007). Families were excluded if there was additional pulmonary disease in the child (e.g., cystic fibrosis), significant developmental delay in the child, or severe psychiatric/medical illness in either caregiver or child.

Procedure. Participants were primarily recruited through the Bioinformatics Core at the CCTR, which is affiliated with the VCU Health System. Analysts at the Bioinformatics Core retrieved information for patients who received medical services for pediatric asthma at VCU within the past year. Identified families were contacted and screened for eligibility and interest. An initial research session was then scheduled. Caregivers completed consent forms and children completed assent forms prior to completing questionnaires. At the two-hour session, interview-based assessments were collected from child and caregiver dyads. As a graduate research assistant for this study, I was responsible for data collection during the baseline visits with families, both in their homes and in the research lab. I also provided supervision to undergraduate students working on this study.

Table 1.

Demographic Characteristics (N=97)
(CARE Study, n=57; CARE-2 Study, n=40)

Variable	Overall	CARE	CARE-2	Test Statistic	*p*-Value (Sig.)
Child Age, mean (*SD*), y	9.44 (1.49)	9.67 (1.48)	9.12 (1.45)	$t(95) = 1.79$	.953
Caregiver Age, mean (*SD*), y	36.79 (8.66)	37.53 (9.28)	35.75 (7.67)	$t(95) = 1.00$	.083
Child sex, *n* (%)				$\chi^2 (1, N = 97) = 1.98$	.159
Male	59 (60.8)	38 (66.7)	21 (52.5)		
Female	38 (39.2)	19 (33.3)	19 (47.5)		
Child Race and Ethnicity, *n* (%)				-	
African American	93 (95.9)	55 (96.5)	38 (95.0)		
Mixed or Multi-Racial	2 (2.1)	1 (1.8)	1 (2.5)		
Other	2 (2.1)	1 (1.8)*	1 (2.5)**		
Caregiver Race and Ethnicity, *n* (%)				-	
African American	92 (94.8)	55 (96.5)	37 (92.5)		
Mixed or Multi-Racial	3 (3.1)	1 (1.8)	2 (5.0)		
Other	2 (2.1)	1 (1.8)*	1 (2.5)**		
Family Income (Past Month), *n* (%)				$\chi^2 (1, N = 95) = 1.36$	.715
<$1,000	40 (41.2)	21 (36.8)	19 (47.5)		
$1,000-$1,999	26 (26.8)	15 (26.3)	11 (27.5)		
$2,000-$2,999	19 (19.6)	13 (22.8)	6 (15.0)		
>$3,000	10 (10.3)	6 (10.5)	4 (10.0)		
Don't Know/Refused/Missing	2 (2.1)	2 (3.5)	0 (0.0)		
Caregiver Relationship to Child, *n* (%)				$\chi^2 (1, N = 97) = 1.56$	.212
Biological Mother	82 (84.5)	46 (80.7)	36 (90.0)		
Biological Father	6 (6.2)	6 (10.5)	0 (0.0)		
Step, Adoptive, or Foster Mother	4 (4.1)	3 (5.3)	1 (2.5)		
Step, Adoptive, or Foster Father	1 (1.0)	0 (0.0)	1 (2.5)		
Grandmother	3 (3.1)	1 (1.8)	2 (5.0)		
Other	1 (1.0)	1 (1.8)	0 (0.0)		

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Caregiver Marital Status, n (%)				χ^2 (1, $N = 97$) = .12	.724
Married	15 (15.5)	9 (15.8)	6 (15.0)		
Separated	6 (6.2)	4 (7.0)	2 (5.0)		
Divorced	8 (8.2)	3 (5.3)	5 (12.5)		
Widowed	3 (3.1)	2 (3.5)	1 (2.5)		
Never Married	65 (67.0)	39 (68.4)	26 (65.0)		
Caregiver Education Level, n (%)	12.96 (1.98)	13.00 (1.90)	12.90 (2.12)	$t(95) = 2.43$	.587

* = Moor; ** = Israelite

Original Data Collection

Participants. In addition to data collected through the CARE Study, 41 demographically-similar families were recruited to complete the CARE-2 Study. One of the 41 families was included in the original CARE Study so their data were dropped. Subsequently, data from 40 participants were included in the second dataset and used for data analysis. In total, data from 97 families were used for the current study. The inclusion and exclusion criteria remained consistent with the CARE Study to ensure that the samples were similar. It was beneficial to combine data from two samples because it increased the overall sample size (i.e., power) for analyses. At the same time, statistically significant demographic differences could have been detected between the families recruited for each of the studies. Such findings might have suggested that the data were not all from a similar population, which would have impacted statistical analyses and interpretation (e.g., generalizability). Data from the two samples were therefore compared and no significant differences were detected. Results from those comparative analyses are reported in Table 1.

Procedure. Recruitment methods were similar to those utilized in the CARE Study (e.g., primarily through the Bioinformatics Core affiliated with the VCU Health System). Recruitment also occurred in the community, including with the pulmonary clinic at the local children's hospital that serves urban children with asthma. Children with asthma and their caregivers were asked to participate in a 45-minute research session. Caregivers first consented to their own participation and then their child's participation; children provided assent. Caregivers and children completed measures separately, each with one research staff member. Families were compensated with a $20 gift card (caregivers) and a prize (children) for their completion of the

surveys. Study visits occurred in families' homes, research offices, or community-based sites (e.g., community center, school, library), depending on the family's preference.

Measures

The following measures were completed by the participants in both studies, unless otherwise noted.

Demographics. Caregivers completed demographic information for both themselves and their children with asthma. The demographics included age, race and ethnicity, monthly income, years of education, current medications, marital status, and caregiver relationship to child.

Neighborhood stress. Children completed the Stress Index, a 23-item measure that assesses stress across three domains: circumscribed events, life transitions, and exposure to violence (Attar, Guerra, & Tolan, 1994; Dubow, Edwards, & Ippolito, 1997). In the current study, the exposure to violence subscale was used to assess neighborhood stress. A sample item asks children, "Have you been afraid to go outside and play, or have your parents made you stay inside because of gangs or drugs in your neighborhood?" Responses include *yes* or *no* to each item, followed by a question about how stressful the target event was for any endorsed items. If any items are endorsed, children are asked to respond on a scale from one *(not at all upset or stressed out)* to three (*very upset or stressed out*). Higher scores suggest more perceived stress. The Stress Index was originally developed among a sample of urban, racial and ethnic minority, elementary-school children and was shown to be related to neighborhood disadvantage and other psychological outcomes (e.g., aggression; Attar et al., 1994). It has been used in other studies with urban children with asthma and has demonstrated good internal consistency (Cronbach's α = 0.80; Koinis-Mitchell et al., 2014). In the combined dataset, the overall scale had adequate

internal consistency (Cronbach's α = 0.77), while the exposure to violence subscale demonstrated poor internal consistency (Cronbach's α = 0.55).

Stressful life events. Caregivers in the CARE-2 Study completed the Stressful Life Events and Conditions Checklist (SLECC; Caserta et al., 2008; Kilmer, Cowen, Wyman, Work, & Magnus, 1998). It is a 32-item measure with the possibility to add up to two other open-ended answers of circumstances that have happened that have been upsetting to the family and child. The measure is a checklist used to capture potential stressful experiences and circumstances faced by a family within the previous six months. The SLECC has five subscales, including: 1) family turmoil; 2) family separation; 3) poverty; 4) neighborhood violence; and 5) family illness/injury. A sample item is: "Our neighborhood has been unsafe." Responses ranged from zero (*no, it did not happen in the past six months*) to three (*yes, it happened and it was very upsetting or stressful*), with higher scores indicating the presence of more stressful life events and circumstances within the family in the past six months. The overall score from this measure was used for data analysis. The measure was initially validated among a sample of low-income, urban African American, Latino, and White families (Kilmer et al., 1998). It has also been used in other studies examining the association between stress and physical health outcomes (e.g., immune function) in children (Caserta et al., 2008). In the CARE-2 Study, internal consistency for the measure was good (Cronbach's α = 0.85).

Perceived discrimination. Caregivers completed the General Ethnic Discrimination (GED) Scale, which assesses racial and ethnic discrimination across the lifetime (Landrine, Klonoff, Corral, Fernandez, & Roesch, 2006). The GED Scale is an 18-item measure that asks participants to respond three times to each question with reference to the past year, the caregiver's entire life, and how stressful the event was for the caregivers. Responses to each of

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the sub-questions are measured on a six-point Likert scale from one (*never; not at all stressful*) to six (*almost all of the time; extremely stressful*). A sample question includes: "How often have you been treated unfairly by your co-workers, fellow students and colleagues because of your race/ethnic group?" Higher scores suggest the presence of more perceived discrimination (past year, lifetime, associated stress) and more stress from discrimination experiences. In an initial validation study with 1,569 racially- and ethnically-diverse participants, the internal consistency for the subscales on the GED Scale was excellent (Cronbach's α = 0.91; Landrine et al., 2006). For the purpose of the current study, the stress subscale was used as an indicator of stress experienced in regard to perceived discrimination. In the combined dataset, internal consistency for the stress subscale was excellent (Cronbach's α = 0.94).

Subjective SES. Two questions assessing subjective SES were administered to caregivers. The two questions were: "Would you say that your family is financially better or worse off than other families?" and "Which of these phrases describes best your family's economic status?" Both questions were scored using a five-point Likert scale ranging from one (*much better; we live very well*) to five (*a lot worse; poor*). These questions were previously used in a study examining control and coping in the context of subjective SES and health and demonstrated good reliability (Greene, 2008). Specifically, 240 urban undergraduate students were recruited to complete several measures, including eight subjective and objective measures of SES (six objective, two subjective). Psychometric analyses demonstrated good reliability between the two items (Cronbach's α = 0.85). In addition, the MacArthur Scale of SSS was significantly correlated with the two questions assessing subjective SES (r = 0.62, p < .001; Greene, 2008). In the combined dataset, internal consistency for the two items was acceptable (Cronbach's α = 0.62).

Child depressive symptoms. Children completed the Children's Depression Inventory (CDI), a 27-item measure that assesses depressive symptoms in children and adolescents ages seven to 17 years (Kovacs, 1985). Each item contains three options for children to select from as their answer. For example, a sample item includes the three options: 1) I have fun in many things; 2) I have fun in some things; 3) Nothing is fun at all. Total scores can range from zero to 54 and higher scores indicate the presence of more depressive symptoms. A sum score greater than 20 indicates clinically-significant symptomatology. The measure has five subscales, including negative mood, interpersonal difficulties, negative self-esteem, ineffectiveness, and anhedonia. The CDI is a widely-used measure of depressive symptoms among children and has demonstrated excellent reliability and validity, including within samples of children with asthma (Bender & Zhang, 2008; Kovacs, 1985). The CDI demonstrated good internal consistency in the combined dataset (Cronbach's $\alpha = 0.81$).

Child asthma self-efficacy. Children completed the Child Asthma Self-Efficacy Scale, a 14-item scale that measures a child's perceived ability to prevent and manage his or her asthma (Bursch et al., 1999). A sample item includes: "How sure are you that you can use your inhaler correctly?" Responses are measured on a scale from one (*not at all sure*) to five (*completely sure*). Higher scores indicate greater asthma self-efficacy. The measure is comprised of two subscales, attack prevention (eight items) and attack management (six items). The original validation study included a sample of 110 children between the ages of seven and 15 years. The measure has demonstrated adequate psychometric properties (Cronbach's $\alpha = 0.75\text{-}0.82$; Bursch et al., 1999). In the combined dataset, internal consistency was acceptable for both the attack prevention subscale (Cronbach's $\alpha = 0.60$) and the attack management subscale (Cronbach's $\alpha = 0.60$).

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Caregiver depressive symptoms. Caregivers completed the Center for Epidemiologic Studies Depression Scale (CES-D), a 20-item measure that assesses self-reported depressed mood (Radloff, 1977). Items are measured on a four-point Likert scale from less than one day (*rarely or none of the time*) to five to seven days (*most or all of the time*). A sample item is: "I had crying spells." Four positively-worded items are reverse-scored to include in the total score. Higher scores suggest the presence of more depressive symptoms and a greater frequency of depressed mood. Specifically, 60 is the highest possible score and a total score of 16 suggests the presence of depressive symptoms. In the present study, fifty-two caregivers (53.6%) had total CES-D scores of 16 or above. The CES-D is a widely-used measure of depressed mood and has demonstrated strong psychometric properties, including among studies that assess depressed mood among caregivers of children with asthma (Bartlett et al., 2001; Radloff, 1977; Shalowitz et al., 2001). In the combined dataset, the measure demonstrated good internal consistency (Cronbach's $\alpha = 0.86$).

Caregiver asthma self-efficacy. Caregivers completed the Parent Asthma Self-Efficacy Scale, a 13-item measure with two subscales assessing caregiver efficacy to prevent an asthma attack (attack prevention; six items) and manage an attack once it begins (attack management; seven items; Bursch et al., 1999). Responses are rated on a five-point Likert scale from one (*not at all sure*) to five (*completely sure*). A sample item asks caregivers, "How sure are you that you can use the medications correctly?" Higher scores indicate greater attack prevention and management efficacy. The measure has demonstrated adequate psychometric properties, including internal consistency and construct validity (Brown et al., 2014; Bursch et al., 1999; Martínez et al., 2009). For example, Brown and colleagues (2014) found high internal consistency in their study across subscales, including attack prevention (Cronbach's $\alpha = .83$),

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attack management (Cronbach's α = 0.90), and within the overall scale (Cronbach's α = 0.92). In the combined dataset, internal consistency for the attack prevention subscale was relatively low (Cronbach's α = 0.67), although it was acceptable for the attack management subscale (Cronbach's α = 0.78).

Child asthma outcomes.

Asthma Assessment Form. Emergency department visits and school days missed were reported by caregivers using the Asthma Assessment Form (AAF; Rosier et al., 1994). The AAF asks participants to report the number of times each of the events has happened in the past four weeks and the past year. It is a widely-used measure of morbidity indicators in pediatric asthma research (e.g., Everhart et al., 2012). In the current study, two of the child asthma outcomes were collected from the Asthma Assessment Form, including the number of asthma-related ED visits and school days missed, both within the past 12 months.

Asthma Control Test. Asthma control was assessed by two versions of the Asthma Control Test. Children ages seven to 11 completed the Childhood Asthma Control Test (cACT; Liu et al., 2007) while 12 year-olds completed the Asthma Control Test (ACT; Nathan et al., 2004). Both versions measure overall asthma control, with items reported by caregivers and/or children depending on child age.

Children 11 years and younger provided responses for four items on the cACT on a four-point Likert scale from zero (*very bad*) to three (*very good*); zero (*it's a big problem, I can't do what I want to do*) to three *(it's not a problem)*; and zero (*yes, all of the time*) to three (*no, none of the time*). A sample item asked children, "Do you wake up during the night because of your asthma?" Caregivers provided responses to three items measured on a six-point Likert scale from five (*not at all*) to zero (*every day*) on the cACT for children younger than 12 years of age. The

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item that assesses symptom-free days asks caregivers to respond to the following question: "During the last four weeks, on average, how many days per month did your child have any daytime asthma symptoms?" Twelve-year-old children provided responses to five items on the ACT measured on five-point Likert scales from one (*all of the time*) to five (*none of the time*); one (*more than once a day*) to five (*not at all*); and one (*very poor*) to five (*very good*). An example of one of the items children responded to was: "How would you rate your asthma control during the past four weeks?"

Scoring and interpretation. Lower scores on the cACT and ACT demonstrate worse asthma control, including the presence of more frequent and problematic asthma symptoms. Nathan and colleagues (2004) and Liu and colleagues (2007) recommend a cut-off point of 19, such that total scores at or below 19 are suggestive of poorly controlled asthma, while overall scores that are above 19 are indicative of well controlled asthma. Among children ages 7-11 years, 49.4% had total cACT scores less than or equal to 19. On the ACT, 30% of 12-year-olds had scores at or below 19. The cACT and ACT are widely-used and have both demonstrated good internal consistency with English-speaking children with asthma and their caregivers (Cronbach's α = 0.79-0.85; Koinis-Mitchell et al., 2014; Schatz et al., 2006). In the combined dataset, internal consistency was found to be acceptable for children ages 7-11 (cACT; Cronbach's α = 0.71) and excellent for children age 12 (ACT; Cronbach's α = 0.91).

Data Analysis Plan

Preliminary analyses. Preliminary analyses included: 1) a comparison of demographic variables from the two datasets to ensure that they did not differ statistically; 2) a power analysis that determined the sample size necessary to achieve significance with the appropriate statistical tests; 3) model checking (assumptions and covariate testing); and 4) missing data analyses.

Comparison of samples. In the current study, data were coded by study (1 = CARE, 2 = CARE-2) and *t*-tests and Chi-square analyses were used for dichotomous and categorical variables, respectively. The following variables were tested between studies: child/caregiver age, child sex, caregiver relationship to child, caregiver marital status, caregiver education level, monthly income, and asthma controller prescription. Child and caregiver age were examined as continuous variables and child sex was dichotomous. Caregiver relationship to child was re-categorized as a dichotomous variable ("biological mother" versus "other caregiver") and the corresponding chi-square was 2x2. Caregiver education level was examined as a continuous variable and monthly income was categorized into four groups (< \$1,000; \$1,000-\$1,999; \$2,000-\$2,999; > \$3,000). The cutoff points for monthly income were selected after running descriptives that included quartile cut-off points, to attempt to have categories that were as close to equally weighted as possible for analyses. Missing, refused, or unknown values for monthly income were removed for this analysis.

Power analysis. A power analysis was conducted using G*Power 3.1 software to determine the number of participants needed to detect significance using the relevant variables and tests. Using a regression model with predictors at power = .80, a sample size of 93 was determined to be sufficient to detect medium effects ($f^2 = 0.15$). This is consistent with G*Power 3.1 power analysis methods reported by Faul and colleagues (2009). The combined sample included data from 97 families, which was sufficient to detect significance. The analyses that included stressful life events, however, only included data from 40 families and therefore did not meet the projected number of participants necessary to detect significance.

Assumptions. Preliminary analyses were conducted to check the models and ensure that the data met the assumptions of parametric tests, including: 1) normally distributed data, 2)

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homogeneity of variance, and 3) independence (Field, 2013). If any of the assumptions were not met, appropriate statistical steps were taken to transform the data before conducting analyses. Descriptives were run on all major study variables to check for skewness, kurtosis, and univariate outliers, following imputation (see Table 2). Consistent with widely-used research methods, skew and kurtosis values of +/- 2 were used for the major study variables (independent variables and mediator variables) to test for normality (Field, 2013; Gravetter & Wallnau, 2014; Trochim & Donnelly, 2006).

Covariate testing. Covariate testing was conducted to ensure that any variability between groups was controlled in the analyses. Variables that were tested as possible significant covariates were child age, child sex, caregiver education, monthly income, and asthma controller prescription. Race/ethnicity was not included given that the study solely targeted racial and ethnic minority families and 95.9% of the families identified as Black or African American. Covariate testing used correlation analyses (child age and caregiver education), analysis of variance (monthly income), and t-tests (child sex and asthma controller prescription). The possible covariates were tested with each of the child asthma outcomes (ED visits, asthma control, school days missed).

Missing data. Overall, less than 5% of the items from the major study variables were missing from the dataset. Little's Missing Completely at Random (MCAR) tests were computed to determine whether missing data were missing at random (Little, 1988). Analyses revealed that almost all data from the major study variables were missing at random (*p*-values ranged from .176-.984), except for caregiver asthma self-efficacy (*p*-values ranged from .002-.003 on both subscales). A single imputation method, like the expectation-maximization (EM) algorithm, is appropriate when only a small portion of data are missing, like in the present study. It is also one

of the better methods for imputing data when data are not missing at random. The EM algorithm provides unbiased parameter estimates and maintains statistical power, compared to list-wise deletion and other single imputation methods (e.g., mean replacement; Enders, 2001; Scheffer, 2002). Missing Value Analysis was computed in SPSS version 23.0 to impute missing data.

Statistical analyses. Analyses were conducted to determine associations between urban stressors (neighborhood stress, stressful life events, perceived discrimination, subjective SES) and child asthma outcomes (ED visits, school days missed, asthma control). Additional analyses examined the possible role of two mediator variables, depressive symptoms and asthma self-efficacy.

Regression. Linear regressions were used to determine associations between urban stressors and child asthma outcomes, including any covariates. Further, to test whether one predictor variable was most robustly associated with any of the tested child asthma outcomes, another series of regressions was completed. Any urban stressors that were significantly associated with the same outcome were entered into the model simultaneously. Step 1 included any relevant covariates identified in the preliminary analyses. Step 2 included the predictor variables that were significantly associated with any of the three child asthma outcomes.

Mediation analyses. Mediation analyses were conducted to examine whether depressive symptoms and self-efficacy mediated the effects of urban stressors on child asthma outcomes in both the child and caregiver models. Baron and Kenny (1986) outline four steps to determine *complete* and *partial* mediation. Step 1 requires that the regression equation provide support for the association between the predictor (urban stressor, such as caregiver-reported perceived discrimination) and outcome (e.g., ED visits). If this association is significant, it suggests that the analyses can continue because there is a significant effect that may be mediated by another

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variable. Step 2 includes an analysis to determine whether the predictor and mediator variables are significantly associated with one another. If this step is significant, the next step can be completed. In step 3, the purpose is to determine whether the mediator is associated with the outcome when controlling for the predictor variable. As such, the predictor and mediator variables are entered into a regression together and a significant outcome would suggest that the mediator is associated with the outcome, even when the predictor is controlled. In the last step, step 4, the goal is to determine complete mediation by determining whether the mediator completely mediates the association between the predictor and outcome variables. This happens when the effect between the predictor and outcome, when controlling for the mediator, equals zero. If step 4 is not significant, but steps 1-3 are significant, *partial* mediation is likely present. If steps 1-4 are all significant, there is evidence for *complete* mediation. Baron and Kenny (1986) note that the analyses need to be coupled with research to provide enough reasoning for the presence of mediation.

Consistent with mediation methods described by Preacher and Hayes (2004), bootstrapping is used to estimate a confidence interval by repeatedly resampling (e.g., 5000 samples) based on data points from the original sample. Bootstrapping is beneficial because it provides a more accurate confidence interval by which to determine the significance of a mediation effect. If zero is not contained in the 95% confidence interval, the indirect effect is significant. An SPSS macro, PROCESS (Hayes, 2012), was used to conduct bootstrapping procedures in the present study.

Results

Preliminary Data Analysis

Comparison of samples. Analyses were run to determine any potential differences between the two datasets that were combined from the CARE and CARE-2 Studies (see Table 1). Other pediatric asthma studies that combined data from multiple samples (e.g., schools) within the same population acknowledged significant differences between samples and reported them accordingly in the beginning of the results (Sarnat et al., 2012; Zora et al., 2013). No significant demographic differences were found between samples in the present study. In addition, scores from all measures (urban stressors, mediators, and outcomes) were compared between datasets. There were no significant differences in scores between CARE and CARE-2 participants on any measures (p-values ranged from .130-.821).

Model checking. Consistent with methods described in the data analysis section, the following variables had skew and/or kurtosis values greater than +/- 2: caregiver perceived discrimination (GED stress subscale; kurtosis = 2.44), child depressive symptoms (CDI; kurtosis = 2.19), ED visits (kurtosis = 3.82), and school days missed (skew = 2.72, kurtosis = 9.09). A standard transformation was completed to create z-scores for the values, although skew and kurtosis values did not change. Based on recommendations from Field (2013), square root transformations were used for the GED stress subscale, CDI, ED visits, and school days missed to normalize values. This transformation was successful: 1) CDI (skew = -0.07, kurtosis = 0.17); 2) GED stress subscale (skew = 1.01, kurtosis = 0.69); 3) ED visits (skew = 0.13, kurtosis = - 0.78); and 4) school days missed (skew = 0.71, kurtosis = 0.61).

Multicollinearity suggests the presence of correlations between predictor variables. Correlations were run between each set of the predictor variables. None of the correlations between predictor variables exceeded 0.80, which is the high cutoff reported by Field (2013) that indicates the presence of multicollinearity (see Table 3, a correlation matrix between all major

study variables). The VIF (variance inflation factor) is a collinearity diagnostic that shows whether an independent variable has a strong linear association to the other predictor variables. Tolerance is another collinearity diagnostic that is the reciprocal of VIF (1/VIF). Tolerance values within normal limits should be less than 10, while VIF values should be no less than 0.1 (Field, 2013; Myers, 1990). All tolerance and VIF values fell within the necessary ranges.

Independence is another assumption of parametric tests and suggests that data from different participants are independent of one another. In the present study, data reported by one participant did not influence the data provided by another participant. The sample, therefore, met the assumption of independence.

Covariate testing. Covariate analyses demonstrated that asthma controller prescription was significantly associated with school days missed. Specifically, there was a significant difference in school days missed between children prescribed a controller medication and those who were not prescribed a controller medication, $t(95) = -2.24$, $p = .009$. Children who were currently prescribed a controller medication missed more school days ($M = 7.24$ days) compared to children who were not currently prescribed a controller medication ($M = 3.11$ days). Asthma controller prescription was therefore controlled for in any analyses that included school days missed as the outcome. No other tested covariates were significantly associated with any other child asthma outcomes.

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Table 2.

Psychometric Properties of the Major Study Variables Following Imputation

Variable	Reporter	n	M	SD	α	Range Potential	Range Actual	Skew	Kurtosis
Perceived discrimination*	Caregiver	97	34.18	17.69	0.94	17-102	17-101	1.01	0.69
Subjective socioeconomic status	Caregiver	97	5.63	1.31	0.62	0-10	2-10	0.48	1.23
Stressful life events	Caregiver	40	13.20	11.23	0.85	0-96	0-40	0.85	0.17
Depressive symptoms	Caregiver	97	17.02	9.80	0.86	0-60	2.86-48	0.96	1.09
Asthma self-efficacy									
Attack prevention	Caregiver	97	3.66	0.36	0.67	1-4	2.50-4	-1.20	1.01
Attack management	Caregiver	97	3.39	0.46	0.78	1-4	2-4	-0.55	0.13
Neighborhood stress	Child	97	2.41	2.94	0.55	0-18	0-11	1.47	1.47
Depressive symptoms*	Child	97	7.33	5.93	0.81	0-54	0-30	-.07	0.17
Asthma self-efficacy									
Attack prevention	Child	97	3.90	0.70	0.60	1-5	2.07-5	-0.51	-0.38
Attack management	Child	97	3.61	0.83	0.60	1-5	1.83-5	-0.29	-0.81
ED visits*	Caregiver	97	2.08	2.32	-	-	0-12	0.13	-0.78
Asthma control									
7-11 years (cACT)	Both	87	18.41	5.02	0.71	0-27	4-26	-0.71	-0.02
12 years (ACT)	Child	10	20.24	5.51	0.91	5-25	11-25	-0.90	-.93
School days missed*	Caregiver	97	6.09	8.33	-	-	0-46	0.71	0.61

*Note: *These variables were successfully transformed using a square root transformation.*

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Table 3.

Correlation Matrix with All Major Study Variables

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Neighborhood stress	-												
2. Stressful life events	.377*	-											
3. Perceived discrimination	-.084	.382*	-										
4. Subjective SES	-.045	.141	.121	-									
5. Caregiver asthma SE: attack prev.	-.057	-.389*	-.050	-.092	-								
6. Caregiver asthma SE: attack man.	.101	.159	.109	.060	.562**	-							
7. Child asthma SE: attack prev.	-.164	-.115	-.102	.004	-.004	-.100	-						
8. Child asthma SE: attack man.	-.148	.156	.039	.119	-.069	-.046	.682**	-					
9. Child depressive symptoms	.301**	.159	-.057	-.097	.056	.054	-.367**	-.274*	-				
10. Caregiver depressive symptoms	.316**	.670**	.224*	.217*	-.208*	-.073	-.084	.030	.265**	-			
11. ED visits	.072	.309	-.057	-.123	-.047	.066	.082	.187	.145	.173	-		
12. School days missed	.110	.427**	.151	-.033	.014	.134	-.128	.004	.050	.211*	.550**	-	
13. Asthma control	-.216*	-.163	.099	-.048	.076	.066	.184	.192	-.295**	-.182	-.150	-.221*	-

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

Main Study Analyses

Regressions.

Child regressions.

Neighborhood stress. Correlations were used to analyze associations between neighborhood stress and ED visits and asthma control (see Table 3). A hierarchical linear regression was used to test the relation between neighborhood stress and school days missed, while controlling for asthma controller prescription (see Table 4). Neighborhood stress was significantly associated with asthma control ($r = -.216$, $p = .033$), such that more neighborhood stress was related to worse asthma control. Neighborhood stress was not associated with ED visits or school days missed.

Child depressive symptoms. A series of correlation analyses were conducted to examine the associations between child depressive symptoms and neighborhood stress, as well as between child depressive symptoms and child asthma outcomes (see Table 3). A hierarchical linear regression was used to determine the relation between child depressive symptoms and school days missed (see Table 4). Child depressive symptoms were significantly associated with neighborhood stress ($r = .301$, $p = .003$) and asthma control ($r = -.295$, $p = .003$). Specifically, more child depressive symptoms were associated with more neighborhood stress and worse asthma control. Child depressive symptoms were not significantly associated with ED visits or school days missed.

Child asthma self-efficacy (attack prevention). Correlation analyses were conducted to determine the associations between child asthma self-efficacy (attack prevention) and neighborhood stress, as well as between child asthma self-efficacy (attack prevention) and child asthma outcomes (see Table 3). A hierarchical linear regression was used to determine the

relation between child asthma self-efficacy (attack prevention) and school days missed (see Table 4). Child asthma self-efficacy (attack prevention) was not significantly associated with neighborhood stress or any child asthma outcomes.

Child asthma self-efficacy (attack management). A series of correlation analyses were conducted to examine the associations between child asthma self-efficacy (attack management) and neighborhood stress, as well as between child asthma self-efficacy (attack management) and child asthma outcomes (see Table 3). A hierarchical linear regression was used to determine the relation between child asthma self-efficacy (attack management) and school days missed (see Table 4). Child asthma self-efficacy (attack management) was not significantly associated with neighborhood stress or any child asthma outcomes.

Caregiver regressions.

Stressful life events. A series of regression analyses was conducted to determine the associations between stressful life events and child asthma outcomes. These analyses were conducted with data from CARE-2 participants only. Two correlation analyses were used to examine the associations between stressful life events and two asthma outcomes, ED visits and asthma control (see Table 3). A hierarchical linear regression was used to examine the relation between stressful life events and school days missed, after controlling for asthma controller prescription. Analyses revealed that stressful life events were not significantly associated with ED visits or asthma control, although it was trending toward significance with ED visits ($r = .309$, $p = .053$). In the hierarchical linear regression, asthma controller prescription was entered in step 1 and stressful life events were entered in step 2. The overall model was significant, $F(2, 37) = 4.19$, $p = .023$, $\Delta R^2 = .18$, $R^2 = .19$. Stressful life events were associated with school days missed after controlling for asthma controller prescription, $t(2, 37) = 2.83$, $p = .008$.

Perceived discrimination. Correlation analyses were computed to examine associations between perceived discrimination and ED visits, as well as between perceived discrimination and asthma control (see Table 3). A hierarchical linear regression was conducted to determine whether perceived discrimination was associated with school days missed, while controlling for asthma controller prescription (see Table 4). Perceived discrimination was not significantly associated with ED visits, asthma control, or school days missed.

Subjective SES. Correlation analyses examined whether subjective SES was associated with ED visits and asthma control (see Table 3). A hierarchical linear regression examined whether subjective SES was associated with school days missed, after controlling for asthma controller prescription. Subjective SES was not significantly associated with ED visits, asthma control, or school days missed.

Caregiver depressive symptoms. A series of correlation analyses was conducted to examine the associations between caregiver depressive symptoms and caregiver-reported urban stressors (stressful life events, perceived discrimination, subjective SES), as well as between caregiver depressive symptoms and child asthma outcomes (see Table 3). A hierarchical linear regression was used to determine the relation between caregiver depressive symptoms and school days missed (see Table 4). Analyses revealed significant associations between caregiver depressive symptoms and the following variables: stressful life events ($r = .670$, $p < .001$), perceived discrimination ($r = .224$, $p = .027$), and subjective SES ($r = .217$, $p = .032$). Specifically, the presence of more caregiver depressive symptoms was associated with more stressful life events, more perceived discrimination, and more stress associated with subjective SES. Caregiver depressive symptoms were not associated with ED visits or asthma control. In the hierarchical linear regression, asthma controller prescription was entered in step 1 and

caregiver depressive symptoms were entered in step 2. The overall model was significant, $F(2, 94) = 4.16$, $p = .019$, $\Delta R^2 = .04$, $R^2 = .08$. Caregiver depressive symptoms were associated with school days missed after controlling for asthma controller prescription, $t(2, 94) = 2.11$, $p = .038$.

Caregiver asthma self-efficacy (attack prevention). Correlation analyses were conducted to determine the associations between caregiver asthma self-efficacy (attack prevention) and caregiver-reported urban stressors, as well as between caregiver asthma self-efficacy (attack prevention) and child asthma outcomes (see Table 3). Caregiver asthma self-efficacy (attack prevention) was associated with stressful life events ($r = -.389$, $p = .013$), such that more caregiver asthma self-efficacy (attack prevention) was related to fewer stressful life events. Caregiver asthma self-efficacy (attack prevention) was not associated with perceived discrimination, subjective SES, ED visits, or asthma control. A hierarchical linear regression was used to determine the relation between caregiver asthma self-efficacy (attack prevention) and school days missed, after controlling for asthma controller prescription, although the outcome was not significant (see Table 4).

Caregiver asthma self-efficacy (attack management). Correlation analyses were conducted to examine the associations between caregiver asthma self-efficacy (attack management) and caregiver-reported urban stressors, as well as between caregiver asthma self-efficacy (attack prevention) and child asthma outcomes (see Table 3). Caregiver asthma self-efficacy (attack management) was not associated with any urban stressors, ED visits, or asthma control. A hierarchical linear regression was conducted to examine the relation between caregiver asthma self-efficacy (attack management) and school days missed, after controlling for asthma controller prescription, but the analysis was not significant (see Table 4).

Multiple regressions. Based on findings from the initial regressions, none of the outcome variables were significantly associated with more than one of the four urban stressor predictor variables. Therefore, no multiple regression analyses were conducted to compare urban stressors with any single child asthma outcome.

Mediation analyses. The Baron and Kenny (1986) method described previously was used for testing a series of child and caregiver mediation models. All mediation analyses were run in sequence with pathways a, b, and c, and then with all of the variables in the model together (c') if the other pathways were significant. Results from all pathways are presented in Tables 5-9 and two models with significant pathways (a, b, and c) are presented below.

Child mediation analyses. In Model 1, neighborhood stress was found to predict worse asthma control (pathway c; $B = -.374$, $p = .033$), and also to predict more child depressive symptoms (pathway a; $B = .119$, $p = .003$). When both neighborhood stress and child depressive symptoms were included in a third regression model, the relation of child depressive symptoms to asthma control was significant (pathway b; $B = -1.103$, $p = .015$), while the relation of neighborhood stress to asthma control dropped to nonsignificance (pathway c'; $B = -.242$, $p = .174$). This final path examines whether the mediator variable (child depressive symptoms) has a significant effect on the dependent variable (asthma control) after controlling for the effect of the independent variable (neighborhood stress). In this case, the effect of neighborhood stress on asthma control, after controlling for child depressive symptoms, was nonsignificant; this suggests the possibility of a mediation effect. Bootstrapping procedures were then used to examine the presence of an indirect effect of neighborhood stress on asthma control via child depressive symptoms. This model, conducted with 5,000 bootstraps, yielded a mean bootstrap estimate of the indirect effect of -0.13. The 95% confidence interval did not include zero (-.3474,

-.0285), which suggests that child depressive symptoms significantly mediated the effect of neighborhood stress on asthma control.

Caregiver mediation analyses. In Model 2, more stressful life events were found to predict more school days missed after controlling for asthma controller prescription (pathway c; $B = .051$, $p = .023$), and also to predict more caregiver depressive symptoms (pathway a; $B = .668$, $p < .001$). When both stressful life events and caregiver depressive symptoms were included in a third regression model, the associations between stressful life events and school days missed (pathway c'; $B = .042$, $p = .101$), as well as between caregiver depressive symptoms and school days missed (pathway b; $B = .014$, $p = .563$) were no longer significant. The analysis did not support the mediation requirement that the mediator variable had a significant effect on the dependent variable after controlling for the effect of the independent variable. Therefore, caregiver depressive symptoms did not significantly mediate the relation between stressful life events and school days missed.

Table 4.

Hierarchical Regressions with School Days Missed

Predictor	B	s_e	t(df)	p
Step 1				
Asthma controller prescription	.666	.344	1.93 (1, 95)	.056
Step 2				
Asthma controller prescription	.644	.345	1.87 (2, 94)	.065
Neighborhood stress	.051	.053	.97 (2, 94)	.334
Step 2				
Asthma controller prescription	.175	.483	.36 (2, 37)	.719
Stressful life events	.051	.018	2.83 (2, 37)	.008*
Step 2				
Asthma controller prescription	.729	.343	2.13 (2, 94)	.036*
Perceived discrimination	.194	.112	1.73 (2, 94)	.086
Step 2				
Asthma controller prescription	.664	.346	1.92 (2, 94)	.058
Subjective SES	-.036	.119	-.30 (2, 94)	.764
Step 2				
Asthma controller prescription	.663	.346	1.92 (2, 94)	.058
Child depressive symptoms	.062	.134	.46 (2, 94)	.644
Step 2				
Asthma controller prescription	.671	.343	1.96 (2, 94)	.053
Child asthma SE (attack prevention)	-.288	.222	-1.30 (2, 94)	.197
Step 2				
Asthma controller prescription	.666	.346	1.92 (2, 94)	.057
Child asthma SE (attack management)	.009	.189	.05 (2, 94)	.963
Step 2				
Asthma controller prescription	.655	.338	1.94 (2, 94)	.056
Caregiver depressive symptoms	.033	.016	2.11 (2, 94)	.038*
Step 2				
Asthma controller prescription	.667	.346	1.93 (2, 94)	.057
Caregiver asthma SE (attack prevention)	.072	.435	.16 (2, 94)	.870
Step 2				
Asthma controller prescription	.663	.343	1.93 (2, 94)	.056
Caregiver asthma SE (attack management)	.449	.338	1.33 (2, 94)	.187

*Note: *p < .05. ** p < .01.

Table 5.

Regression Analyses for Urban Stressors and Child Asthma Outcomes (Pathway c)

	R^2	F(df)	p	B
Neighborhood stress (child)				
ED visits	.005	.49(1, 95)	.484	.022
Asthma control	.047	4.66(1, 95)	.033*	-.374
School days missed	.047	2.34(2, 94)	.102	.051
Stressful life events (caregiver)				
ED visits	.095	4.01(1, 38)	.053	.026
Asthma control	.027	1.04(1, 38)	.314	-.073
School days missed	.185	4.19(2, 37)	.023*	.051
Perceived discrimination (caregiver)				
ED visits	.003	.31(1, 95)	.578	-.037
Asthma control	.010	.94(1, 95)	.335	.364
School days missed	.068	3.41(2, 94)	.037*	.194
Subjective SES (caregiver)				
ED visits	.015	1.47(1, 95)	.229	-.085
Asthma control	.002	.22(1, 95)	.644	-.184
School days missed	.039	1.90(2, 94)	.156	-.036

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

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Table 6.

Regression Analyses for Mediation Variables and Child Asthma Outcomes (Pathway b)

	R^2	F(df)	p	B
Depressive symptoms (child)				
ED visits	.021	2.03(1, 95)	.157	.112
Asthma control	.087	9.07(1, 95)	.003*	-1.288
School days missed	.040	1.96(2, 94)	.147	.062
Asthma self-efficacy, attack prevention (child)				
ED visits	.007	.65(1, 95)	.423	.107
Asthma control	.034	3.31(1, 95)	.072	1.337
School days missed	.055	2.73(2, 94)	.070	-.288
Asthma self-efficacy, attack management (child)				
ED visits	.035	3.43(1, 95)	.067	.204
Asthma control	.037	3.64(1, 95)	.060	1.179
School days missed	.038	1.85(2, 94)	.163	.009
Depressive symptoms (caregiver)				
ED visits	.030	2.91(1, 95)	.091	.016
Asthma control	.033	3.25(1, 95)	.074	-.094
School days missed	.081	4.16(2, 94)	.019*	.033
Asthma self-efficacy, attack prevention (caregiver)				
ED visits	.002	.21(1, 95)	.646	-.119
Asthma control	.006	.56(1, 95)	.457	1.083
School days missed	.038	1.86(2, 94)	.161	.072
Asthma self-efficacy, attack management (caregiver)				
ED visits	.004	.41(1, 95)	.521	.130
Asthma control	.004	.41(1, 95)	.521	.732
School days missed	.056	2.77(2, 94)	.068	.449

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

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Table 7.

Regression Analyses for Urban Stressors and Mediators (Pathway a)

	R^2	F(df)	p	B
Neighborhood stress (child)				
Depressive symptoms	.091	9.49(1, 95)	.003*	.119
Asthma self-efficacy, attack prevention	.027	2.63(1, 95)	.108	-.039
Asthma self-efficacy, attack management	.022	2.12(1, 95)	.148	-.042
Stressful life events (caregiver)				
Depressive symptoms	.449	30.96(1, 38)	< .001**	.668
Asthma self-efficacy, attack prevention	.151	6.77(1, 38)	.013*	-.013
Asthma self-efficacy, attack management	.025	0.98(1, 38)	.328	.006
Perceived discrimination (caregiver)				
Depressive symptoms	.050	5.02(1, 95)	.027*	1.594
Asthma self-efficacy, attack prevention	.003	0.24(1, 95)	.627	-.013
Asthma self-efficacy, attack management	.012	1.15(1, 95)	.287	.036
Subjective SES (caregiver)				
Depressive symptoms	.047	4.71(1, 95)	.032*	1.625
Asthma self-efficacy, attack prevention	.009	0.82(1, 95)	.368	-.025
Asthma self-efficacy, attack management	.004	0.35(1, 95)	.557	.021

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

Table 8.

Mediation Analyses for Direct Effect of Urban Stressors on Child Asthma Outcomes by Mediation Variables (Pathway c' and Statistics for the Overall Model)

Independent variable Mediator variable Dependent variable	B	t(df)	p	R^2	F(df)	p
Neighborhood stress (child) Depressive symptoms Asthma control	-1.103	-2.47(2, 94)	.015*	.105	5.51(2, 94)	.005*
Stressful life events (caregiver) Depressive symptoms School days missed	.014	.58(3, 36)	.563	.192	2.86(3, 36)	.050

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

<center>**Discussion**</center>

Previous research has documented pediatric asthma disparities and the impact of stress on health outcomes, including within pediatric populations. The present study, however, is one of the first to consider multiple types of urban stressors and the way in which they may be associated with child asthma outcomes among low-income, racial and ethnic minority, urban families.

Urban Stressors and Child Asthma Outcomes

The first aim of the study examined associations between urban stressors (reported by children with asthma and by their caregivers) and child asthma outcomes. Neighborhood stress, stressful life events, perceived discrimination, and subjective SES were each examined in associations with ED visits, asthma control, and school days missed. It was hypothesized that more urban stress (more neighborhood stress, more stressful life events, greater perceived discrimination, and lower subjective SES) would be associated with worse child asthma outcomes (more ED visits, worse asthma control, more school days missed).

Child-reported urban stress and child asthma outcomes. Analyses demonstrated that neighborhood stress was significantly associated with asthma control, but not with ED visits or school days missed. Specifically, more neighborhood stress was associated with worse asthma control, which is consistent with previous literature. For instance, Jandasek and colleagues (2011) found that families residing in urban areas generally encountered more barriers (e.g., less access to resources, more exposure to violence) to asthma prevention, management, and treatment, which negatively impact asthma control. It seems that when families feel safer, they may be more capable of contributing to and attending to child asthma management, and previous research supports the relation between perceptions of safety and asthma control (Coutinho et al.,

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2013). Further, it seems likely that experiences with neighborhood violence may worsen the intensity and increase the frequency of the child's asthma symptoms, given what is known about the physiological impact of stress on a child's asthma (Chen & Miller, 2007). It could also be that when children are managing other stressors in their neighborhoods, it limits their ability to properly care for and effectively control their asthma. It may also be that exposure to neighborhood violence is a proxy for more general stressors encountered in the community (e.g., fewer medical resources) that take away from a family's ability to appropriately manage a child's asthma.

My hypothesis was not fully supported; although neighborhood stress was significantly associated with asthma control, it was not significantly related to school days missed or ED visits. Exposure to community violence has previously been shown to be related to more daytime asthma symptoms and hospitalizations; the results from the present study were therefore unexpected (Swahn & Bossarte, 2006; Wright et al., 2004). Perhaps there are other factors (e.g., mental health) that better explain children staying home from school or utilizing emergency care for their asthma. For example, previous research shows that caregiver characteristics, including mental health, physical health, general efficacy, coping skills, and social connections are thought to impact the ways that families manage urban stress (Leventhal & Brooks-Gunn, 2000). For example, social support may be protective against the effects of neighborhood stress because it reduces parental stress in families that reside in dangerous neighborhoods (Conger, Ge, Elder, Lorenz, & Simons, 1994; Elder Jr, Eccles, Ardelt, & Lord, 1995). Among children, asthma-related correlates of depression include increased rates of hospitalization, more wheezing, poorer functional status, more asthma symptoms, and more asthma symptom days (Richardson et al., 2006; Weil et al., 1999). Mental health variables, or other psychosocial stressors in the home and

community, may have more to do with absenteeism from school or taking children to the ED for asthma care compared to asthma-specific indicators.

Caregiver-reported urban stressors and child asthma outcomes. Analyses revealed significant associations between caregiver-reported urban stressors (stressful life events, perceived discrimination, subjective SES) and child asthma outcomes. Stressful life events were not significantly associated with ED visits or asthma control, but they were significantly associated with school days missed. Stressful life events included a variety of stressors, not solely neighborhood violence. The lack of significance between stressful life events and ED visits was surprising based on previous research. For instance, Cabana and colleagues (2004) found higher rates of child asthma hospitalizations and mortality in urban settings comprised of more individuals living in poverty, more neighborhood stressors, and a larger percentage of ethnic minority families. The constructs that were measured by Cabana and colleagues (2004) differed from the constructs that were assessed in the present study, which may explain the difference in findings.

This finding supported the hypothesis that stressful life events would be associated with school days missed. In the context of increased stress levels, it is understandable that children would also miss more school. It may be that children with asthma miss school more because their caregivers are managing more stress (e.g., poverty, unemployment, single family homes) and less able to contribute to consistent asthma management. One study found that missing any school days was related to poor asthma control, exacerbation of asthma symptoms, presence of an asthma attack, urgent healthcare utilization, cost of medical care, and mold detected in the home (Hsu, Qin, Beavers, & Mirabelli, 2016). Research consistently shows that childhood asthma is the most common reason for school absenteeism; more than 10 million school days are

missed each year because of asthma, and this rate is higher among urban children (Akinbami, Moorman, & Liu, 2011). Future research would benefit from ways to address school absenteeism given the negative impact that missing school can have on child development and academic performance (Hsu et al., 2016).

Surprisingly, perceived caregiver discrimination was not significantly associated with any child asthma outcomes, which is not consistent with previous research in the field. Available research suggests that perceived discrimination is associated with worse psychological and physical health outcomes (Pascoe & Richman, 2009). Additionally, previous studies have explored perceived discrimination and child asthma morbidity within the family unit (Koinis-Mitchell et al., 2007, 2010). Two studies found that cultural risk factors, like perceived discrimination, may impact child asthma morbidity, including among racial and ethnic minority families (Koinis-Mitchell et al., 2007, 2010). Both studies examined cultural risk factors in the larger context of cumulative risk models using similar measures. The cumulative risk models included contextual risks (neighborhood stress and poverty) and cultural risks (acculturative stress and discrimination), along with asthma-specific risks (e.g., asthma severity). Neighborhood stress was measured using the Neighborhood Unsafety Scale (Resnick et al., 1997), poverty was defined using the poverty threshold, acculturative stress was assessed using 26 out of 73 items from the Cultural Stress Scale (Cervantes, Padilla, & de Snyder, 1990), and discrimination was measured using a nine-item assessment by Jackson and Williams (2002). The study by Koinis-Mitchell and colleagues (2007) suggested that after controlling for poverty level and asthma severity, more cumulative risk was associated with greater asthma morbidity. The other study by Koinis-Mitchell and colleagues (2010) used the same variables in the cumulative risk model. They found that the cultural variables, acculturative stress and discrimination, both

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had a uniquely important influence on child asthma morbidity within African American and Latino families, compared to other racial and ethnic groups (e.g., non-Latino White).

The current study used a different measure of perceived discrimination, the GED. Although the GED is a validated measure of discrimination, perhaps there was another component of perceived discrimination that was not captured by the measure, or another mechanism that better explains the relation between stress and child asthma outcomes. For example, the stressful life events measure assessed many different types of stressors that families could experience. Perhaps a parallel measure that examined the number of lifetime exposures to perceived discrimination would have provided more information about this type of stress and how it relates to ED visits, school days missed, and asthma control.

Subjective SES was not significantly associated with any child asthma outcomes. Objective SES (monthly income) was also not significantly associated with any child asthma outcomes. These findings were surprising given that school absenteeism is often found in lower income families (Rappaport, Daskalakis, & Andrel, 2011; Rothman, 2001). Further, increased asthma morbidity has been found in low-income, racial and ethnic minority families after controlling for healthcare variability (Joseph et al., 2000; McQuaid & Abramson, 2009). It seems likely that part of the lack of findings with subjective SES was the way in which it was measured. The measure has two items and it is not well-validated, although the items were used in previous research (Greene, 2008). The range included most possible scores (2-10 out of a possible 0-10), although most scores were condensed around the mean (5.64). The present study included mainly low-income families, which may have restricted the range of possible findings given limited variability in objective income. This limitation is consistent with other pediatric asthma studies conducted in low-income, urban areas (Koinis-Mitchell et al., 2007). Based on

extensive literature available on pediatric asthma disparities, it seems likely that income, subjective or objective, remains an important variable to consider in pediatric asthma research (CDC, 2015; Joseph et al., 2000; McQuaid & Abramson, 2009).

Multiple urban stressors and child asthma outcomes. Interestingly, none of the child asthma outcome variables were significantly associated with more than one urban stressor in the present study. Different stressors may be associated with specific asthma outcomes. A cumulative risk model may be useful instead of looking at individual stressors, as it may be the amount of stress versus each specific type of stress, that is important in the context of child asthma outcomes. Future research should explore the impact of stress on child asthma outcomes using a cumulative risk approach to further understand how urban stressors impact child asthma outcomes among low-income, racial and ethnic minority, and urban families (Koinis-Mitchell et al., 2007, 2010).

Depressive Symptoms and Asthma Self-Efficacy

Child mediation models. There was one significant child mediation model in the present study. In the model with child depressive symptoms as the mediator between neighborhood stress and asthma control, child depressive symptoms were found to demonstrate a significant mediation effect. This finding suggests that child depressive symptoms may explain or account for the association between neighborhood stress and asthma control. In other words, neighborhood stress may affect asthma control through a child's depressive symptoms. Depressive symptoms may, therefore, be important for providers to assess and target when working with children with asthma. The findings in the present study are consistent with previous research finding child depressive symptoms to mediate the association between neighborhood stress and asthma morbidity in children (Tobin et al., 2016). Tobin and colleagues

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(2016) collected data from 156 youth between the ages of 10 and 17 years. Caregivers responded to a stress inventory about perceived neighborhood stress, including violence. Children completed the CDI and asthma outcomes were measured with a daily diary and two daily peak expiratory flow rate (PEFR) assessments. Analyses revealed significant indirect effects, such that the association between neighborhood stress and asthma outcomes was partially mediated by anhedonia.

In the present study, further analyses demonstrated that child asthma self-efficacy (attack prevention) was not significantly related to neighborhood stress or any child asthma outcomes. Similarly, child asthma self-efficacy (attack management) was not related to neighborhood stress or any child asthma outcomes. Previous research by Bursch and colleagues (1999) found that children with lower asthma self-efficacy more frequently accessed the ED for asthma treatment. It is also plausible that child asthma outcomes, like ED visits, may be more related to caregiver asthma self-efficacy and decision-making, given that they are often the ones who take their children to the ED. Caregiver asthma self-efficacy may therefore be more relevant to child asthma management.

Caregiver mediation models. In the current study, there were not any significant caregiver mediation models and none of the models trended toward significance. Analyses demonstrated that caregiver depressive symptoms were significantly associated with all three caregiver-reported urban stressors. Specifically, the presence of more depressive symptoms was related to more stressful life events, more perceived discrimination, and more stress associated with subjective SES. Caregiver depressive symptoms were also associated with school days missed, after controlling for asthma controller prescription. Despite the numerous significant associations between caregiver depressive symptoms and urban stressors, as well as between

caregiver depressive symptoms and school days missed, it seems likely that a lack of power is one main reason why no significant mediation models were detected. Previous research, coupled with results from the present study, otherwise provide support for the importance of caregiver depressive symptoms in stress appraisals and child health outcomes. Previous research, for example, suggests that caregivers who meet criteria for depression are three times more likely to have children who are nonadherent to medical treatment (DiMatteo et al., 2000). Maternal depression, in particular, has been associated with child asthma morbidity. Pak and Allen (2012) found that maternal depression was associated with poor adherence and inconsistent healthcare utilization (Bartlett et al., 2001; Brown et al., 2006; Leiferman, 2002; Shalowitz et al., 2001; Weil et al., 1999). Caregiver depressive symptoms should continue to be observed in future child asthma studies given their robust associations with urban stressors and school days missed.

Further analyses revealed that caregiver asthma self-efficacy (attack management) was not significantly associated with any urban stressors, although caregiver asthma self-efficacy (attack prevention) was significantly related to stressful life events. Stressful life events and caregiver depressive symptoms may therefore be important factors to target to improve efficacy, and improving asthma self-efficacy likely has implications for daily asthma management. Previous research that shows that lower caregiver self-efficacy is related to worse asthma morbidity, including more school days missed within the past two months and within the past year (Grus et al., 2001). Future research should continue to consider caregiver asthma self-efficacy as an important component of child asthma management, although it was not a significant mediator in the present study. Other studies have explored caregiver asthma self-efficacy in different models with child asthma health outcomes, including a study by Holland and colleagues (2011). Holland and colleagues (2011) found that caregiver self-efficacy

significantly mediated the relation between caregiver depressive symptoms and child asthma hospitalizations (Holland et al., 2011).

Limitations

This study was unique in its scope, although it had multiple, notable limitations. First, the overall sample size was relatively small, which limited the ability to detect significant differences in the analyses that were conducted (i.e., low power). Any analyses that included stressful life events, in particular, were limited in power due to the low number of participants (CARE-2 only; 40 families) who completed this measure. Also, the datasets used in the present study were collected at two different time periods and then combined. Initially, the concern was that there would be a statistical difference between the two datasets, although analyses refuted this idea; statistical differences between key study demographics were not found.

Another important limitation was the relatively low internal consistency found among some of the study measures.[1] The violence subscale of the neighborhood stress measure had particularly poor internal consistency (Cronbach's $\alpha < 0.60$), which means that the "inter-relatedness" of the items on this subscale was relatively low and may subsequently limit generalizability of the results (Tavakol & Dennick, 2011). Another limitation was in regard to missing study data. According to statistical analyses, all major study measures were missing data completely at random, except for the measure of caregiver asthma self-efficacy. Although it is unknown why caregiver asthma self-efficacy data were found to have significantly non-random missing data, it limits the generalizability of the results with caregiver asthma self-efficacy. Results with caregiver self-efficacy (attack prevention and attack management) should therefore

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[1] Scale if item deleted procedures were conducted to determine whether the internal consistency of any measure improved with the deletion of an item or items. None of the measures had a higher internal consistency with the deletion of one or more items. Therefore, all items in all measures were included in analyses.

be interpreted with caution. In addition, a limitation to the present study was that there was not an objective measure of asthma status. For instance, an objective measure of lung function (e.g., forced expiratory volume [FEV_1]) would more accurately depict level of asthma control, compared to responses from the ACT alone.

Strengths

This study also had several strengths. First, the CARE and CARE-2 Studies both collected data from a population at high-risk for asthma morbidity and mortality (i.e., low-income, racial and ethnic minority, urban). The study team was also able to conduct visits in multiple places, including within the homes of the families, at the research offices, or in community locations (e.g., community resource center). This allowed families to have more choice over the location of data collection and may have increased the number of scheduled and completed visits. Further, I was present on every CARE-2 Study visit that occurred and completed all caregiver interviews, which ensured consistency across data collection for the second portion of the dataset. Lastly, there were minimal missing data from the CARE-2 Study, which was beneficial for data analysis and interpretation.

Future Directions

Asthma disparities persist among low-income, racial and ethnic minority, urban families of children with asthma. Generally speaking, greater understanding of what contributes to these disparities is imperative in future research, including among larger samples of urban families. Future research would benefit from collaboration between entities, including hospitals, researchers, community-based organizations, and schools, given that asthma disparities are due to multiple, interrelated factors. Additionally, studies that incorporate ecological momentary assessment (EMA) methods to collect data in the moment (as opposed to retrospective data

collection) may provide more detailed information about daily experiences of stress encountered by families. Low-income, racial and ethnic minority, urban families can be particularly difficult to recruit, as participating in research may not be a priority for families. Although challenging, future research should target families in their natural environments (e.g., schools, public housing communities) to collect data that are more representative of families that are experiencing stress and difficulty in managing children's asthma.

Another future direction is the impact of individual stressors versus compounded stress to determine whether it is the type of stress or solely the amount of stress experienced by these families that subsequently impacts child asthma management. Stressful life events data collected in the present study provide support for the conceptualization that the number of stressors versus the type of stress may be particularly relevant. As previously mentioned, a cumulative risk approach has been examined among urban families that have a child with asthma. Koinis-Mitchell and colleagues (2007) created a Cumulative Risk Index (CRI) that included multiple risk factors (e.g., acculturative stress, asthma severity) across several levels (e.g., culture, asthma-specific risk). Results suggested that the CRI was significantly associated with ED visits. Relatedly, future research should consider other types of stressors that may contribute to child or caregiving stress and subsequently impact child asthma outcomes in urban families. In addition, social support has been shown to be a protective factor against poor child asthma outcomes (Conger et al., 1994; Elder Jr et al., 1995). As such, perhaps increasing caregiver access to social support may improve coping with exposure to urban stressors and simultaneously managing a child's asthma.

In the present study, child depressive symptoms significantly mediated, or explained, the association between neighborhood stress and asthma control. Future studies should build off this

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research by continuing to explore the validity and generalizability of this finding in larger samples through replication. In addition, in the recent study by Tobin and colleagues (2016), the measure of child depressive symptoms was the same one used in the present study, the Children's Depression Inventory (CDI). Future research should, therefore, explore alternate self-report measures of child depressive symptoms to determine whether child depressive symptoms continue to mediate the association between neighborhood stress and child asthma outcomes. It is unclear whether this finding is specific to the use of the CDI to measure child depressive symptoms. Further, the child model in the present study was based on research that supports a physiological link between emotional health and physical health among children with asthma (Chen & Miller, 2007). Future research should examine other physiological mechanisms or potential risk factors that impact the relation between emotional health (e.g., stress appraisals, depressive symptoms) and child asthma outcomes (e.g., ED visits, asthma control).

Generally, both child and caregiver depressive symptoms continue to be relevant variables to further understand in the context of appraisals and management of stress and child asthma. Although research to date provides strong support for the link between depression and health outcomes, future research should continue to examine the contribution of these variables in larger, urban, and more diverse studies. Similarly, interventions should be developed that are consistent with community input and evidence-based research about asthma in urban families. Specifically, based on the significant mediation model identified in the present study, interventions that target child depressive symptoms may impact the relation between neighborhood stress and child asthma outcomes, such as asthma control. Furthermore, data from the present study continue to provide strong support for the presence of psychology and other mental health professions in the management of childhood asthma given the interrelated nature

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of mental health and physical health outcomes. Ongoing clinical assessment of child and caregiver depressive symptoms is important in order to target families that may be at greater risk for adverse child asthma outcomes, particularly in low-income, racial and ethnic minority, urban families.

Another relevant issue is building a greater understanding of what caregivers consider "normal" for their child's asthma. For example, some caregivers may think daily coughing and wheezing is "normal," and therefore not indicative of poorly controlled asthma. For a few reasons, this is relevant in the present study. First, it may be that families are under-reporting asthma symptoms because caregivers do not identify certain symptoms as indicative of uncontrolled asthma. Second, it may impact caregivers' reports of their asthma self-efficacy. If caregivers feel efficacious in their ability to manage and prevent attacks, learning more about well-controlled asthma may change their views of their abilities to manage the child's asthma. Another option is that perhaps current research methods (e.g., self-report measures) are not accurately measuring child asthma morbidity. This provides support for more objective data collection to examine the impact of stress on child asthma outcomes in future research.

Further, much of the research available to date focuses on negative variables (e.g., neighborhood violence) that may contribute to greater asthma morbidity and mortality. One study showed that events with positive effects were protective against a single negative event, although not against chronic stress (Sandberg et al., 2002). This field could benefit from a strengths-based approach that considers positive factors that are protective to children with asthma and their families, particularly in urban areas. For instance, Koinis-Mitchell and colleagues (2007) identified factors protective against asthma morbidity, including individual-based factors (e.g., more positive attitudes toward school), illness-specific processes (e.g., child

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asthma self-efficacy), and family and cultural processes (e.g., family connectedness, strong ethnic identity). Future research should continue to build on studies like the one by Koinis-Mitchell and colleagues (2007) to create and implement culturally-tailored interventions that focus on family strengths by improving overall family functioning or asthma self-efficacy. It may be that the addition of positive resources and not the removal of negative stressors helps to ameliorate the effects of low-income, racial and ethnic minority, urban families that are faced with multiple stressors and also burdened with the task of managing a child's asthma.

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