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Perceived Discrimination and Cardiovascular Outcomes in Older African Americans: Insights from the Jackson Heart Study

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Abstract

Objective—To assess the associations of perceived discrimination and CV outcomes in African Americans (AA) in the Jackson Heart Study.

Methods—In 5085 AA free of clinical CV disease at baseline enrolled in the Jackson Heart Study from September 26, 2000–March 31, 2004 and followed through 2012, associations of everyday discrimination (frequency of occurrences of perceived unfair treatment) and lifetime discrimination (perceived unfair treatment in 9 life domains) with CV outcomes (all-cause mortality, incident coronary heart disease [CHD], incident stroke, and heart failure [HF] hospitalization) were examined using Cox models.

Results—Greater everyday and lifetime discrimination were more common in participants who were younger, male, had higher education and income, a lower perceived community standing, worse healthcare access, and fewer comorbidities. Prior to adjustment, greater everyday and lifetime discrimination were associated with a lower risk of all-cause mortality, incident CHD, stroke, and HF hospitalization. After adjustment for potential confounders, we found no association of everyday/lifetime discrimination with incident CHD, incident stroke or HF hospitalization; however, a decrease in all-cause mortality with progressively higher everyday discrimination persisted (HR per unit increase in discrimination 0.90, 95% CI 0.82–0.99, P=.02). The unexpected association of everyday discrimination and all-cause mortality was partially mediated by perceived stress.

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Conclusion—We found no independent associations of perceived discrimination with risk of incident CV disease or HF hospitalization in this AA population. An observed paradoxical negative association of everyday discrimination and all-cause mortality was partially mediated by perceived stress.

Keywords

discrimination; mortality; stroke; coronary disease; heart failure

INTRODUCTION

In 1985, the Heckler report[1] demonstrated that African Americans (AA) experienced worse health outcomes than Whites in the United States. Today, AA still suffer from a higher burden of adverse cardiovascular (CV) risk factors such as hypertension[2,3] and obesity[4], and are more likely to develop chronic CV conditions such as heart failure (HF)[5,6]. Perceived discrimination has been shown to play a role in the development of CV risk factors such as hypertension in AA[7], but the associations with CV outcomes have been less thoroughly examined. A recent report from a multi-ethnic cohort study found a modestly increased risk of CV events in participants reporting discrimination[8]. Whether this association persists in an exclusively AA population requires further examination. A better understanding of the role of discrimination in AA is of particular importance in designing public health prevention efforts, as AA are not only disproportionately affected with CV disease (CVD) compared with other races and ethnicities, but also most likely to report discrimination[8,9]. Furthermore, the way in which racial discrimination may lead to differences in health risks and outcomes may be complex and mediated by psychosocial factors such as poverty and education.

The extensive clinical and psychosocial data collected in the Jackson Heart Study (JHS) provide a framework to investigate whether perceived racial discrimination is associated with CV health outcomes and how other psychosocial constructs may mediate this relationship. The goal of this study was to determine the impact of perceived discrimination on outcomes (all-cause mortality, incident stroke, incident coronary heart disease [CHD], HF hospitalization) and to test the hypothesis that individuals with greater perceived discrimination experience worse outcomes and have a higher risk of incident CVD.

METHODS

Data sources

We used data from the JHS, a cohort study of AA adults from the Jackson, Mississippi metropolitan area developed to evaluate risk factors for CV outcomes in this community. Detailed study methods are reported elsewhere.[10–13] Briefly, 5301 participants, aged 21 to 94, were enrolled between September 26, 2000 and March 31, 2004. Participants had a baseline clinical examination and provided responses to interviews and questionnaires on topics including demographics, social and economic factors, medical history, and medications. This analysis uses data collected during the baseline exam visits and follow-up event surveillance data gathered through December 31, 2012. The JHS was approved by the

institutional review boards of Jackson State University, Tougaloo College, the University of Mississippi Medical Center, and the Duke University Health System. All study participants gave written informed consent.

Study population

We included all participants who completed the everyday and lifetime sections of the discrimination instrument at the baseline exam visit. For incident stroke and incident CHD, we excluded patients with prevalent stroke or prevalent CHD at the baseline exam visit, respectively. For HF hospitalization, we included participants who survived through January 1, 2005, the start date for HF hospitalization surveillance.

Exposure definition

Perceived discrimination was measured using three scales from the JHS Discrimination Instrument.[7,12,14] The *everyday discrimination* scale consists of nine statements following the question "How often on a day-to-day basis do you have the following experiences?" Examples include "You are treated with less respect than other people", "People act as if they think you are not smart", and "You are threatened or harassed". Response choices range from "never"(1) to "several times a day"(7) assessing frequency of everyday discrimination. The mean of the nine responses was treated as a continuous variable (range 1–7). The *lifetime discrimination* scale consists of nine domains completing the question "Have you ever felt unfairly treated…?" Examples include "in getting a job", "at school or during training", and "in getting resources or money". The sum of the binary responses ("Yes"=1; "No"=0) was used as a continuous measure (range of 0 to 9). Finally, the *burden of lifetime discrimination* scale is composed of 3 questions asking participants to rate how stressful these experiences have been, to what extent discrimination has interfered with having a full and productive life, and how much harder life has been due to discrimination, scored on a 1 to 4 scale where 4 represents the greatest burden.

Outcome ascertainment

CV endpoints were ascertained by annual telephone follow-up interviews, surveillance of hospitalizations with adjudicated medical abstraction review, and death certificate review.[15] Hospital discharge lists are reviewed for International Classification of Diseases, 9th revision (ICD-9) codes for CV events (CHD, stroke, HF), and if present, hospital records are reviewed in detail by trained abstractors with data entered into a computerized system. For incident stroke and incident CHD events, computerized event data are subsequently reviewed and events adjudicated by a committee. Surveillance for incident stroke, incident CHD and deaths began in September 2000; surveillance of HF hospitalizations began on January 1, 2005; as a result of the delay in HF hospitalization surveillance, we measure time to first HF hospitalization after January 1, 2005 but cannot determine whether subjects had other HF hospitalizations prior to that date.

Covariates

Covariates were selected based on prior knowledge of potential confounders. We categorized these variables into four groups, which were then used as sequential adjustment sets in the

models. Demographic variables included age and sex. Clinical and behavioral variables included smoking status (never, former, or current); body mass index; hypertension, hypercholesterolemia, diabetes mellitus, and estimated glomerular filtration rate. Socioeconomic status variables included income (poor, lower-middle, upper-middle, affluent, or missing); education (less than high school, high school graduate, college degree, or graduate/professional degree); occupation (management/professional, service, sales, construction, production, and other/missing); perceived standing in the community (continuous variable); and healthcare access. The fully-adjusted model included an ordinal scale for social support (Range 0–5, continuous variable, calculated by the sum of items assessing marital status, number of friends and relatives, and involvement in community groups).

Statistical analysis

For descriptive analyses and the assessment of threshold effects, the everyday and lifetime discrimination scores were categorized into quartiles. Baseline characteristics were described by quartile of everyday or lifetime discrimination using frequencies with percentages for categorical variables and means with standard deviations for continuous variables. To compare baseline characteristics between quartiles, we used $\chi 2$ tests for categorical variables and Kruskal-Wallis tests for continuous variables. Kaplan-Meier methods were used to calculate and plot 11-year cumulative incidence of all-cause mortality, incident stroke, and incident CHD and 8-year cumulative incidence for HF hospitalization. Log-rank tests were used to assess differences by quartile.

Unadjusted and adjusted Cox proportional hazards regression models were used to examine the associations of each discrimination measure on a continuous scale (everyday, lifetime and burden) and each of the four outcomes. Participant censoring was set at the time of (a) participant loss to follow-up, or (b) December 31st, 2012, the end of study follow-up; for incident CHD, incident stroke, and HF hospitalization, death was treated as an additional censoring event. Each discrimination measure was parameterized with a linear functional form and Box-Tidwell tests were used to assess potential non-linearity. Covariate groups were sequentially entered into five successive regression models for each outcome: 1) unadjusted, 2) adjusted for demographic variables, 3) adjusted for demographic and clinical/behavioral variables, 4) adjusted for variables in model 3 plus socioeconomic variables, and 5) adjusted for variables in model 4 plus social support. The proportional hazards assumption was tested by including a term for the interaction between each discrimination measure and the log of survival time. Potential effect modification was assessed by including a term for the interaction between each discrimination measure and either age or sex into each of the fully-adjusted models. In a post-hoc analysis, we explored if perceived stress mediated the association of everyday discrimination and mortality by adding perceived stress as a continuous variable to the final model (model 5). Perceived stress should be considered on the causal pathway between discrimination and health outcomes, particularly because the perceived stress questionnaire contains a question, “Over the past 12 months, how much stress did you experience related to racism and discrimination?” We conducted a simple mediation analysis of the relationships between discrimination, stress, and all-cause mortality using the four steps suggested by Baron and Kenny.[16]

Most variables had very low rates of missingness (<5%). For variables with < 5% missingness, we imputed continuous variables to the median value, dichotomous variables to "no", and multichotomous variables to the most frequent categorical value.[17] For household income (15.3% missingness) missing values were treated as a separate category.[18] All analyses were performed using SAS version 9.4 (SAS Institute, Cary, North Carolina). A *P* value of <.05 was used as the level of significance in all analyses.

RESULTS

Study population

In total, 5,301 participants were enrolled in the JHS from September 26, 2000–March 31, 2004, of whom 5,085 (95.8%) completed baseline discrimination questionnaires and were included in analysis. The mean (standard deviation) age of participants was 55.3 (12.8) years and 1,856 (36.5%) were men. Most participants (81.7%) graduated high school and 39.6% had a college or graduate degree.

The vast majority of participants (85%) reported experiencing discrimination at some point in their life. The baseline characteristics of the study population by quartiles of everyday discrimination are shown in Table 1. Participants reporting a higher burden of everyday discrimination were more often younger, male, had higher education, higher income, lower perceived standing in the community, worse perceived healthcare access, higher body mass index, and a lower prevalence of CV risk factors. Similar differences in characteristics were observed when the population was stratified by quartiles of lifetime discrimination (data not shown).

Associations of perceived discrimination and CV outcomes

Over a median follow-up of 9.8 (25^{th}, 75^{th} percentile 8.8, 10.6 years; median 8.0 years, 25^{th}, 75^{th} percentile 7.5, 8.0 years for HF hospitalizations), 573 deaths, 193 incident CHD, 156 incident strokes, and 348 HF hospitalizations were observed. The cumulative incidence of all-cause mortality, incident CHD, incident stroke, and HF hospitalization were higher in participants with lower perceived discrimination (Figures 1 and 2, Supplemental Tables 1 and 2). Accordingly, in the unadjusted model, greater perceived everyday discrimination was associated with a lower risk of all-cause mortality, incident stroke, and HF hospitalization (Table 2). Findings were similar for lifetime discrimination (Table 3). The unadjusted association of perceived discrimination and incident CHD was statistically significant for lifetime discrimination (HR 0.91, 95% CI 0.85, 0.97), but not everyday discrimination (HR 0.88, 95% CI 0.76, 1.03). In participants reporting discrimination, we found no association between the burden of lifetime discrimination and all-cause mortality, incident CHD, incident stroke, or HF hospitalization (*P*>.05 in unadjusted and adjusted analyses, Supplemental Table 3).

Potential confounders and mediators of the associations of perceived discrimination with CV outcomes were adjusted for in a stepwise fashion. Adjusting for age and sex (Model 2, Tables 2 and 3) shifted all of the HR toward, or through, the null, largely due to the fact that older participants reported less discrimination and were at greater risk for incident CVD. In

the fully-adjusted models, we found no statistically significant association of perceived discrimination with incident CHD, incident stroke or HF hospitalization; however, a decrease in all-cause mortality risk with progressively higher perceived everyday discrimination persisted (adjusted HR per unit increase in perceived discrimination 0.90, 95% CI 0.82, 0.99, *P*=.02). However, perceived stress partially mediated this association. The addition of perceived stress to the final model (model 5) resulted in an adjusted HR of 0.92 (95% CI 0.83, 1.01, *P*=.08). The association of lifetime discrimination and all-cause mortality was not significant (HR 0.96, 95% CI 0.92, 1.00, *P*=.06). Results were similar when perceived discrimination was modeled in quartiles (Supplemental Table 4. No differences in the associations of discrimination (everyday, lifetime) and outcomes by age or sex were detected (*P* values for interactions with each discrimination measure for each outcome were all >.05).

DISCUSSION

This study revealed several key findings. First, perceived discrimination was related to demographics, socioeconomic and psychosocial factors in this large, community-based AA cohort. Second, older individuals reported less discrimination than younger individuals, which is of importance when considering the associations of discrimination and age-related outcomes such as CVD and death. Third, in contrast to findings from a multi-ethnic cohort[8], we found no independent associations of perceived discrimination with risk of incident CHD, incident stroke or HF hospitalization. Fourth, we did, however, find an unexpected inverse association of perceived everyday discrimination with all-cause mortality that persisted after adjustment for potential confounders.

Our finding that older participants report less discrimination is consistent with prior reports[7,19], but becomes particularly important when examining the associations of discrimination with risk of outcomes that increase with age, such as those examined in this study. The connection between age and perceived discrimination may relate to factors other than age alone. In the JHS, younger participants had higher education[8,20] and income[8,20] than older participants, and may live and work in environments of greater racial and ethnic diversity where exposure to discrimination would be more likely to occur[9,21] and thus be likely to have adverse effects on proximal (vs. distal) health outcomes.

This is one of the first reports of the associations of discrimination and incident CVD and death in AA. To the best of our knowledge, the only prior study of the associations of discrimination and incident CV events was an analysis of participants in the Multi-Ethnic Study of Atherosclerosis, which enrolled individuals age 45–84 of all races and ethnicities in six United States cities. The authors reported a modest increase in the risk of incident CV events in participants with greater lifetime discrimination (HR 1.28)[8]. As the number of events was approximately half that observed in our study, the authors used a combined endpoint of incident CHD, incident stroke, and CV death in their analysis. While the 26% of AA participants (N=1,718) were more likely to report discrimination, they acknowledge that the power to detect differences by race/ethnicity was limited and stratified analyses by race were not performed. Herein, in an exclusively AA population, we found no independent association of perceived discrimination and incident CHD or incident stroke. Furthermore,

we found no increased risk of HF hospitalization in participants reporting greater discrimination, which has not been examined in previous studies.

There have been two prior reports of the associations of perceived discrimination and all-cause mortality, with disparate results. In AA women enrolled in the Black Women's Health Study, no association between perceived experiences of racism and all-cause mortality was found.[22] By contrast, perceived discrimination was associated with a modest, albeit statistically significant (HR 1.05 per 1 point increase in discrimination scale, 95% CI 1.01–1.09), increased risk of all-cause mortality in older adults participating in the Chicago Health and Aging Project[23]. Our study adds to these prior studies by including AA of both sexes, spanning the adult age spectrum and analyzing multiple measures of discrimination. While participants reporting less discrimination more often died in follow-up, this was mostly accounted for by differences in demographics. In the JHS, the more highly educated, younger AA who are most likely to report experiencing discrimination also have the lowest risk of all-cause mortality due to their demographic and behavioral characteristics. Even after adjustment for demographics, comorbidities, socioeconomic factors, and social support, there was still a slightly lower risk of all-cause mortality in participants with greater perceived discrimination, which was an unexpected finding. However, we found that perceived stress partially mediated this association, and may lie on the causal pathway between perceived discrimination and mortality in AAs. This finding is worthy of analysis in future studies.

There are several potential reasons why perceived discrimination may not be associated with risk of CV events in AA. First, while discrimination has been associated with a higher prevalence of some CV risk factors, such as hypertension[7] and tobacco use[20,24], it has also been linked with CV-protective behaviors such as physical activity.[9] Second, data on the associations of perceived discrimination and subclinical CVD have had mixed results, with one study demonstrating a positive association with coronary artery calcium[25] and another finding no relationship between discrimination and either coronary artery calcification or aortic wall thickness[19]. Third, in the JHS, younger AA report greater levels of discrimination, but also have more ideal health behaviors (diet, physical activity[26]), inflammatory biomarkers (C reactive protein[27]) and clinical risk factors (blood pressure, diabetes) than older participants which may counteract potential negative effects of discrimination on CV outcomes. In other words, the manner by which younger AA in the JHS cope with stressors (such as discrimination) via physical exercise may contribute to the lack of effect of discrimination on CV outcomes we observed. Clearly, more analysis is warranted to further explore the stress-response, behavioral[28], inflammatory, and risk-factor pathway between exposure to discrimination and manifestation of CV outcomes in AA. Fourth, perhaps the examination of perceived discrimination in a population that perceives high levels of discrimination (>65%) may demonstrate a potential 'ceiling' effect of discrimination on CV outcomes. Alternatively, discrimination measures that capture one event in one's lifetime, or that assess everyday experiences of unfair treatment over the last week or month may not capture the intended effect this type of stressor may have on CV events which develop sub-clinically over a greater period of time than when a person is exposed to discrimination. Therefore, a more precise method to capture the complex causal chain between exposure to discrimination and CV outcomes may be to examine the

chronicity (or average change over time) of discrimination and its association with CV outcomes. The chronicity of discrimination likely captures the ongoing effect of interpersonal discrimination which may impact the risk of CV events or all-cause mortality. Targeted approaches to reduce the harmful effects of chronic discrimination (i.e., stress-reduction, mind-body, yoga interventions) may help to mitigate the deleterious consequences of this type of exposure.

Limitations

There are limitations to acknowledge to aid in interpretation of these data. First, this was a retrospective analysis from AA in the Jackson, Mississippi metropolitan area, a community with a very high concentration of AA, and findings may differ in other AA populations. While we adjusted for numerous potential confounders, residual confounding from unmeasured factors may still exist. As perceived discrimination may change over time, the associations of serial measures of discrimination with CV outcomes would be of interest to examine in future studies.

Strengths

There are also several important strengths. The JHS is the largest study of CVD in AA and participants are well characterized in psychosocial measures, which enabled us to examine multiple dimensions of discrimination and key socioeconomic factors. The JHS also has longitudinal surveillance for outcomes, thus enabling us to examine the associations of discrimination and CV outcomes after adjustment for a rich set of potential confounders. CV outcomes were adjudicated by an expert panel, which provides a rigorous assessment of discrimination and clinically relevant CV outcomes.

Clinical Implications

These data, interpreted in the context of prior studies, support that perceived discrimination may be associated with the development of near-term CV risk factors such as hypertension, but is not a strong factor in the long-term development of incident CV events or all-cause mortality in AAs. The examination of potentially modifiable factors (e.g. behavioral, psychosocial, and clinical) that comprise the causal pathways of these associations is paramount to identifying ways to treat individuals at the highest risk of discrimination to optimize outcomes. Perhaps an examination of institutional forms of discrimination, which affect various socioeconomic factors and life chances of at-risk groups, may have a greater effect on CV outcomes than interpersonal discrimination.[7,29]

CONCLUSION

In the JHS, after adjustment for differences in clinical and socioeconomic factors, we found no association between perceived everyday or lifetime discrimination and risk of CV events. An unexpected lower risk of all-cause mortality in those with greater perceived everyday discrimination was observed, and was partially mediated by perceived stress. These findings suggest that, in an AA community with high levels of perceived discrimination, discrimination does not have significant independent adverse effects on long-term CV outcomes. Further work is needed to understand the mechanistic pathway underlying how

discrimination may impact the development of near-term CV risk factors, but not result in worse long-term outcomes.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

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ABBREVIATIONS

AA	African Americans
CHD	coronary heart disease
CI	confidence interval
CV	cardiovascular
CVD	cardiovascular disease
HF	heart failure
HR	hazard ratio
ICD-9	International Classification of Diseases, 9th Revision
JHS	Jackson Heart Study

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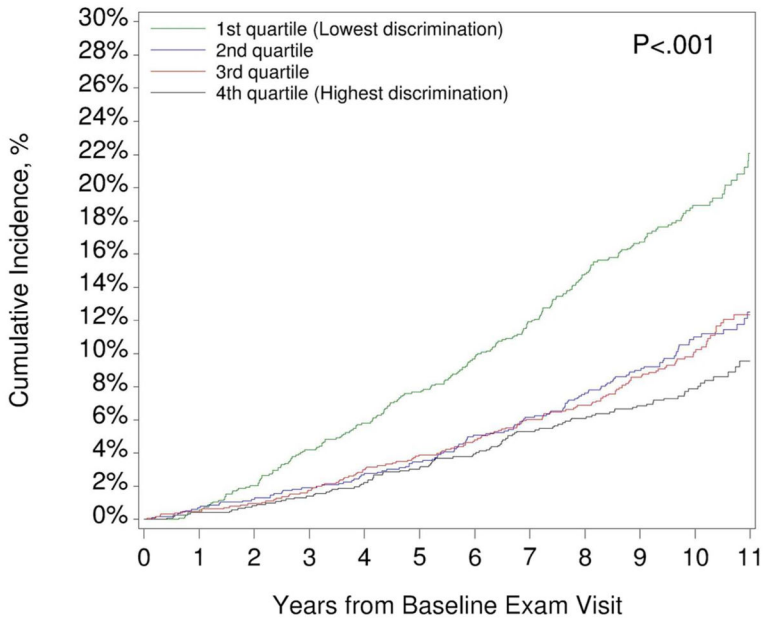


Figure 1A

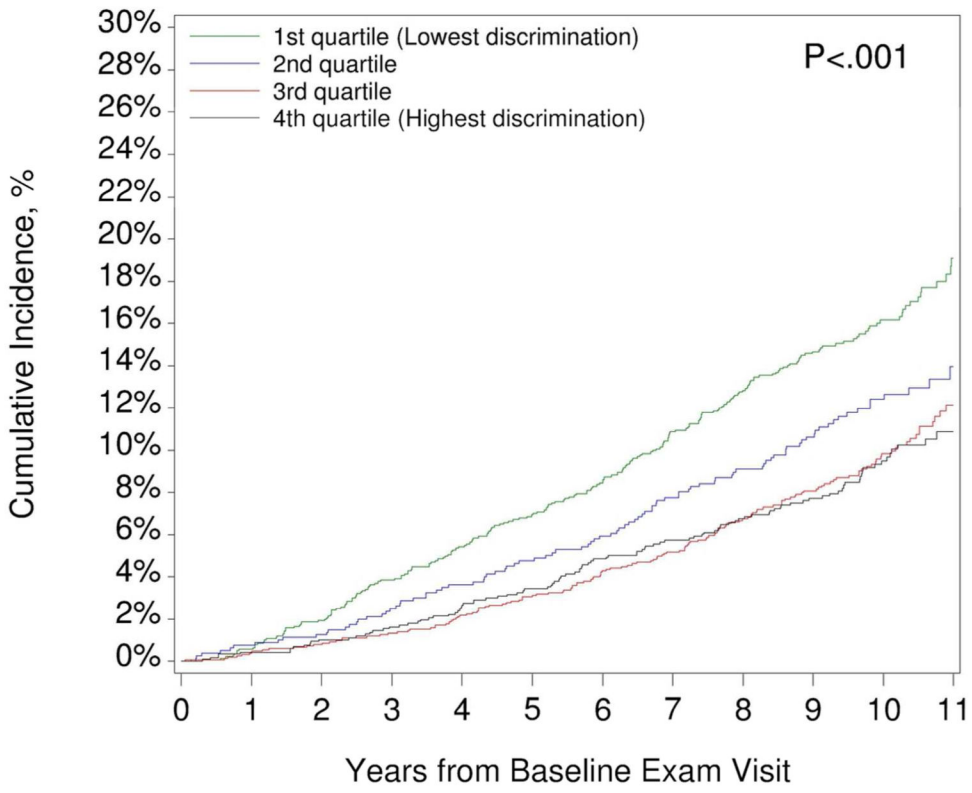


Figure 1B

Figure 1. Cumulative incidence of All-cause Mortality by Quartiles of Everyday and Lifetime Discrimination

The cumulative incidence of all-cause mortality by quartiles of everyday (1A) and lifetime (1B) discrimination are shown.

Figure 1A. All-cause mortality by everyday discrimination

Figure 1B. All-cause mortality by lifetime discrimination

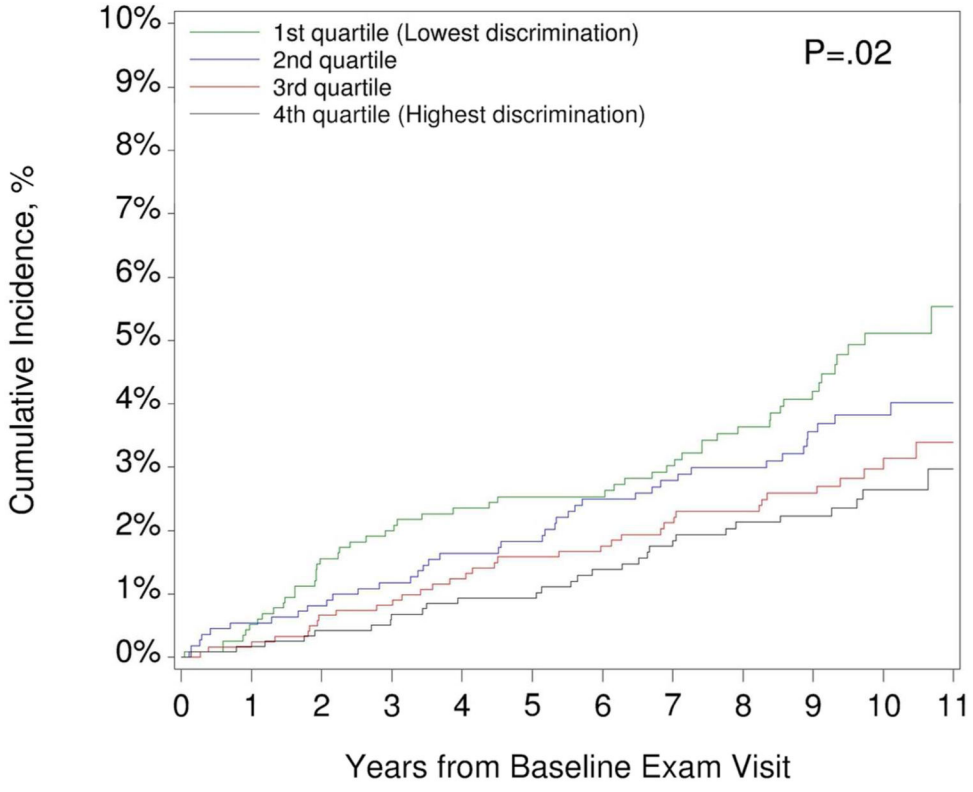
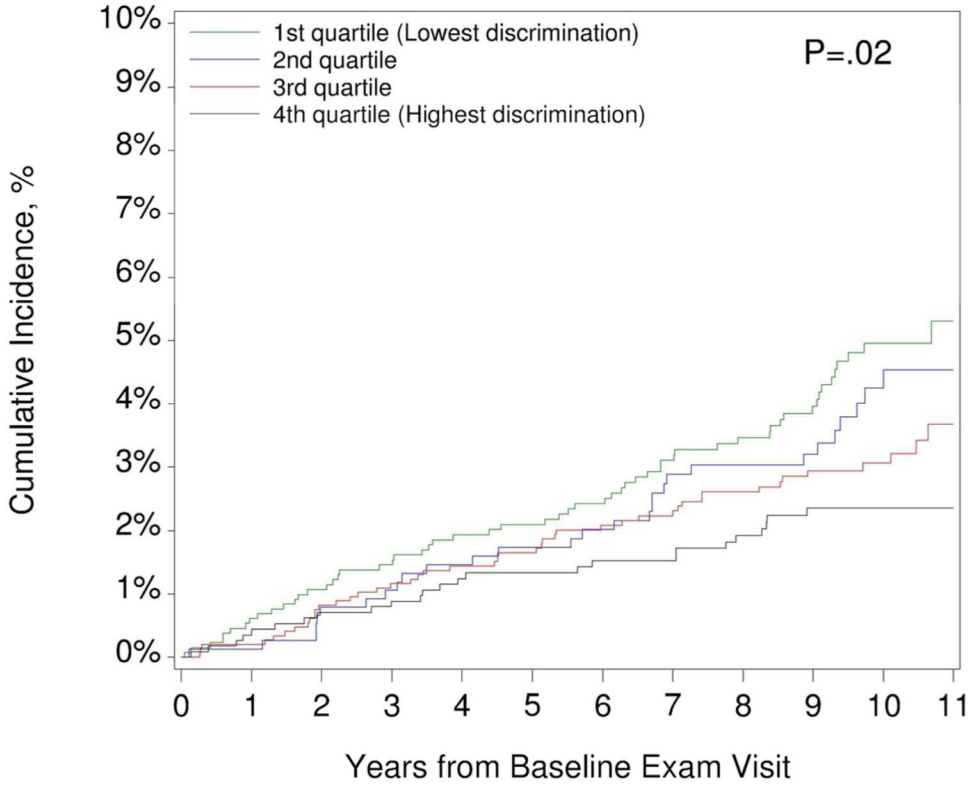


Figure 2A



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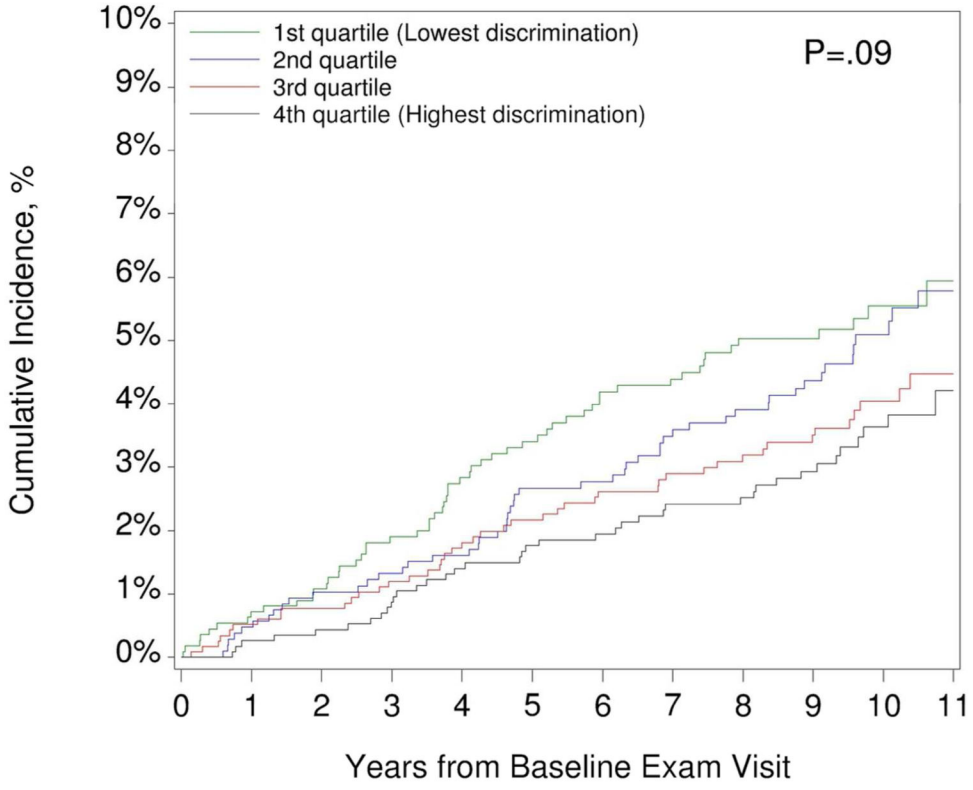

Figure 2C

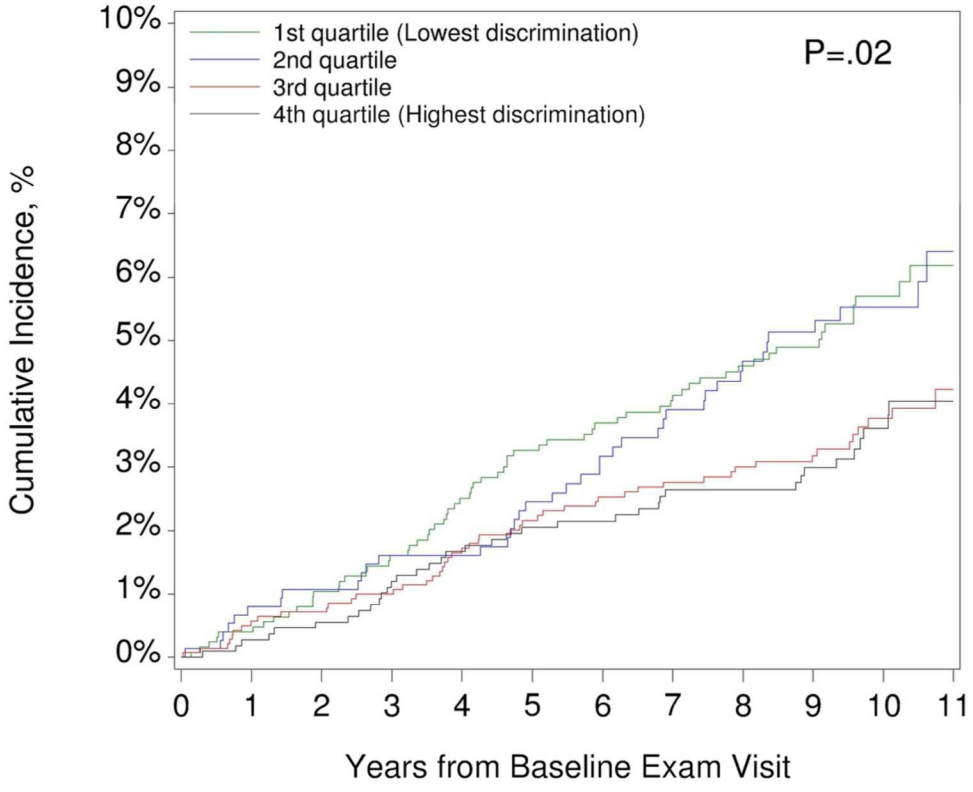

Figure 2D

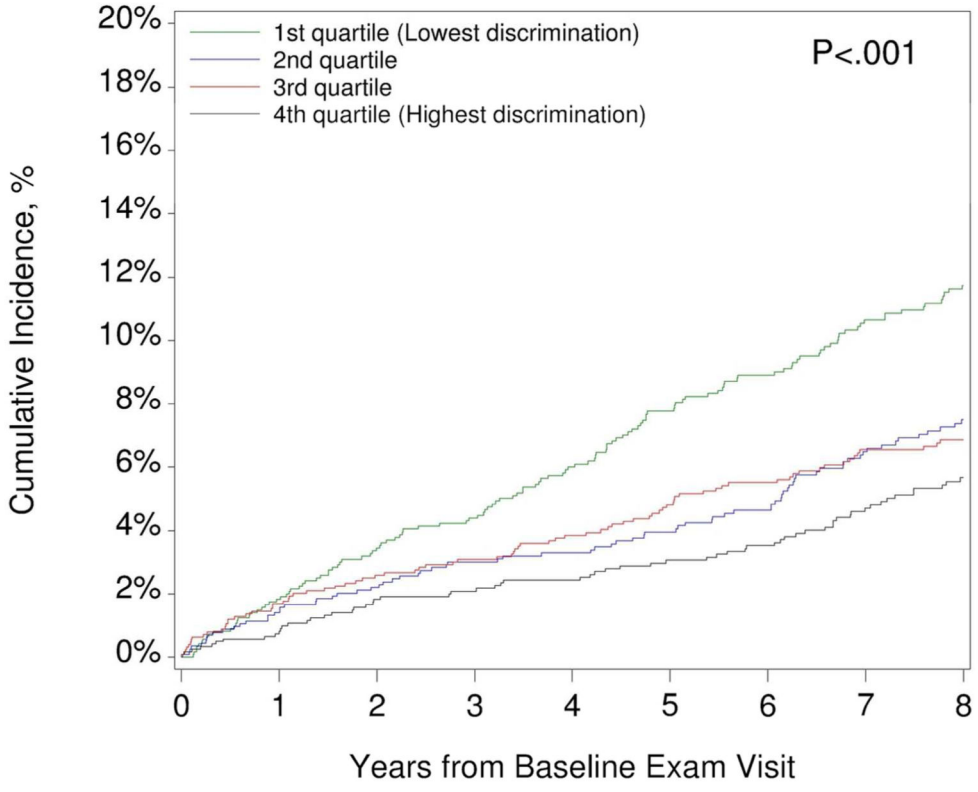

Figure 2E

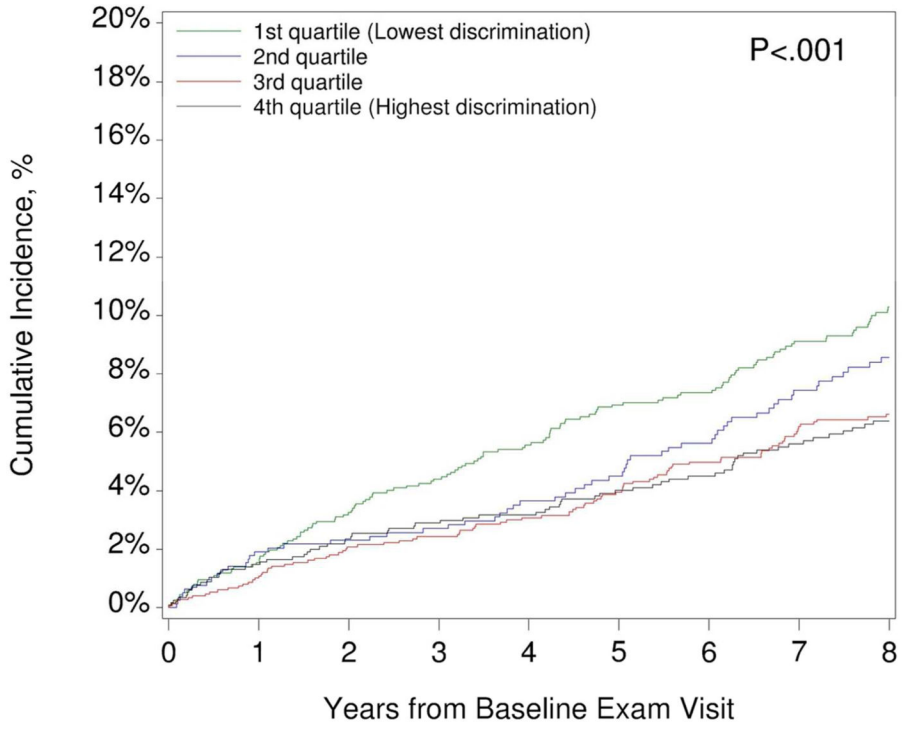

Figure 2F

Figure 2. Cumulative Incidence of Incident Stroke, Incident Coronary Heart Disease, and Heart Failure Hospitalization by Quartiles of Everyday and Lifetime Discrimination

The cumulative incidence of incident stroke (2A, 2B), coronary heart disease (2C, 2D), and heart failure (2E, 2F) by quartiles of everyday and lifetime discrimination are shown.

Figure 2A. Incident Stroke by Everyday Discrimination

Figure 2B. Incident Stroke by Lifetime Discrimination

Figure 2C. Incident CHD by Everyday Discrimination

Figure 2D. Incident CHD by Lifetime Discrimination

Figure 2E. Heart Failure by Everyday Discrimination

Figure 2F. Heart Failure by Lifetime Discrimination

Table 1

Baseline Characteristics of 5,085 Jackson Heart Study Participants by Quartiles of Perceived Everyday Discrimination

	Lowest Discrimination → Highest Discrimination[a]				
	1st Quartile	**2nd Quartile**	**3rd Quartile**	**4th Quartile**	***P* - value**
N	1287	1211	1303	1284	
Demographics					
Age, mean (SD)	60.3 (12.8)	55.9 (12.4)	53.8 (12.3)	51.1 (12.0)	< .001
Male sex, No. (%)	453 (35.2)	377 (31.1)	508 (39.0)	518 (40.3)	< .001
Socioeconomic					
Education, No. (%)					< .001
Less than high school	379 (29.4)	197 (16.3)	174 (13.4)	182 (14.2)	
High school graduate	510 (39.6)	488 (40.3)	545 (41.8)	595 (46.3)	
College degree	218 (16.9)	296 (24.4)	335 (25.7)	323 (25.2)	
Graduate or professional degree	180 (14.0)	230 (19.0)	249 (19.1)	184 (14.3)	
Income[b], No. (%)					< .001
Poor	206 (16.0)	122 (10.1)	162 (12.4)	181 (14.1)	
Lower-middle	316 (24.6)	243 (20.1)	218 (16.7)	265 (20.6)	
Upper-middle	293 (22.8)	308 (25.4)	358 (27.5)	323 (25.2)	
Affluent	258 (20.0)	346 (28.6)	398 (30.5)	310 (24.1)	
Missing	214 (16.6)	192 (15.9)	167 (12.8)	205 (16.0)	
Occupation, No. (%)					< .001
Management/professional	373 (29.0)	490 (40.5)	538 (41.3)	428 (33.3)	
Service	407 (31.6)	279 (23.0)	276 (21.2)	310 (24.1)	
Sales	167 (13.0)	233 (19.2)	216 (16.6)	258 (20.1)	
Construction	78 (6.1)	63 (5.2)	88 (6.8)	82 (6.4)	
Production	243 (18.9)	135 (11.1)	175 (13.4)	196 (15.3)	
Other/Missing[c]	19 (1.5)	11 (0.9)	10 (0.8)	10 (0.8)	
Perceived standing in the community, mean (SD)[d]	8.0 (2.0)	7.8 (1.9)	7.4 (2.0)	7.2 (2.1)	< .001
Social support, mean (SD) [d]	4.1 (0.8)	4.3 (0.8)	4.2 (0.8)	4.1 (1.0)	< .001
Healthcare access, mean (SD) [d]	0.4 (0.7)	0.4 (0.8)	0.5 (0.9)	0.6 (0.9)	< .001

	Lowest Discrimination → Highest Discrimination[a]				
	1st Quartile	2nd Quartile	3rd Quartile	4th Quartile	*P* - value
Physical examination					
BMI, kg/m2, mean (SD)	31.1 (6.6)	31.8 (7.1)	31.7 (7.4)	32.3 (7.7)	.009
Behavioral factors					
Smoking history, No. (%)					< .001
Never smoked	881 (68.5)	842 (69.5)	884 (67.8)	839 (65.3)	
Former smoker	272 (21.1)	234 (19.3)	252 (19.3)	231 (18.0)	
Current smoker	134 (10.4)	135 (11.1)	167 (12.8)	214 (16.7)	
Comorbidities					
Hypertension, No. (%)	889 (69.1)	727 (60.0)	747 (57.3)	698 (54.4)	< .001
Hypercholesterolemia, No. (%)	429 (33.3)	386 (31.9)	364 (27.9)	334 (26.0)	< .001
Diabetes, No. (%)	316 (24.6)	282 (23.3)	266 (20.4)	249 (19.4)	.004
Estimated GFR, mean (SD)	82.9 (19.7)	85.0 (18.2)	86.7 (17.6)	89.1 (17.5)	< .001

BMI= body mass index; GFR= glomerular filtration rate; No.=number; SD=standard deviation

[a]Patients were divided into quartiles by everyday discrimination scores (range 1–7). The range of scores from the lowest to highest quartile were 1.00–1.22, 1.33–1.77, 1.88–2.55, 2.66–7.00.

[b]Income categories were based on family size, US Census poverty levels, and year of baseline clinic visit (2000–2004). Poor represents income below poverty level. Lower-middle, upper-middle, and affluent represent 1–1.5, >1.5 – <3.5, and ≥ 3.5 times the poverty level, respectively.

[c]"Other / missing" occupation includes farming, military, sick, unemployed, homemaker, retired, student, and missing.

[d]Perceived standing in the community scores range from 1–10 with higher scores indicating greater perceived standing. The social support scale ranges from 0–5 with higher scores indicate greater social support. Healthcare access scores range from 0–3 with lower scores indicating better perceived healthcare access.

Table 2

Hazard ratios for the Associations of Everyday Discrimination and All-cause Mortality, Incident Stroke, Incident Coronary Heart Disease, and Heart Failure Hospitalization

Model	All-cause mortality		Incident stroke		Coronary heart disease		Heart failure hospitalization	
	Hazard Ratio (95% CI)[d]	*P*-value	Hazard Ratio (95% CI) [d]	*P*-value	Hazard Ratio (95% CI) [d]	*P*-value	Hazard Ratio (95% CI) [d]	*P*-value
1: Unadjusted	0.74 (0.67, 0.81)	< .001	0.76 (0.63, 0.91)	.003	0.88 (0.76, 1.03)	.11	0.79 (0.70, 0.89)	< .001
2: Age and Sex	0.94 (0.85, 1.03)	.16	0.93 (0.78, 1.11)	.40	1.05 (0.91, 1.22)	.49	0.99 (0.89, 1.12)	.92
3: M2+Behavioral/Clinical[a]	0.91 (0.83, 1.00)	.05	0.90 (0.75, 1.07)	.24	1.05 (0.90, 1.21)	.54	0.97 (0.86, 1.08)	.55
4: M3+Socioeconomic[b]	0.90 (0.82, 0.99)	.03	0.91 (0.76, 1.08)	.28	1.04 (0.90, 1.20)	.62	0.96 (0.85, 1.08)	.50
5: M4+Social Support[c]	0.90 (0.82, 0.99)	.02	0.90 (0.76, 1.08)	.27	1.04 (0.90, 1.20)	.62	0.96 (0.85, 1.08)	.49

[a] Adjusted for all variables in model 2 plus smoking status, body mass index, hypertension, hypercholesterolemia, diabetes mellitus, estimated glomerular filtration rate

[b] Adjusted for all variables in model 3 plus income, education, occupation, perceived standing in the community, healthcare access. Due to low event counts, 3 variables were re-parameterized to reduce the total degrees of freedom for the incident stroke and incident coronary heart disease models only: (1) income was reduced to 3 categories, (2) education was treated as continuous, and (3) occupation was dichotomized.

[c] Adjusted for all variables in model 4 plus social support

[d] Hazard ratios are per 1-point increase in everyday discrimination

Table 3

Hazard ratios for the Associations of Lifetime Discrimination and All-cause Mortality, Incident Stroke, Incident Coronary Heart Disease, and Heart Failure Hospitalization

Model	All-cause mortality		Incident stroke		Coronary heart disease		Heart failure hospitalization	
	Hazard Ratio (95% CI) [d]	*P*-value	Hazard Ratio (95% CI) [d]	*P*-value	Hazard Ratio (95% CI) [d]	*P*-value	Hazard Ratio (95% CI) [d]	*P*-value
M1: Unadjusted	0.88 (0.85, 0.92)	< .001	0.88 (0.81, 0.95)	.001	0.91 (0.85, 0.97)	.007	0.91 (0.86, 0.96)	< .001
M2: Age and Sex	0.94 (0.90, 0.98)	.004	0.93 (0.86, 1.00)	.06	0.95 (0.89, 1.02)	.17	0.97 (0.92, 1.02)	.28
M3: M2+Behavioral/Clinical[a]	0.94 (0.91, 0.98)	.006	0.93 (0.86, 1.01)	.07	0.96 (0.89, 1.03)	.24	0.97 (0.92, 1.03)	.33
M4: M3+Socioeconomic[b]	0.96 (0.92, 1.00)	.04	0.94 (0.86, 1.02)	.12	0.96 (0.89, 1.03)	.27	0.99 (0.93, 1.04)	.65
M5: M4+Social Support[c]	0.96 (0.92, 1.00)	.06	0.94 (0.86, 1.02)	.12	0.96 (0.89, 1.03)	.28	0.99 (0.94, 1.04)	.68

[a] Adjusted for all variables in model 2 plus smoking status, BMI, hypertension, hypercholesterolemia, diabetes mellitus, estimated glomerular filtration rate

[b] Adjusted for all variables in model 3 plus income, education, occupation, perceived standing in the community, healthcare access. Due to low event counts, 3 variables were re-parameterized to reduce the total degrees of freedom for the incident stroke and incident coronary heart disease models only: (1) income was reduced to 3 categories, (2) education was treated as continuous, and (3) occupation was dichotomized.

[c] Adjusted for all variables in model 4 plus social support.

[d] Hazard ratios are per 1-point increase in lifetime discrimination