Research Paper

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Sociodemographic patterns of pain in an urban community sample: an examination of intersectional effects of sex, race, age, and poverty status

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Abstract

Pain disparities based on race, sex, age, and socioeconomic status have been well documented. This study aimed to examine interactions among these sociodemographic factors on self-reported bodily pain in an urban community sample to assess whether membership in multiple at-risk groups confers greater risk for pain independent of depressive symptomatology. Participants (N = 1173) were enrolled in the epidemiological Healthy Aging in Neighborhoods of Diversity across the Life Span (HANDLS) study, and reported experiences of pain in various body sites. Logistic regression was used to examine independent and interactive relations of sociodemographic factors on the likelihood of reporting pain in one or more sites. A significant three-way interaction was found for race, sex, and poverty status (odds ratio [OR] = 6.04, 95% confidence interval [CI] [1.26-28.97], $P = 0.025$). Specifically, among Whites living in poverty, women were more likely to report pain than men ($P = 0.043$), suggesting a double disadvantage of being both female and living in poverty. Among those above the poverty line, African American (AA) men were less likely to report pain than White men ($P = 0.024$) and AA women ($P = 0.019$), potentially due to greater stoicism or coping skills and sources of resilience. Consistent with prior research, significant main effects revealed that older age (OR = 2.16, 95% CI [1.28-3.64], $P = 0.004$) and higher depressive symptoms (OR = 1.03, 95% CI [1.02-1.04], $P < 0.001$) were associated independently with increased likelihood of reporting pain. This study demonstrates that in an urban population, intersecting sociodemographic factors create unique social identities that impact pain, and emphasizes the need for identification of relevant mediational pathways.

Keywords: Pain disparities, Health disparities, Socioeconomic status, Depression, HANDLS

1. Introduction

Pain disparities based on race, sex, age, and socioeconomic status (SES) have been well documented. Although chronic pain is more prevalent in White Americans,[66] African Americans (AA) experience more severe chronic pain, report greater pain-related physical and psychological disability, and are undertreated for pain.[3,7,12,19,24,33,35,37,47,57,66,77,82,84] Although less well studied, pain disparities have been reported for other racial/ethnic groups (eg, Hispanic and Asian).[1,42,69,81] Chronic pain is more prevalent in women than in men; women also experience more daily pain and are at greater risk of developing severe pain after medical procedures compared to men.[28,39,74,87] Advancing age is associated with increased persistent pain, although this seems to plateau after the age of 70 years.[34,39,41,52,72,74,80,87] Low SES is associated with higher prevalence of chronic and debilitating pain, even after adjusting for other sociodemographic factors.[15,33,39,47,64,74]

Mechanisms underlying pain disparities are poorly understood, but likely result from a complex constellation of biopsychosocial factors.[29] For example, depression is more prevalent in groups at risk for pain[27,31,54,56] and is highly comorbid with chronic pain.[4,30,55,79] Pain disparities pose a significant clinical and societal problem, given that many people in the United States belong to one or more of these sociodemographic groups and thus bear a disproportionate burden of pain, suffering, and poor quality of life. Research on pain disparities is particularly important given that U.S. census data indicate that the population is becoming increasingly multiracial, poorer, and older (with older individuals more likely to be female and living in poverty).[13,67]

A key question is whether pain disparities are magnified in individuals who are members of more than one at-risk group (eg, older AA women). Intersectionality theory, which states that people fit into multiple individual/social categories, each characterized by its own level of inequality/power,[22] is increasingly being used as a framework to examine health disparities. Some intersectionality studies report a "multiple disadvantage" effect, in which membership in more at-risk groups is associated with worse health outcomes.[10,11,45,63] Others report "intersectionality paradoxes" in which membership in multiple at-risk groups does

Sponsorships or competing interests that may be relevant to content are disclosed at the end of this article.

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Supplemental digital content is available for this article. Direct URL citations appear in the printed text and are provided in the HTML and PDF versions of this article on the journal's Web site (www.painjournalonline.com).

PAIN 161 (2020) 1044–1051

http://dx.doi.org/10.1097/j.pain.0000000000001793

not lead to worse health.[45] Many pain studies focus on one sociodemographic factor while controlling for others without examining interactions among factors.[39,74] Yet, there is evidence for intersectional effects on pain. For example, 2 studies report higher pain in AA chronic pain patients than in White patients, with low SES mediating this association in older patients,[33,36] revealing complex relations among race, age, and SES.

To date, intersectional effects of race, sex, age, and SES on pain have not been systematically studied. This study aimed to fill this knowledge gap by explicitly examining main effects of and interactions among these sociodemographic factors on the number of pain sites reported by people in an urban-dwelling population. Given the study's exploratory nature, we hypothesized that we would find intersectional effects of sociodemographic factors on pain, but did not explicitly hypothesize whether they would be multiple disadvantage or paradoxical.

2. Methods

2.1. Parent study and participants

The Healthy Aging in Neighborhoods of Diversity across the Life Span (HANDLS) study is an ongoing, 20-year longitudinal investigation of health disparities associated with race and SES (for more information about the design and implementation of HANDLS, see Ref. 23). Briefly, HANDLS participants comprise a fixed cohort of urban-dwelling adults who self-identified as AA or White, and who were aged between 30 and 64 years at baseline. Participants were recruited through household screenings from an area probability sample of 13 census segments in the city of Baltimore, MD. Census segments were predetermined for their likelihood of yielding representative distributions of individuals who were AA and White, men and women, and with annual household incomes (adjusted for household size) $<$ or $\geq$125% of the 2004 Federal poverty level. The institutional review board at the National Institute of Environmental Health Sciences approved the HANDLS study protocol. After initial selection, potential participants were excluded from HANDLS if they met any of the following criteria at baseline: (1) outside of the age range of 30 to 64 years, (2) currently pregnant, (3) within 6 months of active cancer treatment (ie, chemotherapy, radiation, or biological treatments), (4) diagnosed with AIDS, (5) unable to provide informed consent, (6) unable to provide data for at least 5 measures, and (7) unable to provide valid government-issued identification or were currently without a verifiable address.

This study used data from the first wave of HANDLS, which occurred between the years 2004 and 2009. After recruitment and obtaining written informed consent, participants completed a screening and an interview within their households. Subsequently, participants completed a physical examination, medical history interview, cognitive testing, and other assessments on mobile medical research vehicles (MRVs) parked within participants' neighborhoods.

Of the 3720 participants who met criteria for the HANDLS study and participated in the household interview, 2801 completed further data collection on a mobile MRV (including self-reported pain sites). Participants were excluded from this study if they reported a history of dementia (n = 4), brain cancer (n = 3), stroke (n = 60), transient ischemic attack (n = 80), epilepsy (n = 99), multiple sclerosis (n = 14), or Parkinson disease (n = 3). The rationale for these exclusions is based on the likelihood that the disorders would affect pain perception/ability to report pain, cause pain symptoms, or alter neural mechanisms of pain processing. In addition, participants were excluded if they reported regular use of marijuana (former, n = 798; current, n = 351), cocaine/crack (former, n = 422; current, n = 156), opiates (former, n = 299; current, n = 351), or use of methadone (maintenance, n = 171; not maintenance, n = 77). The primary rationale for excluding drug users is that the HANDLS drug use measures are gross self-reported "ever/never" use variables and do not provide sufficient information (such as variety of drugs used, duration of use, use vs abuse and dependence) to assess the complex relationship between pain and substance use. In addition, there is extensive literature demonstrating that use or abuse of these drugs is associated with long-term structural and functional brain abnormalities in key regions involved in pain processing, including (but not limited to) the insula, anterior cingulate cortex, prefrontal cortex, amygdala, and nucleus accumbens.[5,17,25,50,62,65,91] Thus, former or current drug use could potentially confound or, indeed, mediate intersectional effects of interest. Because this could not be assessed in sufficient detail due to the limitations of our measure, we chose to exclude drug users in this study. Finally, participants were excluded if they were missing data for any variables used in the present analyses (n = 216), resulting in a final analysis sample of 1173 participants.

2.2. Measures

2.2.1. Sociodemographic information

Participants reported their birth date, sex, self-identified race, and annual household income during the initial household interview. Annual household income (adjusted for household size) was used to calculate their poverty status, which was dichotomized into below or $\geq$125% of the 2004 Federal poverty level (referred to hereafter as the "poverty line") and used as the current study's measure of SES.

2.2.2. Assessment of pain sites

Assessment of pain sites occurred during the structured medical history interview. Participants were asked by physicians if they had pain in various body sites and provided verbal responses. In this study, we summed the number of pain sites reported by participants, specifically breast pain, abdominal pain, painful urination, neck pain, low back pain, joint pain, and muscle pain. Total pain sites were summed for each participant and ranged from 0 to 5 in our analysis sample.

2.2.3. Adjustment variables

Depressive symptoms and literacy were selected as adjustment variables for this study. The rationale to adjust for depression was due to (1) its complex, bidirectional relationship with pain and (2) literature documenting sociodemographic differences in depression.[2,9,90] Although the latter may indicate that depression could mediate sociodemographic differences in pain, we sought to first characterize sociodemographic differences in pain independent of this potential mediator and examine potential mediators of detected effects in future work. The Center for Epidemiologic Studies Depression (CES-D) scale[75] was used to assess depressive symptoms. CES-D consists of 20 self-report items in which participants rate the frequency that they experienced each symptom during the previous week, on a scale ranging from *Rarely or none of the time*, *less than one day*, to *All of the time*, *5 to 7 days*. Total scores range from 0 to 60, with those greater than or equal to 16 considered elevated for depression.[75]

The CES-D is a widely used depression screener and is considered a valid and reliable measure of depressive symptoms in epidemiologic research.[76]

Total scores from the Word Reading subtest of the Wide Range Achievement Test-3 (WRAT-3[92]), a widely administered and validated reading test, were used to measure and adjust for literacy in this study. Participants completed this measure on the mobile MRVs as part of a broader cognitive test battery. The decision to adjust for literacy, as opposed to education, was based on previous research indicating that assessment of reading ability is a more suitable indicator of quality of education than educational attainment with racially and socioeconomically diverse samples.[16]

2.3. Statistical analyses

All statistical analyses were conducted within the Statistical Package for the Social Sciences (SPSS) version 25. Preliminary data screening revealed that the distribution of the pain variable (number of pain sites) was positively skewed (ie, participants tended to report fewer pain sites), which was not resolved through logarithmic- or square-root transformations. Because normality could not be assumed for parametric tests, the summed variable was dichotomized (0 = no pain sites, 1 = one or more pain sites), and data were examined through logistic regression, which allowed for identifying predictors of the likelihood of experiencing pain in at least one body site. Specifically, we were interested in examining independent and interactive relations of sociodemographic factors (age, sex, race, and poverty status) with likelihood of reporting one or more pain sites. To ensure that reasonable numbers of participants populated each cell of the multiway crosstabs among sociodemographic independent variables, age was dichotomized by splitting the distribution at its median of 50 years, and participants were classified as *younger* (ie, ≤50 years old) or *older* (ie, >50 years old).

First, a preliminary analysis was run with only main effects of age group, sex, race, and poverty status, with depressive symptoms and literacy used as covariates. Subsequently, the primary moderation analysis was run that included as predictors all 2-, 3-, and 4-way interaction and main effects among age group, sex, race, and poverty status, with depressive symptoms and literacy used as covariates. If an interaction effect was found to be significant (at the $P < 0.05$ level), lower-order interactions and main effects nested beneath it were not interpreted (irrespective of their significance), as is standard in multivariable regression approaches. Significant interactions were probed and plotted with the PROCESS macro for SPSS (version 2.16, which allows for analyzing moderated logistic regression; for the manual, see Ref. 40) to assist with interpretation.

3. Results

In the overall sample of nondrug users, 49.7% of participants reported pain in one or more body sites (**Table 1**). As shown in **Table 2**, pain was primarily reported in musculoskeletal sites (eg, neck, back, joint, and muscle). AA (vs White) participants (1) were more likely to be living in poverty, χ^2 (1) = 10.04, $P = 0.002$, (2) had lower literacy scores, $t(1,171) = 8.60$, $P < 0.001$, and (3) reported fewer depressive symptoms, $t(1,171) = 3.25$, $P = 0.001$. In addition, women reported more depressive symptoms than men, $t(1,171) = 2.61$, $P = 0.009$. Distributions of number of pain sites reported were positively skewed in the overall sample as well as all sex, race, and poverty status subgroups (supplemental Table 1, available at http://links.lww.com/PAIN/A936).

The preliminary logistic regression analysis examining only main effects revealed significant associations between the likelihood of reporting pain sites and (1) age group, such that older participants were more likely to report pain sites than younger participants, odds ratio [OR] = 1.93, 95% confidence interval [CI] [1.52-2.45], $P < 0.001$; and (2) sex, such that women were more likely to report pain sites than men, OR = 0.62, 95% CI (0.48-0.80), $P < 0.001$ (supplemental Table 2, available at http://links.lww.com/PAIN/A936). Greater depressive symptoms were also associated with greater likelihood of reporting pain sites, OR = 1.03, 95% CI (1.02-1.04), $P < 0.001$.

Findings from the primary logistic regression analysis containing all main effects and interactions revealed a significant three-way interaction of Sex × Race × Poverty Status with likelihood of reporting one or more pain sites, OR = 6.04, 95% CI (1.26-28.97), $P = 0.025$ (see **Table 3** for full model results, and **Fig. 1**). A significant interaction of OR is similar to a significant beta value for an interaction term in a linear regression. It indicates that a combination of groups in the interaction has significantly greater odds of the outcome than other combinations of groups, in this case when race, sex, and poverty status are included in the model. As is done in a linear regression, probing the interaction to determine which factors contribute to it (as described below) enables interpretation.

Table 1

Participant characteristics in the overall sample of nondrug users and stratified by sex and race.

Variable	Women (n = 800)	Men (n = 373)	Sig.	AA (n = 610)	White (n = 563)	Sig.	All (N = 1173)
Age, % >50 years old	47.6%	50.1%		46.2%	50.8%		48.4%
Sex, % women	—	—		70.2%	66.1%		68.2%
Race, % AA	53.5%	48.8%		—	—		52.0%
Poverty status, % below poverty level	38.6%	34.6%		41.6%	32.7%	**	37.3%
Depressive symptoms,† M ± SD	15.0 ± 11.8	13.2 ± 10.7	**	13.38 ± 10.7	15.6 ± 12.1	**	14.4 ± 11.5
Literacy,‡ M ± SD	42.48 ± 7.6	41.60 ± 9.6		40.3 ± 7.9	44.3 ± 8.3	***	42.2 ± 8.3
Pain sites,§ % with pain sites	53.6%	41.3%	***	46.6%	53.1%	*	49.7%

Sex and race differences shown above were examined with independent-samples *t*-tests and χ^2 tests of independence.
*$P < 0.05$, **$P < 0.01$, ***$P < 0.001$.
† Depressive symptoms were measured with the Center for Epidemiologic Studies-Depression (CES-D) scale.
‡ Literacy was measured with the Wide Range Achievement Test-3 (WRAT-3) Word Reading subtest.
§ Pain sites included breast pain, abdominal pain, painful urination, neck pain, low back pain, joint pain, and muscle pain.
AA, African American; Poverty Level, 125% of 2004 Federal poverty level.

Table 2

Pain reported in the overall sample of nondrug users and stratified by sex, race, age, and poverty status (%).

Pain site/type	Women (n = 800), %	Men (n = 373), %	Sig.	AA (n = 610), %	White (n = 563), %	Sig.	Younger (n = 605), %	Older (n = 568), %	Sig.	Above poverty (n = 735), %	Below poverty (n = 438), %	Sig.	All (N = 1173), %
Breast	2.9	0.0		1.8	2.1		2.1	1.8		2.2	1.6		2.0
Abdominal	1.3	0.5		1.1	0.9		1.2	0.9		0.8	1.4		1.0
During urination	1.0	0.8		0.7	1.2		0.7	1.2		0.7	1.4		0.9
Neck	15.4	10.5	*	10.3	17.6	***	10.4	17.4	**	13.7	13.9		13.8
Low back	39.1	28.2	***	33.4	38.0		30.7	40.8	***	34.8	37.0		35.6
Joint	24.8	19.0	*	21.3	24.7		14.4	32.0	***	20.5	26.9	*	22.9
Muscle	6.8	3.8	*	5.4	6.2		2.6	9.2	***	5.3	6.6		5.8

Differences by sex, race, age group, and poverty status were examined with χ^2 tests of independence.
* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.
AA, African American; Poverty Line, 125% of 2004 Federal poverty level.

Among individuals living above the poverty line, AA men were less likely to report pain sites than (1) AA women, $P = 0.019$, or (2) White men, $P = 0.024$ (**Fig. 1**). In addition, among individuals living below the poverty line, White women were more likely than White men to report pain sites, $P = 0.043$ (**Fig. 1**). There were no significant sex differences in the likelihood of reporting pain sites among AAs living below the poverty line or Whites living above the poverty line (P's > 0.05, **Fig. 1**). There were also no racial differences in the likelihood of reporting pain sites among men living below the poverty line or women across poverty statuses (all Ps > 0.05). Findings also revealed significant main effects of age group, such that older participants were more likely to report pain in one or more sites than younger participants, OR = 2.16, 95% CI (1.28-3.64), $P = 0.004$. Finally, greater depressive symptoms were associated with greater likelihood of reporting pain in one or more sites, OR = 1.03, 95% CI (1.02-1.04), $P < 0.001$.

Of note, 23 women, but no men, reported breast pain. To evaluate whether this discrepancy influenced the findings described above, the logistic regression was rerun without including breast pain as a pain site. The results and interpretation were unchanged (ie, the same main effects and interactions were significant in both models; data not shown), and therefore breast pain was retained as a pain site in this study.

4. Discussion

The unique design of the HANDLS study enabled us to examine intersectional effects of race, sex, age, and poverty status on pain in an urban-dwelling drug use-free community, a crucial question not previously addressed in the literature. We found both multiple-disadvantage and paradoxical effects of intersectionality on pain, independent of depressive symptomatology. We also found that older age was associated with increased likelihood of reporting pain, independent of other factors. Consistent with the literature,[55] higher depressive symptomatology was associated with increased likelihood of pain across all sociodemographic groups. These findings are discussed below in the context of the biopsychosocial model of pain.

4.1. Interaction of sex, race, and poverty: pain in people living in poverty

In participants with household incomes below the poverty line, our study found that White women were significantly more likely to report pain than White men, independent of depressive symptomatology; no significant race differences were found at this poverty level. Although this may be attributable to biopsychosocial risk factors associated with female sex or low SES independently, it may also indicate a double disadvantage effect that includes biopsychosocial risk factors associated with being *both* low SES and female because we did not see differences in pain for White men or women living above the poverty line. Female-specific risk factors include upregulated CNS pain processing,[38] reduced function of endogenous pain inhibitory systems,[73] increased depression and anxiety,[2] and increased use of maladaptive coping skills such as catastrophizing.[20,32] Living in poverty exposes people to chronic stress due to a variety of factors (eg, discrimination, social isolation, substandard health care and housing, and crime exposure), and chronic stress can cause pathophysiological changes associated with adverse health outcomes, including pain.[48,85]

Low-SES White women may experience a unique set of social stressors that contribute to increased risk for adverse health outcomes (including pain) and mortality. Indeed, midlife mortality

Table 3

Logistic regression examining associations of sociodemographic factors and the probability of endorsing one or more pain sites among nondrug users.

Model predictors	*P*	OR	95% CI
Depressive symptoms***	<0.001	1.03	1.02-1.04
Literacy	0.169	1.01	1.00-1.03
Age**	0.004	2.16	1.28-3.64
Sex	0.619	1.17	0.63-2.18
Race	0.709	1.10	0.66-1.85
Poverty status	0.462	1.26	0.69-2.32
Age × sex	0.377	0.68	0.29-1.60
Age × race	0.976	1.01	0.49-2.10
Age × poverty status	0.578	0.78	0.32-1.89
Sex × race	0.060	0.41	0.16-1.04
Sex × poverty status*	0.039	0.29	0.09-0.94
Race × poverty status	0.417	0.72	0.32-1.60
Age × sex × race	0.964	1.03	0.28-3.81
Age × sex × poverty status	0.099	3.94	0.77-20.06
Age × race × poverty status	0.613	1.36	0.41-4.51
Sex × race × poverty status*	0.025	6.04	1.26-28.97
Age × sex × race × poverty status	0.095	0.15	0.01-1.39

*$P < 0.05$, **$P < 0.01$, ***$P < 0.001$.
CI, confidence interval; OD, odds ratio.

rates for White Americans have increased over the past 20 years, particularly in women and those with lower levels of education.[8,93] White women living in poverty may perceive their social status to be lower than other members of their community and may experience more stress as a consequence. Support for this comes from a related HANDLS study that found unemployed White participants perceived their social status to be lower than unemployed AA participants, possibly due to the tendency for people to evaluate their social status through in-group comparisons.[83] In addition, White women living in poverty in Baltimore may have less social support, which is known to buffer stress, reduce depression, promote health, and reduce pain.[21,43,58,70] In support of this, a study of predominantly White women found that those living in poverty feel more isolated and have fewer social connections than their working-class counterparts[86]; by contrast, AA women living in poverty reported having more social support than their White counterparts. Taken together, these findings suggest that in addition to biological and psychological risk factors associated with being female and living in poverty, social and contextual factors may play a critical role in explaining our finding that White women living below the poverty line are more likely to report pain than White men.

4.2. Interaction of race, sex, and poverty: pain in people living above the poverty line

In participants living above the poverty line, we found an intersectional paradox, with AA men significantly less likely to report pain than other groups. Thus, race and sex interacted with poverty status in an unexpected direction not consistent with pain disparities literature that has not examined intersectional effects. The stereotype that AA men feel less pain[14,88] has been debunked widely[7,19,49,61,68] and is not a credible explanation for our findings. Another possibility is that AA men were less likely to report their pain during the physical examination. Based on the literature,[42] AAs are more stoic and less willing to report pain due to beliefs that pain will be dismissed due to health care discrimination and left untreated, and that talking about pain will lead to worse pain and less personal control.[3,35,44,59–61] Together, these attitudes and behaviors likely result from the long history of institutional racism and discrimination in the medical community that have led to undertreatment of pain in AAs.[35]

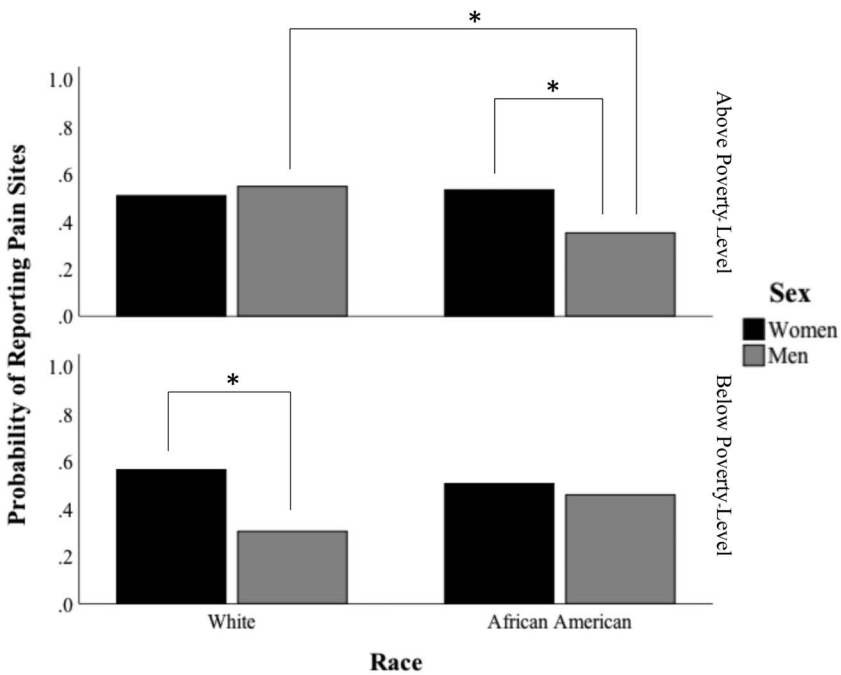

Figure 1. Significant 3-way interaction of Sex × Race × Poverty Status with probability of endorsing one or more pain sites. *$P < 0.05$.

Another explanation for our paradoxical finding is strength-based, in which living above the poverty line confers benefits for AA men. Several studies have shown that high SES AA men have better health outcomes than their low SES counterparts due to advantages such as better access to quality health care, reduced financial stress, time to engage in health promoting behaviors, better coping mechanisms, and sources of resilience that buffer against adverse health effects.[6,46,53] However, participants in HANDLS are low-to-middle income and those falling in the "higher SES" category are unlikely to have incomes comparable to the "high SES" participants in the literature. As a result, most participants living above the poverty line in this study are unlikely to have financial security or other advantages of "high SES" people. Although a related HANDLS study reported that life expectancy for AA men living above the poverty line was significantly higher than AA men living below the poverty line and comparable to that of White men of either poverty status,[94] it is unclear whether a strength-based interpretation is relevant to this population. Future studies are needed to support this interpretation.

4.3. Age effects

Consistent with the literature,[34,41,52] older age was associated with significantly greater likelihood of reporting pain. Older people show upregulated CNS pain processing[18,26,51] and decreased function of endogenous pain inhibitory systems[78,89] in experimental studies. Older individuals tend to experience more social isolation and less self-sufficiency, which is associated with more pain-related disability.[71] Our finding may also result from the type of pain reported in this study, which was predominantly musculoskeletal. Musculoskeletal pain is the most common type of persistent pain in older adults, with other types of pain (eg, headache) decreasing with age.[80] Thus, including pain sites outside of the musculoskeletal system is important for future work because assessing these types of pain may reveal intersectional effects of age with other sociodemographic factors.

4.4. Depression effects

Levels of depressive symptomatology ranged across the sample, with most participants below the criterion for clinical depression. Higher depressive symptomatology was associated with increased likelihood of reporting pain in one or more body sites across all sociodemographic groups. This relationship between depression and pain is well established in the literature, and is hypothesized to be the consequence of shared underlying neural mechanisms possibly triggered by high allostatic load.[4,79] Our finding that the depression–pain relationship is present in all sociodemographic groups adds to this literature. Furthermore, given that depressive symptomatology was higher in our White participants and in our female participants, our results also emphasize the need to examine the potential mediating effects of depression when testing for sociodemographic differences in pain.

4.5. Limitations

This study is cross-sectional and therefore does not establish temporal association. HANDLS included only AA and White, predominantly low-to-middle income adults living in Baltimore, MD. Therefore, our findings may not be generalizable to other ethnic groups, people living in rural or exurban communities, or more affluent individuals. We assessed primarily musculoskeletal pain by participant report; thus, the findings may not generalize to other types of pain and could be influenced by somaticizing tendencies. In addition, pain sites were summed to create a dichotomous variable (due to statistical requirements) that was analyzed using a logistic regression approach; this approach did not enable us to make comparisons among participants who reported pain in different numbers of sites. Furthermore, we did not examine whether disability associated with pain would exhibit similar sociodemographic patterns in our pain-reporting participants.

Finally, the questions of intersectionality addressed in this study were exploratory and explanations for the results were by definition speculative. Future studies by our group will address this limitation by examining biopsychosocial factors that mediate or moderate the sociodemographic patterns found. However, there are some potential mediators that cannot be addressed in our sample, such as drug use. As noted previously, we were unable to determine whether drug use potentially mediated our detected effects due to limitations of our drug use measure; future studies are needed in a population where drug use is better characterized.

5. Conclusions

Despite these limitations, our study makes an important contribution to the pain disparities field by being the first, to the best of our knowledge, to explicitly examine intersectional effects of race, sex, age, and SES. It is an important first step in demonstrating that, consistent with intersectionality theory, intersecting sociodemographic factors create unique social identities that impact risk for pain. Our work emphasizes the need for additional research in this area to move toward a better understanding of pain disparities and their underlying mechanisms, with the long-term goal of identifying groups at risk for pain and developing targeted interventions to reduce this risk.

Conflict of interest statement

The authors have no conflicts of interest to declare.

Acknowledgments

This research was supported by the National Institute on Aging Intramural Research Program of the National Institutes of Health (grant number Z01-AG000194).

Appendix A. Supplemental digital content

Supplemental digital content associated with this article can be found online at http://links.lww.com/PAIN/A936.

Article history:
Received 13 May 2019
Received in revised form 16 December 2019
Accepted 30 December 2019
Available online 7 January 2020

References

[1] Ahn H, Weaver M, Lyon D, Kim J, Choi E, Staud R, Fillingim RB. Differences in clinical pain and experimental pain sensitivity between Asian Americans and Whites with knee osteoarthritis. Clin J Pain 2017;33:174–80.
[2] Altemus M, Sarvaiya N, Epperson CN. Sex differences in anxiety and depression clinical perspectives. Front Neuroendocrinol 2016;35:320–30.
[3] Anderson KO, Green CR, Payne R. Racial and ethnic disparities in pain: causes and consequences of unequal care. J Pain 2009;10:1187–204.

[4] Bair MJ, Robinson RL, Katon W. Depression and pain comorbidity: a literature review. Arch Intern Med 2003;163:2433–45.
[5] Battistella G, Fornari E, Annoni J, Chtioui H, Dao K, Maeder P, Giroud C, Fabritius M, Favrat B. Long-term effects of cannabis on brain structure. Neuropsychopharmacology 2014;39:2041–8.
[6] Bonham VL, Sellers SL, Neighbors HW. John Henryism and self-reported physical health among high—socioeconomic status African American men. Am J Public Health 2004;94:737–8.
[7] Campbell CM, Edwards RR. Ethnic differences in pain and pain management. Pain Manag 2012;2:219–30.
[8] Case A, Deaton A. Mortality and morbidity in the 21st century. Brookings Pap Econ Act 2017:397–476.
[9] Cole MG, Dendukuri N. Risk factors for depression among elderly community subjects: a systematic review and meta-analysis. Am J Psychiatry 2003;160:1147–56.
[10] Cole ER. Intersectionality and research in psychology. Am Psychol 2009; 64:170–80.
[11] Crenshaw KW. Demarginalizing the intersection of race and sex: a Black feminist critique of antidiscrimination doctrine, feminist theory and antiracist politics. Univ Chic Leg Forum 1989;140:139–67.
[12] Cruz-almeida Y, Sibille KT, Goodin BR, Ruiter M, Emily J, Riley JL, King CD, Glover TL, Herbert MS, Schmidt J, Fessler BJ, Staud R, Redden D, Bradley LA, Fillingim RB, Al B. Racial and ethnic differences in older adults with knee osteoarthritis. Arthritis Rheumatol 2014;66:1800–10.
[13] Day J. Population Projections of the United States by age, sex, race, and Hispanic origin: 1995 to 2050. US Department of Commerce, Economics and Statistics Administration, Bureau of the Census, 1996.
[14] Defrin R, Eli I, Pud D. Interactions among sex, ethnicity, religion, and gender role expectations of pain. Gend Med 2011;8:172–83.
[15] Dorner TE, Muckenhuber J, Stronegger WJ, Rsky É, Gustorff B, Freidl W. The impact of socio-economic status on pain and the perception of disability due to pain. Eur J Pain 2011;15:103–9.
[16] Dotson VM, Kitner-Triolo MH, Evans MK, Zonderman AB. Effects of race and socioeconomic status on the relative influence of education and literacy on cognitive functioning. J Int Neuropsychol Soc 2009;15:580–9.
[17] Duerden EG, Albanese MC. Localization of pain-related brain activation: a meta-analysis of neuroimaging data. Hum Brain Mapp 2013;34: 109–49.
[18] Edwards RR, Fillingim RB. Effects of age on temporal summation and habituation of thermal pain: clinical relevance in healthy older and younger adults. J Pain 2001;2:307–17.
[19] Edwards CL, Fillingim RB, Keefe F. Race, ethnicity and pain. PAIN 2001; 94:133–7.
[20] Edwards RR, Haythornthwaite JA, Sullivan MJ, Fillingim RB. Catastrophizing as a mediator of sex differences in pain: differential effects for daily pain versus laboratory-induced pain. PAIN 2004;111: 335–41.
[21] Eisenberger NI. Social ties and health: a social neuroscience perspective. Curr Opin Neurobiol 2013;23:407–13.
[22] Else-quest NM, Hyde JS. Intersectionality in quantitative psychological research : I. Theoretical and epistemological issues. Psychol Women Q 2016;40:155–70.
[23] Evans M, Lepkowski J, Powe N, LaVeist T, Kuczmarski M, Zonderman A. Healthy Aging in Neighborhoods of Diversity across the Life Span (HANDLS): overcoming barriers to implementing a longitudinal, epidemiologic, urban study of health, race, and socioeconomic status. Ethn Dis 2010;20:267–75.
[24] Ezenwa MO, Ameringer S, Ward SE, Serlin RC. Racial and ethnic disparities in pain management in the United States. J Nurs Scholarsh 2006;38:225–33.
[25] Fareed A, Kim J, Ketchen B, Kwak WJ, Wang D, Shongo-Hiango H, Drexler K. Effect of heroin use on changes of brain functions as measured by functional magnetic resonance imaging, a systematic review. J Addict Dis 2019;36:105–16.
[26] Farrell M, Gibson S. Age interacts with stimulus frequency in the temporal summation of pain. Pain Med 2007;8:514–20.
[27] Ferrari AJ, Somerville AJ, Baxter AJ, Norman R, Patten SB, Vos T. Global variation in the prevalence and incidence of major depressive disorder : a systematic review of the epidemiological literature. Psychol Med 2013; 43:471–81.
[28] Fillingim RB, King CD, Ribeiro-Dasilva MC, Rahim-Williams B, Riley JL. Sex, gender, and pain: a review of recent clinical and experimental findings. J Pain 2009;10:447–85.
[29] Fillingim RB. Individual differences in pain: understanding the mosaic that makes pain personal. PAIN 2017;158:S11–18.
[30] Fishbain D, Cutler R, Rosomoff H, Rosomoff R. Chronic pain-associated depression: antecedent or consequence of chronic pain? A review. Clin J Pain 1997;13:116–37.
[31] Fiske A, Wetherell JL, Gatz M. Depression in older adults. Annu Rev Clin Psychol 2009;5:363–89.
[32] Forsythe LP, Thorn B, Day M, Shelby G. Race and sex differences in primary appraisals, catastrophizing, and experimental pain outcomes. J Pain 2011;12:563–72.
[33] Fuentes M, Hart-Johnson T, Green CR. The association among neighborhood socioeconomic status, race and chronic pain in black and white older adults. J Natl Med Assoc 2007;99:1160–9.
[34] Gibson SJ, Farrell M. A review of age differences in the neurophysiology of nociception and the perceptual experience of pain. Clin J Pain 2004;20: 227–39.
[35] Green C, Anderson K. The unequal burden of pain: confronting racial and ethnic disparities in pain. Pain Med 2003;4:277–94.
[36] Green CR, Hart-Johnson T. The association between race and neighborhood socioeconomic status in younger black and white adults with chronic pain. J Pain 2012;13:176–86.
[37] Green CR, Baker TA, Smith EM, Sato Y. The effect of race in older adults presenting for chronic pain management: a comparative study of black and white Americans. J Pain 2003;4:82–90.
[38] Greenspan JD, Craft RM, Leresche L, Arendt-Nielsen L, Berkley KJ, Fillingim RB, Gold MS, Holdcroft A, Mayer EA, Mogil JS, Murphy AZ, Traub RJ. Studying sex and gender differences in pain and analgesia: a consensus report. PAIN 2010;132:26–45.
[39] Grol-Prokopczyk H. Sociodemographic disparities in chronic pain, based on 12-year longitudinal data. PAIN 2017;158:313–22.
[40] Hayes A. Introduction to mediation, moderation, and conditional process analysis: a regression-based approach. New York: Guilford Press, 2013.
[41] Helme RD, Gibson SJ. The epidemiology of pain in elderly people. Clin Geriatr Med 2001;17:417–32.
[42] Hollingshead NA, Matthias MS, Bair MJ, Hirsh AT. Impact of Race and Sex on Pain Management by Medical Trainees: A Mixed Methods Pilot Study of Decision Making and Awareness of Influence. Pain Med. 2014;1:1–11.
[43] House J, KR L, Umberson D. Social relationships and health. Science 1988;241:540–5.
[44] Ibrahim SA, Hanusa BH, Hannon MJ, Kresevic D, Long J, Kwoh CK. Willingness and access to joint replacement among black patients with knee osteoarthritis: a randomized, controlled intervention. Arthritis Rheumatol 2013;65:1253–61.
[45] Jackson PB, Williams DR. The intersection of race, gender, and SES. In: Schulz AJ, Mullings L, editors. Gender, race, class, and health: intersectional approaches. San Francisco: Jossey-Bass, 2006. p. 131–62.
[46] James S. John Henryism and the health of African Americans. Cult Med Psychiatry 1994;18:163–82.
[47] Janevic MR, McLaughlin SJ, Heapy AA, Thacker C, Piette JD. Racial and socioeconomic disparities in disabling chronic pain: findings from the health and retirement study. J Pain 2017;18:1459–67.
[48] Karatsoreos I, McEwen B. Stress and allostasis. In: Steptoe A, editor. Handbook of behavioral medicine: methods and applications. New York: Springer, 2003. p. 649–58.
[49] Kim HJ, Yang GS, Greenspan JD, Downton KD, Griffith KA, Renn CL, Johantgen M, Dorsey SG. Racial and ethnic differences in experimental pain sensitivity. PAIN 2017;158:194–211.
[50] Koob GF, Volkow ND. Neurobiology of addiction: a neurocircuitry analysis. Lancet Psychiatry 2018;3:760–73.
[51] Lautenbacher S, Kunz M, Strate P, Nielsen J, Arendt-Nielsen L. Age effects on pain thresholds, temporal summation and spatial summation of heat and pressure pain. PAIN 2005;115:410–18.
[52] Lautenbacher S, Peters JH, Heesen M, Scheel J, Kunz M. Age changes in pain perception: a systematic-review and meta-analysis of age effects on pain and tolerance thresholds. Neurosci Biobehav Rev 2017;75:104–13.
[53] Lehto RH, Stein KF. The impact of John Henryism on self- reported health behaviors in African American men. J Transcult Nurs 2013;24:291–6.
[54] Lennon MC, Blome J, English K. Depression among women on welfare: a review of the literature. J Am Med Womens Assoc 2002;57:27–31.
[55] Ligthart L, Visscher CM, Van Houtem CMHH, Geels LM, Vink JM, De Jongh A, Boomsma DI. Comorbidity among multiple pain symptoms and anxious depression in a Dutch population sample. J Pain 2014;15: 945–55.
[56] Luppa M, Sikorski C, Luck T, Ehreke L, Konnopka A, Wiese B, Weyerer S, König H, Riedel-heller SG. Age- and gender-specific prevalence of depression in latest-life—systematic review and meta-analysis. J Affect Disord 2012;136:212–21.
[57] McCracken LM, Matthews AK, Tang TS, Cuba SL. A comparison of blacks and whites seeking treatment for chronic pain. Clin J Pain 2001; 17:249–55.
[58] McKillop AB, Carroll LJ, Jones CA, Battié MC. The relation of social support and depression in patients with chronic low back pain. Disabil Rehabil 2017;39:1482–8.

[59] Meghani SH, Houldin AD. The meanings of and attitudes about cancer pain among African Americans. Oncol Nurs Forum 2007;34:1179–86.
[60] Meints SM, Miller MM, Hirsh AT. Differences in pain coping between black and white Americans: a meta-analysis. J Pain 2016;17:642–53.
[61] Meints SM, Stout M, Abplanalp S, Hirsh AT. Pain-related rumination, but not magnification or helplessness, mediates race and sex differences in experimental pain. J Pain 2017;18:332–9.
[62] Mitsi V, Zachariou V. Modulation of pain, nociception, and analgesia by the brain reward center. Neuroscience 2017;338:81–92.
[63] Moradi B, Grzanka PR. Using intersectionality responsibly: toward critical epistemology, structural analysis, and social justice activism. J Couns Psychol 2017;64:500–13.
[64] Morgan CL, Conway P, Currie CJ. The relationship between self-reported severe pain and measures of socio-economic disadvantage. Eur J Pain 2011;15:1107–11.
[65] Nader DA, Sanchez ZM. Effects of regular cannabis use on neurocognition, brain structure, and function: a systematic review of findings in adults. Am J Drug Alcohol Abuse 2018:44:4–18.
[66] Nahin RL. Estimates of pain prevalence and severity in adults: United States, 2012. J Pain 2015;16:769–80.
[67] Najman JM. Health and poverty: past, present and prospects for the future. Soc Sci Med 1993;36:157–66.
[68] Owery DAL. Ethnic differences in pain tolerance: clinical implications in a chronic pain population. 2001;323:316–23.
[69] Palit S, Kerr KL, Kuhn BL, Terry EL, DelVentura JL, Bartley EJ, Shadlow JO, Rhudy JL. Exploring pain processing differences in native americans. Heal Psychol 2013;32:1127–36.
[70] Patrick L, D'Eon J. Social support and functional status in chronic pain patients. Can J Rehabil 1996;9:195–201.
[71] Peat G, Thomas E, Handy J, Croft P. Social networks and pain interference with daily activities in middle and old age. PAIN 2004;112: 397–405.
[72] Pickering G. Age differences in clinical pain states. In: Gibson SJ, Weiner DK, editors. Pain in older persons. Seattle: IASP Press, 2005. p. 67–85.
[73] Popescu A, LeResche L, Truelove EL, Drangsholt MT. Gender differences in pain modulation by diffuse noxious inhibitory controls: a systematic review. PAIN 2010;150:309–18.
[74] Portenoy RK, Ugarte C, Fuller I, Haas G. Population-based survey of pain in the United States: differences among white, African American, and Hispanic subjects. J Pain 2004;5:317–28.
[75] Radloff L. The CES-D scale a self-report depression scale for research in the general population. Appl Psychol Meas 1977;1:385–401.
[76] Radloff L. Center for epidemiologic studies-depressed mood scale (CES-D). In: Fische J, Corcoran K, editors. Measures for clinical practice and research: a sourcebook. New York: Oxford University Press, 2007. p. 139–40.
[77] Reyes-Gibby CC, Aday LA, Todd KH, Cleeland CS, Anderson KO. Pain in aging community-dwelling adults in the United States: non-Hispanic Whites, non-Hispanic Blacks, and Hispanics. J Pain 2007;8:75–84.
[78] Riley JL, King CD, Wong F, Fillingim RB, Mauderli AP. Lack of endogenous modulation and reduced decay of prolonged heat pain in older adults. PAIN 2010;150:153–60.
[79] Robinson MJ, Edwards SE, Iyengar S, Bymaster F, Clark M, Katon W. Depression and pain. Front Biosci 2009;14:5031–51.
[80] Rottenberg Y, Jacobs JM, Stessman J. Prevalence of pain with advancing age brief report. J Am Med Dir Assoc 2015;16:264.e1–264.e5.
[81] Rowell LN, Mechlin B, Ji E, Addamo M, Girdler SS. Asians differ from non-Hispanic whites in experimental pain sensitivity. Eur J Pain 2011;15: 764–71.
[82] Ruehlman LS, Karoly P, Newton C. Comparing the experiential and psychosocial dimensions of chronic pain in African Americans and Caucasians: findings from a national community sample. Pain Med 2005; 6:49–60.
[83] Shaked D, Williams M, Evans MK, Zonderman AB. Indicators of subjective social status: differential associations across race and sex. SSM Popul Health 2016;2:700–7.
[84] Shavers VL, Bakos A, Sheppard VB. Race, ethnicity, and pain among the U.S. Adult population. J Health Care Poor Underserved 2010;21: 177–220.
[85] Sibille KT, Langaee T, Burkley B, Gong Y, Glover TL, King C, Riley JL, Leeuwenburgh C, Staud R, Bradley LA, Fillingim RB. Chronic pain, perceived stress, and cellular aging: an exploratory study. Mol Pain 2012;8:12.
[86] Stephens NM, Cameron JS, Townsend SS. Lower social class does not (always) mean greater interdependence: women in poverty have fewer social resources than working-class women. J Cross Cult Psychol 2014; 45:1061–73.
[87] Tsang A, Von Korff M, Lee S, Alonso J, Karam E, Angermeyer MC, Borges GLG, Bromet EJ, de Girolamo G, de Graaf R, Gureje O, Lepine JP, Haro JM, Levinson D, Oakley Browne MA, Posada-Villa J, Seedat S, Watanabe M. Common chronic pain conditions in developed and developing countries: gender and age differences and comorbidity with depression-anxiety disorders. J Pain 2008;9:883–91.
[88] Wandner LD, Scipio CD, Hirsh AT, Torres CA, Robinson ME. The perception of pain in others: how gender, race, and age influence pain expectations. J Pain 2012;13:220–7.
[89] Washington LL, Gibson SJ, Helme RD. Age-related differences in the endogenous analgesic response to repeated cold water immersion in human volunteers. PAIN 2000;89:89–96.
[90] Watkins DC, Assari S, Johnson-lawrence V. Race and ethnic group differences in comorbid major depressive disorder, generalized anxiety disorder, and chronic medical conditions. J Racial Ethn Heal Disparities 2015;2:385–94.
[91] Weinstein A. Brain imaging studies on the cognitive, pharmacological and neurobiological effects of cannabis in humans: evidence from studies of adult users. Curr Pharm Des 2016;22:6366–63779.
[92] Wilkinson G. WRAT-3: wide range achievement test administration manual. Wilmington: Wide Range, Inc., 1993.
[93] Woolf SH, Chapman DA, Buchanich JM, Bobby KJ, Zimmerman EB, Blackburn SM. Changes in midlife death rates across racial and ethnic groups in the United States: systematic analysis of vital statistics. BMJ Open 2018;362:k3096.
[94] Zonderman AB, Mode NA, Ejiogu N, Evans MK. Race and poverty status as a risk for overall mortality in community-dwelling middle-aged adults. JAMA Intern Med 2016;176:1394–5.