

**The association between mental health status, discrimination, and cardiovascular disease:
Findings from the 2016 California Health Interview Survey**

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Autumn Quarter, 2018

Thesis submitted in completion of Honors Senior Capstone requirements for the DePaul
University Honors Program

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For my family—*Dale, Michelle, and Wesley*

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Acknowledgments

Dr. Molina—Thank you for allowing me to work with you through this process. I am so grateful to have met such an amazing professor who not only sparked my interest in pursuing epidemiology, but has continued to foster my growth and development as an aspiring epidemiologist. Your expertise has challenged me and pushed me to continue questioning, researching, and learning. The skills and knowledge I acquired through your classes as well as in our meetings will stick with me as I pursue graduate school and a career in public health. It has been a pleasure to be your student and an even greater privilege to get to know you over these past couple of years. You're guidance and mentorship has impacted me far beyond this thesis project and I thank you for everything.

Dr. Singleton—Words cannot begin to describe how your guidance and wisdom has helped me throughout the years. You were the first professor I reached out to at DePaul and I am so thankful to have met you. You have been a constant source of strength as you helped me navigate the college experience and constantly pushed me to reach higher in my academic endeavors. The hours we spent talking about school, research, politics, and so many other things has had a profound impact on my time here at DePaul and I thank you for serving as the faculty reader on my final Thesis Project. More than anything, I appreciate your sincerity and commitment to supporting bright ambitious students of color. Your support was integral to my future plans and goals.

Abstract

The relationship between depression and cardiovascular disease is well understood, however less is known about how this relationship varies across racial/ethnic groups. This study seeks to examine the associations between depression, psychological distress, and discrimination as it relates to cardiovascular disease risk. Using the 2016 edition of the California Health Interview Survey, independent odds ratios and multivariate logistic regression was utilized to examine these associations across all race groups while accounting for various demographic factors. The results showed that while depression is still the strongest predictor of cardiovascular disease status, discrimination was not significantly associated with increased cardiovascular disease risk.

Keywords: Cardiovascular Disease, Depression, Discrimination, Race, Mental Health

Introduction:

Cardiovascular disease and depression often occur in the same individual at the same time and while the link between depression and cardiovascular disease is well documented in the literature, cardiovascular disease remains the leading cause of death in the United States for both men and women, across all races (CDC, 2017). Patients with cardiovascular disease experience depression at higher rates than the general population but this has only been confirmed in mostly homogenous, White study samples (Hare, 2013). Few studies have examined this relationship across all races and whether this association is stronger or weaker among racial/ethnic minorities in the United States. This study aims to examine the relationship between depression and cardiovascular disease, giving special consideration to discrimination as a possible mediating factor.

The link between cardiovascular disease and depression has largely been explained by somatic-affective symptoms rather than cognitive-affective symptoms (Cheng et al, 2018; Azevado et al, 2014). Somatic-affective symptoms include those that have to do with physical manifestations of depression such as insomnia, fatigue and work difficulty, whereas cognitive-affective symptoms have more to do with attitudes and perceptions associated with depression such as, pessimism, guilt and self-dislike (Azevado et. al, 2014). While the somatic-affective symptoms of depression are better understood in relation to cardiovascular disease, it is necessary to also consider the cognitive-affective symptoms that may contribute to poor heart health as well. For minority populations, discrimination can influence cognitive-affective symptoms and plays an important role in experiences of stress. The affects of discrimination on various health outcomes is not fully understood but there is evidence suggesting lifetime experiences of discrimination can be detrimental to ones health. The most well-established

relationship between discrimination and adverse health outcomes has been shown among non-Hispanic Black women in the United States, who have a 60% higher risk of preterm birth than their White counterparts (Matthews & MacDorman, 2015). This is important to consider because low birth weight and preterm birth are important indicators of population health, suggesting that racism may actually contribute to worse health outcomes. Another landmark study examining perceived discrimination among Arab/Muslim women immediately after the September 11th terrorist attacks in 2001 found that Arabic-named women were the only group that experienced a significantly increased risk of preterm birth and low birth weight in the 6 months after the attacks (Lauderdale, 2006). These studies indicate that racial discrimination may actually have a direct impact on health outcomes, but has not been extensively examined on other stress related health issues such as depression and cardiovascular disease.

There is reason to believe that a relationship may exist between discrimination and cardiovascular disease. In a study conducted by Sawyer et. al (2012) it was shown that not only experiencing discrimination but merely anticipating prejudice was associated with both psychological and cardiovascular stress responses. Even more telling, previous studies have suggested that self-reported experiences of discrimination are associated with poor mental health status among Blacks, Hispanics, Asians, and American Indians/Native Alaskans (Williams, 2000; Finch, 2000; Noh, 2002; Gee, 2003). Additionally, discrimination not only affects stress responses, but also has a profound impact on the outcomes of cardiovascular disease and depressed patients. Another previous study shows that discrimination in the health care system was associated with poorer quality of care and more unmet health care needs compared to those who have not experienced discrimination (Benjamins, 2013). Given the well-established relationship between cardiovascular disease and depression, it is necessary to consider

discrimination when examining the racial differences in cardiovascular disease risk. The findings from this study may have implications for treatment of cardiovascular and depressed patients and adds to the existing conversation surrounding the affects of racial discrimination on various health outcomes.

Methods:

Participants

The data for this study were obtained from the 2016 edition of the California Health Interview Survey (CHIS). CHIS is conducted annually by the UCLA Center for Health Research Policy in collaboration with the California Department of Public Health and Department of Health Care Services. Data is collected by random-dial telephone survey and addresses a myriad of health topics including; health status, health conditions, health-related behaviors, health insurance, access to health care, and mental health. Demographic data for each participant was also recorded. Given that this study seeks to examine racial differences in the relationship between cardiovascular disease, mental health, and discrimination, CHIS was preferred to other larger national data sets because of its particular focus on providing accurate estimates for California's overall population, putting special emphasis on the major racial and ethnic minority groups. Given California's diverse population, this is easier to capture than in other national data sets.

The sample design utilized a random-digit-dial (RDD) system that connected to roughly 50% landlines and 50% cellular phone numbers. A total of 44 geographic sampling strata were created to represent California's 58 counties. Within the two most populous counties, Los Angeles and San Diego, 14 sub-strata were also created. Residential phone numbers were selected for each geographic sampling stratum. For each landline phone number that was dialed, one adult respondent was randomly selected within the corresponding household. For cellular

calls, the adult whom the phone number belongs to was automatically chosen to complete the survey. All cell phone numbers that were used for non-business purposes were eligible to be selected for participation.

In order to ensure a diverse sample group, interviews were conducted in English, Spanish, Chinese (Mandarin and Cantonese), Vietnamese, Korean, and Tagalog. This consideration allowed participants who did not speak English, or who did not know English proficiently, to complete the survey in their preferred language. RTI International was responsible for conducting phone interviews and recording the corresponding data. The response rate for initial interviews was 6.8% for landlines and 8.4% for cellular lines. Among those, there was 44% response rate for completed landline interviews and 45.4% for cellular line interviews. For the purpose of this study, only the adult (18+) interviews were used for data analysis. A more comprehensive explanation of the survey design and methods can be obtained from the CHIS website (<http://healthpolicy.ucla.edu/chis/design/Pages/methodology.aspx>). In total, 21,055 adults provided completed interviews during the 2016 edition of the California Health Interview Survey and this served as the study sample (n=21,055). Due to the thoroughness of the sample data, no exclusions from the study sample were made.

Measures

Cardiovascular disease

The variable used to measure cardiovascular disease asked respondents “Has a doctor ever told you that you have any kind of heart disease?” The presence of cardiovascular disease was indicated by a “yes” response. The absence of cardiovascular disease was indicated by a “no” response.

Depression

There were multiple questions relating to depression, however none of them indicated a diagnosis of any depressive disorder. Instead, the variable used to measure depression for the purposes of this study asked “About how often during the past 30 days did you feel depressed—Would you say all of the time, most of the time, some of the time, a little of the time, or none of the time?” The responses to this question were scored on a scale from 1-5 (1=none of the time, 2=a little of the time, 3=some of the time, 4=most of the time, 5=all the time). In order to capture the most accurate indication of depression, responses were recoded so that 0=none of the time, a little of the time, and some of the time and 1=most of the time, all of the time.

Psychological Distress

Similar to depression, there were several questions pertaining to serious psychological distress. The variable used for this study asked respondents “Have you had serious psychological distress in the past 30 days?” Presence of serious psychological distress was indicated by a “yes” response while the absence of serious psychological distress was indicated by a “no” response.

Discrimination

In order to understand discrimination, the variable examining lifetime discrimination was used for analyses. The specific question asked was “Over your entire lifetime, how often have you been treated unfairly when getting medical care?” Responses were recorded on a 4 point scale (0=Never, 1=Rarely, 2=Sometimes, 3=Often). It should be noted that no variables inquired about discrimination over one's life in general. Questions pertaining to discrimination were only in regards to discrimination when receiving medical care. Discrimination within health care is still a necessary consideration given its implications on access to health care and adverse health outcomes.

Individual characteristics

In order to produce an accurate picture of the risk associated with the aforementioned measures, various individual characteristics were controlled for. Those variables included; sex, age, race (non-Hispanic White, non-Hispanic Black, Asian, Hispanic, American Indian/Alaskan Native, Other/two or more races), educational attainment (less than high school, some high school, high school graduate, some college, vocational school, associates degree, bachelors degree, masters degree, PhD or higher), marital status (married, divorced/widowed/separated, never married), income (\$10,000 increments), insurance status (uninsured, insured), and chronic conditions (hypertension, and diabetes). Within the logistic regression models; female was the reference for sex, 18-25 was the reference for age, non-Hispanic White was the reference for race, less than high school was the reference for educational attainment, married was the reference for marital status, less than \$10,000 was the reference for income, uninsured was the reference for insurance status, no hypertension was the reference for hyper tension, and no diabetes was the reference for diabetes.

Statistical analyses

Analysis for this study was carried out using the statistical software, StataIC14. The primary analysis of this study utilized a two-step logistic regression with cardiovascular disease status as the outcome of interest. Three models were produced, each containing the nine covariates mentioned in the *individual characteristics* section. These covariates were included for each model so as to account for potential confounding effects that previous literature indicates has an impact on the relationship between various variables of interest and cardiovascular disease outcomes. The first model examines only depression and its association to cardiovascular disease. In order to understand the relationship between depression and cardiovascular disease, a dummy variable was employed so that “0” indicated no depression and “1” denoted the presence of depression in the respondent. The next model included the nine

covariates with the addition of depression and psychological distress. The variable for psychological distress also included a dummy variable so that “0” indicated the absence of psychological distress, while “1” indicated the presence of psychological distress. Finally, the third model included the nine covariates plus the addition of depression, psychological distress, and discrimination. Just as depression and psychological distress utilized a dummy variable, so did the variable for discrimination so that “0” indicated never experienced discrimination, “1” indicated rarely experienced discrimination, “2” sometimes experienced discrimination, and “3” often experienced discrimination. The results of the logistic regression models were reported as odds ratios (OR) and include the significance value, as well as the 95% confidence interval.

Odds ratios were also calculated independently using the crude rates for depression, psychological distress, and discrimination by race. These are reported with their corresponding p-values and 95% intervals.

Results:

From the sample population, 2,251 respondents reported having cardiovascular disease. This amounts to roughly 10.7% of the sample population living with cardiovascular disease. [Table 1.](#) shows the breakdown of each variable used and the percentage within that group with positive and negative cardiovascular disease status. From examining the comparison between positive and negative cardiovascular disease status among each variable, it is clear that some groups experience cardiovascular disease at higher rates than others. For example, the trends outlined in [Table 1.](#) Show that when considering income, generally those who make less than \$100,000 per year seem to have higher rates of cardiovascular disease than those who earn less than \$100,000. That is, rates of cardiovascular disease seem to decrease among the highest earners. Interestingly,

the rate of cardiovascular disease varies greatly across all levels of educational attainment. Although one might expect that higher educational attainment would lead to higher income, and thus lower rates of cardiovascular disease, those who have high levels of educational attainment might also experience chronic stress related to the type of employment they have.

Not surprisingly, males have a much higher rate of cardiovascular disease than woman, perhaps contributing to the generally longer life spans that women have compared to men. Similarly, high rates of cardiovascular disease can be seen in those with diagnosed hypertension and diabetes in accordance with what one would expect given that those with cardiovascular disease have high rates of comorbidity. Those who are divorced/widowed/separated also have a much higher rate of cardiovascular disease than those who are married. Again, this could potentially be explained by the previous research indicating that those who are married have a higher likelihood of maintaining good health since they are more likely to avoid isolation and manage their chronic conditions better.

In terms of the mental health measures used for this study, those with depression and psychological distress have high rates of cardiovascular disease as would be expected. Interestingly, those who report experiencing discrimination often also have an increased rate of cardiovascular disease compared to those who report never, rarely, or only sometimes experiencing discrimination. Finally, rates of cardiovascular disease by race vary greatly. Most surprisingly is the difference in cardiovascular disease rates between Whites, and Blacks. It is well documented and understood that non-Hispanic African-American/Blacks have a disproportionately higher rate of cardiovascular disease than their white counterparts. This data however, suggests otherwise. In fact, according to this data,

Whites have a rate of cardiovascular disease that is 4% higher than African-Americans/Blacks. The results from [Table 1](#). Do support the Hispanic Paradox theory, which posits that despite having increased cardiovascular disease risk, Hispanics suffer from cardiovascular disease far less than any other racial/ethnic group. While Whites have a rate of cardiovascular disease higher than the sample average, American Indians/Native Alaskans still showed the highest rate of cardiovascular disease.

Table 1. Sample characteristics by cardiovascular disease status

Sample Characteristics	Cardiovascular disease	No Cardiovascular Disease
Sample Size	2,251	18,804
Sex (%)		
Female	9.45%	90.55%
Male	12.26%	87.74%
Race/Ethnicity (%)		
White, Non-Hispanic	13.41%	86.59%
African-American/Black, Non-Hispanic	9.16%	90.84%
Asian	8.69%	91.31%
Hispanic	6.20%	93.80%
American Indian/Native Alaskan	15.58%	84.42%
Other/Two or more races	9.87%	90.13%
Educational Attainment (%)		
No Formal Education	10.20%	89.80%
Some High School	9.87%	90.13%
High School Graduate	10.55%	89.45%
Some College	12.48%	87.52%
Vocational School	13.55%	86.45%
Associates Degree	10.43%	89.57%
Bachelors Degree	9.86%	90.14%
Masters Degree	9.75%	90.25%
PhD or Equivalent	13.04%	86.96%
Marital Status (%)		
Married/Partnered	10.64%	89.36%
Divorced/Separated/Widowed	14.64%	85.36%
Never Married	4.56%	95.44%
Income (%)		
Less than \$10,00	12.20%	87.80%
10,000 - 19,000	14.00%	86.00%

20,000 - 29,000	11.37%	88.63%
30,000 - 39,000	10.58%	89.42%
40,000 - 49,000	10.32%	89.68%
50,000 - 59,000	12.42%	87.58%
60,000 - 69,000	11.34%	88.66%
70,000 - 79,000	10.32%	89.68%
80,000 - 89,000	9.66%	90.34%
90,000 - 99,000	10.84%	89.16%
100,000 - 109,000	8.56%	91.44%
110,000 - 119,000	8.83%	91.17%
120,000 - 129,000	8.35%	91.65%
130,000 - 139,000	7.27%	92.73%
140,000 - 149,000	6.30%	93.70%
150,000 - 159,000	7.82%	92.18%
160,000 - 169,000	8.37%	91.63%
170,000 - 179,000	7.58%	92.42%
Over 180,000	7.73%	92.27%
<hr/>		
Insured (%)		
Insured	11.90%	88.81%
Uninsured	3.14%	96.86%
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Chronic Disease (%)		
Hypertension	19.64%	80.36%
Diabetes	23.75%	76.25%
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Perceived Discrimination (%)		
Never	10.27%	89.73%
Rarely	10.63%	89.37%
Sometimes	11.54%	88.46%
Often	14.53%	85.47%
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Mental Health (%)		
Serious Psychological Distress	15.60%	84.40%
Depression	12.63%	87.37%

[Table 2.](#) describes the independent odds ratios of cardiovascular disease, depression, and discrimination by race. In accordance with what can be observed in [Table 1.](#) Non-Hispanic African-Americans are 35% less likely to have cardiovascular disease as their White counterparts. Hispanics had the lowest likelihood of having cardiovascular disease followed by Asians. Interestingly, those who reported their race as other/two or more had a greater likelihood of having cardiovascular disease than African-Americans or Asians, but were still 30% less

likely that Whites to have cardiovascular disease. American Indians/Alaskan Natives were the only racial group to have an increased likelihood of having cardiovascular disease but these results were not statistically significant.

The trends in likelihood for depression are similar to those of cardiovascular disease. All race groups besides Asians showed a lower likelihood of having depression than their White counterparts. These results were significant for Hispanics—who were 30% less likely to report being depressed, and American Indians/Alaskan Natives and African-Americans—who were nearly 50% less likely to report being depressed when compared to Whites. Only Asians showed an increased likelihood of being depressed, by 20%, but these findings were not significant.

Finally, exposure to discrimination when seeking medical care over the course of a lifetime was higher in all race groups besides Asians, when compared to Whites. American Indians/Alaskan Natives were the most likely to report experiencing discrimination. They were almost twice as likely to experience discrimination than their White counterparts. The groups with the next highest likelihood of reporting discrimination was other/two or more races, followed by non-Hispanic African-Americans, who were 88% and 79% more likely to report discrimination. Asians were the least likely to report experiencing discrimination, and were actually 22% less likely than Whites to report discrimination.

Table 2. Independent odds ratios by race (OR)

	OR (95% CI)		
	CVD	Depression	Discrimination
White (reference)	1.00	1.00	1.00
Hispanic	0.43*** (0.38-0.48)	0.70** (0.56-0.86)	1.10** (1.03-1.18)
African-American	0.65*** (0.52-0.81)	0.51*** (0.36-0.73)	1.79*** (1.57-2.04)
American Indian/Alaskan Native	1.19 (0.81-1.75)	0.48* (0.24-0.99)	1.94*** (1.46-2.57)
Asian	0.61*** (0.53-0.70)	1.20 (0.87-1.65)	0.78*** (0.71-0.86)
Other/ Two or more Races	0.70* (0.53-0.95)	0.70 (0.41-1.17)	1.88*** (1.58-2.24)

*p<0.05, **p<0.01, ***p<0.001

The adjusted odds ratio of depression, psychological distress, and discrimination as predictors of cardiovascular disease status are reported in [Table 3](#). Model 1 accounts for the nine demographic/socioeconomic covariates and indicates a significant positive association between depression and cardiovascular disease. That is, those who are depressed, have a 45% greater likelihood of having cardiovascular disease compared to those with no depression. When adding psychological distress to the model equation, the association between depression and cardiovascular disease is not only reduced but is no longer significant. Psychological distress is however, associated with a 32% increased likelihood of cardiovascular disease and is statistically significant. Finally, when adding discrimination to the model equation, there is no significant relationship between depression, psychological distress, and discrimination.

Table 3. Logistic regression analyses predicting likelihood of cardiovascular disease (AOR)

	OR (95% CI)		
	Model 1	Model 2	Model 3
Depression	1.45** (1.11-1.89)	1.18 (0.85-1.63)	1.18 (0.84-1.63)
Psychological Distress		1.32* (1.02-1.71)	1.28 (0.98-1.66)
Discrimination			
	Never (reference)		1.00
	Rarely		1.04 (0.93-1.18)
	Sometimes		1.11 (0.95-1.31)
	Often		1.28 (0.96-1.70)

*p<0.05, **p<0.01, ***p<0.001

Discussion:

The objective of this study was to examine the relationship between depression, psychological distress, and discrimination as predictors of cardiovascular disease in adults, with a specific emphasis on determining differences in these relationships by race. It was hypothesized that racial minority groups, who may face more racial discrimination over their lifetime compared to Whites, would have stronger associations between depression and cardiovascular disease as well as stronger associations between psychological distress and

cardiovascular disease compared to their White counterparts. The calculated independent odds ratios for psychological distress, depression and discrimination were all strongly associated with cardiovascular disease. Interestingly, the direction of these associations were opposite of what was originally hypothesized for depression. That is, all racial/ethnic minority groups besides Asians were significantly less likely to have depression compared to Whites. This is in direct conflict with previous studies showing that both Blacks and Hispanics show elevated depressive symptoms by up to 27% more in Blacks and 33% more in Hispanics when compared to Whites (Glymour, 2012). These results may be attributable to several factors that are difficult to reconcile. First, this data relied on the self-reporting of depression, which may be flawed given the stigma that surrounds mental health issues in some racial/ethnic minority groups. Wong et al. (2017) found that English speaking Hispanics experienced higher levels of self-stigma in regards to their mental health status than Whites and were also more likely to conceal mental health issues from their peers. The same study also found that Spanish speaking Hispanics were the least likely group to utilize mental health services compared to all other races. This suggests that their perceptions surrounding mental health may lead to underreporting of mental health issues such as depression.

Another potential explanation for these discrepancies may be that members of racial/ethnic minority groups possess a degree of resilience due to their minority status that can actually offset the harmful effects of stress associated with discrimination (Spence, 2016). That is, many racial/ethnic minorities are aware of the racism and discrimination that exists in American society and actively create support systems among themselves that help combat the stress related to discrimination. Particularly among African-Americans, it has been found that while higher income and greater educational attainment may decrease some health risks,

their membership in a generally marginalized group does not eliminate their experiences of discrimination and the stress that comes with those experiences (Goosby, 2013). This could help explain why despite every racial/ethnic minority group reporting higher rates of discrimination, they report lower levels of depression. It should also be noted that, since this analysis uses data from the California Health Interview Survey, the findings cannot be generalized to the larger population. According to the US Census Bureau, California is the most diverse state in the US, with the single largest racial group being Hispanics (39.1%). California also has the largest percentage of Asians in the United States (15.2%). This high degree of diversity could affect the reporting of depression related to discrimination. Since California is a very diverse state, depression and psychological stress related to discrimination and racism maybe less salient than somewhere else in the United States that is less diverse, where minority groups may experience more isolation. Future studies examining this relationship could be improved using a nationally representative data set.

From the logistic regression models, it became clear that psychological distress mediates the relationship between cardiovascular disease and depression. It was hypothesized that discrimination would also be a mediating factor leading to increased likelihood of cardiovascular disease; however, based on the results we fail to reject the null hypothesis. While, experiencing discrimination often was associated with an increased risk of cardiovascular disease, it was not statistically significant. Depression still remains the strongest predictor of cardiovascular disease and is mediated by serious psychological distress. The implications of these findings suggest that more can be done to better treat cardiovascular disease patients with depression. Studies have suggested that pharmacologic and psychotherapeutic interventions are safe and effective at reducing

depressive symptoms in patients with cardiovascular disease and may positively impact heart health outcomes (Celano & Huffman, 2011). Unfortunately, these results show that racial/ethnic minorities report lower rates of depression than their White counterparts, potentially leading to under treatment of depression in vulnerable communities. Additionally, they may be less prone to seek out or receive these effective treatments, because of the discrimination they report within the health care system.

While the results were inconclusive as it relates to discrimination and its affect on cardiovascular disease risk, future studies can improve upon this type of analysis in several ways. First, measuring racial discrimination poses a challenge in that it has only been studied through self-reporting of perceived discrimination (Williams, 2008). This study is no different and relied on self-reported data of perceived lifetime discrimination when seeking and receiving medical care. Future studies may include more variables related to discrimination in their analyses that may help minimize confounding variables and establish a more accurate picture of discrimination. Within the CHIS data set, there were 3 other items related to discrimination that, when considered all together, could be included to better understand how discrimination could affect cardiovascular disease risk. These findings however are still valuable for understanding ways to improve detection and treatment of depression and cardiovascular disease in racial and ethnic minorities, given their increased rates of self-reported discrimination within health care.

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