# Discrimination, Other Psychosocial Stressors, and Self-Reported Sleep Duration and Difficulties

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**Objectives:** To advance understanding of the relationship between discrimination and sleep duration and difficulties, with consideration of multiple dimensions of discrimination, and attention to concurrent stressors; and to examine the contribution of discrimination and other stressors to racial/ethnic differences in these outcomes.

**Design:** Cross-sectional probability sample.

**Setting:** Chicago, IL.

**Participants:** There were 2,983 black, Hispanic, and white adults.

**Measurements and Results:** Outcomes included self-reported sleep duration and difficulties. Discrimination, including racial and nonracial everyday and major experiences of discrimination, workplace harassment and incivilities, and other stressors were assessed via questionnaire. In models adjusted for sociodemographic characteristics, greater exposure to racial ($\beta$ = -0.14)) and nonracial ($\beta$ = -0.08) everyday discrimination, major experiences of discrimination attributed to race/ethnicity ($\beta$ = -0.17), and workplace harassment and incivilities ($\beta$ = -0.14) were associated with shorter sleep ($P < 0.05$). The association between major experiences of discrimination attributed to race/ethnicity and sleep duration ($\beta$ = -0.09, $P < 0.05$) was independent of concurrent stressors (i.e., acute events, childhood adversity, and financial, community, employment, and relationship stressors). Racial ($\beta$ = 0.04) and non-racial ($\beta$ = 0.05) everyday discrimination and racial ($\beta$ = 0.04) and nonracial ($\beta$ = 0.04) major experiences of discrimination, and workplace harassment and incivilities ($\beta$ = 0.04) were also associated with more (log) sleep difficulties, and associations between racial and nonracial everyday discrimination and sleep difficulties remained after adjustment for other stressors ($P < 0.05$). Racial/ethnic differences in sleep duration and difficulties were not significant after adjustment for discrimination ($P > 0.05$).

**Conclusions:** Discrimination was associated with shorter sleep and more sleep difficulties, independent of socioeconomic status and other stressors, and may account for some of the racial/ethnic differences in sleep.

**Keywords:** Discrimination, racial and ethnic disparities, sleep difficulties, sleep duration, psychosocial stressors.

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## INTRODUCTION

Discrimination, defined as the differential treatment of people based actual or perceived membership in a particular group,[1] has a powerful role in determining the allocation of resources and prospects for achievement in contemporary society, and racial/ethnic inequalities persist in nearly all domains of life, including employment, housing, consumer interactions, credit markets, education, health care, and the criminal justice system.[2] Discrimination based on race/ethnicity or other personal characteristics is associated with poorer physical and mental health outcomes,[3-5] and investigators are now focused on identifying underlying behavioral, cognitive, and physiological mechanisms through which discrimination affects health.[3] Suboptimal sleep may be one pathway linking perceived discrimination to physical and mental health problems.[6] Sleep problems are associated with poorer outcomes across many health and functional domains, including increased risk of central adiposity,[7,8] obesity,[9] immune function,[10,11] diabetes,[12,13] hypertension,[14]

heart disease,[15,16] motor vehicle accidents,[17] mood disorders,[18] substance abuse,[19] and mortality.[20-23] Beyond health risks, sleep disturbances are also linked to employee absenteeism, lower work productivity, and medical errors.[24] Consequently, inadequate sleep poses a substantial economic burden to society, with an estimated cost of more than $30 billion per year due to medical expenses and lost economic productivity.[24,25]

Sleep duration in the United States varies by race and ethnicity, and the majority of studies report that African Americans (or blacks) have shorter and longer sleep durations in comparison with whites or Hispanics.[26-31] Immigration history is also related to sleep duration. For example, US-born Mexican Americans are 40% more likely to be short sleepers in comparison with Mexican immigrants.[32] To date, limited research has investigated why some racial/ethnic groups have suboptimal sleep, or potential social or environmental conditions that may account for differences by race/ethnicity.[27,33] It is important to understand factors that influence an individual's sleep duration and quality, in order to support the development of effective interventions to address sleep disparities[34] and potentially reduce racial/ethnic disparities in health.

Discrimination is just one of many types of psychosocial stressors that may affect sleep duration or quality. Over the past 10 y, a growing body of research has identified many correlates of sleep problems among adults, including lower socioeconomic status (SES),[28,29,35-37] financial strain,[27,38] urban residence,[6] relationship changes,[39] neighborhood disorder,[40] stressful life

events,[41] psychosocial work characteristics,[42-44] and childhood SES[45] and abuse.[46,47] To date, only a few studies have examined discrimination as a risk factor for sleep problems, and existing studies suggest that discrimination is a risk factor for disrupted sleep.[48-51] In one study of 368 black, white, and Chinese women, everyday discrimination was associated with more subjective sleep complaints and polysomnography (PSG)-assessed wakefulness after sleep onset.[48] In a study of 37 blacks and 56 white Americans, discrimination was associated with less PSG-assessed stage 4 sleep and more self-reported fatigue.[50] A study of 7,148 adults from Michigan and Wisconsin found that perceived racial discrimination when seeking health care was associated with self-reported sleep disturbance after adjustment for a range of potential confounders.[51] In addition, in a sample of 168 Hispanic American immigrants, perceived racism was associated with greater self-reported sleep disturbance.[49] There are also few studies that have examined whether SES or psychosocial stressors can partially account for some of the disparities in sleep problems by race/ethnicity.[6,28,33] In a study of 340 healthcare workers, SES, occupational exposures, and job strain accounted for some of the observed differences in sleep duration between African/Caribbean immigrants and whites.[33] In the National Health Interview Survey, SES and residential context accounted for some of the elevated risk for shorter sleep duration among blacks compared with whites.[52]

Prior research to examine the influence of discrimination on sleep has advanced the field in a number of important ways. However, most of these studies are limited in size,[48-50] and do not take into account other psychosocial stressors that may be related to experiences of discrimination, and are more common among minorities.[53] It is critical for studies to advance beyond modeling discrimination as an isolated experience, but rather to acknowledge and additionally account for other stressors that may disproportionately affect minority groups, and combine with discrimination to affect racial/ethnic variations in health.[3,54] By including additional psychosocial stressors into statistical models, it is possible to examine the influence of discrimination, independent of other potentially correlated stressors. Research on discrimination may also benefit from more nuanced assessments, which enable careful examination of acute (i.e., major experiences) and chronic (i.e., everyday) exposures, as well as attribution for discriminatory experiences. Currently, it is unclear whether acute or chronic experiences of discrimination, or discrimination attributed to race/ethnicity as compared to discrimination attributed to other reasons (e.g., sex, sexual orientation, weight), have similar implications for sleep problems. Prior studies have documented that the negative health effects of discrimination can extend to individuals of all races/ethnicities[3,8,48,54]; therefore, we expect similar associations between discrimination and sleep problems, regardless of attribution.

Using data from a large probability sample adults in Chicago, IL, the goal of this study was to examine the relationship between discrimination and sleep duration and difficulties, with detailed consideration of multiple dimensions of discrimination, and attention to other concurrent stressors. We hypothesized that (1) racial/ethnic and nonracial/ethnic discrimination would predict shorter sleep duration and more sleep difficulties, and that these associations will persist independent of SES and other acute and chronic stressors; (2) that cumulative stressor exposure, including discrimination, would be related to shorter sleep duration and more sleep difficulties in a graded manner; and (3) that discrimination would account for some of the differences in sleep duration and difficulties by race/ethnicity.

## METHODS

### Sample

Data for this study were drawn from the Chicago Community Adult Health Study (CCAHS), a household probability sample of 3,105 adults aged 18 y and older residing in Chicago, IL. Participants were selected from 343 neighborhood clusters previously defined by the Project on Human Development in Chicago Neighborhoods (PHDCN).[55] Face-to-face interviews with one individual per household were completed between May 2001 and March 2003, with a response rate of 71.8%. Data were weighted to match the city of Chicago 2000 census population estimates for age, race/ethnicity, and sex distributions. A total of 122 respondents (3.94%) had missing information on covariates required for this analysis, and thus were excluded. Excluded individuals did not differ from included participants by race/ethnicity, sex, education, exposure to discrimination, or sleep duration or difficulties (all P > 0.05). Accordingly, our analytic sample included 2,983 respondents: 1,184 non-Hispanic blacks, 353 US-born Hispanics, 420 foreign-born Hispanics, and 1,026 non-Hispanic whites.

### Measures

#### Sleep Problems

Sleep duration was self-reported using a single open-ended item: "*How many hours of sleep do you usually get at night?*" This outcome was used as a continuous variable. For a sensitivity analysis, we created a three-category variable to reflect short ($\leq 6$ h), midrange (6-8 h), and long ($\geq 9$ h) sleep durations.[6]

Sleep difficulties were measured using three items, which asked the respondents how often (in the past 4 w) they have had trouble falling asleep, waking up in the middle of the night and finding it hard to get back to sleep, and waking up very early and being unable get back to sleep. Respondents rated each statement on a four-point scale (rarely/never to almost every day), and the mean of the three items was used to reflect sleep difficulties ($\alpha = 0.75$). These items were originally developed for the Alameda County Study.[56] We log-transformed this measure for regression models in light of the skewed distribution.

#### Discrimination

**Racial/Ethnic and Nonracial/Ethnic Discrimination:** Perceived racial/ethnic and non-racial/ethnic discrimination was measured using assessments of (1) major experiences of discrimination, and (2) chronic interpersonal discrimination (i.e., everyday discrimination). The major experiences of discrimination inventory included four items that asked respondents to report the number of times in their life they were (1) unfairly fired from a job, (2) denied a promotion, (3) unfairly treated by police, and (4) unfairly prevented from moving into a neighborhood. After each responding to all four items, respondents provided the primary reason why he/she had experienced unfair treatment (i.e., only one reason was provided, even if

there were multiple events). We calculated scores for racial/ethnic and nonracial/ethnic major discrimination by summing the number of types of major discrimination events attributed to race/ethnicity, and the number of types of major discrimination events attributed to other reasons (besides race/ethnicity).

Everyday discrimination was assessed using a five-item version[57] of the Everyday Discrimination Scale,[58] which asked respondents to report how often (1) they were treated with less courtesy or respect than others, (2) they received poorer service than others, (3) others had acted as if they were not smart, (4) other had acted as if they were afraid of them, and (5) they felt threatened or harassed. There was no specified time frame for these items. Respondents rated each item on a five-point scale, ranging from never to at least once per week, and items were summed to derive the final score ($\alpha = 0.75$). Following administration this scale, respondents reported the primary reason why they had experienced unfair treatment.

Respondents who reported race, ancestry, or national origin as the primary reason for discrimination were coded as having experienced racial/ethnic discrimination; respondents providing any other reason (e.g., age, sex) were coded as having experienced nonracial/ethnic discrimination.[57] We created four separate scores to reflect racial/ethnic and nonracial/ethnic discrimination, for the life events and everyday discrimination assessments. We performed z-score transformations on these scores to facilitate comparison between these measures and improve the skew of the variables.

**Workplace Harassment and Incivilities:** Discriminatory experiences specific to the workplace were assessed using two scales adapted from the Perceived Racism Scale[59] and the Los Angeles Study of Urban Inequality[60]: *job harassment* (two-item five-point scale: frequency that supervisors/coworkers make slurs about racial/ethnic groups; frequency that supervisors/coworkers make slurs about women; $\alpha = 0.71$); and, *unfair treatment on the job* (three item five-point scale: have to work twice as hard as others to get same treatment/evaluation; watched more closely than others; unfairly humiliated in front of others; $\alpha = 0.76$). We performed z-score transformations on these scales, summed them, and performed another z-score transformation to enable comparison with other stressors.

### Other Psychosocial Stressors

We assessed six stressor domains in addition to discrimination, which reflected central dimensions of daily life (i.e., conditions in the home, workplace, and neighborhood). We included these stressors in an effort to measure stressor exposure comprehensively. This enabled us to (1) evaluate the associations between discrimination and sleep problems independent of other important stressors, and (2) examine the cumulative influence of multiple stressors on our outcomes of interest. Prior to fielding the CCHAS, researchers conducted a large pretest in order to develop shorter versions of existing psychosocial stress scales with adequate psychometric properties. This pretest produced scales that provide broad assessments of stressors that are relevant to health outcomes, and racial/ethnic health disparities.[53] A complete list of each set of items is presented in a previous publication.[53] We briefly described the items in each domain, and provided a measure of internal consistency (i.e., Cronbach alpha) for scales that reflect a single underlying construct. All measures within each domain were transformed to z-scores. For domains that included multiple measures, each measure was standardized to a z-score and then summed together. The resulting value was restandardized to a z-score. This procedure facilitated inclusion of multiple assessments within a given domain, and comparisons across domains.[61]

Acute life events included two life event inventories: acute life events over the entire life span (four items: death of a child; victim of a serious physical attack; life-threatening illness/accident to self, life-threatening illness/accident to spouse/child); and acute life events in the past 5 y (nine items: life-threatening illness/accident to someone close; death of someone close; job loss; unemployed and seeking work; household member unemployed and seeking work; moved to worse home/neighborhood; robbed/burglarized; serious financial problems; legal troubles; other upsetting event occurring to self or others).

Financial stress contained two measures: financial strain (two-item five-point scale: satisfaction with financial situation; difficulty paying monthly bills; $\alpha = 0.69$); and an inventory of events reflecting serious economic problems (seven items: sold possessions/cashed life insurance to cover daily expenses; borrowed money from friends/relatives for daily expenses; postponed healthcare visit for financial reasons; unable to purchase medications; government assistance such as welfare or food stamps; obtained loan to consolidate or pay off debt; moved to less expensive housing or into someone else's home due to financial strain).

Community stress included three measures of stressors related to the neighborhood context, adapted from the PHDCN[55]: community violence in past 6 mo (five-item inventory: fight in neighborhood involving weapon; violent argument between neighbors; gang fights; sexual assault/rape; robbery/mugging); personal victimization in community (four-item inventory: violence against you/family member in relation to a mugging/fight/sexual assault; home broken into; property stolen from yard/garage/porch; damage to vehicle/home); and, community disorder (five-item four-point scale: amount of broken glass/trash on sidewalks and streets; graffiti on buildings/walls; vacant houses/storefronts; public alcohol consumption; unsupervised children on the street; $\alpha = 0.77$).

Employment stressors comprised six measures that reflected multiple dimensions of stress: job dissatisfaction (one-item five-point scale); job autonomy (three-item five-point scale: job requires creativity; decision-making; variation in tasks; $\alpha = 0.72$); job insecurity (one-item four-point scale: likelihood of job loss); work demands (three-item four-point scale: excessive work; not enough time; conflicting demands; $\alpha = 0.67$); work-life conflicts (two-item four-point scale: job leaves respondent too tired/stressed to participate in activities with friends/family; participate in community activities; $\alpha = 0.91$); and, job hazards (three-item three-point scale: exposure to dangerous chemicals; exposure to air pollution; risk of accident/injury; $\alpha = 0.70$).

Childhood adversity was assessed using an eight-item scale, with each item rated on a five-point scale ($\alpha = 0.76$). Participants were asked: how often their parents (1) made them feel loved; (2) physically held and comforted them; (3) physically threatened or abused them; (4) verbally threatened or abused them; (5) participated in activities in their school; (6) read to them; (7) how often they went to bed at night

feeling hungry; and, (8) how well off their family was when they were growing up.

Relationship stress comprised five measures adapted from the Americans' Changing Lives study[62]: marital stress (four-item five-point scale: frequency of feeling upset by relationship; excessive demands; criticism by partner; satisfactory outcome for you and partner following a disagreement; α = 0.67); marital abuse (four-item four-point scale: partner drinks too much; pushes/slaps/hits respondent; wastes family money needed for other things; yells or screams at respondent; α = 0.57); child-related stress (three-item five-point scale: frequency children make excessive demands; frequency you feel bothered/upset as parent; happiness with way children have turned out; α = 0.57); total problems for children (six-item inventory: problems with finances; problems with employment; health problems; problems with close relationships; problems with relationship to self or spouse; other problems); and friend criticism (two-item five-point scale: frequency friends/relatives make excessive demands; frequency friends/relatives are critical; α = 0.60).

In addition, we created a cumulative stressor score to characterize high stress across multiple domains by creating a count of the number of stressor domains for which the individual scored in the top quintile.[53] In order to prevent overrepresentation of discrimination experiences in this score, we did not differentiate between racial/ethnic and nonracial/ethnic discrimination assessments, and we combined the assessments of everyday and major experiences of discrimination using the procedure outlined in the previous paragraph for other domains.

### Sociodemographic Characteristics

Black, white, and Hispanic race/ethnicity was assessed via self-report. We stratified Hispanics based on self-reported nativity (i.e., US-born and foreign-born) based on evidence that immigration history is relevant for sleep outcomes.[32] Of the 2,983 respondents, 78 individuals reported "other" race/ethnicity. In exploratory analyses, individuals who identified as "other" race appeared most similar to whites in terms of sociodemographic characteristics. Therefore, we combined the "other" category with whites to optimize available data, and sensitivity analyses (available on request) revealed that the results are unchanged relative to results that excluded these individuals. Respondents reported education (less than high school, high school, some college, college degree or more), household income (less than $10,000, $10,000-$30,000, $30,000-$50,000, $50,000 or more, missing), age, sex, employment status (yes/no), martial/partner status (yes/no), and if he/she had one or more children (yes/no).

### Analysis

Bivariate analyses were performed to examine the distribution of demographic characteristics and stressors by race/ethnicity. Linear regression models were used to calculated least-square mean stressor values by race/ethnicity, adjusted for age and sex. We also used linear regression to examine associations between discrimination and other psychosocial stressors and sleep duration and difficulties. We followed the same model-building sequence for both sleep duration and difficulties. First, we estimated associations between discrimination and the other stressors on the sleep outcomes independently,

using separate regression models. Second, we estimated the associations between discrimination and the other stressor domains on each sleep outcome within a single model. Third, we examined the number of high stressor scores endorsed in relation to sleep duration and difficulties. For each of these steps, we examined associations in models adjusted for sex, age, and race/ethnicity, and again in models that additionally adjusted for SES (i.e., income and education). Finally, we presented the race/ethnicity regression coefficients as sociodemographic, and discrimination and other stressor variables were sequentially added into models. We compared the coefficients for race/ethnicity across models to assess the contribution of discrimination and other stressors to racial disparities in sleep duration and difficulties. All analyses were performed in SAS and used survey commands that account for sample weights and neighborhood cluster.

In a sensitivity analysis, we examined discrimination and other stressors in relation to short, mid-range, and long[5] sleep duration (i.e., a three-category outcome), in light of research showing that treating sleep duration as a continuous variable may obscure relationships found at both ends of the continuum.[63] We used multinomial logistic models with the same model building sequence and covariates that we used to examine sleep duration continuously.

## RESULTS

The distribution of sleep outcomes, sociodemographic factors, and number of high stressor domains is presented in Table 1. Blacks and US-born Hispanics had shorter sleep durations and more sleep difficulties relative to foreign-born Hispanics and whites (P = 0.02). Blacks, US-born Hispanics, and foreign-born Hispanics had lower education (P < 0.0001) and household income (P < 0.0001) relative to Whites, and had higher scores on the assessment of cumulative psychosocial stressors (P < 0.0001).

Table 2 presents the means stressors z-scores stratified by race/ethnicity, and adjusted for age, sex, and any other necessary covariates (e.g., employment status for employment stressors, noted in Table 2). Blacks reported the highest scores for racial/ethnic discrimination (both everyday and major experiences of discrimination), while Whites had the lowest scores (P < 0.0001). Whites reported the highest scores for nonracial/ethnic everyday discrimination, whereas US-born Hispanics had the highest scores for nonracial/ethnic major experiences of discrimination (P < 0.0001). Foreign-born Hispanics had lower scores on workplace harassment and incivilities relative to other racial/ethnic groups (P < 0.0001). Considering other psychosocial stressors (i.e., acute events, financial strain, community stressors, employment stressors, childhood adversity, and relationship stressors), blacks and US-born Hispanics had higher scores relative to whites and foreign-born Hispanics for all stressors (P < 0.05) other than employment stress and childhood adversity.

The top panel of Table 3 presents regression coefficients for the associations of discrimination and other psychosocial stressors with sleep duration. In models adjusted for age, race/ethnicity, and sex, greater exposure to everyday and major experiences of discrimination attributed to race/ethnicity, and workplace harassment and incivilities were associated with shorter

**Table 1**—Sample characteristics

| | Full sample N | Full sample n = 2,983 Mean or % (SE) | Black n = 1,184 Mean or % (SE) | US-born Hispanic n = 353 Mean or % (SE) | Foreign-born Hispanic n = 420 Mean or % (SE) | White n = 1,026 Mean or % (SE) | Difference by race/ethnicity P |
|---|---|---|---|---|---|---|---|
| Proportion of sample (%) | | | 32.0 (2.3) | 11.6 (0.9) | 14.4 (1.2) | 42.0 (2.3) | |
| Sleep duration (h, mean) | 2,983 | 6.8 (0.0) | 6.7 (0.1) | 6.8 (0.1) | 6.9 (0.1) | 6.9 (0.0) | 0.02 |
| Sleep duration category | | | | | | | |
| Short (≤ 6 h) | 1,233 | 40.2 (1.2) | 48.2 (1.9) | 45.3 (3.5) | 36.3 (2.9) | 34.1 (1.8) | < 0.0001 |
| Midrange (> and < 9 h) | 1,546 | 52.6 (1.2) | 43.4 (1.9) | 45.7 (3.4) | 56.3 (3.0) | 60.3 (1.9) | |
| Long (≥ 9 h) | 204 | 7.1 (0.6) | 8.3 (1.1) | 9.0 (2.0) | 7.4 (1.6) | 5.6 (0.9) | |
| Sleep difficulties score (mean) | 2,983 | 1.7 (0.0) | 1.7 (0.0) | 1.8 (0.1) | 1.6 (0.0) | 1.6 (0.0) | < 0.0001 |
| Sex (%) | | | | | | | |
| Male | 1,182 | 47.1 (1.2) | 42.8 (1.7) | 45.9 (3.1) | 49.7 (3.1) | 49.7 (2.0) | 0.04 |
| Female | 1,801 | 52.9 (1.2) | 57.2 (1.7) | 54.1 (3.1) | 50.3 (3.1) | 50.3 (2.0) | |
| Age (y, mean) | 2,983 | 42.3 (0.4) | 44.0 (0.6) | 35.9 (1.2) | 39.5 (0.9) | 43.7 (0.8) | < 0.0001 |
| Education (%) | | | | | | | |
| Less than high school | 754 | 23.4 (1.2) | 23.6 (1.7) | 31.4 (3) | 53.7 (3) | 10.6 (1.4) | < 0.0001 |
| High school | 729 | 23.9 (1.0) | 28.3 (1.5) | 29.9 (3) | 20.8 (2.2) | 19.9 (1.7) | |
| Some college | 789 | 25.0 (1.0) | 30.8 (1.7) | 28.2 (3.1) | 15.1 (2.3) | 23.1 (1.6) | |
| College degree + | 711 | 27.8 (1.7) | 17.3 (1.6) | 10.5 (1.8) | 10.4 (2.1) | 46.5 (2.8) | |
| Income ($/y, %) | | | | | | | |
| Missing | 543 | 18.4 (1.1) | 15.9 (1.5) | 15 (2.5) | 19.1 (2.6) | 20.9 (1.7) | < 0.0001 |
| < 10,000 | 353 | 10.3 (0.7) | 17.1 (1.5) | 10.2 (2.1) | 8.2 (1.7) | 5.8 (0.9) | |
| 10-29,999 | 851 | 26.5 (1.1) | 31.1 (1.7) | 32.3 (3.4) | 34.8 (3) | 18.6 (1.4) | |
| 30-49,999 | 562 | 18.3 (1.0) | 17.8 (1.6) | 20.6 (2.7) | 21.6 (2.3) | 17 (1.7) | |
| 50,000+ | 674 | 26.5 (1.4) | 18.2 (1.4) | 21.9 (2.8) | 16.3 (2.4) | 37.7 (2.4) | |
| Spouse/partner (% yes) | 1,288 | 50.1 (1.3) | 39.3 (1.8) | 48.5 (3.4) | 74.9 (2.7) | 50.3 (2.3) | < 0.0001 |
| Currently employed (% yes) | 1,789 | 61.1 (1.2) | 54.6 (2.1) | 60.3 (3.6) | 68.4 (2.7) | 63.7 (1.9) | 0.001 |
| 1+ children (% yes) | 2,027 | 65.1 (1.6) | 76.8 (1.5) | 64.9 (2.9) | 83.4 (2.2) | 49.9 (2.7) | < 0.0001 |
| Cumulative Stressor Score (%) | | | | | | | |
| 0 | 851 | 31.8 (1.2) | 24.4 (1.8) | 22.5 (2.6) | 32.1 (2.9) | 39.8 (1.9) | < 0.0001 |
| 1 | 847 | 27.9 (1.0) | 23.7 (1.5) | 23.5 (2.6) | 34.3 (3) | 30.1 (1.6) | |
| 2 | 542 | 17.6 (1.0) | 18.9 (1.5) | 20.3 (2.8) | 17.5 (2.3) | 16 (1.5) | |
| 3 | 375 | 11.8 (0.8) | 16.6 (1.4) | 20.4 (2.7) | 9.1 (1.5) | 6.7 (0.9) | |
| 4 | 213 | 6.6 (0.5) | 9.1 (1) | 7.7 (1.7) | 4.7 (1.4) | 5.2 (0.8) | |
| 5+ | 155 | 4.2 (0.4) | 7.2 (0.9) | 5.7 (1.3) | 2.2 (0.8) | 2.1 (0.5) | |

Table presents the unweighted n; means and percents are weighted to reflect the sample population. Race/ethnicity differences were calculated using chi-squared distributions (categorical variables) and analysis of variance (continuous variables). SE, standard error.

sleep durations ($\beta$ = -0.14 (P < 0.01), $\beta$ = -0.17 (P < 0.0001), and $\beta$ = -0.14 (P < 0.0001), respectively), whereas the associations for everyday and major experiences of discrimination attributed to factors other than race/ethnicity were not significant. Higher stressor scores for acute events, financial strain, community disadvantage, childhood adversity, and relationship stressors were associated with shorter sleep duration (P < 0.05), with beta coefficients ranging from -0.09 for childhood adversity to -0.20 for relationship stressors. These findings were largely unchanged after adjustment for SES, with the exception of employment stress, which became significantly associated with shorter sleep in the fully adjusted model ($\beta$ = -0.10, P < 0.05). Models 3 and 4 present associations for each stressor, adjusted for all other stressors considered. In a model that included all psychosocial stressors and SES (model 4), major experiences of discrimination attributed to race/ethnicity, relationship stressors, and financial strain maintained associations with shorter sleep (P < 0.05).

The bottom panel of Table 3 presents beta-coefficients and standard errors for associations of discrimination and other psychosocial stressors and (log) sleep difficulties, adjusted for age, race/ethnicity, sex, and any necessary covariates. All five measures of discrimination and all six other psychosocial stressors were associated with more sleep difficulties (P < 0.01), in models unadjusted (model 1) and adjusted for SES (model 2). Similar to models of sleep duration, relationship stress had the largest association ($\beta$ = 0.09, P < 0.0001). In a single model that included all stressors together and covariates for SES (model 4), racial/ethnic and nonracial/ethnic everyday discrimination, acute events, financial strain, community disadvantage, and relationship stressors remained significantly associated with sleep difficulties (P < 0.05).

Table 4 presents associations between cumulative stressor exposure and sleep duration and difficulties adjusted for demographic characteristics, including SES. The accumulation of high stressor exposure is modeled as total number stressor

**Table 2**—Mean stressor z-scores stratified by race/ethnicity, adjusted for age and sex

| | Black | US-born Hispanic | Foreign-born Hispanic | White | Difference by race/ethnicity |
|---|---|---|---|---|---|
| **Discrimination** | | | | | |
| Racial/ethic | | | | | |
| Everyday | 0.39 (0.03) | 0.10 (0.05) | -0.18 (0.04) | -0.32 (0.03) | < 0.0001 |
| Major experiences | 0.44 (0.03) | 0.04 (0.05) | -0.25 (0.04) | -0.28 (0.03) | < 0.0001 |
| Nonracial/ethnic | | | | | |
| Everyday | -0.04 (0.03) | 0.04 (0.05) | -0.49 (0.05) | 0.21 (0.03) | < 0.0001 |
| Major experiences | 0.14 (0.03) | 0.21 (0.05) | -0.31 (0.05) | -0.06 (0.03) | < 0.0001 |
| Workplace harassment and incivilities[a] | 0.03 (0.03) | 0.09 (0.05) | -0.38 (0.04) | -0.15 (0.02) | < 0.0001 |
| **Other stressors** | | | | | |
| Acute events | 0.21 (0.03) | 0.12 (0.05) | -0.41 (0.05) | -0.23 (0.03) | < 0.0001 |
| Financial strain | 0.11 (0.03) | -0.07 (0.05) | -0.17 (0.04) | -0.27 (0.03) | < 0.0001 |
| Community disadvantage | 0.24 (0.03) | -0.03 (0.05) | -0.32 (0.05) | -0.35 (0.03) | < 0.0001 |
| Employment stress[a] | 0.01 (0.02) | -0.02 (0.03) | 0.04 (0.03) | 0.01 (0.02) | 0.84 |
| Childhood adversity | -0.10 (0.03) | 0.16 (0.05) | 0.33 (0.05) | -0.13 (0.03) | < 0.0001 |
| Relationship stress[b] | 0.10 (0.03) | -0.02 (0.05) | -0.26 (0.04) | -0.27 (0.02) | < 0.0001 |

All values are are mean stressor z-scores with standered error in parentheses. Mean z-scores and standard errors were estimating using the least square mean function in regression models. Difference by race/ethnicity according to omnibus F-value from regression models. Weighted data to reflect sample population. [a]Adjusted for employment status. [b]Adjusted for cohabitation status and whether the respondent is a parent. SE, standard error.

scores in the top quintile of the sample distribution. Relative to individuals who were not in the top quintile for any of the stressor domains, individuals with two ($\beta$ = -0.37), three ($\beta$ = -0.58), and five or more ($\beta$ = -0.86) high stressors had significantly shorter sleep durations (P < 0.01). Sleep durations for individuals reporting one high stressor or four high stressors did not differ significantly from those who did not have any high stressors (P > 0.05). Considering (log) sleep difficulties, relative to individuals who had no high stressor domains, individuals with one ($\beta$ = 0.07), two ($\beta$ = 0.14), three ($\beta$ = 0.23), four ($\beta$ = 0.21), or five or more ($\beta$ = 0.43) high stressors had elevated sleep difficulties scores (P < 0.01).

Table 5 presents differences in sleep duration and difficulties by race/ethnicity, and examines the extent to which discrimination and other stressors may account for these differences. Blacks had significantly shorter sleep duration compared to whites (model 1), adjusted for age and sex; this difference persisted after adjustment for SES (model 2) and other demographic characteristics (model 3). This difference attenuated to nonsignificance after adjustment for racial/ethnic everyday and major experiences of discrimination, nonracial/ethnic everyday and major experiences discrimination, and work-place harassment and incivilities (model 4). The coefficient was reduced by 65%, changing from -0.23 in model 1 to -0.08 in model 4.

Considering sleep difficulties, in models adjusted for age and sex, blacks and US-born Hispanics had greater sleep problems relative to whites (model 1: $\beta$ = 0.07, P < 0.01 and $\beta$ = 0.13, P < 0.0001, respectively). After adjustment for SES (model 2), the difference in sleep difficulties for blacks compared to whites was attenuated to marginal significance ($\beta$ = 0.04, P < 0.10) whereas the difference for US-born Hispanics was attenuated by one third, yet remained significantly different from whites ($\beta$ = 0.09, P < 0.01). In the subsequent model that adjusted for other demographic characteristics (model 3), the difference in

sleep difficulties for US-born Hispanics compared to whites was sustained ($\beta$ = 0.08, P < 0.01). This difference was attenuated to marginal significance when discrimination was additionally included in the model (model 4; $\beta$ = 0.06, P < 0.10), and was no longer significant once all stressor variables were included (model 5, $\beta$ = 0.04, P = 0.14). *Post hoc* analyses (not shown) suggest that discrimination met criteria for a mediator for the association between African American racial status and sleep duration, and the association between US-born Hispanic status and sleep difficulties (i.e., (1) these racial/ethnic identities were associated with discrimination measures, (2) discrimination measures were associated with the sleep outcomes, and (3) associations between race/ethnicity and the sleep outcomes were attenuated when discrimination measures were included in the model [see model 4]).[64]

We performed a sensitivity analysis to investigate discrimination in relation to sleep duration as a categorical outcome (i.e., short, mid-range, and long sleep; see Appendix 1). In a fully adjusted multinomial logistic regression model that included demographics, SES, and other psychosocial stressors, relative to midrange sleep, none of the discrimination assessments were associated with greater odds of long sleep, and everyday discrimination attributed to race/ethnicity was associated with lower odds of long sleep (odds ratio = 0.73, 95% confidence interval: 0.54-0.99). None of the discrimination assessments were associated with greater odds of short sleep compared to midrange sleep, which provided evidence that treating sleep duration as a continuous variable was appropriate.

### DISCUSSION

Using data from a large probability survey that collected rich information on a range of discrimination experiences and other psychosocial stressors, we documented associations between discrimination and shorter sleep duration and greater

**Table 3**—Linear regression models predicting sleep duration (h) and sleep difficulties score

| Stressors (z-score) | Separate models for each stressor | | Single models with all stressors included | |
|---|---|---|---|---|
| | Model 1 Baseline covariates β (SE) | Model 2 Adjusted for SES[c] β (SE) | Model 3 Baseline covariates β (SE) | Model 4 Adjusted for SES β (SE) |
| **Outcome: sleep duration** | | | | |
| Discrimination | | | | |
| Racial/ethnic | | | | |
| Everyday | -0.14 (0.04)[e] | -0.14 (0.04)[e] | -0.08 (0.04)[g] | -0.07 (0.04)[g] |
| Major experiences | -0.17 (0.04)[f] | -0.17 (0.04)[f] | -0.10 (0.04)[d] | -0.09 (0.04)[d] |
| Nonracial/ethnic | | | | |
| Everyday | -0.07 (0.04)[g] | -0.08 (0.04)[d] | -0.05 (0.04) | -0.05 (0.04) |
| Major experiences | -0.03 (0.03) | -0.04 (0.03) | 0.05 (0.04) | 0.04 (0.04) |
| Workplace harassment and incivilities[a] | -0.14 (0.03)[f] | -0.14 (0.03)[e] | -0.05 (0.04) | -0.04 (0.04) |
| Other stressors | | | | |
| Acute events | -0.17 (0.04)[f] | -0.18 (0.04)[f] | -0.08 (0.04)[g] | -0.08 (0.04)[g] |
| Financial strain | -0.16 (0.04)[f] | -0.19 (0.04)[f] | -0.07 (0.04)[g] | -0.09 (0.04)[d] |
| Community disadvantage | -0.11 (0.03)[e] | -0.11 (0.03)[e] | -0.03 (0.03) | -0.03 (0.03) |
| Employment stress[a] | -0.09 (0.05)[g] | -0.10 (0.05)[d] | -0.01 (0.05) | -0.01 (0.05) |
| Childhood adversity | -0.09 (0.03)[e] | -0.10 (0.03)[e] | -0.01 (0.03) | -0.02 (0.03) |
| Relationship stress[b] | -0.20 (0.04)[f] | -0.20 (0.04)[f] | -0.12 (0.05)[e] | -0.12 (0.05)[e] |
| **Outcome: (log) sleep difficulties** | | | | |
| Discrimination | | | | |
| Racial/ethnic | | | | |
| Everyday | 0.03 (0.01)[e] | 0.04 (0.01)[f] | 0.02 (0.01)[d] | 0.03 (0.01)[d] |
| Major experiences | 0.03 (0.01)[e] | 0.04 (0.01)[e] | 0.01 (0.01) | 0.01 (0.01) |
| Nonracial/ethnic | | | | |
| Everyday | 0.05 (0.01)[f] | 0.05 (0.01)[f] | 0.02 (0.01)[d] | 0.03 (0.01)[e] |
| Major experiences | 0.04 (0.01)[f] | 0.04 (0.01)[e] | 0.01 (0.01) | 0.01 (0.01) |
| Workplace harassment and incivilities[a] | 0.04 (0.01)[e] | 0.04 (0.01)[e] | 0.00 (0.01) | 0.00 (0.01) |
| Other stressors | | | | |
| Acute events | 0.08 (0.01)[f] | 0.08 (0.01)[f] | 0.03 (0.01)[e] | 0.03 (0.01)[e] |
| Financial strain | 0.08 (0.01)[f] | 0.08 (0.01)[f] | 0.04 (0.01)[e] | 0.04 (0.01)[e] |
| Community disadvantage | 0.06 (0.01)[f] | 0.06 (0.01)[f] | 0.02 (0.01)[e] | 0.03 (0.01)[d] |
| Employment stress[a] | 0.05 (0.02)[e] | 0.05 (0.02)[e] | 0.02 (0.02) | 0.02 (0.02) |
| Childhood adversity | 0.04 (0.01)[f] | 0.04 (0.01)[e] | 0.01 (0.02) | 0.00 (0.01) |
| Relationship stress[b] | 0.09 (0.01)[f] | 0.09 (0.01)[f] | 0.06 (0.01)[f] | 0.06 (0.01)[f] |

Note sample cluster. [a]Adjusted for employment status. [b]Adjusted for cohabitation status and whether the respondent is a parent. [c]Adjusted for education (4 categories: < high school, high school, some college, college degree or more) and income (5 categories: < $10,000, $10,000-$30,000, $30,000-$50,000, $50,000+, missing). [d]P < 0.05. [e]P < 0.01. [f]P < 0.0001. [g]P < 0.10.

sleep difficulties. Specifically, racial/ethnic everyday and major experiences of discrimination, nonracial/ethnic everyday discrimination, and workplace harassment and incivilities were associated with shorter sleep duration in individual models, adjusted for SES. In addition, major experiences of discrimination attributed to race/ethnicity continued to be associated with shorter sleep duration, independent of SES and other psychosocial stressors. All five assessments of discrimination were associated with greater sleep difficulties in individual models adjusted for SES. Also, associations between racial/ethnic and nonracial/ethnic everyday discrimination and sleep difficulties were sustained after adjustment for other psychosocial stressors and SES. These findings indicate a unique contribution of discrimination to sleep duration and difficulties.

Our results also revealed that higher scores across psychosocial stress domain, as reflected by the cumulative stressor score, were associated with shorter sleep duration and greater sleep difficulties. These findings document the importance of jointly considering multiple psychosocial stressor domains for understanding population differences in sleep duration and difficulties. Our analyses also showed that the difference in sleep duration between black and white respondents was attenuated by 65% after adjustment for discrimination, and that the difference in sleep difficulties scores between US-born Hispanic and white respondents was attenuated by 25% after adjustment for discrimination. To our knowledge, this is the first study to document the contribution of discrimination to racial/ethnic differences in sleep duration or difficulties, and it suggests that

discrimination may be one mechanism for racial/ethnic differences in sleep in the United States

This study used a detailed assessment of discrimination, which allowed us to examine dimensions of discrimination related to chronicity and attribution. In the fully-adjusted model, only racial/ethnic-attributed major experiences of discrimination was associated with sleep duration. This was contrary to our hypothesis of similar associations regardless of attribution, which was informed by previous research that found that discrimination was linked to similar emotional responses among blacks and whites.[65] Based on previous research,[48] we had expected racial/ethnic and nonracial/ethnic everyday discrimination to be independently associated with sleep duration; however, associations between everyday discrimination and sleep duration were not sustained after adjustment for other psychosocial stressors. For sleep difficulties, everyday discrimination, regardless of attribution, was associated with more sleep problems, whereas major experiences of discrimination (racial/ethnic or nonracial/ethnic) were not. Based on previous research documenting associations for both everyday and major experiences of discrimination with health outcomes, we had expected to observe similar associations for everyday and major experiences of discrimination.[3-5] It may be the case that everyday discrimination has greater implications for sleep difficulties given that this measure reflects more common, fairly routines offences occurring in day-to-day life.

The racial/ethnic patterns of sleep duration and sleep difficulties in this study were largely consistent with prior studies that found shorter sleep among blacks compared to whites, and among US-born Hispanics compared to foreign-born Hispanics.[6,32] We observed a smaller black-white difference in sleep duration compared to previous studies,[26-28] which could be due to the urbanicity of our sample,[6] or differences in measurement (e.g., our measure only asked about sleep during the night rather than total hours usually slept during a 24-h day, or use of self-report rather than objectively assessed sleep). Our findings correspond with prior research that has documented associations between discrimination and sleep problems,[48-50] and other psychosocial stressors including financial strain,[27,38] relationship changes,[39] neighborhood disorder,[40,66] stressful life events,[41] psychosocial work characteristics,[42-44] and childhood SES[45] and abuse.[46,47]

Our results extend the current literature by examining multiple psychosocial stressors together, which enabled us to document associations between discrimination and sleep problems, independent of other potentially correlated psychosocial stressors. If replicated in longitudinal analyses, there may be clinical implications of these findings. For example, it may be possible to develop therapies that can help individuals to effectively cope with discrimination and other stressors and thus attenuate the risk presented by these exposures for sleep and related health outcomes. It will also be important to carry out prospective research that can carefully examine the temporal order between discrimination and other stressors, sleep, and chronic health problems. It is possible the chronic health problems mediate the association between stressors and sleep, or

**Table 4**—Adjusted associations between cumulative stressor score and sleep duration (h) and sleep difficulties score

| Cumulative Stressor Score (%) | Sleep duration β (SE) | (Log) Sleep difficulties score β (SE) |
|---|---|---|
| 0 (reference) | – | – |
| 1 | -0.15 (0.09)[c] | 0.07 (0.02)[a] |
| 2 | -0.37 (0.10)[a] | 0.14 (0.02)[b] |
| 3 | -0.58 (0.11)[b] | 0.23 (0.03)[b] |
| 4 | -0.19 (0.16) | 0.21 (0.04)[b] |
| 5+ | -0.86 (0.17)[b] | 0.43 (0.05)[b] |

Models adjusted for age, sex, race/ethnicity, income, education, spouse/partner, employment status, and whether the respondent has one or more children. Data are weighted and models account for sample cluster. [a]P < 0.01. [b]P < 0.0001. [c]P < 0.10. SE, standard error.

**Table 5**—Change in racial disparity in sleep duration and sleep difficulties after accounting for demographic variables, discrimination, and other stressors

| | Model 1 β (SE) | Model 2 β (SE) | Model 3 β (SE) | Model 4 β (SE) | Model 5 β (SE) |
|---|---|---|---|---|---|
| **Sleep duration (h)** | | | | | |
| Black | -0.23 (0.08)[a] | -0.28 (0.08)[a] | -0.23 (0.08)[a] | -0.08 (0.09) | -0.03 (0.09) |
| US-born Hispanic | -0.19 (0.11)[c] | -0.22 (0.11)[c] | -0.19 (0.11)[c] | -0.09 (0.11) | -0.07 (0.12) |
| Foreign Hispanic | -0.02 (0.10) | -0.05 (0.11) | 0.01 (0.11) | -0.03 (0.11) | -0.02 (0.11) |
| White | – | – | – | – | – |
| **(Log) Sleep difficulties dcore** | | | | | |
| Black | 0.07 (0.02)[a] | 0.04 (0.02)[c] | 0.03 (0.02) | -0.01 (0.02) | -0.04 (0.02) |
| US-born Hispanic | 0.13 (0.03)[b] | 0.09 (0.03)[a] | 0.08 (0.03)[a] | 0.06 (0.03)[c] | 0.04 (0.03) |
| Foreign Hispanic | 0.003 (0.03) | -0.05 (0.03) | -0.04 (0.03) | -0.01 (0.03) | -0.02 (0.03) |
| White | – | – | – | – | – |

Data are weighted and models account for sample cluster. Model 1: adjusted for age, and sex. Model 2: Model 1+ education, income. Model 3: Model 2+ employment status, cohabitation/marital status, and whether the respondent is a parent. Model 4: Model 3+ racial everyday and major experiences of discrimination, non-racial everyday and major experiences of discrimination, and workplace harassment and incivilities. Model 5: Model 4+ other stressor domains (acute events, finances, community disadvantage, employment stress, childhood adversities, and relationship stressors). [a]P < 0.01. [b]P < 0.0001. [c]P < 0.10. SE, standard error.

that chronic health problems result from poorer sleep outcomes that are associated with exposure to discrimination and other stressors; a deeper understanding of the temporal ordering of these associations will have implications for strategies to protect health.

Although this analysis provides novel information about the relationship between discrimination and sleep problems, there are limitations that are important to acknowledge. Notably, this study used self-reported assessments of sleep duration and sleep quality. Self-reported sleep duration was assessed using a single question, and we do not know how this estimate relates to physiological sleep duration. Validation studies suggest that individuals tend to overestimate the amount of sleep that they get.[26] In this sample, sleep duration and difficulties were correlated ($r$ = -0.29, P < 0.0001) which provides some construct validity for these assessments. In addition, numerous studies show that self-reported assessments of sleep duration and difficulty prospectively predict morbidity and mortality.[12,15,16,21] However, we acknowledge that our findings should be replicated using objectively assessed sleep outcomes, sleep measures taken over several nights (to arrive at more accurate assessment of sleep duration), and other domains such as sleep efficiency and wakefulness after sleep onset. In addition, this study is cross-sectional, which makes it impossible to establish the causal order. Another limitation is that some of the stressor scales had relatively low Cronbach alpha coefficients. Finally, our results may not generalize to nonurban areas, or cities other than Chicago, IL.

This study has a number of notable strengths, including data from a large probability sample representative of Chicago, IL. Of the existing studies on discrimination and sleep, this is the first to use a representative sample, and it is many times larger than previous studies on this topic. The sample also had a large number of African American and Hispanic respondents, with a substantial portion of Hispanic respondents born outside of the United States. This made it possible to consider US and foreign-born Hispanics separately, which revealed important differences. An additional methodological strength is that CCHAS included a detailed assessment of discrimination, and measures on a wide array of other stressors and sociodemographic characteristics. This enabled us to control for co-occurring stressors and demographic characteristics, which strengthened our ability to conclude that the observed relationships were not simply reflecting differences in other social experiences that were correlated with discrimination.

In conclusion, this study documented that discrimination is associated with shorter sleep duration and more sleep difficulties, independent of SES and other types of psychosocial stressors. Our findings provide support for notion that discrimination may partially account for some of the racial/ethnic differences in sleep duration and difficulties. Two important goals outlined in *Healthy People 2020* are to increase the proportion of adults in the United States who get sufficient sleep, and to reduce of racial/ethnic disparities in health.[67] Future studies are needed to develop interventions and social policies that address risk factors for poor sleep outcomes, and to directly evaluate whether suboptimal sleep functions as a mechanism that connects discrimination and other psychosocial stressors to racial/ethnic disparities in health.

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**Appendix 1**—Multinomial odds ratios (95% confidence interval) of short (≤ 6 h) and long (≥ 9 h) sleep duration relative to midrange sleep duration (6-8 h) for discrimination and other psychosocial stressors

| Stressors (z-score) | Stressors included in separate models | | | All stressors included in one model | | |
|---|---|---|---|---|---|---|
| | Mid-range | Short OR (95% CI) | Long OR (95% CI) | Mid-range | Short OR (95% CI) | Long OR (95% CI) |
| Discrimination | | | | | | |
| Racial | | | | | | |
| Everyday | 1.00 | 1.15 (1.05, 1.26)[b] | 0.73 (0.56, 0.95)[a] | 1.00 | 1.07 (0.95, 1.22) | 0.73 (0.54, 0.99)[a] |
| Major experiences | 1.00 | 1.16 (1.05, 1.29)[b] | 0.81 (0.65, 1.00)[d] | 1.00 | 1.06 (0.94, 1.19) | 0.89 (0.69, 1.14) |
| Nonracial | | | | | | |
| Everyday | 1.00 | 1.13 (1.03, 1.24)[a] | 1.06 (0.86, 1.29) | 1.00 | 1.06 (0.93, 1.19) | 0.92 (0.72, 1.18) |
| Major experiences | 1.00 | 1.13 (1.02, 1.24)[a] | 1.16 (0.99, 1.35)[d] | 1.00 | 1.00 (0.90, 1.12) | 1.16 (0.99, 1.36)[d] |
| Workplace harassment and incivilities | 1.00 | 1.23 (1.09, 1.38)[b] | 0.90 (0.69, 1.19) | 1.00 | 1.07 (0.93, 1.23) | 0.90 (0.64, 1.25) |
| Other Stressors | | | | | | |
| Acute events | 1.00 | 1.32 (1.20, 1.46)[c] | 1.13 (0.94, 1.36) | 1.00 | 1.17 (1.04, 1.31)[a] | 1.20 (0.97, 1.49)[d] |
| Financial strain | 1.00 | 1.29 (1.16, 1.44)[c] | 0.93 (0.74, 1.15) | 1.00 | 1.12 (0.99, 1.26)[d] | 0.89 (0.70, 1.14) |
| Community disadvantage | 1.00 | 1.11 (1.01, 1.22)[a] | 0.90 (0.75, 1.08) | 1.00 | 0.98 (0.88, 1.09) | 0.87 (0.72, 1.06) |
| Employment stress | 1.00 | 1.26 (1.08, 1.47)[b] | 1.09 (0.76, 1.56) | 1.00 | 1.13 (0.95, 1.35) | 1.19 (0.80, 1.77) |
| Childhood adversity | 1.00 | 1.14 (1.03, 1.25)[a] | 0.92 (0.76, 1.11) | 1.00 | 1.02 (0.91, 1.13) | 0.93 (0.76, 1.14) |
| Relationship stress | 1.00 | 1.30 (1.17, 1.46)[c] | 1.06 (0.82, 1.39) | 1.00 | 1.18 (1.04, 1.33)[b] | 1.13 (0.84, 1.52) |

Data are weighted and models account for sample cluster. All models are race/ethnicity, sex, age, education (4 categories: < high school, high school, some college, college degree or more), income (five categories: < $10,000, $10,000-$30,000, $30.000-$50,000, $50,000+, missing), employment status, cohabitation status, and whether the respondent is a parent. [a]P < 0.05. [b]P < 0.01. [c]P < 0.0001. [d]P < 0.10. CI, confidence interval.