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Association Between Substandard Housing and Asthma in African-American Children

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Abstract

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MPH, American Public University, 2012

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Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

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Abstract

An improved understanding of the role of housing in asthma prevalence among African-American children is essential to addressing the issues associated with asthma and housing that perpetuate racial and ethnic health disparities. This study was conducted to examine the influence of substandard housing on the odds of asthma among low-income African-American children. The social ecological model was used as the theoretical framework for this study, that allowed consideration of the housing environment where African-American children live as an influential determinant of respiratory health. A cross-sectional research design using data obtained from the 2012 National Health Interview Survey and Comprehensive Housing Affordability Strategy were used to examine the association between income level and asthma and substandard housing and asthma among African-American children. Odds ratios derived from logistic regressions were used to determine the significance of the association between family income level and asthma diagnosis among African-American children. Linear regression was used to assess the strength of the association between an affirmative asthma diagnosis and substandard housing among low-income African-American children. The findings derived from this study suggest that income level was the most significant predictor of asthma risk among African-American children between the ages of 5-14 regardless of the absence or presence of housing issues within the child's home environment. The conclusions of this study have the potential to enact social change by demonstrating the need for improved population health data and additional research into other variables, beyond the scope of housing, that contribute to asthma risk in African-American children.

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Dedication

I would like to thank my wonderful Committee Chair, Dr. JaMuir Robinson for your constant encouragement and support throughout the entire dissertation process. I would also like to extend a special thank you to Dr. Zin Htway for your patience and assistance with analyzing the data for my study. I am also grateful for the guidance of Dr. Simone Salandy, my Committee Member. I would also like to express my sincere gratitude to both my parents and my husband for their unwavering support and unconditional love throughout my dissertation journey. Lastly, I would like to honor my sweet daughter, Londyn. You are my motivation, inspiration, and my most wonderful blessing.

Above all others, I would like to thank God, for without Him, none of this would have been possible.

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Chapter 1: Introduction to the Study

Currently, data focused on asthma prevalence and housing regarding African-American children is limited. Previous studies that have explored the topic of housing as a social determinant of health that affects asthma have often grouped African-American children into a general category of racial and ethnic minorities, that has convoluted the asthma prevalence trends that apply to African-American children. In this study, I investigated whether the increased prevalence of asthma among African-American children was related to substandard housing conditions. The goal was to investigate the role of housing in the asthma prevalence outcomes of African-American children. In this chapter I will provide background information of the topic, explain the purpose of the study, give a brief outline of the methodology for the study, explain limitations that threaten aspects of the validity of the study, and describe the significance of the study to the discipline of public health.

Background

Childhood asthma remains a significant health burden on the U.S. economy. Global health estimates indicate that more than 10% of the children in the world are affected by asthma (Harju et al., 2015). In the United States, asthma remains the most prevalent childhood chronic disease (Gong et al., 2014). The highest prevalence and mortality rates of asthma within the United States have been found to be among African-American children (Pacheco et al., 2014; Sato et al., 2013; Thakur et al., 2014). Although asthma prevalence has remained an important public health issue, studies focused on the

causative factors of increased asthma prevalence among African-American children remain limited.

Research has shown that housing plays a significant role in health outcomes (Beck et al., 2012). Housing has been consistently noted to affect the respiratory health of individuals, especially the health of children. As a result, the housing condition that a child lives in has been recognized as a significant social determinant of health (Cutts et al., 2011; Thomas, 2014). Estimates based on current housing data indicate that nearly 2 million U.S. children live in substandard housing (Holupka & Newman, 2011). Previous research found that racial and ethnic minority children were at a considerable disadvantage for living in poor quality home environments when compared to their White counterparts (Sato et al., 2013). Further, individuals of lower socioeconomic status were more likely to live in substandard housing (Thakur et al., 2014). However, poor quality housing could not be understood by a sole examination of the variables associated with household income (Sun & Sundell, 2011).

Despite research suggesting that housing affected health outcomes for children, research had not provided an accurate profile of U.S. children (Holupka & Newman, 2011). Most of the data that are related to the topic of asthma in racial and ethnic minority children are based on data collected to generate conclusions for the entire U.S. population. However, population-based asthma outcome rates do not account for the variance of prevalence between different racial and ethnic groups (Akinbami et al., 2014). Not addressing the underlying differences between racial and ethnic groups limits information that is collected on what may affect the prevalence rates of asthma outcomes

(Akinbami et al., 2014). Meanwhile, disparities in asthma morbidity continue to be disproportionately noted in disadvantaged populations and communities (Beck et al., 2013).

The current scope of understanding regarding housing and asthma among children is based on population-based asthma outcome rates. Research findings derived by Sato et al. (2013) suggest that the asthma risk caused by home quality varies among racial and ethnic minority children. Therefore, the topic should be examined separately for each segment of the racial and ethnic minority population of children. Currently the risk factors that contribute to persistent asthma in low-income, minority children remain unclear (Tamesis et al., 2013). The aim of this study was to provide a unique perspective of the relationship between substandard housing and the prevalence of asthma among African-American children.

Problem Statement

The physical infrastructure of the home environment has been recognized as a critical aspect of both social equity and health (Jacobs, 2011). However, environmental health disparities caused by substandard housing conditions continue disproportionately to affect the health outcomes of racial and ethnic minorities (National Institutes of Health, 2014). The Centers for Disease Control and Prevention [CDC] (2012) have acknowledged the importance of the conditions of the home environment in that an individual resides as a critical determinant of health. Although substandard housing has been formally recognized as an important public health issue, housing related health disparities continue to persist in communities comprised of low-income, racial and ethnic

minorities (Jacobs et al., 2014). According to the CDC (2015), African-American children between the ages of 5-14 are the population segment that most frequently demonstrates poor respiratory health outcomes such as asthma. However, putting various ethnic and racial minority groups into one generalized category on national population health surveys has affected specified disease surveillance data for particular communities and individualized racial and ethnic minority population subgroups (Liao et al., 2011). As a result, the topic of housing disparities and poor respiratory health outcomes has typically been generalized to encompass the entire population segment of ethnic and racial minorities rather than focusing on a population subgroup such as African-American children (CDC, 2012). For instance, low-income African-American children who reside in federal subsidized housing are consistently identified to be the most at-risk for both substandard housing and asthma (Hayward et al., 2015). Further research on this significant public health topic will help broaden the understanding of the relationship between housing disparities and persistent racial and ethnic, environmental health disparities (Jacobs, 2011).

Study Purpose

The purpose of this study was to expand the scope of understanding regarding the role of substandard housing as an important environmental determinant of health among racial and ethnic minorities by examining the role of substandard housing in the prevalence rates of asthma among African-American children who reside in substandard housing. The intent of this study was to investigate whether increased odds of an affirmative asthma diagnosis among African-American children was related to residing in

home environments that are substandard. A quantitative research approach with secondary datasets was used to address this gap. The use of secondary data allowed the significance of the relationship between substandard home environments and asthma among African-American children to be determined statistically without the necessity to survey this vulnerable segment of the population.

Research Questions and Hypotheses

Research Question 1: Do African-American children who are low-income have higher odds of having asthma than African-American children who are not low-income?

$H_0$1: There is no difference in the odds of having asthma among African-American children who are low-income when compared to the odds of having asthma among African-American children who are not low-income.

$H_1$1: There is a statistical difference in the odds of having asthma among African-American children who are low-income when compared to the odds of having asthma among African-American children who are not low-income.

Research Question 2: Is there an association between asthma diagnosis and substandard housing among African-American children who are low-income?

$H_0$2: There is no association between substandard housing and asthma in African-American children who are low-income.

$H_1$2: There is an association between substandard housing and asthma diagnosis among African-American children who are low-income.

Theoretical Framework

The theoretical framework that was used for this study was the socioecological model (SEM). The SEM originated from an attempt to better understand the ecology of human development that extended beyond the laboratory environment (Bronfenbrenner, 1977). Bronfenbrenner (1977) suggested that the entire lifespan, settings, environment, social structures, institutional, and cultural patterns of individuals had to be considered when attempting to understand individuals. Golden and Earp (2012) further asserted that the SEM recognizes that individuals are a part of larger social systems that interact with one another to influence health outcomes.

The SEM proposed by Bronfenbrenner (1977) suggests that there are four levels that influence the health of individuals: the microsystem, mesosystem, exosystem, and macrosystem. The macrosystem is used to denote the individual (Bronfenbrenner, 1977; Henderson & Henderson, 2015). The mesosystem is the level that describes the community of the individual (Henderson & Henderson, 2015). The policies that govern the individual are considered to be the exosystem (Bronfenbrenner, 1977; Henderson & Henderson, 2015). The macrosystem includes the cultural patterns and sociocultural patterns that influence the health behaviors of individuals (Bronfenbrenner, 1977). The SEM suggests that the environment in that individuals live is a multilayered system comprised of social, physical, and cultural aspects that affect health (Golden & Earp, 2009). The reciprocal relationship between individuals and their environment influences health outcomes (Golden & Earp, 2009). The use of the SEM as the theoretical basis for this study is further explained in Chapter 2.

Nature of the Study

I used a quantitative research method for this study. The use of quantitative research methods allowed for the examination of the relationship between significant variables related to substandard housing and asthma within African-American children. The cross-sectional research approach was employed to address the research aims of the study. Using the cross-sectional research approach allowed for the determination of the odds of the health outcome of focus (asthma diagnosis) and the determinant of health (substandard housing) within the population of African-American children investigated over a short duration of time (see "Chapter 8: Case-control and Cross-sectional Studies," 2017). The cross-sectional survey research design also allowed for the determination of whether substandard housing and poor respiratory health outcomes among African-American children were related. To diminish the potential ethical concerns that could have arisen when collecting data from child participants, secondary data collected by the National Center for Health Statistics and the U.S. Department of Housing and Urban Development were used.

The independent variables for the first research question were socioeconomic status and child age. The dependent variable for this research question was asthma diagnosis. The aim of the first research question was to compare the odds of an affirmative asthma diagnosis among the overall population of African-American children to the odds of having asthma among African-American children who derived from low-income families. The comparison of the odds of an affirmative asthma diagnosis between the two segments of the African-American child population was statistically analyzed

using logistic regression. The odds ratios derived were used to demonstrate whether the family income level of African-American children affected their odds of having asthma.

The second research question was designed to investigate whether there was a significant association between asthma and substandard housing among low-income African-American children. The independent variables, indicative of substandard housing, that were used to examine this research question were housing type and housing condition. Child age and socioeconomic status also served as additional independent variables that were considered. The dependent variable for the second research question was also asthma diagnosis. Inability to align the data between the two datasets resulted in the need to perform an Analysis of covariance (ANCOVA) to assess the relationship between the two variables substandard housing and asthma prevalence. Data collected to assess the relationship between asthma and substandard housing among low-income African-American children were then analyzed using linear regression.

Definitions

The following terms will be used throughout the remaining sections of this dissertation:

Asthma prevalence: the existing condition of asthma that has been positively diagnosed by a physician (Colton et al., 2015).

Housing: The physical quality of the home and surrounding neighborhood influences that may affect health behavior (Holupka & Newman, 2011).

Housing environment: Accounts for the quality, stability, type, and cost of the home (Bowen et al., 2013; Coley et al., 2013).

Neighborhood setting: Comprised of the racial, residential, and socioeconomic climate of a neighborhood or community (Brenner et al., 2013).

Substandard housing: Housing that is unsanitary, contains moderate to severe housing defects, or can be considered a hazardous home environment (Hayward et al., 2015; Holupka & Newman, 2011).

Operational Definitions

The following operational definitions describe how each variable used in this study were measured. Each definition provided has been adapted from the variable definitions used in the National Health Interview Survey (NHIS) and U.S. Department of Housing and Urban Development linked dataset (National Center for Health Statistics, 2013, 2016).

Asthma diagnosis: The confirmation or denial of an affirmative diagnosis of asthma by a physician.

Child age: The categorical age (4-15 years) of the child at the time of data collection.

Housing condition: The number of housing defects identified by the adult participant at the time of data collection (may be less than one or greater than or equal to three defects).

Housing status: The status (renter or owner) of the adult occupant of the of the home environment in that the sample child resides.

Housing type: The categorical classification of the ownership type of the dwelling represented by the home in that the child participant lives (owner-occupied or renter-occupied).

Socioeconomic status: The percentage above or below the area median income based on the national average of the income for a family of four as defined by the U.S. Department of Housing and Urban Development.

Assumptions

In this study, I assumed that the secondary data sources used to conduct the proposed study were collected in a manner reflective of acceptable scientific rigor. Additionally, the assumption was made that the interviewers responsible for collecting the health data used for this study did not deviate in any way from the assigned survey protocol. I also assumed that there are no existing personal biases that may influence the way this study was conducted.

Scope and Delimitations

This study was focused on the trends associated with asthma prevalence in African-American children that are related to housing. Children of other races and ethnicities were excluded to allow for the examination of the topic of substandard housing and asthma prevalence among African-American children. As a result of the current health statistics that suggest that asthma prevalence is highest among children between the ages of 5-14, data contained within the NHIS dataset for children outside of this age group were excluded in both the examination of asthma and housing trends in the African-American children examined in the study.

I primarily concentrated on African-American children who derived from low-income families. The narrow focus of this study on African-American children between the ages of 5-14 who were determined to be below the 2012 national poverty threshold at the time of data collection limits the generalizability of the study findings. The conclusions drawn from this study may not apply to children of other racial and ethnic backgrounds. Additionally, rates of asthma prevalence may differ for children younger than 5 years old and older than 15. Lastly, the lack of availability of a linked dataset significantly limits the findings derived from the study. At the time that this study was conducted, there was no method to match the child health data of the participants to their actual home environment.

Limitations

There are several limitations that may compromise the validity of the findings of this study. The secondary datasets used to conduct this study may not be representative or inclusive of the actual cases of each condition or variable examined (Beck et al., 2012). The use of secondary data also did not allow for follow-up data to be obtained from participants that may, in some cases, alter a particular response given. Additionally, according to Thakur et al. (2014), many secondary datasets used in health disparity research fail to account for the occurrence of nonresponses when collecting data pertaining to individual and household income. The NHIS dataset acknowledges the occurrence of nonresponse as an overall limitation of the dataset (National Center for Health Statistics, 2016). However, detailed explanations for the lack of response by participants were only provided for the NHIS. Interviewers who conducted the NHIS

noted that failure to locate a translator, broken appointments, participant absence, failure to reach a participant via telephone, participant refusal, and privacy concerns were the most frequent causes of nonresponse (CDC, 2016b).

An additional limitation of this study involved the use of the cross-sectional research method. The cross-sectional research method did not allow for the direction of causality between the variables of substandard housing and asthma prevalence to be determined (Vangeepuram et al., 2012). The selected research method also did not account for the time and economic climate in that the data were collected, that may influence or alter the responses given by participants (Coley et al., 2013). Using the cross-sectional research design may have also introduced data that reflect a misrepresentation of current health data due to the relocation of residents since the original time of data collection (Firebaugh & Farrell, 2015). According to Firebaugh and Farrell (2015), the cross-sectional research design may also result in the inclusion of obsolete data that may have changed since the initial collection of data at a specific point in time.

The NHIS and Comprehensive Housing Affordability Strategy (CHAS) datasets used to collect the necessary data for this study are based on the self-reported health status of survey participants, posing an additional limitation to this study. The broad nature of self-reported health data may result in the misclassification and underestimation of causal associations between study variables (Adamkiewicz et al., 2014). The use of self-reported health data also does not allow for the cross-tabulation of self-reported health data with confirmed medical data (Jacobs et al., 2014). Therefore, survey

responses could not be validated for accuracy (Ownby et al., 2015; Turyk et al., 2013). Finally, self-reported health data are relatively subjective in nature and may be altered by the introduction of recall bias on the behalf of the participant (Jacobs et al., 2014).

Significance

Previously conducted studies have focused on the issue of substandard housing and the health outcomes of all racial and ethnic minority children who are either low-income or reside in inner city communities (CDC, 2012; Jacobs, 2011). Other researchers have only examined the topic of asthma and housing to understand its effects on child development. Studies have yet to narrow the topic of focus to African-American children—the population segment whose respiratory health is most frequently affected by substandard housing conditions. This study addresses this gap with a focus only on the issue of substandard housing and asthma among African-American children.

This study is unique because it addresses a significant contributor to persistent health disparities among racial and ethnic minorities (see Jacobs, 2011). Understanding the type of housing in that U.S. children live in is critical to the development of policies that appropriately target important housing issues such as substandard housing (Holupka & Newman, 2011). The results of this study have implications to expand the scope of understanding and the knowledge base regarding the role of adequate housing in the prevention of asthma among African-American children. This research study will provide a basis that can be used to promote social change in the current policies and standards that outline the accepted requirements for adequate housing environments.

Healthy housing has long been recognized as a critical factor to decrease asthma disparities (Woods et al., 2016). Optimal child health begins with healthy homes (Schmeer & Yoon, 2016). Therefore, additional studies such as this one are necessary to better understand the effect of the home environment on the prevalence of childhood illnesses (Sato et al., 2013). Realizing that social change takes time and continued effort, it is my intent that this research will expand the knowledge base needed to enact social change regarding the topic of substandard housing and childhood asthma.

Summary

Housing has been long recognized as an influencer of health. However, data on the topic of housing regarding child health remains limited. In this study the constructs of the SEM were applied to examine the role of substandard housing in the resulting asthma diagnosis among African-American children. In the next chapter the origins and foundational precepts of the SEM will be outlined. A comprehensive review of the literature regarding the general topics of asthma disparities, indoor environmental toxins, and substandard housing will also be provided in Chapter 2. []

Chapter 2: Literature Review

Introduction

The topic of asthma and children has been widely studied; however, few studies have focused on the physical condition of the home environment and the occurrence of asthma in children. Many of the studies conducted have focused on the role of housing regarding child development rather than the physical aspects of the home environment that contribute to the development of chronic diseases, such as asthma, in children (Holupka & Newman, 2011). Although increased prevalence rates of asthma have been found among African-American children, the grouping of racial and ethnic minority children into one general category has made identifying specific health trends like increased asthma prevalence rates of asthma difficult to determine. Additionally, studies have not addressed the specific environmental threats within the home that individually contribute to asthma in African-American children. Thus, the purpose of this study was to examine the relationship between asthma among African-American children and substandard home environments.

The literature review provides a comprehensive view of current literature regarding disparities in asthma that affect African-American children such as race and ethnicity and socioeconomic status, the indoor environmental toxins that pose the greatest threat to asthmatic children, and the aspects of substandard housing that are the most relevant to examining asthma among African-American children. The following literature review was conducted using the key search terms *asthma*, *African-American children*, *housing disparities*, *racial and ethnic disparities*, and *substandard housing*. Google

Scholar, PubMed, SocIndex, Medline, CINAHL, and ProQuest were the databases used to compile the literature review presented. To reflect the most current literature available regarding the topic of focus, the literature review conducted was restricted to articles published between 2011 and 2016.

Theoretical Foundation

The SEM was used as the theoretical framework to guide this study. The SEM originated from a desire to explore the ecology of human development beyond the constraints imposed by the laboratory setting (Bronfenbrenner, 1977). The ecological model first suggested by Bronfenbrenner (1977) considered the entire lifespan of individuals, considered the settings of individuals, recognized that the primary settings of individuals were interrelated, acknowledged the influence of formal and informal social structures, and examined the institutional patterns of individuals' cultures and subcultures. The model also recognizes the influential force that the environment exerts on the health behaviors of individuals (Bronfenbrenner, 1977). According to McLeroy, Bibeau, Steckler, and Glanz (1988), the SEM shifted the focus of ecologically-based theoretical frameworks from the lifestyle and behavior of individuals to the environmental modifications necessary to promote health among individuals.

Acknowledgment of the reciprocity of the interaction between individuals and their environment by the SEM suggests that the constant interaction between the two is the causative factor that yields either favorable or unfavorable health outcomes (Golden & Earp, 2012). Although the constructs of the model have been communicated in various ways, the original language used by Bronfenbrenner (1977) will be used for this study.

The SEM is a systems theory that upholds that individuals are embedded within larger social systems, and it is the interdependent and bidirectional interactions of socio-ecological systems that influence health (Golden & Earp, 2012; Henderson & Henderson, 2015).

The four levels of systems that comprise the SEM are the microsystem, the mesosystem, the exosystem, and the macrosystem (Bronfenbrenner, 1977). The microsystem would be represented by the individual or the setting of the individual (Bronfenbrenner, 1977; Henderson & Henderson, 2015). The mesosystem would be the community in that an individual resides (Henderson & Henderson, 2015). The exosystem would entail the policies that govern the individual or the major setting of the individual (Bronfenbrenner, 1977; Henderson & Henderson, 2015). Lastly, the macrosystem would be cultural patterns that formulate the institutional patterns exhibited by the individual (Bronfenbrenner, 1977). The SEM was applied in this study as follows:

- Microsystem: The type of home environment in that the child lives.
- Mesosystem: The community type (rural or urban).
- Exosystem: The neighborhood setting.
- Macrosystem: Sociocultural patterns that affect asthma prevalence.

Studies aimed to address social justice issues that affect health have heavily used the SEM (Henderson & Henderson, 2015). Ecological models have also been used in studies that identify environmental sources of disease (McLeroy et al., 1988). For example, Champaloux and Young (2015) used a socioecological approach to evaluate the influence of chronic health conditions like asthma on the level of education attained by

youth. They were able to assess the role of community-level variables on individual-level variables and concluded that chronic health conditions affected educational attainment (Champaloux & Young, 2015). Schmeer and Yoon (2016) further demonstrated the functionality of the SEM when investigating the role of the home environment and inflammation in children. They used the constructs of the SEM to examine the influence exerted by the repeated daily interactions between children and their home environments on the overall well-being of the children studied. Schmeer and Yoon also used the SEM to assess the physical characteristics of the children's homes regarding health risks.

Disparities in Asthma

Race/Ethnicity

The race and ethnicity of children independently contribute to disparities in asthma prevalence. Using data obtained from the 2007 National Survey of Children's Health, Kitsantas, Kornides, Cantiello, and Wu (2013) identified several risk factors that influence children's propensity for developing certain chronic diseases, and one factor was the racial and ethnic background of the child. When comparing the role of neighborhood setting and race and ethnicity as risk factors for asthma, race and ethnicity have also been found to be a more significant risk factor in the development of asthma in children than the actual neighborhood in that the child lived (Keet et al., 2014). Further, the variations in the prevalence of childhood health conditions have been found to be statistically significant across racial and ethnic minority groups (Mehta, Lee, & Ylitalo, 2013). Research has also acknowledged a child's ethnic and racial background as a significant predictor of asthma risk (Mitchell et al., 2016). For example, Colton et al.

(2015) determined that racial and ethnic minorities who reside in impoverished living conditions are 2 to 4 times more likely to develop asthma because of their persistent exposure to indoor environmental toxins.

Consistent with the literature on risk factors for asthma, researchers have found the prevalence rates of chronic health conditions, including asthma, to be higher in African-American children (Kitsantas et al., 2013; Oraka, Iqbal, Flanders, Brinker, & Garbe, 2013; Sun & Sundell, 2011). Data collected between 2001 and 2010 from the National Center for Health Statistics and the NHIS indicated that the prevalence rates of asthma have persistently continued to increase among African-American children (Akinbami, Moorman, Simon, & Schoendorf, 2014). Additionally, in a cross-sectional study of a nationally representative sample of U.S. children, African-American children were found to be more likely to report having asthma when compared to their White counterparts (Oraka et al., 2013). An additional study that included 400 children with asthma showed that 59% of the child participants self-identified as African-American (Teach et al., 2015). Mehta et al. (2013) also noted that African-American children consistently demonstrated increased asthma prevalence when compared to White children. Thus, being African-American has been determined to be a significant risk factor for an increased risk of asthma (Ownby et al., 2015).

Although the severity of asthma is often difficult to quantify, the rates of asthma-related hospitalizations and mortality rates have yielded significant insight into the asthma disparities that affect African-American children. Having a minority racial or ethnic background has been determined to increase the odds that a child would visit the

emergency department to be treated for a preventable asthma condition (Nath & Hsia, 2014). Woods et al. (2016) also noted the increased frequency at that African-American children are hospitalized with asthma complications. Data obtained from 117 African-American children from a pulmonary clinic registry indicated that African-American children are twice as likely to be hospitalized for asthma (Mitchell, Bilderback, & Okelo, 2016). An additional study with NHIS survey results from 1998-2009 indicated that African-American children are twice as likely as their White counterparts to have visited the emergency room and to have had an asthma attack within the 12-month period before the time that the study was conducted (Mehta et al., 2013). Population-based rates for asthma outcomes further indicated that African-American children are 7.1 times more likely to die from asthma when compared to their White counterparts (Akinbami et al., 2014). Though some research has suggested that asthma hospitalization and mortality rates have decreased among African-American children, racial and ethnic asthma disparities have remained and, in many cases, worsened (Akinbami et al., 2014; Oraka et al., 2013). The increased rates of prevalence, hospitalizations, and asthma-related emergency visits among African-American children, when compared to their White counterparts, indicates that asthma disparities have not only persisted but increased over time (Mehta et al., 2013).

Neighborhood Setting and African-American Children

The role of the environmental context of a neighborhood has been noted as a risk for asthma in children. Keet et al. (2014) used census data to assess the prevalence of asthma among children residing in inner-city environments versus those living in non-

inner-city settings and found that neighborhood setting played a minimal role in the risks that a child would develop asthma. However, neighborhood setting has been significantly associated with increased asthma admission rates among children (Beck et al., 2013). Cultural aspects, population density, and transportation types have been identified as factors that determine the health outcomes associated with neighborhood settings (Beck et al., 2013; Kitsantas et al., 2013).

The term *neighborhood* has been used to describe varying contexts of the aspects of community settings that influence the asthma risk of children. In some cases, the neighborhood setting has sometimes been used to denote only the residential environment in that an asthmatic child resides (Brenner, Zimmerman, Bauermeister, & Caldwell, 2013). However, some consider the complete setting in that a child spends their time, including home, school, and selected place of worship as the neighborhood that influences asthma outcomes among children (Sharp, Denney, & Kimbro, 2015). Independent of how the neighborhood of a child is defined, there is agreement that the level of disadvantage within an asthmatic child's neighborhood has a direct influence on the severity of asthma experienced by the child (Brenner et al., 2013; O'Campo et al., 2015; Sharp et al., 2015). O'Campo et al. (2015) categorized neighborhood disadvantage according to the percentage of low-income households, the unemployment rate, the percentage of single-parent households, the percentage of high school dropouts, and the average household income contained within a neighborhood. O'Campo et al. found that the level of neighborhood disadvantage, rather than the actual neighborhood context, was the aspect that determined health outcomes. Brenner at al. (2013) also suggested that

neighborhood disadvantage exerted an individual-level of influence on the health outcomes experienced by children. Findings from a stratified random sample of participants from the Los Angeles Family and Neighborhood Survey further indicated that in highly disadvantaged neighborhoods, the neighborhood context exerted minimal influence on health and the residential disadvantage has the most significant effect on the health of children (Sharp et al., 2015).

Socioeconomic Status

Children of low socioeconomic status are disproportionately affected by asthma. The onset of asthma has been found to be significantly earlier in children of families of lower socioeconomic status (Tamesis et al., 2013). Tamesis et al. (2013) found that causative factors associated with low socioeconomic status such as low birth weight, symptom severity, and maternal psychological well-being may all be predictive factors for asthma in children. Similarities between asthma morbidity rates have also been found in children who reside in urban and rural settings with similar family socioeconomic statuses (Valet et al., 2011). Further, Keet et al. (2014) identified being low-income as an independent risk factor for the development of asthma regardless of whether the child resided in an inner-city environment.

Socioeconomic status has been found to influence both the outcomes and consequences of asthma (Chen, 2014). Lower income status has been associated with worsened asthma symptoms in children (Teach et al., 2015; Thakur et al., 2014). In a case-control study of African-American youth, Thakur et al. (2014) found that 40.1% of the youth had poorly controlled asthma and derived from families of low socioeconomic

status. Children from low-income families have also been found to have higher rates of asthma-related emergency department visits (Nath & Hsia, 2014). The results obtained from a longitudinal study of a nationally representative sample of 9,000 children suggested that that asthma diagnosis was more prominent in African-American children from single-mother households who experienced economic hardship (Chen, 2014). Although some linked the increased prevalence rates of asthma among racial and ethnic minorities to diminished socioeconomic status, the variance in prevalence rates of asthma among racial and ethnic minorities and their White counterparts cannot be fully explained by socioeconomic status (Beck, Huang, Chundur, & Kahn, 2016; Sun & Sundell, 2011).

The findings regarding the association between socioeconomic status and asthma have consistently had inconsistencies and discrepancies. A Swedish population-based cohort study indicated that socioeconomic status could not be used as a sole predictor of asthma outcomes among children (Gong et al., 2014). Thakur et al. (2014) also recommended that the socioeconomic index to predict asthma outcomes was more accurate than the usage of the individual indicators of socioeconomic status alone. In several cases, statistically significant associations between individual socioeconomic indicators and asthma outcomes in children have been unachieved (Gong et al., 2014; Harju et al., 2015). The use of a socioeconomic index rather than individual socioeconomic indicators indicated that the farther down an African-American child falls on the socioeconomic gradient, the greater the odds are that the child will exhibit more severe asthma symptoms (Thakur et al., 2014). Regardless of inconsistent findings,

socioeconomic status continues to be an influential factor in the assessment of asthma outcomes (Chen, 2014).

Indoor Environmental Toxins

The findings of previous research studies have provided a basis for the notion that indoor environmental toxins may contribute to asthma-related complications in children. The presence of mold and pests have been identified as significant environmental toxins regarding asthma in children (Colton et al., 2015). Bivariate analysis of the results of a survey administered to 478 children who had been hospitalized for asthma found that 30% were found to be sensitized to cockroaches, and 50% demonstrated sensitivity to mold (Beck et al., 2015). A longitudinal study of 908 children with asthma indicated that 51% of the children's homes had dust, 17% reported the presence of mold, and 12% acknowledged the presence of cockroaches in their homes (Woods et al., 2016). Woods et al. (2016) further concluded that dust, mold, and cockroaches served as the most significant risk factors that worsen the asthmatic condition in children.

The presence of indoor environmental toxins has been noted to exacerbate asthma-related complications. In a study of 235 Dominican Republic residents, 39.2% of the cases of asthma diagnosed by a physician were attributed to residential risk factors (Colton et al., 2015). The presence of indoor environmental toxins within the home environment has been noted as the most significant risk factor that contributes to asthma in children, independent of race, ethnicity, or socioeconomic status (Colton et al., 2015; Sun & Sundell, 2011; Woods et al., 2014). Children hospitalized for asthma were found to have 1.84 greater odds of revisiting the ER or being re-hospitalized within a 12-month

period if they resided in homes with unfavorable living conditions (Beck et al., 2016). A study of parental knowledge of asthma triggers found within the home environment indicated that African-American parents are frequently unaware and have not received physician guidance regarding indoor environmental toxins that may serve as asthma triggers (Biskey et al., 2011).

Substandard Housing

Health Risks Associated with Substandard Housing

Independent of physical location, substandard home environments expose residents to specific health hazards. Gielen et al. (2012) conducted a study to determine the quality of substandard housing units utilizing 46 of the standards set forth by the U.S. Department of Housing and Urban Development housing quality standards. In-home observation allowed the researchers to determine that 99% of the homes assessed failed to meet acceptable housing quality measures (Gielen et al., 2012). Visual inspections of substandard homes consistently indicated the presence of multiple health hazards (Adamkiewicz et al., 2014; Beck et al., 2012; Coley et al., 2013; Gielen et al., 2012). The results obtained from 20 randomly selected housing developments in Boston, Massachusetts, that sought to assess the conditions of homes in regard to mold, combustion byproducts, second-hand smoke, chemicals, pests, and inadequate ventilation confirmed the presence of multiple health hazards in substandard homes. The results indicated that less than 1% of the substandard homes assessed were free from health risks, 46% contained four or more risks, and 2% of the households studied included the six hazards considered (Adamkiewicz et al., 2014). A study of 387 asthmatic children

indicated that 38.2% of the children lived in homes with inadequate housing conditions, 43.1% lived in homes with mold, 27% had homes with roaches, and 80% of the child participants' homes had dust that could be visually observed (Turyk et al., 2013). The presence of housing unit deficiencies that create health hazards has been noted to diminish significantly the health outcomes that result from resident exposure to substandard home environments (Schwartz & Meltzer, 2016).

Indoor allergens were more commonly found in public housing developments that were comprised of substandard living conditions (Hayward et al., 2015). Pests infestation was the most frequently noted health risk identified in substandard homes (Adamkiewicz et al., 2014; Beck et al., 2012). Structural issues commonly found within substandard homes, such as damaged ceilings, walls, and floors were attributed as the causal pathways for both pests and mold (Adamkiewicz et al., 2014; Gielen et al., 2012). The compromised building structure of substandard homes exacerbates the problems associated with common indoor allergens found within these home environments.

Issues Addressing the Health Impacts of Substandard Housing

Many of the studies conducted regarding substandard housing have relied upon self-reported health data as the primary mode of data collection. Nebbitt et al. (2014) relied on the self-reported health data of 782 adolescents to assess the perceptions of African-American youths living in public housing. Although the data obtained provided insight into the perceptions of the adolescents, the researchers noted the use of self-reported health data as a considerable limitation of their study (Nebbitt et al., 2014). Most studies regarding the topic of substandard housing utilized self-reported health data

obtained from parents or caregivers to draw conclusions relating to the issue of substandard housing in relation to children (Adamkiewicz et al., 2014; Bailie, Stevens, & McDonald, 2011; Jacobs et al., 2014; Novoa et al., 2015). Adamkiewicz et al. (2014) suggested that the broad nature of self-reported health data may lead to the underestimation of causal associations between significant variables associated with substandard housing. Self-reported health data was found to introduce the possibility of recall bias into studies that relied upon baseline and follow-up self-reported data (Bailie et al., 2011; Jacobs et al., 2014). Self-reported health data may provide insight regarding the health outcomes of the substandard housing population; however, an alternative data source should be utilized concurrently to strengthen the credibility of study findings.

At-Risk Populations

Children. Children are at greatest risk of living in substandard housing. Children comprise more than half of the substandard housing population (Nebbitt, Williams, Lombe, McCoy, & Stephens, 2014; Novoa et al., 2015). A four-city study conducted by Nebbitt et al. (2014) indicated that 75% of the residents of a public housing development in New York City were determined to be under the age of 18. The large population of children that live in substandard housing is concerning considering that children spend a majority of their time in the home (Coley, Leventhal, Lynch, & Kull, 2013; Schmeer & Yoon, 2016). Children from within single-parent households were found to be the most disadvantaged when examining housing (Holupka & Newman, 2011). The lives of low-income children were determined to be disproportionately affected by substandard

housing conditions (Schmeer & Yoon, 2016). For many children, substandard home environments represent an unavoidable, persistent health hazard.

The health effects of substandard housing are substantial in children and consistently contribute to child-related health disparities. Data obtained from the electronic medical records of 45 children who lived in substandard housing units indicated that childhood health disparities are worsened by poor quality housing (Beck et al., 2012). Hierarchal linear models further demonstrated that housing quality also played a pivotal role in the development of children (Jacobs et al., 2014). Because of the various ways in that the poor-quality living conditions found within substandard home environments affect the health outcomes of children, Jacobs et al. (2014) suggested that poor quality housing could be the strongest predictor of children's overall well-being. Housing has been found to exert both direct and indirect effects on child well-being (Holupka & Newman, 2011). Independent of physical condition, impoverished living conditions have consistently been associated with increased asthma risk among children (Ownby et al., 2015).

African-Americans. Inequality in housing has historically and presently placed African-Americans at an increased likelihood of residing in homes that are beneath the acceptable living standard. Utilization of the Gini Index, that is used to assess inequality, indicated that housing inequality between African-Americans and Whites has decreased by 40% since 1980 (Firebaugh & Farrell, 2015). However, U.S. Census data from 2010 indicated that African-Americans still have a higher propensity to reside in impoverished communities that contain substandard home conditions (Firebaugh & Farrell, 2015;

Nebbitt et al., 2014). In a study of 246 caregivers of young children who resided in substandard homes, 98% of the participants were found to be African-American women (Gielen et al., 2014). These findings are consistent with other studies that have also concluded that African-American women comprise the largest population segment of substandard housing residents (Gielen et al., 2012; Hayward et al., 2015; Jacobs et al., 2014).

A study that included 131 urban, low-income children between the ages of 6-13 with asthma found that the African-American children lived in home environments with significant defects, such as compromised building structure and the presences of rodents and pests when compared to the White and Latino counterparts (Sato et al., 2013). Sato et al. (2013) further noted that significant disparities exist in the physical quality of the African-American child's home environment, placing African-American children at a considerable disadvantage regarding the quality of their home environment. The increase in asthma disparities among African-Americans, when compared to their White counterparts, has been attributed to the differences in risks associated with substandard housing (Mehta et al., 2013). Revised housing standards have been implemented to decrease housing inequality and create safer home environments; however, the issue of substandard housing continues to affect the lives of African-Americans disproportionately.

Resident Perceptions

The perceptions of substandard housing residents have been an important focus of previous studies. A nationally representative sample of substandard housing residents

indicated that 51% of the residents perceived housing as a primary concern (Bowen et al., 2013). Data obtained from the American Housing Survey indicated that residents of substandard housing perceived the neighborhood setting in that their home existed to be an extension of their housing (Holupka & Newman, 2011). Substandard housing residents believed that they had no alternative housing options and had no choice but to live in the poorly conditioned homes that they had been assigned (Firebaugh & Farrell, 2015; Sato et al., 2013).

A focus group study comprised of African-American women from low-income housing developments indicated that residents perceived their substandard home environment to be unhealthy, detrimental to their wellbeing, and lacking opportunities for them to lead a healthy lifestyle (Hayward et al., 2015). Similarly, data collected from the 2009-2010 Flyer Information Survey Project indicated that residents of substandard housing developments believed that their housing segregated them and posed a significant barrier to achieving optimal health (Bowen et al., 2013). Substandard housing residents perceived their negative adverse health outcomes to be a result of the unsanitary and hazardous housing conditions in that they lived (Hayward et al., 2015). Low-income public housing residents in Baltimore, Maryland indicated that their well-being would only improve once the environmental conditions of their homes improved (Hayward et al., 2015).

Summary

The factors that contribute to increased asthma prevalence rates among African-American children are complex and multifaceted. However, current literature repeatedly

demonstrates that asthma prevalence is higher among African-American children. Although childhood asthma morbidity and mortality outcomes have improved overall; the disparity of asthma among African-American children and their White counterparts has continued to worsen. Research that has focused on neighborhood setting as a risk factor for asthma in children has found that the aspect of the neighborhood that is of concern in addressing asthma disparities is not the actual neighborhood itself, but the level of disadvantage present within the neighborhood that a child resides. In addition to neighborhood disadvantage, lower socioeconomic status has been found to increase asthma severity in children.

Substandard housing has been used to describe home environments that contain either severe building defects, or the presence of indoor environmental toxins that threaten the health of individuals. Children and African-Americans experience an increased susceptibility for living in substandard home environments. Substandard housing has been found to contain indoor environmental toxins that exacerbate the symptoms of asthma in children. The utilization of surveys that have relied upon self-reported health data have posed a significant challenge to accurately assessing the role of substandard housing in the worsening of asthma among children. Many substandard home environments contain multiple health risks. However, mold, dust, and cockroaches are consistently identified as the most important indoor environmental toxins found within substandard home environments that pose the most prominent health risks to asthmatic children.

Current literature demonstrated that African-American children were most frequently the population segment that consistently experienced unfavorable asthma outcomes. However, research efforts that have specifically examined the relationship between specific environmental factors that have contributed to the increased risk of asthma among this vulnerable segment of the population has remained absent. Although the relationship between substandard housing conditions and asthma has been extensively studied, the possibility of the significance of the role of substandard housing in asthma among African-American children had yet to be explored. Therefore, this study aimed to examine the relationship between substandard housing and the prevalence of asthma among African-American children. Further study of the topic was intended to extend the knowledge available regarding the role of unfavorable housing conditions in the perpetuation of asthma disparities. Improved understanding of the role of housing in the continuation of health disparities that affect African-American children will provide greater insight and understanding of the specific areas of focus that must be addressed in public health interventions aimed to improve the overall health of this vulnerable segment of the population.

Chapter 3: Research Method

Introduction

African-American children of low-income families consistently exhibit an increased prevalence of asthma. Although housing has been a risk factor for asthma in children, the topic has been studied from the perspective of child development rather than regarding the respiratory health outcomes that result from inadequate housing. Exploration of the possible relationship between substandard home environments and increased asthma rates among African-American children presents an opportunity to address this health disparity from an alternative perspective. In this chapter, the research design, sample population, datasets, plan for data analysis, and ethical considerations of the study will be explained. The central purpose of this study was to examine the relationship between substandard housing and increased asthma prevalence among African-American children.

Research Design and Rationale

The aim of this study was to investigate whether an association existed between substandard housing and the occurrence of asthma in African-American children. The topic was examined using a cross-sectional research design relying on secondary datasets. Most of previously conducted research studies regarding housing and the health outcomes of children have relied on qualitative, nonexperimental research methods, that compromises the statistical rigor and provides limited generalizability of the findings (Coley et al., 2013). As a result, in this study I used a nonexperimental, quantitative research design to ensure statistical accuracy. A quantitative research design was used to

produce data that could be analyzed to identify the statistical significance of any relationship that may exist between substandard housing and asthma prevalence in the included sample of African-American children, that offered generalizations that could be applied to the overall population of African-American children.

I chose a cross-sectional research design because I did not need to determine directional causality, as I was seeking only to determine the significance of the association between substandard housing and asthma in African-American children. The cross-sectional research design allowed for the use of secondary data sources, that contained nationally representative data, while also ensuring that the identities of the child participants were protected. Secondary datasets are widely used in public health research studies. The use of secondary datasets has been useful in cases where the research effort aims to investigate issues that affect vulnerable segments of the population, or in cases where members of the target population may be difficult to reach for primary data collection (Hayward et al., 2015; Novoa et al., 2015). The use of secondary datasets also diminished the likelihood that the study would be challenged or negatively impacted by either time or budgetary constraints. I used the data obtained through both the NHIS and the CHAS. NHIS and CHAS data collected in 2012 was the most recent data available that could be correlated and used to assess the health and housing statuses of African-American children simultaneously.

Research Questions and Hypotheses

Research Question 1: Do African-American children who are low-income have higher odds of having asthma than African-American children who are not low-income?

$H_0$1: There is no difference in the odds of having asthma among African-American children who are low-income when compared to the odds of having asthma among African-American children who are not low-income.

$H_1$1: There is a statistical difference in the odds of having asthma among African-American children who are low-income when compared to the odds of having asthma among African-American children who are not low-income.

Research Question 2: Is there an association between asthma diagnosis and substandard housing among African-American children who are low-income?

$H_0$2: There is no association between substandard housing and asthma in African-American children who are low-income.

$H_1$2: There is an association between substandard housing and asthma diagnosis among African-American children who are low-income.

Methodology

Target Population

The target population of the study conducted was African-American children between the ages of 5-14. Although an actual calculation of the size of the U.S. population who are both African-American and children could not be derived, estimates formulated from the most current Census data, at the time of study, indicated that 13.3% of the 321 million members of the U.S. population self-identified as African-American. Of this 13.3%, nearly one-fourth of the African-American population were under the age of 18 (U.S. Census, n.d.). National asthma data further indicated that African-American

children between the ages of 5-14 were the population segment who exhibited the highest frequency and severity of childhood asthma (CDC, 2015a).

Sampling Procedure

The sample of African-American children was derived from all the available cases contained within the 2012 NHIS dataset that satisfied the inclusion criteria outlined by the parameters of the study. The sampling units used to select the research participants were African-American children between 5-14 years old. Children of other races and ethnicities were excluded to allow for a specific focus on African-American children. Children younger than 5 years old were also excluded from the study sample. The aspects of focus when examining the sample population selected for participation in the study were asthma diagnosis and home environment.

The datasets chosen to investigate the aims of the study were the NHIS and the CHAS, that included data collected through the American Community Survey. Use of these datasets allowed for the examination of asthma prevalence and the housing conditions of the homes that house African-American children between the targeted ages of 5-14. The NHIS dataset allowed for the collection of demographic data, such as race and ethnicity, family income, parental educational level, and health status for the child participants. CHAS data collected by the U.S. Department of Housing and Urban Development provided data regarding housing type, housing location, housing condition, and family income level. Data contained within both datasets were matched to align participants in both datasets.

National Health Interview Survey. The NHIS is administered to civilian, noninstitutionalized members of the U.S. population (Oraka et al., 2013). Data for the NHIS are obtained through a cross-sectional survey, that collects data through personal household interviews of one adult and one child. The NHIS aims to collect data about health status, health care access, and health progress (National Center for Health Statistics, 2015). Multistage, probability sampling is used in the data collection procedure of the NHIS, that allows for the oversampling of specific groups of racial and ethnic minorities including African-Americans (Oraka et al., 2013). The NHIS monitors trends of illness and provides categorical health data based upon socioeconomic status and demographic characteristics (National Center for Health Statistics, 2015).

Comprehensive Housing Affordability Strategy and American Community Survey. Data for the CHAS are derived from data collected through the American Community Survey (Office of Policy and Development, U.S. Department of Housing, n.d.). The American Community Survey is an ongoing survey that is administered annually and aims to collect demographic, housing, economic, and social data (U.S. Census Bureau, n.d.). The CHAS provides specific data regarding the housing problems and housing needs of low-income families. The most recent data reflected by the CHAS dataset were collected from 2009-2013. The data included within this dataset provided relevant information that can be used to assess the various housing environments of African-American children.

Sample Size Calculation

G*Power 3.1.9.2 software was used to calculate the required sample size for each of the research questions to be investigated in this study. The first research question sought to examine whether the odds of having asthma differs for African-American children who are low-income when compared to the odds of having asthma among African-American children whose families are not low-income. Asthma diagnosis, socioeconomic status and child age were used as the variables to formulate the comparison of asthma prevalence among African-American children who are low-income versus those that are not. The second research question aimed to determine the significance between substandard housing and asthma diagnosis among low-income African-American children. In addition to asthma diagnosis and housing condition, the following variables were included: housing type, socioeconomic status, and child age.

Logistic regression was performed to examine the first research question of focus in this study. The logistic regression employed an alpha level .05, and a power level of 80%. A medium effect size of .50 was used as the outcome of interest (asthma diagnosis) was expected to be a frequent occurrence within this population (Emory University, n.d.). Data collected through the 2014 NHIS indicated that the prevalence of asthma among African-American children between the ages of 5-14 was 14.5% (CDC, 2016a). The inclusion of these parameters in the sample size calculation yielded a required sample size of 568 participants. However, data for all the participants that satisfy the inclusion parameters of this study was used to examine each research question.

ANCOVA was used to examine the secondary research question. A linear regression was also used to compute z-scores corresponding to the frequency of asthma diagnosis among the African- American children, between the ages of 5-14, categorized according to the Census region in that the child resides. These z-scores were then cross-tabulated with the housing data within the CHAS. The significance of an affirmative asthma diagnosis within each housing type, according to their condition (absence/presence of housing issues) was then utilized to assess the significance between substandard housing and asthma diagnosis.

Data Analysis

The first research question of the study compared the odds of asthma within the low-income population of African-American children versus those who are not low-income. The independent variables for the first research question were socioeconomic status and child age. The dependent variable for this research question was asthma diagnosis that was measured according to the confirmation or denial of an asthma diagnosis. Logistic regression statistical tests were used to calculate the odds ratios of asthma diagnosis between the two groups of African-American children.

The second research question aimed to investigate if substandard housing is related asthma diagnosis among African-American children who derive from low-income families. The independent variables used to examine this research question were child age, socioeconomic status, housing condition, and housing type. Asthma diagnosis once again served as the dependent variable for the second research question. A detailed description of the measure of each variable is further outlined in Table 1.

Table 1

Variables Used in Analysis

Variable	Type	Definition
Child Age (I)	Categorical	4-15 years
Housing Condition (I)	Dichotomous	<= 1 housing defects or >3 housing defects
Asthma Diagnosis (D)	Dichotomous	Yes/No
Housing Type (I)	Categorical	Owner-occupied/Renter-occupied
Socioeconomic Status (I)	Categorical	Low-income (>50% AMI; <80% AMI)/Very low-income (>30% AMI; <50% AMI)/Extremely low-income (<30% AMI)

Note. * (I) =independent variable, (D) =dependent variable. AMI = area median income

ANCOVA was first used to statistically analyze the relationship between the variables and asthma diagnosis. However, the similarity of the results to derived from the ANCOVA necessitated the need to employ the use of linear regression to examine the significance of the substandard housing in relation to asthma diagnosis among low-income African-American children. The outcomes derived provided a measure of significance between the variables associated with substandard housing and asthma diagnosis experienced by participants. The variables and statistical tests for each research question are further explained in Table 2.

Table 2

Statistical Tests Used in Data Analysis

Research Question	Variable	Statistical Test	Data Source
RQ1	Child Age (I) Socioeconomic status (I) Asthma Diagnosis (D)	Logistic regression/Odds ratios	NHIS
RQ2	Child Age (I) Socioeconomic status (I) Housing Condition (I) Housing Type (I) Asthma Diagnosis (D)	ANCOVA/Linear Regression	NHIS & CHAS

Note. *(I) =independent variable, (D) =dependent variable

Study Limitations

Threats to External Validity

The most significant threat to the external validity of the study involved the questionable validity and reliability of the variables contained within the NHIS and CHAS data sets. According to the National Center for Health Statistics (2016), the data contained within the CHAS datasets was collected primarily for administrative purposes and not for the intent of research. Therefore, the data may have introduced reliability issues resulting from the manner in that the data is reported. An additional threat to the external validity of the results obtained from the study may be imposed by the data collection procedure used to obtain NHIS data. The NHIS dataset only contained the data for one sample adult and one sample child per household interviewed. As a result, varying, yet significant, health data for other residents of the same household could have been excluded from the dataset. Additionally, non-response of potential participants due

to language barriers, unavailability, failed communication, privacy concerns, and disinterest may have also affected the quality of the data contained within the secondary dataset (CDC, 2016b). The exclusion of possibly relevant data from non-surveyed members of U.S. households may have affected the results obtained that correspond to the rate of asthma prevalence, therefore potentially limiting the generalizability of the study outcomes to children of other races and age groups.

Threats to Internal Validity

The internal validity of the study may be affected by various discrepancies in the data collection procedures used to collect both NHIS and U.S. Department of Housing and Urban Development data. NHIS data is collected solely based on the responses provided by one adult in a household via a telephone-based interview (National Center for Health Statistics, 2015). The sole use of a telephone survey did not require additional proof that supports the responses provided by survey participants. Therefore, no medical support exists to confirm the absence or presence of asthma in the children sampled. An additional threat to the internal validity of the study involves the different methods used to collect data for household members by U.S. Department of Housing and Urban Development surveyors. The lack of uniformity and the limitations involved in the data collection procedures used to obtain both NHIS and U.S. Department of Housing and Urban Development data present possible challenges to the internal validity of the overall study.

Human Rights Protection

The confidentiality of NHIS participants was upheld by the guidelines set forth by section 308(d) of the Public Service Act (National Center for Health Statistics, 2015). To ensure the privacy of NHIS participants, all possible sources of identification were removed from the data contained within NHIS and CHAS datasets. As an additional precautionary measure, statistical totals that may have allowed for a specific location to be identified that could reveal the identities of survey participants were withheld from all datasets. Before data collection, participants were required to provide the interviewer with their informed consent to participate in the NHIS and CHAS surveys. Survey participants were also given a detailed explanation of the anticipated use of the data collected, and the steps taken to protect each participant's privacy. The data contained within both datasets contained no information that could be matched in a manner that revealed the identity of participants. Prior to beginning this study, permission was granted by the Institutional Review Board of the university to conduct this study. The IRB approval number for this study was 09-27-17-0397396.

Summary

In this chapter, I provided an outline of the methodology used to conduct this study. The selected research design and methodology selected allowed for each of the research questions of interest to be examined in a manner which protected the anonymity of the child participants of interest. In Chapter 4, I will discuss the results formulated from the conduction of this study. I will provide the descriptive and demographic characteristics for the participants used to assess each research question, outline the

statistical findings for each of the research questions, and provide the results derived for both research questions.

Chapter 4: Results

Introduction

The purpose of this dissertation was to examine whether substandard housing conditions influenced an affirmative asthma diagnosis in low-income African-American children. I also sought to assess whether the odds of an affirmative asthma diagnosis among African-American children differed according to family socioeconomic level. The results were derived from a cross-sectional design using data obtained from the 2012 NHIS and housing data averages collected from the 2008-2012 CHAS. This chapter will outline the process of data collection and analysis, address discrepancies from the preliminary plan for data collection, explain the results determined by the statistical analyses performed, and summarize the findings in accordance to the research questions.

Data Collection

The plan for data collection originally proposed and included in earlier chapters was revised to accommodate the scope of the study. The original plan for data collection included the use of data contained within a NHIS-U.S. Department of Housing and Urban Development linked dataset. However, after closer examination of the dataset, the primary variable of focus, substandard housing, was found to be missing from the linked dataset. As a result, data from the 2012 NHIS and the 2012 CHAS datasets were used to conduct the necessary analysis. Congruency between the two datasets could not be statistically achieved; therefore, both datasets were analyzed separately using varying forms of statistical analysis. Logistic regression was used to examine the first research question, that was designed to assess whether the odds of being a low-income African-

American child increased the odds of an affirmative asthma diagnosis. Originally, ANCOVA was selected as the most appropriate statistical test to formulate a comparison between substandard housing and an affirmative asthma diagnosis among this same population segment. However, after conducting the ANCOVA analysis, it was discovered that additional statistical analysis would be required to derive appropriate comparisons between the variables of focus—substandard housing and asthma. Therefore, a linear regression was also conducted, that resulted in meaningful statistical results that could be used to assess the second research question of the study.

Statistical Findings for Research Question 1

Research Question 1: Do African-American children who are low-income have higher odds of having asthma than African-American children who are not low-income?

$H_0$1: There is no difference in the odds of having asthma among African-American children who are low-income when compared to the odds of having asthma among African-American children who are not low-income.

$H_1$1: There is a statistical difference in the odds of having asthma among African-American children who are low-income when compared to the odds of having asthma among African-American children who are not low-income.

Descriptive and Demographic Characteristics

The dataset used to examine the first research question included data from a sample of African-American children collected through the NHIS. Although the complete dataset contained child health data for children between the ages of 0-17, only the data related to the children between the ages of 5-14 was included in the formal analysis (N =

2033). The data were derived from the responses provided by the present adult at the time of survey administration. Each of the child participants were identified to be African-American only. The asthma data reflected whether the adult was aware of the child ever being diagnosed with asthma by a doctor or healthcare provider. The total combined family income was categorized from $0 to over $100,000. The 2011 poverty thresholds defined by the Census Bureau were used to categorize the ratios of family income to the poverty threshold; poverty thresholds ranged from under 0.50 to 5.00 and over. The household number for each sample child participant was used to align the health data of each child participant with the appropriate family income data.

The average age of the sample child participant was 8.86 years old. The descriptive statistics derived for the sample of child participants demonstrated that 77.8% of the participants had never received an affirmatory asthma diagnosis by a medical provider (N = 1582). The family income ratio of 52.8% of the children included in the analysis was determined to be under 0.50, representative of a family income level that fell extremely below the national poverty threshold.

Results

A logistic regression was conducted to examine the first research question. The dependent variable that measured whether the sample child had ever been told that they had asthma was *yes*. An affirmative response of *yes* was coded with a 0, and a negative response of *no* indicating that the sample child had never been told that they had asthma was coded with a 1. Children with a family income ratio under 0.50 were used as the reference category to analyze the association between family income level and asthma

diagnosis. The results derived for children whose family income ratio was 0.50-0.74 to the poverty threshold demonstrated that the odds of an African-American child being very low-income and having an affirmative asthma diagnosis was 1.51 with a 95% confidence interval of [1.17, 1.96], $p = .002$. For children whose family income ratio was 0.75-0.99 to the poverty threshold, family income level was found to be insignificant ($p = .177$) for predicting the occurrence of asthma. The odds ratio for African-American children whose family income ratio was between 1.00-1.24 of the national poverty threshold was determined to be 1.75 with a 95% confidence interval of [1.16, 2.62], $p = .007$, indicating that exceeding the poverty threshold was also a significant predictor for asthma among African-American children between 5-14. The statistical results derived further indicated that African-American children within this income demographic have the highest odds of the three income categories assessed of having an affirmative asthma diagnosis. Although asthma was found to be significant for very low-income African-American children and African-American children above the poverty threshold, the obtained values of the confidence interval for both variables compromised the precision of the predicted odds for both groups of children. The results of the logistic regression conducted are provided in Table 3.

Table 3

Logistic Regression Results for Asthma Diagnosis and Family Income Level

Income Level	*β*	*S.E.*	Wald. Statistic	Sig.	95% *CI*	*OR*
Under 0.50			12.033	.007		
0.50 - .0.74	1.511	.132	9.804	.002	[1.17, 1.96]	1.51
0.75 – 0.99	1.304	.196	1.822	.177	[.887, 1.92]	1.30
1.00 – 1.24	1.746	.207	7.26	.007	[1.16, 2.62]	1.75

*Reference Category Income Level = Under 0.50

Statistical Findings: Research Question 2

Research Question 2: Is there an association between asthma diagnosis and substandard housing among African-American children who are low-income?

$H_0$2: There is no association between substandard housing and asthma in African-American children who are low-income.

$H_1$2: There is an association between substandard housing and asthma diagnosis among African-American children who are low-income.

Descriptive and Demographic Characteristics

A subset of the original sample set used to analyze the first research question was used to assess the second research question. Data obtained from 1,120 (N = 1120) low-income African-American children (family income ratio under 0.50), also between the ages of 5-14 years old, was used to examine the second research question. Additionally, housing data averages collected between 2008-2012 by the U.S. Department of Housing and Urban Development, for each of the 50 states, was used to extract the housing data

needed to examine the second research question. The housing data utilized was representative of categorical data compiled according to the housing category represented by the condition of the home, the U.S. Department of Housing and Urban Development area median family income, and race/ethnicity of the homeowner or legal occupant of the home. The housing data obtained could only be aligned to the complimentary health data at the regional level. Therefore, the covariate "region" was used in the ANCOVA conducted to formulate the comparisons between low-income African-American children with a confirmed asthma diagnosis and substandard housing.

The means of the frequency of an affirmative asthma diagnosis adjusted for initial differences were ordered as expected across the 4 regions. The northeast region had the largest adjusted mean (M = 1.79), the Midwest region had a slightly smaller adjusted mean (M = 1.78), the adjusted mean for the western region was slightly smaller than the mean of Midwest region (M = 1.74), and the adjusted mean for the southern region was the smallest (M = 1.72). As indicated in Table 4, there was minimal variation between the derived means of asthma among low-income African-American children across the four Census regions. The adjusted means derived for each region indicated that the region that the sample child participant resided did not significantly influence the asthma diagnosis of the child. This lack of variation between the means of asthma among low-income African-American children throughout the United States required further statistical analysis to examine the variables of interest.

Table 4

Derived Asthma Means for the Four Census Regions

Region	Mean	*SD*	*N*
Northeast	1.7900	.00000	9
Midwest	1.7800	.00000	12
South	1.7200	.00000	16
West	1.7400	.00000	13
Total	1.7522	.02881	50

Dependent Variable: Asthma

Results

A one-way ANCOVA was conducted to compare the occurrence of substandard housing among low-income African-American children diagnosed with having asthma. The independent variable substandard housing had 3 levels: no housing issues, 1 housing issue, and greater than 1 housing issue. The dependent variable was the absence or presence of an asthma diagnosis, as confirmed by a self-reported participant response. The covariate used was the region in that the child participant resided at the time that the 2012 NHIS was conducted. A preliminary analysis evaluating the homogeneity-of-slopes assumption indicated that the relationship between the covariates and the dependent variable did not differ significantly as a function of the independent variable, F (1,26) = .000, MSE = .000, p = N/A, partial η^2 = 1.00. The ANCOVA was not significant, F (3,26) = N/A, MSE =, p = N/A. The strength of the relationship between substandard housing and the dependent variable, according to region, was insignificant. Furthermore, the results derived from the ANCOVA further illustrated that the examination of substandard housing and affirmative asthma diagnosis among low-income African-American was

inconclusive at the regional level. A lower level of analysis was required to effectively derive comparisons by that the variables of interest could be examined.

Upon the realization that the ANCOVA was an inadequate statistical test to draw meaningful comparisons that could be used to assess whether substandard housing influenced the occurrence of asthma among low-income African-American children, a linear regression was conducted. To conduct the linear regression, the z-score for each of the substandard housing categories provided by the CHAS dataset was calculated and used as the independent variable. The variable "asthma" that denoted the mean for an affirmative asthma diagnosis for each child was coded for the region in that each state coincides. The state variable contained within the housing dataset was used to categorize the region in that each household resided. Deriving z-scores for the housing data enabled the housing data to be normalized based on region, rather than state. The normalization of the data using the region variable then allowed the regional means for the child asthma data to be analyzed according to the regional housing data.

The CHAS dataset only contained housing data representative of low-income households. The U.S Department of Housing and Urban Development defined a low-income family as one in that the calculated area median family income is below 80%. Families with a calculated area median family income of 50% were very low-income, and families with an area median family income falling below 30% were categorized as extremely low-income. The results derived from the linear regression (Table 5) indicated that substandard housing was a significant variable in asthma among low-income African-American children who resided in all owner-occupied home environments that

were categorized to contain one or more housing issues. Asthma was determined to be significant in each of the three owner-occupied housing types with one or more identified housing issues. The significance of asthma in both low-income (area median family income >50%</=80%), β = -.009, p = .027). and very low-income African-American homes was nearly identical (area median family income >30%</=50%, β = -.009, p = .029). However, the results obtained also indicated that asthma was most significant in extremely low-income African-American owner-occupied home environments that did not contain any known housing issues (area median family income >30%</=50%, β = -.011, p = .009).

Table 5

Linear Regression Results and Confidence Intervals Using Asthma Z-Scores

Housing Category	Housing Issues	Income	β	95% CI	Sig.
Owner Occupied	1+	</= 30%	-.008	[-.016, .000]	.043
Owner Occupied	1+	>30%</=50%	-.009	[-.017, -.001]	.029
Owner Occupied	1+	>50%</=80%	-.009	[-.017, -.001]	.027
Owner Occupied	0	</= 30%	.003	[-.006, .011]	.516
Owner Occupied	0	>30%</=50%	-.011	[-.018, -.003]	.009
Owner Occupied	0	>50%</=80%	-.009	[-.017, -.001]	.022
Renter Occupied	1+	</= 30%	-.004	[-.012, .004]	.310
Renter Occupied	1+	>30%</=50%	-.002	[-.010, .006]	.605
Renter Occupied	1+	>50%</=80%	-.006	[-.014, .002]	.135
Renter Occupied	0	</= 30%	-.002	[-.010, .006]	.613
Renter Occupied	0	>30%</=50%	-.002	[-.010, .006]	.611
Renter Occupied	0	>50%</=80%	-.004	[-.013, .004]	.279

Dependent Variable: Asthma

Summary

The results of the various statistical tests conducted indicated that income-level was the most significant predictor of asthma among African-American children between the ages of 5-14. The results of the analysis conducted to examine the first research question that aimed to assess the odds of an affirmative asthma diagnosis among varying socio-economic levels of African-American children demonstrated that being low-income or of higher-income significantly influenced the odds of a positive asthma diagnosis among African-American children. Similar conclusions were derived from the analyses used to examine the second research question, where the statistically significant household type for an affirmative asthma diagnosis appeared to rely upon income level rather than the absence or presence of housing issues. The results obtained suggested that although housing is a significant variable of consideration when examining asthma among African-American children; income level may be a more significant predictor for asthma than housing environment.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

The purpose of this study was to assess whether the odds of being diagnosed with asthma among African-American children varied according to income level. I also sought to determine whether substandard housing was significantly related to an affirmative asthma diagnosis among low-income African-American children. The 2012 NHIS dataset was used as the source of health data for the African-American children included in the analyses. The housing data averages computed between 2008-2012 that comprised the 2012 CHAS data were used to obtain all relevant data pertaining to the condition of housing. The remaining sections of this chapter will include the findings of the study, the limitations of the study, recommendations for both public health research and practice, implications for social change, and the chapter will conclude with an overall synopsis of the study.

Summary of Findings

The results of this study supported the findings of several research studies that indicated that family income was the most significant predictor for asthma diagnosis among African-American children. The statistical findings regarding the first research question suggested a significance between being low-income and having an affirmative asthma diagnosis for African-American children. Asthma was found to be significant ($p < .01$, $OR = 1.51$) among African-American children with a family income ratio of 0.50-0.74 of the national poverty threshold. Based on the results, being low-income was a significant predictor of a confirmed asthma diagnosis among African-American children.

However, the statistical results derived from the examination of the first research question also indicated the same for higher income African-American children whose family income ratio was 1.00-1.24 of the national poverty threshold ($p < .01$, $OR = 1.75$). These findings indicate that an additional predictor is needed to better assess the alternative factors that may contribute to asthma among African-American children.

The results obtained for the first research question supported previous findings that have suggested that being African-American was an important risk factor of asthma for children, regardless of socioeconomic income level (Kitsantas et al., 2014; Mitchell et al., 2016). The findings further support the notion that although family income level may influence asthma outcomes among African-American children, race and ethnicity remain the most prominent predictor variable. Therefore, other variables known to contribute to the occurrence of asthma among this population segment should be simultaneously considered to identify other critical variables that may be attributing factors to the observed phenomena.

The statistical findings of the second research question highlighted two important details regarding asthma and substandard housing. First, the derived mean scores for each of the four regions exhibited little variation. Therefore, the frequency of an affirmative asthma diagnosis among low-income African-American children was independent of regional location. This finding supported Keet et al.'s (2014) conclusion that neighborhood setting or location was insignificant when considering the asthma risk posed to a child. The second detail from the second research question's results illustrated the incapability of drawing meaningful comparisons regarding substandard housing and

asthma at the regional level. Additional statistical tests conducted to assess the secondary research question indicated asthma to be significant in homes comprised of African-American children that identified their homes as possessing one or more housing issues and for homes indicating that their homes did not possess any housing issues.

The findings associated with the secondary analysis of the second research question supported research regarding the issue of childhood asthma and income. Asthma was found to be significant in low-income homes that contain housing issues and in homes with no known housing issues. This supported the conclusions previously drawn by Valet et al. (2011) and Keet et al. (2014) that suggested that income was the most significant predictor variable of asthma among children. However, recently conducted studies suggested that further examination of the role of genetics, other environmental variables, and obesity may yield information that could help to explain why income alone was insignificant for predicting the occurrence of asthma in African-American children. For example, review of the current literature landscape regarding the topic of asthma among African-American children suggested further research into the comorbidity between asthma and other health conditions such as obesity (Baffi, Winnica, & Holguin, 2015; Martin et al., 2016). Hayden et al. (2018) also recently concluded that genetics was a significant influencer of asthma risk in children.

Interpretation of Findings

The findings of this study offer insight regarding the importance of environment in health outcomes of particularly African-American children. The SEM developed by Bronfenbrenner (1979) suggested that various aspects of the environment that surrounds

individuals throughout their lifetime affects their health outcomes. I sought to assess one aspect of the overall environment that influences the health outcomes of African-American children: housing. The findings of this study can be used as a preliminary point of consideration when attempting to assess the contribution of an African-American child's environment on his or her asthma status. Although children spend a significant amount of time within their home environments, the entire environment of a child should be considered to assess the asthma risk of children (Rabinovitch et al., 2016). For example, Hauptman and Phipatanaku (2015) proposed that the school environment was a significant source of environmental exposure that should be regarded when addressing asthma morbidity in children. Further study regarding other aspects that comprise the environment of African-American children must also be examined to address the increased prevalence of asthma among African-American children (D'Amato et al., 2015). The inclusion of additional environmental factors that influence the asthma risk of African-American children aligned with the precepts offered by the SEM, that emphasize the need to consider the overall environment of a person when attempting to examine a specific health outcome. The findings of this study further support the foundational constructs of the SEM that challenge the notion that the health of individuals can be assessed within the constructs of a laboratory environment (Bronfenbrenner, 1979).

Limitations of the Study

The most significant limitation of this research study was the lack of availability of linked data that could be used to examine the role of housing condition in the respiratory health outcomes experienced by African-American children. An attempt to

stratify the data between two varying datasets, according to region, proved to be too broad to adequately assess the role of substandard housing in the absence or presence of an affirmative asthma diagnosis among low-income African-American children. The generalizability of the study findings derived are limited because of the narrow focus of the role substandard housing on the frequency of a positive asthma diagnosis among low-income African-American children. The findings of the study conducted cannot be appropriately generalized to other children of other racial/ethnic backgrounds, or to other children whose family income levels exceeded the national poverty threshold set forth in 2012. Additionally, the inclusion parameter of African-American children between the ages of 5-14, limits the expansion of the study findings to other African-American children who may be low-income, but may be older or younger than the inclusion parameters set forth. As mentioned earlier, the use of self-reported health data posed a significant limitation to the validity of the confirmed or denied response indicating whether the sample child of focus had ever been told by a physician that they had asthma.

Recommendations

Based upon the findings and conclusions drawn from the conduction of this research study; the shortcomings of national population health data were once again evidenced. The results obtained from this study demonstrated a need for more in-depth population health data. The reliance on self-reported health data for population health research studies poses a significant limitation to not only the availability, but also the reliability of population health datasets. The reliance on self-reported health data to assess the topic of asthma among African-American children will continue to offer

limited insight into the expanse of this significant public health issue. A physical review of the health records of asthmatic African-American children is needed to properly assess the residential status and location of the children (Alexander & Currie, 2017). The additional challenge encountered regarding the unavailability of linked datasets between health data and social determinants of health, such as housing, also demonstrated a need for increased linkage of datasets that can be utilized by public health researchers to more effectively assess the role of social determinants of health on public health outcomes. The research study conducted further demonstrated the influential role of socio-economic status on the health outcomes evidenced in African-American children; as supported by the current research landscape.

The statistical significance of asthma as a health outcome among African-American children demonstrated that increased asthma prevalence among this population segment remains a critical topic of public health practice (Akinbami et al., 2014; Flores & Lin, 2013). Williams and Mofya (2016) suggested that targeted approaches that include both health and education must be implemented to adequately address the issue of asthma among racial and ethnic minorities. Public health practitioners must aim to provide patient-specific health communication that demonstrates cultural competence to effectively diminish persisting racial and ethnic health disparities, such as asthma (McClelland et al., 2013; Patel et al., 2014). Although progress has been made in understanding the role of various aspects of the environment that result in significant health disparities, such as asthma, among African-American children; practitioners must ensure that health communication initiatives and disease prevention interventions

encompass a comprehensive approach that includes considerations of the many aspects that comprise the overall environment of African-American children. The persistence of asthma trends and increased prevalence of asthma among African-American children demonstrated the necessity for this significant public health topic to remain an area of focus in the environmental health policy conversation.

Implications

Housing has been identified as a significant predictor of health, especially among children. However, the availability of congruent data that can be used to simultaneously assess the two variables is severely limited. The conclusions drawn from this study demonstrated the need for improved methods in deriving both health and housing data at the individual level. Additionally, a renewed focus on the prevention of unfavorable respiratory health conditions among children, such as asthma, is needed. Williams and Mofya (2016) suggested that approaches to address topics of racial and ethnic health disparities, such as asthma, should reflect consideration of both cultural diversity and cultural competency.

As many researchers have previously concluded, socioeconomic level did not offer a complete explanation into the reasoning of increased asthma prevalence and persistent asthma disparities among African-American children. The findings of this study offer valuable insight into the expanse of the influential factors of asthma among African-American children. The conclusions derived from this study demonstrated the role of housing as a significant contributor to asthma among low-income African-American children. Although further inquiry regarding the role of housing in asthma

prevalence among African-American children will unquestionably offer critical insight and valuable understanding of the role of the housing environment and its contribution to asthma. The overall conclusions of this study suggest the further examination of asthma risk factors that extend beyond the scope of the home environment and beyond the constraints of family income level is necessary to fully address and improve this persistent health disparity. Asthma was determined to be significant in owner-occupied homes that identified at least one issue within the home environment among low-income African-American children. However, the same was found to be true in owner-occupied homes that did not contain any notable housing issues. These findings suggest that other variables beyond the extent of focus for this study influenced the occurrence of asthma among low-income African-American children.

Conclusion

African-American children of varying income levels are at increased level of receiving an affirmative asthma diagnosis. The persistent diagnosis of asthma among African-American children further demonstrated the need for the implementation of more rigorous interventions aimed to increase the awareness of asthma prevention measures among parents and caregivers. Although housing has been identified as a possible influencer of respiratory health outcomes in children in previous research efforts conducted with the intent of exploring the topic of asthma among children from racial/ethnic minority backgrounds, the data available to adequately assess the topic remains limited. An expansion in the definition of substandard housing, as outlined by the housing issues set forth by the U.S. Department of Housing and Urban Development,

coupled with a diminished reliance on self-reported health data would allow for the examination of the topic of housing and asthma to be comprehensively examined. Conducting additional research that aims to explore the genetic contribution of asthma in children, coupled with further research into the various aspects that comprise the environment of children would undoubtedly yield positive gains in understanding influencers of asthma in children; and specifically, African-American children.

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