



Race and Ethnic Differences in the Associations between Cardiovascular Diseases, Anxiety, and Depression in the United States

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Abstract

Introduction: Although cardiovascular diseases and psychiatric disorders are linked, it is not yet known if such links are independent of comorbid medical diseases and if these associations depend on race and ethnicity. This study aimed to determine if the associations between cardiovascular diseases with general anxiety disorder (GAD) and major depressive episode (MDE) are independent of comorbid medical diseases and if these links differ among African Americans, Caribbean Blacks, and Non-Hispanic Whites.

Methods: This cross-sectional study enrolled African American, Caribbean Black, and Non-Hispanic White adults who had participated in the National Survey of American Life (NSAL), 2001 - 2003. Data on socio-economics (age, sex, and education level) were collected. Self-reported physician diagnosed cardiovascular diseases (heart disease, atherosclerosis, hypertension, and stroke) and chronic medical conditions (peptic ulcer, cancer, diabetes, liver disease, kidney disease, asthma, other chronic respiratory diseases, sickle cell anemia, and glaucoma) were measured. The 12-month GAD and MDE were measured using the Composite International Diagnostic Interview (CIDI). Logistic regressions were fitted to data to determine if the associations between cardiovascular diseases and 12-month GAD and 12-month MDE are independent of socio-economic status and comorbid chronic medical diseases across race and ethnic groups.

Results: Above and beyond other medical conditions, heart disease and atherosclerosis were associated with 12-month GAD among Caribbean Blacks, but not African Americans or non-Hispanic Whites. Hypertension was associated with 12-month MDE among African Americans, and heart disease was associated with 12-month MDE among Caribbean Blacks. None of the cardiovascular diseases were associated with 12-month MDE among non-Hispanic Whites, while all the other medical conditions were controlled.

Conclusion: Our study showed race and ethnicity may be associated with specific patterns of comorbidity between cardiovascular diseases and 12-month MDE and GAD. By other words, the link between psychiatric disorders and cardiovascular diseases may depend on race and ethnicity. More research is needed to explore the behavioral and mental health profile of individuals with heart disease based on race and ethnicity. Race and ethnicity should inform mental health evaluation of patients with cardiovascular diseases.

Keywords: Race, Ethnicity, Anxiety, Depression, Cardiovascular Disease, Chronic Medical Conditions

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1. Introduction

Cardiovascular diseases (CVD) -composed of coronary artery disease, hypertension, and stroke [1]- are the leading cause of death in the United States [2], claiming 600,000 lives each year [3]. CVD constitutes 17% of overall national expenditures on health [4-6]. The medical costs of CVD have grown at an average annual rate of 6%, explaining 15% of the increase in medical spending [7].

Although there is an established link between cardiovascular diseases and depression [8], most studies on the association between cardiovascular diseases and depression have not controlled for the effect of other chronic medical conditions [9-12]. A study on about 2,200 adults with seven chronic medical conditions such as heart disease, renal disease, liver disease, and rheumatoid conditions showed that coronary artery disease was associated with higher depression symptoms, compared to other chronic medical conditions. In that study, heart disease was not associated with higher anxiety

symptoms compared to other chronic medical conditions. The study suggested that among primary care patients, those with heart disease have a unique need for screening, diagnosis, and treatment of depression, compared to patients with other chronic medical conditions [13]. Analysis of data of over 15,000 patients with different medical conditions has also suggested that cardiovascular conditions are associated with impairment in functioning more than urogenital conditions, hearing impairments, and dermatologic conditions [14].

Very few studies are available on the moderating effect of race and ethnicity on the associations between chronic physical conditions and psychiatric disorders [15, 16]. The Available research has mostly studied the main effect of race or ethnicity instead. Among patients with a chronic medical disease, presence of comorbid psychiatric disorder(s) is associated with worse outcomes [17]. Researchers attribute this link to the effect of poor mental health on self-care [18] and

disease management [19]. Comorbid psychiatric disorders affect perception of symptoms [18], quality of life [20], medication adherence [21], service utilization and mortality [22], as well.

The current study was conducted to compare African Americans, Caribbean Blacks, and non-Hispanic Whites for the associations between cardiovascular diseases, medical comorbidities and 12-month general anxiety disorder (GAD) and 12-month major depressive episode (MDE).

2. Methods

This cross sectional study used data from the National Survey of American Life (NSAL), 2001-2003. The NSAL was a part of the Collaborative Psychiatric Epidemiology Surveys (CPES), funded by the National Institute of Mental Health. The Institute Review Board of the University of Michigan approved the study. All the participants provided informed consent.

2.1. Participants

The NSAL used a national household probability sample of Black adults (18 years and older). Although African Americans were residents of either large cities or other urban or rural areas, all Caribbean Blacks were sampled from large cities only. Features of sampling design, procedures, and interviewer training and supervision have been described elsewhere [23-25]. African-American individuals were identified as Blacks who did not identify any ancestral tie in the Caribbean. The Afro-Caribbean population was composed of Blacks who self-identified as being of the Caribbean ancestry. The White population included all the Caucasian adults except people of self-reported Hispanic ancestry [26]. The NSAL White sample is designed to be optimal for comparative analyses. Thus, the NSAL White sample is not optimal for descriptive analysis of the U.S. White adult population [26].

2.2. Inclusion and Exclusion Criteria

The NSAL survey populations included all US adults in the three target groups who were age 18 and older and resided in households located in the contiguous 48 states. The NSAL survey populations were restricted to adults who were able to complete the interview in English. Institutionalized individuals including those in prisons, jails, nursing homes, and long-term medical or dependent care settings were excluded. Although military personnel living in civilian housing were eligible for the study, residents of housing located on a military base or military reservation were excluded from this study [26].

2.3. Sampling

The NSAL has used multi-stage sampling. The NSAL 'core' samples included a national area probability sample of households and a special supplemental sample of households in areas of high Caribbean Black residential density. The NSAL Core national sample was designed to be optimal for a national study of the African-American survey population. The design of the NSAL Core sample closely resembled the

National Survey of Black Americans, 1979-80. The NSAL supplement design served solely to enroll a large sample size from the Caribbean Blacks. The NSAL national area probability sample was selected independently of other CPES samples [26].

2.4. Interview

Data was collected through face to face computer-assisted (86%) or telephone (14%) interviews. Interviews typically lasted an average of 140 minutes. All interviews were conducted in English. The final response rate was 72.3% overall. The response rate was 70.7% for African Americans, 77.7% for Caribbean Blacks (n=695), and 69.7% for Whites (n=606).

2.5. Measures

Each participant reported presence of fourteen medical conditions (i.e. arthritis / rheumatism, peptic ulcers, cancer, hypertension, diabetes, chronic liver disease, chronic kidney disease, stroke, asthma, other chronic lung diseases, atherosclerosis, sickle cell disease, heart disease, and glaucoma). Socio-demographic information collected for this study included age, sex, and educational level.

2.6. Outcomes

Twelve-month GAD and MDE were operationalized using a modified version of the World Mental Health Composite International Diagnostic Interview (CIDI), a fully structured diagnostic interview. The CIDI evaluates a wide range of DSM-IV mental disorders, and has been used reliably on the World Mental Health project [27].

2.7. Statistical Analysis

To adjust for weights based on the complex sampling design and non-response, we used Stata version 13 for data analysis. The NSAL has used a multistage sample design involving clustering and stratification, which requires statistical techniques to provide nationally representative rates. Sub-population analyses for all survey regressions were applied.

Race/ethnicity-specific logistic regressions were fitted to the data, while considering 12-month GAD and MDE as outcomes (6 regression models), self-reported physician diagnosed cardiovascular diseases (heart disease, atherosclerosis, hypertension, and stroke) as predictors, and medical comorbidities and socio-economic status as controls. A few conditions were automatically dropped from the model because of the low sample of individuals with those conditions. Adjusted Odds Ratios (OR) and 95% Confidence Intervals (CI) were reported. P-values less than 0.05 were considered statistically significant.

3. Results

Out of all participants, 985 individuals did not have any chronic conditions, 948 had one chronic condition, 651 had two conditions, 413 had three conditions, 294 had four conditions, 172 had five conditions, and 197 had six or more chronic conditions. Socio-demographics of the participants of each race/ethnic group are presented in Table 1.

3.1. 12-Month GAD

Heart disease (OR=4.926), and atherosclerosis (OR=8.621) were associated with 12-month GAD among Caribbean Blacks, but not among African Americans or non-Hispanic Whites. Hypertension was associated with 12-month MDE among African Americans and heart disease was associated with 12-month MDE among Caribbean Blacks. None of the cardiovascular diseases were associated with 12-month MDE among non-Hispanic Whites. Among Caribbean Blacks, heart disease (OR=4.926) was associated with higher odds of

12-month GAD, while hypertension (OR=0.138) was associated with lower odds of 12-month GAD. Among non-Hispanic Whites, heart diseases were not associated with higher odds of 12-month GAD (Table 2).

3.2. 12-Month MDE

Among African Americans, hypertension (OR=2.041) was associated with higher likelihood of 12-month MDE. Among Caribbean Blacks, heart disease (OR=18.174) was associated with higher likelihood of 12-month MDE. Heart diseases were not significantly associated with 12-month MDE among non-Hispanic Whites (Table 3).

Table 1. Demographic data among Non-Hispanic Whites, African Americans and Caribbean Blacks

	African American	Caribbean Black	White	Total
Characteristics	n (%)	n (%)	n (%)	n (%)
Sex				
Male	1,271 (44.03)	643 (50.87)	372 (47.26)	2,286 (45.87)
Female	2,299 (55.97)	978 (49.13)	519 (52.74)	3,796 (54.13)
Marital Status				
Married	960 (32.91)	559 (37.56)	383 (47.36)	1902 (40.25)
Partner	260 (8.74)	131 (12.58)	44 (6.59)	435 (7.81)
Separated	286 (7.16)	128 (5.37)	37 (3.11)	451 (5.08)
Divorced	524 (11.75)	178 (9.29)	147 (13.06)	849 (12.31)
Widowed	353 (7.90)	78 (4.29)	103 (7.83)	534 (7.74)
Never Married	1,170 (31.55)	542 (30.92)	173 (22.05)	1,885 (26.81)
Region				
Northeast	411 (15.69)	1135 (55.69)	107 (22.67)	1,653 (20.56)
Midwest	595 (18.81)	12 (4.05)	83 (7.96)	690 (12.91)
South	2,330 (56.24)	456 (29.11)	609 (54.60)	3,395 (54.48)
West	234 (9.25)	18 (11.14)	92 (14.76)	344 (12.06)
	Mean (SD) ¹	Mean (SD)	Mean (SD)	Mean (SD)
Education	12.43 (2.23)	12.93 (1.00)	13.32 (5.00)	12.89 (2.65)
Age (Years)	42.33 (14.50)	40.28 (5.78)	44.98 (31.11)	43.57 (16.61)
Income (\$ US)	36,846 (33,236)	47,017 (15,242)	47,397 (75,266)	42,455 (39,594)

¹Weights have been considered.

SD= standard deviation

Table 2. Association between 12-month major depression episode and chronic somatic conditions among African Americans and Caribbean Blacks and Non-Hispanic Whites

	OR	95% CI	SE	t	P	
Caribbean Blacks						
Heart Disease	18.174	4.509	73.247	12.246	4.3	<0.001
Hypertension	1.478	0.839	2.601	0.404	1.4	0.167
Stroke	0.1	0.003	3.123	0.167	-1.4	0.18
Atherosclerosis	1.71	0.154	19.01	1.991	0.5	0.649
African Americans						
Heart Disease	1.584	0.8	3	0.495	1.47	0.2
Hypertension	2.041	1.2	3.3	0.497	2.93	<0.001
Stroke	0.822	0.3	2.1	0.373	-0.43	0.7
Atherosclerosis	1.575	0.8	2.9	0.486	1.47	0.2
Non-Hispanic Whites						
Heart Disease	-	-	-	-	-	-
Hypertension	1.38	0.625	3.045	0.512	0.87	0.4
Stroke	0.076	0.002	2.534	0.125	-1.57	0.138
Atherosclerosis	3.55	0.618	20.401	2.913	1.54	0.143

The effects of age, gender, education, Peptic Ulcer, Cancer, Diabetes, Liver Disease, Kidney Disease, Asthma, Other Chronic Respiratory Diseases, Sickle Cell Anemia, and Glaucoma are controlled.

OR= Adjusted Odds Ratio

95% CI= 95% Confidence Interval

SE = Standard Error

Table 3. Association between 12-month general anxiety disorder and chronic somatic conditions among African Americans and Caribbean Blacks and Non-Hispanic Whites

	OR	95% CI		SE	t	P
African Americans						
Heart Disease	1.088	0.5	2.6	0.459	0.2	0.8
Hypertension	1.366	0.8	2.5	0.401	1.06	0.3
Stroke	1.747	0.6	5.5	0.993	0.98	0.3
Atherosclerosis	2.112	0.9	5	0.892	1.77	0.1
Caribbean Blacks						
Heart Disease	4.926	2.454	9.889	1.66	4.7	<0.001
Atherosclerosis	8.621	1.454	51.135	7.419	2.5	0.02
Hypertension	0.138	0.023	0.831	0.12	-2.3	0.032
Stroke	3.232	0.277	37.687	3.838	1	0.333
Non-Hispanic Whites						
Hypertension	1.396	0.665	2.932	0.486	0.96	0.353
Stroke	0.664	0.09	4.87	0.621	-0.44	0.667
Atherosclerosis	1.761	0.302	10.268	1.457	0.68	0.504
Heart Disease	1.175	0.302	4.578	0.75	0.25	0.804

The effects of age, gender, education, Peptic Ulcer, Cancer, Diabetes, Liver Disease, Kidney Disease, Asthma, Other Chronic Respiratory Diseases, Sickle Cell Anemia, and Glaucoma are controlled.

OR= Adjusted Odds Ratio

95% CI= 95% Confidence Interval

SE = Standard Error

4. Discussion

In the current study, the associations between cardiovascular diseases and 12-month MDE and GAD were different between African Americans, Caribbean Blacks, and non-Hispanic Whites. Atherosclerosis and heart disease were associated with 12-month GAD among Caribbean Blacks, but not African Americans or non-Hispanic Whites. Hypertension was associated with 12-month MDE among African Americans, and heart disease was associated with 12-month MDE among Caribbean Blacks. None of the cardiovascular diseases were associated with 12-month MDE among non-Hispanic Whites.

In one study, being labeled as hypertensive was associated with high depressive symptoms among Blacks but not Whites [28]. Race and ethnic differences in the effects of “labeling” may bring new insights to the understanding of race and ethnic variations in the associations between chronic medical diseases and mental health. It is believed that the psychological effect of labeling may be independent of the effect of disease [28]. Even for the conditions that are generally asymptomatic, awareness of the presence of a disease may result in functional limitation [29]. Based on the theory of illness cognition, individuals’ response to awareness of the presence of the disease may shape the effect of an illness [30]. Race and ethnicity may also influence adaptation of sick roles following being diagnosed with a chronic medical condition [31].

Previous studies have reported associations between anxiety, depression, and coronary artery disease [32, 33]. Roest and colleagues performed a meta-analysis to determine the effect of anxiety on the incidence of coronary heart disease among initially healthy people. They reviewed twenty studies that comprised about 250,000 persons with a mean follow-up of 11.2 years. Results suggested that people with high levels of anxiety have a higher risk of coronary heart disease (hazard

ratio = 1.26), independent of demographic variables, biological risk factors, and even health behaviors [34].

We could not find an association between heart diseases and MDE among Whites. Although most previous studies have shown higher rates of anxiety and depression among patients with heart disease [35, 36], most of these results come from bivariate analyses, which do not account for other medical conditions.

A longitudinal study showed a statistically significant interaction between the effect of race and heart failure on level of disability; that means that the effects of heart failure on disability might be larger for Blacks than for Whites [37]. The authors attributed their results to the Black-White differences in time to diagnosis and treatment of medical diseases [38-40]. This is in support of the hypothesis that suggests that due to exposure to more stressors, a particular chronic disease might be more disabling among Blacks [41].

There are a few studies suggesting that the association between depression and heart disease may be heterogeneous [10,42]. A prospective cohort of 136,293 community-dwelling postmenopausal women failed to show a link between new antidepressant use and increased incidence of cardiovascular disease [42]. As a result, there is a need for studying variables that may moderate this link. Some researchers believe it is still premature to describe depression as a cause of heart disease [43] and that more research is needed before drawing a causal link between depression and heart disease [44].

There are a few studies suggesting that risk of depression among patients with heart disease may depend on race and ethnicity. In one study, although 48% of patients with heart disease were scored as having high depressive symptoms, Whites were more likely to be depressed than African Americans [45]. Another study reported that Blacks were most likely to meet criteria for comorbid cardiovascular disease

and depression. The disease burden of depression was also highest among Black respondents [46].

As depression increases risk of morbidity and mortality associated with cardiovascular diseases [47-52], our findings may have clinical and public health implications. Depression has been consistently shown to influence outcomes of cardiovascular diseases [53-56]. Several studies also suggest an increased risk of cardiovascular disease in the general population associated with depression or high depressive symptoms [9-12].

Race and ethnicity influence individuals coping with stressors, including chronic medical conditions. Based on the transactional model developed by Lazarus & Folkman (1984), different abilities to cope with medical conditions may result in variation in mental health consequences of stressors among populations and individuals [57, 58]. In addition, race and ethnicity are closely linked to social class and social power in the United States. In the presence of cardiovascular disease, people of different race and ethnicities may have different access to resources (e.g., access to quality health care, higher likelihood to utilize health care services, etc.) that are needed for adjustment with such a medical disease.

Race and ethnicity may influence our primary and secondary appraisals. These factors may also influence coping strategies (i.e. problem-focused or emotion-focused) following exposure to stress due to suffering from a chronic disease [57, 58]. These factors also influence availability of emotional and tangible social support that is needed to live with a medical illness [59].

Beliefs associated with illness (illness beliefs) may be another factor in explaining race and ethnic differences in psychological effects of chronic medical conditions. Compared to Whites, Blacks have reported higher concern about having hypertension, and more frequently believe that hypertension is a serious health risk [60]. At the same time, compared to Whites, Blacks less frequently believe that lifestyle modification lowers blood pressure [61]. Greater perceived seriousness and lower perceived control may lead to higher vulnerability of Blacks to negative mental health consequences of being diagnosed as having a chronic medical disease [62].

Our study may contribute to better understanding of a complex paradox in health disparities between Blacks and Whites. Although in comparison to Whites, Blacks have higher number of chronic medical conditions [63-65], they are less frequently diagnosed as having mood and anxiety disorders [66]. Jackson et al, believe that there are contradictory Black-White disparities in physical and mental health that question the presumed associations between stressful conditions and poor mental health [67]. As our findings suggest, there are racial and ethnic differences in the links between chronic conditions and mental health. This knowledge is hoped to help us better understand the racial and ethnic disparities in physical and mental health [68-70].

The current study has implications for research and practice. Results may be useful to health care providers who care for patients with cardiovascular diseases. Based on our study, screening programs for recognition of anxiety and depression disorders among patients with medical conditions may benefit from considering race and ethnicity of the target patient. We argue that physicians need to account for race and ethnicity when their concern is the link between cardiovascular diseases, chronic conditions, and psychiatric disorders [71].

Unfortunately, little information exists on how disparities in physical health contribute to disparities in mental health across ethnic and racial groups. Future research should test if race and ethnic differences in links between psychiatric disorders shape disparities in outcomes of cardiovascular disease across groups.

Our study had a few limitations. Cardiovascular diseases and other chronic conditions were measured using self-report of a physician diagnosis of the conditions. Race and ethnicity may influence validity of self-reported medical conditions [72]. Even if validity of self-reported chronic conditions is similar across race and ethnic groups, [73] Whites may be more aware of their health problems, as they have higher access to the health care, and more frequently use care. The sample size was different between groups; thus our analysis did not have similar statistical power across race and ethnic groups. The study was also limited in data on medications, and interventions for cardiovascular and also other chronic medical disorders. It has been suggested that CIDI may over diagnose depression among Caribbean Blacks [66, 74]. As this study has a cross sectional design, causative inference was not possible. As most of the literature, we conceptualized anxiety and depression as consequences of cardiovascular diseases and other chronic diseases [75-79]. For the cardiovascular disease, however, anxiety and depression may also be possible causes of chronic medical illnesses. [34-35, 80]

Race and ethnic groups may influence comorbidity between cardiovascular disease and mental illness [81-84]. Race and ethnicity, gender, and country are contextual factors that shape the effects of risk and protective factors on physical and mental health [85-92].

5. Conclusion

Particular comorbidities may need specific attention among ethnic and racial groups. Clinicians who provide care for cardiovascular disease, anxiety, or depression may benefit from knowing the race/ethnic specific patterns of associations between these conditions.

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Authors' Contributions

Assari has designed, analyzed, drafted and revised the manuscript. Lankarani has contributed to the interpretation of the findings and revision of the manuscript.

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