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The role of perceived discrimination in predicting changes in health behaviours among African Americans in the Jackson Heart Study

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ABSTRACT

Background This study examined whether perceived discrimination was associated with health behaviours over time and whether associations of discrimination with behaviours varied by attribution of discrimination.
Methods Multinomial logistic regression was used to estimate ORs and CIs for the associations of discrimination (everyday, lifetime, stress from lifetime discrimination) with health behaviours (cigarette smoking, alcohol use) over time among 3050 African Americans in the Jackson Heart Study from visit 1 (2000–2004) to visit 3 (2009–2013). Smoking status was classified as persistent current, persistent former, persistent never, current to former and former/never to current smokers. Alcohol use status was classified as persistent heavy, persistent moderate/none, heavy to moderate/none and moderate/none to heavy alcohol users.
Results Higher everyday discrimination was associated with persistent current smoking (OR per SD higher discrimination 1.26, 95% CI 1.11,1.43) and with persistent former smoking (high vs low OR 1.32, 95% CI 1.02,1.70) relative to persistent never smoking. Similar findings were observed for lifetime discrimination and persistent current smoking (high vs low OR 1.85, 95% CI 1.15,2.95) and with persistent former smoking (high vs low OR 1.45, 95% CI 1.06,1.98). Participants reporting lifetime discrimination as very stressful compared with not stressful were more likely to be persistent former smokers (OR 1.44, 95% CI 1.04,1.99). Associations did not vary by discrimination attribution.
Conclusion Discrimination did not predict changes in smoking status or alcohol use. Discrimination was associated with persistent current smoking status, which may provide a plausible mechanism through which discrimination impacts the health of African Americans.

INTRODUCTION

African Americans have a higher risk of cardiovascular disease (CVD)[1–3] compared with other racial and ethnic groups in the USA.[3 4] Racial discrimination has been hypothesised to contribute to these well-documented racial inequities. In support of this hypothesis, studies have linked perceived discrimination to subclinical CVD[5] and to CVD events.[6] However, questions remain regarding the specific mechanisms that may explain these associations.

One plausible mechanism through which discrimination may impact cardiovascular health is via the stress pathway, whereby stress arising from discrimination activates the sympathetic nervous system and hypothalamic-pituitary-adrenal axis.[7 8] Another potential mechanism linking discrimination to cardiovascular health is through maladaptive coping behaviours in response to stress,[9] such as smoking[10–12] and alcohol use.[13 14]

There is evidence to suggest that African Americans may engage in maladaptive behaviours as one way to buffer or reduce the chronic stress that results from discrimination.[15 16] Maladaptive coping behaviours in response to discrimination are further compounded by targeted marketing of tobacco and alcohol products within African American communities,[17] and may contribute to the disproportionate burden of chronic illness among African Americans. Chronic illnesses occur disproportionately among African Americans, which may be a consequence of engaging in such behaviours.[16 18]

Several studies have reported associations of discrimination with smoking and alcohol use.[12 19–23] However, these studies have been mostly cross-sectional, limiting causal inferences. In addition, they have not explored the moderating role of discrimination attribution in the association between discrimination and health behaviours. Discrimination attributed to race has been posited to be a more intense form of discrimination affecting African Americans.[24] Thus, the impact of discrimination on health behaviours may differ among those attributing discrimination to race and those attributing discrimination to other reasons.[19]

The Jackson Heart Study (JHS) provides an opportunity to address these gaps in our understanding of the links between discrimination and health behaviours. We used data from the JHS to examine the extent to which multiple measures of discrimination (everyday, lifetime) and stress from lifetime discrimination are associated with changes in health behaviours (smoking and alcohol) over time, and whether discrimination attribution modifies these associations. Based on the plausible mechanisms linking discrimination to smoking and alcohol use, we hypothesised that high levels of discrimination would be associated with the persistence of smoking and alcohol use over time and with the uptake of these behaviours (eg, from never to current). We further hypothesised that the appraisal of lifetime discrimination as stressful would also lead to persistence or uptake of unhealthy behaviours.

METHODS

The JHS cohort

The JHS is a community-based, prospective cohort study that was designed to examine CVD among non-institutionalised African American adults (21–95 years of age), who live in the tricounty area of Jackson, Mississippi (Hinds, Madison, Rankin counties). Participants were sampled from four recruitment pools at baseline: (1) Jackson participants of the Atherosclerosis Risk in Communities study (30%); (2) participants randomly sampled from the Mississippi Department of Transportation Driver's License and Identification List (17%); (3) volunteers who signed up for the study (22%); and (4) family members of participants who agreed to be a part of the study (31%). Additional details about the design and recruitment of participants are described elsewhere.[25–27]

Information on demographics, health behaviours, CVD risk factors and psychosocial factors (including discrimination) was obtained from self-administered questionnaires, in-home interviews and clinical examinations across three waves of data collection (2000–2013).[25 28] JHS participants were enrolled (n=5306) during baseline, henceforth referred to as visit 1 (2000–2004). Additional data were collected during the follow-up assessments at visit 2 (2005–2008) and visit 3 (2009–2013).[25 29] Follow-up rates were 79.2% from visit 1 to visit 2 (n=4205) and 90.8% from visit 2 to visit 3 (n=3819). A fourth wave of data collection is ongoing.

Measures

Discrimination

Two measures of discrimination, everyday and lifetime, were obtained at visit 1. Everyday discrimination was adapted from Williams' Everyday Discrimination Scale (Cronbach's α=0.88) to capture how often on a day-to-day basis participants experienced unfair treatment in their everyday lives within nine domains (eg, …treated with less courtesy…, people act as if you are dishonest). Responses ranged from 1 ('never') to 7 ('several times a day')[30] (online supplemental table S1). Everyday discrimination was examined as a continuous variable by taking the mean of the response scores to each of the nine questions and converted to SD units. Based on these responses, we also created tertiles of everyday discrimination.

Lifetime discrimination was based on Nancy Krieger's Lifetime Discrimination Scale (Cronbach's α=0.78)[30] and captured the lifetime occurrence (yes/no) of unfair treatment experienced by participants across nine domains (eg, at work, at school, getting a job) (online supplemental table S1). Due to the skewed distribution of lifetime discrimination values, lifetime discrimination was not treated as a continuous variable. Based on previous literature,[31] we summed the responses for which unfair treatment was reported across the nine domains (ranging from 0 to 9),[32 33] and created three categories of lifetime discrimination (low: no discrimination (0), medium: values <median value (range from 1 to 2), high: values ≥median value (range from 3 to 9)) to address the skewed distribution of the lifetime discrimination values.

Perceived stress that derives from lifetime discrimination (or appraisal)[30] was also examined as a separate exposure among participants who reported at least one experience of lifetime discrimination[7 8] (online supplemental table S1).

Participants who reported experiencing discrimination were also asked to answer a single question indicating the main reason for experiences of discrimination (separate questions for everyday discrimination and lifetime discrimination).

Predetermined response options for discrimination attribution were age, sex, race, height, weight or some other reason. Based on prior work, two categories of discrimination attribution (racial vs all non-racial factors combined) were created from the predetermined attribution responses.[19 31]

Health behaviours

Outcomes included self-reported smoking and alcohol use that were collected from interviewer-administered questionnaires at visit 1 (2000–2004) and visit 3 (2009–2013). No health behaviour information was available for visit 2 (2005–2008). Using data from the two visits, we created a single variable for each person and for each of the two behaviours that captured change in that behaviour between visit 1 and visit 3.

Smoking

At visit 1, cigarette smoking status was based on two questions from the Tobacco Use form: (1) 'Have you smoked at least 400 cigarettes in your lifetime?' and (2) 'Do you now smoke cigarettes?'[34] Based on the responses to these two questions, we created three categories to define cigarette smoking status at visit 1: (1) current smoker (>400 cigarettes in the lifetime and currently smoking); (2) former smoker (>400 cigarettes in the lifetime and currently not smoking), and (3) never smoker (≤400 cigarettes in the lifetime). The smoking question at visit 3 was slightly different. At visit 3, participants were asked about whether they ever used any tobacco products regularly (including cigars, or cigarillos, pipes, chewing tobacco, or snuff/dip) in the past 12 months ('In the past 12 months have you ever regularly used a tobacco product?') and asked separately about the number of cigarettes smoked per day, cigars smoked per week, pipefuls of pipes smoked per week, tobacco chewed per week and cans of dip/snuff used per week. Using the responses to these two questions we created two categories to define cigarette smoking status at visit 3: (1) current smoker (regular use of a tobacco product in the past 12 months and smoked ≥1 cigarette per day in the past 12 months) and (2) not current smoker (no regular use of a tobacco product in the past 12 months or 0 cigarettes smoked per day in the past 12 months).

Based on previous work,[35] we classified change in cigarette smoking status from visit 1 to visit 3 into five groups: (1) persistent current: 'current' at visit 1 and 'current' at visit 3; (2) persistent former: 'former' at visit 1 and 'not current' at visit 3; (3) persistent never: 'never' at visit 1 and 'not current' at visit 3; (4) current to former (improved): 'current' at visit 1 and 'not current' at visit 3; and (5) former/never to current (worsened): 'former' or 'never' at visit 1 and 'current' at visit 3.

Alcohol use

At visit 1 and visit 3, alcohol use was defined per the responses to the following questions asked in the Alcohol and Drug Use questionnaire: In the past 12 months, (1) Have you ever consumed an alcoholic beverage? and (2) On average, on the days that you drank alcohol, how many drinks (eg, 12-ounce beer, a 4-ounce glass of wine or an ounce of liquor) did you have a day? Based on the responses to these two questions, we used the Centers for Disease Control and Prevention classification to create three categories of alcohol use: (1) heavy drinking (consumed >1 drink per day for women, consumed >2 drinks per day for men), (2) moderate drinking (consumed 1 drink per day for women and consumed 1–2 drinks per day for men), and (3) none (consumed 0 drinks per day or never consumed an alcoholic beverage or stopped drinking alcohol more than 1 year ago).[36]

Table 1 Visit 1 characteristics by categories of discrimination, the Jackson Heart Study, 2000–2004

	Overall	Everyday discrimination				Lifetime discrimination				Stress from lifetime discrimination			
		Low n=986	Medium n=1086	High n=978	P value	Low n=389	Medium n=905	High n=1756	P value	Very stressful n=621	Moderately stressful n=1496	Not stressful n=533	P value
Age, mean±SD	54.3±12.0	57.5±12.2	54.4±11.9	51.0±11.2	<0.001	58.0±13.0	54.2±12.8	53.5±11.2	<0.001	55.0±11.3	53.2±11.7	54.0±12.5	0.004
Sex, %					<0.001				<0.001				<0.001
Women	64.2	67.9	64.9	59.7		68.1	69.2	60.8		71.2	62.1	59.3	
Education, %					<0.001				<0.001				<0.001
<High school	15.2	22.5	11.8	11.7		29.6	17.5	10.9		15.9	10.8	15.9	
High school graduate/GED	17.2	19.8	15.8	16.0		25.4	21.4	13.1		17.5	14.3	18.9	
>High school	67.6	57.7	72.4	72.3		45.0	61.1	76.0		66.5	74.9	65.1	
Income, %					<0.001				<0.001				<0.001
Poor	12.3	13.9	9.2	14.0		16.5	13.6	10.6		15.5	10.8	9.4	
Lower-middle	22.6	26.4	19.0	22.7		30.8	26.0	19.0		26.2	20.2	18.9	
Upper-middle	30.9	28.3	33.8	30.5		26.7	31.5	31.6		26.6	31.1	38.7	
Affluent	34.2	31.4	38.0	32.8		26.0	28.9	38.8		31.7	37.8	33.0	
Occupation, %					<0.001				<0.001				0.002
Management/professional	41.2	36.4	47.3	39.3		27.8	37.1	46.3		37.8	46.0	41.8	
Service	21.9	26.7	18.4	20.9		33.7	24.5	18.0		24.6	18.4	19.7	
Sales	18.1	17.1	16.9	20.3		13.3	19.3	18.5		20.3	19.1	15.9	
Construction	5.2	4.0	5.3	6.4		6.7	4.3	5.4		4.3	4.9	6.4	
Production	13.2	15.4	11.4	12.9		17.7	14.5	11.5		12.7	11.4	15.6	
Other	0.4	0.4	0.5	0.2		0.8	0.3	0.3		0.3	0.3	0.6	

Everyday discrimination: low=1.00–1.44, medium=1.55–2.33, high=2.44–7.00.
Lifetime discrimination: low=0.00–0.00, medium=1.00–2.00, high=3.00–9.00.
Stress from lifetime discrimination: the sample was restricted to participants who reported at least one instance of lifetime discrimination (n=2650).
GED, general equivalency diploma.

Table 2 Visit 1 characteristics by health behaviours over the follow-up period, the Jackson Heart Study, 2000–2013

	Cigarette smoking behaviour status from visit 1 to visit 3						Alcohol use behaviour status from visit 1 to visit 3				
	Persistent current n=235	Persistent former n=533	Persistent never n=2134	Current to former n=112	Former/never to current n=36	P value	Persistent heavy n=237	Persistent moderate/none n=2358	Heavy to moderate/none n=291	Moderate/none to heavy n=164	P value
Age, mean±SD	51.0±9.5	59.4±10.0	53.4±12.4	55.0±10.6	50.8±13.7	<0.001	48.0±11.6	55.8±11.8	51.5±11.6	47.3±11.2	<0.001
Sex, %						<0.001					<0.001
Women	48.9	50.3	70.0	54.5	66.7		50.2	66.2	56.7	70.1	
Education, %						<0.001					0.03
<High school	20.0	20.6	12.9	19.6	27.8		13.5	16.0	13.4	9.8	
High school graduate/GED	19.1	20.1	15.9	19.7	30.5		17.7	17.8	13.1	14.0	
>High school	60.9	59.3	71.2	60.7	41.7		68.8	66.2	73.5	76.2	
Income, %						<0.001					0.14
Poor	22.1	12.8	10.7	17.0	22.2		18.1	11.5	13.4	12.8	
Lower-middle	26.0	22.7	21.9	25.9	25.0		23.6	23.0	19.9	18.9	
Upper-middle	31.1	28.9	31.5	30.3	30.6		28.3	31.1	29.9	34.1	
Affluent	20.8	35.6	35.9	26.8	22.2		30.0	34.4	36.8	34.2	
Occupation, %						<0.001					<0.001
Management/professional	24.3	37.0	44.9	31.2	27.8		32.1	41.6	42.6	46.3	
Service	27.7	23.6	20.6	23.2	30.6		20.2	22.8	17.2	18.9	
Sales	13.2	14.6	19.6	17.0	16.7		18.6	17.9	17.2	22.0	
Construction	11.5	7.3	3.6	10.7	13.9		9.3	4.3	10.6	3.7	
Production	22.5	17.5	10.9	17.0	11.0		19.4	13.0	11.7	9.1	
Other	0.8	0.0	0.4	0.9	0.0		0.4	0.4	0.7	0.0	
Everyday discrimination											
Continuous, mean±SD	2.42±1.10	2.07±0.97	2.08±0.99	2.22±1.03	1.95±1.03	<0.001	2.35±1.14	2.07±0.99	2.25±1.00	2.13±0.91	<0.001
Categorical, %						<0.001					<0.001
Low: 1.00–1.44	22.1	34.3	33.0	27.7	41.7		27.4	33.8	27.2	26.8	
Medium: 1.55–2.33	33.6	33.8	36.4	33.9	36.1		30.4	36.0	33.3	42.1	
High: 2.44–7.00	44.3	31.9	30.6	38.4	22.2		42.2	30.2	39.5	31.1	
Lifetime discrimination, %											
Categorical, %						0.10					0.05
Low: 0.00–0.00	10.2	12.9	13.0	12.5	11.1		11.8	13.4	9.6	10.4	
Medium: 1.00–2.00	24.3	25.7	31.2	30.4	33.3		29.1	30.4	24.1	29.9	
High: 3.00–9.00	65.5	61.4	55.8	57.1	55.6		59.1	56.2	66.3	59.7	
Stress from lifetime discrimination*, %						0.01					0.99
Very stressful	23.0	27.4	22.2	30.6	18.7		23.1	23.2	24.4	24.5	
Moderately stressful	50.2	54.1	58.2	51.0	46.9		54.8	56.8	55.7	55.8	
Not stressful	26.8	18.5	19.6	18.4	34.4		22.1	20.0	19.9	19.7	

Continued

Table 2 Continued

	Cigarette smoking behaviour status from visit 1 to visit 3						Alcohol use behaviour status from visit 1 to visit 3				
	Persistent current n=235	Persistent former n=533	Persistent never n=2134	Current to former n=112	Former/never to current n=36	P value	Persistent heavy n=237	Persistent moderate/none n=2358	Heavy to moderate/none n=291	Moderate/none to heavy n=164	P value
Attribution of everyday discrimination†, %						0.02					0.35
Racial	43.9	56.1	49.9	46.4	38.5		44.6	50.4	51.2	53.4	
Non-racial	56.1	43.9	50.1	53.6	61.5		55.4	49.6	48.8	46.6	
Attribution of lifetime discrimination‡, %						0.83					0.18
Racial	62.9	66.2	63.3	64.3	62.5		70.7	63.0	64.4	63.9	
Non-racial	37.1	33.8	36.7	35.7	37.5		29.3	37.0	35.6	36.1	

*Stress from lifetime discrimination: the sample was restricted to participants who reported at least one instance of lifetime discrimination: smoking (persistent current, n=209; persistent former, n=464; persistent never, n=1847; current to former, n=98; former/never to current, n=32); alcohol (persistent heavy drinker, n=208; persistent moderate/none, n=2033; heavy to moderate/none, n=262; moderate/none to heavy, n=147).
†Attribution of everyday discrimination: smoking (persistent current, n=212; persistent former, n=428; persistent never, n=1805; current to former, n=97; former/never to current, n=26); alcohol (persistent heavy drinker, n=204; persistent moderate/none, n=1960; heavy to moderate/none, n=256; moderate/none to heavy, n=148).
‡Attribution of lifetime discrimination: smoking (persistent current, n=210; persistent former, n=461; persistent never, n=1840; current to former, n=98; former/never to current, n=32); alcohol (persistent heavy drinker, n=208; persistent moderate/none, n=2025; heavy to moderate/none, n=261; moderate/none to heavy, n=147).
GED, general equivalency diploma.

Based on prior work,[35] we classified change in alcohol use status into four groups: (1) persistent heavy: 'heavy' at visit 1 and 'heavy' at visit 3; (2) persistent moderate/none: 'moderate' or 'none' at visit 1 and 'moderate' or' none' at visit 3; (3) heavy to moderate/none (improved): 'heavy' at visit 1 and 'moderate' or 'none' at visit 3; and (4) moderate/none to heavy (worsened): 'moderate' or 'none' at visit 1 and 'heavy' at visit 3.

Covariates

Baseline covariates included age (continuous), sex (men, women) and socioeconomic status (SES, captured by education, income and occupation). Self-reported educational attainment was classified into three categories: (1) less than high school diploma; (2) high school graduate or general equivalency diploma; and (3) vocational school, trade school or college graduate. Income that was based on family income, family size and poverty level was classified as (1) poor; (2) lower-middle; (3) upper-middle; and (4) affluent. Occupation was coded as: (1) management/professional; (2) service; (3) sales; (4) construction; (5) production; and (6) other (farming, fishing, forestry, military, sick, unemployed, retired, other). We conceptualised discrimination would lead to health behaviours, which would then lead to chronic health conditions. Therefore, we did not include chronic health conditions as covariates in the models.

Statistical analysis

Of the 5306 JHS participants, 3819 were eligible to be included in our study because they completed both visits 1 and 3. We excluded 117 participants who had missing information on either alcohol or smoking status at visit 1 or visit 3, an additional 144 who had missing information on everyday or lifetime discrimination at visit 1 and another 508 were excluded because they had missing information on SES at visit 1. Participants who completed visits 1 and 3 but were excluded from our analyses (n=769), were as likely as the participants who were included in our final analyses (n=3050) to experience discrimination (lifetime, everyday), smoke cigarettes and consume alcohol.

The distribution of the visit 1 characteristics of the study population were examined across categories of discrimination and health behaviours. Differences in the distribution were tested using χ^2 tests or t-tests and described using percentages for categorical variables and means with SDs for continuous variables. Multinomial logistic regression was used to estimate ORs and CIs for the associations of dimensions of discrimination (everyday, lifetime, stress from lifetime discrimination) with the between-visit (2000–2013) status change in smoking and alcohol, sequentially adjusting for age, sex and SES variables. Specifically, the multinomial logistic regression modelled the categorical status change variable (a single measure per participant; five categories for smoking and four categories for alcohol use) as the outcome and the baseline discrimination score at visit 1 as the exposure. Model 1 was not adjusted for any other variables; model 2 adjusted for age and sex; and model 3 adjusted for age, sex and SES. Interaction product terms were included in the models to test the statistical significance of effect modification by discrimination attribution. Results were considered statistically significant if the probability value (p value) was <0.05. Analyses were performed using Statistical Analysis Software (SAS) version 9.4 (SAS Institute Inc, Cary, NC).

RESULTS

The sample was 64% women, 68% college educated, 34% affluent and 41% had a management/professional occupation.

Table 3 ORs and 95% CIs for the effects of everyday discrimination, lifetime discrimination and stress from lifetime discrimination on the smoking behaviour status of African Americans in the Jackson Heart Study

	Persistent current			Persistent former			Current to former			Former/never to current		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Everyday discrimination												
SD units	1.35 (1.20,1.52)	1.29 (1.14,1.46)	1.26 (1.11,1.43)	0.99 (0.90,1.10)	1.10 (1.00,1.22)	1.10 (0.99,1.22)	1.14 (0.95,1.36)	1.16 (0.97,1.40)	1.15 (0.95,1.38)	0.86 (0.60,1.24)	0.81 (0.55,1.19)	0.82 (0.57,1.19)
Medium vs low	1.38 (0.96,1.99)	1.30 (0.90,1.88)	1.51 (1.04,2.20)	0.89 (0.71,1.12)	1.01 (0.79,1.28)	1.05 (0.82,1.33)	1.11 (0.69,1.81)	1.15 (0.70,1.87)	1.23 (0.75,2.03)	0.79 (0.37,1.67)	0.74 (0.35,1.57)	0.90 (0.42,1.95)
High vs low	2.16 (1.52,3.06)	1.90 (1.33,2.72)	1.96 (1.36,2.84)	1.00 (0.79,1.27)	1.30 (1.01,1.67)	1.32 (1.02,1.70)	1.50 (0.93,2.40)	1.59 (0.98,2.59)	1.61 (0.98,2.63)	0.58 (0.24,1.37)	0.50 (0.21,1.21)	0.54 (0.22,1.33)
Lifetime discrimination												
Medium vs low	0.99 (0.60,1.63)	0.96 (0.58,1.58)	1.14 (0.68,1.90)	0.83 (0.60,1.14)	0.99 (0.71,1.38)	1.02 (0.73,1.43)	1.01 (0.54,1.92)	1.07 (0.56,2.04)	1.17 (0.61,2.24)	1.25 (0.40,3.92)	1.18 (0.38,3.70)	1.50 (0.47,4.74)
High vs low	1.50 (0.95,2.35)	1.35 (0.85,2.12)	1.85 (1.15,2.95)	1.11 (0.83,1.48)	1.32 (0.97,1.79)	1.45 (1.06,1.98)	1.07 (0.59,1.93)	1.09 (0.60,1.98)	1.29 (0.70,2.39)	1.17 (0.40,3.44)	1.08 (0.36,3.21)	1.72 (0.57,5.23)
Stress from lifetime discrimination												
Very stressful vs not stressful	0.76 (0.50,1.14)	0.87 (0.57,1.32)	0.79 (0.52,1.22)	1.30 (0.96,1.77)	1.43 (1.04,1.97)	1.44 (1.04,1.99)	1.47 (0.81,2.68)	1.61 (0.88,2.95)	1.59 (0.86,2.93)	0.48 (0.18,1.31)	0.49 (0.18,1.34)	0.48 (0.17,1.34)
Moderately stressful vs not stressful	0.63 (0.45,0.89)	0.64 (0.45,0.91)	0.64 (0.45,0.92)	0.98 (0.75,1.29)	1.05 (0.80,1.40)	1.08 (0.81,1.43)	0.93 (0.54,1.62)	0.97 (0.56,1.69)	1.00 (0.57,1.76)	0.46 (0.21,1.01)	0.45 (0.21,0.99)	0.51 (0.23,1.14)

Everyday discrimination: low=1.00–1.44, medium=1.55–2.33, high=2.44–7.00.
Lifetime discrimination: low=0.00–0.00, medium=1.00–2.00, high=3.00–9.00.
Model 1: unadjusted.
Model 2: adjusted for age and sex.
Model 3: adjusted for model 2+socioeconomic status (education, income, occupation).
Persistent never smoking (never at visit 1 to never at visit 3) was the reference category for smoking behaviour status over time.
Stress from lifetime discrimination: the sample was restricted to participants who reported at least one instance of lifetime discrimination (n=2650).

Table 4 ORs and 95% CIs for the effects of everyday discrimination, lifetime discrimination and stress from lifetime discrimination on the alcohol use behaviour status of African Americans in the Jackson Heart Study

	Persistent heavy			Heavy to moderate/none			Moderate/none to heavy		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Everyday discrimination									
SD units	1.30 (1.15,1.46)	1.14 (1.00,1.30)	1.12 (0.99,1.28)	1.19 (1.06,1.34)	1.10 (0.98,1.24)	1.10 (0.97,1.24)	1.07 (0.91,1.25)	0.94 (0.79,1.11)	0.94 (0.79,1.11)
Medium vs low	1.04 (0.73,1.48)	0.88 (0.62,1.26)	0.94 (0.65,1.34)	1.15 (0.84,1.58)	1.05 (0.77,1.44)	1.03 (0.75,1.41)	1.48 (1.00,2.18)	1.27 (0.85,1.88)	1.25 (0.84,1.88)
High vs low	1.72 (1.24,2.39)	1.22 (0.87,1.71)	1.22 (0.86,1.72)	1.63 (1.20,2.21)	1.34 (0.98,1.83)	1.31 (0.95,1.79)	1.30 (0.86,1.97)	0.95 (0.62,1.45)	0.94 (0.61,1.44)
Lifetime discrimination									
Medium vs low	1.09 (0.69,1.72)	0.91 (0.57,1.47)	0.99 (0.61,1.60)	1.10 (0.70,1.74)	0.99 (0.62,1.58)	1.02 (0.64,1.62)	1.27 (0.72,2.24)	1.03 (0.57,1.83)	1.01 (0.56,1.81)
High vs low	1.19 (0.78,1.82)	0.96 (0.62,1.48)	1.08 (0.69,1.69)	1.64 (1.08,2.49)	1.42 (0.93,2.16)	1.42 (0.92,2.18)	1.37 (0.81,2.33)	1.14 (0.67,1.96)	1.11 (0.64,1.92)
Stress from lifetime discrimination									
Very stressful vs not stressful	0.90 (0.58,1.37)	1.07 (0.69,1.66)	1.01 (0.65,1.58)	1.06 (0.72,1.56)	1.13 (0.76,1.67)	1.11 (0.75,1.66)	1.07 (0.64,1.77)	1.13 (0.68,1.90)	1.15 (0.68,1.94)
Moderately stressful vs not stressful	0.87 (0.61,1.25)	0.87 (0.60,1.25)	0.87 (0.60,1.26)	0.99 (0.71,1.38)	0.97 (0.69,1.37)	0.96 (0.68,1.36)	0.99 (0.64,1.54)	0.96 (0.62,1.50)	0.96 (0.62,1.51)

Everyday discrimination: low=1.00–1.44, medium=1.55–2.33, high=2.44–7.00.
Lifetime discrimination: low=0.00–0.00, medium=1.00–2.00, high=3.00–9.00.
Model 1: unadjusted.
Model 2: adjusted for age and sex.
Model 3: adjusted for model 2+socioeconomic status (education, income, occupation).
Persistent moderate/none alcohol use (moderate or none at visit 1 to moderate or none at visit 3) was the reference category for alcohol use behaviour status over time.

Participants reporting high everyday discrimination were more likely to be younger, men, college educated and had higher income than those reporting low everyday discrimination. Those reporting high levels of lifetime discrimination were more likely to be younger and men (table 1).

Eight percent of participants were persistent current smokers across both visits, 17% remained former smokers, 70% remained never smokers, 4% had improved smoking status (current to former) and 1% had a worsened smoking status (former or never to current) (table 2). Persistent current smokers were more likely to be younger, men, less college educated and had lower income compared with those who maintained their status as never smokers. Persistent current smokers also reported higher levels of everyday and lifetime discrimination compared with persistent never smokers (table 2).

Eight percent of participants were persistent heavy alcohol drinkers across both visits, 77% were persistent moderate or non-users of alcohol at both visits, 10% improved their alcohol use (heavy to moderate or none) and 5% developed worse alcohol use behaviour (moderate or none to heavy) (table 2). Participants who were persistent heavy alcohol users were younger and more educated than those who engaged in moderate alcohol use/ abstained from alcohol over the follow-up period. They were also more likely than persistent moderate users/non-users of alcohol to experience high levels of discrimination (everyday, lifetime) (table 2).

In models adjusted for age, sex and SES, everyday discrimination was associated with higher odds of being a persistent current smoker in a graded fashion (OR for tertiles of score: medium vs low OR 1.51, 95% CI 1.04,2.20; high vs low OR 1.96, 95% CI 1.36,2.84). Each SD higher score was associated with 26% higher odds of being a persistent current smoker (OR 1.26, 95% CI 1.11,1.43). Being in the highest tertile of everyday discrimination was also associated with a higher odds of being a persistent former smoker (high vs low OR 1.32, 95% CI 1.02,1.70) relative to persistent never smokers (table 3, model 3).

Lifetime discrimination was also associated with higher odds of being a persistent current smoker (high vs low OR 1.85, 95% CI 1.15,2.95) and being a persistent former smoker (high vs low OR 1.45, 95% CI 1.06,1.98) relative to persistent never smokers after adjustment for age, sex and SES (table 3, model 3).

Participants reporting lifetime discrimination as very stressful compared with not stressful were also more likely to be persistent former smokers (OR 1.44, 95% CI 1.04,1.99) relative to persistent never smokers (table 3, model 3). Everyday discrimination and lifetime discrimination were not associated with changes in alcohol use or persistent alcohol use (table 4, model 3).

Discrimination attribution did not modify the associations between discrimination and health behaviours (smoking status and alcohol use) over time for everyday discrimination (p value for interaction: smoking, p=0.38; alcohol, p=0.67), lifetime discrimination (p value for interaction: smoking, p=0.97; alcohol, p=0.91) or stress derived from lifetime discrimination (p value for interaction: smoking, p=0.21; alcohol, p=0.43).

DISCUSSION

Most studies investigating discrimination and health behaviours have been cross-sectional and few have included multiple dimensions of discrimination. Our study is the only study, to our knowledge, to examine the associations of discrimination with change in cigarette smoking status and alcohol use over time in a large sample of African American adults. In our study, everyday discrimination, lifetime discrimination and stress from lifetime discrimination were not associated with changes in smoking status or alcohol use. High levels of everyday and lifetime discrimination were, however, associated with being a persistent current smoker and with being a persistent former smoker. High stress derived from lifetime discrimination was also associated with being a persistent former smoker.

Our findings for persistent current smoking status are consistent with previous cross-sectional studies that observed a positive association between lifetime discrimination and current smoking among African Americans in the JHS (only among women, regardless of discrimination attribution),[19] Coronary Artery Risk Development in Young Adults[20 37] and the Multi-Ethnic Study of Atherosclerosis.[21] The only study[19] to include everyday discrimination also reported a positive association of everyday discrimination with current smoking among African American men and women in the JHS (regardless of discrimination attribution). Unlike previous work showing that reports of racial discrimination as extremely stressful were associated with higher rates of smoking,[22] we found no evidence that stress from lifetime discrimination was associated with persistent current smoking, but the sample size (n=209) in this group was relatively small.

Findings for alcohol use have been mixed, with some studies reporting an association between lifetime discrimination and increased alcohol use,[20 21 37] but one study reporting no evidence of an association between workplace discrimination and heavy drinking.[38] Everyday discrimination, lifetime discrimination and stress from lifetime discrimination were not associated with changes in alcohol use, which may be due to the lower prevalence of alcohol use observed in the JHS or to measurement error in alcohol use, which is known to be difficult to measure.

There is evidence to suggest that stress associated with discrimination causes individuals to become more vulnerable to depression, anxiety disorder and psychological distress, which can lead to cigarette smoking[12] and alcohol use.[39] It has also been hypothesised that African Americans may engage in unhealthy behaviours to cope with the elevated stress arising from discrimination.[40] Indeed, this hypothesis has been put forward to explain the paradox by which some mental health outcomes are better in African Americans than White Americans, but physical health outcomes show the opposite pattern.[40] Our results are consistent with an impact of stress from discrimination on smoking as demonstrated by the association of discrimination with persistent smoking. While we hypothesised that cigarette smoking and alcohol use were strategies used to cope with stress from discrimination, we were unable to explicitly test whether the participants engaged in maladaptive behaviours to reduce stress from discrimination.

Several limitations of the data should be considered when interpreting our findings. The sample only included African American adults residing in Jackson, Mississippi, which limited the generalisability of our findings to African Americans in other regions. Discrimination was analysed at one point in time, which prevented us from examining the impact of time-varying discrimination on health behaviours over time. Due to lack of information on the timing of exposure to discrimination, it was not possible to examine the lag time between exposure to discrimination and occurrence of health behaviours. While the overall sample size was adequate in our study, there was limited power to detect significant associations between discrimination and changes in smoking status due to small numbers in the group of former or never smokers at visit 1 who changed to current smokers at visit 3. Similarly, sample size may have limited our ability to detect effect modification by attribution

of discrimination. Additional follow-up of the JHS will allow extension of these analyses, yielding more power.

Residual confounding was also a possibility because of the lack of data on episodic or binge drinking, as well as data on availability of tobacco and alcohol products. In addition, the results may be biased due to the inclusion of participants who were more educated and had a higher income than those who were excluded from our study. Our study benefited from the use of multiple measures of discrimination, a large sample of African American adults, a heterogeneous population, the long follow-up period and the longitudinal study design which allowed for the examination of changes in smoking and alcohol use status.

Our study expands on previous studies to highlight the impact of discrimination on persistent current smoking status. We show that experiences of discrimination may result in persistent smoking. Importantly, stress resulting from these interpersonal experiences may affect smoking by also interacting with other manifestations of structural racism at different levels including living in stressful neighbourhood environments, experiencing stressful jobs and the targeting of tobacco marketing to African American communities, among other factors. The impact of structural racism on health thus needs to be examined using measures of racism (and its consequences) at multiple levels. Our study adds to growing evidence on the many ways in which structural racism affects the health of African Americans.

What is already known on this subject

► Previous studies have reported associations between perceived discrimination and adverse health behaviours. However, most studies have been cross-sectional.

What this study adds

► This study examined the associations of multiple measures of discrimination (everyday, lifetime) with changes in health behaviours over time in a large population-based cohort of African Americans. We found that everyday discrimination and lifetime discrimination are related to persistent smoking among African Americans. These results further highlight the mechanisms through which discrimination affects the health of African Americans.

Disclaimer The views expressed in this manuscript are those of the authors and do not necessarily represent the views of the National Heart, Lung, and Blood Institute; the National Institute on Minority Health and Health Disparities (NIMHD); the National Institutes of Health; or the U.S. Department of Health and Human Services.

Competing interests None declared.

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