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Chronic discrimination and bodily pain in a multi-ethnic cohort of midlife women in the Study of Women's Health Across the Nation

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Abstract

A growing literature links discrimination to key markers of biobehavioral health. While racial/ethnic differences in pain are seen in experimental and clinical studies, the authors were interested in how chronic discrimination contributes to pain within multiple racial/ethnic groups over time. Participants were 3,056 African American, Caucasian, Chinese, Hispanic and Japanese women from the Study of Women's Health Across the Nation (SWAN). The Everyday Discrimination Scale was assessed from baseline through thirteen follow-up exams. The bodily pain subscale of the SF-36 was assessed annually. There were large racial/ethnic differences in reports of discrimination and pain. Discrimination attributions also varied by race/ethnicity. In linear mixed model analyses, initially adjusted for age, education, and pain medications, chronic everyday discrimination was associated with more bodily pain in all ethnic groups (beta= −5.84, p<.002 for Japanese; beta = −6.17, p<.001 for African American; beta = −8.74, p<.001 for Chinese; beta= −10.54 for Caucasians, p<.001; beta = −12.82, p<.001 for Hispanic). Associations remained significant in all ethnic groups after adjusting for additional covariates in subsequent models until adding depressive symptoms as covariate; in the final fully-adjusted models, discrimination remained a significant predictor of pain for African American (beta = −4.50, p<.001), Chinese (beta= −6.62, p<.001); and Caucasian (beta = −7.86 p<.001) women. In this longitudinal study, experiences of everyday discrimination were strongly linked to reports of bodily pain for the vast

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CONFLICT OF INTEREST

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majority of women. Further research is needed to determine if addressing psychosocial stressors, such as discrimination, with patients can enhance clinical management of pain symptoms.

Keywords

Chronic Discrimination; Bodily Pain; Depressive Symptoms; Midlife Women

INTRODUCTION

Self-reported exposure to discrimination is a psychosocial stressor that impacts health and likely contributes to health disparities [30,48]. Published research has focused on the impact of discrimination on all-cause and cardiovascular disease (CVD) mortality [1,16]; health outcomes such as hypertension [27,41], breast cancer [44]; adverse cardiometabolic measures like higher c-reactive protein levels [29] and increased visceral fat [31]; and poor health behaviors including smoking [28]. Numerous studies have documented associations between discrimination and depressive symptoms [2,41] and depressive symptoms have been linked to pain in prior research in the SWAN cohort [5]. Although early research focused primarily on African Americans, recent studies have found associations between reports of discrimination and various health outcomes in Asian-Americans [18,21] and Latinos [34].

Researchers have begun to explore the unique role of exposure to discrimination as a contributor to pain severity across various racial/ethnic groups. In a cross-sectional study of older African American male military veterans, perceived racial discrimination was associated with greater bodily pain rating [7]. In the Midlife in the United States (MIDUS) study, major lifetime discriminatory events and perceived day to day discrimination were most strongly associated with low back pain in cross sectional analyses among African American men and women, respectively, but not in Caucasians [13]. These findings suggest that exposure to discrimination may be a particularly strong contributor to pain for African Americans; however whether other racial/ethnic minority groups are equally impacted by discrimination has yet to be fully elucidated.

Further, the association between increased reports of physical pain in African Americans and Latinos is well-documented, both in experimental settings [14,38] and clinical settings [11,40] which may be partially attributable to the higher rates of discrimination reported by members of ethnic minority groups [45,49]. It is important to recognize and address possible contributors to pain as chronic pain has been linked to increased cardiovascular risk, including an analysis using the same study population used in the present analysis [8].

Our goal with this work was to use longitudinal data to better understand the relationship between discrimination and pain in midlife women in a multi-ethnic cohort from the Study of Women's Health Across the Nation (SWAN) [43]. We hypothesized that higher self-reported chronic experiences of everyday discrimination would be associated with worse pain ratings. With both discrimination and pain measures obtained over more than a decade, the longitudinal nature of this community-based cohort study can capture the experience of prolonged exposure to everyday discrimination, which is impossible to assess in cross

sectional analyses. Because some (but not all) studies have found that the effects of discrimination on stress and health are stronger for racial/ethnic minority groups than for Caucasians [9], we examined associations within racial/ethnic groups. We examined the role of covariates, most notably depressive symptoms, as potential confounders of any significant associations.

METHODS

Participants

Participants for the current analysis included the cohort from all seven-sites of SWAN, a community-based, longitudinal study of the menopausal transition. The baseline examination, conducted between 1995 and 1997, recruited over 3,000 women from five racial/ethnic groups including Caucasian, African American, Japanese, Chinese and Hispanic. Each site had approximately fifty percent Caucasian and fifty percent non-Caucasian enrollment, with one non-Caucasian racial/ethnic group per site except for African Americans enrolled in 4 sites while Chinese, Hispanic and Japanese women were each enrolled at only one site. Women aged 42–52 years of age with an intact uterus and at least one ovary were invited to participate in SWAN as long as they had menstruated in the previous three months, were not currently pregnant or breast feeding, and had not used reproductive hormone preparations affecting ovarian or pituitary function in the past three months. Several population-sampling techniques were used and IRB approval was obtained by all sites, as previously described [43]. At study entry and annually thereafter women at all sites completed a standard assessment that included self-administered and interviewer-administered questionnaires assessing social, economic, behavioral, psychological, health and lifestyle characteristics. Interviews and questionnaires were available in English, Spanish, Cantonese, and Japanese. All women provided written informed consent.

Study Variables

Data for the current study were obtained from questionnaires administered at baseline and approximately annually for 13 visits. Data on everyday discrimination were collected at baseline and follow-up years 1, 2, 3, 7, and 10. Covariates including site, ethnicity, and education were collected at baseline. Pain symptoms along with covariates depressive symptoms, age, menopausal status, hormone therapy use, body mass index (BMI), very stressful life events, pain medication use, and smoking status were collected for each follow-up visit.

Everyday Discrimination

Respondents were asked to indicate how frequently they experienced each of 10 types of discrimination on a day-to-day basis over the past 12 months using a modified version of the Detroit Area Study Everyday Discrimination scale [50] which assessed everyday occurrences of unfair treatment. Sample questions included: being treated with less courtesy or respect than others; receiving poorer service than others at restaurants or stores; being called names, insulted, threatened, or harassed; having people act afraid of the respondent; and having people act as if the respondent was dishonest, not smart, or not as good as they were. For each of the 10 items, respondents noted the frequency of occurrence using a 1–4

descriptor scale (1 = “never” to 4 = “often”) resulting in a final average score of 1 to 4. Internal reliability for the Everyday Discrimination Scale in this multi-ethnic cohort was good at 0.81 to 0.82 at all six time points. Chronic discrimination was constructed by averaging all the perceived discrimination measures [32] reported up to and including the visit with the bodily pain assessment. The Everyday Discrimination scale has been widely used across samples with African-American, Latino and Asian participants [2,6,19,33,39], and prior analysis of this cohort and others has shown that it is valid for use across racial/ethnic groups [25,33], and taking into account chronic exposures [32]. Attributions for experiences of discrimination were also assessed. At baseline SWAN women who answered “sometimes” or “often” to any item on the Everyday Discrimination scale were also asked to indicate the “main reason” for their experiences. At follow-up year one (and subsequent years), women who answered “sometimes” or “often” were asked whether “any of the following” were reasons for their experiences and respondants could choose more than one attribution from a list including race, gender, and language among others.

SF-36 Bodily Pain

Pain was assessed with the bodily pain subscale from the MOS 36-Item Short-Form Health Survey (SF-36) [46]. This subscale combines responses from two questions including: (1) how much bodily pain a person has had during the past 4 weeks (none, very mild, mild, moderate, severe, or very severe); and (2) how much her pain interfered with normal work including work outside the home and housework during the past 4 weeks (not at all, slightly, moderately, quite a bit, or extremely). For the purpose of this analysis, we used the combined SF-36 bodily pain subscale, which transforms the individual scores to a scale with a range from 1–100 with higher scores indicating less pain or better functionality [47].

Covariates

Potential cofounding variables that might be related to both pain and perceived discrimination were chosen as covariates. Age was measured in years. Site reflected the location for the respondents including Boston, Massachusetts; Detroit, Michigan; Los Angeles, California; Newark, New Jersey; Oakland, California; Pittsburgh, Pennsylvania; and Chicago, Illinois (referent category). Race/ethnicity was self-reported as African American, Chinese, Hispanic, Japanese or Caucasian (referent category). Respondents reported 1 of 5 educational levels, from achieving less than a high school diploma, high school diploma, some college, college diploma, through post-graduate education (referent category). SWAN uses bleeding patterns to categorize menopausal status: premenopausal (no bleeding irregularity in past 3 months), early perimenopausal (less predictable menses in last 3 months), late perimenopausal (no menstrual bleeding for at least 3 months but no more than 12 months), post-menopausal (no menstrual bleeding for at least 12 months), surgical menopausal (bilateral oophorectomy or hysterectomy), and undetermined (use of hormone therapy or hysterectomy without bilateral oophorectomy prior to 12 months of amenorrhea). Premenopausal was the referent category. Cigarette smoking status was based on current use. Body mass index was calculated as weight in kilograms divided by height in meters squared. The number of very upsetting life events was categorized as 0, 1, or 2 or more events. The number of opioids and over-the-counter medications for pain (including headaches and arthritis) taken at least two times per week in the past month was categorized

as 0, 1, or 2 medications. Depressive symptoms were measured with the 20-item Center for Epidemiologic Study Depression (CES-D) scale, which assesses the frequency of being bothered by depressive symptoms in the past week on a scale from 0 (rarely) to 3 (most or all of the time) [37]. Responses to the 20 items are summed for a total score ranging from 0–60. CES-D scores of 16 or higher indicate high depressive symptoms with clinical implications [35]. A total of 246 women (7%) were excluded from our analysis; six participants had incomplete discrimination questions at baseline, and 240 were excluded because they had fewer than two valid pain assessments at visits without a report of recently broken bones.

Statistics

All analyses were done in SAS 9.3 (SAS Institute Inc., Cary NC). We calculated univariate descriptive statistics and frequencies for the independent and dependent variables of interest in the longitudinal cohort from all SWAN sites. Neither outliers nor violations from normality were detected. We assessed baseline differences across ethnicities by analysis of variance for continous variables and logistic regression (binomial respectively multinomial depending on number of categories) for categorical variables. Our main outcome was the bodily pain subscale of the SF-36 with scores ranging from 0 to 100. Our main predictor was the chronic discrimination measure [32] reported up to and including the visit with the bodily pain assessment. We used a series of mixed effects regression models with a random intercept to account for varying initial levels of pain; a random slope for the effect of time (in years since study baseline) on pain accommodated varying rates of change in pain across participants over the thirteen-year follow-up. Because of the large race/ethnic differences in reports of discrimination as well as pain, we included an interaction term of race/ethnicity and discrimination in the series of models. We also present race/ethnic-specific models.

Potentially cofounding variables that might be related to both pain and perceived discrimination were chosen for inclusion within the analytic model in a stepwise order. In Model 1 we adjusted for baseline age and education, and use of pain medications, which was modeled as a time-varying covariate. We made further adjustments in models 2, 3, and 4 for time-varying covariates including menoapusal status and hormone therapy (HT) use (Model 2), then adding BMI, smoking, and upsetting life events (Model 3), and finally adding CES-D (Model 4). Goodness of fit was assessed with the Bayes Information Criterion [24]. Models used an unstructured covariance [22], which provided the best fit to the data. In addition to overall discrimination, we also analyzed discrimination attributed to race, gender, and language in separate models. Several sensitivity analyses were conducted. Since attributions were collected differently at baseline than at follow-up visits, analyses were repeated without the baseline visit.

RESULTS

Participants were 3,056 women, approximately half of whom were Caucasian, in keeping with the study design. Table 1 shows the characteristics of the cohort at baseline. Participants were approximately 46.4 years of age (SD=2.7), and highly educated, with 50.3% of the sample reporting a college degree or higher. At baseline, with higher scores

indicating less pain, the average pain score was 69.4 (SD=22.3); Japanese women reported the least pain (mean SF-36 score=75.4 ± 22.3) and Hispanic women reported the most pain (mean SF-36 score=54.4 ± 25.8). Everyday discrimination scores were 1.7 ± 0.5 overall, lowest in Hispanics (1.2 ± 0.4), and highest in African Americans (1.9 ± 0.5). High depressive symptoms were reported by 27.2% of participants. The average BMI was in the overweight range (27.7 ± 6.5), and 33.8% of women reported taking one or more medications for pain. Average follow-up time was 12.8 ± 4.7 years, and varied for all ethnic groups. Chinese (14.2 ± 3.7 years) and Japanese (14.2 ± 3.3 years) women had the longest follow-up time; Hispanic women had the lowest average follow-up time (10.0 ± 6.2 years). Women of all racial/ethnic groups were comparable in age at baseline but differed significantly on all other variables (Table 1).

Table 2 presents results of linear mixed models including an interaction term of race/ethnicity and discrimination with Caucasians as the reference group, showing a strong negative impact of discrimination on pain. Estimates were weakened after inclusion of covariates but remained highly significant in all models. The relation of chronic discrimination with pain reports was stronger in Caucasian women than African American women in all models with statistical significance in all models. To examine the question whether discrimination affected some racial/ethnic groups more than others, we reran the models in Table 2 with different race/ethnic groups as reference group. The relation of discrimination with pain reports was stronger in Hispanic women than African American women in all models and than Japanese in all models.

Tables 3a–e present the results of the race/ethnicity specific linear mixed models, showing a strong negative impact of discrimination on pain in all ethnic groups including Caucasians in Models 1. Estimates were little changed and remained significant after additional adjustments in Models 2 and 3 including menopausal status and then factors related to lifestyle. Further adjusting for depressive symptoms (Model 4) reduced estimates by up to 30%, with the estimates most attenuated for Hispanic and Japanese women (beta = −6.63, p=0.06 for Hispanic; beta= −3.48, p=0.60 for Japanese); the association remained significant for Caucasians (beta = −7.86, p<.001), Chinese (beta = −6.62, p<.001), and African Americans (beta = −4.50, p<.001).

We examined the attribution frequencies to the query at baseline SWAN about “the main reason ” for experiences of discrimination. Race/ethnicity was the most frequent attribution across all racial/ethnic minority groups, reported on average by 31.9% of the entire cohort, ranging from 60.4% of African American to 32.3% of Japanese participants. However, only 6% of Caucasion subjects reported race/ethnicity as the main reason. Caucasians reported gender as the main reason for discrimination most commonly at 22.7%, compared to African American and Chinese women at just under 5%. In follow-up year one (and subsequent years), when the SWAN attribution query changed to “any… reasons” and respondents could make more than one attribution, an average of 50% of respondents attributed discrimination to race/ethnicity, ranging from 77% of African Americans to 16% of Caucasians. In the multiple attribution analysis, over half of the sample reported gender as a reason for discrimination, with African Americans highest at 53.7% and Hispanics lowest at 32%. For Chinese and Hispanic participants, language was the second highest attributon at 45% and

40%, respectively. In post hoc analyses, we reran the models using race-specific, gender-specific, and language-specific discrimination scores; the results were similar to the analyses presented in Table 2 showing a statistically significant negative impact on bodily pain, whether we included data from the baseline visit or not.

DISCUSSION

This study showed that reports of chronic everyday discrimination were associated with higher pain ratings over a thirteen year follow up, in community-dwelling midlife women. This suggests a possible relationship between the social pain of discrimination and reports of bodily pain. Basic science research suggests that social pain relies on some of the same neural regions that process physical pain, highlighting a possible physical-social pain overlap [15]. Pain management providers should take this possible relationship into consideration when evaluating and treating pain patients as it is currently not customary to query patients about discrimination when considering psychosocial stressors.

Although recent attention has been drawn to the untoward health effects of discrimination, in particular in racial/ethnic minorities, we were interested in the impact of discrimination on pain, utilizing longitudinal data to capture chronic discrimination exposure. Notably, at baseline, Hispanics had the highest pain ratings and African Americans had the highest everyday discrimination scores. Given the differences in pain and discrimination scores, we assumed that the effects of discrimination on pain would also differ by racial/ethnic groups. We were able to use a series of mixed effects regression models, including an interaction term of race/ethnicity and discrimination, to examine the impact of discrimination on pain in five racial/ethnic groups. We found association that were significant in all models. In the race/ethnicity specific models, the magnitude of the associations did vary across racial/ethnic groups, and for each of the five groups in the successive models including multiple covariates in a stepwise order. This may be related, in part, to differences at baseline; racial/ethnic groups differed significantly on all demographic variables except age. Thus it is possible that there were unique within-group effects that we were unable to account for in the analysis of the full cohort. For example, the final model adjusted for depressive symptoms was no longer significant in the Hispanic and Japanese women. This suggests that depressive symptoms may be the most important pathway through which experiences of discrimination impact pain in Hispanic and Japanese women; however pathways for women from other racial/ethnic backgrounds may be different. Consistent with epidemiologic data and prior studies, there were significant racial/ethnic differences in BMI, which was a particularly robust predictor of pain outcomes. Although the literature on discrimination and BMI has been mixed [10,22,31], it is possible that there were some discrimination by BMI interactions on pain for certain subgroups.

Additionally, it is possible that the significant relationship between everyday discrimination and longitudinal pain ratings seen in Caucasian and minority women alike may refect gender bias as well as racial/ethnic bias. Sex differences in regards to pain have been attributed to multiple biological and psychosocial processes [3] but the impact of everyday discrimination on pain has not been addressed by gender. Exploring the role of discrimination experienced as gender bias as a risk factor for pain may be an important area for future research. Similar

to our findings, a recent review addressing attributions for discrimination showed mixed findings across racial/ethnic groups, gender and other factors [30]. The authors concluded that the experience of mistreatment might be more important for health outcomes than the reason for the mistreatment and recommended additional research related to attributions. Future research could include qualitative research to better understand discriminatory themes shared by midlife women.

Since SWAN participants are community dwelling midlife women traversing the menopause, our findings are most applicable to pain experiences for midlife women in the general population, adding to the laboratory and clinical pain studies findings in the literature. Rather than thinking of pain only as a symptom of underlying disease, it is important to consider pain as a marker of social rejection and a precursor of other chronic illnesses. Along with discrimination, pain is receiving attention as a factor that could have health consequences, in particular related to depression [5] and cardiovascular risk [8]. Mental health providers should consider that chronic exposure to discrimination, in particular racism, has been implicated in mental health outcomes [19,23,36]. Alterations in the hypothalamic-pituitary-adrenal (HPA) axis related to chronic racism may not only have negative mental health affects but also damage bodily systems and lead to undesirable physical outcomes such as obesity and CVD [4]. Greater cardiovascular risk is detrimental in all groups, particularly in minority groups already at higher risk of CVD [26,51]

Limitations

The SWAN study only included one measure of discriminatory experiences, thus we may not have captured all of the relevant social pain relating to discrimination that women may experience. It is likely that discriminatory experiences vary significantly between different cultures and these variations have implications for the results. Measuring discrimination comprehensively will require researchers to capture multiple domains of discrimination including chronic, acute, and traumatic, as well as personal, vicarious and anticipatory [30]. The change in attribution question for the discrimination survey from baseline to follow-up SWAN visits did not impact our main finding but limits longitudinal comparisons, at least regarding attributions. There may have been a differential attrition of women in SWAN who, for instance, had more pain and could not attend follow-up visits. There may also be reporting biases. SWAN does not have a comprehensive, clinically relevant measure of pain. This may limit direct application to clinical populations but our findings are in keeping with previous findings in patient populations. These results should not be generalized beyond midlife women living in the United States. Despite these limitations, the multi-ethnic, longitudinal nature of SWAN provides excellent data for this analysis.

CONCLUSION

We found that self-reported experiences of everyday discrimination are associated with higher pain ratings in a multi-ethnic sample of midlife women. This extends previous basic science and clinical studies adding a longitudinal analysis taking into consideration chronic exposure to discrimination. Future work is needed related to the construct of discimination and its signficance in different domains such as race/ethnicity/cultural identity, gender and

others, as attributions for the discrimination varied across racial/ethnic groups. The experience of chronic discrimination is another unique psychosocial variable that should be considered in healthcare, including prevention and treatment, from primary care clinics to specialty care for pain and mental health disorders.

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Table 1

Characteristics of the Cohort at Baseline Overall and by Race/Ethnicity

	Total (N=3056)		Hispanic (N=229)		Chinese (N=242)		Japanese (N=275)		African American (N=860)		Caucasian (N=1450)		p-value**
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	
Age, years	46.4	2.7	46.3	2.8	46.5	2.6	46.7	2.7	46.3	2.7	46.3	2.7	0.222
BMI (kg/m^2)	28.2	7.3	29.3	6.2	23.3	3.9	22.9	3.7	31.8	7.8	27.8	6.9	<.001
SF-36 Bodily Pain Score (0–100)	69.4	22.3	54.4	25.8	74.4	23.0	75.4	20.1	67.2	23.5	71.1	20.0	<.001
Everyday Discrimination	1.7	0.5	1.2	0.4	1.8	0.5	1.6	0.5	1.9	0.5	1.6	0.4	<.001
	N	%	N	%	N	%	N	%	N	%	N	%	
Number of pain medications													
2	32	1.0	1	0.4	0	0	0	0	17	2.0	14	1.0	<.001
1	868	28.4	80	34.9	39	16.1	43	15.6	252	29.3	454	31.3	
0	2156	70.5	148	64.6	203	83.9	232	84.4	591	68.7	982	67.7	
Education													
≤ high school	727	23.8	160	69.9	69	28.5	48	17.5	225	26.2	225	15.5	<.001
some college	993	32.5	47	20.5	51	21.1	95	34.6	351	40.8	449	31.0	
college	628	20.5	17	7.4	70	28.9	85	30.9	138	16	318	21.9	
graduate school	708	23.2	5	2.2	52	21.5	47	17.1	147	17	458	31.6	
Pre-menopausal*	1608	52.6	122	53.3	148	61.2	170	61.8	422	49.3	746	51.7	<.001
Smoking	497	16.3	33	14.4	3	1.2	35	12.7	205	23.8	221	15.2	<.001
CES-D=16+	722	23.6	100	43.9	33	13.6	40	14.5	226	26.3	323	22.3	<.001
No. of Upsetting Life													
≥2	880	28.9	53	23.1	25	10.3	52	18.9	292	34.3	458	31.6	<.001
1	623	20.5	53	23.1	41	16.9	45	16.4	180	21.2	304	21.0	
0	1542	50.6	123	53.7	176	72.7	178	64.7	379	44.5	686	47.4	

*At baseline, participants were either pre- or peri-menopausal

**p-value from ANOVA for continuous variables, from chi-square tests for categorical variables

Table 2

Relationship of Chronic Everyday Discrimination and Bodily Pain: Total (N=3056)

	Model 1			Model 2			Model 3			Model 4		
	β-Estimate	**SE**	**P-value**	**β-Estimate**	**SE**	**P-value**	**β-Estimate**	**SE**	**P-value**	**β-Estimate**	**SE**	**P-value**
Intercept	**79.36**	**1.80**	**<.001**	**79.45**	**1.80**	**<.001**	**77.54**	**1.79**	**<.001**	**76.26**	**1.76**	**<.001**
Time, 10 yrs	**−1.59**	**0.26**	**<.001**	**−1.44**	**0.38**	**<.001**	**−0.87**	**0.39**	**0.028**	**−1.05**	**0.39**	**0.007**
Discrimination *	**−10.39**	**0.93**	**<.001**	**−10.42**	**0.93**	**<.001**	**−8.59**	**0.91**	**<.001**	**−7.48**	**0.89**	**<.001**
Race/Ethnicity												
Black	**−9.20**	**2.42**	**<.001**	**−9.30**	**2.42**	**<.001**	**−6.20**	**2.36**	**0.009**	**−5.84**	**2.31**	**0.012**
Hispanic	−5.73	3.87	0.139	−5.88	3.88	0.130	−6.36	3.83	0.097	−5.27	3.77	0.163
Chinese	1.62	3.99	0.684	1.52	3.98	0.703	−0.37	3.86	0.924	−0.55	3.78	0.883
Japanese	−4.11	3.54	0.246	−4.35	3.54	0.219	**−7.63**	**3.43**	**0.026**	−6.92	3.35	0.039
Caucasian	Reference			Reference			Reference			Reference		
Race/Ethnicity * Discrimination												
Black	**4.26**	**1.34**	**0.002**	**4.31**	**1.34**	**0.001**	**3.50**	**1.31**	**0.008**	**3.18**	**1.29**	**0.013**
Hispanic	−3.71	2.95	0.209	−3.65	2.96	0.217	−3.12	2.93	0.287	−3.00	2.88	0.298
Chinese	1.30	2.23	0.561	1.34	2.23	0.549	0.23	2.16	0.917	0.20	2.12	0.927
Japanese	3.99	2.21	0.071	4.11	2.21	0.063	**4.24**	**2.14**	**0.048**	3.81	2.09	0.069
Caucasian	Reference			Reference			Reference			Reference		
Baseline age, yrs **	**−2.37**	**1.04**	**0.022**	**−2.27**	**1.04**	**0.030**	**−2.22**	**1.00**	**0.027**	**−2.38**	**0.97**	**0.015**
Education												
≤ high school	**−6.21**	**0.86**	**<.001**	**−6.18**	**0.86**	**<.001**	**−4.80**	**0.83**	**<.001**	**−4.22**	**0.81**	**<.001**
Some College	**−4.30**	**0.76**	**<.001**	**−4.26**	**0.76**	**<.001**	**−3.28**	**0.73**	**<.001**	**−2.95**	**0.71**	**<.001**
College	−1.29	0.85	0.129	−1.26	0.84	0.136	−0.90	0.81	0.262	−0.71	0.78	0.367
Graduate school	Reference			Reference			Reference			Reference		
Number of pain medications												
2	**13.87**	**0.83**	**<.001**	**13.88**	**0.83**	**<.001**	**13.59**	**0.87**	**<.001**	**13.60**	**0.87**	**<.001**
1	**8.46**	**0.83**	**<.001**	**8.43**	**0.83**	**<.001**	**8.14**	**0.87**	**<.001**	**8.17**	**0.86**	**<.001**
0	Reference			Reference			Reference			Reference		
Postmenopausal				−0.23	0.37	0.541	−0.25	0.39	0.517	−0.27	0.39	0.490

	Model 1			Model 2			Model 3			Model 4		
	β-Estimate	**SE**	**P-value**	**β-Estimate**	**SE**	**P-value**	**β-Estimate**	**SE**	**P-value**	**β-Estimate**	**SE**	**P-value**
HT use				−0.47	0.41	0.246	−0.26	0.42	0.539	−0.31	0.42	0.450
BMI, kg/m^2 *							**−3.94**	**0.25**	**<.001**	**−3.94**	**0.25**	**<.001**
Smoker							**−1.93**	**0.58**	**0.001**	**−1.79**	**0.57**	**0.002**
No. of Upsetting Life Events												
≥2							**−2.96**	**0.31**	**<.001**	**−2.28**	**0.31**	**<.001**
1							**−1.10**	**0.30**	**<.001**	**−0.80**	**0.30**	**0.009**
0							Reference			Reference		
CES-D=16+										**−5.22**	**0.36**	**<.001**

Models adjusted for: (1) race/ethnicity, baseline age, education, number of pain medications; (2) all variables in Model (1) plus post-menopausal status and HT use; (3) all variables in Model (2) plus BMI, smoking status, number of upsetting life events; (4) all variables in Model (3) plus CES-D. Menopausal status, hormone therapy use, BMI, smoking, life events, and CES-D in models 2, 3, 4 are all time varying. Significant associations are bolded.

*Average discrimination up to and including the pain visit;

**Centered

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Table 3a

Relationship of Chronic Everyday Discrimination and Bodily Pain: Hispanic (N=229)

	Model 1			Model 2			Model 3			Model 4		
Effect	**β-Estimate**	**SE**	**P-value**	**β-Estimate**	**SE**	**P-value**	**β-Estimate**	**SE**	**P-value**	**β-Estimate**	**SE**	**P-value**
Intercept	**82.32**	**12.01**	**<.001**	**81.01**	**12.15**	**<.001**	**86.97**	**12.79**	**<.001**	**82.51**	**12.28**	**<.001**
Time, 10 yrs	**−2.78**	**1.37**	**0.043**	−2.39	2.16	0.269	1.18	2.28	0.603	−0.50	2.25	0.825
Chronic Discrimination *	**−12.82**	**3.42**	**<.001**	**−12.94**	**3.42**	**<.001**	**−9.11**	**3.48**	**0.009**	−6.24	3.32	0.060
Baseline Age, yrs **	−1.46	4.39	0.740	−1.43	4.42	0.747	−0.83	4.45	0.852	−1.56	4.12	0.705
Education												
≤ high school	−5.64	8.13	0.488	−4.20	8.29	0.613	−0.80	8.38	0.924	1.38	7.79	0.860
Some college	−3.01	8.43	0.721	−1.70	8.58	0.843	0.94	8.65	0.914	2.51	8.04	0.755
College	3.40	9.16	0.711	5.20	9.30	0.577	9.53	9.37	0.310	9.17	8.69	0.292
Graduate School	Reference			Reference			Reference			Reference		
Number of pain medications												
2	2.51	7.94	0.752	2.41	7.96	0.762	−9.45	8.82	0.284	−6.20	8.72	0.478
1	−1.22	7.98	0.879	−1.33	8.01	0.868	−12.10	8.84	0.171	−8.79	8.75	0.315
0												
Post-menopausal												
Yes				−0.66	2.51	0.792	−2.06	2.62	0.430	−1.50	2.58	0.560
No				Reference			Reference			Reference		
HT use												
Yes				6.12	4.07	0.133	**8.68**	**4.42**	**0.050**	7.37	4.36	0.092
No				Reference			Reference			Reference		
BMI, kg/m^2 **							**−3.76**	**1.28**	**0.003**	**−3.32**	**1.20**	**0.006**
Smoker												
Yes							**−6.07**	**2.66**	**0.023**	**−5.89**	**2.56**	**0.022**
No							Reference			Reference		
No. of Upsetting Life Events												
≥2							**−8.72**	**2.02**	**<.001**	**−6.63**	**2.02**	**0.001**
1							−2.60	1.95	0.182	−1.21	1.94	0.534
0							Reference			Reference		

	Model 1			Model 2			Model 3			Model 4		
Effect	**β-Estimate**	**SE**	**P-value**	**β-Estimate**	**SE**	**P-value**	**β-Estimate**	**SE**	**P-value**	**β-Estimate**	**SE**	**P-value**
CES-D												
16+										**−11.77**	**1.74**	**<.001**
<16										Reference		

Models adjusted for: (1) baseline age, education, number of pain medications; (2) all variables in Model (1) plus post-menopausal status and HT use; (3) all variables in Model (2) plus BMI, smoking status, number of upsetting life events; (4) all variables in Model (3) plus CES-D. Menopausal status, hormone therapy use, BMI, smoking, life events, and CES-D in models 2, 3, 4 are all time varying. Significant associations are bolded.

*Average discrimination up to and including the pain visit;

**Centered

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Table 3b

Relationship of Chronic Everyday Discrimination and Bodily Pain: Chinese (N=242)

	Model 1			Model 2			Model 3			Model 4		
Effect	**β-Estimate**	**SE**	**P-value**	**β-Estimate**	**SE**	**P-value**	**β-Estimate**	**SE**	**P-value**	**β-Estimate**	**SE**	**P-value**
Intercept	**64.12**	**7.34**	**<.001**	**64.72**	**7.34**	**<.001**	**61.37**	**7.42**	**<.001**	**58.65**	**7.37**	**<.001**
Time, 10 yrs	−0.25	0.91	0.786	−0.40	1.27	0.752	−0.20	1.29	0.877	−0.51	1.28	0.688
Chronic Discrimination *	**−8.74**	**1.95**	**<.001**	**−8.79**	**1.95**	**<.001**	**−8.02**	**1.94**	**<.001**	**−6.62**	**1.92**	**<.001**
Baseline Age, yrs **	−4.38	3.51	0.213	−4.36	3.53	0.218	−3.54	3.50	0.313	−3.77	3.39	0.268
Education												
≤ high school	−3.62	2.57	0.161	−3.64	2.56	0.157	−3.83	2.53	0.132	−3.18	2.45	0.196
Some college	−2.05	2.75	0.457	−2.05	2.74	0.454	−0.98	2.73	0.719	−0.65	2.64	0.807
College	0.89	2.56	0.730	0.83	2.55	0.744	1.40	2.51	0.578	1.32	2.43	0.588
Graduate School	Reference			Reference			Reference			Reference		
Number of pain medications												
2	**28.53**	**6.17**	**<.001**	**28.26**	**6.18**	**<.001**	**28.63**	**6.18**	**<.001**	**29.41**	**6.17**	**<.001**
1	**17.99**	**6.20**	**0.004**	**17.85**	**6.20**	**0.004**	**18.45**	**6.20**	**0.003**	**19.05**	**6.19**	**0.002**
0	Reference			Reference			Reference			Reference		
Post-menopausal												
Yes				0.18	1.23	0.884	0.32	1.28	0.801	0.59	1.27	0.646
No				Reference			Reference			Reference		
HT use												
Yes				−2.97	1.52	0.051	−3.00	1.53	0.051	**−3.17**	**1.53**	**0.038**
No				Reference			Reference			Reference		
BMI, kg/m^2 **							**−3.06**	**1.41**	**0.030**	**−3.31**	**1.38**	**0.017**
Smoker												
Yes							3.38	5.85	0.563	3.92	5.77	0.498
No							Reference			Reference		
No. of upsetting life events												
≥2							**−3.73**	**1.35**	**0.006**	**−2.76**	**1.37**	**0.043**
1							**−2.58**	**1.11**	**0.020**	**−2.18**	**1.11**	**0.050**
0							Reference			Reference		

	Model 1			Model 2			Model 3			Model 4		
Effect	**β-Estimate**	**SE**	**P-value**	**β-Estimate**	**SE**	**P-value**	**β-Estimate**	**SE**	**P-value**	**β-Estimate**	**SE**	**P-value**
CES-D												
16+										**−6.58**	**1.31**	**<.001**
<16										Reference		

Models adjusted for: (1) baseline age, education, number of pain medications; (2) all variables in Model (1) plus post-menopausal status and HT use; (3) all variables in Model (2) plus BMI, smoking status, number of upsetting life events; (4) all variables in Model (3) plus CES-D. Menopausal status, hormone therapy use, BMI, smoking, life events, and CES-D in models 2, 3, 4 are all time varying. Significant associations are bolded.

*Average discrimination up to and including the pain visit;

**Centered

Table 3c

Relationship of Chronic Everyday Discrimination and Bodily Pain: Japanese (N=275)

	Model 1			Model 2			Model 3			Model 4		
Effect	**β-Estimate**	**SE**	**P-value**	**β-Estimate**	**SE**	**P-value**	**β-Estimate**	**SE**	**P-value**	**β-Estimate**	**SE**	**P-value**
Intercept	**77.88**	**5.15**	**<.001**	**77.79**	**5.16**	**<.001**	**74.11**	**5.25**	**<.001**	**71.89**	**5.19**	**<.001**
Time, 10 yrs	0.90	0.72	0.209	1.36	1.08	0.211	2.07	1.15	0.072	**2.43**	**1.14**	**0.034**
Chronic Discrimination *	**−5.84**	**1.90**	**0.002**	**−5.75**	**1.90**	**0.003**	**−4.20**	**1.91**	**0.028**	−3.48	1.86	0.062
Baseline Age, yrs **	−1.84	3.15	0.560	−1.47	3.20	0.646	−2.48	3.17	0.435	−2.44	3.07	0.428
Education												
≤ high school	−5.44	2.89	0.061	−5.41	2.90	0.063	−5.56	2.87	0.054	−4.67	2.78	0.094
Some college	**−6.21**	**2.46**	**0.012**	**−6.24**	**2.46**	**0.012**	**−6.96**	**2.43**	**0.005**	**−6.18**	**2.35**	**0.009**
College	**−4.90**	**2.49**	**0.050**	−4.87	2.49	0.052	**−5.44**	**2.46**	**0.028**	**−4.73**	**2.38**	**0.048**
Graduate School	Reference			Reference			Reference			Reference		
Number of pain medications												
2	**10.86**	**3.56**	**0.002**	**10.79**	**3.56**	**0.002**	**11.30**	**3.57**	**0.002**	**12.45**	**3.57**	**0.001**
1	4.27	3.58	0.233	4.22	3.58	0.239	4.74	3.60	0.188	5.91	3.60	0.101
0	Reference			Reference			Reference			Reference		
Post-menopausal												
Yes				−0.61	1.11	0.586	−1.11	1.17	0.341	−1.55	1.17	0.185
No				Reference			Reference			Reference		
HT use												
Yes				−0.53	1.32	0.684	0.25	1.36	0.854	0.26	1.36	0.847
No				Reference			Reference			Reference		
BMI, kg/m^2 **							**−3.16**	**1.26**	**0.012**	**−3.11**	**1.23**	**0.012**
Smoker												
Yes							−0.04	2.03	0.982	−0.09	2.00	0.965
No							Reference			Reference		
No. of upsetting life events												
≥2							**−3.19**	**1.00**	**0.001**	**−2.29**	**1.01**	**0.024**
1							−1.74	0.93	0.062	−1.35	0.93	0.149
0							Reference			Reference		

	Model 1			Model 2			Model 3			Model 4		
Effect	**β-Estimate**	**SE**	**P-value**	**β-Estimate**	**SE**	**P-value**	**β-Estimate**	**SE**	**P-value**	**β-Estimate**	**SE**	**P-value**
CES-D												
16+										**−5.78**	**1.13**	**<.001**
<16										Reference		

Models adjusted for: (1) baseline age, education, number of pain medications; (2) all variables in Model (1) plus post-menopausal status and HT use; (3) all variables in Model (2) plus BMI, smoking status, number of upsetting life events; (4) all variables in Model (3) plus CES-D. Menopausal status, hormone therapy use, BMI, smoking, life events, and CES-D in models 2, 3, 4 are all time varying. Significant associations are bolded.

*Average discrimination up to and including the pain visit;

**Centered

Table 3d

Relationship of Chronic Everyday Discrimination and Bodily Pain: African American (N=860)

	Model 1			Model 2			Model 3			Model 4		
Effect	**β-Estimate**	**SE**	**P-value**	**β-Estimate**	**SE**	**P-value**	**β-Estimate**	**SE**	**P-value**	**β-Estimate**	**SE**	**P-value**
Intercept	**73.80**	**2.87**	**<.001**	**73.83**	**2.87**	**<.001**	**76.06**	**2.81**	**<.001**	**75.53**	**2.77**	**<.001**
Time, 10 yrs	**−2.47**	**0.56**	**<.001**	**−2.08**	**0.78**	**0.008**	**−2.06**	**0.80**	**0.010**	**−2.38**	**0.80**	**0.003**
Chronic Discrimination *	**−6.17**	**1.09**	**<.001**	**−6.14**	**1.09**	**<.001**	**−5.22**	**1.06**	**<.001**	**−4.50**	**1.05**	**<.001**
Baseline Age, yrs **	−0.94	2.27	0.679	−0.76	2.28	0.739	−0.87	2.13	0.682	−1.16	2.08	0.575
Education												
≤ high school	**−9.88**	**1.87**	**<.001**	**−9.80**	**1.87**	**<.001**	**−9.29**	**1.75**	**<.001**	**−8.60**	**1.71**	**<.001**
Some college	**−6.28**	**1.74**	**<.001**	**−6.20**	**1.73**	**<.001**	**−5.39**	**1.62**	**0.001**	**−5.02**	**1.58**	**0.002**
College	−2.41	2.10	0.252	−2.36	2.10	0.261	−2.21	1.96	0.261	−1.99	1.91	0.298
Graduate School	Reference			Reference			Reference			Reference		
Number of pain medications												
2	**12.67**	**1.36**	**<.001**	**12.66**	**1.36**	**<.001**	**12.62**	**1.42**	**<.001**	**12.33**	**1.42**	**<.001**
1	**7.35**	**1.35**	**<.001**	7.32	1.35	**<.001**	**7.54**	**1.41**	**<.001**	**7.38**	**1.41**	**<.001**
0	Reference			Reference			Reference			Reference		
Post-menopausal												
Yes				−0.61	0.74	0.406	−0.43	0.76	0.570	−0.42	0.76	0.586
No				Reference			Reference			Reference		
HT use												
Yes				−1.41	0.91	0.121	−1.12	0.93	0.231	−1.17	0.93	0.210
No				Reference			Reference			Reference		
BMI, kg/m^2 **							**−4.12**	**0.46**	**<.001**	**−4.14**	**0.45**	**<.001**
Smoker												
Yes							**−4.44**	**1.00**	**<.001**	**−4.30**	**1.00**	**<.001**
No							Reference			Reference		
No. of upsetting life events												
≥2							**−3.28**	**0.60**	**<.001**	**−2.79**	**0.61**	**<.001**
1							−0.99	0.62	0.107	−0.69	0.62	0.265
0							Reference			Reference		

	Model 1			Model 2			Model 3			Model 4		
Effect	**β-Estimate**	**SE**	**P-value**	**β-Estimate**	**SE**	**P-value**	**β-Estimate**	**SE**	**P-value**	**β-Estimate**	**SE**	**P-value**
CES-D												
16+										**−4.80**	**0.71**	**<.001**
<16										Reference		

Models adjusted for: (1) baseline age, education, number of pain medications; (2) all variables in Model (1) plus post-menopausal status and HT use; (3) all variables in Model (2) plus BMI, smoking status, number of upsetting life events; (4) all variables in Model (3) plus CES-D. Menopausal status, hormone therapy use, BMI, smoking, life events, and CES-D in models 2, 3, 4 are all time varying. Significant associations are bolded.

*Average discrimination up to and including the pain visit;

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Table 3e

Relationship of Chronic Everyday Discrimination and Bodily Pain: Caucasian (N=1450)

	Model 1			Model 2			Model 3			Model 4		
Effect	**β-Estimate**	**SE**	**P-value**	**β-Estimate**	**SE**	**P-value**	**β-Estimate**	**SE**	**P-value**	**β-Estimate**	**SE**	**P-value**
Intercept	**73.80**	**2.87**	**<.001**	**73.83**	**2.87**	**<.001**	**76.06**	**2.81**	**<.001**	**75.53**	**2.77**	**<.001**
Time, 10 yrs	**−2.47**	**0.56**	**<.001**	**−2.08**	**0.78**	**0.008**	**−2.06**	**0.80**	**0.010**	**−2.38**	**0.80**	**0.003**
Chronic Discrimination *	**−10.54**	**0.85**	**<.001**	**−10.49**	**0.85**	**<.001**	**−8.74**	**0.84**	**<.001**	**−7.86**	**0.83**	**<.001**
Baseline Age, yrs **	−0.94	2.27	0.679	−0.76	2.28	0.739	−0.87	2.13	0.682	−1.16	2.08	0.575
Education												
≤ high school	**−9.88**	**1.87**	**<.001**	**−9.80**	**1.87**	**<.001**	**−9.29**	**1.75**	**<.001**	**−8.60**	**1.71**	**<.001**
Some college	**−6.28**	**1.74**	**<.001**	**−6.20**	**1.73**	**<.001**	**−5.39**	**1.62**	**0.001**	**−5.02**	**1.58**	**0.002**
College	−2.41	2.10	0.252	−2.36	2.10	0.261	−2.21	1.96	0.261	−1.99	1.91	0.298
Graduate School	Reference			Reference			Reference			Reference		
Number of pain medications												
2	**14.67**	**1.11**	**<.001**	**14.70**	**1.11**	**<.001**	**14.47**	**1.17**	**<.001**	**14.49**	**1.17**	**<.001**
1	**7.35**	**1.35**	**<.001**	**7.32**	**1.35**	**<.001**	**7.54**	**1.41**	**<.001**	**7.38**	**1.41**	**<.001**
0	Reference			Reference			Reference			Reference		
Post-menopausal												
Yes				−0.61	0.74	0.406	−0.43	0.76	0.570	−0.42	0.76	0.586
No				Reference			Reference			Reference		
HT use												
Yes				−1.41	0.91	0.121	−1.12	0.93	0.231	−1.17	0.93	0.210
No				Reference			Reference			Reference		
BMI, kg/m^2 **							**−4.12**	**0.46**	**<.001**	**−4.14**	**0.45**	**<.001**
Smoker												
Yes							**−4.44**	**1.00**	**<.001**	**−4.30**	**1.00**	**<.001**
No							Reference			Reference		
No. of upsetting life events												
≥2							**−3.28**	**0.60**	**<.001**	**−2.79**	**0.61**	**<.001**
1							−0.99	0.62	0.107	−0.69	0.62	0.265
0							Reference			Reference		

	Model 1			Model 2			Model 3			Model 4		
Effect	**β-Estimate**	**SE**	**P-value**	**β-Estimate**	**SE**	**P-value**	**β-Estimate**	**SE**	**P-value**	**β-Estimate**	**SE**	**P-value**
CES-D												
16+										**−4.80**	**0.71**	**<.001**
<16										Reference		

Models adjusted for: (1) baseline age, education, number of pain medications; (2) all variables in Model (1) plus post-menopausal status and HT use; (3) all variables in Model (2) plus BMI, smoking status, number of upsetting life events; (4) all variables in Model (3) plus CES-D. Menopausal status, hormone therapy use, BMI, smoking, life events, and CES-D in models 2, 3, 4 are all time varying. Significant associations are bolded.

*Average discrimination up to and including the pain visit;

**Centered