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Discrimination and Health: The Mediating Role of Daily Stress Processes

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Objective: Exposure to discrimination is consistently linked with worse physical and mental health outcomes. One potential reason is that discriminatory experiences shape the way people interpret and affectively react to daily stressful events which in turn impacts health. The current study examined the role of these two daily psychological stress processes as a pathway linking the longitudinal association between perceived discrimination and health outcomes. ***Method:*** Participants in the National Study of Daily Experiences (NSDE), a subset of the Midlife in the United States (MIDUS) study, were followed over three waves spanning 20 years (N = 1,315). Perceptions of lifetime and everyday discrimination were measured by questionnaire at Wave 1; daily assessments of stress, threat appraisals, and negative affect were assessed through 8 days of daily dairies at Wave 2; measures of physical health (chronic conditions, functional limitations, and self-rated physical health) and mental health (depression, anxiety, and self-rated mental health) were assessed at Wave 3. Each wave of data was collected 9–10 years apart. ***Results:*** Lifetime and everyday discrimination were associated with worse physical and mental health outcomes 20 years later. Daily threat appraisals and negative affective reactivity to daily stressors mediated the effect of discrimination on physical and mental health. ***Conclusion:*** Daily psychological stress processes are a potential mechanism by which exposure to unfair treatment relates to health. Findings underscore the insidious nature of unfair treatment and demonstrate how such experiences may be particularly consequential for daily stress processes and later physical and mental health outcomes.

Keywords: daily stress, discrimination, health, negative affect, stress appraisals

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Discrimination—unequal treatment on the basis of group membership (e.g., age, race, gender, sexual orientation, nationality, religion, or weight)—is a strong predictor of poor psychological and physical health (Lewis et al., 2015; Schmitt et al., 2014; Williams et al., 2019). Perceptions of discrimination are a specific type of stressful life experience that may lead to individuals having more threatening appraisals and heightened negative reactions to daily stressful events in general (Bolger & Zuckerman, 1995). These heightened stress processes, in turn, shape future health and well-being (e.g., Piazza et al., 2013). Daily cognitive and affective stress processes have been proposed as one pathway linking perceived discrimination to future health outcomes (Hoggard et al., 2012; Ong et al., 2009). However, this mechanism has not been directly tested. The current study uses three waves of a large national study to examine two relatively unexplored mediators through which perceived discrimination may negatively shape future physical and mental health: threat appraisals and negative affective (NA) reactivity to daily stressors.

Discrimination, Daily Stress Processes, and Health

Perceived discrimination has been linked to a wide range of adverse physical and mental health outcomes (for a review, see Lewis et al., 2015). The majority of literature linking discrimination and health has focused on instances of racial discrimination (e.g., Taylor et al., 2007; Williams & Mohammed, 2009). A smaller, yet compelling, literature has examined links between other forms of discrimination (i.e., gender, weight, age) with health outcomes (e.g., Jackson et al., 2019; Sutin et al., 2015). People who report greater instances of discrimination report worse mental health (e.g., depression, psychiatric distress, and generalized anxiety disorder; Kessler et al., 1999; Pieterse et al., 2012; Schmitt et al., 2014; Williams &

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The data analysis plan and hypotheses were preregistered on Open Science Framework (Anonymized pre-registration link: https://osf.io/9rt5d/?view_only=97d12881eff540d48c0875c85869a484).

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Mohammed, 2009). Additionally, discrimination has been linked with worse physical health including hypertension (Dolezsar et al., 2014), heart disease (Jackson et al., 2019), breast cancer (Taylor et al., 2007), and mortality risk (Barnes et al., 2008; Sutin et al., 2015). Despite the well-documented relationships between discrimination and health outcomes, mechanisms that account for these associations are poorly understood.

The relationship between perceived discrimination and health outcomes may, in part, be explained by how people deal with stressful events in their daily lives that are unrelated to discriminatory experiences. Psychological responses to daily stressors can impact long-term health (Charles et al., 2013; Epel et al., 2018). The perceived negative impact of a stressor determines if it is seen as threatening, and these threat appraisals shape affective responses (Almeida et al., 2005; Blascovich & Mendes, 2000; Lazarus & Folkman, 1984). These cognitive and affective daily stress processes, in turn, can shape long-term changes in physical and mental health. Greater threat appraisals and negative affective reactions in response to daily stressors are associated with a range of physical and mental health outcomes including cellular aging (O'Donovan et al., 2012), chronic medical conditions (Piazza et al., 2013), depressive symptoms (Charles et al., 2013), and mortality (Mroczek et al., 2015). Despite the theoretical plausibility that appraisals and affective reactions to daily stressors may partially explain links between perceived discrimination and health, no study has examined these daily stress processes as mediators. Experiencing discrimination may shape the habitual ways individuals appraise and affectively react to daily stressful events, such as having an argument or missing a work deadline. Models proposing perceived discrimination as a potent and distinct source of chronic stress suggest people belonging to disadvantaged groups have greater risk for health problems because they are more likely to appraise everyday events as threatening and are more emotionally reactive to daily stressors (Bolger & Zuckerman, 1995; Pascoe & Smart Richman, 2009). People who experience discrimination are often in environments where they are exposed to events that are potentially or actually harmful, such as structural barriers to obtaining resources as well as interpersonal threats such as ostracism or exclusion (Major et al., 2002). Consequently, people who experience discrimination may be under chronic stress by having to be constantly vigilant or "on guard" for potential threats (Lewis et al., 2015). Studies have demonstrated that individuals who experience chronic stress are more reactive to a wide range of daily stressful events and perceive them as more threatening (Almeida et al., 2005; Serido et al., 2004).

The Current Study

The focus of the current study was to examine links between perceived discrimination and health. This study examined perceived discrimination in general and did not examine specific associations of racism with stress and health. Racism is a particularly insidious form of unfair treatment. Despite the fact that there may be unique pathways linking racism and health, unfair treatment due to many factors including race, age, gender, sexual orientation, and physical appearance, predicts health outcomes in diverse groups across a broad range of national contexts (Barnes et al., 2008; Lewis et al., 2015; Williams et al., 2019). This suggests any form of unfair treatment may negatively impact health, and diverse groups may be vulnerable to adverse health outcomes. Recent research has highlighted a need to consider a broad range of social categories simultaneously when examining associations between discrimination and health, with the acknowledgment that doing so will render larger associations than when only a single social category is considered (Lewis et al., 2015).

Using a national database, the current study investigated the link between perceived discrimination and physical and mental health by examining whether threat appraisals and NA reactivity to daily stressful events mediated the relationship between perceived discrimination and health outcomes over a 20-year period. The first aim of this study was to replicate and extend previous findings linking perceived discrimination with poor physical and mental health. To capture a more comprehensive assessment of discrimination, we included assessments of *lifetime discrimination*, which reflects the accumulation of major experiences of discrimination such as being unfairly denied a promotion or loan, and *everyday discrimination*, which highlights exposure to day-to-day experiences such as being treated with less courtesy or respect than others (Williams & Mohammed, 2009). We hypothesized that perceptions of lifetime and everyday discrimination would predict three self-reported physical health outcomes (self-rated physical health, chronic conditions, and functional limitations) and three self-reported mental health outcomes (self-rated mental health, depression, and anxiety). Our second aim investigated the role of threat appraisals and NA reactivity in mediating the relationship between discrimination and health. We hypothesized that experiencing both lifetime and everyday discrimination would predict greater threat appraisals and greater negative reactions to daily stressors. Thus, our hypothesized model situates perceived discrimination as a predictor of health that is serially mediated by threat appraisals and negative affective reactivity to daily stressors. The current study is novel in that it tests longitudinal associations between perceived discrimination, cognitive-affective stress processes, and health in a large sample of adults across the life span and three waves of data across a period of 20 years.

Method

Participants completed Waves 1–3 of the Midlife in the United States (MIDUS) study. MIDUS is a national longitudinal study of U.S. adults ages 25–75. Data were collected in 1995–1996 (MIDUS 1; Wave 1), 2004–2006 (MIDUS 2; Wave 2), and 2013–2014 (MIDUS 3; Wave 3) through a telephone interview and self-administered questionnaire. During Wave 2, a subset of the MIDUS 2 participants (n = 2,022) also completed the National Study of Daily Experiences (NSDE), a daily diary study where participants reported their everyday experiences every evening for eight consecutive days. Participants completed a total of 14,912 days of a possible 16,176 days (completion rate 92%). Compared with participants who completed the NSDE II, nonrespondents were more likely to be male, non-White, and report higher levels of daily discrimination and worse health across all Wave 1 health indicators.

Participants in the current analyses completed the telephone interview and self-administered questionnaire at Wave 1, reported experiencing at least one stressor during NSDE II, and had data for at least one health indicator at Wave 3. The final sample included 1,315 participants (95% White, 58% female; M age at Wave 1 = 46 years, SD = 11.19). Participants with full data were more likely to be

younger, female, White, and report lower levels of daily discrimination and better health across all Wave 1 health indicators. In the final sample, 117 participants were missing data for chronic conditions, and 98 participants were missing data for functional limitations. Based on this sample size, there is adequate power (> .90) for detecting small effects (r = .10) for the relationship among lifetime and everyday discrimination, daily stress processes, and health outcomes. The MIDUS protocol was approved by the University of Wisconsin–Madison Institutional Review Board; the current study was exempt from IRB review because we used publicly available, deidentifiable data. Written informed consent was received for all participants. The data analysis plan and hypotheses were preregistered on Open Science Framework. (Preregistration link: https://osf.io/9rt5d/?view_only=97d12881eff540d48c0875c85869a484).

Measures

Wave 1 Lifetime and Everyday Discrimination

Reports of lifetime discrimination were assessed across 11 settings including academics (discouraged from continuing education, denied scholarship), financial services (denied a bank loan, prevented from renting or buying a home, given inferior service), employment (not hired or promoted), and experiences of social hostility (forced out of a neighborhood, hassled by the police; Kessler et al., 1999). Due to the skewed nature of the data, and in line with previous studies (Friedman et al., 2009; Ong & Williams, 2019), we calculated a summary index of lifetime discrimination by recoding responses into 3 categories (none, 1–2 instances, 3 or more).

Instances of everyday discrimination were assessed with the widely used 9-item Everyday Discrimination Scale (Williams et al., 1997). Participants rated the frequency of different forms of unfair treatment in their daily lives on a scale from 1 (*never*) to 4 (*often*). Instances of unfair treatment included being treated with less courtesy or respect than others, receiving poorer service than others at restaurants or stores, being called names, insulted, or harassed, having people act afraid of them, and having people act as if they were dishonest, not smart, or not as good as they were. Responses were averaged to form a summary score of everyday discrimination (α = .93).

Respondents reported the main reason for experiencing discrimination including "race, ethnicity, gender, age, weight, religion, physical appearance, sexual orientation, or other characteristics." Participants could choose more than one category. The most reported reason for discrimination was gender (43%), followed by age (24%), weight (18%), other factors (18%), race (17%), appearance (11%), religion (7%), ethnicity (6%), and sexual orientation (5%).

Wave 2 Daily Stressors

Daily stressors were measured using the Daily Inventory of Stressful Events (DISE; Almeida et al., 2002). Participants were asked if they had experienced any stressors in the past 24 hr including: having an argument with someone; almost having an argument but avoiding it; a stressful event at work or school; a stressful event at home; experiencing discrimination; having something bad happen to a close friend; and having anything else bad or stressful happen. Items were summed for each day. Participants reported between 0 and 5 stressors on each day of the interview (M = .57, SD = .41). Given the skewed nature of the data (participants reported experiencing two or more stressors on only 10% of days) and in line with previous studies (e.g., Sin et al., 2015), a dichotomous variable was created to indicate the occurrence of any stressor on a given day (1 = *yes*, 0 = *no*).

Wave 2 Threat Appraisals

As part of the DISE, after indicating experiencing a stressful situation that day, participants indicated whether the stressful situation had a negative effect on any eight appraisal domains including disruption of daily routine, risk to financial situation, the way they felt about themselves, the way others feel about them, their health or safety, the health of someone they care about, plans for the future, and their relationship with someone close to them (Almeida et al., 2002). Participants rated the risk for each question on a scale from 1 (*no risk at all*) to 4 (*a lot of risk*). Scores were averaged across all appraisal domains for each stressor reported, and those scores were then averaged across all days, yielding one overall threat appraisal score per participant. The measure reflects average threat appraisal severity across all stressors, domains, and days. This measure has been shown to correlate with a range of health and well-being outcomes (Almeida et al., 2005; Mayer et al., 2021).

Wave 2 Daily Negative Affect

Daily negative affect was assessed using scales developed for the MIDUS Study (Mroczek & Kolarz, 1998). Participants were asked how much over the past 24 hr they felt: nervous, worthless, hopeless, lonely, afraid, jittery, irritable, ashamed, upset, angry, frustrated, restless or fidgety, so sad nothing could cheer them up, and everything was an effort. Participants used a 5-point scale from 0 (*none of the time*) to 4 (*all of the time*). Scores were averaged across the items for each day (α ranged from .83 to .86).

Wave 2 NA Reactivity

We calculated NA reactivity using a two-level multilevel model where Level 1 modeled NA as a function of stress exposure, with the intercepts representing NA experienced on nonstressor days and the slopes representing the change in NA from a nonstressor day to a stressor day. The level 2 models adjusted for between-person stress exposure. This method calculates how much NA reactivity individuals experience while adjusting for average stressor exposure and has been used in previous studies examining NA reactivity (e.g., Charles et al., 2013; Leger et al., 2021). The following models were generated using SAS PROC MIXED:

$$\begin{aligned} \text{Level 1}: \ & NA_{ij} = \beta_{0j} + \beta_{1j}\left(\text{Stressor Day}_{ij}\right) + r_{ij} \\ \text{Level 2}: \ & \beta_{0j} = \gamma_{00} + \gamma_{01}\left(\text{Average Stress}_{j}\right) + \mu_{0j} \\ & \beta_{1j} = \gamma_{10} + \mu_{1j} \end{aligned}$$

Wave 1 and 3 Chronic Conditions and Functional Limitations

Participants reported whether they experienced each of 27 chronic conditions including asthma, arthritis, back problems, stomach problems, ulcers, high blood pressure, stroke, migraines, and autoimmune disorders in the past 12 months (Marmot et al., 1997). The total number of conditions was summed to create a

composite score. More than 90% of participants reported five or fewer chronic illnesses. To correct the positive skew, participants with four or more chronic conditions were grouped together, in line with previous studies (Wolff et al., 2002).

Functional limitations were assessed with the combined scores of two measures: activity of daily living (ADL) and instrumental activity of daily living (IADL; Katz et al., 1963). ADLs reflect a person's ability to function without assistance on tasks including bathing or dressing oneself, walking one block, and climbing one flight of stairs. IADLs reflect a person's ability to engage in other everyday activities. These items included lifting or carrying groceries, climbing several flights of stairs, walking more than one mile, walking several blocks, engaging in moderate activity, and engaging in vigorous activity. For each item, participants indicated the extent to which their health limited their ability to perform these daily activities on a 4-point scale from 1 (*not at all*) to 4 (*a lot*). Scores were summed and averaged with higher scores indicating greater functional limitations. Combining ADLs and IADLs to measure functional limitation has the advantage of a greater response range, while continuing to measure the unidimensional construct of functional limitation (Spector & Fleishman, 1998).

Wave 1 and 3 Self-Rated Physical and Mental Health

Self-rated physical health was assessed with the question "In general, would you say your physical health is excellent, very good, good, fair, or poor?" Self-rated mental health was assessed with the question "In general, would your say or mental or emotional health is excellent, very good, good, fair, or poor?" Participants rated their answers on a scale from 1 (*excellent*) to 5 (*poor*). Higher responses corresponded with worse health. Self-rated health is an established indicator of health risk and has been shown to be an excellent longitudinal predictor of a range of objective health outcomes (Benyamini, 2011). Both items have been linked to health outcomes in previous MIDUS studies (Ferraro & Wilkinson, 2015).

Wave 1 and 3 Anxiety and Depression

Depressive and anxiety symptoms were determined using Composite International Diagnostic Interview Short Form scales from MIDUS (CIDI-SF; Kessler et al., 1998). Participants who reported feeling sad, blue, or depressed almost every day, for at least most of the day, for two weeks or more in a row during the past 12 months and who also experienced at least four depressed affect or anhedonia symptoms during this time were coded as having met the criteria for a depressive disorder. For Generalized Anxiety Disorder, participants had to endorse that they worry a lot more than most people; that they worry every day, just about every day, or most days over the past 12 months, and that they experienced three out of 10 symptoms on most days (e.g., restless because of worry, keyed up, irritable because of worry). The final depression and anxiety outcomes were binary variables: participants with either disorder were scored as 1, and those who did not meet the criteria were scored as 0. At Wave 3, 11% of the total sample was classified as having depression and 2% of the total sample were classified as having anxiety.

Wave 1 Covariates

Measures of gender (0 = *men*, 1 = *women*), age, race (0 = *White*, 1 = *non-White*), and education (0 = *no college*, 1 = *college education*) were adjusted for in all analyses. Race was dichotomized due to the small number of non-White participants (5%). Previous research has linked these factors with health outcomes (e.g., Crimmins & Saito, 2001). Sensitivity analyses included neuroticism, which was assessed by participant ratings of how much four adjectives (moody, worrying, nervous, and calm) described them on a scale from 1 (*not at all*) to 4 (*a lot*). Items were summed and averaged (α = .74; Lachman & Weaver, 1997). Sensitivity tests also included a person's average exposure to stressors that were at least moderately severe.

Analysis Plan

We first tested descriptive associations among study variables using bivariate correlations. We then tested links between Wave 1 discrimination, Wave 2 daily threat appraisals and NA reactivity, and Wave 3 health using negative binomial regressions for the outcome of chronic conditions, linear regressions for the outcomes of functional limitations and self-rated physical and mental health, and logistic regression for depression and anxiety. All models adjusted for age, gender, race, education, and a baseline health variable (i.e., baseline chronic conditions in the model predicting chronic conditions). Sensitivity tests were included to adjust for neuroticism and average stressor exposure. Lastly, we tested if Wave 1 discrimination predicted Wave 3 health via Wave 2 NA reactivity and threat appraisals using the SPSS PROCESS macro, a bootstrap procedure for serial mediation (Preacher & Hayes, 2008). We examined the statistical significance of the indirect effects, which are significant at $p < .05$ if the 95% confidence interval does not include zero, by using 10,000 bootstrapped samples to create 95% bias-corrected confidence intervals. To facilitate interpretation and to provide estimates of effect size, all continuous variables were converted into standard deviation units.

Results

Descriptive Statistics

Table 1 displays descriptive statistics and correlations for all study measures. Respondents were on average 46 years old (SD = 11.19) at Wave 1 and were 58% female. Most respondents (72.4%) had a college education. Approximately 24% of participants reported one or two major discriminatory events in their lifetime, and 14% reported three or more discriminatory lifetime events at Wave 1. Women reported more lifetime discrimination, $t(1238) = -3.86$, $p < .001$, than men, but there were no gender differences in everyday discrimination, $t(1302) = -1.46$, $p = .144$. Non-White participants reported greater lifetime, $t(1313) = -5.87$, $p < .001$, and everyday, $t(1302) = -12.08$, $p < .001$, discrimination than White participants. There were no differences between education level and reports of lifetime, $t(1302) = -1.95$, $p = .051$, or everyday, $t(1302) = -1.18$, $p = .237$, discrimination.

Lifetime discrimination and everyday discrimination were positively correlated with one another (r = .40). Greater instances of lifetime discrimination at Wave 1 were associated with both greater NA reactivity and higher threat appraisals at Wave 2, as well as worse physical and mental health outcomes, except for anxiety, at Wave 3. Similarly, higher levels of everyday discrimination were associated with greater NA reactivity and more threat appraisals at Wave 2, and worse self-rated physical and mental

Table 1
Descriptive Statistics and Correlations Among Variables of Interest

Variable	*M*/%	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Wave 1 Lifetime Discrimination	0.52	0.73	—	0.40	0.06	**0.10**	**0.08**	**0.11**	**0.12**	**0.11**	**0.08**	0.03	−0.03	**0.10**	**0.16**	0.05	**0.10**
2. Wave 1 Everyday Discrimination	12.64	4.32		—	**0.13**	**0.12**	0.06	0.06	**0.15**	**0.19**	**0.10**	0.06	**−0.14**	0.04	**0.32**	0.03	**0.19**
3. Wave 2 NA Reactivity	0.16	0.10			—	**0.35**	**0.11**	**0.14**	**0.16**	**0.25**	**0.17**	**0.17**	**−0.11**	0.03	0.04	**−0.08**	**0.28**
4. Wave 2 Threat Appraisals	0.40	0.29				—	**0.09**	**0.10**	**0.12**	**0.16**	**0.12**	**0.11**	**−0.08**	0.01	0.06	0.04	**0.11**
5. Wave 3 Chronic Conditions	2.11	1.46					—	**0.47**	**0.39**	**0.24**	**0.19**	0.07	**0.22**	**0.13**	0.05	**−0.09**	**0.15**
6. Wave 3 Functional Limitations	1.70	0.80						—	**0.56**	**0.33**	**0.16**	**0.09**	**0.32**	**0.19**	0.01	**−0.22**	**0.14**
7. Wave 3 Self-rated Physical Health	2.53	1.02							—	**0.58**	**0.24**	**0.09**	**0.08**	0.02	**0.09**	**−0.16**	**0.16**
8. Wave 3 Self-rated Mental Health	2.36	0.95								—	**0.31**	**0.16**	0.01	0.05	0.05	**−0.17**	**0.28**
9. Wave 3 Depression	11%										—	**0.28**	**−0.09**	0.06	0.06	−0.03	**0.13**
10. Wave 3 Anxiety	2%											—	**−0.07**	**0.06**	**0.02**	−0.05	0.12
11. Age	45.66	11.19											—	0.03	−0.04	**−0.09**	**−0.17**
12. Gender (ref = men)	58%													—	0.01	**−0.11**	**0.10**
13. Race (ref = non-White)	95%														**—**	0.03	−0.01
14. Education (ref = no college)	72%															—	**−0.09**
15. Neuroticism	2.21	0.66															**—**

Note. Significant values are indicated in bold and are significant at the $p < .01$ level.

health and greater likelihood of depression at Wave 3. NA reactivity and threat appraisals at Wave 2 were positively correlated with one another, and greater NA reactivity and threat appraisals at Wave 2 were correlated with worse Wave 3 physical and mental health outcomes.

Discrimination and Health

Results from regression analyses predicting Wave 3 physical and mental health are shown in Table 2. After adjusting for relevant covariates and baseline health, greater instances of lifetime discrimination at Wave 1 were associated with worse physical and mental health at Wave 3 including more functional limitations, worse self-rated physical health, and worse self-rated mental health. Similarly, greater everyday discrimination at Wave 1 was associated with worse physical and mental health at Wave 3, with the exception of anxiety.

Mediation Analyses: Lifetime Discrimination

Physical Health Outcomes. We tested three indirect effects between lifetime discrimination and the physical health outcomes (see Figure 1). First, as hypothesized, the indirect effect of lifetime discrimination on all three outcomes through Wave 2 threat appraisals and NA reactivity was significant (chronic conditions: β = .01, 95% CI [.001, .011], functional limitations: β = .01, 95% CI [.001, .010], self-rated physical health: β = .003, 95% CI [.001, .010]). This indicates the relationship between lifetime discrimination and physical health was serially mediated by threat appraisals and NA reactivity. Second, the indirect path from lifetime discrimination to chronic conditions and functional limitations through threat appraisals alone was significant (chronic conditions: β = .01, 95% CI [.001, .028], functional limitations: β = .01, 95% CI [.001, .020]). Third, we tested the indirect path from lifetime discrimination to physical health through NA reactivity alone. This path was nonsignificant for all outcomes (chronic conditions: β = .01, 95% CI [−.005, .018], functional limitations: β = .003, 95% CI [−.004, .012], self-rated physical health: β = .003, 95% CI [−.004, .013]).

Mental Health Outcomes. When testing indirect effects between lifetime discrimination and mental health outcomes, there were no significant indirect effects of Wave 2 NA reactivity and appraisals on depression or anxiety. However, there were significant indirect effects on self-rated mental health. The indirect effect of lifetime discrimination on self-rated mental health through threat appraisals and NA reactivity was significant (β = .01, 95% CI [.001, .010]), showing threat appraisals and NA reactivity serially mediated the relationship between lifetime discrimination and self-rated mental health. The indirect path from discrimination to self-rated mental health through threat appraisals alone was also significant (β = .01, 95% CI [.001, .016]). The indirect path from lifetime discrimination to self-rated mental health through NA reactivity alone was nonsignificant (β = .004, 95% CI [−.008, .017]).

Mediation Analyses: Everyday Discrimination

Physical Health Outcomes. We tested the indirect effects between everyday discrimination and physical health outcomes (See Figure 2). Like lifetime discrimination, the indirect effect of everyday discrimination on all three outcomes through Wave 2 threat appraisals and NA reactivity was significant (chronic conditions: β = .01, 95% CI [.001, .024], functional limitations: β = .003, 95% CI [.001, .006], self-rated physical health: β = .003, 95% CI [.001, .006]). The indirect path from everyday discrimination to physical health through threat appraisals alone was also significant (chronic conditions: β = .01, 95% CI [.001, .010], functional limitations: β = .01, 95% CI [.001, .017]). The indirect path from everyday discrimination to physical health through NA reactivity alone was significant for all outcomes (chronic conditions: β = .01, 95% CI [.002, .021], functional limitations: β = .01, 95% CI [.001, .012], self-rated physical health: β = .003, 95% CI [.001, .015]).

Mental Health Outcomes. The indirect effect of everyday discrimination on depression and self-rated mental health through Wave 2 threat appraisals and NA reactivity was significant (depression: β = .01, 95% CI [.002, .020], self-rated mental health: β = .01, 95% CI [.001, .010]). The indirect path from everyday discrimination to both mental health measures through threat appraisals alone was also significant (depression: β = .02, 95% CI [.002, .052], self-rated mental health: β = .01, 95% CI [.001, .014]). The

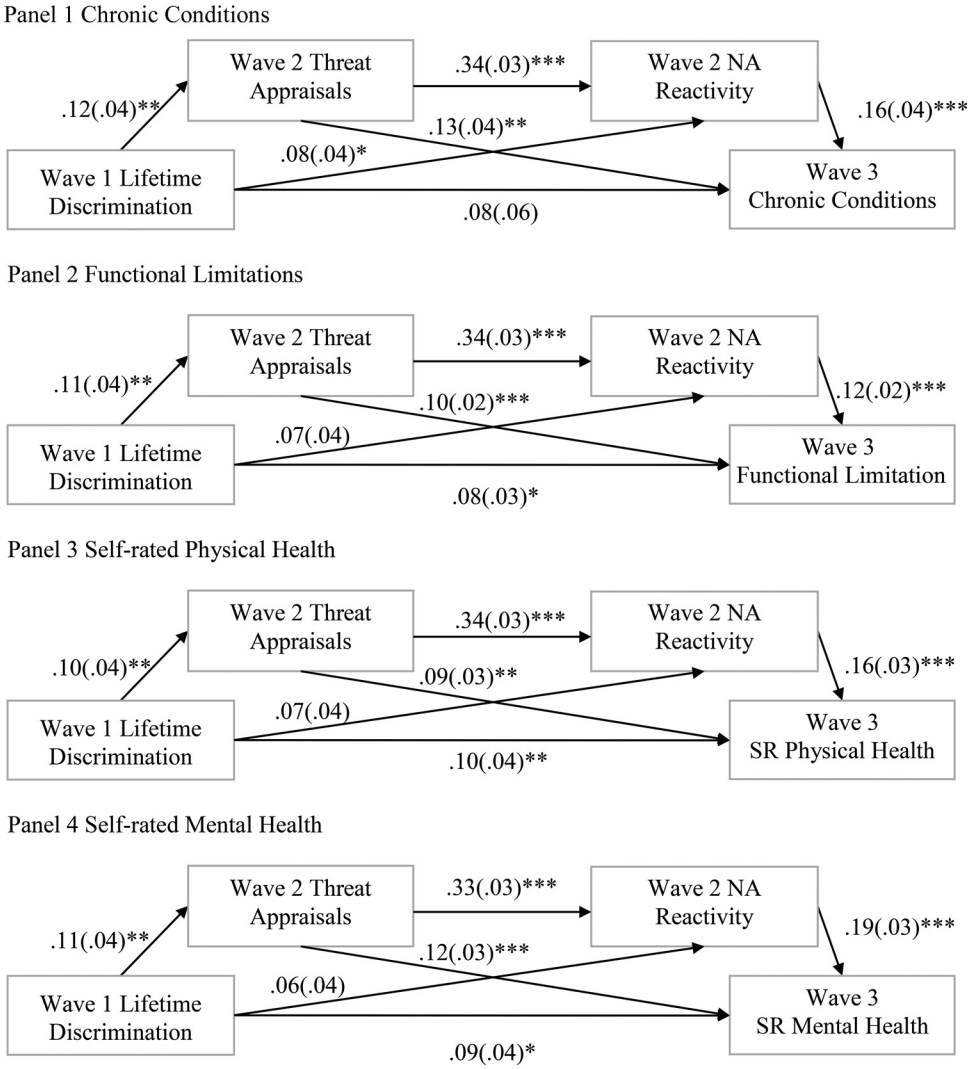
Table 2
OLS, Negative Binomial, and Logistic Regression Models Predicting Wave 3 Health Outcomes

	Lifetime discrimination											
	Chronic conditions		Functional limitations		Physical health		Mental health		Depression		Anxiety	
Variable	β	[95% CI]	β	[95% CI]	β	[95% CI]	β	[95% CI]	*OR*	[95% CI]	*OR*	[95% CI]
Lifetime	0.05†	[0.00, 0.10]	0.07**	[0.03, 0.16]	0.08**	[0.04, 0.18]	0.08**	[0.03, 0.18]	1.21	[0.95, 1.54]	0.81	[0.58, 2.00]
Age	0.13***	[0.08, 0.17]	0.23**	[0.18, 0.28]	0.04	[−0.01, 0.92]	−0.02	[−0.01, 0.00]	0.77**	[0.64, 0.93]	0.54*	[0.31, 0.93]
Gender[a]	0.14**	[0.06, 0.22]	0.09***	[0.08, 0.27]	−0.03	[−0.15, 0.04]	0.00	[−0.10, 0.11]	0.76	[0.52, 1.12]	0.45	[0.14, 1.44]
Race[b]	0.13	[−0.04, 0.30]	−0.00	[−0.22, 0.20]	0.04	[−0.03, 0.40]	0.04	[−0.03, 0.41]	0.53	[0.27, 1.02]	0.57	[0.11, 2.98]
Education[c]	−0.09*	[−0.18, −0.12]	−0.14***	[−0.43, −0.22]	−0.10***	[−0.34, −0.12]	−0.13***	[−0.40, −0.17]	1.22	[0.82, 1.82]	0.36*	[0.13, 0.96]
W1 health	0.14***	[0.11, 0.17]	0.42***	[0.37, 0.47]	0.40***	[0.35, 0.45]	0.34***	[0.29, 0.39]	4.04***	[2.68, 6.07]	3.55***	[1.25, 5.63]
	Everyday discrimination											
	Chronic conditions		Functional limitations		Physical health		Mental health		Depression		Anxiety	
Variable	β	95% CI	β	95% CI	β	95% CI	β	95% CI	*OR*	95% CI	*OR*	95% CI
Everyday	0.04†	[0.00, 0.08]	0.06*	[0.01, 0.11]	0.07*	[0.02, 0.12]	0.14***	[0.09, 0.19]	1.17†	[0.98, 1.41]	1.11	[0.72, 1.72]
Age	0.13***	[0.09, 0.17]	0.24***	[0.19, 0.29]	0.05*	[0.00, 0,10]	0.00	[−0.01, 0.00]	0.80*	[0.66, 0.97]	0.54*	[0.31, 0.94]
Gender[a]	0.15***	[0.07, 0.23]	0.09***	[0.09, 0.28]	−0.02	[−0.14, 0.05]	0.01	[−0.09, 0.11]	0.74	[0.51, 1.09]	0.43	[0.13, 1.41]
Race[b]	0.12	[−0.06, 0.30]	−0.01	[−0.25, 0.19]	0.03	[−0.09, 0.37]	0.01	[−0.19, 0.27]	0.6	[0.29, 1.20]	0.66	[0.11, 3.92]
Education[c]	−0.11*	[−0.19, −0.02]	−0.14***	[−0.41, −0.21]	−0.10***	[−0.33, −0.11]	−0.13***	[−0.39, −0.17]	1.21	[0.81, 1.80]	0.35*	[0.13, 0.96]
W1 health	0.14***	[0.11, 0.17]	0.42***	[0.37, 0.47]	0.40***	[0.35, 0.45]	0.33***	[0.27, 0.38]	3.97***	[2.64, 5.97]	3.59***	[1.33, 5.65]

Note. OLS = Ordinary Least Squares; CI = confidence interval; Lifetime = lifetime discrimination at Wave 1; Everyday = everyday discrimination at Wave 1; W1 health = respective baseline health variable at Wave 1.
[a]Reference = men. [b]Reference = non-White. [c]Reference = no college.
† $p < .10$. * $p < .05$. ** $p < .01$. *** $p < .001$.

Figure 1

Associations Between Lifetime Discrimination, Stress Processes, and Health



Note. NA = negative affect; SR = self-rated. Standardized coefficients and standard errors are presented.
*$p < .05$. ** $p < .01$. ***$p < .001$.

indirect path from everyday discrimination to both mental health variables through NA reactivity alone was also significant (depression: β = .02, 95% CI [.004, .043], self-rated mental health: β = .01, 95% CI [.002, .020]). Everyday discrimination did not significantly predict Wave 3 anxiety, and there were no significant indirect effects of NA reactivity or threat appraisals.

Sensitivity Tests

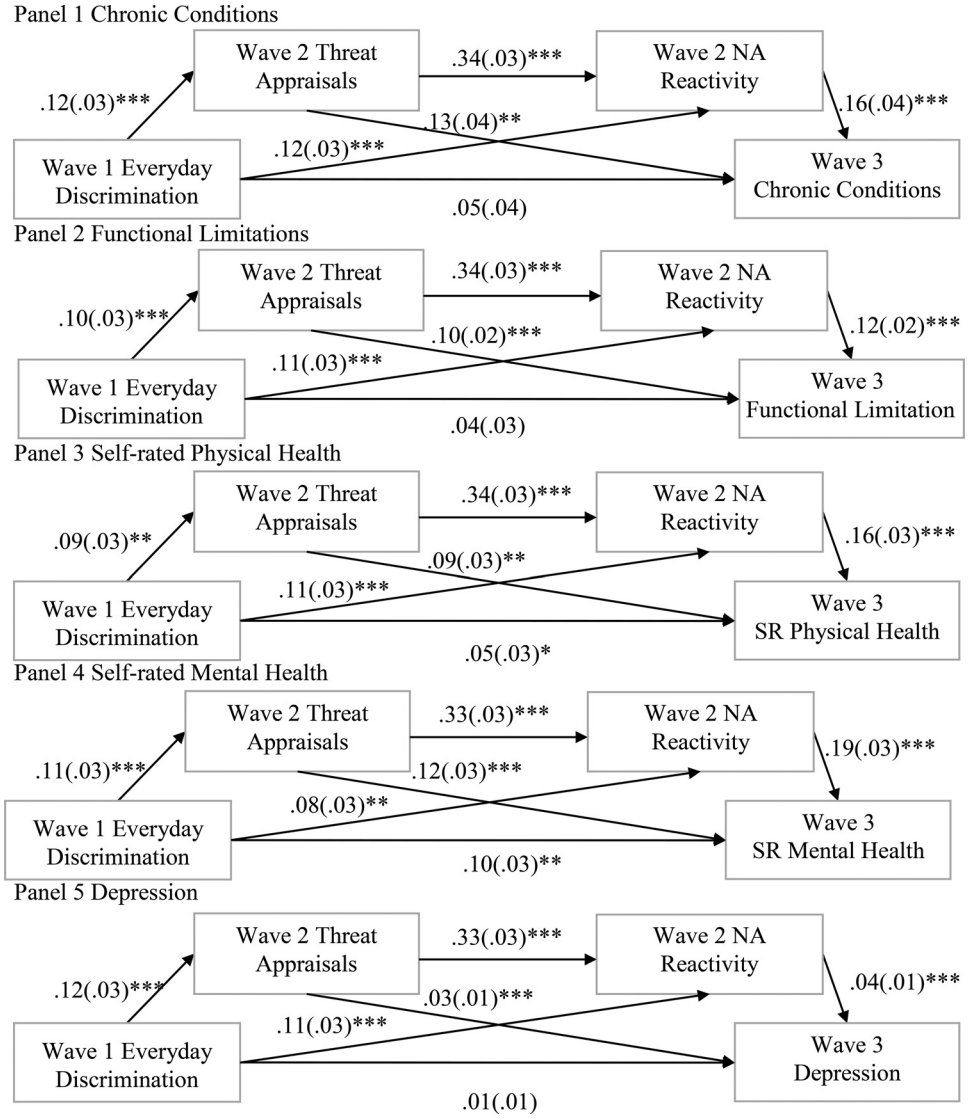
In line with other studies testing associations between discrimination and health (i.e., Friedman et al., 2009) and daily stress processes and health (i.e., Mayer et al., 2021), we tested models to examine the potential role of neuroticism, the stable tendency to perceive events negatively. It is possible that those who perceive greater discrimination may do so because of a general negative emotional orientation, which may be linked with health. Additionally, we included average exposure to moderate to severe stressors to ensure that ratings of threat appraisals were not driven by stressor exposure. Participants who had higher neuroticism and stressor exposure reported more instances of lifetime discrimination ($r = .10$, $p < .001$; $r = .10$, $p < .001$, respectively), everyday discrimination ($r = .19$, $p < .001$; $r = .13$, $p < .001$), and worse mental and physical health outcomes at Wave 3 (*r*s range from .09 to .33). Inclusion of neuroticism and average stressors in the models did not affect the associations between lifetime and everyday discrimination, daily stress processes, and health (see the online supplemental materials).

Discussion

Exposure to unfair treatment has a strong impact on a range of physical and mental health outcomes (Lewis et al., 2015; Paradies, 2006; Williams et al., 2019). The current study is the first to examine

Figure 2

Associations Between Everyday Discrimination, Stress Processes and Health



Note. NA = negative affect; SR = self-rated. Standardized coefficients and standard errors are presented.
*$p < .05$. **$p < .01$. ***$p < .001$.

daily cognitive and affective stress processes as a risk pathway that explains the longitudinal associations between discrimination and physical and mental health outcomes. Both lifetime discrimination and everyday discrimination were associated with physical and mental health 20 years in the future. Greater instances of lifetime discrimination were associated with greater numbers of chronic conditions, greater functional impairment, and worse self-rated physical and mental health. Greater instances of everyday discrimination were associated with those same outcomes in addition to a greater likelihood of developing depression. Furthermore, how people appraised and reacted to daily stressful experiences mediated this relationship.

The current research advances the literature on discrimination, daily stress processes, and health in a few important ways. First, these results provide support for a large body of research showing both major and routine instances of discrimination have detrimental impacts on physical and mental health outcomes later in life (Lewis et al., 2015; Paradies et al., 2015; Williams et al., 2019). Contrary to our expectation, however, only everyday discrimination was associated with the likelihood of developing depression, and neither lifetime nor everyday discrimination was associated with the likelihood of developing anxiety. This was initially surprising, as prior research has documented strong and consistent associations between perceived discrimination and various indicators of mental health (Lewis et al., 2015; Paradies et al., 2015). However, most studies only measure everyday discrimination (e.g., Lewis et al., 2015), and other studies have found everyday discrimination is more strongly related to psychological distress than lifetime discrimination (Kessler et al., 1999), which is consistent with our findings. Additionally, few

participants in our sample met the criteria for depressive disorder (11% at Wave 3) and anxiety disorder (2% at Wave 3). Lack of variability in depression and anxiety scores may explain the null findings. Conversely, the significant relationship between discrimination and self-reports of mental health, a measure with greater variability and a broader assessment of mental health, might suggest any effects for depression and anxiety were masked by invariance.

Second, this research provides a glimpse into the everyday life of individuals who have experienced unfair treatment. Both lifetime and everyday discrimination predicted greater threat appraisals and NA reactivity in response to daily stressors, which is in line with studies showing individuals who experience chronic stress are more likely to appraise stressors as threatening and are more emotionally reactive to everyday events (Serido et al., 2004). People who have experienced discrimination may appraise daily events as more threatening than those who have not because (a) the daily stressors they experience are more severe and threatening and (b) they are hypervigilant for potential threat in their environment. In turn, these heightened threat perceptions act as a source of chronic stress that lead to greater emotional reactions to daily events (Almeida et al., 2005). These findings suggest people who have experienced unfair treatment are more cognitively and affectively reactive to daily stressors because they perceive those stressors to be more harmful (Adler et al., 1994).

Finally, this study sheds light on the role of daily psychological stress processes as a persistent risk pathway linking discrimination and health. Threat appraisals and NA reactivity to daily stressors partially explained the relationship between discrimination and physical and mental health outcomes. This study is the first to link two distinct measures of discrimination with both future physical and mental health outcomes and psychological mediators in a single investigation across two decades and three waves of data collection. This has major implications for interpreting why experiencing discrimination predicts broad-based physical and mental health. Discrimination can have long-lasting impacts on how individuals interpret and affectively respond to everyday events. Over time, repeated heightened reactions to daily stressful events may cause wear and tear on bodily systems, making people more vulnerable to disease (McEwen & Stellar, 1993). Thus, people who have experienced unfair treatment see daily events as being more threatening, which has an impact on their emotional reactions to these events, which over time can lead to adverse physical and mental health consequences. Notably, NA reactivity to daily stressors by itself did not significantly mediate the relationship between discrimination and health. Daily threat appraisals in particular may constitute a risk for those who have experienced discrimination and provide a promising target for intervention. Mindfulness interventions, for example, facilitate the reappraisal of stressors as nonthreatening and have been shown to improve a range of health-related outcomes (Creswell et al., 2019). Developing more adaptive daily stress processes such as lowering threat appraisals through various coping strategies, may mitigate some of the detrimental effects of discrimination on health (Williams et al., 2019).

Threat appraisals and affective reactions to daily stressors may be one way discrimination shapes health, but it is by no means the only way. One important caveat is that the amount of variance accounted for by the indirect effect of these daily stress processes is small (i.e., between 3% and 6% of the total effect of lifetime and everyday discrimination on health outcomes was mediated by daily stress processes). By comparison, previous work on the impact of socioeconomic and social factors on health has proposed that 10% to 15% of preventable deaths in the United States are attributable to the imbalance of access to medical care, and upward of 50% of deaths are attributable to disparities in social factors such as income, education, and employment (Braveman et al., 2011; McGinnis et al., 2002). Discrimination can affect health through myriad pathways at multiple levels. Institutionalized discrimination can affect health through reduced access to health care, substandard living conditions, and reduced opportunities for advancement. Effective solutions to combat the discrimination/health link will need to be comprehensive and emphasize policies that push for systemic changes (Williams & Purdie-Vaughns, 2016).

This study had a few limitations that should be addressed in future research. First, most participants in this study were White and well-educated; only 5% of participants were non-White. Because of the racial homogeneity in the sample, we cannot extend these results to underrepresented ethnic/racial populations or determine the specific associations of racism on daily stressors and future health. Additionally, these results may also not extend to those with lower socioeconomic standing. Future work should include replications across non-White populations, in particular, given racial discrimination is a fundamental driver of health disparities. Nonetheless, these results highlight the importance of broadening the consideration of the health impacts of unfair treatment to include other aspects of identity that can be stigmatized (e.g., gender, weight, and age discrimination). A second limitation was how discrimination and health were measured. The discrimination measures were based on self-report and did not include comprehensive assessments of structural discrimination (e.g., socioeconomic mobility). All three measures of physical health have strong predictive outcomes in the literature but are, nonetheless, limited by self-reports. Future work should extend these findings by examining objective measures of health. Finally, given the observational nature of the data and that the analyses used in this study only examined perceived discrimination and daily stress processes at a single timepoint, we are unable to make claims about causal associations between discrimination, daily stress processes, and health. Yet, theoretical models suggest stress and stress reactivity resulting from discrimination contribute to health disparities, not the other way around (e.g., Ong et al., 2009; Pascoe & Smart Richman, 2009). Furthermore, both lifetime and everyday discrimination are chronic stressors that have significant trait-like stability. Future work can further examine the chronic nature of discrimination and its impact on health.

This study is among the first to examine daily cognitive-affective stress processes as a mechanism that links discrimination with future physical and mental health outcomes. Experiencing discrimination shapes the way in which everyday stressors are appraised and experienced, creating an underlying vulnerability that has detrimental physical and mental health consequences later in life. Continuing to examine daily psychological stress processes as a pathway from self-reported experiences of discrimination to physical and mental health underscores the insidious nature of unfair treatment and the toll it takes on daily life.

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