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# An Examination of the Relationship between Discrimination, Depression, and Hypertension in Native Hawaiians

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## Abstract

Native Hawaiians bear a disproportionate burden of hypertension. Discrimination and depression are potential hypertension risk factors. Although the relationship between discrimination and depression is well established, how these factors affect hypertension risk in indigenous populations remains unknown. We examined the relationship between discrimination, depression, and hypertension in adult Native Hawaiians. We hypothesized that greater frequency of perceived discrimination and greater frequency of depressive symptoms would independently increase the likelihood of having hypertension.

Surveys were mailed to 540 adult Native Hawaiians residing on five Hawaiian Homesteads. The surveys measured: hypertension status, sociodemographic factors (age, gender, income, employment status), body mass index (BMI), physical activity frequency, smoking, Hawaiian cultural affiliation, American cultural affiliation, perceived discrimination, and depressive symptoms.

Respondents (n=171) were mostly female (71%), a mean age of 57yrs, and 54% reported having hypertension. The logistic regression model included perceived discrimination, depression, BMI, frequency of vigorous physical activity, and Hawaiian cultural affiliation, and sociodemographic variables. The model showed that Hawaiian cultural affiliation and discrimination were significantly related to hypertension status. Depression was not related to hypertension status. Interaction analysis found that for individuals with lower Hawaiian cultural affiliation, frequent perceived discrimination was significantly associated with lower odds of having hypertension.

The negative association between perceived discrimination and hypertension status was opposite from hypothesized. However, the interaction suggests this relationship holds only for less culturally affiliated individuals. These results underscore the varied nature of hypertension

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determinants and may have clinical implications for the treatment of hypertension in Native Hawaiians.

**Keywords**

Native Hawaiians; perceived discrimination; depression; hypertension; Native Hawaiian cultural affiliation

Hypertension, commonly known as high blood pressure, is the most common and modifiable risk factor for cardiovascular disease (CVD) (Kaplan, 2006; Pieske, 2008; World Health Organization, 2012; World Heart Federation, 2015). It causes 50% of ischemic strokes and elevates risk for hemorrhagic stroke, coronary heart disease, kidney failure, and blindness (Centers for Disease Control and Prevention, 2015; World Heart Federation, 2015). Annually, hypertension is the primary cause of death for over 300,000 Americans (Murphy, Xu, Kochanek, Curtin, & Arias, 2017). Factors that influence hypertension risk are complex, involving an array of behavioral (e.g., physical activity, tobacco use) and biological (e.g., BMI, cholesterol, age) risk factors (Emerging Risk Factors et al., 2009; Henderson et al., 2007; Jha et al., 2013). This research focuses on two potential and related risk factors for hypertension – discrimination and depression (C. M. Dolezsar, J. J. McGrath, A. J. Herzig, & S. B. Miller, 2014; Figueredo, 2009; Meng, Chen, Yang, Zheng, & Hui, 2012). Discrimination is defined as the unjust treatment of individuals based on characteristics such as race, age, gender, or class. Depression is a serious mood disorder that is characterized by hopelessness and sadness. Although the relationship between discrimination and depression is well established (Khan, Ilcisin, & Saxton, 2017; Molina & James, 2016; Paradies et al., 2015), how they interplay to affect hypertension risk in indigenous populations has yet to be fully examined.

Studies examining the relationship between perceived discrimination and hypertension present mixed findings, but overall suggest a positive association (Brondolo, Love, Pencille, Schoenthaler, & Ogedegbe, 2011; Brondolo, Rieppi, Kelly, & Gerin, 2003; C. M. Dolezsar et al., 2014; D. R. Williams & Neighbors, 2001). The relationship between discrimination and hypertension can be explained by stress theory. According to stress theory, a stressor is a situation or context external to an individual that challenges their ability to achieve their desired outcome and stress is the resulting internal state (Pearlin, Aneshensel, 1992; 1983). The ability to effectively manage stressors, in this case, discrimination is tied to a person's resources (e.g., emotional, social support, mental) and how well they can mobilize these resources to manage or remove these stressors. The lower a person's social status, the more likely they are to experience discrimination and the fewer resources they have at their disposal for dealing with this experience (Bolger & Zuckerman, 1995). Increasingly, stress has been identified as a potential risk factor for hypertension (Aneshensel, 1992; Cuffee, Ogedegbe, Williams, Ogedegbe, & Schoenthaler, 2014; Hicken, Lee, Morenoff, House, & Williams, 2014; Pearlin, 1989; Rosenthal & Alter, 2012). Chronic psychosocial stressors can led to adverse physiological responses, such as elevated blood pressure, placing a person at risk for cardiovascular disease (Hermosura, Haynes, & Kaholokula, 2018).

The majority of the published literature suggests a positive association between depression and hypertension (Cuffee et al., 2014; Gangwisch et al., 2010; Ginty, Carroll, Roseboom, Phillips, & de Rooij, 2013; Nabi et al., 2011). A meta-analysis of prospective cohort studies found depression to be a risk factor for hypertension (Meng et al., 2012). It is thought that patients with depression experience other risk factors, such as inadequate physical activity and alcohol and tobacco use, which may increase the likelihood of developing hypertension.

Discrimination and depression may be also impacting hypertension risk among Native Hawaiians, the indigenous people of Hawai'i. The National Health Interview Survey indicates that Native Hawaiians have a higher prevalence of hypertension (41%) than the general U.S. population (25%) (Schiller, Lucas, Ward, & Peregoy, 2012). Analysis of Hawai'i health insurance data showed that Native Hawaiians had the second highest prevalence of hypertension in the state and die from cardiovascular disease at greater rates and younger ages (Balabis, 2007; Look, 2005). Cho (2013) found that Native Hawaiians have the highest prevalence of current depression compared to any other ethnic group in Hawai'i. Native Hawaiians have an increased risk to poorer health outcomes due to determinants of health that are linked to cultural and historical trauma (i.e., cultural suppression, loss of land, etc.) and experiences of oppression, racism, and discrimination (Antonio et al., 2016; Hermosura et al., 2018; Kaholokula, Nacapoy, Grandinetti, & Chang, 2008).

Kaholokula et al. (2010) found that perceived racial discrimination was significantly associated with hypertension in Native Hawaiians. However, this study did not control for possible biological or behavioral confounders, such as BMI or tobacco use. To date, no studies have examined the influence of depressive sypmtoms on hypertension in Native Hawaiians. However, research has shown an association between depressive symptoms and diabetes (a risk factor for hypertension) in Native Hawaiians (Kaholokula, Haynes, Grandinetti, & Chang, 2006). Research also indicates that depressive symptoms and discrimination are positively associated in Native Hawaiians (Antonio et al., 2016). Further research is needed to understand the relationship between depressive symptoms, discrimination, and hypertension in Native Hawaiians and to determine if patterns found in other ethnic groups are replicated in Native Hawaiians.

A potential confounder in theses relationships is ethnic identity. Studies exploring the relationship between racial identity and discrimination propose equivocal and conflicting findings. Scholars propose two frameworks that describe the relationship between racial discrimination and racial identity (Yoo & Lee, 2008). According to the Social Identity Theory, individuals with increased racial identity maintain a positive self-image and positive self-esteem, while demonstrating a strong motivation to maintain ties with others within the racial group (Burrow & Ong, 2010; Tajfel & Turner, 1986). The ability to maintain a positive self-identity may help to mediate adverse health outcomes affiliated with chronic stress, including perceived discrimination, and may therefore serve as a buffer to stress resulting from persistent or multiple experiences of racial discrimination. On the other hand, the Rejection Sensitivity Theory proposes that individuals who experience increased sense of identity, such as increased sense of racial identity, may be more prone to rejection sensitivity (Yoo & Lee, 2008). Those who experience increased rejection sensitivity may

experience exacerbated adverse psychological outcomes related to rejection, including acts of discrimination (Downey & Feldman, 1996).

Research has explored cultural identity as a moderator between stressors, such as discrimination, and health outcomes in indigenous populations. Previous literature exploring the role of cultural identity in the health of Native Hawaiians has suggested that cultural identity may intensify acculturative and environmental stressors and increase risk of type 2 diabetes (Kaholokula et al., 2008). In another cross-sectional study, Native Hawaiian adolescents with stronger cultural identity had an increased risk for suicide attempts (Yuen et al., 2000). However, the limitations of this study must be acknowledged given that important covariates were not included in this study. Research focusing on other Indigenous peoples has demonstrated conflicting information regarding the role of cultural identity. In recent studies, cultural identity has been identified as a coping resource that may protect against negative health outcomes (Ramirez & Hammack, 2014; Wexler, 2014).

The present research was conducted in partnership with five Hawaiian Homestead communities on the islands of O'ahu and Hawai'i. The Hawaiian Homes Commission Act of 1920, set aside 200,000 acres across the six major Hawaiian Islands for the creation of Hawaiian Homestead communities. This government-protected land is available for a 99-year lease for $1 per year to individuals of at least 50% Native Hawaiian ancestry. Approximately, 30,855 Native Hawaiians reside in homestead communities (Department of Hawaiian Home Lands, 2013). Many of these communities are located in low socioeconomic areas, and it is suspected that residents are at increased risk for exposure to negative psychosocial determinants of health. However, little research has examined psychosocial determinants of health in these communities. Hawaiian Homestead communities offer a unique opportunity to examine the effects of discrimination and depression on hypertension risk among Native Hawaiians because of their higher degree of Hawaiian ancestry (e.g., stronger Hawaiian phenotype) and living in a predominately Native Hawaiian.

## Purpose

The purpose of this study was to examine the relationship between perceived discrimination, depression, and hypertension in adult Native Hawaiians residing on Hawaiian Homesteads, controlling for other known behavioral (i.e., cultural affiliation) and biological risk factors for hypertension. We hypothesized that more frequent experiences with discrimination and a higher level of depression would increase the likelihood of having hypertension, controlling for sociodemographic, biological, and behavioral factors.

## Methods

Using a community-based participatory research (CBPR) approach, the authors, which includes academic and community based investigators, adapted pre-existing assessment scales to create the Homestead Health Survey. The community investigators were leaders from a Hawaiian Homestead community who participated in all stages of this research from identifying a need to better understand the health of their communities to designing the

survey and methods as well as recruiting and administering the surveys. They also assisted with data interpretation and the preparation of this report. This study was reviewed and approved by the Institutional Review Board at Human Studies Program at the University of Hawai'i at Mānoa under the title "Homestead Health Survey," protocol 22690.

## Procedures

Surveys were mailed to every house in five homestead communities, three on the island of O'ahu (391 households) between January and April 2015 and two on Hawai'i Island (149 households) in April 2017. The surveys were mailed to the homestead leasees, however any household member could complete the survey. We had a response rate of 32% (171 out of 540 households). This is an ongoing study with plans to recruit from additional homesteads across the Hawaiian Islands. Surveys were also accompanied by a personalized cover letter that described the informed consent process and information on the purpose of the study. Respondents were asked to return the survey within three weeks of receipt. Reminder postcards were mailed 12 days after the survey was mailed to those households from whom we had not received a survey. Respondents were asked to return the survey via USPS using the addressed and stamped envelop provided. Those who participated in the study received a $15 gift card as a compensation for their time.

## Instruments / Measures

**Demographic variables.—**Demographic variables were collected using a demographic form that asked about age, income, employment status, and sex. Select items from the Behavioral Risk Factor Surveillance Survey (BRFSS) were used (Nguyen & Salvail, 2013). Respondents to select the answer that best describes their employment status (employed for wages full-time, 2) employed for wages part-time, self-employed, student, homemaker, retired, unable to work, out of work for 1 year or more, or out of work for less than 1 year). Respondents were asked to select the range in which their annual household income falls (less than $10,000, from $10,000 to $14,999, from $15,000 to $19,999, from $20,000 to $24,999, from $25,000 to $34,999, from $35,000 to $49,999, from $50,000 to $74,999, $75,000 or more, or don't know/not sure). This survey also assessed for health behaviors including physical activity, tobacco use, and BMI. Physical activity was measured by two items, one to capture moderate activity and one to capture vigorous active. In each item, respondents reported the amount of moderate or vigorous physical activity that they engaged in during the past month. The items were scored on a Likert type scale from 1 (more than 4 times a week) to 5 (rarely or never). Lower scores indicated more frequent physical activity. Body mass index (BMI) was measured based on the survey respondents' reporting of their weight in pounds and height in feet and inches (BMI = (weight in pounds × 703) ÷ (height in inches$^2$)).

**Cultural Affiliation.—**Sociocultural variables included respondents' identification with the Native Hawaiian and American cultures. Native Hawaiian cultural affiliation and American cultural affiliation, respectively, were measured with the Hawaiian Cultural Identity Scale (HCIS) and the American Cultural Identity Scale (ACIS) (Kaholokula, Iwane et al. 2010). Both scales consisted of 4-items including: 1) How knowledgeable are you of traditional Hawaiian/American culture and lifestyle?, 2) How involved are you in Hawaiian/

American culture and lifestyle?, 3) How do you feel toward the Hawaiian/American culture and lifestyle?, and 4) How often do you associate with people of the Hawaiian/American culture and lifestyle? Each item was scored on a range from 1 to 5, with a score of 1 indicating lower affiliation with the listed culture and a score of 5 indicating a higher affiliation with the listed culture. Therefore, total scores on each scale range from 4–20. Higher scores demonstrated increased identification with the Hawaiian or American culture. HCIS and ACIS had high internal consistency as indicated by their Cronbach's alphas 0.97 and 0.99, respectively.

**Discrimination.—**Discrimination was measured with the Everyday Discrimination Scale (EDS), which measures the frequency of experiencing perceived acts of discrimination in a respondent's day-to-day life (Williams, Yu, Jackson, & Anderson, 1997). The EDS consists of 9-items with responses that ranged in value from 1 (never) to 6 (almost every day). Sample items of the EDS include: "You are treated with less courtesy than other people are" and "People act as if they are afraid of you." Scores range from 9–54 with higher scores indicating an increased frequency of perceived acts of discrimination. Internal consistency for the EDS was high in our full sample (N=139) with a Cronbach's Alpha of 0.90.

**Depression.—**Frequency of depressive symptoms was measured with the 11-item Center for Epidemiologic Studies-Depression (CES-D) measure (Radloff, 1977). The Brief form was used rather than the long from due to the length of the overall survey and in effort to minimize respondent burden. The CES-D has four sub-scales that assess the frequency of depressed affect, positive affect (reverse coded), somatic symptoms, and interpersonal symptoms. Depressed affect includes feelings of depression, loneliness, and sadness; positive affect includes feelings of happiness and enjoyment of life; somatic symptoms include physical symptoms related to depression; and interpersonal symptoms include symptoms related to interpersonal interactions. Responses were based on a Likert scale, from rarely (less than 1 day) to most of the time (5–7 days). Scores range from 0–33, with higher scores indicating an increased frequency of depressive symptoms. The Cronbach's alpha for the CES-D in our sample was 0.83.

**Hypertension.—**Hypertension was assessed through the inclusion of a question that asked participants "Have you ever been told by a doctor, nurse, or other health professional that you have high blood pressure?" Respondents were provided three answer choice including: No, Yes, currently (within the last year), and Yes, previously (over one year ago). Self-reported hypertension has been shown to be a reliable and valid measure. (Martin, Leff, Calonge, Garrett, & Nelson, 2000; Okura, Urban, Mahoney, Jacobsen, & Rodeheffer, 2004)

## Data Reduction and Statistical Analysis

Employment status was collapsed into two levels: employed or unemployed/retired. The annual household income variable was collapsed into four levels: less than $25,000, $25,000-$49999, $50,000-$74,999, and more than $75,000. Respondents were considered to have hypertension if they had been told by a health professional that they had high blood pressure either within the last year or over one year ago. Frequencies and percentages were calculated for the categorical variables and means and standard deviations were calculated

for continuous variables. For missing depression data, one missing out of all the items was replaced with the average score of all the other items as an imputation. A bivariate correlation analysis examined the correlations between all variables. Point-biserial correlation was conducted to identify variables significantly associated with hypertension status. All of the variables significantly correlated with the outcome variable were entered into a logistic regression model. The logistic regression model also included sociodemographic variables (i.e., gender, age, employment status, and income) and our independent variables of interest (i.e., discrimination and depression). Multiple logistical regression was conducted to examine the relative contribution of discrimination and depression in accounting for the odds of hypertension while controlling for sociodemographic variables and those variables with significant association with hypertension status. To assess the HCIS as a moderator, the interaction between HCIS and EDS was evaluated in the logistic regression model. The standardized (β), Wald statistic, and Odds Ratios are presented.

## Results

### Participant Characteristics

Table 1 presents the characteristics of our sample population. Respondents were mostly female (71.1%), had a mean age of 57yrs (SD = 13.89yrs, range from 24yrs to 86yrs), and 54% reported having hypertension. The vast majority of the respondents were employed (96%). While a quarter reported a household income of less that $25,000, almost half (46%) reported a household income greater that $74,999. Individuals who reported hypertension tended to be older, have higher BMIs, and greater affiliation with their Hawaiian culture than those who reported being having no hypertension.

### Bivariate Associations

We examined the sociodemographic, psychosocial, and sociocultural variables for their bivariate associations with hypertension status (Table 2). Four variables had significant bivariate associations with hypertension: age ($r = 0.39$, $p < 0.001$), BMI ($r = 0.28$, $p < 0.001$), HCIS ($r = 0.17$, $p = 0.04$), and vigorous physical activity ($r = 0.20$, $p = 0.02$). Our independent variables of interest – CES-D and EDS scores – did not have significant bivariate associations with hypertension status. However, EDS and CES-D scores had a significant positive association with each other ($r = 0.31$, $p < 0.001$).

### Logistic Regression on Hypertension

We entered into the logistic regression model sociodemographic variables (i.e., age, income), our variables of interest (i.e., EDS, CES-D), and variables that had significant ($p < 0.05$) bivariate associations with hypertension status (i.e., frequency of vigorous physical activity, BMI, HCIS) as independent variables with hypertension status as the dependent variable. The model presented in Table 3 showed that HCIS ($OR = 0.52$; 95% CI: 0.28, 0.97) and EDS ($OR = 0.62$; 95% CI: 0.44, 0.87) were significantly associated with hypertension status, net the aforementioned covariates. Greater frequency of reported experiences of discrimination was associated with lower odds of having hypertension. The direction of this

association was opposite from what we had expected. Therefore, we further examined the interaction effects of HCIS and EDS on hypertension status.

### Interaction between Hawaiian cultural affiliation and discrimination on hypertension status

We found a significant interaction effect ($\chi^2 = 5.90$, $p = 0.02$). To further explore this interaction, we examined the impact of EDS on the odds of having hypertension by quintile of HCIS (Table 4). Scores on the HCIS broke down the quintiles. The first quintile was composed of those with the lowest scores, indicating less cultural affiliation, and the fifth quintile was composed of those with the highest scores, indicated more cultural affiliation. We found that for individuals in lowest two quintiles of HCIS scores, higher scores on EDS was associated with a lower odds of having hypertension *(OR* = 0.74; 95% CI: 0.61, 0.91) and *(OR* = 0.86; 95% CI: 0.77, 0.95). The OR for individuals in the 3rd quintile was not significantly different that 1.00. However, as we moved up in quintile, the ORs began to approach significance. For individuals in the 5th quintile (i.e., those with the highest HCIS scores), higher scores on EDS were moderately significantly *(p* = 0.07) associated with greater odds of having hypertension (*OR* = 1.31; 95% CI: 0.98, 1.74).

## Discussion

The purpose of our study was to examine the influence of both depression and discrimination on the likelihood of having hypertension in Native Hawaiians. We hypothesized that the frequency of perceived discrimination and experience of depressive symptoms would increase the odds of having hypertension. We did not find a relationship between the frequency of depressive symptoms and hypertension. However, we did find that the frequency of perceived discrimination was associated with the likelihood of having hypertension, albeit in a direction opposite of our hypothesis. We examined Hawaiian cultural affiliation as a potential moderator of the relationship between discrimination and hypertension risk. We found that in respondents with lower levels of affiliation with the Hawaiian culture, the frequency of perceived discrimination decreased the likelihood of reporting hypertension. However, for respondents with greater Hawaiian cultural affiliation, greater perceived discrimination trended toward an increased likelihood of having hypertension albeit statistically non-significant.

The main effect of discrimination on hypertension status suggested that increased experiences of discrimination are related to a lower likelihood of hypertension. One potential explanation for these results is personality characteristics. Personality characteristics, such as pessimism or indifference, could impact both the tendency to perceive and report discrimination (Lewis, Cogburn, & Williams, 2015). Alternatively, individuals with hypertension may have personal characteristics that increase their risk for hypertension but decrease their propensity of reporting experiences of discrimination. It is also possible that individuals with increased hypertension have other personal characteristics that serve as a buffer to stressors, decreasing their susceptibility to stressors that are beyond their control, including discrimination. Another potential confounder in the use of self-reported discrimination is minimization bias. This occurs when individuals under-report their

experience of discrimination (Kaiser, 2006). Research suggests that denying the presence of a stressor is a coping strategy (Vos & De Haes, 2007).

As noted in the introduction, Kaholokula et al. (2010) found that higher levels of perceived ethnic discrimination was significantly associated with having hypertension in Native Hawaiians, but they did not control for BMI. In a subsequent study by Kaholokula et al (2012), they found that higher levels of perceived ethnic discrimination was associated with higher systolic blood pressure in Native Hawaiians, but that their association was attenuated by BMI. They hypothesized that obesity may also be associated with ethnic discrimination, a notion supported by McCubbin and Antonio's (2012) finding of an association between obesity and overt discrimination in Native Hawaiians. Given these previous findings, our finding of a negative association between perceived discrimination and hypertension risk, was unexpected. This association persisted after controlling for socio-demographics, BMI, physical activity levels, and depression.

The most novel finding is the interaction effect of discrimination and cultural affiliation on hypertension status, which suggests that the psychosocial stressor of discrimination decreases the likelihood of having hypertension for those with lower Hawaiian cultural affiliation. Conversely, while not significant, there is a trend of discrimination increasing the likelihood of having hypertension for those with high Hawaiian cultural affiliation. This suggests that cultural affiliation may act as a moderator of the relationship between discrimination and hypertension.

Researchers have found moderators of the relationship between perceived discrimination and hypertension. One potential moderator is internalized racism (Chae, Nuru-Jeter, & Adler, 2012). The authors found that pro- verse anti- black attitudes moderated the relationship between perceived discrimination and hypertension in Blacks. Individuals with anti-Black attitudes who experienced racism were more likely to report hypertension that those with pro-Black attitudes.

Rejection sensitivity theory supports also the idea of ethnic identity as a moderator. Rejection sensitivity is defined as an individual's heightened perception and reaction to perceived rejection (Downey & Feldman, 1996). Accordingly, individuals with greater cultural affiliation may be more sensitive to perceived rejection based on their ethnicity (i.e., racial discrimination) than individuals with low ethnic identity (Kawamoto, Nittono, & Ura, 2015; Yoo & Lee, 2008). Individuals less affiliated with the Hawaiian culture may not ruminate on their experiences of discrimination and may find these experiences less stressful. Thus the experience has less of an impact on their risk for hypertension.

Previous research has also found a relationship between acculturation and type 2 diabetes, a risk factor for hypertension in Native Hawaiians. After controlling for confounders, Native Hawaiians with high Hawaiian and low American cultural affiliation were more likely to have type 2 diabetes than those in with low Hawaiian cultural affiliation or high Hawaiian and high American cultural affiliation (Kaholokula et al., 2008). A meta-analysis that found ethnic identity significantly moderated the relationship between discrimination and health. In 40% of the studies with a significant relationship, the strength of ethnic identity

augmented the relationship between perceived discrimination and negative health outcomes (Pascoe & Richman, 2009). This highlights the need for future research to better understand the complex relationship between ethnic identity and perceived discrimination (Pascoe & Richman, 2009). Forced acculturation has adversely impacted Native Hawaiians from the loss of cultural traditions, discrepancies between western and Hawaiian values, and having a lower social status in their native land (Crabbe, 2007). Research and Native Hawaiian scholars emphasize the importance of cultural revitalization and identity as a protective factor (Office of Hawaiian Affairs, 2017a, 2017b) against mental health symptoms and negative impacts of psychosocial factors, such as discrimination (Mossakowski, 2003).

These findings need to be interpreted within the context. Previous studies by Kaholokula et al. (2010) measured ethnic discrimination (i.e., racism) specifically, and in the context of oppression. We, including our community partners, wanted to measure general perceptions of discrimination (e.g., due to income, race, age, gender, skin color) in which ethnic discrimination is just one. By allowing respondents to select the main reason for their discrimination we are able to conduct future analyses of gender or income based discrimination. We chose the EDS for this reason as well as its broad use in the discrimination literature (Dolezar, McGrath, Herzig, & Miller, 2014). Many of the general perceptions of discrimination measured by the EDS strongly intersect. However, there may be a difference between discrimination due to ethnicity or race and discrimination due to an array of factors that may or may not overlap for Native Hawaiians. Also, previous research included Native Hawaiians who likely varied in their ethnic admixture because they did not restrict their recruitment to Native Hawaiians residing on Homestead. A large number of Native Hawaiians report multiple ethnic ancestries (Research and Economic Analysis, 2016). Because we focused on Native Hawaiians residing on homestead, our sample included Native Hawaiians who had at least 50% Hawaiian ancestry and living closely among other Native Hawaiians. Thus, the negative association between discrimination on hypertension risk among Native Hawaiians may be influenced by a complex permutation of sociodemographic (e.g., income, education level), social-cultural (e.g., degree of cultural affiliations), psychosocial (e.g., coping style), and environmental (e.g., living in multi-ethnic neighborhoods vs. Hawaiian Homesteads) factors that could either serve to buffer or exacerbate these effects.

## Limitations and Future Directions

This study has several limitations. The sample size for this study is small. Combining current hypertension diagnosis with previous diagnosis is a potential limitation. The data are cross-sectional. Therefore, causation cannot be inferred. There is also limited variation in reported discrimination and depressive symptoms, which may have reduced our ability to find significant correlations with hypertension status.

Based on the limitations of this study, the researchers identified several future directions for the study. One consideration is to expand the sample population to include individuals from Hawaiian Homesteads throughout the state of Hawai’i thereby increasing the sample size and improving its representativeness of individuals residing on Hawaiian Homesteads. The current sample includes residents from three established, urban homesteads and two,

recently constructed rural homesteads. Due to the lack of data on Hawaiian Homesteads, we don't know the representativeness of the current sample. However, it would be reasonable to assume that representativeness would be improved by including homesteads from various areas (i.e., windward, leeward, central) on each island with homesteads. Future studies may also consider including a sample of Native Hawaiians who do not reside on Hawaiian Homesteads to consider whether differences exist between the associations of perceived discrimination and hypertension risk. An increased sample size would allow for a more robust moderation analysis via structural equation modeling.

Future studies may also consider the way different types of discrimination (i.e., covert and overt) may contribute to the negative or positive associations of hypertension. In a previous study that explored perceptions of discrimination and obesity (McCubbin & Antonio, 2012), findings supported the notion that overt acts of discrimination increased the likelihood of higher BMI, while increased covert acts of discrimination appeared to decrease the likelihood of higher BMI. Therefore, future studies could examine potential differences in the relationship between the experience of overt and covert acts discrimination and hypertension risk. Future researchers may also consider the different forms of discrimination to determine whether an association exists between the perceived reasons of discrimination (i.e., race, gender, education or income level, or physical disability) and reported hypertension risk. Furthermore, factors that may buffer against both discrimination and hypertension should also be considered in future studies. Factors of consideration may include cultural connectedness or social support and the way emotional support may mediate or intensity experiences of discrimination and risk of hypertension. Lastly, hypertension may be further explored as a potential proxy to other determinants of health and health-related factors.

The direct and indirect costs associated with hypertension in the US totaled $73.4 billion in 2009 (Lloyd-Jones et al., 2009). Understanding the complex risk and protective factors, and their potential interaction, is important in addressing excess hypertension burden. Researchers should continue to explore the complicated relationships between hypertension and psychosocial and sociocultural variables. .

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**Public Significance Statement:**

Hypertension, a major contributing factor in cardiovascular disease risk, disproportionately impacts Native Hawaiians. Perceived discrimination and depressive symptoms may be important risk factors for hypertension. Our study suggests the impact of perceived discrimination on hypertension risk may depend on an individual's level of affiliation with the Hawaiian culture.

**Table 1:**

Participant Characteristics

| Characteristics | Hypertension N = 75 | No Hypertension N= 64 | Combined N = 139 | *p* value |
|---|---|---|---|---|
| Gender | | | | 0.09 |
| Male | 28 (37.33) | 17 (26.56) | 45 (32.37) | |
| Female | 47 (62.67) | 47 (73.43) | 94 (67.63) | |
| Age | 63.04 ± 11.79 | 50.43 ± 13.20 | 57.28 ± 13.89 | **<0.001** |
| Employment status | | | | 0.67 |
| Employed | 72 (97.30) | 60 (95.24) | 132 (96.35) | |
| Unemployed/Retired | 2 (2.70) | 3 (4.76) | 5 (3.65) | |
| Annual Household income | | | | 0.13 |
| < $25,000 | 16 (23.88) | 8 (13.79) | 24 (19.20) | |
| $25,000-$49,999 | 21 (31.34) | 18 (31.03) | 39 (31.20) | |
| $50,000-$74,999 | 4 (5.97) | 12 (20.69) | 16 (12.80) | |
| > $74,999 | 26 (38.81) | 20 (34.48) | 46 (36.80) | |
| BMI | 33.15 ± 6.84 | 28.84 ± 6.14 | 31.20 ± 6.86 | **<0.001** |
| Current Smoker | 13 (18.06) | 11 (17.19) | 24 (17.65) | 0.87 |
| Moderate Physical Activity | 2.79 ± 1.40 | 2.30 ± 1.29 | 2.56 ± 1.37 | 0.40 |
| Vigorous Physical Activity | 3.68 ± 1.49 | 2.97 ± 1.44 | 3.35 ± 1.50 | **0.01** |
| CES-D | 15.61 ± 4.84 | 15.36 ± 5.02 | 15.50 ± 4.91 | 0.91 |
| EDS | 16.43 ± 8.01 | 17.98 ± 7.01 | 17.15 ± 7.58 | 0.31 |
| HCIS | 8.60 ± 2.89 | 7.92 ± 2.80 | 8.29 ± 2.86 | **0.04** |
| ACIS | 9.44 ± 3.28 | 8.91 ± 2.55 | 9.19 ± 2.96 | 0.29 |

Note: data are presented as mean ± standard deviation or n (frequency). CES-D = Center for Epidemiologic Studies-Depression; EDS = Everyday Discrimination Scale; HCIS = Hawaiian Cultural Identity Scale; ACIS = American Cultural Identity Scale

**Table 2:**

Summary of correlations between primary study variables

| | | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | HTN Status | −0.14 | 0.39*** | 0.28*** | 0.13 | 0.20* | 0.01 | −0.01 | −0.09 | 0.17* | 0.11 |
| 2. | Gender | – | − 0.01 | 0.02 | 0.14 | 0.12 | 0.17* | 0.09 | −0.12 | −0.09 | −0.21** |
| 3. | Age | | – | −0.01 | 0.02 | 0.12 | 0.07 | −0.04 | −0.14 | 0.02 | −0.03 |
| 4. | BMI | | | – | 0.25** | 0.33*** | −0.01 | −0.01 | 0.20* | 0.03 | <0.01 |
| 5. | Moderate Physical Activity | | | | – | 0.75*** | −0.06 | 0.10 | −0.02 | 0.04 | 0.03 |
| 6. | Vigorous Physical Activity | | | | | – | 0.03 | 0.09 | −0.03 | 0.05 | 0.03 |
| 7. | Current Smoker | | | | | | – | 0.11 | −0.01 | −0.01 | 0.03 |
| 8. | CES-D | | | | | | | – | 0.31*** | 0.11 | 0.05 |
| 9. | EDS | | | | | | | | – | 0.17* | <0.01 |
| 10. | HCIS | | | | | | | | | – | 0.44*** |
| 11. | ACIS | | | | | | | | | | – |

Note: CES-D = Center for Epidemiologic Studies-Depression; EDS = Everyday Discrimination Scale; HCIS = Hawaiian Cultural identity Scale; ACIS = American Cultural Identity Scale

* $p < 0.05$,

** $p < 0.01$,

*** $p < 0.001$

**Table 3.**

Logistic regression of sociodemographic, biological, and psychosocial variables on hypertension status

| Variable | DF | OR | SE | 95% CI | | Wald $\chi^2$ | *p* |
|---|---|---|---|---|---|---|---|
| Age | **1** | 1.09 | 0.02 | 1.05 | 1.14 | 16.77 | <0.001 |
| BMI | **1** | 1.18 | 0.05 | 1.08 | 1.28 | 13.68 | <0.001 |
| Sex (female vs. male) Income | **1** | 0.49 | 0.15 | 0.27 | 0.88 | 5.64 | 0.02 |
| 25K – 49K (vs. < 25K) | **1** | 0.93 | 0.65 | 0.23 | 3.68 | 0.01 | 0.91 |
| 50K – 74K (vs. <25K) | **1** | 0.83 | 0.77 | 0.14 | 5.07 | 0.04 | 0.84 |
| > 75K (vs. < 25K) | **1** | 0.91 | 0.44 | 0.35 | 2.36 | 0.04 | 0.84 |
| Physical Activity | **1** | 1.29 | 0.26 | 0.87 | 1.91 | 1.57 | 0.21 |
| Employment Status (yes vs. no) | **1** | 1.36 | 0.93 | 0.35 | 5.22 | 0.20 | 0.65 |
| CES-D | **1** | 1.06 | 0.08 | 0.92 | 1.22 | 0.61 | 0.43 |
| EDS | **1** | 0.62 | 0.11 | 0.44 | 0.87 | 7.80 | 0.01 |
| HCIS | **1** | 0.52 | 0.17 | 0.28 | 0.97 | 4.16 | 0.04 |

**Table 4.**

Effect of discrimination and on the Odds Ratios of having hypertension by Hawaiian Cultural Identity Scale quintile

| Variable | OR | 95% CI | | *p* value |
|---|---|---|---|---|
| EDS * HCIS | | | | |
| 1st quintile | 0.74 | 0.61 | 0.91 | 0.003 |
| 2nd quintile | 0.86 | 0.77 | 0.95 | 0.003 |
| 3rd quintile | 0.99 | 0.90 | 1.08 | 0.763 |
| 4th quintile | 1.13 | 0.95 | 1.36 | 0.173 |
| 5th quintile | 1.31 | 0.98 | 1.74 | 0.069 |

Note: EDS = Everyday Discrimination Scale, HCIS = Hawaiian Cultural Identity Scale. HCIS scores range from 4 to 20. 1st quintile = 4 – 6; 2nd quintile = 7 – 9; 3rd quintile = 10 – 12; 4th quintile = 13 – 15; 5th quintile = 16 – 20.