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Perceived Discrimination as a Moderator of the Relationship Between Allostatic Load and Asthma Control

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Abstract

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MA, Ohio Christian University, 2019

MS, National Louis University, 1995

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

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Abstract

While asthma prevalence in the United States is generally declining, African Americans tend to experience poorer outcomes regarding asthma severity and control. The purpose of the present study was to test whether discrimination (every day and lifetime) moderated the relationship between allostatic load and asthma severity/asthma control (dyspnea and peak flow). In previous literature, researchers established the relationship between allostatic load and asthma severity/asthma control among African Americans. The biopsychosocial model and allostatic load theory served as the theoretical frameworks for this study. In this cross-sectional, nonexperimental, quantitative design, 201 African Americans between the ages of 34 and 82 years were selected from a larger sample of participants of the Midlife Development in the United States. The MIDUS studies were designed to examine physical and psychological predictors of midlife development. Multiple regression analysis using the PROCESS macro for SPSS was utilized to test the four hypotheses. One research question guided the research does every day and lifetime discrimination moderate the relationship between allostatic load and asthma control?" (Utilizing peak flow readings and dyspnea levels). The findings indicated one model was statistically significant. Everyday discrimination was found to moderate the relationship between allostatic load and levels of dyspnea; no other model was statistically significant. Results suggest that chronic exposure to discrimination can increase allostatic load, resulting in chronic diseases. These chronic diseases include heart attacks, strokes, high blood pressure, obesity, and diabetes. Implications for positive social change include encouraging physicians to take a holistic approach to treat diseases, especially when treating minority patients who experience discrimination.

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Dedication

I would like to thank God for being my source of strength and carrying me through this journey. I dedicate this dissertation to the great women in my life. I would like to thank my grandmothers Annie Mae and Raintree. Your legacy of fortitude and tenacity to achieve your individual dreams have always been a guiding force in my life. I would like to thank my amazing mother who has always supported my dreams and given me the confidence to turn to myself for answers. I dedicate this study to my three Awesome Earth Angels, Carissa, Kira, and Kaleah, whose love and support inspire me to be a better person. Thank you, girls, for being my daily inspiration and motivation!!! I would like to thank my Dear Aunt Betty who covered me continually in prayer and always believed in me. I would like to thank my Sweet Aunt Pat whose encouragement will always be invaluable to me.

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Chapter 1 Introduction to the Study

The morbidity rate of a population is a good indicator of health. In 1928, Louis Israel Dublin made a compelling plea for the improvement in the health of African Americans. Dublin advocated for the improvement in the health of African Americans to make it more equivalent to that of Caucasians. Dublin (1928) insisted that the equality of the health of African Americans would eradicate many disadvantages in this group. He argued that the improvement in African Americans' health would improve their economic status and increase their natural abilities as no other improvement could (Dublin, 1928). Some 90 plus years later, health disparities persist in African Americans (Noonan et al., 2016).

Researchers are aware that as a group, African Americans suffer more adverse effects from chronic disease than any other population (Centers for Disease Control and Prevention [CDC], 2011). Twenty percent of African Americans have reported psychological stress, but only 50% seek treatment (CDC, 2021). According to the National Kidney Foundation [NKF] (2017), African Americans suffer renal failure three times more often than Caucasian Americans. According to the Minority Report (as cited in Cunningham et al., 2017), African Americans have the highest rate of cancer and the lowest rate of survival. African Americans are also twice as likely to die from heart disease as Caucasians. African Americans are 50% more likely to have a high blood pressure than Caucasians, and 60% more likely to have diabetes than Caucasians (Cunningham et al., 2017). In addition, amputations of the lower extremities occur 60.9% in African Americans with diabetes compared to 26.8% of Caucasians with diabetes (CDC, 2021).

Moreover, African Americans are three times more likely than Caucasians to catch COVID-19 and two times more likely to die from COVID-19 than Caucasians (Wen & Sadeghi, 2020). In Milwaukee County, 69% of the deaths from COVID-19 were African Americans. This is an astronomical number as African Americans only make up 26% of Milwaukee County's population. In the state of Louisiana, 70% of the deaths from COVID-19 were among African Americans (Wen & Sadeghi, 2020).

These health disparities are seen across disease types in African Americans.

The same type of health disparities persists in African Americans who have asthma. Asthma is a chronic lung condition that involves inflammation, narrowing of the airway, wheezing, coughing, and shortness of breath (National Heart, Lung, and Blood Institute [NHLBI], 2013).This chronic physical condition can be intensified through exposure to psychological factors, such as chronic stress (Baiardini et al., 2015; Ross et al., 2017). Asthma is of interest because of its documented association with psychological factors (Adam et al., 2017; Baiardini et al., 2015; Van Lieshout & Macqueen, 2012). African Americans experience more negative effects from asthma when compared to other races and ethnicities (American Lung Association [ALA],

2020; Asthma and Allergy Foundation of America [AAFA], 2020; CDC, 2019; National Health Interview Survey [NHIS], 2013; Silvers & Lang, 2012). In addition, asthma is the third most common cause of death in the United States behind cancer, which is second, and heart disease, which is first (CDC, 2021).

Since the 1980s, asthma prevalence has steadily increased across all racial groups (CDC, 2021; Global Initiative for Asthma [GINA], 2014). However, the

most substantial increase in asthma prevalence has occurred in African American women

(AAFA, 2020). African Americans are diagnosed with asthma 42% more often than Caucasians (ALA, 2012). In addition, African American women often have poorer asthma control, which leads to an increase in asthma symptoms, such as asthma exacerbations, wheezing, coughing, shortness of breath, and night-time awakenings due to asthma symptoms (ALA, 2012). Asthma control is divided into three categories: well-controlled, not controlled, and poorly controlled. Due to the lack of asthma control that African Americans experience, they are three times more likely to die from an asthma attack than any other ethnic group (ALA, 2012; AAFA, 2020; CDC, 2019). These existing asthma-related health disparities have confounded the medical community.

Researchers have examined several variables as possible contributors to the current health disparities in African Americans with asthma, including genetics, poor medication regimen adherence, patients who are not responsive to asthma medications, lack of access to medical care, poor communication with physicians, misinformation, and lack of education. However, even when adjusting for these factors, they do not adequately account for the significant disparities in health that persist among African American women (CDC, 2019).

Research remains inconclusive as to the relationship between these factors and the large numbers of African Americans with asthma. The medical profession has shifted its focus from the biological and environmental factors of asthma and is now focusing its attention on re-examining the psychological and sociological

components of this disease. One area that is being examined by the medical community is the interaction between chronic stress and disease (Mariotti, 2015; Schmerling et al., 2018; Yao et al., 2019). More specifically, researchers are examining the body's response to chronic stress. One novel measure of the body's response to chronic stress is allostatic load. Allostatic load is defined as the wear and tear on the body because of over or under activity of the allostatic process (McEwen & Stellar, 1993).

Several studies have examined the effect of chronic stress and allostatic load on disease; however, studies on the impact of chronic stress on African Americans are sparse (Black et al., 2015; Burchard et al., 2015). It is plausible that the psychological impact of perceived racial discrimination experienced by African Americans with asthma increases their allostatic load levels, causing poor asthma control. Thus, the purpose of this study was to examine the effect of perceived racial discrimination (chronic stressors) and allostatic load on asthma control. Several studies have been conducted on the relationship between chronic illness (asthma) and stress (discrimination).

Chen and Miller (2007) found that stress increases inflammatory responses in people with asthma. When people with asthma encounter chronic stress, cortisol levels rise, which, in turn, increases inflammation. Inflammation has been associated with worsening asthma symptoms (Hunter, 2012). Carlisle (2014) conducted a study on perceived discrimination and chronic illness and concluded that perceived discrimination resulted in adverse health outcomes. It is evident from this study that discrimination not only impacts psychological health but it also impacts physical health. Madubata et al. (2019) ascertained that discrimination increased thoughts of

suicide in African Americans. Again, this study underlines the negative psychological effect of discrimination.

Geronimus et al. (2010) studied the effects of stress by examining telomere lengths and oxidative stress in both African American and Caucasian women. This study was conducted using data from the 1997-1998 Survey of Women Across America [SWAN]. The SWAN study is a longitudinal study designed to examine the health of women during middle age. The SWAN study was conducted on African American, Asian, and Caucasian women at multiple sites throughout the United

States and examined data on telomere lengths, which are the protective caps on DNA, in African American and Caucasian women only. The sample was randomly selected from a subsample of the SWAN study respondents. A total of 215 participants were selected, comprising 115 African Americans and 110 Caucasian women. The researchers discovered that stress causes accelerated biological aging in African American women. Geronimus et al. (2010) used least squares regression to regress the median telomere lengths on race, perceived stress, poverty, and smoking. Results indicated that African American women were more negatively impacted by perceived stress, poverty, smoking, and waist to hip ratio than Caucasian women. Smoking was the only variable that equally and negatively impacted both Caucasian and African American women.

Researchers have indicated that African Americans suffer more adverse effects from various stressors (Duru et al., 2012; Williams et al., 2012). Coogan et al. (2014) found a relationship between discrimination and adult-onset asthma. This

ground-breaking longitudinal study revealed that those not diagnosed with asthma in childhood later developed asthma after reporting experiences of discrimination. Coogan et al.'s study closely aligned with the current study because it addressed the relationship between experiences of discrimination and asthma. However, this study differed in that the researchers examined the relationship between experiencing discrimination as a child and developing asthma as an adult.

While researchers have found a relationship between chronic diseases and poor health outcomes, there remains a gap in the literature regarding the interaction between perceived discrimination and allostatic load on asthma control. No existing literature was found that examined the interaction between perceived discrimination, allostatic load, and asthma control. This study can offer relevant information to current knowledge. If the allostatic load and perceived discrimination are determined to be critical factors in asthma control, health care providers can possibly offer coping techniques to their patients to reduce the adverse effects of both. In addition, the results of this study may potentially provide patients and health care providers with information that can reduce health disparities in African American women.

Problem Statement

Chronic stressors are harmful in many ways. Chronic stress contributes to chronic diseases, such as obesity, high blood pressure, strokes in African Americans, and asthma (Agyemang & Powell-Wiley, 2013; CDC, 2011; Kaholokula, 2016; Salleh, 2008; Williams, et al., 2012). Clearly, research studies have indicated that the health of African Americans is negatively impacted by chronic stress.

Perceived discrimination and allostatic load are both recognized as having negative impacts on health (Djuric et al., 2010; Greer, 2010). There is mounting evidence regarding the deleterious effects of chronic stressors on health. However, the moderating effect of chronic stress on asthma control in African Americans has yet to be studied. Perceived discrimination and allostatic load may combine to have a moderating impact on asthma control. There is a gap in the literature regarding the moderating effect of perceived discrimination (as chronic stressors) and allostatic load on asthma control. It is possible that gaining a better understanding of the moderating effect of perceived discrimination and allostatic load on asthma control is essential to controlling asthma. A better understanding of how perceived discrimination and allostatic load impact asthma control can improve the overall health of African

American women with asthma.

Purpose of the Study

The purpose of this quantitative study was to examine the relationships between perceived discrimination (chronic stressor), allostatic load, and asthma control in African Americans. I used archival data collected from the Midlife Development in the United States Studies [MIDUS] (2004, 2006, 2013) (Brim et al., 2020). The sample size of African Americans in this study was N = 201; their ages ranged between 34 and 82 years. The MIDUS studies were conducted to determine how biomedical, psychological, and social factors impact adults from young adulthood through old age. The MIDUS studies included diaries on daily stress, which was particularly useful in my examination of chronic stressors. These data can be used to examine how stress impacts health. Researchers have concluded that

stress contributes to stress-related diseases, such as cardiovascular disease, obesity, diabetes, and even death (Djuric et al., 2010; Geronimus et al., 2010; Mariotti, 2015; Ranabir & Retu, 2011; Radler, 2014). The present study may contribute to social change through the acquisition of additional information on the effects of perceived discrimination and allostatic load on asthma control in African Americans.

Should it be found that perceived discrimination moderates the relationship between allostatic load and asthma control, physicians and mental health care providers can routinely assess African American women (and men) with poorly controlled asthma for exposure to psychosocial stressors such as perceived discrimination? If psychosocial stressors, such as perceived discrimination, are found to be present, then support can be given to assist patients in mitigating the negative effects of perceived discrimination on the allostatic load process in general and as it impacts asthma control in African Americans.

The dependent variable was asthma control, the independent variable was allostatic load, and the moderator variable was perceived discrimination (everyday and lifetime). Allostatic load is measured in the MIDUS surveys by examining scores from 10 biomarkers of health; from these scores, an allostatic load index (ALI) is obtained. The ALI is used to determine relationships between stress and health outcomes (Mauss et al., 2015). Seeman et al. (2001) used allostatic load index scores to assess the functioning of bodily systems that are potentially impacted by psychosocial stressors. The examination of the ALI index scores allowed estimation of the effects of perceived discrimination on a health outcome (asthma control) in African Americans. The 10 biomarkers included in the MIDUS study that is used to calculate the ALI score are cortisol, epinephrine, norepinephrine, and

dehydroepiandrosterone sulfate, systolic and diastolic blood pressure, waist-hip ratio, high-density lipoprotein (HDL), total cholesterol ratio, immunoglobulin E (IgE), and glycosylated hemoglobin (Seeman et al., 2001). Higher ALI scores indicate greater psychological stress, and lower scores indicate better adaption to stress (Seeman et al., 2001). Allostatic load index scores and allostatic load will be used interchangeable in this dissertation.

Covariates were assessed to increase the accuracy of results (Schneider et al., 2015). The covariates included in this study were age, bronchodilator use, education level, exercise, gender, history of asthma, total income from all sources, marital status, and smoking status. The comparison of the data from these variables afforded me a clearer understanding of the factors that affect asthma control in African Americans. The implications for social change include providing researchers and healthcare providers with information that can potentially reduce health disparities in

African Americans.

Research Question and Hypotheses

The following research question and hypotheses were used to guide the research study. One research question was examined, and four hypotheses were tested. The four hypotheses were used to account for two versions of discrimination and two versions of asthma control readings.

Research Question: Does discrimination (every day and lifetime) moderate the relationship between allostatic load and asthma control?

Separate regression analyses were completed for each dependent variable to determine the relationship between dependent and independent variables. Covariates

included in all analyses of the study were age, bronchodilator use, education level, exercise, gender, history of asthma, total income from all sources, marital status, and smoking status. The hypotheses are as follows.

H_{01}: The relationship between allostatic load, as measured by a sum of biomarkers, and asthma control, as measured by peak flow readings, is not moderated by everyday discrimination, as measured by Williams's Everyday Discrimination scale, in African Americans, while controlling for key covariates.

H_{a1}: The relationship between allostatic load, as measured by a sum of biomarkers, and asthma control, as measured by peak flow readings, is moderated by everyday discrimination, as measured by Williams's Everyday Discrimination scale, in African Americans, while controlling for key covariates.

H_{02}: The relationship between allostatic load, as measured by a sum of biomarkers, and asthma control, as measured by the level of dyspnea, is not moderated by everyday discrimination, as measured by Williams's Everyday Discrimination scale, in African Americans, while controlling for key covariates.

H_{a2}: The relationship between allostatic load, as measured by a sum of biomarkers, and asthma control, as measured by the level of dyspnea, is moderated by everyday discrimination, as measured by Williams's Everyday Discrimination scale, in African Americans, while controlling for key covariates.

H_{03}: The relationship between allostatic load, as measured by a sum of biomarkers, and asthma control, as measured by peak flow readings, is not moderated by lifetime discrimination, as measured by Williams's Lifetime

Discrimination Scale, in African Americans, while controlling for key covariates.

H_{a3}: The relationship between allostatic load, as measured by a sum of biomarkers, and asthma control, as measured by peak flow readings, is moderated by lifetime discrimination, as measured by Williams's Lifetime Discrimination Scale, in African Americans, while controlling for key covariates.

H_{04}: The relationship between allostatic load, as measured by the sum of biomarkers, and asthma control, as measured by the level of dyspnea, is not moderated by lifetime discrimination, as measured by Williams's Lifetime Discrimination Scale, in African Americans, while controlling for key covariates.

H_{a4}: The relationship between allostatic load, as measured by the sum of biomarkers, and asthma control, as measured by the level of dyspnea, is moderated by lifetime discrimination, as measured by Williams's Lifetime Discrimination Scale, in African Americans, while controlling for key covariates.

In this study, I examined asthma control by analyzing data on the progressive levels of dyspnea and peak expiratory flow measurements in respondents with asthma.

Stressors associated with discrimination were measured using Williams's Everyday Discrimination Scale (EDS) as well as the Lifetime Discrimination Scale, a scale developed by the MIDUS authors. The EDS examined how many times the participants were exposed to acute, chronic stressors and perceived discrimination. The Perceived Discrimination Scale is a two-part scale that consists of daily and lifetime discrimination (Williams et al., 1997). ALI scores were calculated by taking the sum of the 10 biomarkers scores for African American women. According to

researchers, the higher the allostatic load score, the more significant the impact of the stressors (Seeman et al., 2001).

Theoretical Framework

In this study, I examined the moderating effect of perceived discrimination on the relationship between allostatic load and asthma control. Perceived discrimination is defined as the manifestation of negative behavior, such as mistreatments, misjudgments, and unfair treatment towards a member of a minority group (Banks et al., 2006; Williams et al., 1999). Perceived discrimination is a social construct that has harmful psychological and biological effects on the recipient. Perceived discrimination negatively impacts the psychological wellbeing of an individual, causing a myriad of negative emotions ranging from anger to depression to suicidal ideations (Pascoe & Smart-Richman, 2009). These negative emotions trigger hormonal responses (increase in cortisol and epinephrine, etc.) in the body that can lead to poor health outcomes. For this study, discrimination and perceived discrimination are used interchangeably.

The Perceived Discrimination Scale consists of two scales: EDS and Lifetime Discrimination Scale. The EDS was developed to detect chronic and episodic perceived discrimination. This scale consists of nine items measured on a 6point Likert scale, and the scores range from 1 to 54. The Lifetime Discrimination Scale consists of 11 items measured by adding the number of times over a lifetime a respondent has perceived mistreatment. Higher scores indicate greater perceived discrimination. Previous studies have indicated that both the EDS and the Lifetime Discrimination Scale are reliable and valid with a reliability of .95 (Clark et al., 2004;

Jang et al., 2010).

Individuals who experience perceived discrimination are more susceptible to heightened psychological and physical responses to stress (Clark et al., 1999). Researchers have concluded that perceived discrimination is a chronic stressor and has adverse health consequences (Glei et al., 2007; Kessler et al., 1985; Pascoe & Smart-Richman, 2009; Pieterse et al., 2012; Williams & Mohammed, 2009). The above terms are developed in greater detail in Chapter 2.

In studying the relationship between perceived discrimination and health outcomes, general adaptation syndrome (GAS), the biopsychosocial model, and the allostatic load theory all provide excellent foundations for designing a theoretical framework. The focus of the literature included in this study is on the relationship between perceived discrimination as a chronic stressor and allostatic load the body's response to stress (Balon & Wise, 2015; Clark et al., 1999; Geronimus et al., 2010; Glei et al., 2007; Williams et al., 2012). The models below were used in the study to examine the moderating effect of perceived discrimination (chronic stressor) and cumulative stress (allostatic load) on asthma control (outcome).

Selye (1973) an endocrinologist, injected rats with various substances and discovered that he could elicit the same response no matter which substance he injected. The laboratory rats all displayed symptoms of stress due to the injections. This experiment leads Selye to discover stress and the GAS. Stress, according to Selye (1973), is the body's response to any demand or challenge. The GAS outlines a predictable way in which the body responds to stress and is therefore categorized as a response-based model of stress. The response-based model of stress posits that

when individuals encounter stress, a biological response occurs in response to that stress.

Stressors are anything that is perceived as a challenge, threat, or damage. In this study, the stressor was perceived discrimination.

The GAS model describes the stages that the body goes through when it encounters stress. In response to stress, the body goes through three universal stages: alarm, resistance, and exhaustion (Selye, 1973). The initial stage prepares the body for action, for fight or flight. During the first stage, the pituitary gland releases glucocorticoids, which are hormones. In response to the release of glucocorticoids, the adrenal glands release cortisol and adrenaline into the bloodstream. These hormones change the activity of the hypothalamic-pituitary-adrenocortical axis (HPA). The second stage is the resistance state. During this stage, a decrease in circulating stress hormones occurs; if the threat or stress has dissipated, then the body returns to homeostasis (Selye, 1973). In the event the body does not return to homeostasis, exhaustion, the last stage, occurs.

During the exhaustion stage, the body is weakened and can no longer recuperate from the physiological damage of stressors (Geronimus et al., 2010; Selye, 1973; Szanton et al., 2005). Selye (1973) stated, “Every stress leaves an indelible scar, and the organism pays for its survival after a stressful situation by becoming a little older” (p. 12). While the GAS model of stress and disease focuses on the way the body adapts when it encounters stressors, the biopsychosocial model came about as the result of Engel’s efforts to broaden the medical community’s approach to disease (BMJ, 2002).

Up until the 21st century, scientists diagnosed diseases primarily from biological and medical standpoints (BMJ, 2002). The biomedical premise of disease posits that the cause of disease stems from biological factors. However, in 1954,

Grinker coined the term biopsychosocial model some 20 plus years before Engel. Grinker (1954), a neurologist and psychiatrist, wanted the medical community to address not only biological factors of disease but also the psychological and social factors of disease. While Grinker introduced the biopsychosocial concept, Engel in 1977 made the biopsychosocial theory famous (Smith, 2002).

The biopsychosocial model moved medicine away from the cause-effect biomedical model to a multi-systems approach to disease that included biological, psychological, and social components (Smith, 2002). Engel (1977) hailed the term biopsychosocial as a blueprint for research and a model for physicians and psychiatrists to follow in healthcare. Engel and Romano further developed the biopsychosocial model to offer a fuller explanation of disease by incorporating the complexity of the interaction of the biological, psychological, and sociological factors in the process and severity of the disease.

The biopsychosocial model is an extension of the stress-vulnerability model. This model pertains to the interaction between the biological, psychological, and social conditions, which determine the cause, manifestation, and course of health and disease (Engel, 1977; Melchert, 2011). According to Pascoe and Smart-Richman (2009), both the mental and physical health status of an individual is impacted by psychological, social, and biological factors; therefore, it is crucial to

the health of individuals for healthcare professionals to focus on all three factors when treating patients.

The next stress-response model is the allostatic load model. McEwen and Stellar (1993) developed this theory to elucidate the negative impact of chronic stressors on health. According to McEwen and Stellar (1993), "Allostatic load is the wear and tear on the body that occurs due to its attempts to achieve stability through change" or allostasis (p. 1). In 1988, Sterling and Eyer developed the term allostasis to describe how the heart adapts to resting and active states. Allostasis is the physiological process that the body goes through when the body encounters challenges or stress from a changing environment. These challenges or stressors elucidate a negative response from the body. This process of being forced to adapt to adverse psychological conditions can result in wear and tear on the body that can precipitate chronic disease. Allostatic load is the cumulative effect on the body due to its attempt to maintain allostasis. McEwen and Stellar (1993) developed the term allostatic load to clarify the multisystem dysregulation that takes place when the body is forced to adapt to chronic or multiple stressors. Chronic stressors or multiple stressors can negatively impact health outcomes (Clark et al., 1999).

There are four types of allostatic load. The first type occurs when people experience repeated or multiple "hits" from new stressors. The second type occurs when a person does not adapt to current stressors. The third type occurs after a prolonged stress response and delayed shut down of the stress response. The fourth type occurs when there is an inadequate response by one mediator, which consequently leads to other mediators trying to compensate, thus causing hyperactivity (McEwen, 1998). Researchers have determined that allostatic load

results in both physical and emotional dysfunction (Djuric et al., 2010; Geronimus et al., 2010). While each type of allostatic load differs, all can result in wear and tear and stress on the body.

While all three models are classified under the stress response model, each one encompasses unique characteristics. The GAS model of stress concludes that chronic stress leads to chronic disease through the overexposure of the body to stress hormones. The GAS model is unique in that it categorizes the stress response into three general stages: alarm, resistance, and exhaustion. The biopsychosocial model posits that disease should be viewed holistically; therefore, what affects the psychological and social aspects of one's life, such as perceived discrimination, will also impact the biological aspect of health (asthma control). The allostatic load theory introduces allostasis, the process that the body goes through to adapt to chronic stressors (McEwen, 2000). Allostatic load is the wear and tear on the body that occurs as the result of dysregulation in the allostasis process.

All three stress response models provide a firm basis for investigating the moderating effect of perceived discrimination and allostatic load on asthma control. Understanding the negative impact of perceived discrimination on allostatic load and asthma control can assist physicians, psychologists, and patients in developing strategies to cope with the negative psychological and physical effects of perceived discrimination.

Nature of the Study

In this quantitative study, I examined the moderating effect of perceived discrimination on the relationship between allostatic load and asthma control in

African Americans. It should be noted that originally the analysis was to include only African American women; however, due to limited data from African Americans in the MIDUS studies, men and women were retained for all analyses. A quantitative design allows the exploration of the factors or variables that influence an outcome (Creswell, 2017). Lewis et al. (2009) adopted the quantitative method to examine the relationship between perceived discrimination and blood pressure in African American and Caucasian adults in a research study. This method was effective in examining the relationship between experiences of perceived discrimination and allostatic load on asthma control.

The data for this study were from the MIDUS I, II, III population studies (University of Wisconsin, 2011). The MIDUS studies were the first national studies conducted on the midlife development of non-incarcerated residents in the United States (University of Wisconsin, 2011). These studies were created by scholars from the fields of psychology, epidemiology, anthropology, medicine, demography, sociology, and health policy (Ryff & Lachman, 2019).

I selected this study for three main reasons. First, the MIDUS studies focused on midlife, the period that researchers have found African Americans are most susceptible to wear and tear (Geronimus et al., 2010) on their bodies. Second, these studies addressed the impact of behavioral, psychological, perceived discrimination, social factors, and their relationship to biological changes in the body. Third, this study added a sub-study of African American women to ensure representation of this group. The participants completed telephone interviews and mail surveys; blood samples and anthropometric data were collected by trained medical professionals

between 2004 and 2009. Also, participants completed assessments that included demographic, psychological, and social characteristics.

This research design was nonexperimental, as there was no manipulation of variables on my part. Statistical analysis was primarily regression using the Process Macro in SPSS. SSPS Version 27 was used to explore the relationships between the independent variables of perceived discrimination and allostatic load and the dependent variable asthma control in African Americans.

Definitions

Acute severe/uncontrolled asthma: Asthma that is not controlled by using high-dose corticosteroids and long-acting beta-agonist (American Academy of Allergy Asthma and Immunology [AAAAI], 2016).

Allergic/atopic/extrinsic asthma: Caused by an allergic reaction (AAAAI, 2016).

Allostasis: The process of adaptation to stressors (McEwen, 2017).

Allostatic load: The result of excessive or continued exposure to chronic stress (stressors) on the body (Geronimus et al., 2006).

Asthma: A chronic inflammatory condition of the lung; a disorder characterized by breathing difficulties (AAAAI, 2016).

Asthma control: When asthma symptoms, including exacerbations, are either reduced or eliminated (Reddel, 2009). Asthma control was measured in this study by using dyspnea levels and peak flow readings.

Asthma exacerbation: The sudden emergence of asthma symptoms, such as difficulty in breathing, coughing, wheezing, and chest tightness (AAAAI, 2016).

Asthma severity: Refers to four categories of asthma: intermittent, mild, moderate, and severe. Intermittent asthma is characterized by an individual experiencing less than one asthma attack per week, asymptomatic and normal peak expiratory flow (PEF) between attacks, and less than two nocturnal symptoms. Mild asthma is characterized by greater than one attack per week but less than one per day, and little or no medication between attacks. Moderate asthma is characterized by daily asthma attacks that limit activity. In addition, nocturnal symptoms are present and occur more than once per week. Severe asthma is characterized by continuous asthma attacks that limit physical activity, more than 10 missed school days, or workdays. In addition, there are frequent nocturnal symptoms, and two or more hospitalizations per year (NHLBI, 2013).

Biopsychosocial theory: The interaction between the biological, psychological, and social conditions that determine the cause, manifestation, and course of health and disease (Engel, 1977; Melchert, 2011).

Discrimination: The mistreatment or prejudicial treatment on the grounds of race, age, gender, or sex (Williams et al., 2012).

General adaptation syndrome (GAS) model: Describes the stages that the body goes through when it encounters stress. In response to stress, the body goes through three universal stages: alarm, resistance, and exhaustion (Selye, 1973).

Inflammation: The biological response to remove something deemed as harmful, such as irritants, pathogens, and damaged cells. Inflammation can cause

redness, swelling, heat, or inflamed tissues. Inflammation can also be an allergic reaction affecting the nose, lungs, joints, and throat (American College of Allergy and Asthma [ACAA], 2016).

Intrinsic asthma: Asthma that is not caused by external factors (Asthma Allergy Foundation of America [AAFA], 2020).

Peak flow (PEF): A tool used to measure how well a person can blow air out of their lungs (GINA, 2016).

Perceived discrimination: A manifestation of negative behavior, such as mistreatments, misjudgments, and unfair treatment towards a member of a minority group (Banks et al., 2006; Williams et al., 1999).

Perceived Discrimination Scale: Composed of two scales: EDS and Lifetime Discrimination Scale. The EDS measures daily perceived discrimination, and the Lifetime Discrimination Scale measures perceived discrimination over a lifetime.

Progressive levels of dyspnea: Progressive levels of shortness of breath. This breathlessness ranges from 0 to 4 on a Likert scale.

Stress: Any element that disrupts the balance between a living organism and its environment (Ranabir & Reetu, 2011).

Stressor: Refers to environmental stimuli capable of causing stress. Stress can be due to social, physiological, and psychological factors (Szabo et al., 2012).

Assumptions

It was assumed that the sample of the participants was representative of

African Americans with asthma in the United States, not only in Milwaukee, Wisconsin. Additionally, it was assumed that all participants answered the questionnaire truthfully and thoroughly.

Limitations

This study was limited to data from the MIDUS studies, which comprised previously collected secondary survey data. Because the data from the MIDUS studies were previously obtained, the ability to cross-check for accuracy was limited; as a result, this allowed for a possible increase in statistical error. Another limitation was that literature is sparse on the relationship between asthma control, perceived discrimination, and allostatic load. A thorough search of the research has been conducted to evaluate the relationship between race, sex, gender, asthma control, asthma prevalence, discrimination, chronic stressors, and allostatic load. I consulted with a statistician who was familiar with data analysis using the MIDUS studies to ensure that the data were analyzed correctly.

Significance of the Study

Creating a spark for positive social change is an essential purpose of this study. This study could be significant in igniting positive social change in the following three ways. First, I examined the impact of perceived discrimination and allostatic load on asthma control in African Americans. Second, this study filled in gaps in an area of research that has received little attention. Third, if a moderating effect is found between perceived discrimination and allostatic load and asthma control, physicians can implement strategies to help African American patients cope with the effects of perceived discrimination and allostatic load. The findings from

this study can provide more appropriate resources to assist African Americans in achieving asthma control.

Summary

In this study, I examined the psychological and social stressors that may mitigate poor asthma control in African Americans. Exploring possible causes for poor asthma control in African Americans is crucial due to the (a) the significant morbidity resulting from this disease, (b) the psychological and physiological burden of the disease, and (c) the financial cost of asthma. Additional information and knowledge are important; this knowledge can assist in closing the gap in health care disparities for African Americans with asthma. This study was unique in three ways. First, I examined the potential relationship between allostatic load and asthma control in African Americans. Second, I examined if there was a moderating effect between perceived discrimination (chronic stressor) and asthma control. Third, I explored if there was a relationship between asthma control and perceived discrimination in African Americans.

Chapter 1 provided the foundation for the study as well as a discussion of the increased prevalence of asthma and the health disparities in African Americans. In Chapter 2, the literature review addresses asthma control, chronic diseases, perceived discrimination, chronic stressors, and allostatic load. Additionally, there is a discussion of how perceived discrimination as a chronic stressor affects allostatic load and a possible explanation for the disproportionate number of African Americans with asthma.

Chapter 2 Literature Review

Asthma is a long-term, life-threatening disease, which causes inflammation and narrowing of the airways. This sometimes-debilitating disease affects an estimated 300 million people worldwide. Researchers have estimated that by 2025, there will be 100 million new cases of asthma worldwide (GINA, 2016). In the United States alone, 25 million adults suffer from asthma (GINA, 2016). Asthma is not only physically and emotionally burdensome but asthma treatments are financially onerous. In the United States, asthma treatments cost over $80 billion annually (CDC, 2021). According to the CDC (2021), asthma patients made 11 million doctor visits and 1.3 million emergency room visits. According to the ALA in 2012, 188,965 people were hospitalized for asthma.

This chronic condition affects African Americans more often than any other population. African American women are diagnosed with asthma 20% more often than Caucasian women. African Americans are also hospitalized with asthma complications three times more often than any other population. Asthma deaths are higher in African Americans overall; however, African American women die three times more often from asthma attacks than African American men (AAFA, 2015; ALA, 2014; CDC, 2011). African Americans between the ages of 40 and 64 suffer the most from the burden of this disease (AAFA, 2014; ALA, 2012; NHIS, 2014; Slivers & Lang, 2012;). These statistics highlight the existing disparities and the failure of current asthma treatments in African Americans.

Asthma Control and Asthma Severity

In the United States, money spent on treating chronic diseases accounts for 75% of the 2.2 trillion dollars spent on healthcare annually (CDC, 2019). Asthma is a chronic inflammatory condition that affects some 27 million adults and children in the United States alone (NHLBI, 2013). There are two types of inflammation: acute and chronic (Cohen et al., 2012; Murdoch & Lloyd, 2010). Acute inflammation develops as a normal part of the disease process (Cohen et al., 2012; Murdoch & Lloyd, 2010).

However, chronic inflammation is ongoing, persistent, and potentially dangerous. According to Monadi et al. (2015), chronic stress can lead to chronic inflammation that leads to disease.

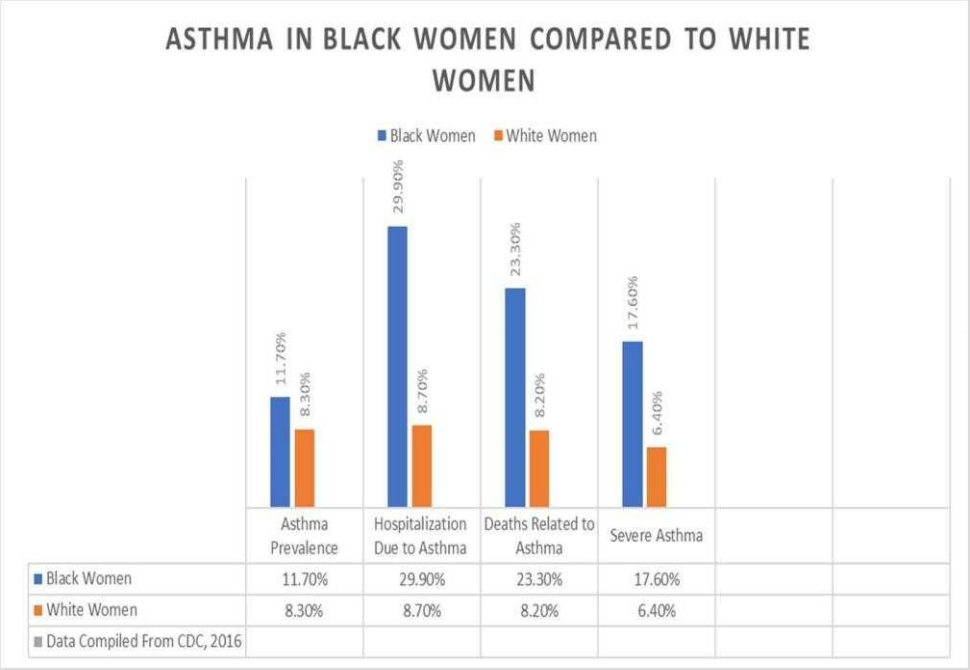
At one time, asthma was believed to be a disease originating solely from the psyche. However, researchers have discovered that inflammation plays a role in this disease (Chen & Miller, 2007; Holgate, 2010; Monadi et al., 2015). Over the past 20 years, the incidence and prevalence of asthma have steadily increased across all racial and age groups (GINA, 2014). However, further examination has revealed that African Americans suffer more adverse effects from asthma than any other group. African Americans are two to three times more likely than Caucasians to have severe asthma (ALA, 2004; AAFA, 2020; O'Byrne et al., 2010; Bell et al., 2010; Bollmeier, 2017; CDC, 2019; Ohno, 2017). According to the CDC (2021), 17.6% of African Americans, compared with 6.4% of Caucasian Americans, went to the emergency room in 2011 for treatment of asthma-related illnesses. In 2017, 88.5% of African Americans were hospitalized for asthma-related illnesses compared to 23.6% of Caucasian Americans. According to Zhang et al. (2019), African

Americans are hospitalized due to asthma 3 to 5 times more often than Caucasians, and 5% of

African Americans, compared to .8% of Caucasians, die from asthma. Figure 1 shows how asthma affects African American and Caucasian women. That prevalence of asthma is not very different by race, and the medical consequences of asthma differ significantly by race. This suggests the likelihood of a large psychosocial component to the disparity.

Figure 1

Asthma in Black Women Compared to Caucasian Women



Research has progressed in the treatment of asthma in the general population (ALA, 2004; CDC, 2019; NHLBI, 2013). However, these same successes are not duplicated in reducing the prevalence and severity of asthma in African Americans. Research has indicated that African Americans suffer more significant ill effects from asthma when compared to other groups. Asthma is a complex disease with varying degrees of intensity and severity. Even with the advent of stronger

medications to treat severe asthma, asthma disparities persist in African Americans. These health disparities have confounded both the medical community and researchers alike. Researchers have considered such factors as access to healthcare, biology, socioeconomic status (SES), environmental triggers, comorbidities, asthma phenotype, medication adherence, and inadequate treatment as possible explanations to these disparities (Baiardini et al., 2015 & 2011; Nyenhuis et al., 2017). However, even when controlling for these factors, disparities in asthma prevalence and severity in African American women persist (Frieri et al., 2015; Janevic et al., 2012; Sternal, 2010).

Historically, the medical profession has categorized asthma as one of seven psychosomatic illnesses, with the other six being peptic ulcers, colitis, hypertension, cardiac arrhythmia, hyperthyroidism, and neuro-dermatitis (National Institute of Mental Health [NIMH], 2007). The purpose of the present study was to examine a possible moderating effect of perceived discrimination on the relationship between allostatic load and asthma control (which is measured by levels of dyspnea) in African Americans. Asthma is a chronic medical condition, and perceived discrimination is a chronic stressor. It is plausible that asthma control can be adversely affected by perceived discrimination and allostatic load. The biopsychosocial model of health served as the theoretical foundation of this study. According to the biopsychosocial model of health, biology and psychosocial factors interact to impact diseases (Bulatao & Anderson, 2004). The biopsychosocial model of health posits that there is a mindbody connection between psychosocial factors and health (Engel, 1977).

This chapter includes a discussion of the literature search strategy and theoretical foundations. Included is a detailed literature review that examines studies on the impact of chronic stressors on health outcomes, the impact of perceived discrimination on chronic disease, and the impact of allostatic load on chronic disease.

Literature Search Strategy

Articles were selected using the following search terms and topics: *asthma, uncontrolled asthma, asthma statistics, asthma in African Americans, asthma and stress, chronic disease and discrimination, chronic disease and allostatic load,* and *chronic stress and disease*. Sources included the American Asthma Association, CDC, ALA, American Psychological Association, National Asthma Education and Prevention Program, GINA, and Asthma and Allergy Foundation of America. Databases searched included Academic Search Complete, ProQuest, Medline, SAGE,

Psych Info, Psych Articles, and Science Direct. Several journals, including The Journal of Asthma, Journal of Respiratory Health, Journal of Behavioral Medicine, Pharmacogenomics, National Institute of Health, American Journal of Health, Journal of Pneumology, and Asthma, Research, and Practice, were searched specifically due to their focus on asthma. I accessed databases and articles through Walden University, Cambridge University, Harvard University, and the Skokie Public Libraries.

Over 300 peer-reviewed articles were reviewed, and 120 were selected. The literature review spans approximately 8 years, from 2012 to 2021. However, some

references date earlier than 2012 due to their originality and value to the present research.

Theoretical Foundations

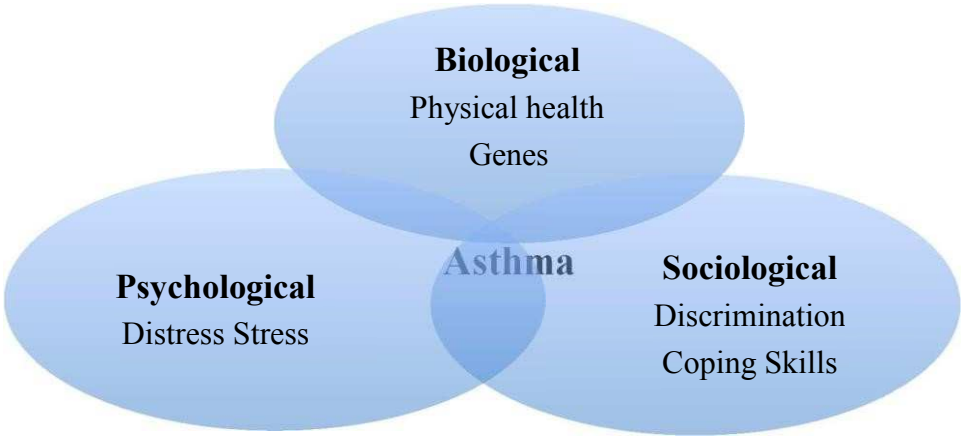
During the 1930s, Alexander was known as one of the founding fathers of psychosomatic medicine. Physicians who ascribe to psychosomatic medicine concentrate on finding the middle ground between psychoanalysis and physiology. Psychosomatic was defined by Fava and Sonino (2010) as a physical illness originating from psychological distress. They believed that there was a connection between physical illness and psychological distress or stress. Psychosomatic medicine emphasized the relationship between mind and disease; while the psychosomatic theory was more encompassing than the biomedical approach, it did not consider social factors. The biopsychosocial model of health became popular primarily due to the incompleteness of the previous models. In 1954, Grinker coined the phrase biopsychosocial model. Grinker revolutionized this term, which emphasized the significant role that biology plays in the field of psychiatry (Ghaemi, 2009).

During the 1970s, the primary approach to disease was the biomedical model. Engel was dissatisfied with the biomedical approach, as it did not consider a systems approach to disease. In addition, Engel found the biomedical approach to be dehumanizing, reductionistic, and over-analytical, and it did not consider the path and severity of illness like the psychosocial model (as cited in Borrell-Carrió et al., 2004). Engel revolutionized the term *biopsychosocial* to define his systemic or holistic approach to medicine (Ghaemi, 2009).

The biopsychosocial model of health was developed by Engel as a holistic path for clinicians to better understand and respond to the needs of their patients. According to Dogar (2007), psychological and social variables impact illness, but the degree of impact is determined by the individual and the severity of the illness. The biopsychosocial model of health considers the complex interaction between biological, psychological, and social factors that impact the development and course of various disease states. Figure 2 depicts the interaction between these three factors.

Figure 2

The interconnectedness of the Three Components of the Biopsychosocial Model of Health



Note. From "Older Adults' Needs and Preferences for Open Space and Physical Activity In and Near Parks: A Systematic Review," by L. Levy-storms, L. Chen, and A. Loukaitou-Sideris, 2017, *Journal of Aging and Physical Activity, 26,* pp.1-45. (https://doi.org/10.1123/japa.2016-0354). Adapted with permission.

The two psychological models that guided the direction of the research hypotheses were the biopsychosocial model of health and the allostatic load model. These two models have been used to examine the interrelationships of biological,

psychological, and social factors on the etiology of the disease. In this study, the biopsychosocial model of health and the allostatic load model was used to examine the effects of chronic stress (discrimination) and allostatic load on chronic disease (asthma).

Literature Review

The significant burden that asthma exerts on African American women indicates that a better understanding of the etiology of this disease is needed. Researchers are now looking in new directions regarding the burden of asthma on African Americans. This new direction has led to psychologists examining the impact of chronic stress on the etiology of asthma (Bourdin et al., 2019; RibeiroSilva et al., 2018; Ronaldson et al., 2015; Yonas et al., 2012). According to Rosenberg et al. (2014), chronic stress changes the patterns and expressions of DNA. In addition, these researchers found that asthma symptoms, triggered by stress, are set in motion by pathogenic processes in the airways, causing symptoms. They concluded that psychosocial stressors could cause asthma and posttraumatic stress disorder in youths. Yonas et al. (2012) discovered that factors at the community level, including SES and violence; family level, such as divorce and maternal and paternal stress; and individual level, including posttraumatic stress disorder and genetic factors, can impact asthma outcomes. They found that psychosocial stress causes genetic variations, DNA methylation, inflammatory gene expressions, and a decreased responsiveness to steroids, the main ingredient in asthma medications. In addition, postnatal stress resulted in increases in tumor necrosis factor-alpha and total IgE, proteins, and antibodies that all increase inflammation. In addition, the researchers found that prenatal stress altered cord

blood cells' immune responses. Thus, they noted that chronic stress has been found to cause negative effects on health in children and adults.

Ribeiro-Silva et al. (2018) conducted a cross-sectional study on ninth-grade Brazilian children to examine the effects of the complex interaction between psychosocial, economic, and environmental factors on asthma. The researchers used data collected from the 2012 edition of The National Adolescent School-based Health Survey. Ribeiro-Silva et al. (2018) investigated the effects of economic, environmental, and psychosocial factors on the etiology of asthma in children. In this cross-sectional study, they examined 109,104 Brazilian children. The researchers examined the determinants of asthma symptoms in children (wheezing and shortness of breath). They found the highest association between asthma and psychosocial stress. Stress appeared to be the vehicle that propelled

Chronic Psychological Stress

Stress is a universal condition that is experienced by every individual. However, chronic stress has been shown to be associated with negative health outcomes in several studies. Researchers have linked chronic stress to disease (Clark et al., 1999; Jang et al., 2008; Mays et al., 2007; Perry et al., 2013; Thrasher et al., 2012; Williams & Wyatt, 2015). In addition, researchers have discovered that perceived discrimination is a chronic stressor (Paradies, 2006; Williams & Mohammed, 2009; Williams & Wyatt, 2015). Chronic stressors adversely impact both mental and physical health outcomes.

According to McEwen (1998), stress is triggered by physical or psychological demands. Stress is a word that is commonly used to denote an adverse

effect; however, stress can be either positive or negative. Positive stress, also known as eustress, is stress that motivates, is short-term, is within our coping boundaries, and improves performance (Singer, 2017). Distress or negative stress can cause anxiety or concern; it is uncomfortable; it is outside of our coping limits and can be short-term or long-term. However, for the present study, *stress* denotes chronic stress or negative stress.

Stress is an inevitable factor in every life. Stress is any situation that disturbs the normal equilibrium in a living organism's environment (Ranbir & Reetu, 2011). Researchers have found that short-term stress can be beneficial because it facilitates alertness and perpetuates survival (Robinson, 2018; Tsigos et al, 2020). However, ongoing, persistent, chronic stress can be deleterious to the health of the individual (Djuric et al., 2008; Geronimus et al., 2010; Ranbir & Reetu, 2011; Robinson, 2018; Tsigos et al, 2020).

Chronic stress refers to persistent, long-term stressors, such as discrimination or chronic diseases. Often people that experience chronic stress feel they have no control over their stress (Chen & Miller, 2007). In response to stress, the body secretes additional hormones to prepare for the flight or fight reaction. Allostasis (homeostasis) occurs when the body attempts to adapt to changes in response to stressors. When acute stress is perceived, stress hormones rise, then decline after the resolution of the stressor. However, when chronic stress persists, hormones remain elevated (Tsigos et al., 2020). Under chronically stressful conditions, catecholamines and cortisol levels are elevated and remain elevated for prolonged periods (Tsigos et al., 2020). The consistent elevation of stress hormones can eventually cause dysregulation, which interrupts the body's ability to shut off the

release of stress hormones. As a result, the body remains in a state of anxiety and alertness (Sterling

&

Eyer, 1988).

Researchers have found a relationship between chronic stress and chronic disease, particularly inflammatory diseases such as cancer and cardiovascular and endocrine diseases (Duru et al., 2012; Tomfohr et al., 2016). Persistent elevation of catecholamines and cortisol causes "wear and tear" and, ultimately disease and even death (Deuster et al., 2011; Duru et al., 2012; Geronimus et al., 2010; Tomfohr et al., 2016). The hypothesis examined in this study was African Americans who have asthma and are chronically exposed to discrimination will have higher allostatic load levels and decreased asthma control. Perceived discrimination is a chronic stressor that will be addressed in the next section.

Perceived Discrimination

Perceived discrimination is a social construct being examined by researchers as a possible variable that perpetuates health disparities (Abramson et al., 2015; Lewis et al., 2015; Priest & Williams, 2018). Researchers have discovered associations between experiences of discrimination and poor health outcomes. For example, researchers have found a relationship between discrimination and obesity, cancer, drug abuse, alcoholism, cardiovascular disease (CVD), diabetes, and the onset of asthma (Coogan et al., 2014; McDonald et al., 2014; Pascoe & SmartRichman 2009, Williams et al., 2012; Williams & Mohammed, 2009). The present study differs from the previous studies in that the relationship between asthma control, perceived discrimination, and allostatic load will be examined.

Discrimination is a component of racism, sexism, and other types of oppression that can take the form of either institutionalized or interpersonal discrimination (Versey & Curtain, 2016). Williams et al. (1999) described perceived discrimination as the perception of negative treatment because of a group membership. Evidence shows that self-reported or perceived discrimination is associated with negative health outcomes (Barnes et al., 2008; Clark et al., 1999; Lewis et al.,2015; Mays et al., 2007; Paradies 2006; Pascoe & Smart-Richman, 2009; Smedley, 2012; Williams & Mohammed, 2009). The words *discrimination* and *perceived discrimination* are used interchangeably in this study.

Perceived discrimination is a chronic stressor that negatively impacts the health of those who experience it. While many ethnicities experience discrimination, research indicates that African Americans are adversely affected by perceived discrimination more than any other racial group in the United States (Assari et al., 2017; Ben et al., 2017; DeLilly & Flaskerud, 2012; Geronimus et al., 2006). Empirical evidence shows that African American women perceive the negative impact of discrimination more than African American men. In addition, African American women indicate that their health status is impacted by perceived discrimination more often than African American men (Himmelstein et al., 2015). Perceived discrimination impacts African Americans from all social and economic strata, including African Americans from the middle and upper classes (Goosby et al.

2018; Goosby & Heidbrink, 2013; Williams & Mohammed, 2009).

Perceived discrimination is characterized by feelings of low self-worth, having little or no control over life outcomes, widespread exclusion, and feelings of

devaluation (Skosireva et al., 2014). There is a growing body of research that provides empirical evidence that perceived discrimination elicits toxic emotions which negatively impact the mental and physical health of the individual (Djuric et al., 2010; Geronimus et al., 2010; Ranbir & Reetu, 2011; Robinson, 2018; Tsigos et al., 2020;
Wofford et al., 2017). The toxic emotions resulting from chronic stress can cause psychological stress. Researchers indicate that perceived discrimination is a chronic stressor that can lead to wear and tear on the body (Seeman et al., 2001; Pascoe & Smart-Richman, 2009).

According to researchers, perceived discrimination can adversely affect the health of those who experience it (Brown et al., 2018; Jennings et al., 2014; Olanga & Finn, 2014; Schmitt et al., 2014; Schweiger & Parducci, 1981). In fact, according to a recent study by Brown et al. (2018), an estimated 4.1 million Americans suffer from chronic pain due to discrimination. Brown et al. (2018) conducted an archival study on perceived discrimination and chronic pain using the MIDUS I, II, and III studies. Their analysis included 1,908 adults between the ages of 40 and 84 years. The researchers concluded that as the incidences of everyday discrimination increased, chronic pain also increased.

Experts suggest that chronic stress resulting from perceived discrimination negatively impacts health through various biological and psychological mediators (Campbell & Ehlert, 2012; Geronimus et al., 2006; McEwen, 1998). Some researchers suggest that chronic stress negatively impacts health outcomes via behavioral changes. These behavioral changes are often negatively manifested in such behaviors as smoking cigarettes, drug use, taking risks, reduction in exercise,

reduction in sleep, and poor adherence to medication regimens (Blodorn et al., 2016; Cozier et al., 2014; Mather, 2012; Williams et al., 1999). The Brown et al. (2018) study was similar to a cross-sectional study completed on 4,939 African American adults between 35 and 84 years of age who participated in the Jackson Heart Study conducted in Mississippi (Sims et al., 2016). The researchers examined the association between everyday, lifetime perceived discrimination, and the burdens of discrimination and cigarette smoking. They found an inverse relationship between cigarette smoking and reports of everyday discrimination (Sims et al., 2016). The Jackson Hospital Discrimination Instrument Scale (JHDIS) was used in this study. This study used three subscales: Everyday Discrimination, Lifetime Discrimination, and the Burden of Discrimination scales. The Everyday Discrimination scale was adapted from the Williams Discrimination Scale (Williams et al., 1997). This scale included the following questions: "How often on a day-to-day basis do you have the following experiences?" "…treated with less courtesy and… less respect…, people act as if …you are dishonest…, and you are a threat" (Williams et al., 1997; Sims et al., 2016). Their responses ranged from 1 (never) to 7 (several times a day).

Researchers queried participants about experiences of discrimination over their lifetime. Responses were yes or no answers. If the participants answered yes, then they were asked this question: "When you had experiences like these, have they been - not stressful, moderately stressful, or very stressful?" "Has discrimination interfered with life?" and "how much harder has life been…?" "Not at all, a little, some, or a lot?" Researchers totaled individual responses, for which the respondents answered that discrimination had occurred at least one or more times. Scoring was continuous, ranging from 1 (*low burden*) to 4 (*greater burden*). The internal

reliability of the scale was moderate ($\alpha = 0.63$). After participants answered questions that pertained to discrimination, the participants were asked to report the reason they believed they experienced discrimination. The answers ranged from (1) *no discrimination (referent)*; (2) *low discrimination (below the median) attributed to race*; (3) *low discrimination attributed to nonracial factors*; (4) *high discrimination (at or above the median) attributed to race*; and (5) *high discrimination attributed to nonracial factors*. Researchers then examined the participants coping styles (either problem-focused or emotion-focused) by asking how they responded once they encountered discrimination. Researchers concluded that everyday discrimination was associated with an increase in smoking and an increase in fat consumption in women. Researchers found an association between everyday and lifetime discrimination in both men and women and less sleep. The burden of discrimination was associated with less sleep and an increase in smoking in women but not men (Sims et al., 2016).

According to Billings and Moos (1981), there are two basic types of coping; emotional and problem-focused. This study also substantiates findings in previous studies which conclude that most women make coping decisions based on emotions, whereas men base solutions focused on problem-solving. (Kelly et al., 2008; Kessler et al., 1985; Liddon, 2018). Women in this study made emotional decisions based on their need to reduce negative emotional responses that occurred because of experiencing discrimination, whereas men focused on the source of the discrimination and determining solutions based on cognitively focused problemsolving skills (Sims et al., 2016).

Scientists suggest that discrimination (a social construct) affects physiological health through the mind-body connection (Anderson, 2012; Littrell, 2008; Thayer & Kuzawa, 2015, Williams et al., 2012). More specifically, discrimination causes psychological stress that perpetuates physiological responses. These physiological responses can, over time, cause poor health outcomes. When the body encounters stress, certain hormones are released. One such hormone that is involved in the stress response is cortisol. While normal cortisol production is beneficial to the body, when there is a dysregulation in the release of cortisol, problems can result. Cortisol is believed to facilitate the retention of fear-based memories, which elicit the fight or flight response (Hannibal & Bishop, 2014; Linz et al., 2018). In addition, some experts suggest that a dysregulation in diurnal or waking cortisol levels can predict poor health (Adam et al., 2017; Huynh et al., 2016).

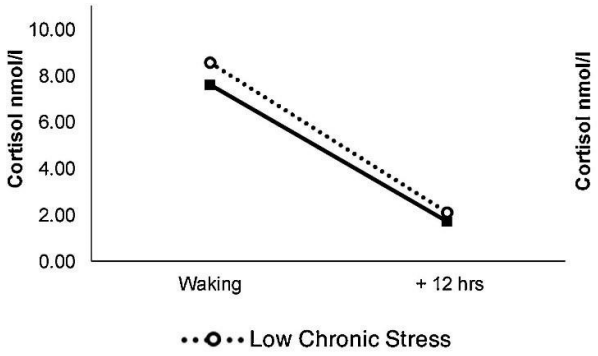
Zeiders et al. (2014) examined the relationship between cortisol levels and experiences of discrimination. This study was conducted with 140 juniors from a suburb of Chicago and Los Angles high schools. The purpose of this study was to examine the effects of discrimination in youths and their diurnal cortisol rhythms. The study collected salivary cortisol levels from participants three times a day. In addition, participants completed the everyday discrimination scale to measure discrimination experienced by the youths. The results of the study indicated that as experiences of discrimination increased, the higher the dysregulation in diurnal cortisol levels (Kuras et al., 2017; Lee et., 2018; Zeiders et al., 2014).

Typically, the largest amount of diurnal cortisol is released in the bloodstream 30 minutes upon waking. Cortisol levels slowly decline throughout the

day and are at their lowest at midnight. Figure 3 is a depiction of the normal release of cortisol to the bloodstream throughout the day.

Figure 3

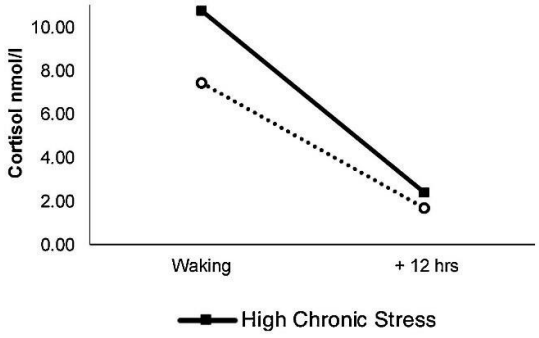
Low Chronic Stress



Note. From *Chronic stress exposure, diurnal cortisol slope, and implications for mood and fatigue: Moderation by multi-locus HPA-Axis genetic variation. Retrieved from* https://www.sciencedirect.com. Reprinted with permission.

Figure 4

High Chronic Stress



Note. From Chronic stress exposure, diurnal cortisol slope, and implications for mood and fatigue: Moderation by multi-locus HPA-Axis genetic variation. Retrieved from https://www.sciencedirect.com. Reprinted with permission.

The black scatter plots in Figure 4 represent the release of cortisol and are indicative of a person experiencing chronic stress. Figure 4 indicates higher than

normal cortisol production throughout the day, which is a result of chronic stress. According to researchers, higher than normal diurnal cortisol levels are associated with poor health outcomes as these abnormal levels are related to stress-related biological dysregulation (Kuras et al., 2017). Chronic stress can cause cortisol dysregulation, which can result in disease.

Some experts indicate that there is an association between experiencing stress and discrimination and developing cardiovascular disease (Dunlay, 2017; Ronaldson et al., 2015). In another study, researchers used data from the MultiEthnic Study of Atherosclerosis (MESA), an ongoing population cohort study conducted on n = 6,508 adults. The participants are between the age of 45 and 84 years and from six United States clinics located in Baltimore, Chicago, St. Paul, Los Angeles, Winston-Salem, and New York City. The purpose of this study was to examine the effects of everyday and lifetime discrimination on a group of multiethnic middle-aged participants that had no previous cardiovascular disease. The results of the study indicated that both everyday and lifetime discrimination increased cardiovascular risk in middle-aged adults for all ethnicities (Everson-Rose et al., 2015). The design of this study is like that of Zeiders et al. (2014). Researchers in both studies examined the effects of discrimination (everyday and lifetime). Zeiders et al. (2014) examined the impact of discrimination in minority youths. The results of these studies speak to the harmful effects of discrimination as a stressor. While these studies examined the impact of discrimination on chronic disease, they differ from the present study, which will explore the effects of both perceived discrimination and allostatic load on asthma control in African American women.

Coogan et al. (2014) found an association in African American women between the onset of asthma and experiences of discrimination. They used data from Boston University's African American Women's Health Study to examine the association between experiences of discrimination and the onset of asthma in African American women. The study was a large study conducted on 38,142 African American women in the United States who ranged in age from 21 to 69 years. This study took place between 1997 through 2011. The purpose of the study was to examine the relationship between adult onset of asthma in African American women and one type of chronic stress, racial discrimination. The researchers excluded all participants from the study that had pre-existing asthma. Every two years, the participants were given questionnaires to answer about discrimination and asthma. The participants answered questions about their experiences of everyday discrimination and their asthma status in addition to other questions relating to demographics. Researchers concluded there was a direct relationship between adult onset of asthma and experiences of racial discrimination. While the participants differed in age and gender, the results received were similar; discrimination adversely impacts health.

While previous studies have examined the effects of stressors on disease and the onset of asthma and discrimination, this study differed in the following ways. The researcher examined the relationship between perceived discrimination, asthma control (progressive levels of dyspnea), and allostatic load in African Americans. The researcher conducted an archival study using data from MIDUS II studies. The study involved examining variables to determine if perceived discrimination

moderates and the relationship between allostatic load and asthma control in African Americans.

Researchers agree that discrimination is a chronic stressor that adversely affects the health outcomes of the recipients (Cozier., 2014; Jee-Lyn García & Sharif, 2015; Williams & Mohammed, 2009). Some researchers suggest the association between chronic stressors, such as discrimination, and disease occurs through the process of allostatic load (Hannibal & Bishop, 2014; Stephens, 2014; Williams et al., 2012). One pathway under investigation regarding the role of the allostatic load is via the HPA.

Allostatic Load

The HPA axis is involved in the body's response to chronic stress and allostatic load. Allostatic load is a relatively new concept and was coined by McEwen and Seeman (1999). They coined the term allostatic load to explain the physiological effect that stressors have on the body. The definition of the allostatic load is the cumulative effect of wear and tear on the body due to chronic stress (McEwen, 1998; McEwen & Seeman, 1999; Geronimus et al., 2010). Chronic stress activates a multisystem stress response in the body; this response involves the cardiovascular, neuroendocrine, metabolic, and immune systems (Danese and McEwen, 2012; Duru et al., 2012). The wear and tear on the body negatively impact the body's ability to adapt to stressors due to a dysregulation in the functioning of the stress response (McEwen and Gianaros, 2010). The body's attempt to maintain stability in response to change is a process called allostasis (McEwen & Seeman, 1999). Sterling and Eyer (1988) created this term to explain how the mammalian stress response evolved to ensure species survival while limiting physical damage.

When we encounter stress or stressors, physical and psychological changes occur to manage the stress or stressors. In acute stress, these changes occur through the activation of the sympathetic nervous system (SNS). In chronic stress, these changes occur through the HPA axis and the metabolic system. These changes occur in two phases. The first phase is the determination of whether a situation is threatening or not. If hypothalamus activity causes the determination that a situation is threatening, it sends a signal to the pituitary gland which sends a message to the adrenal medulla. Under acute stress (short-term stress) the second phase involves the activation of the sympathomedullary axis (SAM) which is responsible for the release of catecholamines in preparation for the fight or flight (McEwen & Gianaros, 2010). During the acute stage, the SAM triggers inflammation to protect the tissues from damage (Read & Grundy, 2014). The third phase is considered a chronic state in which the HPA axis releases cortisol (Ross et al., 2017). Cortisol, a type of glucocorticoid, is released into the bloodstream. Changes occur in the HPA axis, the autonomic nervous system (ANS), the management of the sympathetic nervous system, and other bodily systems. The release of stress hormones through the bloodstream results in an increased heart rate increased blood pressure, and increased respiration rate (Geronimus et al., 2006). When the threat has abated, bodily functions return to normal via the parasympathetic branch (Read & Grundy, 2014). However, when there is a dysregulation in the stress response, the cessation of the stress response is delayed or does not occur (Read & Gundy, 2014). Therefore, a prolonged release of stress hormones and allostasis does not happen. When the body does not reach allostasis, allostatic load occurs.

The allostatic load can occur under various conditions. According to McEwen (1998), the allostatic load can occur under the following four conditions: Repeated

"hits" by multiple stressors; lack of adaptation; prolonged response because of delayed shut down of the stress response; and while under activity of one stress response mediator that leads to overactivity in another stress response mediator (McEwen, 1998; McEwen, 2010). The allostatic load can result from any one or combination of these conditions.

The following studies pertain to the impact that chronic stress has on health. These studies examine the exposure to stress and the biological, and psychological effects of stress. The first study compared the effects of allostatic load in African Americans compared to the allostatic load in Caucasians. The second study examined mortality rates in African Americans and Caucasians and compared them to levels of allostatic load. The third study examined the impact of allostatic load over the life course of middle-aged women, and the last study examines the effect of discrimination and allostatic load in midlife.

Researchers have found an association between allostatic load and health status in African Americans and Caucasians. One study conducted by Deuster et al. (2011) examined allostatic load in African Americans when compared to Caucasians. This study was completed by analyzing biomarkers in respondents. The participants were 84 African Americans and 45 Caucasians ($N = 129$) between the ages of 18 and 45 years. The researchers examined behavioral, psychosocial, neuroendocrine, and personality biomarkers in their assessment of allostatic load using blood and saliva samples. The researchers reported that African American women were at a higher risk of obesity, cardiovascular disease, and diabetes. In addition, the allostatic load was higher in African Americans in 9 out of the 10 areas examined (Deuster et al., 2011).

Duru et al. (2012) studied the mortality rates of African Americans compared to Caucasians. The sample size was N= 4,515 African American and Caucasian men and women aged 35 to 64 years. The researchers used data from the National Health and Nutrition Examination Survey (1988-1994). The purpose of the study was to examine if the allostatic load influences higher mortality rates in African Americans. The researchers examined ten biomarkers to ascertain allostatic load levels. The ten biomarkers were: systolic blood pressure, diastolic blood pressure, glycated hemoglobin, glomerular filtration rate, albumin, triglycerides, c-reactive protein, homocysteine, total cholesterol, and waist to hip ratio. The allostatic load values are provided in Table 1.

Table 1

Allostatic Load Input Measures Compared Across Black and Caucasian Men and Women

Biomarkers	Black men	Caucasian men	Black women	Caucasian women
Systolic Blood pressure	28.0	17.8	26.2	13.2
Diastolic blood pressure	38.8	30.2	42.4	26.6
Glycated hemoglobin	49.9	19.6	48.0	20.7
Glomerular filtration rate	10.8	19.0	8.0	18.5

Albumin	27.	13.6	28.5	12.0
Triglycerides	5 16.	26.4	13.1	22.4
C-reactive protein	2 33.	22.6	37.0	23.1
Homocysteine	7 12.	9.2	9.1	8.8
Total cholesterol	1 20.	26.5	19.0	21.9
Waist to hip ratio	6 14.	24.4	31.9	22.4

2

Note. Adapted from "Allostatic Load Burden and Racial Disparities in Mortality," by

O. K. Duru, N. T. Harawa, D. Kermah, and K. C. Norris, 2012, *Journal of the National Medical Association*, *104*(1-2), pp. 89–95. https://doi.org/10.1016/s0027-9684(15)30120-6

Table 1 indicates that in 9 out of 10 areas, African Americans in this study have higher allostatic load values than their Caucasian counterparts. According to Duru et al. (2012), the results indicated that African American men had higher mean allostatic load scores than Caucasian men (2.5 vs. 2.1, respectively). The mean allostatic load scores in African American women were 2.6 compared with 1.9 in Caucasian women. The researchers posited that the burden of allostatic load offers a

possible explanation for the higher mortality rates in African Americans. Duru et al. (2012) found that each one-point increase in allostatic load translated into an increase in mortality (Duru et al., 2012). This study is like that conducted by Deuster et al. (2011) in that both studies examined allostatic load values calculated by adding each biomarker and then dividing the sum of each biomarker by 10. Results of both studies consistently found that allostatic load scores were higher in African Americans when compared to Caucasian Americans. The study completed by Duru et al. (2012) differed in that it examined the mortality rates by disease types in African compared to Caucasian Americans.

Another longitudinal study examined allostatic loads in middle-aged women. This study included 1,932, middle-aged women between the ages of 42 and 53. The data used by researchers came from the Study of Women's Health Across the Nation (SWAN). The sample size included non-Hispanic Caucasian, African American, Chinese, and Japanese women across the United States. The purpose of this study was to examine the effects of the allostatic load over the life span of women (Chyu & Upchurch, 2018). This study was selected because the participants are women and middle-aged. Researchers indicated that the cumulative effects of wear and tear on the body increase allostatic load over time. The researchers in this study found that African American women had the highest allostatic load score at 3.53; Caucasian women had allostatic load scores of 2.37; Chinese women had allostatic load scores of 1.85, and Japanese women had allostatic load scores of 1.93. Researchers also found that over the entire seven years of the study, allostatic load scores steadily increased by 2% for all races.

Empirical evidence indicates that higher allostatic load scores could be an indicator of future disease and mortality (Chyu & Upchurch, 2018; Duru et al., 2012; Edes & Crewa, 2017; Shields & Slavich, 2017). The results of the SWAN study indicated that as women age, allostatic load scores increase, a possible reaction to the wear and tear imparted on the body. This study was like the longitudinal study completed by Duru et al. (2012); both examined the effects of allostatic load on health and mortality, and both found that African American women have higher allostatic load scores than any other group. However, this study differed from the previous studies in that the participants were all women and were middle-aged from diverse ethnicities and socio-economic backgrounds.

Brown et al. (2018) examined the effects of perceived discrimination on chronic pain in African Americans. The researchers hypothesized that the higher the experiences of discrimination, the greater the chronic pain. This study was completed using data from the MIDUS II and MIDUS III waves. The study used a sample of

1,908 individuals from the MIDUS studies (MIDUS II 2005-2006 and MIDUS III 2013-2016) (Ryff & Lachman, 2019). Participants of MIDUS II and MIDUS III answered 11 questions on lifetime perceived discrimination and ten questions on everyday discrimination. One limitation mentioned in this study was that participation rates were higher in Caucasians, married individuals, and people with better health and higher education in the original MIDUS I study than in MIDUS II and MIDUS III (Brown et al., 2018). Therefore, the population in MIDUS II likely experienced less discrimination than the population of the United States. However,

the researchers found that their hypothesis was correct: As perceived discrimination increased, there was an increase in chronic pain.

The last study examined the relationship between perceived discrimination, anger control, and allostatic load. While many studies have investigated the relationship between socioeconomic status, discrimination, and health, this study is novel in that the researchers examined discrimination, anger control, and allostatic load. The researchers completed a study on 909 non-Hispanic Caucasian men and women from the MIDUS II study. The researchers examined the data collected on perceived discrimination scores, ten biomarkers of allostatic load, and data on how well the participants controlled their anger. The results of the study indicated that when participants did not control their anger when exposed to what they believed to be discriminatory acts; their allostatic load scores increased. In addition, the greater the perception of discrimination, the higher the allostatic scores of the participant. This study is essential to understanding the harmful effect of discrimination on all people regardless of ethnicity and race.

MIDUS Milwaukee

The MIDUS studies are a series of longitudinal studies sponsored by The John D. and Catherine T. Mac Arthur Foundation and the National Institute on Aging at the National Institutes of Health. The data obtained from the MIDUS studies are archived at the University of Michigan. This research study will be conducted using secondary data from the MIDUS Refresher African American subsample. The data consists of interviews, self-completed questionnaires, physical assessments, and blood, saliva, and urine tests. The MIDUS studies are the first National Study of Midlife

Development in the United States (Ryff et al., 2021). The original MIDUS I study is a longitudinal study with a response rate of 75% (Ryff et al., 2021). The MIDUS I studies were completed in 1995-1996. MIDUS, I involved one 30-minute phone interview and two 50-page self-administered questionnaires. The primary focus of the MIDUS studies was the role of behavioral, psychological, and social factors on the health and wellbeing of a national sample of Americans. The MIDUS I study is novel in three main areas. First, it consisted of a large and diverse population. The participants included siblings of the respondents and a twin study. Second, the data from MIDUS studies have been used in many scientific fields. Third, the study utilized many assessments to measure the following areas: health/illness, sociodemographic factors, genetic factors, life challenges, health barriers, psychological and social factors, and neurobiological factors. MIDUS I was so successful in obtaining this information that the University of Wisconsin received additional funding for a follow-up study in 2004 from the National Institute on Aging at the National Institutes of Health. MIDUS II was developed to continue the study from 2004-2006 (Ryff et al., 2021). The primary goal of MIDUS II was a follow-up to MIDUS I and to obtain threshold assessments along with additional questions about coping, stressful events, optimism, caregiving, and cognitive functioning. A subsample was added to MIDUS II of N=592 African Americans. The purpose of this additional sample was to examine the problems that specifically affect minority populations.

The MIDUS II study consists of the original national sample project, a daily diary study, cognitive functioning, biomarkers, and neuroscience projects. The importance of the addition of these projects is pivotal as this information permits

insight into the impact of coping, stressful events, optimism, and caregiving on health and well-being.

A third study, the Midlife in Japan was developed in 2008. The Midlife in Japan study was developed with a probability sample of Japanese adults N=1,027 who resided in Japan, who ranged in age from 30 to 79 years of age. (Ryff et al., 2021). Data were collected to obtain baseline information, psychological characteristics, mental health, physical health, and health behaviors. A biomarker study was added in
2009-2010. The purpose of this study was to compare longitudinal data from the MIDJA with the United States sample, MIDUS I.

In 2011-2014 the MIDUS Refresher was developed to replenish the original sample MIDUS I. The investigators recruited a sample of 3,577 adults aged 25 to 74 years (Ryff et al., 2021). Questions pertaining to how socioeconomic status, psychological and biological factors impacted African Americans were added. This follow-up study repeated the baseline assessment and added additional questions pertaining to the economic recession, optimism, coping, stressful life events, and caregiving.

In 2013-2014 MIDUS III was conducted as a follow-up to MIDUS I and MIDUS II. This study repeated baseline assessments and collected measures of cognitive functioning, daily diaries were completed, biomarkers, and neuroscience data were collected. Cognitive functioning was examined to determine if there is a relationship between cognition and mental and physical health. Daily diaries were collected to examine the impact of daily stressors on biological systems, whereas the

biomarker project identified biopsychosocial factors that impact health outcomes. The neuroscience project examined such areas as emotional reactivity and recovery and emotional reactivity and biological changes (Ryff & Lachman, 2019).

These instruments were used to determine how health is impacted by socioeconomic factors, stressors, life transitions, genetic factors, and social relationships (Ryff et al., 2021). MIDUS investigators included another subsample of N=508 African Americans from the Milwaukee, Wisconsin area to improve the relevancy of the study.

Summary

Researchers have relied upon the principles of stress theories and allostatic load models to understand the effects of chronic stress on health outcomes. The purpose of the present study was to examine the potential relationship between perceived discrimination, asthma control, and allostatic load in African Americans. Specifically, I investigated whether discrimination affected allostatic load, causing worsening asthma symptoms in African Americans with asthma. I also investigated the moderating effect of discrimination on the relationship between allostatic load and asthma control. It is pertinent when addressing the current health disparities in African Americans with asthma to investigate various factors that may potentially mitigate poor asthma control and greater asthma severity. Discrimination and allostatic load can be harmful to the health of people of all races, ethnicities, genders, and ages. The purpose of this study was to examine the detrimental impact of both discrimination and allostatic load on asthma control in African American women with asthma. Chapter 3 presents a detailed examination of the research design and analysis plan.

Chapter 3 Research Method

The purpose of this study was to investigate the potential relationship between perceived discrimination, allostatic load, and asthma control in African American women. In this chapter, I describe the research design, rationale, and methodology used to examine the research question and hypotheses. Included in this chapter is a description of the MIDUS studies and projects, a description of variables, covariates, threats to validity, data collection procedures, research questions, and data analysis.

Research Design and Rationale

A cross-sectional, nonexperimental, quantitative design was chosen to examine if perceived discrimination moderates the relationship between allostatic load and asthma control in African American women in an archival study. According to Creswell (2017), a quantitative, nonexperimental design is the best design to use when working with archival data. An experimental design would not have been suitable for this study because it includes variables that cannot be manipulated or controlled. The strength of a cross-sectional design is that it can compare different population groups at one time. Cross-sectional designs also permit the researcher to compare different variables at the same time (Frankfort-Nachmias & Leon-Guerrero, 2018). The criterion variable in this study was asthma control and the predictor variables were perceived discrimination and allostatic load. Perceived discrimination and allostatic load can be classified as chronic stressors. According to the biopsychosocial model, chronic stressors (such as perceived discrimination and allostatic load) can negatively impact health (Engel, 1977). According to the

allostatic load theory, chronic stressors (such as perceived discrimination) can cause wear and tear on bodily systems, resulting in poor health outcomes (McEwen, 2000). Allostatic load is the physiological breakdown in response to cumulative physiological, psychological, and social wear and tear caused by stress (McEwen, 2000). It is plausible that chronic stress caused by experiences of discrimination increases the allostatic load, which causes African American women to be more vulnerable to poor asthma control. In the examination of the moderating effect of perceived discrimination and allostatic load on asthma control, certain covariates were examined (described below) to decrease the impact that covariates may exert on the dependent variable.

Methodology

Population, Sampling, and Sampling Procedures

There were 7,108 participants in the MIDUS I study who completed the original study, and 1,499 who completed the daily diary in 1995/1996. The MIDUS participants lived in the United States and were noninstitutionalized, Englishspeaking adults who ranged in age from 25 to 74 years. The number of participants selected from a random digit dialing process was $N = 3,487$. The oversamples came from five metro areas with a sample size of $N = 7,573$. The siblings of the participants from the RDD sample were also included with a sample size of $n = 950$.

This study also included a national sample of twin pairs ($N = 1,914$).

The MIDUS II study was a follow-up study to the MIDUS I study. The

MIDUS II study included four projects. One of the four projects was the Biomarker Project, which included a sample of $N = 201$ African Americans. The data for this study were extracted from MIDUS II and the MIDUS II Project 4 biomarker studies. A random sample was used to accurately represent the minority population of Milwaukee, Wisconsin (Ryff et al., 2021). The MIDUS II biomarker studies were conducted from 2004 to 2009. The data were initially collected for the National Survey of Midlife Development in the United States (Ryff et al., 2021). The MIDUS studies were conducted to examine the effects of behavioral, psychological, and social factors on age-related differences in the health and well-being of a representative sample of the United States (Ryff et al., 2021).

Inclusion Criteria

The participants in the Milwaukee sample ranged in age from 25 to 82 years. The areas in Milwaukee that were more densely populated with African Americans were sampled at higher rates (Ryff et al., 2021). Therefore, more participants came from areas that were densely populated by African Americans. Likewise, in the areas that had fewer African Americans, a smaller portion was sampled from those areas.

Exclusion Criteria

Non-English-speaking participants were excluded from this study as were participants who were classified or self-identified a being from a racial group other than African American or Caucasian. In addition, children, teenagers, and participants under 25 years of age were excluded from this study (Ryff et al., 2021).

Power Analysis

G*Power software was used to calculate the necessary sample size. A standard power level of .80, and a medium effect size with an alpha of .05 were used to complete the analysis (Cohen et al., 2012; Faul et al., 2007). According to the G*Power calculations, the sample size should be a minimum of 198 participants. The MIDUS II studies included a sample size of African Americans of $N = 201$. Thus, the above sample size was adequate to accommodate a power of .80 (Faul et al., 2007).

Use of Archival Data

Procedure for Gaining Access to the Data Set: All data and documentation for the MIDUS I, MIDUS II, MIDUS III, and MIDUS projects are available through the Inter-University Consortium for Political and Social Research (ICPSR). The MIDUS Milwaukee Subsample data are restricted. I was granted permission from the ICPSR University of Michigan to use these data. This Milwaukee subsample data have been de-identified to protect the identity of the participants.

Instrumentation and Operationalization of Constructs and Variables

There were nine covariates: age, bronchodilator use, education level, exercise, gender, history of asthma, total income from all sources, marital status, and smoking status. There was one dependent variable, asthma control, and one moderator variable with two forms, perceived discrimination, and lifetime discrimination; the independent variable was allostatic load, comprising 10 biomarkers. The variables came from two datasets: the African American sample of the MIDUS II and the MIDUS II biomarker study. The biomarker dataset comprised 201 African Americans who provided biological data at follow-up. Thus, there were

201 African American participants eligible for the study. The list of variables, along with their names in the dataset and the dataset from which each was extracted, is in the Appendix.

Covariates

Age: The continuous numeric variable age was determined by answers to the question, "What was your age at your most recent birthday?" Respondents were given the option to record their age or refuse to answer.

Bronchodilator Use: Bronchodilators dilate the bronchial tubes to allow for more air to enter the airways. Frequency of use was notated in the medication history of MIDUS Milwaukee subsample participants. The participants were asked whether they used bronchodilators (yes or no). Due to skip patterns, several participants had a response of not applicable. Those were recoded to no.

Education Level: Education was determined by answers to the following question: "What is the highest level of education achieved?" Possible answers to this question were as follows: (a) no school/some school (1-6 grade); (b) junior high school (7-8); (c) some high school (9-12, no diploma); (d) GED; (e) graduated from high school; (f) 1 to 2 years of college, no degree; (g) 3 or more years of college, no degree; (h) graduated from a 2 year college; (i) graduated from a 4 to 5 year college; (j) some graduate school; (k) Master's degree; (l) PhD. E.D. MD. LLB, JD; and (m) other professional degrees.

Exercise: The participants' level of exercise was assessed by the answer to, "Do you engage in regular exercise at least 20 minutes or more per week?" The exercise was a binary variable (yes or no). The answer to this question was

important as some researchers have indicated that while exercise can exacerbate asthma symptoms, lack of exercise could indicate asthma severity (Heikkinen et al., 2018).

Gender: The dichotomous variable gender was determined by answering the question, "What is your biological gender?" The respondents were requested to select male or female. Gender was an essential variable as women are more negatively impacted by severe asthma compared to men (CDC, 2021). Originally, only women were to be selected; however, due to sample size constraints, the analyses were broadened to include both men and women.

History of Asthma: Respondents were asked, "Is there a family history of asthma?" For the answer to the question, "Is there a family history of asthma?" the respondent could answer yes, no, or do not know. This question was important as researchers have found that asthma can be hereditary down from parent to child (Barnes, 2011).

Total Income from all Sources: Respondents were asked to report their income from several sources, including labor, government support, and others. Income from all sources was summed to a total income. Income was an important covariable as there is a positive relationship between poverty and asthma (Ganesh et al., 2018).

Marital Status: Marital status, which is a categorical variable, was determined by asking, "What is your current marital status?" The participants could select from the following options (a) married, (b) never married, (c) divorced, or (d) separated. This was an important question as marital status can have a positive outcome on health (Jung et al., 2018)

Smoking Status: The nominal variable was determined by the respondent's answers to the question, "Do you currently smoke cigarettes regularly?" Respondents selected either yes or no. Controlling for this allowed me to account for the possible effect of smoking on asthma control.

Predictor, Outcome, and Moderator Variables

Allostatic Load: The MIDUS researchers collected several data points that were used in the present study as biomarkers of allostatic load. The data were collected via blood tests, urine collection, and saliva samples. The MIDUS researchers obtained biomarkers from participants over 2 days. The assessments used on Day 1 were medication charts, medication history, self-administered questionnaire, Pittsburgh Sleep Questionnaire, physical exam (vitals), and 12-hour urine collection. On Day 2, 12-hour urine samples were collected, fasting blood samples were drawn, and the psychophysiology experiment protocol was given; the patient also received a short physical exam. These biomarker assessments were collected during an overnight stay at the Madison, Wisconsin location. The importance of the biomarkers project is that the results of these assessments give insight into how psychological factors impact biological dysregulation (Djuric et al., 2010). The biomarkers used in this study included cortisol, epinephrine, norepinephrine, dehydroepiandrosterone sulfate, systolic and diastolic blood pressure, waist-hip ratio, HDL, total cholesterol ratio, IgE, and glycosylated hemoglobin (Seeman et al., 2001). Higher ALI scores indicated greater psychological stress and lower scores indicated better adaption to stress (Seeman et al., 2001).

To compute allostatic load, each biomarker was first converted to a *Z*-score to put all biomarkers on the same metric (Mauss et al., 2015). The total score was then created by summing the individual *Z*-scores of the 10 biomarkers (Edes & Crewa, 2017). The higher the number, the greater the allostatic load.

Asthma Control: Progressive levels of dyspnea were used to measure asthma control. More episodes of breathlessness indicate lower asthma control. Progressive Levels of Dyspnea is a scale that was created for the MIDUS studies. Dyspnea was measured by the answers to a four-question survey. This scale was designed by looking at affirmative answers to the following questions: Do you get short of breath in the following situations: When to hurrying or ground level or walking up a slight hill, when walking with other people your age or on level ground, when walking at your own pace on level ground, and when walking or dressing? Each was coded as yes or no, and the responses were summed.

Asthma Control (PEF): PEF (in liters per minute) is a measurement used for people with asthma to determine how well their asthma is controlled. PEF measurements were assessed as part of the biomarker test of the MIDUS participants. PEF scores are obtained by using either a digital or manual PEF meter. The device is designed with a mouthpiece having a premarked tick pointer and a dial used to measure air expelled. The pointer moves according to how much air is forced from the lungs upon blowing. The digital version measures both airflow volume and velocity. The more air expelled, the greater the lung's capacity to move air in and out of the lungs. Lower readings indicate less air intake and possible bronchial obstruction, resulting in lower asthma control (NHLBI, 2013).

Participants with asthma were asked to inhale and then quickly blow out as much air as possible. The PEF was then handed to me who read and recorded their measurements. The test was performed three times on each participant to obtain the participants' best score, and that score was used for the selected variable.

Discrimination Scales

Two scales were developed by Williams et al. (1997) to measure perceived discrimination. These scales are Everyday Discrimination and Lifetime Discrimination. The EDS measures experiences of day-to-day discrimination. Williams et al. (1997) developed the EDS to detect chronic and episodic perceived discrimination. This scale consists of nine items on a 6-point Likert scale. Scores range from 1 to 4 (1= *often*, 2 = *sometimes*, 3 = *rarely*, and 4= *never*). The Lifetime Discrimination Scale measures how many times participants were treated unfairly over the course of their lifetime. This scale consists of 11 items. For both scales, a higher number reflects more experiences of discrimination. Previous studies indicated a value for Cronbach's alpha of 0.95 (Cherian et al., 2016; Clark et al., 2004; Jang et al., 2010).

Data Analysis

Research Question: Does discrimination (everyday and lifetime) moderate the relationship between allostatic load and asthma control, controlling for key covariates?

Separate regression analyses were completed for each dependent variable to determine the relationship between dependent and independent variables. Covariates included in all analyses study were age, bronchodilator use, education level,

exercise, gender, history of asthma, total income from all sources, marital status, and smoking status. The hypotheses are as follows.

H_{01}: The relationship between allostatic load, as measured by a sum of biomarkers, and asthma control, as measured by peak flow readings, is not moderated by everyday discrimination, as measured by Williams's Everyday Discrimination scale, in African Americans, while controlling for key covariates.

H_{a1}: The relationship between allostatic load, as measured by a sum of biomarkers, and asthma control, as measured by peak flow readings, is moderated by everyday discrimination, as measured by Williams's Everyday Discrimination scale, in African Americans, while controlling for key covariates.

H_{02}: The relationship between allostatic load, as measured by a sum of biomarkers, and asthma control, as measured by the level of dyspnea, is not moderated by everyday discrimination, as measured by Williams's Everyday Discrimination scale, in African Americans, while controlling for key covariates.

H_{a2}: The relationship between allostatic load, as measured by a sum of biomarkers, and asthma control, as measured by the level of dyspnea, is moderated by everyday discrimination, as measured by Williams's Everyday Discrimination scale, in African Americans, while controlling for key covariates.

H_{03}: The relationship between allostatic load, as measured by a sum of biomarkers, and asthma control, as measured by peak flow readings, is not moderated by lifetime discrimination, as measured by Williams's Lifetime Discrimination Scale, in African Americans, while controlling for key covariates.

H_{a3}: The relationship between allostatic load, as measured by a sum of biomarkers, and asthma control, as measured by peak flow readings, is moderated by lifetime discrimination, as measured by Williams's Lifetime Discrimination Scale, in African Americans, while controlling for key covariates.

H_{04}: The relationship between allostatic load, as measured by the sum of biomarkers, and asthma control, as measured by the level of dyspnea, is not moderated by lifetime discrimination, as measured by Williams's Lifetime Discrimination Scale, in African Americans, while controlling for key covariates.

H_{a4}: The relationship between allostatic load, as measured by the sum of biomarkers, and asthma control, as measured by the level of dyspnea, is moderated by lifetime discrimination, as measured by Williams's Lifetime Discrimination Scale, in African Americans, while controlling for key covariates.

Statistical Package for Social Sciences (SPSS) Version 27 was used to analyze all data. Moderation was tested using Process Macro (Hayes, 2017). The Process macro is an extension that can be added to SPSS to simplify moderation and mediation analyses. Descriptive statistics were computed for all covariate, dependent, and independent variables. Next, a simple regression was conducted to examine the covariates-only model. Finally, the process macro was used to test the moderation effect.

Threats to Validity

There are many benefits to using archival data, including convenience, no endangerment to participants, less time reviewing and obtaining data. The archival

data in the MIDUS I, II, III archival studies and projects were designed by highly esteemed scholars from diverse areas of expertise. The number of participants in these studies is quite large. Some of the studies included data from over 7,000 participants. Columb and Atkinson (2016) stated that the larger the sample, the more reliable the results tend to be. In addition, the internal consistency of the Everyday Discrimination Scale was measured by Gonzales et al. (2016) to be .83. According to Beatty Moody et al. (2016), the internal consistency of the Lifetime discrimination scale has an alpha of .91. According to Cronbach (1951), an alpha value of .70 and above is an indicator of good reliability. Data from the MIDUS studies have been used 1,250 times as of 2019 (Ryff, et al., 2021). However, there are some concerns with archival studies in the following area: No ability to followup, potential bias outcome assessment, the bias of self-identification, and alternate explanations for outcomes or associations. Cofounding errors produce significant threats to the validity of this proposed study because casual associations between the predictor and criterion variable could be related to a separate outside variable/factor (Creswell, 2017). In addition, one threat that might impact the MIDUS Studies, in particular, is the differential attrition error, which can occur in studies with multiple phases where subjects have been invited to participate in both studies but have refused (Creswell, 2017).

Ethical Procedures

All data and codebooks for the MIDUS I, II, III, Refresher, and MIDJA studies are available through the ICPSR. According to the ICPSR guidelines and policies have been put in place to ensure that data from questionnaires, face-to-face and phone interviews, medical information, medical and psychological assessments,

and statistical methods have been cleaned and screened to ensure the confidentiality and privacy of all study participants. The MIDUS data sets have been de-identified, and the researcher cannot assess any confidential attributes of the data.

These procedures instituted by ICPSR satisfy the Health and Human Services Policy regarding the protection of humans in research. According to the Office for Human Research Protection Services Advisory Committee, protective measures must be taken to ensure that identifying information is not included when collecting data from participants. If it is necessary to collect identifying information from participants, steps must be taken to keep that information private (HRPSAC, 2011; Rodriguez et al., 2003). The Institutional Review Board (IRB) approved the study (#04-20-21-0090929).

Summary

This chapter described how the MIDUS archival studies and projects were used, the research question, hypotheses, power, sample size, variables, the methodology used to guide the research, threats to validity, the IRB procedures, and the summary. In addition, this section included an overview of the data collection and data analysis procedures. Chapter 4 provides detailed information pertaining to the results of the analysis. Chapter 5 will give provide detailed information as to possible explanations for the results of the analysis.

Chapter 4 Results

The purpose of this quantitative study was to examine archival data from the MIDUS II Milwaukee study and the MIDUS Biomarker studies. Data from these studies were analyzed to ascertain if discrimination moderates the relationship

between allostatic load and asthma control (dyspnea). Asthma control was measured by examining levels of dyspnea and peak flow measurements. The research question addressed whether discrimination moderates the relationship between allostatic load and asthma control while controlling for key covariates. The following four hypotheses were tested:

Research Question: Does discrimination (everyday and lifetime) moderate the relationship between allostatic load and asthma control, controlling for key covariates?

Separate regression analyses were completed for each dependent variable to determine the relationship between the dependent and independent variables. Covariates included in all analyses study were age, bronchodilator use, education level, exercise, gender, history of asthma, total income from all sources, marital status, and smoking status. The hypotheses are as follows.

H_{01}: The relationship between allostatic load, as measured by a sum of biomarkers, and asthma control, as measured by peak flow readings, is not moderated by everyday discrimination, as measured by Williams's EDS, in African Americans, while controlling for key covariates.

H_{a1}: The relationship between allostatic load, as measured by a sum of biomarkers, and asthma control, as measured by peak flow readings, is moderated by everyday discrimination, as measured by Williams's EDS, in African Americans, while controlling for key covariates.

H_{02}: The relationship between allostatic load, as measured by a sum of biomarkers, and asthma control, as measured by the level of dyspnea, is not

moderated by everyday discrimination, as measured by Williams's EDS, in African Americans, while controlling for key covariates.

H_{a2}: The relationship between allostatic load, as measured by a sum of biomarkers, and asthma control, as measured by the level of dyspnea, is moderated by everyday discrimination, as measured by Williams's EDS, in African Americans, while controlling for key covariates.

H_{03}: The relationship between allostatic load, as measured by a sum of biomarkers, and asthma control, as measured by peak flow readings, is not moderated by lifetime discrimination, as measured by Williams's Lifetime Discrimination Scale, in African Americans, while controlling for key covariates.

H_{a3}: The relationship between allostatic load, as measured by a sum of biomarkers, and asthma control, as measured by peak flow readings, is moderated by lifetime discrimination, as measured by Williams's Lifetime Discrimination Scale,
in African Americans, while controlling for key covariates.

H_{04}: The relationship between allostatic load, as measured by the sum of biomarkers, and asthma control, as measured by the level of dyspnea, is not moderated by lifetime discrimination, as measured by Williams's Lifetime Discrimination Scale, in African Americans, while controlling for key covariates.

H_{a4}: The relationship between allostatic load, as measured by the sum of biomarkers, and asthma control, as measured by the level of dyspnea, is moderated by lifetime discrimination, as measured by Williams's Lifetime Discrimination

Scale, in African Americans, while controlling for key covariates.

This chapter contains the results of the data analysis for this study. The data analysis section includes a presentation of the results of the descriptive analyses and the results of the tests for moderation. The results are discussed in Chapter 5.

Results

Demographics

The analysis sample included $N = 201$ African American men and women who completed the MIDUS II and provided biomarker data. The average age was 50.67 years (SD = 10.59) and ranged from 34 to 82 years. The sample was mostly female (68%). This sample included 24.9% who were married. Most of the sample has at least 1 to 2 years of college (M = 6.07). Mean income was $38,859 ($SD$ = $33,891) and ranged from $0 to $218,000. Approximately 30.3% of the respondents indicated that they smoked daily. Table 2 contains basic descriptive information of the sample. According to the United States Census data (United States Census, 2021), this sample is somewhat comparable to similar characteristics of the population. Approximately 44.8% of the population is between 18 and 64 years of age. Per capita income is $34,103, and the sample has a somewhat higher education level at around 1 to 2 years of college, compared with only 32% of the population having a bachelor's degree or higher.

Table 2

Basic Demographic Information

Variable	*SD*	Mean	Min	Max	Skewness	Kurtosis
Age	10.59	50.67	34	82	.569	-.168

Education level	2.49	6.07	1	12	.659	-.194
Total oncome	33,890	38,859	0	218,000	1.602	4.02

Note. Education level: 1 = no school/some grade school (1-6), 2 = junior high school (7-8), 3 = some high school (9-12), 4 = GED, 5 = graduated from high school, 6 = 1 to 2 years of college, 8 = grad, from 2-year college, 9 = graduated from a 4 or 5 year college, or Bachelor's Degree, Master's Degree, 12 = Ph.D., Ed.D, MD, DDS, LLB, LLD, JD, or other professional, 97 = don't know.

Independent Variable – Allostatic Load

Table 3 contains basic descriptive information for the independent variables in this study. The mean systolic blood pressures of the respondents in this study were 133.66, 13.66 points above what the AMA (2018) stated is healthy. Mean diastolic blood pressure was 79.11, which is near the average of 80 mm (AMA, 2018). The average waist-hip ratio of the respondents was 89, which is close to the recommended value of 80 (see World Health Organization, 2021). Mean blood DHEA-S (ug/dL) was 103.46, which varies by age. Mean HDL cholesterol (mg/dL) for this sample was

59.22; the optimal value is greater than 60 mg/dL. The mean for total cholesterol (mg/dL) for the respondents was 183.84, below the optimal level of 200 mg/dL (Medline Plus, 2021). The mean urine cortisol was 0.96 ug/dL; normal cortisol readings vary from 10 to 55 ug/dL during the day. The mean A1c for the respondents of this study was 6.65%. According to the ADA (2018), the normal range for A1c levels is below 5.7%. The mean level for this sample for urine

epinephrine (ug/dL) was 0.16; the normal range is from 0 to .014. The mean urine norepinephrine was 2.379 ug/dL. According to University of Rochester Medical Encyclopedia (2021), the normal range is from .007 to 0.17. The respondent's average *Z* score for the allostatic load was 000. The mean daily discrimination was 14.5, and the mean lifetime discrimination was 3.05.

Table 3

Allostatic Load Variable

Variable	Mean	*SD*	Min	Max	Skewness	Kurtosis
Diastolic blood pressure	79.11	12.11	54	125	.713	.564
Systolic blood pressure	133.66	21.03	89	222	.762	1.453
DHEA-S	103.467	81.39	4.0	685.0	2.522	13.018
HDL	59.22	19.42	28	121	1.139	1.181
Total cholesterol	183.84	41.02	93	3.26	.495	.575
Cortisol	.960	.956	.019	5.5	2.291	6.540
A1C hemoglobin	6.65	1.92	3.58	19.66	3.444	15.289
Waist-hip ratio	.8913	.0953	.6477	1.29	1.360	5.123
Epinephrine	.16	.17	.02	1.2	3.120	12.436
Norepinephrine	2.38	1.97	22	14	2.652	9.765
Allostatic load *Z*-scores	4.437	.000	-8.91	12.65	.780	.316

Moderator and Dependent Variables

Table 4 contains information for the dependent and moderator variables. The mean dyspnea level was 0.93 (*SD* = 1.24), with a range from 0 to 4. The mean peak flow level was 398.72 L/min (*SD* = 110.23), with a range = 150 to 750. Mean Everyday Discrimination was 14.50 (*SD* = 6.5), with a range = 9 to 32. Mean

Lifetime

Discrimination was 3.05 (*SD* = 2.90, with a range of 0 to 11.

Table 4

Descriptive Information for Moderator and Dependent Variables

Variables	Mean	*SD*	Range
Dependent variable Dyspnea	.93	1.24	0-4
Dependent variable peak flow	398.72 l/m	110.23	150-750
Moderator variable daily discrimination	14.50	6.5	9-32
Moderator variable lifetime discrimination	3.05	2.90	.11

Table 4 provides correlations among the independent, moderator, and dependent variables. In addition, tolerance and variance inflation values were calculated to determine if multicollinearity existed between the predictor variables. Multicollinearity occurs when variables are closely correlated when one predictor variable can predict the value of another variable (Kraha, 2012; McLeod, 2019). However, based on multicollinearity statistics and the correlations noted in Table 5, multicollinearity does not exist in these data.

Table 5

Correlations Among Independent, Dependent, and Moderator Variables

Variable	Allostatic load	Dyspnea	Peak flow	Daily disc	Lifetime disc
Allostatic load	1	-.005	0.19*	113	.143
Dyspnea	-.005	1	-.234**	.031	-.002
Peak flow	.194**	- 234**	1	.081	.094
Daily discrimination	.113	.031	.081	1	.557**
Lifetime	.143*	-.002	094	.557*	1

discrimination

Results of Regression Analyses

The four regression models were tested. Only one of the tests of moderation was statistically significant; in all other models, the interaction and main effects did contribute to the variance in the dependent variables and are not reported. The following three null hypotheses must be retained.

H_{02}: The relationship between allostatic load, as measured by a sum of biomarkers, and asthma control, as measured by the level of dyspnea, is not moderated by everyday discrimination, as measured by Williams's EDS, in African Americans, while controlling for key covariates. The overall model was statistically significant, F (12, 179) = 5.13, p = <.001, R^2 = .26. However, the moderation effect was not statistically significant, B = -0.003, t = -1.17, p = .24.

H_{03}: The relationship between allostatic load, as measured by a sum of biomarkers, and asthma control, as measured by peak flow readings, is not moderated by lifetime discrimination, as measured by Williams's Lifetime Discrimination Scale, in African Americans, while controlling for key covariates. The overall model was statistically significant, F (12, 186) = 11.07, p = .13, R^2 = 42%. However, the moderation effect was not statistically significant, B = 0.69, t = 1.54, p = .13.

H_{04}: The relationship between allostatic load, as measured by the sum of biomarkers, and asthma control, as measured by the level of dyspnea, is not moderated by lifetime discrimination, as measured by Williams's Lifetime Discrimination Scale, in African Americans, while controlling for key covariates.

The overall model was not statistically significant, F (12, 182) = 5.24, $p < .001$, R^2 =26%. However, the moderation effect was not statistically significant, $B = 0.0009$, $t = 0.15$, $p = .88$.

The following null hypothesis can be rejected.

H_{01}: The relationship between allostatic load, as measured by a sum of biomarkers, and asthma control, as measured by peak flow readings, is not moderated by everyday discrimination, as measured by Williams's EDS, in African Americans, while controlling for key covariates.

The overall model was statistically significant, F (12, 183) = 11.45, $p < .001$, $R^2 = .43$. Everyday discrimination moderates the relationship between allostatic load and peak flow reading. Overall explained variance for the model summary was $R^2 = 0.43$, indicating that covariates, main effects, and interaction effects accounted for 43% variance in peak flow. Age ($B = -1.71$, $p = .008$) and gender ($B = -116.16$, $p = .000$) were the two covariates that added significantly explained variance to the model; this was also true of all other models in which the moderation effect was not statistically significant. Older age and being male were associated with lower peak flow readings. The interaction effect was also statistically significant ($B = 0.47$, $p = .028$). Thus, the null hypothesis can be rejected that everyday discrimination does not moderate the relationship between allostatic load and peak flow reading. At lower levels of discrimination, the higher allostatic load is associated with lower peak flow readings. However, at higher reported everyday discrimination, the relationship reverses: There is a positive correlation between allostatic load and peak flow. Table 6 contains the results of the test of the full model, and Figure 5 shows a graph of the interaction effect.

Table 6

Regression Results for the Test of Everyday Discrimination as a Moderator of the Relationship Between Allostatic Load and Peak Flow Readings

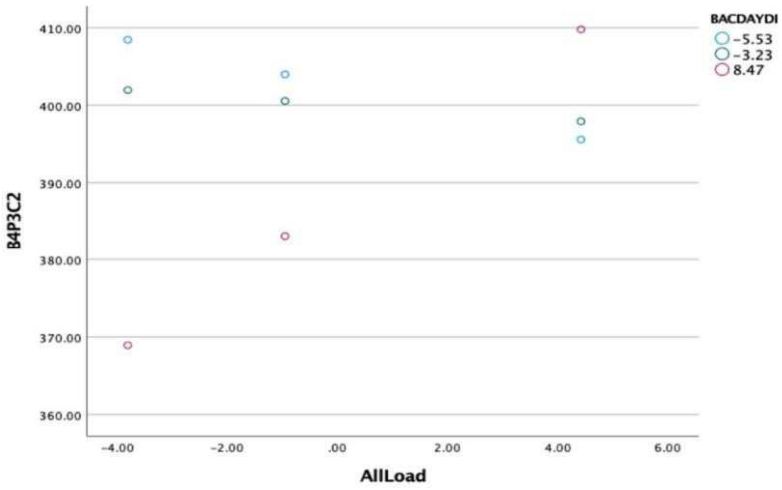
Variable	*B*	*P*	LLCI	ULCI
Age	-1.7146*	.008	-2.9797	-.4494
Education level	4.089	0.13	-46.5228	46.2524
Income	0.0004	0.08	0.0000	0.0008
Bronchodilator use	-0.1352	0.99	-46.5228	46.2524
Exercise	-14.61	0.28	-40.9405	11.7217
Gender	-116.19*	0.008	-145.7947	-86.5942
History of asthma	14.75	0.46	-24.6213	54.1173
Marital status	-3.2230	0.50	-12.5523	6.1063
Smoking status	-17.84	0.22	-46.6291	-10.9481
Allostatic load	1.0137	0.49	-1.8612	3.8886
Everyday discrimination	-1.0451	0.30	-3.0216	0.9314
Interaction	0.4663	0.028	0.0499	0.8827

Note. *B* = unstandardized regression coefficient; LLCI = Lower Limit 95% Confidence Interval; ULCI = Upper Limit 95% Confidence Interval

* = statistically significant

Figure 5

Test of the Interaction of Everyday Discrimination (Moderator) and Allostatic Load (Independent Variable)



Note. B4P3C2 = Peak Flow Reading; AllLoad = Allostatic Load; BACDAYDI = Every Discrimination.

The above statistical data indicates that Ha1, Ha2, and Ha4 are not statically significant. Asthma control is not statistically moderated by Allostatic load and Lifetime Discrimination. However, The Covariates in my study do impact the results. The two primary covariates were age and Gender. When looking at Model 3 Ha3, the relationship between Dyspnea and Peak Flow use is moderated by Everyday Discrimination, one can see that there is a significant relationship between these variables. The data and their significance will be examined in chapter 5. The implications of the test of the interaction will be explored in Chapter 5.

Chapter 5 Discussion, Conclusions, and Recommendations

The purpose of the study was to examine whether discrimination moderated the relationship between allostatic load and asthma control. Asthma control was measured using peak flow readings and levels of breathlessness (dyspnea) in the presence of everyday and lifetime discrimination as moderator variables. This study used an archival dataset that included a sample of African Americans from Milwaukee, Wisconsin. No prior studies were found that examined the impact of

discrimination in this manner on physical health. Poor asthma control is a significant burden for people with asthma; asthma control is important, as control contributes to better health and quality of life for those who suffer from this disease. The results of the tests of moderation indicated that everyday discrimination moderates the relationship between asthma control, as measured by peak flow measurement and allostatic load. In all models, including those that were not significant, males and those who were older were associated with lower peak flow readings. No other covariates or main effects were statistically significant.

Interpretation of Findings

Everyday discrimination moderated the relationship between allostatic load and peak flow reading. Variables in the model explained 43% of the variance in peak flow reading; most of the explained variance came from knowing the respondent's age and gender. In the interaction term, at higher levels of discrimination and higher levels of allostatic load, the peak expiratory flow reading was higher, which was a counterintuitive finding. GAS and allostatic load theory can provide an explanation.

According to Selye (1973), when the brain perceives a stressor, it goes through three stages, including (a) fight or flight, during which the individual recognizes a threat that results in the release of stress hormones; (b) resistance, during which hormonal chemicals that were released in the first stage are now used to resist or resolve the threat; and (c) exhaustion, during which all of the body's stress-fighting abilities have been depleted. Exhaustion leads to dysregulation and disease (Selye, 1973). According to allostatic load theory (McEwen, 2000), when the brain perceives a threat, it sends a message to the adrenal glands to release stress response hormones

into the bloodstream that will allow one to meet the challenge or threat. The initial stress hormones that are released are cortisol, epinephrine, and norepinephrine. Cortisol helps one to be more focused and alert. Epinephrine and norepinephrine work together to constrict blood vessels and increase heart rate, and they also work to dilate the bronchioles, allowing more oxygen to be taken into the lungs. The increase in oxygen allows the one in danger to be able to run for longer periods of time.

In this study, participant cortisol was well below the normal range of 10 to 45 ug/dl; the sample readings ranged from .019 to 5.54 ug/dl, with a mean of .96 ug/dl.

Such readings are too low for the first or second stages of the stress response cycle. Mean epinephrine was .16 ug/dl, substantially higher than the normal range of 0 to .014 ug/dl. Norepinephrine levels were 2.38 ug/dl and substantially higher than the normal range of .007 - .17 ug/dl. Cortisol levels were low, and epinephrine and norepinephrine levels were both elevated. One explanation is from stress response theory. Each time the brain perceives a threat, the stress response automatically begins. One of the main functions of epinephrine is to increase the lung's ability to take in more oxygen, which would account for the higher peak expiratory flow measurements at higher levels of allostatic load.

Discrimination can be considered a perceived threat. Each time an individual meets an acute stressor, such as discrimination, the stress response repeats itself, resulting in a near-constant activation of the stress response that causes dysregulation.

The lack of cortisol causes the stress response to be stuck at the resistance stage. Cortisol, when working as designed, shuts down the stress response, reduces inflammation, and helps to convert glucose into energy, control blood pressure, and to facilitate the body's natural repair abilities.

In this sample, norepinephrine and epinephrine levels were elevated, which can lead to higher blood pressure (mean level in this study was 133/79 mmHg, which is somewhat elevated compared to the normal of 120/80 mmHg), heart rate, and, thus, increased availability of oxygen. The symbiotic relationship between epinephrine, norepinephrine, and cortisol has been broken. Cortisol stores are below normal, and the result is a stress response system that can no longer repair or restore the body to homeostasis. When cortisol stores are depleted, dysregulation occurs in the stress response; it does not shut down. The body remains in a heightened sense of arousal, in anticipation of the next threat. Thus, in this way, discrimination can cause dysregulation, due to the chronic wear and tear on the stress response.

The results of this study indicated that asthma control and allostatic load are moderated by everyday discrimination. According to the stress response, chronic stressors cause dysregulation and disease (McEwen, 1998). Elevated norepinephrine and epinephrine and depleted cortisol stores are evidence of this dysregulation. According to the allostatic load theory (McEwen, 2017), this dysregulation causes wear and tear on bodily processes, which can result in death.

The other three null hypotheses were retained. Lifetime discrimination appears to not have been a factor; these indicators represent generalized

discrimination that includes many more types than race. This is an interesting finding, as discrimination based on race is clearly implicated in the findings.

Limitations of the Study

This study was limited to an archival data sample of African Americans from Milwaukee, Wisconsin, one of the most racially and politically segregated states in the country (Bailey et al., 2017). Thus, the sample in Milwaukee may not be typical of that of other major cities. This study was limited to African Americans men and women ages 25 to 82. In addition, the sample size was somewhat small at 201 participants. Originally, the study was to focus on African American women, but the sample size of women in the resulting data set was too small for meaningful analysis. Because discrimination is an issue for most, if not all, African Americans, men and women were included to create a more robust sample. MIDUS data sets could not be merged across all studies or projects to yield biomarker data for all participants who were originally oversampled to achieve a more representative sample. The MIDUS studies also only captured the experiences of African Americans born in the United States. Larger samples of African Americans in other major metropolitan areas can improve the generalizability of the findings. It is possible that the study was underpowered. The sample size was smaller than what was originally planned, but according to power analyses, the sample should have resulted from adequate power.

The study was original to be accomplished using African American women; however, both men and women needed to be included in the final sample to ensure adequate power. In order to reduce the researcher's bias, I performed three tasks, including (a) keeping the importance of honesty and integrity in research front and center, (b) using

archival data subset of the MIDUS studies that were executed in a reliable and valid way, and (c) using quantitative analysis to help establish a more objective approach to the study.

Recommendations for Research and Practice

This research has confirmed that African Americans suffer the most harm from chronic illnesses (van Eeghen et al., 2018). Future studies specifically examining how discrimination and allostatic load impact health inequalities can be beneficial in improving the health of this cohort. Education is an essential part of making progress.

It is important that clinicians educate their patients on the hazards of discrimination. In addition, equipping patients with the tools to cope with the negative effect of discrimination crucial to improving the lives of African Americans. Future studies should include a larger sample to confirm the generalizability of the findings. The original goal of the study was to examine these characteristics in African American women. However, the number of African Americans completing the biomarker study resulted in a smaller sample than anticipated. Given that gender was an important predictor, future research should focus on these differences using larger samples.

Blacks are not the only group who experience discrimination. Research studies should be conducted on other minority populations as well, such as Latinx, to examine the impact of racial discrimination on health. It would be useful to examine the impact of other forms of discrimination as well, such as those experienced by the lesbian, gay, bisexual, transgender, and queer communities, on

health. Examining the effects of discrimination on other diseases such as diabetes, obesity, and heart disease could also afford additional knowledge in this area.

Future studies can also examine the severity of chronic diseases when participants have been exposed to everyday and lifetime discrimination with clearer definitions of what is short-term versus what is long-term discrimination. Examining the impact of support systems, including marriage, on discrimination and physical health is important. In this study, no statistical association was found between lifetime discrimination as a moderator of the relationship between allostatic load and asthma control. More research is needed to ascertain the role lifetime discrimination plays in physical health. The implications for the impact of discrimination on physical health have implications for allostatic load theory and how stress mediates physical health. These implications should be explored in future analyses.

Finally, clinicians can develop tools to assess people with asthma for a better understanding of the psychological stressors that could potentially lead to worsening asthma. These tools can include specific methods to measure asthma severity; for example, the gold standard is the asthma control test. Better tools should be developed to align allostatic load variables more closely to specific diseases. Education is also an important component of treatment. Educating health care providers about the impact of discrimination on physical health is important, as this may not be widely understood. In addition, educating patients on how discrimination impacts their health can help them to learn ways to be proactive in the control of their own health in the face of discrimination.

To complement the findings of this study, further qualitative research would be useful. There is room for more understanding about the specific way's

discrimination impacts health and potentially health care access as well. Understanding the lived experiences of African Americans, combined with biomarker data, could be very useful in understanding how they manage their physical health in the face of stress resulting from discrimination.

Implications for Social Change

The results of this study emphasize the harmful effects of discrimination on psychological and physiological processes. While psychological stressors cannot be eradicated, clinicians can assess and equip their clients with coping tools to help manage chronic stressors, highlighting the role of self-awareness and selfmoderation in the control of the disease. As a researcher, I would like to sound the alarm, wake people up to the fact that yes, discrimination is morally and ethically wrong. However, there is more: Discrimination is a chronic stressor that contributes to worsening disease states and even death. Psychological stressors such as discrimination adversely impact health through the dysregulation of the stress response. This study has the potential to promote positive social change by bringing into focus the negative and harmful effects of discrimination. It may help draw practitioners away from the physiological etiology of disease to assess the psychological components as well. It is important to remind researchers and clinicians that the mind and body are intrinsically combined; what affects one impacts the other. Discrimination not only “hurts one’s feelings,” but it can also carry a significant physical health burden. The present study highlighted the importance of treating disease holistically and of acknowledging that chronic stress is the genesis of many diseases. The positive outcome is a step closer to closing the health disparity gap.

Conclusion

Grave health inequalities exist in African Americans. The purpose of this study was to elucidate one of the possible contributors to existing health inequalities in this cohort. Everyday discrimination was found to moderate the relationship between allostatic load and peak expiratory flow. Thus, chronic exposure to even what might be considered by some to be a lessor stressor -- discrimination – has the potential to increase the allostatic load and result in physical diseases, including heart attack, stroke, high blood pressure, obesity, and diabetes.

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Variable Matrix

Variable	MIDUSII Item	Notes
Variable Type		

Covariate	Age	BACRAGE 22840
Covariate	Bronchodilator use	B4XTCS_12 29282 Multum Therapeutic Sub-Class 125 - 5 bronchodilators: YES/NO?
Covariate	Education Level	BACB1 22840 Highest level of education completed 1No school/Some grade school (1-6) 2Eighth grade/junior high school
Covariate	Exercise	B4H25 29282 Keeping these definitions in mind, do you engage in regular exercise, or activity, of any type for 20 minutes or more at least 3 times/week? Y1Yes 2No
Covariate	Gender	BACRSEX 22840 Respondent Gender 1Male2Female 8Refused/Unknown
Covariate	History of Asthma	BACAS11A 22840 Asthma-Bronchitis-emphysema ever Yes/No
Covariate	Total Income	BACTINC2 22840 Household total income (wage, pension, ssi, govt asst) Mean imputed. Income in total dollars
Covariate	Marital Status	BACB19 22840 1Married/2Separated/3divorced/4widowed/5ne ver married/7don't know/8refused/9inapp
Covariate	Smoking Status	BACA39 22840 Now smoke cigarettes regularly (1Yes/2No/9Inapp
Independent Variable	Allostatic Load (10 biomarkers)	B4P1GD 29282 Average Diastolic Blood Pressure B4P1GS 29282 Average Reading Systolic Blood Pressure BACWSTHI 29282 Waist to Hip Ratio B4BDHEAS 29282 DHEAS Reading B4BHDL 29282 HDL Cholesterol Reading B4BCHOL 29282 Total Cholesterol Reading B4BCORTL 29282 Urine Cortisol B4BHA1C 29282 Blood hemoglobin a1c% B4BEPIN 29282 Urine Epinephrine (ug/dL) B4BNOREP 29282 Urine norepinephrine (ug/dL)
		BACDYSPN 22840 Progressive Levels of Dyspnea (Check to see if this is a calculated variable)
Dependent Variable	Asthma Control	B4P3C2 29282 Peak Flow: in L/min
Dependent Variable	Peak Expiratory Flow	
Moderator Variable	Everyday Discrimination Scale	BACDAYDI 22840 Daily Discrimination Moderator Lifetime BACLFEDI 22840 Summary Lifetime Discrimination Variable "Constructed variable, for details see "Documentation for Psychosocial Constructs and Composite Variables in Milwaukee 2 Project 1".

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