Pain Medicine, 21(10), 2020, 2123–2136
doi: 10.1093/pm/pnaa189
Advance Access Publication Date: 21 September 2020
Original Research Article

OXFORD

PAIN & AGING SECTION

Life Stressors: Elevations and Disparities Among Older Adults with Pain

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Funding sources: This work was supported by grants from the National Institutes of Health, National Institute on Aging (R21AG053593), and National Institute on Alcohol Abuse and Alcoholism (R01AA15685).

Conflicts of interest: The author has no conflicts of interest to report.

Abstract

Objective. To examine stressor elevations among older adults with pain, and gender and race disparities in the dual burdens of late-life pain and stressors. **Design.** Cross-sectional. **Setting.** Community. **Subjects.** Participants in the Longitudinal Late-Life Health study (LLLH; N = 1,884) and the Health and Retirement Study (HRS; N = 7,704). **Methods.** Pain and stressor measures were harmonized across the LLLH and HRS samples. Analyses of covariance were conducted to determine the effects of older adults' pain, gender, race, and interactions between these factors, on their stressors in nine separate life domains, and in stressors overall. **Results.** In both the LLLH and HRS samples, older adults with painful conditions (joint, back, headache, chest pain), more numerous painful conditions, more severe pain, and more pain interference had elevated stressors in all life domains, compared with older adults without or with less serious pain. Pain was more prevalent among women and nonwhites than men and whites. Stressor exposure was higher for men than women in most life domains; it was higher for nonwhites than whites in all life domains. For certain types of pain and life domains, pain and gender, as well as pain and race, interacted to predict stressor elevations. **Conclusions.** Late-life pain is associated with elevations in stressors, and there are gender and race disparities in the dual burdens of heightened pain and elevated stressors in later life. Pain and stressors are not consistently more strongly linked among older women than older men, or among older nonwhite than older white persons.

Key Words: Stressors; Pain; Older Adults; Gender; Race

Introduction

Pain is common in later life. Between 55% and 66% of late-middle-aged and older adults affirm four-week prevalence of pain [1,2]; 72% to 86% of older adults report having had pain in the last year [3–5]. Chronic and other forms of pain may increase, or reach peak levels, during later life [6–8]. The high prevalence of pain and its associated personal, social, and economic costs are expected to grow given the swelling ranks of post–World War II "baby boom" cohorts. Accordingly, it is important to further research aimed at the prediction, prevention, and effective treatment of late-life pain [9–11].

The biopsychosocial model of pain posits that pain is a product of complex interactions among biological, psychological, and social factors. This perspective has informed most pain research of the last 50 years [12–15]. Historically, however, pain research has devoted unequal attention to the three components of the biopsychosocial model of pain; biological factors have received the most research attention, followed by psychological factors, and lastly by social factors [12,14,16,17].

Only a small body of research has focused on the social environmental determinants of pain. Positive prospective associations have been demonstrated between

traumatic experiences early in life and subsequent development of chronic and musculoskeletal pain [12,18–22]. Financial hardship and living in economically disadvantaged neighborhoods have been shown to be associated with poorer pain outcomes, including slower recovery from painful injuries and the development of chronic pain [23,24]. In general, social support provided by family members and friends contributes to positive pain-related outcomes, but one specific expression of social "support," solicitousness, has been found to predict more pain-related disability [12,25]. Social relationships in the workplace and macro-level social factors related to workplace injuries (e.g., legislation and compensation systems) have been shown to influence workers' pain outcomes, including back pain and pain-related disability due to injuries [12,17,26,27].

In several of these studies, the explanatory factor for poorer pain outcomes was conceived to be "stress" [28], but this intrapersonal psychological and physiological experience, indicative of being taxed by environmental conditions [29,30], should be distinguished from *stressors*, the environmental events or circumstances that tax one's functioning and well-being [29,31]. Research on the sociology of health has substantiated that stressor elevations are associated with negative health outcomes across a range of major conditions, including cardiovascular illness, rheumatoid arthritis, cancers, and depressive symptoms, among people of all ages [29,32–34]. Thus, one might expect to find a positive association between stressors and pain. However, it appears no research has examined the relationship between life stressors and pain among older adults.

Research on the sociology of health also has shown that stressor exposures and poorer health outcomes are unequally distributed in the population, varying by demographic factors, including gender and race [34,35], and that vulnerability to poorer health outcomes as a result of stressor exposure varies by gender and race [36–38]. Accordingly, gender and race are important factors to consider in examining pain and stressors among older adults.

With respect to pain, studies of mixed-age and older samples have shown that women have more pain-related medical conditions, such as musculoskeletal disorders, headaches, fibromyalgia, and widespread pain, than do men. However, there is inconsistent evidence regarding gender differences in pain severity and pain interference [39–43]. Studies of mixed-age samples generally show that prevalence rates of chronic pain and pain-related medical conditions are higher among whites than nonwhites, though there is mixed evidence for race-related differences in pain frequency, intensity, and interference [44–46].

With respect to stressor exposure, gender differences have been reported, but they occur only within specific stressor domains rather than globally (i.e., as reflected in overall composite stressor measure scores [47]. For example, McDonough and Walters [37] found that, compared with men, women experienced more stressors in the domains of social life, work life, children, and family health, but had fewer stressors in the domain of finances. Similarly, McLeod and associates [36] reported that women had more stressors involving illness and death of close family members, friends, and pets than did men, but they were less likely to report stressors involving victimization and finances.

Little research has addressed whether nonwhites have higher stressor exposures than do whites. In a 2007 review of the literature, Hatch and Dohwenrend [47] concluded that exposure to negative life events is higher among African Americans and other racial/ethnic minorities than among majority whites. Consistent with this, Sternthal and colleagues [38] found a higher overall number of stressors among African Americans and Hispanics than among non-Hispanic whites. These stressor exposure differences held across a variety of life domains including early-life trauma, negative life events, finances, interpersonal relationships, and neighborhood/community.

The differential stressor vulnerability hypothesis [48,49] suggests that the strength of the association between stressors and poor health outcomes, such as chronic medical conditions and psychological distress, is stronger among women than men and among nonwhites compared with whites. As concerns gender, there is some support for this hypothesis: Stressors and negative health outcomes are sometimes more strongly associated for women than for men (e.g., [36,37,50,51]), but these differential, gender-related associations are found only in certain life domains and for certain health outcomes [48]. Regarding race, Sternthal and associates [38] found no evidence to support the differential vulnerability hypothesis.

In sum, no contemporary theoretical models feature physical and social environmental factors, including stressors, as important correlates of late-life pain. To further such models, this investigation examines data from two large, existing studies of health and aging in order to establish that late-life pain and stressors are linked, to determine whether late-life pain and stressors are unequally distributed by gender and by race, and to test the proposition that, whereas pain and stressors are linked for all older adults, older women and older nonwhite adults with pain are especially likely to experience stressor elevations. By inference, previous research findings suggest the following predictions: 1) older adults with various types of pain (back, joint, headache, chest), more numerous painful conditions, more severe pain, and pain interference will have elevated stressors in multiple life domains, and overall, compared with older adults with no or less serious pain; 2) there will be gender- and race-related disparities in the distributions of older adults' pain and stressors; specifically, a) pain will be more prevalent among older women than older men; older women

will differ from older men in their stressor exposures, though this will vary by life domain; and b) both pain and stressors will be elevated among older nonwhites compared with older whites; and 3) pain will interact with gender and race to predict stressor elevations. Specifically, pain will be associated with stressor elevations among all older participants, but especially among older women and among older nonwhite adults.

These predictions were tested in two separate, large community samples of older adults in which pain and stressors were assessed using identical or very similar measures. This provided an opportunity to harmonize the pain and stressor measures across the two samples, then to determine whether relationships between pain and stressors found in one of the samples could be reproduced in the other. Such reproduction across harmonized data sets can increase confidence in study findings.

Method

Samples

The samples for this investigation were drawn from two parent investigations of aging and health: Longitudinal Late-Life Health (LLLH) and the Health and Retirement Study (HRS).

The LLLH was a 20-year longitudinal study of 1,884 late-middle-aged community residents from Northern California. Data for this investigation were collected through mailed surveys and interviews, for a total of six waves of data collection, the first beginning in 1986–1988 and the last occurring in 2006–2008. At baseline assessment, LLLH participants were between the ages of 55 and 65, almost 90% white, and comparable to similarly aged national community samples with respect to health characteristics (for further details on the LLLH baseline sample, see [52,53]).

For the present investigation, data from two LLLH subsamples were analyzed: a) the overall baseline sample of 1,884 individuals, from whom information was obtained about presence of joint, back, headache, and chest pain, but not about pain severity and pain interference, and b) a subsample of 690 of the original 1,884 participants who, seven years after baseline assessment, provided for the first time information about their pain severity and pain interference.

The Health and Retirement Study (HRS) has conducted longitudinal biennial health assessments ("core interviews") of nationally representative samples of adults age 50+ since 1992 [54–56]. In 2006, the HRS began for the first time to collect psychosocial data from study participants, including information about their stressors in the domains of childhood/adolescent trauma, neighborhood environment, work, finances, and interpersonal relationships with spouses, children, extended family members, and friends [57]. The HRS sample for this investigation comprises the 7,703 older adults who completed the 2006 HRS psychosocial questionnaire; all of these participants also had completed the 2006 HRS core interview (for further details regarding the HRS design and measures, see [55,56]).

Measures

Demographic Characteristics

In both the LLLH and HRS samples, baseline measures of demographic characteristics included age, in years, and gender (0 = male, 1= female). The LLLH and HRS samples were predominately white (91% and 83%, respectively). Due to this very skewed distribution, race was dichotomized as 0 = white, 1 = nonwhite.

Pain

In both the LLLH and HRS samples, participants were assessed for presence (0 = no, 1 = yes) of each of four types of pain: joint, back, headache, and chest pain; number of painful conditions was a count of these painful conditions, categorized as 1 = none or only one and 2 = two or more. In the LLLH study, pain severity and pain interference were assessed with two SF-12 Health Survey items [58]: "How much bodily pain have you had in the past month?" (rated 0 = none to 5 = very severe) and "During the past month, how much did pain interfere with your normal activities (including activities inside and outside your home)?" (rated 0 = not at all to 4 = extremely). In the HRS study, pain severity was rated on a scale of 0 (none) to 3 (severe), and pain interference was assessed with a single item asking participants whether their pain made it difficult for them to engage in their usual activities (0 = no, 1 = yes). To make the LLLH and HRS measures of pain severity commensurate, they were dichotomized: low pain severity = 0 (no to mild pain); high pain severity = 1 (moderate to very severe pain). To make the pain interference measures commensurate, the LLLH measure of pain interference was dichotomized as 0 = no and 1 = yes.

Life Stressors

A measure of negative life events was not available in the HRS data. However, given the historical importance of using measures of negative life events to predict health-related outcomes, this measure was used in the present study. In the LLLH sample, negative life events were measured using the Life Stressors and Social Resources Inventory (LISRES [59,60]), which is a count of 33 possible non-health-related negative events (e.g., death of a loved one, moving, having a car or home burglarized) that had occurred in the past year. Negative, health-related events were excluded from this measure because of their potential overlap with the pain measures used in this study.

In the LLLH sample, early-life trauma was measured by a count of eight items (e.g., school, legal, work, interpersonal problems) from the early-life section of Lemke

and associates' [61] life history of stressors inventory. In the HRS sample, it was measured by a count of four items (school, legal problems, parental addiction, physical abuse) from Krause and colleagues' measure of lifetime trauma before age 18 [62].

In the LLLH sample, neighborhood stressors were assessed by four LISRES items (e.g., houses maintained, streets clean); in the HRS sample, they were assessed with five items (e.g., area clean, safe to walk) from the Mendes de Leon et al. [63] measure of neighborhood disorder. In the LLLH sample, work stressors were assessed with three LISRES items (work pressure, rushed work, unpleasant physical work conditions), and in the HRS with three items (work pressure, work fast, and physically demanding work [57]). Financial stressors were assessed in the LLLH sample with six items from the LISRES (e.g., sufficient money for medical care, entertainment, a large unexpected bill), and in the HRS study they were assessed with the Campbell et al. [64] measure of financial strain, the answer to the question "How difficult is it for you to meet your monthly payments?" rated on a scale of 0 = not at all to 4 = very difficult.

In both the LLLH and HRS samples, chronic interpersonal stressors were assessed with six LISRES items (e.g., lack of empathy, critical, disappointing), within four life domains (spouse, children, extended family, and friends). In both samples, a composite measure of overall stressors was calculated by summing participants' stressor scores across the domains of neighborhood, work, finances, and interpersonal stressors involving spouse, extended family, and friends, then dividing the sum by the number of nonmissing domains (e.g., some participants did not complete the work stressor section of the LISRES because they were retired; some were not partnered due to divorce or widowhood, so they did not complete the spouse section of the LISRES). In both the LLLH and HRS samples, the individual stressor domain measures were only moderately intercorrelated; these measures have good reliability and validity [52,57,59–61].

Statistical Analyses

First, descriptive statistics were used to determine the demographic and pain characteristics of the LLLH and HRS samples. Next, analyses of covariance were conducted to compare mean stressor levels of participants: a) with and without joint, back, headache, and chest pain, b) with lower and higher numbers of painful conditions, c) with lower and higher levels of pain severity, and d) with and without pain interference, after statistically adjusting for age, gender, and race. These demographic factors were chosen as covariates because of their known associations with both stressors and pain. Next, analyses of covariance were conducted to determine the main effects of pain characteristics and gender, and interactions between them, on participants' overall stressors, after statistically adjusting for age and race. The same analyses were conducted to determine the main and interactive effects of pain characteristics and race on participants' overall stressors, after statistically adjusting for age and gender. Finally, subsidiary analyses of covariance were conducted to determine interactions of pain and gender, and pain and race, on stressors within each of nine separate stressor domains (negative life events, early-life trauma, neighborhood, work, finances, spouse, children, extended family, and friends), after statistically adjusting for relevant demographic factors. All of the analyses were conducted using SPSS 26 statistical software.

Table 1. Demographic and pain characteristics of the LLLH and HRS samples

	LLLH M (SD) or %	HRS M (SD) or %
Demographic characteristics		
Age, y	61.4 (3.2)	67.6 (10.7)
Female	37.3	58.8
Nonwhite	9.4	17.2
Pain characteristics		
Joint pain	48.7	60.1
Back pain	37.6	37.1
Headache pain	15.6	10.3
Chest pain	20.4	5.8
No. of painful conditions		
0	30.9	29.0
1	32.4	37.3
2+	36.6	33.7
Pain severity		
Lower	60.3	75.6
Higher	39.7	24.4
Pain interference	55.6	21.7

For pain severity: lower = no or mild pain; higher = moderate to very severe pain.
LLLH = Longitudinal Late-Life Health study; HRS = Health and Retirement Study.

Results

Sample Characteristics

Table 1 shows the demographic and pain characteristics of the LLLH and HRS samples. Compared with the LLLH sample, the HRS sample was somewhat older (61 vs 68 years) and comprised more women (37% vs 59%) and nonwhite (9% vs 17%) participants.

Joint pain was common in both samples (49% and 60%, respectively), as was back pain (about 37%). Between 10% and 16% of participants reported headache pain. Chest pain was reported by about 20% of the LLLH sample and 6% of the HRS sample. In both samples, about 30% of participants had none of these painful conditions; 32% of the LLLH sample and 37% of the HRS sample had only 1 of them. About 37% of the LLLH sample and 34% of the HRS sample had 2 or more of the painful conditions.

Almost 40% of participants in the LLLH sample experienced higher levels of pain severity; this was true for

about 24% of the HRS sample. Pain interference occurred for over half of the LLLH sample and about 22% of the HRS sample.

Stressors by Type of Painful Condition

Table 2 compares stressor levels, in multiple life domains, of participants with joint, back, headache, and chest pain, with those of participants reporting none of these types of pain, statistically adjusting for age, gender, and race, in the LLLH and HRS samples. Negative life events were not measured in the HRS sample, but in the LLLH sample participants who had joint, back, headache, and chest pain had almost twice as many non-health-related negative life events, such as death of a loved one, loss of job, or an accident during the past 12 months, as participants who experienced none of these types of pain.

Levels of early-life trauma, which included death of someone close, problems at school, and serious interpersonal problems during adolescence, were elevated among participants in the LLLH sample who had joint, back, headache, and chest pain, compared with participants who were free of all of these types of pain. In the HRS sample, levels of early-life trauma, which included school or legal problems, parental addiction, or physical abuse before the age of 18, were significantly elevated among participants with joint, back, headache, and chest pain relative to participants who had none of these types of pain.

Similarly, in both the LLLH and HRS samples, participants with each of these four types of painful conditions reported elevated neighborhood stressors, such as unclean streets, unsafe walking conditions, and problems with neighbors, as compared with participants without back, joint, headache, or chest pain. With the exception of participants in the HRS who reported chest pain, participants in both the LLLH and HRS samples who reported having back, joint, headache, and chest pain had significantly higher levels of work stressors, which included pressured and unpleasant physical work conditions, compared with participants free of these painful conditions.

In addition, in both samples, participants with joint, back, headache, and chest pain had significantly more financial stressors than those without these types of pain. They also had significant elevations in chronic interpersonal stressors in the domains of spouse, children, extended family, and friends and higher scores on the composite measure of overall stressors.

Stressors by Number of Painful Conditions, Pain Severity, and Pain Interference

Table 3 compares the stressors of participants with lower and higher levels of number of painful conditions and pain severity and the stressors of participants with and without pain interference, after statistically adjusting for age, gender, and race. In both the LLLH and HRS samples, across stressor domains, participants with two or more painful conditions had more stressors than did participants with no or only one painful condition.

In the LLLH sample, participants' negative life events, early-life trauma, neighborhood stressors, and work stressors were not measured during the data collection wave at which their pain severity and pain interference were assessed, so stressors in these domains cannot be compared with those found in the HRS sample. However, in the HRS sample, stressors in the domains of early-life trauma, work, finances, spouse, children, extended family, and friends, and overall, were all elevated among participants with higher compared with lower levels of pain severity. Moreover, stressors in all of these domains were higher among people who reported that pain was interfering with their daily activities and sleep than among those without pain interference.

For the stressor domains of finances, chronic interpersonal stressors involving spouses, children, extended family, and friends, and the overall composite measure of stressors, the HRS sample results reproduced those found in the LLLH sample. In each of these domains, stressors were higher among participants with higher compared with lower levels of pain severity and among those who experienced pain interference compared with those with no pain interference.

Pain Characteristics, Gender, and Stressor Elevations

In the LLLH sample, women were more likely than men to have joint, back, and headache pain: 54% vs 46%, 40% vs 37%, and 18% vs 14%, respectively. However, chest pain was less prevalent among women than men: 18% vs 22%. Women also were more likely to have two or more painful conditions (40% vs 35%), higher levels of pain severity (43% vs 38%), and pain that interfered with their daily activities and sleep (59% vs 53%). Of these gender differences, those for prevalence of joint, headache, and chest pain and number of painful conditions were statistically significant ($\chi^2 = 11.67$, $P < 0.01$; $\chi^2 = 5.15$, $P < 0.01$; $\chi^2 = 5.20$, $P < 0.01$; and $\chi^2 = 5.41$, $P < 0.02$, respectively).

A similar pattern of differences was found in the HRS sample. Women were more likely than men to have joint, back, and headache pain (65% vs 53%, 39% vs 34%, and 13% vs 7%, respectively) but about the same prevalence of chest pain (6%). Women were more likely to have two or more painful conditions (37% vs 29%), report higher levels of pain severity (28% vs 20%), and report that pain interfered with their daily activities and sleep (25% vs 18%). Except for chest pain prevalence, all of these group differences were statistically significant ($\chi^2 = 122.78$, $P < 0.01$; $\chi^2 = 19.98$, $P < 0.01$; $\chi^2 = 80.98$, $P < 0.01$; $\chi^2 = 0.39$, $P = 0.28$; $\chi^2 = 62.37$, $P < 0.01$; $\chi^2 = 60.07$, $P < 0.01$; $\chi^2 = 49.23$, $P < 0.01$, respectively).

Table 2. Stressor levels among older adults with joint, back, headache, and chest pain, adjusting for age, gender, and race

	Joint Pain									
	LLLH					HRS				
Stressor Domains	N	Without, M (SE)	With, M (SE)	F	*P* Value	N	Without, M (SE)	With, M (SE)	F	*P* Value
Negative life events	1,437	2.13 (0.12)	3.73 (0.19)	120.61	0.000	–	-	–	–	–
Early-life trauma	1,438	0.34 (0.04)	0.47 (0.03)	5.94	0.015	6,867	0.26 (0.01)	0.35 (0.01)	34.80	0.000
Neighborhood	1,418	1.88 (0.09)	2.55 (0.07)	38.26	0.000	6,643	6.84 (0.13)	8.10 (0.09)	64.13	0.000
Work	612	5.26 (0.18)	6.19 (0.15)	16.25	0.000	2,295	3.60 (0.06)	3.83 (0.06)	6.98	0.008
Financial	1,435	3.33 (0.19)	4.94 (0.14)	46.75	0.000	6,723	0.83 (0.02)	1.07 (0.01)	92.37	0.000
Chronic interpersonal										
Spouse	1,130	5.69 (0.21)	6.72 (0.16)	15.79	0.000	4,718	4.63 (0.09)	5.12 (0.06)	21.53	0.000
Child	1,219	6.35 (0.20)	6.87 (0.15)	4.11	0.043	6,175	3.85 (0.08)	4.40 (0.05)	35.78	0.000
Extended family	1,330	8.12 (0.18)	8.58 (0.14)	4.23	0.040	6,410	4.13 (0.07)	4.66 (0.05)	36.01	0.000
Friends	1,435	6.69 (0.15)	7.30 (0.11)	11.22	0.001	6,273	3.35 (0.06)	3.70 (0.04)	23.03	0.000
Overall stressors	1,426	5.33 (0.10)	6.20 (0.07)	51.69	0.000	6,669	3.92 (0.04)	4.50 (0.03)	112.61	0.000
	Back Pain									
Stressor Domains	N	Without, M (SE)	With, M (SE)	F	*P* Value	N	Without, M (SE)	With, M (SE)	F	*P* Value
Negative life events	1,229	2.14 (0.12)	3.70 (0.10)	104.38	0.000	-	–	–	–	–
Early-life trauma	1,230	0.35 (0.04)	0.52 (0.04)	9.62	0.002	5,059	0.28 (0.01)	0.39 (0.01)	40.14	0.000
Neighborhood	1,216	1.90 (0.08)	2.47 (0.07)	26.66	0.000	4,906	6.85 (0.12)	8.21 (0.11)	65.70	0.000
Work	542	5.27 (0.17)	6.19 (0.17)	14.68	0.000	1,919	3.68 (0.06)	3.90 (0.07)	5.91	0.015
Financial	1,227	3.39 (0.19)	4.99 (0.16)	41.92	0.000	4,965	0.85 (0.02)	1.20 (0.02)	148.20	0.000
Chronic interpersonal										
Spouse	963	5.67 (0.21)	7.00 (0.18)	24.04	0.000	3,584	4.64 (0.08)	5.26 (0.08)	29.17	0.000
Child	1,041	6.38 (0.20)	7.17 (0.17)	8.76	0.003	4,526	4.01 (0.08)	4.76 (0.07)	52.91	0.000
Extended family	1,145	8.16 (0.18)	8.96 (0.16)	11.05	0.001	4,750	4.26 (0.07)	4.97 (0.06)	52.82	0.000
Friends	1,227	6.73 (0.15)	7.47 (0.12)	15.31	0.000	4,588	3.43 (0.06)	3.87 (0.05)	31.21	0.000
Overall stressors	1,222	5.36 (0.10)	6.35 (0.08)	62.92	0.000	4,922	4.00 (0.04)	4.70 (0.04)	144.00	0.000
	Headache Pain									
Stressor Domains	N	Without, M (SE)	With, M (SE)	F	*P* Value	N	Without, M (SE)	With, M (SE)	F	*P* Value
Negative life events	815	2.13 (0.11)	4.02 (0.15)	105.89	0.000	–	–	-	–	–
Early-life trauma	815	0.35 (0.04)	0.58 (0.06)	9.38	0.002	3,022	0.30 (0.01)	0.43 (0.02)	26.23	0.000
Neighborhood	808	1.89 (0.09)	2.55 (0.12)	20.06	0.000	2,942	6.85 (0.12)	8.89 (0.21)	67.85	0.000
Work	373	5.27 (0.17)	6.62 (0.27)	18.30	0.000	1,335	3.70 (0.06)	4.07 (0.12)	7.68	0.006
Financial	812	3.36 (0.18)	5.62 (0.24)	55.03	0.000	2,967	0.89 (0.02)	1.40 (0.004)	157.49	0.050
Chronic interpersonal										
Spouse	636	5.70 (0.21)	7.30 (0.29)	19.72	0.000	2,218	4.67 (0.09)	5.55 (0.15)	24.90	0.000
Child	636	6.41 (0.20)	7.26 (0.27)	6.36	0.012	2,688	4.16 (0.08)	4.97 (0.13)	28.34	0.000
Extended family	765	8.15 (0.18)	8.88 (0.24)	5.65	0.018	2,848	4.37 (0.07)	5.5 (0.13)	60.03	0.000
Friends	814	6.71 (0.15)	7.59 (0.20)	12.27	0.000	2,729	3.45 (0.06)	4.05 (0.10)	23.29	0.000
Overall stressors	808	5.36 (0.10)	6.59 (0.13)	59.92	0.000	2,953	4.06 (0.04)	5.08 (0.08)	135.73	0.000
	Chest Pain									
Stressor Domains	N	Without M (SE)	With M (SE)	F	*P* Value	N	Without M (SE)	With M (SE)	F	*P* Value
Negative life events	905	2.11 (0.12)	4.71 (0.14)	211.35	0.000	–	–	–	-	–
Early-life trauma	905	0.34 (0.04)	0.52 (0.05)	7.06	0.008	2,678	0.29 (0.01)	0.42 (0.03)	18.10	0.000
Neighborhood	895	1.88 (0.09)	2.67 (0.10)	36.43	0.000	2,605	6.88 (0.12)	9.04 (0.28)	49.93	0.000
Work	381	5.26 (0.17)	6.28 (0.26)	11.12	0.001	1,133	3.69 (0.06)	3.86 (0.22)	0.52	0.469
Financial	903	3.37 (0.22)	6.39 (0.22)	107.45	0.000	2,626	0.86 (0.02)	1.38 (0.05)	109.75	0.000
Chronic interpersonal										
Spouse	697	5.62 (0.21)	7.55 (0.25)	35.29	0.000	1,951	4.63 (0.08)	5.44 (0.20)	13.69	0.000
Child	760	6.38 (0.21)	7.68 (0.24)	17.17	0.000	2,384	4.06 (0.08)	5.11 (0.17)	31.81	0.000
Extended family	847	8.16 (0.18)	9.03 (0.21)	10.41	0.001	2,521	4.31 (0.07)	4.97 (0.16)	14.01	0.000
Friends	903	6.76 (0.15)	8.01 (0.18)	29.80	0.000	2,443	3.48 (0.06)	3.79 (0.13)	4.52	0.034
Overall stressors	895	5.35 (0.10)	6.91 (0.11)	111.24	0.000	2,611	4.03 (0.04)	4.94 (0.10)	72.51	0.000

For joint, back, headache, and chest pain: Without = does not have this or any of the other types of pain; With = has this type of pain.
LLLH = Longitudinal Late-Life Health study; HRS = Health and Retirement Study.

Table 3. Stressor levels among older adults by number of painful conditions, pain severity, and pain interference, adjusting for age, gender, and race

	Number of Painful Conditions									
	LLLH					HRS				
Stressor Domains	N	Lower, M (SE)	Higher, M (SE)	F	*P* Value	N	Lower, M (SE)	Higher, M (SE)	F	*P* Value
Negative life events	1,884	2.71 (0.80)	4.08 (0.10)	113.49	0.000	–	–	–	–	–
Early-life trauma	1,884	0.35 (0.03)	0.56 (0.04)	19.84	0.000	7,703	0.29 (0.01)	0.39 (0.01)	51.02	0.000
Neighborhood	1,860	2.11 (0.06)	2.58 (0.07)	25.06	0.000	7,450	7.30 (0.08)	8.43 (0.12)	60.64	0.000
Work	817	5.60 (0.12)	6.34 (0.18)	11.29	0.001	2,700	3.70 (0.04)	3.91 (0.08)	6.00	0.014
Financial	1,880	3.71 (0.12)	5.55 (0.16)	80.05	0.000	7,535	0.90 (0.01)	1.22 (0.02)	187.38	0.000
Chronic interpersonal										
Spouse	1,498	6.10 (0.14)	7.17 (0.19)	21.74	0.000	5,364	4.80 (0.06)	5.32 (0.08)	27.09	0.000
Child	1,606	6.55 (0.13)	7.18 (0.18)	8.06	0.005	6,910	4.03 (0.05)	4.74 (0.07)	72.40	0.000
Extended family	1,760	8.11 (0.12)	9.00 (0.16)	19.87	0.000	7,203	4.34 (0.05)	4.96 (0.07)	57.81	0.000
Friends	1,880	6.19 (0.10)	7.65 (0.13)	29.20	0.000	7,023	3.47 (0.04)	3.86 (0.05)	35.88	0.000
Overall stressors	1,870	5.56 (0.06)	6.55 (0.08)	90.54	0.000	7,480	4.12 (0.03)	4.75 (0.04)	159.69	0.000
	Pain Severity									
	LLLH					HRS				
Stressor Domains	N	Lower, M (SE)	Higher, M (SE)	F	*P* Value	N	Lower, M (SE)	Higher, M (SE)	F	*P* Value
Negative life events	–	–	–	–	–	–	–	–	–	–
Early-life trauma	–	–	–	–	–	7,703	0.31 (0.01)	0.40 (0.01)	34.12	0.000
Neighborhood	–	–	–	–	–	7,450	7.41 (0.08)	8.54 (0.14)	50.79	0.000
Work	–	–	–	–	–	2,700	3.67 (0.04)	4.22 (0.09)	28.52	0.000
Financial	685	3.24 (0.20)	4.73 (0.25)	22.14	0.000	7,535	0.91 (0.01)	1.32 (0.02)	257.99	0.000
Chronic interpersonal										
Spouse	518	5.81 (0.23)	6.68 (0.29)	5.47	0.020	5,364	4.84 (0.05)	5.39 (0.10)	24.76	0.000
Child	600	6.43 (0.21)	7.92 (0.27)	18.93	0.000	6,910	4.07 (0.05)	4.91 (0.08)	82.58	0.000
Extended family	598	8.70 (0.21)	9.48 (0.26)	5.44	0.020	7,203	4.39 (0.04)	5.04 (0.08)	52.36	0.000
Friends	682	7.13 (0.15)	7.95 (0.19)	11.97	0.001	7,023	3.52 (0.04)	3.85 (0.06)	20.47	0.000
Overall stressors	676	6.30 (0.13)	7.34 (0.16)	26.23	0.000	7,484	4.17 (0.03)	4.85 (0.05)	157.63	0.000
	Pain Interference									
	LLLH					HRS				
Stressor Domains	N	No, M (SE)	Yes, M (SE)	F	*P* Value	N	No, M (SE)	Yes, M (SE)	F	*P* Value
Negative life events	–	–	–	–	–	–	–	–	–	–
Early-life trauma	–	–	–	–	–	7,703	0.30 (0.01)	0.41 (0.01)	45.33	0.000
Neighborhood	–	–	–	–	–	7,450	7.40 (0.08)	8.71 (0.15)	62.45	0.000
Work	–	–	–	–	–	2,700	3.68 (0.04)	4.23 (0.10)	25.81	0.000
Financial	685	2.92 (0.23)	4.55 (0.21)	27.44	0.000	7,535	0.91 (0.01)	1.35 (0.02)	262.32	0.000
Chronic interpersonal										
Spouse	518	5.64 (0.27)	6.56 (0.25)	6.37	0.012	5,364	4.81 (0.05)	5.56 (0.10)	42.07	0.000
Child	600	6.00 (0.25)	7.82 (0.22)	30.08	0.000	6,910	4.08 (0.05)	4.96 (0.09)	82.62	0.000
Extended family	598	8.63 (0.24)	9.31 (0.22)	4.31	0.038	7,203	4.38 (0.04)	5.15 (0.08)	67.35	0.000
Friends	682	6.95 (0.17)	7.87 (0.16)	15.48	0.000	7,023	3.51 (0.04)	3.93 (0.07)	29.82	0.000
Overall stressors	676	6.03 (0.15)	7.25 (0.14)	38.18	0.000	7,484	4.17 (0.03)	4.93 (0.05)	180.22	0.000

For joint, back, headache, and chest pain: No = does not have this or any of the other types of pain; Yes = has this type of pain. For number of painful conditions: lower = 0–1 painful conditions; higher = 2+ painful conditions. For pain severity: lower = no or mild pain; higher = moderate to very severe pain.

LLLH = Longitudinal Late-Life Health study; HRS = Health and Retirement Study.

Table 4 shows the main effects of pain characteristics and gender, as well as the interactions of pain characteristics by gender, on elevations in the overall composite measure of stressors, after statistically adjusting for age and race, in the LLLH and HRS samples. As shown by values under the columns for men and women in the LLLH and HRS samples, with the exception of HRS participants with chest pain, men consistently had higher overall stressor levels than women. These main effects of gender on overall stressor levels were statistically significant to at least $P < 0.014$.

In the LLLH sample, as shown by the rows within types of pain (e.g., joint: no, yes), for both men and women, overall stressors were elevated for those with each type of pain (joint, back, headache, chest), higher number of painful conditions, higher pain severity, and pain interference. All of these main effects of pain on overall stressors were statistically significant at $P < 0.000$.

Table 4. Stressors overall among men and women by painful condition, pain severity, and pain interference, adjusting for age and race

		LLLH								
					M.E. Gender		M.E. Pain		Interaction Gender by Pain	
Pain Characteristics		N	Men, M (SE)	Women, M (SE)	F	*P* Value	F	*P* Value	F	*P* Value
Joint		1,426			13.39	0.000	46.29	0.000	0.69	0.41
	No		5.47 (0.12)	5.12 (0.16)						
	Yes		6.42 (0.10)	5.86 (0.11)						
Back		1,222			14.71	0.000	55.48	0.000	1.07	0.30
	No		5.50 (0.12)	5.14 (0.16)						
	Yes		6.59 (0.11)	5.96 (0.13)						
Headache		808			9.59	0.002	55.93	0.000	0.76	0.38
	No		5.50 (0.12)	5.14 (0.16)						
	Yes		6.84 (0.17)	6.20 (0.19)						
Chest		895			6.04	0.014	99.44	0.000	0.03	0.87
	No		5.47 (0.12)	5.13 (0.16)						
	Yes		7.05 (0.14)	6.64 (0.20)						
No. of painful conditions		1,870								
	Lower		5.75 (0.08)	5.23 (0.11)	30.67	0.000	83.00	0.000	0.59	0.44
	Higher		6.81 (0.11)	6.13 (0.13)						
Pain severity		676			10.03	0.002	25.05	0.000	0.00	0.96
	Lower		6.56 (0.16)	5.89 (0.21)						
	Higher		7.59 (0.21)	6.94 (0.25)						
Pain interference		676			11.72	0.001	36.81	0.000	0.11	0.74
	No		6.33 (0.18)	5.56 (0.25)						
	Yes		7.49 (0.17)	6.86 (0.21)						
		HRS								
					M.E. Gender		M.E. Pain		Interaction Gender by Pain	
Pain Characteristics		N	Men, M (SE)	Women, M (SE)	F	*P* Value	F	*P* Value	F	*P* Value
Joint		6,669			18.40	0.000	108.43	0.000	2.12	0.145
	No		4.01 (0.06)	3.79 (0.06)						
	Yes		4.59 (0.05)	4.43 (0.04)						
Back		4,922			10.62	0.001	137.87	0.000	3.47	0.063
	No		4.16 (0.06)	3.86 (0.06)						
	Yes		4.75 (0.06)	4.66 (0.05)						
Headache		2,953			13.06	0.000	121.05	0.000	0.26	0.610
	No		4.22 (0.62)	3.93 (0.61)						
	Yes		5.31 (0.14)	4.92 (0.87)						
Chest		2,611			0.41	0.52	68.33	0.000	4.43	0.035
	No		4.18 (0.06)	3.89 (0.06)						
	Yes		4.85 (0.15)	5.00 (0.13)						
No. of painful conditions		7,484								
	Lower		4.25 (0.04)	4.03 (0.04)	11.96	0.001	146.79	0.000	0.51	0.476
	Higher		4.83 (0.07)	4.69 (0.05)						
Pain severity		7,484			15.61	0.000	153.61	0.000	1.42	0.233
	Lower		4.26 (0.04)	4.10 (0.04)						
	Higher		5.03 (0.08)	4.74 (0.06)						
Pain interference		7,484			8.57	0.003	164.05	0.000	0.09	0.765
	No		4.28 (0.04)	4.09 (0.04)						
	Yes		5.02 (0.09)	4.86 (0.06)						

For joint, back, headache, and chest pain: No = does not have this or any of the other types of pain; Yes = has this type of pain. For number of painful conditions: lower = 0–1 painful conditions; higher = 2+ painful conditions. For pain severity: lower = no or mild pain; higher = moderate to very severe pain.

LLLH = Longitudinal Late-Life Health study; HRS = Health and Retirement Study.

In the LLLH samples, mean values showed a pattern in which overall stressors were lowest among women having little or no pain and highest among men reporting painful conditions, more numerous painful conditions, more severe pain, and pain interference, but there were no statistically significant interactions between gender and pain on overall stressor levels. As shown in the bottom section of Table 4, almost all of the main and interaction effects found in the HRS sample reproduced those found in the LLLH sample.

Table 6 summarizes the results of subsidiary analyses to determine the interactions of pain and gender on

stressors within each of the nine separate stressor domains. As shown in the top half of the table, all of the types of pain, and number of painful conditions, interacted with gender to predict stressors in five of the nine specific stressor domains. Having painful conditions was associated with higher elevations in negative life events, financial stressors, and spouse stressors for women compared with men. In contrast, they were associated with higher elevations in friend stressors for men than for women. Whereas back pain was linked to higher levels of work stressors among men compared with women, chest pain was associated with elevated work stressors among women compared with men.

Pain Characteristics, Race, and Stressor Elevations

In the LLLH sample, nonwhites were somewhat more likely than whites to have joint, back, headache, and chest pain: 52% vs 48%, 44% vs 37%, 23% vs 15%, and 22% vs 20%, respectively. Nonwhites also were more likely to have two or more painful conditions (46% vs 36%), to have higher levels of pain severity (49% vs 39%), and to report that pain interfered with their daily activities and sleep (64% vs 55%). These group differences were statistically significant for back and headache pain and number of painful conditions ($\chi^2 = 3.82$, $P < 0.05$; $\chi^2 = 7.20$, $P < 0.01$; and $\chi^2 = 6.68$, $P < 0.01$, respectively).

These findings were partially reproduced in the HRS sample. In the HRS sample, there were no differences between nonwhites and whites in prevalence of joint pain, back pain, number of painful conditions, or higher pain severity (about 60%, 37%, 34%, and 24%, respectively, in both groups). However, nonwhites were more likely to report headache (12% vs 10%), chest pain (7% vs 6%), and pain interference (24% vs 21%); the differences for headache pain and pain interference reached statistical significance ($\chi^2 = 7.32$, $P < 0.01$; and $\chi^2 = 3.35$, $P < 0.05$, respectively).

Table 5 describes the effects of pain characteristics, race, and their interaction, on the composite measure of overall stressors, after statistically adjusting for age and gender, in the LLLH and HRS samples. In the LLLH sample, consistently across types of pain, number of painful conditions, pain severity, and pain interference, nonwhite participants had higher overall stressor levels than white participants. This finding was reproduced in the HRS sample.

In both samples, the lowest stressor levels were found among whites with little or no pain, and the highest stressor levels occurred among nonwhites who affirmed joint, back, headache, and chest pain and those with more numerous painful conditions, more severe pain, and pain interference. Only back pain, in interaction with nonwhite race, was statistically significant at $P < 0.05$.

Subsidiary analyses revealed that some statistically significant interactions between pain and race predict stressor elevations in specific life domains: Back pain, headache, and chest pain were associated with especially elevated stressors in the domains of finances, neighborhood, and extended family for nonwhite participants with pain.

Discussion

Almost no research has focused on social determinants of pain, though recent studies have demonstrated associations between social environmental factors, such as early-life trauma, financial hardship, disordered neighborhoods, and problematic work conditions, and poorer pain outcomes, including the development of musculoskeletal, chronic, and debilitating pain and slower recovery from painful injuries [12,17–27]. However, none of these investigations has conceptualized the adverse social and physical environmental circumstances in their studies as "stressors," examined stressors across a variety of life domains, or focused on the relationship between pain and stressors among older adults.

Consistent with research on the sociology of health, showing positive associations between stressors and negative health outcomes across a range of major medical conditions and symptoms [29,32–34], this investigation demonstrated elevations in stressors across multiple life domains among older adults with pain. Compared with older adults without joint, back, headache, or chest pain, older adults with these conditions had elevated stressors in all of the life domains we examined: negative life events, early-life trauma, work, finances, spouse, children, extended family, and friends, and in overall stressors. Moreover, older adults with more numerous painful conditions, more severe pain, and pain that interfered with daily activities and sleep also experienced stressor elevations in all of these life domains. Almost all of these findings reproduced across two large community samples, lending strength to the conclusion that pain and stressors are linked in later life.

However, because the data were cross-sectional, the direction of causality in this association is unknown. On one hand, the positive associations found here may reflect the negative impacts of older adults' pain on their social contexts [65]. On the other, they may indicate that stressors influence the development and maintenance of late-life pain. Likely the effects are reciprocal and perhaps, temporally, tightly bound. In this regard, physical pain and social pain have been shown to share common neural substrates [66,67]; this may help explain why people with more exposure to early-life trauma have more physical pain later in life [68,69]. This commonality may also account for simultaneous elevations in people's physical pain and their perceptions of elevated stressors, especially in the domains of interpersonal stressors involving family and friends. Further longitudinal research

Table 5. Stressors overall among white and nonwhite participants by painful condition, pain severity, and pain interference, adjusting for age and gender

		LLLH								
					M.E. Race		M.E. Pain		Interaction Race by Pain	
Pain Characteristics		N	White, M (SD)	Nonwhite, M (SD)	F	*P* Value	F	*P* Value	F	*P* Value
Joint		1,426			11.62	0.001	17.71	0.000	0.20	0.660
	No		5.27 (0.10)	5.94 (0.37)						
	Yes		6.12 (0.08)	6.99 (0.23)						
Back		1,222			23.89	0.000	36.68	0.000	4.25	0.039
	No		5.28 (0.10)	5.93 (0.36)						
	Yes		6.20 (0.09)	7.99 (0.25)						
Headache		808			10.60	0.001	27.84	0.000	0.58	0.450
	No		5.29 (0.10)	5.95 (0.36)						
	Yes		6.48 (0.14)	7.54 (0.34)						
Chest		895			8.73	0.003	38.87	0.000	0.22	0.640
	No		5.29 (0.10)	5.96 (0.37)						
	Yes		6.83 (0.12)	7.75 (0.36)						
No. of painful conditions		1,870								
	Lower		5.49 (0.07)	6.12 (0.22)	30.00	0.000	52.03	0.000	3.51	0.061
	Higher		6.42 (0.09)	7.71 (0.25)						
Pain severity		676			5.96	0.015	7.82	0.005	0.00	0.999
	Lower		6.23 (0.13)	7.15 (0.51)						
	Higher		7.27 (0.17)	8.18 (0.51)						
Pain interference		676			6.15	0.013	8.10	0.005	0.17	0.680
	No		5.95 (0.15)	7.06 (0.59)						
	Yes		7.19 (0.14)	7.99 (0.44)						
		HRS								
					M.E. Race		M.E. Pain		Interaction Race by Pain	
Pain Characteristics		N	White, M (SE)	Nonwhite, M (SE)	F	*P* Value	F	*P* Value	F	*P* Value
Joint		6,669			166.05	0.000	82.75	0.000	2.47	0.120
	No		3.79 (0.05)	4.58 (0.11)						
	Yes		4.33 (0.03)	5.34 (0.07)						
Back		5,922			142.89	0.000	102.94	0.000	2.73	0.100
	No		3.86 (0.05)	4.66 (0.11)						
	Yes		4.52 (0.04)	5.58 (0.10)						
Headache		2,953			88.10	0.000	109.14	0.000	3.56	0.059
	No		3.91 (0.05)	4.73 (0.11)						
	Yes		4.85 (0.08)	6.08 (0.16)						
Chest		2,611			59.70	0.000	59.88	0.000	2.82	0.093
	No		3.89 (0.05)	4.71 (0.10)						
	Yes		4.72 (0.11)	5.98 (0.22)						
No. of painful conditions		7,484								
	Lower		3.98 (0.03)	4.83 (0.07)	224.49	0.000	119.95	0.000	4.65	0.031
	Higher		4.56 (0.04)	5.69 (0.10)						
Pain severity		7,484			170.43	0.000	89.66	0.000	0.00	0.990
	Lower		4.01 (0.03)	4.95 (0.07)						
	Higher		4.69 (0.05)	5.64 (0.11)						
Pain interference		7,484			157.67	0.000	104.54	0.000	0.01	0.930
	No		4.01 (0.03)	4.95 (0.07)						
	Yes		4.77 (0.06)	5.70 (0.12)						

For joint, back, headache, and chest pain: No = does not have this or any of the other types of pain; Yes = has this type of pain. For number of painful conditions: lower = 0–1 painful conditions; higher = 2+ painful conditions. For pain severity: lower = no or mild pain; higher = moderate to very severe pain.

LLLH = Longitudinal Late-Life Health study; HRS = Health and Retirement Study.

is needed to address the causal direction of relationships between life stressors and pain among older adults.

Notably, the stressor elevations found among older adults with pain were relatively modest. Compared with biological and psychological determinants of pain, stressful environmental circumstances may have weaker and less direct associations with older adults' pain. Further research should be aimed at understanding the indirect pathways, via key physiological and psychological processes, through which stressful life circumstances result in adverse pain outcomes for older adults. For example, physiological and psychological reactivity to stressors,

Table 6. Summary of interactions of pain with gender and race, within specific stressor domains, in the LLLH and HRS samples

Stressor Elevations by Pain Characteristics and Gender

		Mean Stressors in Pain, Gender Groups				Interaction Gender by Pain‡	
Pain Characteristics	Stressor Domain	No, Men	Yes, Men	No, Women	Yes, Women	F	*P* Value
Joint	Finances*	0.81	0.99	0.82	1.13	7.38	0.007
Back	Negative life events†	2.14	3.38	2.12	4.20	7.01	0.008
	Work†	5.21	6.52	5.36	5.60	4.65	0.031
	Finances*	0.85	1.01	0.85	1.26	7.98	0.005
	Friends†	7.16	8.23	6.04	6.27	4.58	0.033
Headache	Friends†	7.14	8.48	6.06	6.29	4.75	0.030
Chest	Negative life events†	2.13	4.21	2.11	5.71	16.60	0.000
	Work*	3.87	3.63	3.50	4.23	4.40	0.036
	Finances*	0.56	1.21	0.87	1.53	9.71	0.002
	Spouse*	4.41	4.76	4.89	6.28	5.74	0.017
No. of painful conditions	Finances*	0.87	1.12	0.92	1.28	4.88	0.027

Stressor Elevations by Pain Characteristics and Race

		Mean Stressors in Pain, Race Group				Interaction Race by Pain§	
Pain Characteristics	Stressor Domain	No, White	Yes, White	No, Nonwhite	Yes, Nonwhite	F	*P* Value
Back	Finances†	3.20	4.60	4.86	8.71	7.28	0.007
Headache	Neighborhood*	6.27	8.06	9.53	12.65	4.73	0.030
Chest	Extended family*	4.32	4.75	4.29	5.85	6.74	0.010

For joint, back, headache, and chest pain: No = does not have this or any of the other types of pain; Yes = has this type of pain. For No. of painful conditions: no = 0 or 1; yes = 2 or more.

*HRS sample is the source of the interaction effect.

†LLLH sample is the source of the interaction effect.

‡These interaction effects adjusted for age and race.

§These interaction effects adjusted for age and gender.

including inflammatory, immunologic, emotional, and cognitive responses to stressors, may mediate relationships between older adults' stressors and their pain outcomes. Similarly, future research should focus on identification of the key moderating factors that account for variation in the strength of the relationship between late-life stressors and pain. For instance, some research has shown that sense of control is a key moderator of the impacts of older adults' stressors on their levels of depressive symptoms and cognitive function [70,71]. Research on these mediating and moderating factors can lead to discovery of factors that can be modified to help prevent or minimize the effects of late-life stressors on older adults' pain outcomes.

As predicted, in both the LLLH and HRS samples there were gender and race disparities in the distributions of pain and stressors. Consistent with previous findings from mixed-age and older samples [39–43], older women generally exceeded older men in prevalence of painful conditions, number of painful conditions, pain severity, and pain interference. Several biological and psychological mechanisms may help explain these differences, including, at the biological level, hormonal, cortical processing and endogenous opioid system differences between women and men and, at the psychological level, gender differences in pain coping strategies, catastrophizing, and adoption of stereotypic gender roles [39,42].

Across all categories of pain, overall stressors were higher for men than women. However, certain types of pain (joint, back, chest, more numerous painful conditions) were associated with especially pronounced stressor elevations for women, but only in certain stressor domains (negative life events, finances, work, spouse); for men, back and headache pain were associated with especially strong stressor elevations in the domains of work and friends. This is only partly consistent with previous findings suggesting that whereas women have more stressors in social domains, such as relationships with family and friends, men have more in the domains of work and finances [36,37,47]. However, it is consistent with the observation that whatever gender differences there are in stressor exposures and in associations between health-related variables and stressors, they appear to vary by specific stressor domain [48].

Past studies have yielded inconsistent findings regarding race differences in pain prevalence, intensity, and interference [44–46]. This study demonstrated a higher prevalence of painful conditions, more numerous painful conditions, higher pain severity, and more pain interference among nonwhite than white older adults. Similar to findings reported by Stenthal and colleagues [38], nonwhite older adults also consistently reported higher elevations in stressors across each of the individual stressor domains. For older nonwhite adults, back pain, headache, and chest pain appear associated with especially

pronounced elevations in stressors in the domains of finances, neighborhood, and extended family. Taken together, these results suggest a need for further research on gender- and race-related disparities in the distributions of, and connections between, late-life pain and stressors, focusing on their manifestations within specific domains of pain and stressors.

This study has several limitations. Foremost, its cross-sectional design precludes inferences about the direction of causality between older adults' pain and stressors. Also, the results describe pain and stressors among mainly white, "younger old" community residents; it is not known how they generalize to specific minority race and ethnic groups and to "older old" and institutionalized older adults. This investigation's pain measures had limitations. For example, although the presence of back pain was assessed, no information was obtained about the frequency, severity, or chronicity of a participant's back pain.

Notwithstanding its limitations, this study has several strengths. It was comprised of two large samples of older community residents assessed with established measures of pain and life stressors. Because these measures were identical or very similar in the two samples, they could be harmonized, then used to establish the reproducibility of relationships found in the samples. As yet there is no consensus on the best methods to judge successful reproduction of study results [72], but according to one criterion established by the Open Science Collaboration [73], shared statistical significance of effects, this investigation clearly demonstrated substantial overlap between findings obtained in the LLLH and HRS samples.

This study also provides preliminary evidence, and points the way toward future research, that may eventually translate to clinical and public health practices to prevent and modify associations between late-life stressors and pain. For example, screening procedures might be employed to identify older adults whose stressors and demographic and psychosocial characteristics put them at elevated risk of poorer pain outcomes. Interventions targeting key mediators and moderators of the pain–stressor relationship, such as physiological and cognitive responses to stressors and sense of control, might be developed to diminish associations between late-life stressors and pain.

In conclusion, this study adds significantly to the body of pain research that highlights the importance of the social component of the biopsychosocial model for furthering knowledge of the etiology, consequences, and prevention of pain. It extends earlier research by demonstrating connections between older adults' pain and stressor elevations, gender- and race-related disparities in these elevations, and the domain specificity with which pain and gender, and pain and race, interact to predict stressor elevations. Finally, this investigation maps out future research directions toward the eventual development of clinical and public health interventions aimed at disrupting links between stressors and pain in later life.

Acknowledgments

I am grateful to Sonya SooHoo for her assistance developing the data files used in this investigation and for her help with manuscript preparation.

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