AN EPIDEMIOLOGIC STUDY OF COMORBID CARDIOVASCULAR DISEASE, MAJOR DEPRESSIVE DISORDER AND PERCEIVED DISCRIMINATION AMONG BLACK AMERICANS

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ABSTRACT

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While research has suggested a trend toward increased comorbidity between cardiovascular disease and major depressive disorder in Blacks, understanding this comorbid outcome in relation to perceived discrimination is lacking, with even less known about the relationship between ethnic minority subgroups. The aims of this cross-sectional analysis are to explore the association between comorbid cardiovascular disease and major depressive disorder and perceived discrimination among U.S. Blacks, and to understand differences in the strength of association between subgroups (*i.e.,* African Americans and Caribbean Blacks). Multinomial logistic regression models, were estimated using National Survey of American Life (2001-2003) Black participants, age 50 years and older (N=1,512) to study the association between perceived discrimination and comorbid CVD/MDD, MDD only, and CVD only compared to no MDD or CVD. Additional models included the interaction between perceived discrimination and ethnicity to address variations in the strength of associations by subgroups. Results indicate that each one-unit increase in perceived discrimination is significantly associated with a 70% increased risk of comorbid CVD/MDD compared to those without CVD or MDD (RRR=1.7, $p \leq 0.05$), and for each one-unit increase in perceived discrimination, African Americans have a 30% decreased risk of comorbid CVD/MDD compared to Caribbean Blacks (RRR=0.7, p=0.4). Results of this research support an association between perceived discrimination and comorbid CVD/MDD among Blacks, and motivate additional research of risk factors for U.S. Black subgroups.

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KEY TO ABBREVIATIONS

CVD/MDD	Cardiovascular disease and major depressive disorder
CVD	Cardiovascular disease
MDD	Major Depressive Disorder
AHA	American Heart Association
NHANES	National Health and Nutrition Examination Survey
BP	Blood pressure
CHD	Coronary heart disease
DSM	Diagnostic and Statistical Manual of Mental Disorders
WHO	World Health Organization
CPES	Collaborative Psychiatric Epidemiology Survey
CIDI	Composite International Diagnostic Interview
NSAL	National Survey of American Life
CV	Cardiovascular
HRQOL	Health related quality of life
NSAL	National Survey of American Life
HDL	High density lipoprotein
BMI	Body mass index
IRB	International Review Board
SES	Socioeconomic status
RRR	Relative risk ratio
FP	Fractional polynomial

CHAPTER 1. AIMS AND OBJECTIVES

The current thesis is a secondary analysis of cross-sectional data to examine the association between comorbid cardiovascular disease and major depressive disorder (CVD/MDD)[1] and perceived discrimination among Black individuals in the United States.

1.1. Among Black individuals, does perceived discrimination predict comorbid cardiovascular disease and major depressive disorder?

The public health importance of comorbid (CVD/MDD) is the large disease burden of each disease separately (1)(2), frequency of co-occurrence (3), and magnitude of those living with disability from the condition(s) (1)(2). As perceptions of racial discrimination affect the lives of Black Americans and this population is at greater risk of disease compared to White Americans (4), the extent to which discrimination predicts comorbid CVD/MDD in this population needs to be studied.

> **AIM 1.** To explore the association between comorbid cardiovascular disease and major depressive disorder and perceived discrimination among Black individuals, 50 years of age and older, in the United States.
>
> **HYPOTHESIS 1.** Among Black individuals age 50 years and older, perceived discrimination is associated with an increase in the prevalence of comorbid CVD/MDD compared to those without CVD or MDD.

[1] Cardiovascular Disease (CVD); Major Depressive Disorder (MDD)

1.2. Are there differences between subgroups of ethnic minorities?

The extent to which an individual is seen as Black in this country and perceives discriminatory treatment based on this label may not be uniform. Likewise, understanding an association of perceived discrimination and comorbid CVD/MDD may not be uniform among Black Americans is of interest, as it may point to at risk subgroups. For the purpose of this study, Black Americans refers to African Americans and Caribbean Black individuals as an aggregated minority group. In the interest of extending on previous research that has disaggregated ethnic minority groups to find subgroup associations (3), the current study will apply the same practice.

AIM 2. To explore differences in the strength of association between comorbid CVD/MDD and perceived discrimination between African American and Caribbean Black individuals, 50 years of age or older, in the United States.

HYPOTHESIS 2. There is a stronger association between perceived discrimination and comorbid CVD/MDD in African American individuals compared to Caribbean Black individuals, 50 years of age or older, in the United States.

CHAPTER 2. BACKGROUND AND SIGNIFICANCE

The purpose of the current chapter is to describe the burden of CVD and MDD and present known associations of CVD, MDD, and comorbid CVD/MDD in relation to perceived discrimination. Particular focus is made to Black individuals, signifying the importance of further study of the potential relationship between comorbid CVD/MDD and perceived discrimination.

2.1. Perceived Discrimination: Understanding Exposure

Racism encompasses the ordered categorization and the associated adverse attitudes, beliefs, and subsequent treatment towards certain groups of individuals (5). There are three levels of racism to be identified: institutionalized, personally mediated, and internalized (5). Institutionalized racism occurs at a structural level (e.g., laws, customs) in that resources and power (e.g., quality education, employment) are in disproportionate availability (5). Personally mediated racism occurs at an interpersonal level in that intentional or unintentional discrimination and prejudice cause disrespect, among other negative actions (5). Internalized racism occurs in members of the stigmatized race in that acceptance of racist acts affects their own feelings and behaviors (5). These levels are commonly referred to when discussing racism and each level has been found to be associated with health outcomes (5).

Furthermore, the manner in which racism is assessed increases the construct's complexity. Racism can be measured explicitly, that is by self-report, or implicitly, which uses sophisticated computer based timed reaction tests to measure unconscious associations (6). Both explicit and implicit measures of racism have been shown to be associated to health outcomes (6).

The current thesis will focus on explicit, personally mediated racism. While said level of racism encompasses both prejudice and discrimination, the specific interest to be studied is discrimination, which can be defined as unequal treatment based on race (5). The importance of studying discrimination is that it is still commonly experienced by Black individuals (6) and has been shown to be associated with health, such as cardiovascular and mental health (7). At the level of discrimination, the current thesis is specifically interested in perceived discrimination due to the stress that may come from applying meaning to experienced discriminatory acts based on personal and social history (4). It is the plausibly experienced stress that makes one's judgment and perception important and what potentially leads to poor health (4).

As detailed above, the conceptualizations of racism and discrimination are numerous and complex. Being that an individual's perception of discrimination is important due to the resulting stress that is experienced, perceived discrimination is a useful construct for the measurement of discrimination (4). Perceived discrimination has been defined as the unfair treatment experienced as "discourtesy, disrespect, and harassment" (8). Studying perceived discrimination can be done in terms of 1) lifetime discrimination defined as major life experiences, or 2) everyday discrimination defined as relatively minor, chronic, habitual experiences (9). The Detroit Area Study created questionnaires for each of these aspects of perceived discrimination in order to understand discrimination's potential relationship to mental and physical health (4). While some questionnaires measure perceived discrimination in the context of race, the Detroit Area Study questionnairs framed questions in the context of unfair treatment (4). An Unfair treatment context, opposed to race context, allows this questionnaire to be used for the comparison of Black and White individuals, as discriminatory treatment can be

experienced by both groups and affect health outcomes (4). Through the Detroit Area Study, both lifetime and everyday discrimination were found to be inversely associated with psychological well-being, but only everyday discrimination, measured using The Everyday Discrimination Scale, was associated with self-reported ill-health (4). Based on the consideration of perception, unfair treatment context, and assessment of everyday discrimination, The Everyday Discrimination Scale as a measure of perceived discrimination is important in studying race-related stress associated with health outcomes (4).

Review of stress and health has demonstrated chronic stressors affect both physical and mental health, with resulting effects including poor self-rated health, hypertension, psychological distress, anxiety, and depression (10). Chronic stressors can include race related stress such as discrimination, which partially explains racial health disparities (10). While stress and discrimination may be difficult to disentangle, through the following review it will become clear the importance of discrimination and the physical and mental reactivity plausibly elicited, with a potential susceptibility among Black individuals.

2.2. Cardiovascular Disease: Definitions and Disease Burden

CVD is known as disease of the heart and blood vessels, which includes a range of conditions, including atherosclerotic and hypertensive diseases (11). Myocardial infarctions and strokes largely contribute to CVD disease (11). However underlying processes, namely atherosclerosis and hypertension, can occur, leaving the disease latent in individuals and CVD surveillance difficult (11). In order to better affect prevention, detection, and treatment, surveillance has expanded CVD case definitions to include some or all CVD major risk factors. The American

Heart Association (AHA) uses the National Health and Nutrition Examination Survey (NHANES) for CVD prevalence, which currently includes myocardial infarction, angina pectoris, heart failure, stroke, and hypertension (1).

Based on the AHAs definition of CVD and known risk factors for CVD, Gonzalez & Tarraf (2013) defined CVD as the presence of diabetes, hypertension, heart disease, or stroke (3). Participant endorsement of a health care professional having reported the presence of one or more of these conditions was considered a self-reported medical history of CVD (3). Defining CVD through one or more of the risk factors/diseases (*i.e.,* hypertension, diabetes, heart disease, or stoke) is useful due to the large contribution these conditions have to CVD and to the extent to which major risk factors predict disease that may otherwise be subclinical from the inherent difficulties of studying CVD. Importantly, the current thesis study relies solely on self-reported physician diagnoses of one or more of these conditions to define CVD and will focus on the CVD case definition as defined by Gonzalez and Tarraf (2013) (3).

To better understand the general presentation of CVD, one can look at the how the AHA defines the CVD risk factors/diseases (*i.e.,* hypertension, diabetes, heart disease, or stroke). Hypertension is defined by a systolic blood pressure (BP) greater than or equal to 140 mmHg or a diastolic blood pressure greater than or equal to 90 mmHg or taking antihypertensive medication or having been told at least twice by a physician/health care professional that you have hypertension (1). Diabetes mellitus is defined as a fasting blood glucose greater than or equal to 126 mg/dL and a calibrated HbA1c level greater than or equal to 6.5% (1). Heart disease is defined as a buildup of plaque in the arteries, which can encompass several conditions, including myocardial

infarction (12). Lastly, stroke is defined as blood vessels leading to or in the brain either are blocked or burst (12). While identifying and defining CVD may have its challenges, of great public health concern is the large disease burden throughout the country and particularly for Black individuals. Among adults in the U.S., an estimated 85.6 million have at least one type of CVD (1). An estimated 15.5 and 6.6 million Americans, 20 years of age or older, have suffered from coronary heart disease (CHD) (also known as heart disease) and stroke, respectively (1). In 2013, CVD death rates were 270.6 and 356.7 per 100,000 for White and Black male Americans, respectively and 183.8 and 246.6 per 100,000 for White and Black female American, respectively (1). Diabetes mellitus and hypertension, major risk factors for CVD, are also more prevalent in Black individuals compared to Whites in America(1). Among Black individuals in the U.S. 18 years of age and older, 33% have hypertension, 15.4% have diabetes mellitus, 5.5% have coronary heart disease, and 4.0% have a history of stroke (1). CVD and the associated risk factors are largely prevalent in the U.S. and disproportionately affect Black Americans.

Primarily, CVD risk increases with age, with men and women's risk starting to increase at approximately age 45 and 55, respectively (13). Corresponding to the increased risk at middle age, CVD and many of the associated risk factors can occur around this time, making age 50 a target age in CVD study inclusion criteria (3). Considering at risk age groups and Black American's greater CVD disease burden, Black individuals age 50 years and older will be of particular interest in the current study.

2.3. Major Depressive Disorder: Definitions and Disease Burden

The Diagnostic and Statistical Manual of Mental Disorders, fourth edition (DSM-IV)[2], defines Major Depressive Disorder as having one or more Major Depressive Episodes, as the condition is episodic in nature (14). Episodes are characterized as having five or more of the following symptoms, which persist most of the day, for the majority of the days for at least two consecutive weeks: (1) depressed mood (2) lost interest/pleasure in all or most activities by self-report or observer (3) individual experiences significant change in weight (loss or gain) or appetite (decrease or increase) (4) insomnia or hypersomnia (5) psychomotor agitation or retardation by self-report or observer (6) fatigue or diminished energy (7) individual feels worthless or an excessive/inappropriate amount of guilt (8) difficult to think, concentrate, or be decisive (9) recurrent thoughts of death, suicidal ideation, or suicide attempt or plan (14). One of the five symptoms must be depressed mood or loss of interest/pleasure in all or most activities (14). In addition, the symptoms must be associated with clinically significant distress or social/occupational/other important area of functional impairment (14). Condition may not be better explained by effects of a substance, other medical condition, or bereavement (14).

In the U.S. the disease burden of MDD is substantial. An estimated 15.7 million have had at least one Major Depressive Episode in the past year with Major Depression having the largest burden of disability of all mental and behavioral disorders (2). Based on prevalence estimates from the Collaborative Psychiatric Epidemiological Surveys (CPES), 14.3% of Caribbean Blacks, 12.3% of African Americans, and 20.4% of Whites, age 18 years and older, meet criteria for lifetime

[2] Since the NSAL was conducted the DSM-V has been implemented. In the context of the current study, the only notable difference between editions is bereavement is no longer an exclusion in MDD diagnoses.

Major Depression (15). Six point seven percent of adults in the U.S. have had at least one Major Depressive Episode in the past year, with Black individuals being of higher odds of reoccurrence compared to White individuals (15).

The risk factors associated with depression have been investigated resulting in a range of individual and environment characteristics. Potential risk factors for depression include: family history, chronic conditions, stress (e.g., divorce), trauma, major life changes (e.g., financial struggles), domestic violence/abuse, female, being a homemaker, those never or previously married, low income, unemployment, disability, and living near or close to poverty (16) (17) (18). While geography has been shown to be unrelated, a study indicated those living in the Northeast or Midwest regions of the U.S. are less likely to have clinically severe MDD compared to other regions (18). Conversely, retired or Black individuals are less likely to have depression (18). Assessment of MDD using the World Health Organization (WHO) Composite International Diagnostic Interview (CIDI) has shown risk of onset is relatively low until the teen years, which then risk increases linearly (18). Also, those 30-44 and 45-59 years of age had the highest odds of meeting criteria for lifetime MDD compared to those 60 years and older (18).

For the purpose of the current thesis, certain individual characteristics are of focus. Higher odds of lifetime MDD among those of middle age (*i.e.,* 45-59) is noteworthy in that CVD primarily emerges in middle age and adults of this age are also of increased risk for disease (18). In addition, despite higher odds of lifetime MDD for Whites relative to Blacks (18), both Caribbean Black and African Americans have higher odds of recurrent MDD episodes compared to Whites (15) (18) . Based on middle age being an important time for both physical and mental health and

Blacks having higher odds of recurrent MDD, there is justification of further study of this population to better understand disease and associated determinants.

2.4. Cardiovascular Disease and Major Depressive Disorder: A Trend of Comorbidity

A growing body of work has highlighted trends toward increased comorbidity of physical and mental illness, namely MDD and CVD. From CPES data, Gonzalez and Tarraf's (2013) analysis indicated that among those 50 years of age and older who met the criteria for MDD, two thirds also reported a diagnosis of comorbid CVD (3). Additionally, among those meeting criteria for MDD, Blacks had the highest risk of meeting criteria for comorbid CVD/MDD compared to Whites (*i.e.,* larger odds ratio than that of Cubans, Puerto Ricans, and Mexicans compared to Whites) (3). Results such as this suggest that MDD and CVD largely present together and that Black individuals are a particularly high risk group among ethnic groups in the U.S. (3).

The co-occurrence of MDD and CVD is further supported by a review of the comorbid condition (19). Although confounded by the selection of clinical populations, early studies have shown that those with melancholia had higher rates of cardiovascular (CV) related deaths and that those with MDD or Manic-depressive Disease were more likely to die of CV related deaths (19). With adequate adjustment for smoking and cardiac risk factors and using community surveys, it was found that depression, measured with a hopelessness scale, was associated with myocardial infarction and CV related death (19). The association of CVD and depression persisted in studies with a particular focus on coronary heart disease (CHD), both Major and Minor Depression, congestive heart failure, and ischemic stroke (19). Aforementioned trends exemplify consistency as they span mortality and morbidity and varying degrees/forms of both CVD and MDD.

Importance of this comorbid outcome is heightened through studies addressing quality of life. In Australia, quality of life related to comorbid CVD/MDD, MDD only, CVD only, and neither MDD or CVD was investigated. Health related quality of life (HRQOL), assessing mental, physical, and social functioning dimensions of life, along with a Kessler 10 item questionnaire[3] assessing psychological distress were used (21). It was found that comorbid CVD/MDD was associated with the lowest HRQOL and had the largest percentage of psychological distress with 68.95% of those with comorbid CVD/MDD having experienced some degree (*i.e.,* moderate to high) of psychological distress (21). As MDD and CVD are highly prevalent diseases, commonly co-occur, and are associated with poor quality of life, the study of potential risk factors in Black individuals, who are seemingly more susceptible, is of epidemiologic and public health interest.

2.5. Perceived Discrimination and the Association with CVD and MDD

2.5.1. Cardiovascular Disease and Perceived Discrimination

Perceived discrimination has been shown to be associated with poor health, specifically CVD. Evidence for the relationship is demonstrated through associations of discrimination to CVD risk factors. Review suggests perceived discrimination, including both institutional and personally mediated measurements, is associated with hypertension with an effect modification showing a stronger association for males, Blacks, older individuals, and those with less education (22). While most studies researching said relationship focus on blood pressure (BP) or hypertension outcomes, ambulatory BP allows researchers to better understand BP in the natural environment. Ambulatory BP monitoring, with both walking and nocturnal measurements, in relation to

[3] A caveat to this study's interpretation is that the Kessler 10 item questionnaire's intended use is to screen for the general presence of psychological distress and does not necessarily correspond to a depression diagnosis (20).

personally mediated racism indicated perceived discrimination was associated with nocturnal BP (23). Moreover, BP dipping (*i.e.,* BP decreases from walking to nocturnal hours) was associated with an inverse association to perceived discrimination (23). Results suggest the increased risk of not having one's nocturnal BP recover due to perceived discrimination may be a link between racism and CVD (23).

Using the National Survey of American Life (NSAL) African American men in the U.S. were studied for the association between The Major Experiences of Discrimination and CVD history (*i.e.,* hypertension, atherosclerosis, heart attack, and stroke) (24). In addition, internalized racial group attitudes were measured by asking participants if they agreed with Blacks being lazy, giving up easily, or being violent (24). While the association between reporting more situations of racial discrimination and history of CVD was not significant, once negative racial group attitudes were added into the model there was a significant increase in the odds of having history of CVD (24). Moreover, African American men who reported low negative racial group attitudes, but experienced two or more experiences of racial discrimination had higher odds of CVD history (24). Those who reported no racial discrimination, but endorsed more negative racial group attitudes had higher odds of having CVD history (24). Results suggest that internalization and racial discrimination both increase the odds of CVD history among African American men (24).

However, some studies have produced inconsistent findings regarding the relationship between discrimination and CVD. Cross-sectional analysis in Boston, Massachusetts studied explicit, implicit, and institutional discrimination in relation to CVD risk (6). Explicit discrimination was

measured using both The Major Experiences of Discrimination and The Everyday Discrimination scales (4), implicit discrimination was measured using an association test, and structural racism was measured by assessing Jim Crow birthplace status (*i.e.,* born in a state with a history legal racial discrimination) (6). CVD risk was measured through systolic BP, hypertension, and the Framingham CVD 10-year risk score (*i.e.,* age, diabetes, smoking, treated and untreated blood pressure, total cholesterol, HDL cholesterol, and BMI data) (6). Findings were mixed in that among Black participants, significant associations were only seen between Jim Crow birthplace status and hypertension and explicit self-reported discrimination and Framingham 10-year risk score (6). Not all measures of discrimination were associated with increased risk of CVD, as hypothesized, but the sample was relatively unhealthier and poorer. Results from this study, although mixed, provide support for the association between racial discrimination and CVD and suggest the relationship is worth further study (6).

2.5.2. Major Depressive Disorder and Perceived Discrimination

Mental illness, specifically depression, has also been shown to be associated with discrimination. Cross-sectional analysis of working-class Black Americans examined the association between racial discrimination and psychological distress (25). Racial discrimination was measured by the validated Experiences of Discrimination questionnaire which assesses discrimination in different domains (e.g., work, medical care) (25). Psychological distress was measured by the validated Kessler six item questionnaire[4] which assessed sadness, nervousness, restlessness, hopelessness, worthlessness, or "that everything was an effort" (25). Racial discrimination was strongly

[4] Similar to a previously mentioned caveat, the Kessler six item questionnaire is intended for screening of non-specific severe mental distress, although it has been shown to be correlated with depression and moderate mental distress (25)(24).

associated with psychological distress, even after the adjustment for age, gender, unfair treatment, social desirability, poverty, and education (25). For both U.S. and foreign-born Black individuals, odds ratios after the adjustment of covariates were 6.9 for U.S. born (95% CI-1.4, 35.7) and 6.8 for foreign-born (95% CI=2.5, 18.3) suggesting a strong relationship between reported racial discrimination and psychological distress (25).

Additional research has indicated that both The Major Experiences of Discrimination and The Everyday Discrimination scales are inversely associated with psychological well-being (4).While more precisely, NSAL research has shown that among African American and Caribbean Black individuals, perceived discrimination (*i.e.,* The Everyday Discrimination scale (4)) is significantly associated with depressive symptoms (e.g., helplessness, crying) in both groups (26). The aforementioned study resulted in a similar magnitude of association for each Black subgroup, suggests that perceived discrimination is a risk factor for depressive symptoms in African Americans and Caribbean Blacks, and prompts further subgroup study (26).

2.5.3. Comorbid Cardiovascular Disease and Major Depressive Disorder and Perceived Discrimination

The independent associations between discrimination and MDD and CVD have been described above, along with mention of a trend in comorbid presentation of CVD and MDD. However, there is currently not a large body of research regarding the comorbid outcome in relation to perceived discrimination among Black Americans. Using the NSAL dataset, history of mood disorder (*i.e.,* major depression, dysthymia, or bipolar I/II) and history of cardiovascular disease (*i.e.,* hypertension, atherosclerosis, heart attack, or stroke) were studied in relation to The Major Experiences of Discrimination questionnaire (7). Among Black Americans aged 50 years and older, an association between racial discrimination and CVD was found to be effect modified by

history of mood disorder, in that it strengthened the association (7). A relationship between discrimination and comorbid CVD/MDD is suggestive of this finding, however, major events, instead of minor events of discrimination experienced chronically, were studied and mood disorders were aggregated (7). Said research provides support for a relationship between discrimination and comorbid CVD/MDD, while justifying the need for further research to investigate effects of perceived discrimination, in this case The Everyday Discrimination scale, and possible subgroup associations.

2.6. Disaggregating the Target Population

CVD, MDD, and comorbid CVD/MDD review has highlighted Black individuals as a potential at risk population. Previous research aiming at thorough investigation of comorbid CVD/MDD trends has disaggregated ethnic minority groups in order to address possible subgroup associations (3), namely Black has been disaggregated to African American and Caribbean Black ethnicities. Presently, it is unclear which ethnic minority subgroup is at greater risk for poor health outcomes, as Caribbean Blacks may have better self-rated health and life expectancy, but African Americans are of relatively lower odds for mood/anxiety disorders (27). Reasoning for differences in associations among African American and Caribbean Black ethnicities could be psychosocial (*i.e.,* socioeconomic) or behavioral factors. As low socioeconomic status is associated with poorer health outcomes and is partially responsible for health disparities (4), we would expect Caribbean Blacks' notably higher household income compared to that of African Americans' to correspond to African Americans' poorer health status (26). However, behavioral factors such as Caribbean Blacks' propensity to be unwilling to accept and/or seek mental health professionals, may lead them to be relatively more vulnerable compared to African Americans

(28). Much is to be understood of Black subgroups in terms of perceived discrimination and comorbid CVD/MDD, MDD only, and CVD only.

Support for African American's being the subgroup of greater has been observed in several studies. NSAL analysis indicated that among Black individuals 55 years of age and older, there was a stronger positive association between perceived discrimination and depressive symptoms in African Americans than of that in Caribbean Blacks (26). Examining mental illness along with chronic conditions, another NSAL study indicated that among men 45 years of age and older with mood/anxiety disorders (e.g., MDD), African Americans were of greater odds of having chronic physical health conditions (e.g., CVD) than Caribbean Blacks compared to Whites (27). Similarly, a NSAL study has shown that among those with diabetes, African Americans, but not Caribbean Blacks, with lifetime MDD were of increased odds of medical comorbidities (e.g., CVD) (29). Based on said findings, one would predict African Americans to be more susceptible to comorbid CVD/MDD given exposure to perceived discrimination.

Conversely, some evidence implies Caribbean Blacks are the higher risk subgroup compared to African Americans. In youths, it was found that although Caribbean Black and African American individuals showed no significant differences in discrimination, Caribbean Black individuals had higher levels of depressive symptoms at high levels of discrimination, suggesting this population may be more vulnerable (30). A study of Black individuals attending an urban psychiatric outpatient clinic reported that Caribbean Black were twice as likely to have a depression diagnosis compared to African Americans (31). Among Black American adults in the NSAL, Caribbean Blacks have been shown to be significantly more likely than African Americans to report a history of CVD (7). Furthermore, although a NSAL study established that among both

African Americans and Caribbean Black individuals, lifetime MDD was associated with increased odds of chronic medical condition(s) (e.g., CVD) compared to no lifetime MDD, this association was stronger for Caribbean Blacks (32). Aforementioned findings propose that Caribbean Blacks compared to African Americans would be have a stronger association between perceived discrimination and comorbid CVD/MDD.

Currently, the relationship between perceived discrimination and comorbid CVD/MDD compared to no MDD or CVD between disaggregated Black ethnicities is inconclusive. Previous studies have produced mixed findings between the associations of mental illness (e.g., depression) and chronic conditions (e.g., CVD) and discrimination in Caribbean Black compared to African American individuals. Inconsistencies in the patterns of exposure and disease among Black Americans warrant further study to understand possible at risk populations.

2.7. Significance of Current Study

Many studies have been conducted with the aim of understanding discrimination as a risk factor for MDD or CVD. However, thorough analysis on discrimination as a risk factor for comorbid CVD/MDD has not been performed. Imperative to this study is the manner in which comorbid CVD/MDD is defined and the context and level in which discrimination is measured. Furthermore, defining the analytic sample to study high risk populations and disaggregating to determine possible subgroup associations needs to be explored in order to fully understand the relationship between discrimination and comorbid CVD/MDD.

CHAPTER 3. METHODS

3.1. Data

Data and corresponding documentation, description, user-guide, and codebook information was obtained from the Collaborative Psychiatric Epidemiology Surveys (CPES) 2001-2003 [United States] (Alegria, Jackson, Kessler, & Takeuchi) provided by the Inter-University Consortium for Political and Social Research (33). All information is publicly accessible with de-identified participant data. The current thesis study has been determined not "human subjects" research, as defined by the U.S. Department of Health and Human Services regulations, and Michigan State University's International Review Board (IRB) approval was deemed unnecessary.

The National Survey of American Life (NSAL) from the CPES was the dataset used for secondary data analysis. The aim of the NSAL was to study ethnic differences associated with mental disorders and corresponding risk and protective factors. The sample was obtained using a multistage area probability design with sampling weights to account for unequal probability of selection and non-response bias to allow for population-level inferences. The sampling procedure was done through primary stage sampling of U.S. Metropolitan Statistical Areas and counties, a second stage sampling of area segments, a third stage sampling of housing units within the segments, and then the random selection of an eligible participant from the housing units. Inclusion criteria were as follows: African-American, Afro-Caribbean[5], and non-Hispanic White adults, age 18 years and older, and residing in households in the coterminous United States. Exclusion criteria were as follows: institutionalized individuals, residing on military bases, and non-English speakers. NSAL interviews were conducted between early 2001 and spring of 2003

[5] The term "Caribbean Black" will be used to reference Afro-Caribbean.

and were primarily done through the use of computer-assisted personal interviews in the homes of the participants. Approximately 14 percent of interviews were conducted partially or completely by telephone. A total of 6,199 interviews were conducted, 3,570 of which were from African American, 1,623 from Caribbean Black and 1,006 from non-Hispanic White participants. However, in the actual dataset there are 6,082 interviews due to interviews excluded for sampling errors. The overall NSAL response rate was 71.5%.

3.2. Sample

The process of identifying the analytic sample is displayed in Figure 1 (Appendix C). The NSAL (2001-2003) completed 6,082 participants, of which 3,570 were African American, 1,438 were Caribbean Black, 891 were non-Latino White, and 183 were other Hispanic participants. Inclusion criteria comprised male and female participants who reported ethnicity as African American or Caribbean Black and a current age of 50 years or older. Exclusion criteria comprised all participants who reported ethnicity as non-Hispanic White and all participants that reported current age as younger than 50 years old, regardless of ethnicity. Selection criteria resulted in a target population of 1,512 participants. Participants with missing CVD, MDD, or perceived discrimination data were then removed from the target population, which resulted in the exclusion of 89 participants. The resulting analytical sample included 1,423 participants, of which 1,057 were African American and 366 were Caribbean Black.

3.3. Measures

3.3.1. Perceived Discrimination

The exposure of interest, perceived discrimination, is a derived variable, constructed from The

Everyday Discrimination Scale created by William, Yu, Jackson, and Anderson (1997) during the 1995 Detroit Area Study. The Everyday Discrimination Scale assesses race-related stress as chronic, routine, and relatively minor day-to-day events experienced by the individual. Unlike previous research, the questions of discrimination were asked in the context of unfair treatment, as opposed to race. The Everyday Discrimination Scale's reliability and validity were assessed by Taylor, Kamarck, and Shiffman (2004). Internal consistency reliability was found to be good, which was concluded from a Cronbach's alpha of 0.80. Validity of the questionnaire was found from significant positive associations of The Everyday Discrimination Scale with perceived stress, depression, day-to-day negative affect, and social strain.

The questions were asked to the participants as follows: In your day-to-day life, how often have any of the following things happened to you? You are treated with less courtesy than other people. You are treated with less respect than other people. You receive poorer service than other people at restaurants or stores. People act as if they think you are not smart. People act as if they are afraid of you. People act as if they think you are dishonest. People act as if they are better than you. You are called names or insulted. You are threatened or harassed.

Responses to questions included: almost every day, at least once a week, a few times a month, a few times a year, less than once a year, or never, coded as five through zero, respectively. Each participant's responses were averaged (summed and divided by nine) to create a continuous exposure variable. Higher scores from The Everyday Discrimination Scale correspond to higher levels of perceived discrimination.

3.3.2. Comorbid Cardiovascular Disease and Major Depressive Disorder

The outcome of interest, comorbid CVD/MDD, is a derived variable defined using Gonzalez & Tarraf's (2013) procedure as follows: (1) Participants have a DSM-IV diagnosis of lifetime MDD with a self-reported depressive episode occurring at 50 years of age or older. (2) Participants reported a doctor or health professional diagnosed participant with one or more CVD risk factor, including diabetes, hypertension, or disease (e.g., heart disease or stroke) (3). Participants must have met both criteria, (1) and (2), to be considered diagnosed with the comorbid CVD/MDD outcome. For the purposes of comparison of contributing components of comorbid CVD/MDD three polychotomous mutually exclusive outcome levels were identified: (1) MDD only (*i.e.,* participants with MDD diagnosis, but without CVD diagnosis). (2) CVD only (*i.e.,* participants with CVD diagnosis, but without MDD diagnosis). (3) No MDD or CVD (*i.e.,* participants without MDD diagnosis and without CVD diagnosis).

CVD diagnosis is considered self-reported medical history of CVD. The measure was obtained through one or more self-reported physician diagnoses of CVD risk factors or acute CVD, including diabetes, hypertension, or disease (e.g., heart disease or stroke). While the "gold standard" of CVD is clinical evidence, based on the questionnaire nature of the cross-sectional NSAL study, self-reported physician diagnosis was used. The validity of self-report regarding CVD has been found to be questionable with disease being under-reported, with under-reporting increasing with age (34).

Lifetime MDD with a depressive episode occurring at age 50 years or older was obtained through the *Diagnostic and Statistical Manual of Mental Disorders* IV (DSM-IV), World Mental

Health (WMH)-Composite International Diagnostic Interview (CIDI) (DSM-IV WMH-CIDI) criteria (American Psychiatric Association, 2000). The WMH-CIDI is intended to produce mental disorder diagnoses based on World Health Organization International Classification of Diseases criteria through interviews conducted by trained lay persons (33). The validity of the WMH-CIDI has been found to be good due to significant associations between CIDI and clinician diagnoses (33). The MDD diagnostic algorithm used is included in Appendix C.

3.3.3. Other Variables

Third variables included in the model are as follows: age (continuous), gender (male, female), self-reported ethnicity (African American, Caribbean Black), education (<12 years, = 12 years, 12-15 years, >16 years), household income (continuous), and region of the country (Northeast, West, South, Midwest). The aforementioned third variables were included due to previous research indicating the given characteristics corresponded to differences in disease (*i.e.,* MDD, CVD) risk. Specifically, the AHA has cited increased CVD risk with increasing age, males, Black (compared to White) individuals, and lower socioeconomic status (SES) (*i.e.,* education, household income) (1). MDD research has likewise indicated MDD risk increases in middle age (*i.e.,* age of onset increases and continues linearly starting at teen years and middle age shows elevated risk), White (compared to Black) individuals, in or near poverty, and with lower levels of education (18). Region was included due to inference that perceived discrimination meaning could vary by U.S. region given the country's history of civil rights and racism. In addition, CV health is less prevalent in the South (1) and MDD has been shown to be less clinically severe in the Northeast and Midwest (18).

3.4. Statistical Analysis

The analysis was conducted using Stata 12.1 Special Edition. Stata code created by Dr. Tarraf was used with permissions. For population-level inferences survey weights were applied to descriptive and regression analyses.

Descriptive statistics of demographic characteristics were generated for the target population (N=1,512), analytic sample (N=1,423), and dropped participants (N=89). Participants dropped for missing data (N=89) and the analytic sample (N=1,423) were compared with chi-square tests on discrete variables to identify possible biases in the analytic sample. Among the analytic sample, mean perceived discrimination scores by demographic characteristics were calculated using survey weights and repeated with stratification by ethnicity. Linear regressions were used to test perceived discrimination variation between African Americans and Caribbean Blacks. Prevalence estimates and 95% confidence intervals of comorbid CVD/MDD, MDD only, CVD only, and no MDD or CVD by demographic characteristics were calculated using the analytic sample with the subpop option in Stata.

To assess the linearity assumption of the effect of perceived discrimination on outcomes, methods to scale a continuous covariate were performed. A histogram was used to assess distribution of perceived discrimination. Lowess smoothing curves comparing perceived discrimination with CVD, MDD, and comorbid CVD/MDD outcomes were created. Multivariate fractional polynomials were tested against linear specification.

To test Hypothesis 1, multinomial logistic regression models were created. Relative risk ratios

were calculated to test for associations between comorbid CVD/MDD, MDD only, and CVD only and perceived discrimination compared to no MDD or CVD. Model one tested independent main effects of perceived discrimination in relation to the outcomes, model two adjusted for age, gender, and ethnicity, and model three was further adjusted for age, gender, education, household income, and region of residence. To test Hypothesis 2, the procedure used for hypothesis one was repeated while including an interaction term for perceived discrimination and ethnicity.

CHAPTER 4. RESULTS

The results will present descriptive statistics, exposure distribution, outcome prevalence estimates, and multivariate logistic regression results.

4.1. Demographic Characteristics

Demographic characteristics of the NSAL (2001-2003) target population, analytic sample, and dropped participants are presented in Table 1 (Appendix A). The target population (N=1,512) consisted of a relatively larger proportion of females (61.8%), participants 50-64 years of age (61.0%), and African Americans (75.1%). The average household income of participants was $32,564 and with the majority having reported less than or equal to 12 years of education and residence in the southern region of the U.S. (55.6%)[6]. Obtaining the analytic sample dropped 89 participants due to missing data regarding CVD, MDD, or perceived discrimination. Dropped participants (N=89) and the analytic sample (N=1,423) did not vary significantly by most demographic characteristics, except for ethnicity and region ($p \leq 0.05$).

4.2. Perceived Discrimination

Perceived discrimination scores were averaged by demographic characteristics (Appendix A, Table 2) with a sample mean of 0.98 (SE = 0.04). Among the analytic sample, higher mean perceived discrimination scores were reported for males, participants 50-64 years of age, and participants with greater than or equal to 13 years of education. Perceived discrimination scores increased slightly with increasing household income. Of the U.S. regions, those in the south reported the lowest mean perceived discrimination score.

[6] The target population's weighted demographic characteristics are presented separately in Table 6 of Appendix B.

Mean perceived discrimination scores of African Americans and Caribbean Blacks were compared by demographic characteristics, although, ethnicity did not significantly predict mean perceived discrimination among demographic subgroups. Caribbean Black males reported lower mean perceived discrimination compared to African American males, however Caribbean Black females reported higher mean perceived discrimination compared to African American females. Within both Caribbean Black and African Americans groups, those 50-64 years of age reported higher mean perceived discrimination than those age 65+ years. Among African Americans, those with 13-15 years of education reported the highest mean perceived discrimination score, however, among Caribbean Blacks, those with greater than or equal to 16 years of education reported the highest mean perceived discrimination score. Among participants living in the South region of the U.S., Caribbean Blacks had lower mean perceived discrimination than African Americans.

4.3 Comorbid CVD/MDD, MDD only, CVD only, and No MDD or CVD

Table 3 (Appendix A) presents prevalence estimates of comorbid CVD/MDD, MDD only, CVD only, and no MDD or CVD with respect to demographic characteristics among the analytic sample. Within each demographic characteristic subgroup, the largest proportion of participants met the criteria for CVD only, followed by no MDD or CVD. Overall, 5.3% of the analytic sample met criteria for comorbid CVD/MDD. Comorbid CVD/MDD and CVD only criteria were met by a larger proportion of females than males. Both comorbid CVD/MDD and MDD only criteria were met by a larger proportion of those age 50-64 years old than those 65+. Among Caribbean Black and African Americans ethnicity, 7.1% and 5.2%, respectively met the criteria for comorbid CVD/MDD. Prevalence of CVD only decreased with education slightly, while

prevalence of no MDD or CVD increased with education slightly. Comorbid CVD/MDD had the highest prevalence in the Northeast.

4.4. Multinomial Logistic Regression Models

The linearity assumption for perceived discrimination was assessed (Table 7, Figure 2, and Figure 3; Appendices B and D). Figure 2 (Appendix D) displays a histogram with a zero "never" perceived discrimination spike, suggesting these participants may be different and contribute to a nonlinear distribution. Lowess smoothing curves (Figure 3, Appendix D) showed linearity for perceived discrimination in relation to CVD, but not MDD. Being that MDD was not the main outcome of interest this did not warrant nonlinear specification. The lowess smoothing curve of perceived discrimination in relation to comorbid CVD/MDD (*i.e.,* the main outcome of interest) did suggest nonlinear specification, yet fractional polynomial modeling (Table 7, Appendix B) demonstrated the linear model was the best fit. While categorizing perceived discrimination (Table 8, Appendix B) may have remedied the mixed findings in regards to the linearity assumption and allowed for more precise interpretation of the effect of perceived discrimination[7], small cell sizes would not permit testing of Aim 2. Thus, the linear specification of the perceived discrimination variable was used in the created multinomial logistic regression models. Relative Risk Ratios (RRR) for covariates included in each model are presented in Table 8 and Table 9 Appendix C.

[7] Based on the models using perceived discrimination as a categorical variable (Table 8, Appendix B), the effect of each unit increase of perceived discrimination on comorbid CVD/MDD, MDD only, and CVD only is not equal.

4.4.1. Aim 1: Comorbid CVD/MDD, MDD only, and CVD only and Perceived Discrimination

Multinomial logistic regression models assessed associations between comorbid CVD/MDD, MDD only, and CVD only and perceived discrimination compared to no MDD or CVD, as presented in Table 4 (Appendix A). Among the analytic sample, each one-unit increase in perceived discrimination is significantly associated with 70% increased relative risk of meeting the criteria for comorbid CVD/MDD compared to no MDD or CVD (RRR=1.7, $p \leq 0.05$). Each one-unit increase in perceived discrimination is significantly associated with approximately two times increased relative risk of meeting the criteria for MDD only compared to no MDD or CVD (RRR=2.2, $p \leq 0.05$). Although non-significant, each one-unit increase in perceived discrimination is associated with a 10% increased relative risk of meeting CVD only criteria compared to no MDD or CVD.

After adjustment for age, gender, and ethnicity, each one-unit increase in perceived discrimination is significantly associated with two times increased relative risk of meeting the criteria for comorbid CVD/MDD compared to no MDD or CVd (RRR=2.0, $p \leq 0.05$). Compared to males, perceived discrimination among females is associated with a significantly higher relative risk for meeting the criteria for comorbid CVD/MDD (RRR=4.3, $p \leq 0.05$) (Appendix C, Table 8). Each one-unit increase in perceived discrimination is significantly associated with approximately two time increased relative risk of MDD only compared to no MDD or CVD (RRR=2.1, $p \leq 0.05$). Although non-significant, each one-unit increase in perceived discrimination is associated with 20% increased relative risk of meeting CVD only compared to no MDD or CVD.

Adjustment for education, household income, region of residence, along with age, gender, and ethnicity, indicated that each one-unit increase in perceived discrimination was significantly associated with a 90% increased relative risk of meeting criteria for comorbid CVD/MDD compared to no MDD or CVD (RRR=1.9, $p \leq 0.05$). Each one-unit increase in perceived discrimination is significantly associated with approximately two times increased relative risk of meeting the criteria for MDD only compared to no MDD or CVD; RRR=2.2, $p \leq 0.05$). Compared to males, perceived discrimination among females is associated with a significantly higher relative risk for meeting the criteria for comorbid CVD/MDD (RRR=3.9, $p \leq 0.05$) (Appendix B, Table 8). Although non-significant, each one-unit increase in perceived discrimination is associated with a 20% increased relative risk of meeting CVD only compared to no MDD or CVD.

4.4.2. Aim 2: Comorbid CVD/MDD, MDD only, and CVD only and Perceived Discrimination-Ethnicity Interaction

Multinomial logistic regression models were performed to assess associations between comorbid CVD/MDD, MDD only, and CVD only and perceived discrimination-ethnicity interaction compared to no MDD or CVD (Appendix A, Table 5). Without adjustment, for each one-unit increase in perceived discrimination, African Americans significantly have nearly three times increased relative risk of meeting criteria for MDD only compared to Caribbean Blacks (RRR=2.9, $p \leq 0.05$). For each one-unit increase in perceived discrimination, African Americans have a 30 % decreased relative risk of meeting criteria for comorbid CVD/MDD compared to Caribbean Blacks, although non-significant. For each one-unit increase in perceived

discrimination, African Americans have a 40% increased relative risk of meeting criteria for CVD only compared to Caribbean Blacks, although non-significant.

Adjustment for age and gender indicate that for each one-unit increase in perceived discrimination, African Americans have nearly three times the relative risk of meeting criteria for MDD only compared to Caribbean Blacks (RRR=3.2, $p \leq 0.05$). For each one-unit increase in perceived discrimination, African Americans have a 30% decreased relative risk of meeting the criteria for comorbid CVD/MDD compared to Caribbean Blacks, although non-significant. For each one-unit increase in perceived discrimination, African Americans have 40% increased risk for meeting criteria for CVD only, compared to Caribbean Blacks, although non-significant. Adjustment for education, household income, region, along with age and gender, indicated that for each one-unit increase in perceived discrimination, African Americans have three and a half times the increased relative risk of meeting criteria for MDD only, compared to Caribbean Blacks (RRR=3.5, $p \leq 0.05$). Fully adjusted models did not change the associations between perceived discrimination-ethnicity interaction and comorbid CVD/MDD and CVD only.

CHAPTER 5. DISCUSSION

The purpose of the discussion is to interpret the analysis presented in Chapter 4, to offer explanations in the context of reviewed literature, and to review strengths and limitations of the current thesis.

5.1. Interpretations

Results indicated perceived discrimination is significantly associated with a 70% increased risk of meeting the criteria for comorbid CVD/MDD compared to no MDD or CVD, among Black NSAL participants age 50 years and older. The aforementioned relationship held, and was even strengthened, after adjustment (*i.e.,* model two: age, gender, ethnicity; model three: age, gender, ethnicity, education, household income, and region). Females have approximately four times increased risk of meeting criteria for comorbid CVD/MDD for each one-unit increase in perceived discrimination, compared to males. To address Aim 1 of the current study, results provide support for the primary hypothesis that perceived discrimination is associated with an increase in prevalence of comorbid CVD/MDD compared to no MDD or CVD.

To understand if MDD or CVD are disproportionally contributing to an association of perceived discrimination to comorbid CVD/MDD, *a priori* comparisons of MDD only and CVD only to no MDD or CVD were included in the multinomial logistic regression. Results indicate that among Black participants, perceived discrimination is significantly associated with approximately twice the risk of meeting the criteria for MDD only compared to no CVD or MDD. The significant relationship is maintained after adjustment. Although non-significant, perceived discrimination is associated with an increased risk of meeting criteria for CVD only compared to no MDD or

CVD. Based on these results, MDD only may be a more influential contributor to the relationship between perceived discrimination and comorbid CVD/MDD.

Potential subgroup associations between perceived discrimination and comorbid CVD/MDD were explored by disaggregating Black ethnicity into African American and Caribbean Black. Results suggest that for each one-unit increase in perceived discrimination, African Americans have a 30% decreased risk of meeting the criteria for comorbid CVD/MDD compared to Caribbean Blacks. In relation to Aim 2, the results do not support the hypothesis that there is a stronger association between perceived discrimination and comorbid CVD/MDD in African Americans compared to Caribbean Black individuals. Notably, said results were not found to be significant, meaning one cannot be certain if this was due to lack of power or lack of effect. As the cell size of participants meeting comorbid CVD/MDD criteria was small (n= 67) and was then stratified by ethnicity, it is likely the results were non-significant due to lack of power. Despite the assumption that the study was underpowered, results should be interpreted with caution.

For each one-unit increase in perceived discrimination, African Americans are nearly three times more likely to meet criteria for MDD only compared to Caribbean Blacks. The significant relationship holds even after adjustment. For each one-unit increase in perceived discrimination, African Americans have a 30% increased risk of meeting the criteria for CVD only compared to Caribbean Blacks. From these findings, one can reason that African Americans are of increased risk of MDD or CVD only given perceived discrimination compared to Caribbean Blacks, but are less likely to meet criteria of the comorbidity.

5.2. Support and Explanations

From the knowledge gathered from literature review, the relationship between perceived discrimination and comorbid CVD/MDD has not been largely studied. However, results of the current thesis are consistent with known previous research in terms of the comorbid presentation of MDD and CVD and discrimination as an associated exposure. Using the same case definitions as the current study, CPES cross-sectional analysis indicated that among individuals age 50 years and older meeting the criteria for MDD, Blacks were the most likely ethnicity to meet criteria for comorbid CVD/MDD compared to non-Latino Whites (3). Another study indicated that among those with a history of mood disorder, including major depression, experiencing high levels of racial discrimination has been associated with an increased risk of CVD compared to those who reported experiencing no racial discrimination (7). The abovementioned findings, along with the current thesis, point to the importance of those meeting criteria for MDD, as these individuals may be prone to reporting history of CVD, with perceived discrimination a likely determinant.

A possible mechanism linking MDD, CVD, and perceived discrimination is the sympathetic nervous system. As research has continued to support the association between MDD and CVD, exploratory analysis among those with MDD was conducted to understand if a subtype of depression was responsible for the association due to the heterogeneity of MDD symptoms (35). Analysis suggested that among those with MDD, cardiac disease was associated with symptoms of sympathetic arousal (*i.e.,* palpitations, tremors, blurred vision, tinnitus, or increased sweating, dyspnea, hot/cold flashes, chest pain) (35). Thus, those with MDD may be susceptible to CVD through sympathetic arousal (35). Furthermore, stress from environmental exposures such as racism, can induce sympathetic arousal, which if sustained may lead to CVD (e.g., hypertension)

(36). Based on the aforementioned premises, it may follow that among those with MDD there is a susceptibility to CVD, which be activated through environmental stress, such as perceived discrimination.

Additionally, results of the current thesis indicate that given exposure to perceived discrimination, African Americans are of decreased risk of meeting the criteria for comorbid CVD/MDD compared to Caribbean Blacks. While literature supports associations between mental and physical illness in Caribbean Black individuals (7) (31) (32), the relationship between comorbid CVD/MDD and perceived discrimination among Black ethnicities has not been thoroughly studied. NSAL data was used is a comparable study to conclude that in the positive association between mood disorder (e.g., major depression) and racial discrimination (*i.e.,* Major Experiences of Discrimination) in predicting CVD history, Caribbean Blacks were of increased risk compared to African Americans (7). While this study differs in the chosen constructs, it provides support for the findings that African Americans are of decreased risk of meeting the criteria for comorbid CVD/MDD given discrimination compared to Caribbean Blacks.

If in fact, African American individuals are of decreased risk of comorbid CVD/MDD given perceived discrimination compared to Caribbean Black individuals, a behavioral mechanism may explain this relationship. It possible that both African Americans and Caribbean Blacks are of comparable risk for comorbid CVD/MDD given perceived discrimination exposure, yet different health treatment leads to differences in comorbidity. It has been shown that although lifetime MDD prevalence rates are similar for both African Americans and Caribbean Blacks, of those who meet criteria, fewer Caribbean Blacks than African Americans receive any form of

treatment (37). Additionally, Caribbean Blacks may not be as accepting of mental health treatment as African Americans (28). As a result of potential differences in treatment for mental illness, such as MDD, Caribbean Blacks may have higher rates of comorbid CVD/MDD.

5.3. Strengths and Limitations

Several strengths of the current thesis suggest the findings to be meaningful. The NSAL is a nationally representative sample, which includes both African American and Caribbean Black ethnic minorities, thus increasing the generalizability of the large psychiatric epidemiology survey. Also, the chosen outcome and exposure constructs, comorbid CVD/MDD and perceived discrimination, have been used by previously published work (3)(4), with perceived discrimination having been validated (9). The constructs, along with the relatively small and unbiased dropped group of missing data (N=89), increase the internal validity of the analysis.

There are limitations to consider in the interpretation of the present study. First, there was a limited number of cases of comorbid CVD/MDD (n=67) and even smaller cell sizes when the sample was disaggregated into Caribbean Black and African American ethnicities. Although it was possible to preform analysis with the limited number of cases, results may not be reliable and be responsible for non-significant findings regarding hypothesis two. Likewise, missing data regarding CVD, MDD, or perceived discrimination excluded 89 individuals. While comparisons of demographic characteristics between dropped participants and the analytic sample did not indicate bias, it is possible that missing information did not occur at random due to the sensitive subject matter of both the exposure and outcome(s). Second, given the cross-sectional design of the study, the data and resulting inferences are slightly restricted. There may be questions in the

validity of the self-report survey data regarding physician diagnosed history of CVD. However, the validity of self-report CVD data has been shown to be under-reported, with under-reporting increasing with age. Thus, the results may present conservative estimates. Similarly, MDD diagnosis validity could be of question, however, the CIDI has been shown to have strong validity due to significant associations with clinician diagnoses (33). In addition, cross-sectional analysis does not allow causal inference, due the inability to establish temporality. In this sense, one cannot be certain perceived discrimination preceded MDD, CVD, or the comorbid condition. Despite this limitation, defining MDD with both lifetime MDD and a depressive episode at 50 years or older, strengthens the conjecture of MDD comorbidly presenting with CVD, as a middle age depressive episode and increased risk of CVD become more likely to coexist. Third, the MDD definition of both lifetime MDD and a depressive episode at 50 years or older may be somewhat restrictive in that it is possible participants who are 50 years of age have not had a chance to have a depressive episode and/or that a depressive episode occurred at age 49 years of age. Potentially, the subgroups of comorbid CVD/MDD and MDD only may not be representative of individuals with MDD occurring at middle age due to depressive episode cut-point at 50. From the aforementioned limitation, individuals who in actuality have comorbid CVD/MDD or MDD only would be categorized as CVD only or no MDD or CVD. With the majority of the analytic sample being 50-64 years of age (61.6%), it is possible effects of this age limitation could occur, which would likely bias the results toward the null. Fourth, DSM-IV definitions were used to diagnose MDD, however the current edition of the DSM (IV) differs in the diagnosis did not exclude bereavement. Therefore, by current standards comorbid CVD/MDD and MDD only cases could be underestimated through the exclusion of bereavement. Despite the limitations, the study provides important information regarding the

association between comorbid CVD/MDD and perceived discrimination among Black Americans 50 years of age and older.

Also worth mentioning is that the current thesis may be limited by the extent to which personally mediated and internalized racism can be disentangled. As one's judgement and perception of discriminatory acts have been cited as meaningful in the corresponding stress experienced and subsequent health outcomes (4), it becomes uncertain the role of internalized feelings and behaviors. Conceptually, personally mediated and internalized racism may not be mutually exclusive.

5.4. Conclusion

The current thesis addresses the association between comorbid CVD/MDD and perceived discrimination among Black Americans, with attention paid to MDD only and CVD only outcomes and African American and Caribbean Black ethnic subgroups. While associations between discrimination and MDD and CVD may be established, a limited amount of research has investigated comorbid CVD/MDD and perceived discrimination, specifically. Results suggest that perceived discrimination increases the risk of meeting criteria of comorbid CVD/MDD compared to no MDD or CVD. Moreover, the current thesis provides a significant contribution to the disaggregated study of ethnic minorities. While much of the previous research conducted treats Black Americans as a homogenous group, the current study suggests African Americans have a decreased risk of meeting the criteria of comorbid CVD/MDD than Caribbean Blacks. Research of this nature is important as the disease burden of MDD and CVD are substantial in the United States and trends in increased comorbidity highlight Black Americans

as an at risk population. Future studies must be done to further understand the association between comorbid CVD/MDD, with cohort studies being an important next step in order to establish temporality of perceived discrimination and MDD, CVD, and comorbid CVD/MDD. Likewise, if Caribbean Blacks are more susceptible to comorbid CVD/MDD given perceived discrimination, future studies may further disaggregate Caribbean Black into Haitian, Jamaican, and Trinidadian subgroups. Understanding nativity, culture, and health related behavior should also be investigated in the potential relationship between perceived discrimination and comorbid CVD/MDD. As Black individuals have been identified as an at risk population for comorbid CVD/MDD, which has a substantial disease burden in the U.S., perceived discrimination as a determinant has important public health implications in both mental and physical health of these individuals.

APPENDICES

APPENDIX A

Tables

Table 1. Unweighted demographic characteristics among National Survey of American Life (2001-2003) Black participants, age ≥ 50 years, in the United States

Demographic Characteristics	Target Population N=1,512 n (%)	Analytic Sample N=1,423 n (%)	Dropped Participants N=89 n (%)	p-value[b]
Gender				
Males	578 (38.2)	548 (38.5)	30 (33.7)	0.366
Females	934 (61.8)	875 (61.5)	59 (66.3)	
Age (years)	62.6 (9.9)[a]	62.5 (9.8)[a]	65.2 (10.2)[a]	0.011[c]
50-64	922 (61.0)	876 (61.6)	46 (51.7)	0.064
65+	590 (39.0)	547 (38.4)	43 (48.3)	
Ethnicity				
Caribbean Black	377 (24.9)	366 (25.7)	11 (12.4)	0.005
African American	1,135 (75.1)	1,057 (74.3)	78 (87.6)	
Education (years)				
0-11	551 (36.4)	518 (36.4)	33 (37.1)	0.689
12	474 (31.4)	422 (31.1)	32 (36.0)	
13-15	229 (15.2)	218 (15.3)	11 (12.4)	
≥ 16	258 (17.1)	245 (17.2)	13 (14.6)	
Household income	32,564 (31,725)[a]	32,904 (32,160)[a]	27,142 (23,170)[a]	0.097[c]
$0-49,999	1,208 (79.9)	1,128 (79.3)	80 (89.9)	0.109
$50,000-99,999	234 (15.5)	227 (16.0)	7 (7.9)	
$100,000-149,999	48 (3.1)	47 (3.3)	1 (1.1)	
$150,000-200,000	22 (1.4)	21 (1.5)	1 (1.1)	
Region				
Northeast	390 (25.8)	379 (26.6)	11 (12.4)	< 0.001
Midwest	210 (13.9)	182 (12.8)	28 (31.5)	
South	840 (55.6)	792 (55.7)	48 (53.9)	
West	72 (4.8)	70 (4.9)	2 (2.2)	

Target population (N=1,512) includes those individuals who self-identified their ethnicity as Caribbean Black or African American, with a current age of ≥50 years.
Analytic sample (N=1,423) is exclusive of participants with missing data for MDD, CVD, or perceived discrimination.
[a] Presented as mean (standard deviation).
[b] Chi-square tests performed to test independence between analytic sample selection and each demographic characteristic to assess potential bias.
[c] In the case of mean (standard deviation), two sample t-tests were performed to compare mean differences between the analytic sample (N=1,423) and the dropped participants (N=89) to assess potential bias.

Table 2. Weighted mean perceived discrimination score by demographic characteristics among National Survey of American Life (2001-2003) Black participants, age ≥ 50 years, the United States

Demographic Characteristics	Analytic Sample N=1,423 Mean (SE)	African American N=1,057 Mean (SE)	Caribbean Black N=366 Mean (SE)	p-value[a]
Sample	0.98 (0.04)	0.98 (0.04)	0.98 (0.12)	0.994
Gender				
Males	1.14 (0.06)	1.15 (0.06)	1.02 (0.18)	0.520
Females	0.86 (0.04)	0.86 (0.04)	0.94 (0.08)	0.354
Age (years)				
50-64	1.14 (0.05)	1.14 (0.05)	1.15 (0.21)	0.991
65+	0.72 (0.05)	0.72 (0.05)	0.69 (0.14)	0.836
Education (years)				
0-11	0.95 (0.06)	0.94 (0.07)	1.03 (0.13)	0.547
12	0.90 (0.06)	0.90 (0.06)	0.80 (0.15)	0.522
13-15	1.11 (0.07)	1.12 (0.07)	0.93 (0.15)	0.263
≥ 16	1.10 (0.07)	1.09 (0.07)	1.12 (0.32)	0.917
Household Income				
$0-49,999	0.93 (0.04)	0.94 (0.05)	0.82 (0.07)	0.150
$50,000-99,999	1.12 (0.06)	1.11 (0.07)	1.17 (0.13)	0.701
$100,000-149,999	1.23 (0.21)	1.19 (0.10)	1.36 (0.76)	0.821
$150,000-200,000	1.23 (0.13)	1.23 (0.14)	0.97 (0.16)	0.223
Region				
Northeast	1.00 (0.05)	0.99 (0.06)	1.03 (0.09)	0.749
Midwest	1.10 (0.08)	1.09 (0.08)	1.51 (0.43)	0.353
South	0.89 (0.05)	0.89 (0.05)	0.76 (0.09)	0.191
West	1.31 (0.13)	1.33 (0.12)	1.10 (0.71)	0.755

Sampling weights have been applied to all perceived discrimination means in order to derive population level inference.

Perceived discrimination for each participant was derived by calculating a mean score for The Everyday Discrimination Scale, a 9-item questionnaire assessing frequency of perceived discrimination. Perceived discrimination, by demographic characteristics, were calculated by averaging participants' perceived discrimination mean, by demographic subgroups.

[a] P-values correspond to linear regression coefficients of ethnicity (*i.e.,* African Americans compared to Caribbean Black reference groups) in relation to perceived discrimination outcome, by demographic subgroup (e.g., gender).

Table 3. Comorbid CVD/MDD, MDD only, CVD only, and no CVD or MDD prevalence by demographic characteristics among National Survey of American Life (2001-2003) Black participants, age ≥ 50 years, in the United States

Demographic Characteristics	Comorbid CVD/MDD N=67 Proportion (95% CI)	MDD only N=24 Proportion (95% CI)	CVD only N=882 Proportion (95% CI)	No MDD or CVD N=450 Proportion (95% CI)
	5.3 (3.9, 6.7)	1.5 (1.0, 2.1)	63.8 (60.0, 67.7)	29.3 (26.0, 32.6)
Gender				
Males	2.7 (0.9, 4.4)	2.0 (0.6, 3.5)	62.8 (57.3, 68.2)	32.5 (27.6, 37.5)
Females	7.4 (5.1, 9.6)	1.1 (0.4, 1.8)	64.7 (59.4, 70.0)	26.8 (22.2, 31.5)
Age (years)				
50-64	6.0 (4.0, 8.0)	2.2 (1.3, 3.1)	58.5 (53.7, 63.3)	33.2 (29.0, 37.5)
65+	4.0 (2.3, 5.8)	0.4 (-0.1, 0.8)	72.7 (68.4, 77.0)	22.9 (18.4, 27.4)
Ethnicity				
Caribbean Black	7.1 (-0.9, 15.2)	1.8 (-0.2, 3.8)	60.3 (52.9, 67.7)	30.8 (26.5, 35.1)
African American	5.2 (3.8, 6.6)	1.5 (0.9, 2.1)	64.1 (60.1, 68.1)	29.3 (25.8, 32.7)
Education (years)				
0-11	6.0 (3.6, 8.4)	1.0 (0.2, 1.9)	68.5 (62.7, 74.4)	24.5 (19.1, 29.8)
12	4.0 (1.3, 6.6)	1.9 (0.2, 3.5)	62.9 (57.4, 68.3)	31.3 (26.5, 36.0)
13-15	5.0 (2.1, 7.8)	1.3 (-0.4, 3.0)	62.6 (52.5, 70.7)	32.2 (22.5, 41.8)
≥ 16	6.6 (2.1, 11.1)	2.1 (-0.3, 4.6)	58.2 (49.3, 67.1)	33.1 (24.1, 42.1)
Household Income				
$0-49,999	5.7 (4.1, 7.3)	1.5 (1.0, 2.1)	64.9 (61.5, 68.3)	27.9 (24.8, 31.0)
$50,000-99,999	3.8 (0.5, 7.2)	1.4 (-0.1, 2.9)	60.0 (49.9, 70.0)	34.8 (24.4, 45.2)
$100,000-149,999	6.8 (-3.8, 17.3)	0	60.8 (43.8, 78.9)	32.4 (16.8, 48.0)
$150,000-200,000	0	6.0 (-3.7, 15.7)	66.8 (42.6, 91.1)	27.2 (5.17, 49.1)
Region				
Northeast	8.0 (3.7, 12.3)	1.3 (-0.2, 2.9)	59.2 (49.1, 69.3)	31.4 (24.7, 38.2)
Midwest	6.2 (1.4, 10.9)	1.8 (0.0, 3.6)	64.5 (56.0, 73.0)	27.5 (20.4, 35.6)
South	4.2 (2.6, 5.8)	1.6 (1.0, 2.3)	64.2 (60.1, 68.3)	30.0 (26.0, 39.4)
West	5.0 (-1.8, 11.7)	0.7 (-0.6, 2.0)	69.4 (53.3, 85.5)	24.9 (10.4, 39.4)

Sampling weights have been applied to all prevalence estimates for the sample (N=1,423) in order to derive population level inference.
CVD is defined as history of cardiovascular disease by self-reported health professional diagnosis of hypertension, diabetes, heart disease, or stroke.
MDD is defined as WMH-CIDI diagnosis of lifetime major depression with a depressive episode occurring at age ≥ 50 years.

Table 4. Associations between comorbid CVD/MDD, MDD only, CVD only and perceived discrimination compared to no CVD or MDD among National Survey of American Life (2001-2003) Black participants, age ≥ 50 years, in the United States

	Model 1[a]		Model 2[b]		Model 3[c]	
	RRR[d] (95% CI)	p-value	RRR[d] (95% CI)	p-value	RRR[d] (95% CI)	p-value
Comorbid CVD/MDD	1.7 (1.2, 2.5)	0.005	2.0 (1.3, 3.0)	0.003	1.9 (1.2, 2.9)	0.007
MDD only	2.2 (1.4, 3.5)	0.001	2.1 (1.3, 3.6)	0.005	2.2 (1.2, 4.1)	0.013
CVD only	1.1 (0.9, 1.3)	0.635	1.2 (0.9, 1.5)	0.148	1.2 (0.9, 1.5)	0.233

Results from multinomial logistic regression models using the analytic sample (N=1,423).
No MDD or CVD is the reference group for comorbid CVD/MDD, MDD only, or CVD only.
[a]Model 1: unadjusted.
[b]Model 2: adjusted for age, gender, and ethnicity.
[c]Model 3: adjusted for age, gender, ethnicity, education, household income, and region.
[d]RRR presented is for perceived discrimination term.
Age and household income are modeled as continuous variables.

Table 5. Associations between comorbid CVD/MDD, MDD only, CVD only and perceived discrimination with Black ethnicity interaction compared to no CVD or MDD among National Survey of American Life (2001-2003) Black participants, age ≥ 50 years, in the United States

	Model 1[a]		Model 2[b]		Model 3[c]	
	RRR[d] (95% CI)	p-value	RRR[d] (95% CI)	p-value	RRR[d] (95% CI)	p-value
Comorbid CVD/MDD	0.7 (.3, 1.6)	0.357	0.7 (0.3, 1.8)	0.483	0.7 (0.3, 1.7)	0.362
MDD only	2.9 (1.4, 5.9)	0.004	3.2 (1.4, 7.6)	0.008	3.5 (1.4, 8.7)	0.007
CVD only	1.3 (0.6, 2.8)	0.476	1.4 (0.6, 3.0)	0.426	1.4 (0.7, 2.9)	0.385

Results are from multinomial logistic regression models using the analytic sample (N=1,423).
No MDD or CVD is the reference group for comorbid CVD/MDD, MDD only, or CVD only.
All models included interaction term between perceived discrimination and ethnicity, along with perceived discrimination and ethnicity main effect terms.
[a]Model 1: unadjusted
[b]Model 2: adjusted for age and gender
[c]Model 3: adjusted for age, gender, education, household income, and region
[d]RRR presented is for perceived discrimination ethnicity interaction term.
Age and household income are modeled as continuous variables.

APPENDIX B

Supplemental Tables

Table 6. Weighted demographic characteristics among National Survey of American Life (2001-2003) target population of Black participants, age ≥ 50 years, in the United States

Demographic Characteristics	Target Population N=1,512 Proportion
Gender	
Males	44.1
Females	55.9
Age (years)	
50-64	62.5
65+	37.5
Ethnicity	
Caribbean Black	5.7
African American	94.3
Education (years)	
0-11	35.0
12	31.3
13-15	16.6
≥ 16	17.0
Household income	
$0-49,999	75.5
$50,000-99,999	18.4
$100,000-149,999	4.0
$150,000-200,000	2.1
Region	
Northeast	18.2
Midwest	16.8
South	55.3
West	9.8
Target Population (N=1,512) includes participants that reported ethnicity as Caribbean Black or African American and current age ≥ 50 years.	

Table 7. Fractional polynomial model selection procedure for the National Survey of American Life (2001-2003) target population of Black participants, age ≥ 50 years, in the United States

Variable	Model (vs.)	Deviance	Deviance difference	P-value	Powers (vs.)
Perceived discrimination	Linear FP2	2,456.0	4.6	0.461	1 1, 3
	Final	2,456.0			1
Fractional polynomial model tests perceived discrimination as fractional polynomials against a linear model of perceived discrimination. FP=fractional polynomial.					

Table 8. Associations between comorbid CVD/MDD, MDD only, CVD only and categorized perceived discrimination compared to no CVD or MDD among National Survey of American Life (2001-2003) Black participants, age ≥ 50 years, in the United States

	Model 1[a]	Model 2[b]	Model 3[c]
Perceived Discrimination	RRR[d] (95% CI)	RRR[d] (95% CI)	RRR[d] (95% CI)
Comorbid CVD/MDD			
Moderate	1.6 (0.9, 2.7)	1.9* (1.1, 3.2)	1.7 (1.0, 3.0)
High	3.4* (1.3, 9.0)	4.2* (1.5, 11.5)	3.7* (1.3, 10.1)
MDD Only			
Moderate	1.0 (0.3, 3.7)	0.7 (0.2, 2.8)	0.8 (0.2, 3.3)
High	9.1* (1.9, 43.2)	6.8* (1.6, 29.6)	7.4* (1.4, 38.7)
CVD Only			
Moderate	1.2 (0.9, 1.6)	1.4* (1.1, 1.9)	1.4* (1.1, 2.0)
High	0.9 (0.5, 1.8)	1.1 (0.6, 2.1)	1.1 (0.6, 2.0)

*p≤0.05
Results are from multinomial logistic regression models performed with the analytic sample (N=1,423).
No CVD or MDD is the reference group for comorbid CVD/MDD, MDD only, or CVD only.
Low perceived discrimination exposure is the reference group for perceived discrimination exposure.
[a]Model 1: unadjusted
[b]Model 2: adjusted for age, gender, and ethnicity
[c]Model 3: adjusted for age, gender, ethnicity, education, household income, and region
[d]RRR presented is for perceived discrimination term.
Age and household income are in models as continuous variables.

Table 9. Associations between comorbid CVD/MDD, MDD only, CVD only and perceived discrimination compared to no CVD or MDD among NSAL (2001-2003) Black participants, age ≥ 50 years, in the United States

	Model 1[a]		Model 2[b]		Model 3[c]	
	RRR[d]	95% CI	RRR[d]	95% CI	RRR[d]	95% CI
Comorbid CVD/MDD						
Perceived Discrimination	1.7*	1.2, 2.5	2.0*	1.3, 3.0	1.9*	1.2, 2.9
Age			0.99	1.0, 1.0	1.0	0.9, 1.0
Gender Male			ref		ref	
Female			4.3*	1.8, 10.4	3.9*	1.7, 9.0
Ethnicity Caribbean Black			ref		ref	
African American			0.7	0.2, 2.1	0.8	0.2, 2.5
Education (years) 0-11					ref	
12					0.5	0.2, 1.3
13-15					0.6	0.2, 1.6
≥16					1.1	0.5, 2.5
Household Income					1.00	
Region Northeast					ref	
Midwest					1.0	0.3, 2.8
South					0.6	0.2, 1.3
West					0.8	0.2, 4.1
MDD only						
Perceived discrimination	2.2*	1.4, 3.5	2.1*	1.3, 3.6	2.2*	1.2, 4.1
Age			0.9	0.8, 1.0	0.9	0.8, 1.0
Gender Male			ref		ref	
Female			1.0	0.3, 2.8	1.1	0.3, 3.5
Ethnicity Caribbean Black			ref		ref	
African American			0.8	2.6	0.6	0.2, 2.4
Education (years) 0-11					ref	
12					1.4	0.4, 5.8
13-15					0.7	0.2, 2.3
≥16					1.1	0.1, 11.5
Household Income					1.00	
Region Northeast					ref	
Midwest					1.8	0.2, 14.1
South					1.5	0.3, 8.8
West					0.6	0.1, 5.3

* p≤0.05
Results are from multinomial logistic regression models using the analytic sample (N=1,423).
No MDD or CVD is the reference group for comorbid CVD/MDD, MDD only, and CVD only.
[a]Model 1: unadjusted
[b]Model 2: adjusted for age, gender, and ethnicity
[c]Model 3: adjusted for age, gender, ethnicity, education, household income, and region of country
[d]RRR presented is for perceived discrimination term.

Table 9 (cont'd)

	Model 1[a]		Model 2[b]		Model 3[c]	
	RRR[d]	95% CI	RRR[d]	95% CI	RRR[d]	95% CI
CVD only						
Perceived Discrimination	1.1	0.9, 1.3	1.2	0.9, 1.5	1.2	0.9, 1.5
Age			1.0*	1.0, 1.0	1.0*	1.0, 1.0
Gender Male			ref		ref	
Female			1.3	0.9, 1.8	1.3	0.9, 1.8
Ethnicity Caribbean Black			ref		ref	
African American			1.1	0.8, 1.4	1.0	0.7, 1.5
Education (years) 0-11					ref	
12					0.8	0.5, 1.1
13-15					0.7	0.4, 1.2
≥16					0.6	0.4, 1.0
Household Income					1.00	
Region Northeast					ref	
Midwest					1.3	0.8, 2.1
South					1.1	0.7, 1.8
West					1.6	0.6, 4.0

* p≤0.05
Results are from multinomial logistic regression models using the analytic sample (N=1,423).
No MDD or CVD is the reference group for comorbid CVD/MDD, MDD only, and CVD only.
[a]Model 1: unadjusted
[b]Model 2: adjusted for age, gender, and ethnicity
[c]Model 3: adjusted for age, gender, ethnicity, education, household income, and region of country
[d]RRR presented is for perceived discrimination term.

Table 10. Associations between comorbid CVD/MDD, MDD only, CVD only and perceived discrimination with Black ethnicity interaction compared to no CVD or MDD among NSAL (2001-2003) Black participants, age ≥ 50 years, in the United States

	Model 1[a]		Model 2[b]		Model 3[c]	
	RRR[d]	95% CI	RRR[d]	95% CI	RRR	95% CI
Comorbid CVD/MDD						
Perceived Discrimination	2.5*	1.2,5.2	2.6*	1.2, 5.5	2.8*	1.2, 6.2
Perceived Discrimination x Ethnicity	0.7	0.3, 1.6	0.7	0.3, 1.8	0.7	0.3, 1.7
Ethnicity Caribbean Black	ref		ref		ref	
African American	1.50	0.4, 6.0	1.3	0.3, 5.3	1.6	0.4, 6.6
Age			1.0	1.0, 1.0	1.0	0.9, 1.0
Gender Males			ref		ref	
Females			4.3*	1.8, 10.4	3.8*	1.6, 9.0
Education (years) 0-11					ref	
12					0.5	0.2, 1.3
13-15					0.6	0.2, 1.6
≥16					1.1	0.5, 2.6
Household Income					1.0*	1.0, 1.0
Region Northeast					ref	
Midwest					0.9	0.3, 2.8
South					0.6	0.2, 1.3
West					0.8	0.2, 4.2
MDD only						
Perceived discrimination	0.8	0.5, 1.3	0.7	0.4, 1.4	0.7	0.3, 1.3
Perceived discrimination x Ethnicity	2.9*	1.4, 5.9	3.2*	1.4, 7.6	3.5*	1.4, 8.7
Ethnicity Caribbean Black	ref		ref		ref	
African American	0.2	0.1, 1.2	0.2	0.0, 1.1	0.0	0.02, 1.1
Age			0.9	0.8, 1.0	0.9	0.8, 1.0
Gender Male			ref		ref	
Female			1.0	0.3, 2.9	1.1	0.3, 3.6
Education (years) 0-11					ref	
12					1.4	0.3, 5.6
13-15					0.7	0.2, 2.2
≥16					1.1	0.1, 12.0
Household Income					1.0	1.0, 1.0
Region Northeast					ref	
Midwest					1.8	0.2, 14.1
South					1.5	0.3, 8.4
West					0.6	0.1, 4.9

* p≤0.05
Results are from multinomial logistic regression models using the analytic sample (N=1,423).
No MDD or CVD is the reference group for comorbid CVD/MDD, MDD only, CVD only.
All models included interaction term between perceived discrimination and ethnicity, along with perceived discrimination and ethnicity main effect terms.
[a]Model 1: unadjusted.
[b]Model 2: adjusted for age, gender, and ethnicity.
[c]Model 3: adjusted for age, gender, ethnicity, education, household income, and region of country.
[d] RRR presented is for perceived discrimination X ethnicity interaction term.

Table 10 (cont'd)

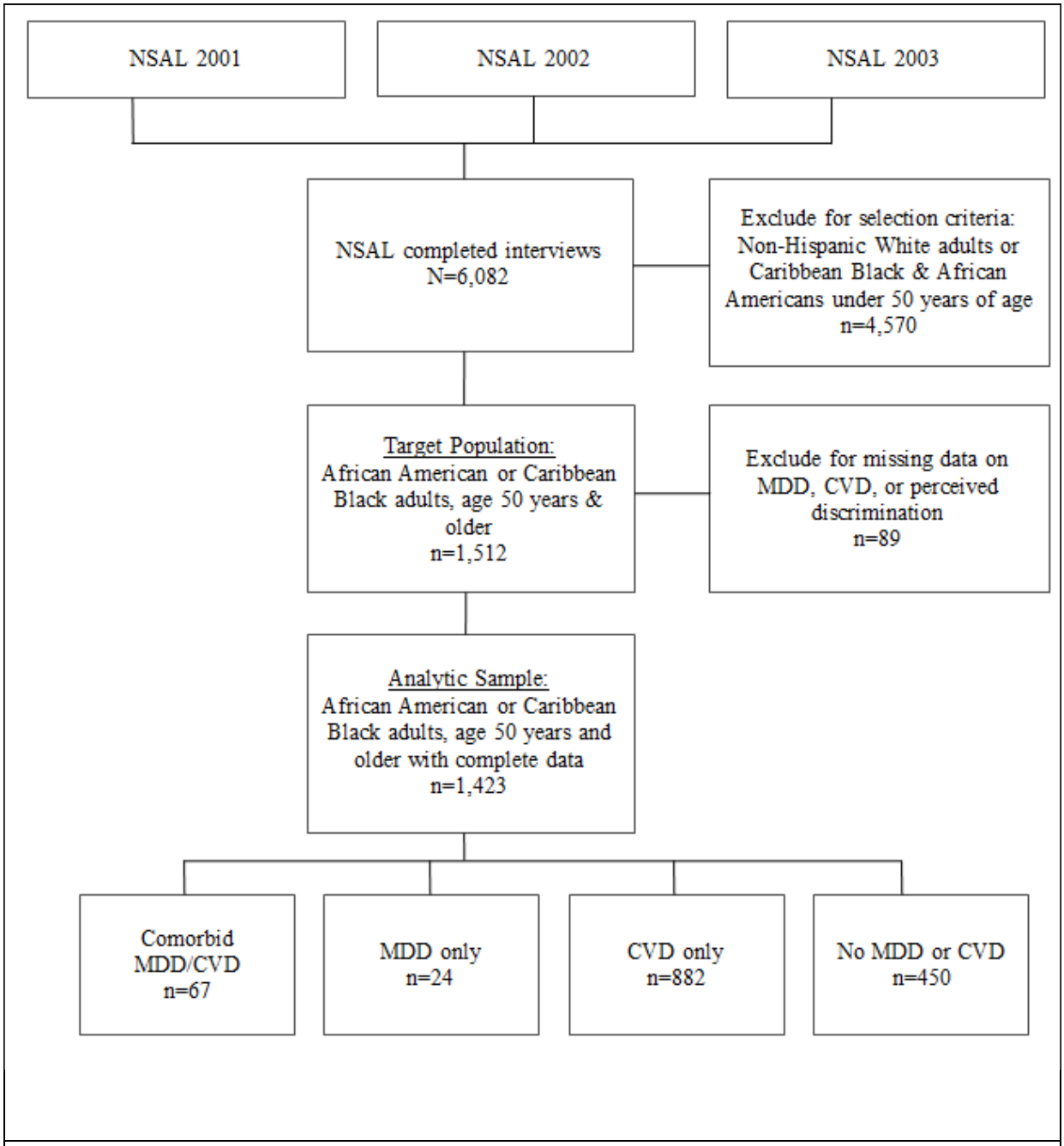
	Model 1[a]		Model 2[b]		Model 3[c]	
	RRR[d]	95% CI	RRR[d]	95% CI	RRR[d]	95% CI
CVD only						
Perceived Discrimination	0.8	0.4, 1.7	0.9	0.4, 1.9	0.9	0.4, 1.8
Perceived discrimination x Ethnicity	1.3	0.6, 2.8	1.4	0.6, 3.0	1.4	0.7, 2.9
Ethnicity Caribbean Black	ref		ref		ref	
African American	0.9	0.4, 1.9	0.8	0.3, 1.9	0.8	0.3, 1.8
Age			1.0*	1.0, 1.0	1.0*	1.0, 1.0
Gender Male	ref		ref		ref	
Female			1.3	0.9, 1.8	1.3	0.9, 1.8
Education (years) 0-11					ref	
12					0.8	0.5, 1.1
13-15					0.7	0.4, 1.2
≥16					0.6	0.4, 1.0
Household Income					1.0	1.0, 1.0
Region Northeast					ref	
Midwest					1.3	0.8, 2.1
South					1.1	0.7, 1.8
West					1.6	0.6, 3.9

* p≤0.05
These results are from multinomial logistic regression models performed with the analytic sample (N=1,423). No CVD or MDD is the reference group for comorbid CVD/MDD, MDD only, CVD only.
All models included interaction term between perceived discrimination and ethnicity, along with perceived discrimination and ethnicity main effect terms.
[a]Model 1: unadjusted.
[b]Model 2: adjusted for age, gender, and ethnicity.
[c]Model 3: adjusted for age, gender, ethnicity, education, household income, and region of country.
[d] RRR presented is for perceived discrimination X ethnicity interaction term.

APPENDIX C

Figures

Figure 1. Process for identifying the analytic sample from the National Survey of American Life (2001-2003) for the current cross-sectional thesis analysis

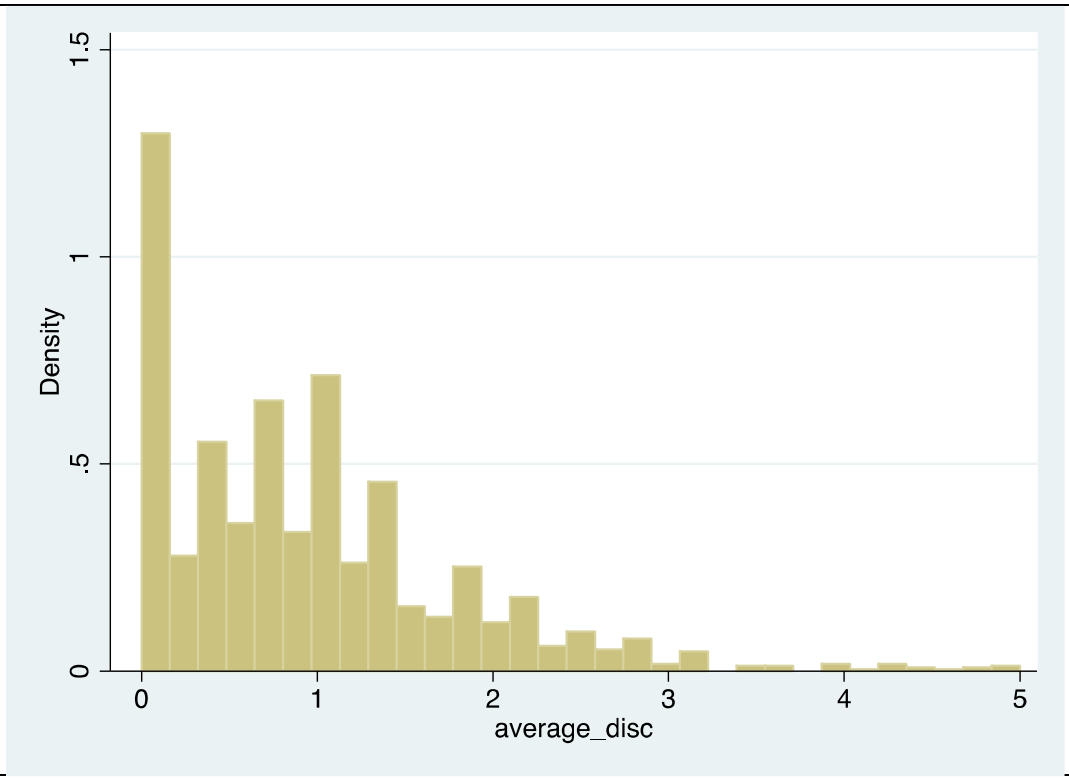


The target population (N=1,512) includes participants with missing data who meet the inclusion/exclusion criteria.
The analytic sample (N=1,423) are the participants in which all statistical analyses were performed on.
CVD is defined as history of cardiovascular disease by self-reported health professional diagnosis of hypertension, diabetes, heart disease, or stroke.
MDD is defined as WMH-CIDI lifetime major depression with a depressive episode occurring at age 50 years or older.
Comorbid CVD/MDD is defined as meeting the abovementioned CVD and MDD criteria.

APPENDIX D

Supplemental Figures

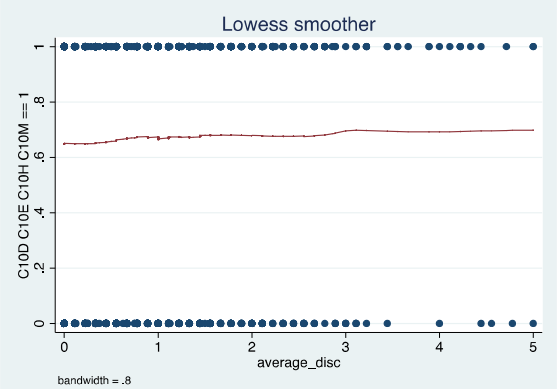
Figure 2. Histogram of perceived discrimination from the National Survey of American Life (2001-2003) among Black participants, age ≥ 50 years, in the United States



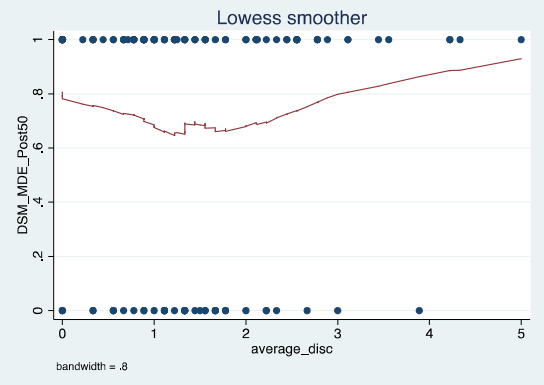
A histogram was used to assess the linearity assumption of the continuous variable, perceived discrimination.
Perceived discrimination is a continuous variable derived from averaging each participant's nine responses to The Everyday Discrimination Scale.

Figure 3. Lowess smoothing curves of perceived discrimination in relation to MDD and CVD from the National Survey of American Life (2001-2003) among Black participants, age ≥ 50 years, in the United States

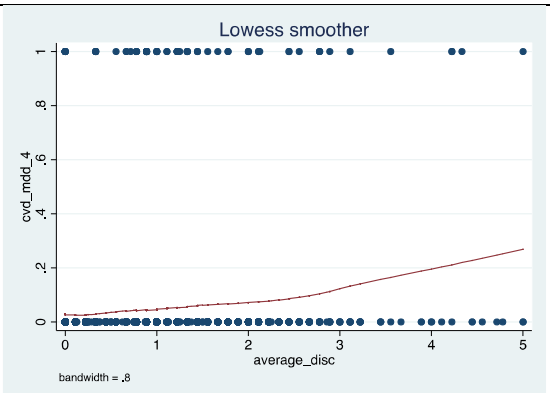
3a. Lowess smoothing curve of smoothed average perceived discrimination and any* CVD



3b. Lowess smoothing curve of smoothed average perceived discrimination and any* MDD



3c. Lowess smoothing curve of smoothed average perceived discrimination and Comorbid CVD/MDD



Lowess smoothing curves were used to assess the linearity assumption of the continuous variable, perceived discrimination which is derived from averaging each participant's nine responses to The Everyday Discrimination Scale.
*Any CVD or MDD refers to any participant among analytic sample who meets criteria and not mutually exclusive outcomes.

APPENDIX E

Diagnostic Algorithm

DSM-IV Major Depressive Episode

A. Five (or more) of the following symptoms have been present during the same 2-week period and represent a change from previous functioning; at least one of the symptoms is either (1) depressed mood or (2) loss of interest or pleasure.
Note: DSM-IV states that children and adolescents may be "irritable rather than sad". This is not operationalized when examining adults who report symptoms from childhood.

Part 1 AND Part 2.

Part 1. Symptoms have been present during the same 2 week period and at least one of the symptoms is either (1) depressed mood or (2) loss of interest or pleasure.

(D22b >= 2 weeks OR D22d >= 2 weeks OR D39 >= 2 weeks) AND (D24a is Yes(1) OR D24b is Yes(1) OR D24c is Yes(1) OR D24d is Yes(1) OR D24e is Yes(1) OR D24f is Yes(1)

Part 2. At least five of the following symptoms must be present and represent a change from previous functioning:
Note: "change from previous functioning" is implicit in the item corresponding to each symptom (e.g., "more than usual", "less than usual").

1. depressed mood most of the day, nearly every day, as indicated by either subjective report(e.g.,, feels sad or empty) or observation made by others.
D24a is Yes(1) OR D24b is Yes(1) OR D24c is Yes(1) OR D24d is Yes(1)
2. markedly diminished interest or pleasure in all, or almost all, activities most of the day, nearly every day(as indicated by either subjective account or observation made by others)
D24e is Yes(1) OR D24f is Yes(1)
3. significant weight loss when not dieting or weight gain (e.g.,, a change of more than 5% of body weight in a month), or decrease or increase in appetite nearly every day.
D26a is Yes(1) OR (D26f >= 10 lbs/5 kilos) OR D26b is Yes(1) OR (D26d >= 10 lbs/5 kilos)
4. insomnia or hypersomnia nearly every day.
D26g is Yes(1) OR D26h is Yes(1)
5. psychomotor agitation or retardation nearly every day(observable by others, not merely subjective feelings of restlessness or being slowed down).
D26m is Yes(1) OR D26o is Yes(1)
6. fatigue or loss of energy nearly every day.
D26j is Yes(1)
7. feelings of worthlessness or excessive or inappropriate guilt(which may be delusional) nearly every day(not merely self-reproach or guilt about being sick)
D26v is Yes(1)
8. diminished ability to think or concentrate, or indecisiveness, nearly

every day(either by subjective account or as observed by others)
D26p is Yes(1) OR D26r is Yes(1) OR D26s is Yes(1)
9. recurrent thoughts of death (not just fear of dying), recurrent suicidal ideation without a specific plan, or a suicide attempt or a specific plan for committing suicide.
D26aa is Yes(1) OR D26bb is Yes(1) OR D26cc is Yes(1) OR D26dd is Yes(1) OR D26ee is Yes(1)

B. The symptoms do not meet criteria for a Mixed Episode
Not operationalized.

C. Part 1 OR Part 2.

Part 1. The symptoms cause clinically significant distress.
D17 is (2,3,4) OR D18 is (1,2) OR D19 is (1,2,3) OR D24b is Yes(1)
Part 2. The symptoms cause clinically significant impairment in social, occupational, or other important areas of functioning.
D28 is (3,4,5) OR D28a is (1,2,3) OR (At least 1 value of D66a-D66d is between 4 and 10)

D. The symptoms are not due to the direct physiological effects of a substance (e.g.,, a drug of abuse, a medication), or are not due to a general medical condition.

Note: D29b is used as an initial screener only. All open ended items are reviewed by a clinician to determine organic exclusion.
D29a is NOT missing and D29c1 is NOT(missing,1,7,8,9)

E. Part 1 OR Part 2 OR Part 3

Part 1. The symptoms are not better accounted for by Bereavement.
NOT(value of 3 in D23a)
Part 2. If the symptoms are associated with bereavement, they persist for longer than two months
(D22b > 2 months) OR (D22d > 2 months)
Part 3. If the symptoms are associated with bereavement, they are characterized by (a) marked functional impairment, (b) morbid preoccupation with worthlessness, (c) suicidal ideation, (d) psychotic symptoms, or (e) psychomotor retardation. At least one of a-e must be present.
a. D19 is (1) OR D28 is (4,5) OR D28a is (1,2) OR (At least 1 of D66a-D66d is between 7 and 10) OR
(10 <= D68 <= 365)
b. D26v is Yes(1)
c. D26cc is Yes(1) OR D26dd is Yes(1) OR D26ee is Yes(1)
d. Not operationalized
e. D26l is Yes(1) OR D26m is Yes(1)

APPENDIX F

IRB Approval Letter

MICHIGAN STATE
UNIVERSITY

Determined Not "Human Subjects"

March 2, 2016

Hector González
Email: hmgonzalez@epi.msu.edu

Re: Determination of Human Subject Research
IRB#16-337 Comorbid cardiovascular disease and major depressive disorder and perceived discrimination

Dear Dr. González:

It has been determined that the activity described in your application to the IRB submitted February 22, 2016 does not meet the definition of "human subjects" as defined by the U.S. Department of Health and Human Services (DHHS) regulations for the protection of human research subjects.

Human Subject
For DHHS, "human subject" means "a living individual about whom an investigator (whether professional or student) conducting research obtains: (1) Data through intervention or interaction with the individual, or (2) Identifiable private information." [45 CFR 46.102(f)].

After reviewing the information you have provided, it has been determined that:
☐ Living individuals are not involved
☐ The activity is not "about" the living individual
☒ Will not obtain data through interaction or intervention or private identifiable information

The project involves analyses of de-identified data from the publicly available National Survey of American Life.

Hence, your activity does not involve human subjects.

Therefore, the federal regulations for the protection of human subjects would not apply to your project and you do not need MSU IRB approval to proceed. However, please note that while MSU IRB approval is not required, other federal, state, or local regulations or requirements or ethical or professional standards may still be applicable based on your activity.

If any of these circumstances change, please contact the IRB as your activity may involve human subject research and require IRB approval.

If you have any further questions, please contact the MSU IRB office at 517-355-2180.

Sincerely,

Harry McGee, MPH
BIRB Vice Chair

c: Samantha Bauer (bauersam@msu.edu)

Office of Regulatory Affairs
Human Research Protection Programs

Biomedical & Health Institutional Review Board (BIRB)

Community Research Institutional Review Board (CRIRB)

Social Science Behavioral/Education Institutional Review Board (SIRB)

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