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Psychological Predictors of Perceived Age and Chronic Pain Impact in Individuals with and without Knee Osteoarthritis

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Abstract

Objective—Chronological age is a risk factor in chronic pain; however, aging research supports the premise that physical and psychological health may better predict perceived age. Given the lack of evidence on perceived age in the context of chronic pain, the current study presents novel findings about the relationship between perceived age, chronic pain impact, and psychological function in adults with and without knee osteoarthritis.

Methods—This secondary analysis was part of an ongoing multi-site observational cohort study to understand the progression of knee pain and disability. Community-dwelling adults (N=227) ages 45+ completed measures of trait resilience, trait positive and negative affect, pain catastrophizing, subjective perceptions of age, and the Graded Chronic Pain Scale.

Results—On average, participants reported feeling 10 years younger than their chronological age; however, this effect was attenuated in individuals reporting high-impact pain. Lower perceived age was associated with lower pain impact (low pain/low disability), while higher perceived age correlated with higher pain impact (high pain/high disability) and more adverse psychological effects. Using hierarchical linear regression, high-impact pain and positive affect emerged as statistically significant predictors of perceived age, whereas no differences were observed among trait resilience, negative affect, or pain catastrophizing.

Discussion—These findings highlight the importance of a biopsychosocial approach in understanding the intersection between psychological and physical factors associated with chronic

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pain. Addressing negative self-perceptions of aging, while simultaneously augmenting positive affect, through psychological therapies may mitigate pain and disability.

Keywords

chronic pain; high-impact pain; osteoarthritis; positive affect; perceived age

Introduction

The global population of older adults is rapidly increasing and is expected to amount to 2.1 billion persons by 2050.[1] This social demographic transformation will result in increasing risks for chronic health conditions such as osteoarthritis (OA). In particular, the prevalence of knee OA has more than doubled over the past several decades, giving rise to unprecedented levels of high-impact chronic pain and disability.[2,3] High-impact chronic pain is characterized by persistent pain resulting in significant levels of interference and restriction of participation in work, social, and self-care activities for at least six months or longer.[4,5] Identifying and understanding the characteristics of persons with substantial life interference and pain intrusion from high-impact chronic pain is of national significance.[4]

Age is a risk factor for the development and progression of OA and chronic pain.[6,7] Some contend, however, that chronological age lacks precision in representing the aging process and the subsequent health deterioration associated with growing older.[8] Rather, perceived (i.e., subjective) age is postulated to be a more robust predictor of physical and psychological function in older adults.[9,10] Perceived age measures self-perception of age/aging by evaluating how “old” individuals feel, think, appear, and act/behave,[8,11–13] and several studies have highlighted key associations between this construct and a range of health-related outcomes. In particular, older perceived age is related to higher risk of mortality,[14–16] chronic illness,[17] bodily pain,[18–19] impairment in activities of daily living,[18,20] and poorer cognitive functioning and self-rated health.[18,21] These risks also extend biologically, as subjectively feeling older is linked to obesity,[22] systemic inflammation,[23] greater concentrations of cystatin C,[41] and decreased regional gray matter volume.[24] Together, these findings suggest that feeling older than one’s chronological age may reflect aging-related biological and cellular health changes, such that perceived age could be a more sensitive indicator of not only aging, but one’s current health condition.[8,24]

While most research has focused on health correlates of perceived age, there is also emerging evidence that psychological factors are associated with perceived age. For instance, individuals high in optimism,[25,26] extroversion and openness to experience, [27–28] well-being,[18,25] and self-efficacy[26,28–29] report more youthful subjective ages, while greater depressive symptoms have been observed among those with an older perceived age.[19–20,30] In a diary study, Kotter-Grühn et al.[31] found that daily variability in negative affect was predictive of older perceived age. Others have shown that concurrent increases in positive affect and decreases in negative affect over a four-year period reduced perceptions of felt age,[32] signifying that temporal changes in emotional affect are likely to influence perceived age attributions.

The negative impact of chronic pain on physical and psychosocial well-being is overwhelmingly high.[4,33] In a recent study of Korean older adults, lower pain intensity was correlated with, but not predictive of, younger subjective age.[19] However, it is important to note that participants in this study reported low levels of current pain (3/10), suggesting that the association between perceived age and pain may be stronger once pain becomes more intrusive. Indeed, having a younger perceived age may protect against the detrimental effects of high-impact chronic pain, whereas feeling older could increase a person's risk for aging-related health problems and negative psychological functioning. Yet, to our knowledge no published research has investigated the role of perceived age in a chronic pain population, despite the association of perceived age with psychological factors that are known to correlate with chronic pain (e.g., resiliency measures, positive and negative affect).[11,31–32,34–35] Therefore, the purposes of this analysis are to: (1) determine differences in perceived age across pain impact (i.e., high/low pain intensity and high/low disability) and (2) identify psychological predictors (i.e., trait resilience, positive affect, negative affect, pain catastrophizing) of perceived age. Our hypotheses were:

H1: Individuals with knee OA reporting high pain impact, as evidenced by greater pain and disability, would also report greater perceived age.

H2: Psychological predictors would uniquely predict perceived age, above and beyond pain impact, such that negative affect and pain catastrophizing would positively correlate with older perceived age and trait resilience and positive affect would be inversely associated.

Methods

Participants and Procedures

This secondary data analysis included individuals from a large, community-based, multisite (University of Florida and University of Alabama at Birmingham) prospective case-control cohort study examining ethnic differences in central pain processing and disability among individuals with or at risk for unilateral or bilateral knee OA (Understanding Pain and Limitations in Osteoarthritic Disease-2 [UPLOAD-2] Study, 2015–2017). Participants (N=227) with and without knee OA aged 45–85 who self-identified as non-Hispanic and "Black/African American" (NHB) or "White/Caucasian/European" (NHW) were recruited from the community using multiple methods such as flyer postings throughout the community, radio and print media announcements, orthopedic clinic recruitment, and word-of-mouth referral.

Approval for study procedures was obtained from the Institutional Review Boards at the University of Florida and University of Alabama at Birmingham. Participants' eligibility for study inclusion was determined through a telephone screening, and participants met inclusion criteria if they had knee pain and screened positive for symptomatic knee OA[36] or reported no knee pain (i.e., control cohort). Our screening method was designed to be sensitive in designating individuals as having clinical knee OA.[37] In addition, all participants were negative for rheumatologic conditions (e.g., rheumatoid arthritis) or knee injuries that could explain knee pain. Given the extensive variability in defining and classifying OA, we adopted an inclusive approach that would foster our ability to understand factors associated with a broad range of OA characteristics (mainly knee pain), from very early signs to more advanced disease. The study design also included a non-knee OA control group. Participants in this group were included if they reported mild pain (i.e., GCPS Grade I) in the past 6 months, with the stipulation that it resulted in no more than mild interference with daily activities. This was done to increase the generalizability of our findings as many adults in this age range experience occasional, non-pathologic knee pain. Exclusion criteria included the following health conditions: 1) prosthetic knee replacement or other major surgery to the arthritic knee; 2) history of symptomatic heart disease or cardiac event; 3) peripheral neuropathy; 4) systemic rheumatologic conditions (e.g., rheumatoid arthritis, systemic lupus erythematosus); 5) long-term daily opioid use; or 6) hospitalization within the preceding year for any psychiatric disorder. Additional information on the screening, inclusion/exclusion criteria, and study procedures have been reported previously.[38] All participants provided written informed consent and were compensated for study participation.

Measures

Demographics—The following sociodemographic and physical health data were acquired: chronological age, self-reported sex, ethnic and racial identity, income, education, marital status, employment, body mass index (BMI), and a medical health history. Height was assessed to the nearest cm using a wall stadiometer and body weight was measured to the nearest 0.1 kg using a digital scale. Calculation of BMI was determined by weight in kilograms divided by height in meters squared.

Perceived Age Questionnaire (PAQ)—Perceived age was measured using the 4-item personal age questionnaire developed by Kastenbaum et al.[39] and further validated by Goecke and Kunze.[56] To assess perceived age (i.e., feeling, appearance, activities, interests),[39] participants were asked: "Most people seem to have other ages besides their official or date of birth age. The questions that follow have been developed to find out about your unofficial age. Please tell us which age you feel you are by placing age (in years) in the blank for each question." Statements included, "I feel as though I am ( ) years old," "I look as though I am ( ) years old," "I do most things as though I were ( ) years old," and "My interests are mostly those of a person ( ) years old." In the current sample, Cronbach's α for this measure was high (α=0.80). Based upon a principal component analysis (see data analysis section), items were combined into a composite score using the mean from all four questions. A difference score was computed by subtracting chronological age from perceived age. A negative value indicated younger perceived age, while positive values denoted older perceived age. Values of zero signify that perceived age is equal to chronological age.

Graded Chronic Pain Scale (GCPS)—The 7-item GCPS was used to assess current, worst, and average knee pain during the past six months (pain intensity score), as well as the degree to which knee pain has interfered with daily activities (disability score). Thus, the GCPS serves as the measure of pain impact for these analyses.[33] Items were averaged and multiplied by 10 to generate index scores for pain intensity and disability, with higher scores indicating greater symptomatology. These 7 items were used to generate 5 hierarchical categories: grade 0 to grade IV.[40] Based upon previous specifications, categories were dichotomized to denote low pain impact (GCPS grades I and II) or high pain impact (GCPS grades III or IV).[33] Control subjects (GCPS grade 0) were analyzed separately.

Brief Resilience Scale (BRS)—The BRS is a 6-item self-report questionnaire that examines the ability to recover, or "bounce back", from stress and adapt to stressful situations.[41] Each item ranges from 1 (strongly disagree) to 5 (strongly agree), with higher scores indicative of greater psychological resilience.

Positive and Negative Affect Schedule (PANAS)—As a measure of trait affect, participants indicated the frequency to which they generally experience 10 positive (e.g., enthusiastic) and 10 negative (e.g., distressed) feelings.[42] These 20 items are rated on a 5-point scale ranging from 1 (very slightly or not at all) to 5 (extremely) with a total subscale ranging from 10 to 50. It yields two scores, one for positive affect (PA) and one for negative affect (NA).

Coping Strategies Questionnaire-Revised (CSQ-R)—The CSQ-R is used to measure patients' use of pain coping strategies.[43–44] There are seven subscales consisting of six cognitive strategies and one behavioral strategy; however, this study only used the 6-item pain catastrophizing sub-scale (e.g., It is terrible, and I feel it is never going to get any better; I feel I can't stand it anymore). Participants use a 7-point Likert scale from 0 (never do that) to 6 (always do that) to rate how often they use each strategy to cope with pain including having pain-related catastrophic thoughts.

Data Analysis

Data were analyzed using SPSS 24.0 (IBM, Chicago, IL). Prior to data analysis, a principal component analysis was conducted to determine whether the four items of the PAQ formed a unidimensional measure. The analysis revealed the presence of a single-dimension solution (item loadings between .56 and .75), accounting for 62.1% of the variance in scores (Kaiser-Meyer-Olkin=.76; Bartlett's Test of Sphericity=<.001). Therefore, the feeling, appearance, activities, and interest age items were combined into a perceived age composite score using the mean from all four questionnaires. Differences across pain impact groups for sociodemographic and clinical characteristics were examined using chi-square for categorical variables and analysis of variance for continuous variables. Given group differences in age, race, income, education, marital status, employment, and BMI, these variables were dummy coded (categorical only) and included as covariates in subsequent analyses. Study site was also included as a covariate to account for sociodemographic differences between participants at UF and UAB, and due to a significant site difference in perceived age ($F[1, 225]=16.48$, $p \leq 0.001$; Mdiff=5.57; UF: M=−12.30; UAB: M=−6.73). Bivariate correlations were conducted to examine interrelationships among sociodemographic variables, psychological function (trait resilience, positive and negative affect, pain catastrophizing), perceived age, and pain impact. Multivariate analysis of variance/covariance models were used to examine differences in perceived age and psychological variables as a function of pain impact group. Unadjusted and adjusted (controlling for sociodemographic covariates) models were analyzed for comparison. Multiple linear regression analyses were conducted to examine the unique contribution of psychological functioning measures to self-reported perceived age (dependent variable). Chronological age, race, income, education, marital status, employment, BMI, and study site location were entered into the first block of the regression; pain impact group was entered into the second block; trait resilience, positive affect, negative affect, and pain catastrophizing were entered into the final block. Pain impact was dummy-coded such that the control group was the referent group for comparison. For all analyses, listwise deletion was used such that cases with missing data on any of the predictor or criterion variables were omitted. To obtain effect size estimates, partial eta squared (η_p^2) was calculated from generalized linear model analyses (η_p^2: small=0.01, medium=0.06, and large=0.14). Significance was set at p<.05 (two-tailed).

Results

Participant Characteristics

There was a total of 274 participants, but 47 (17%) were excluded due to missing data (no pain: n=5; low pain impact: n=11; high pain impact: n=8), thus leaving 227 participants for the analysis. Demographic and clinical characteristics are presented in Table 1 for the overall sample and across pain impact groups. In general, the majority of participants were female and NHW, with a mean age of 57.9 years. Thirty-six percent of the sample had an income less than $20,000 per annum and over 58% had a college degree. Most participants were unmarried and not employed, with a BMI in the obese range (M=31.4 kg/m^2). Approximately one-third (34.4%) of the sample reported pain and disability consistent with high impact pain. Comparing across groups, individuals with high impact pain were more likely to be younger, NHB, have a lower income, unmarried, and not employed. Additionally, individuals in the high pain impact group had a higher BMI than individuals in the control and low pain impact groups and reported significantly greater pain intensity and disability on the GCPS. The proportions of men and women did not significantly differ across pain impact groups. Approximately 83.7% of the sample (n=190) reported a younger perceived versus chronological age.

Bivariate Correlations

Table 2 presents bivariate correlations among sociodemographic and key study variables. Feeling older than one’s chronological age was associated with higher BMI (p=.002), as well as younger actual age (p<.001). Higher pain impact was significantly associated with lower income (p<.001) and education (p=.004), unemployment (p=.001), and higher BMI (p=.002). Further, there were modest correlations with race (p=.001) and marital status (p<.001), such that NHBs and married participants demonstrated higher pain impact. Amongst key variables, older perceived age was associated with greater negative affect (p<.001), pain catastrophizing (p<.001), and pain impact (p=.001), and was inversely associated with trait resilience (p<.001) and positive affect (p<.001). Pain impact demonstrated small to large positive correlations with negative affect and pain catastrophizing (ps<.001), and a small negative correlation with trait resilience (p=.002).

Pain Impact Group Differences across Study Measures

Table 3 presents unadjusted and adjusted analyses for group comparisons across study variables. In unadjusted analyses, significant group differences emerged for perceived age (p=.001), trait resilience (p=.009), negative affect (p<.001), and pain catastrophizing (p<.001), but not for positive affect (p=.143). While participants generally perceived their age as lower than their chronological age (M=−10.3 years, SD=10.2), this difference was smaller for the high pain impact group, relative to the control (p=.001) and low pain impact groups (p=.005). Pairwise comparisons revealed that negative affect was greater among those with high impact pain, relative to controls (p<.001) and individuals with low impact pain (p=.001). Further, trait resilience was lower among the high pain impact group relative to controls (p=.002). Significant differences emerged across all pain groups for pain catastrophizing (ps<.01). After adjusting for relevant covariates, these effects remained for perceived age (p=.049) and pain catastrophizing (p<.001); however, significant differences were only found for perceived age when comparing across the high pain impact and control groups (p=.015).

Prediction of Perceived Age by Psychological Variables

Hierarchical multiple regression was used to assess the contribution of psychological measures (trait resilience, positive affect, negative affect, pain catastrophizing) to perceived age, after controlling for the influence of sociodemographic characteristics (Table 4). Chronological age, race, income, education, marital status, employment, BMI, and study site were entered into Step 1, explaining 18% of the variance in perceived age (F=5.85, p<.001). When entered into the second block, pain impact (dummy-coded) contributed an additional 2% to the model, above and beyond the contribution of sociodemographic factors (FΔ=3.07, p=.049). In particular, there was a significant and positive relationship between high pain impact (when compared to the control group) and perceived age (p=.015), but not with low pain impact (p=.255). After entry of trait resilience, positive affect, negative affect, and pain catastrophizing at Step 3, the total variance explained by the model was 25.8% (F=5.12, p<.001). The five psychological measures explained an additional 5.4% of the variance in perceived age (FΔ=3.76, p=.006), with only positive affect emerging as a significant predictor (p=.006). Specifically, higher levels of positive affect were associated with feeling younger than one's chronological age. In a post-hoc analysis, given the significant correlation between perceived age and positive affect, when controlling for positive affect, there is still a significant difference in perceived age across pain impact groups in both adjusted and unadjusted analyses.

Discussion

With longer life expectancies, discrepancies between chronological and perceived age are increasing[18,28] although many adults across the chronological continuum are living with multiple physical, mental, and cognitive health conditions.[18] Our study is one of the first to extend the literature on perceived age by specifically exploring the relationship with pain impact. Aligning with study hypotheses, we found several significant relationships between perceived age and pain impact: (1) adults generally reported feeling younger than their chronological age; however, individuals with high pain impact reported older perceived age,

(2) perceived age was correlated with numerous demographics, clinical, and psychological factors, and (3) high-impact pain and positive affect were the most robust predictors of perceived age.

As in previous studies,[8,18,45] our results show that a majority of participants (84%) identified with a younger age identity. On average, younger perceived age was noted across all pain groups; however, this difference was attenuated for individuals with higher pain impact. This is worth noting given that a moderate proportion of our sample reported high-impact pain, signaling the importance of assessing perceived age, particularly in individuals with more severe and disabling pain. In addition, our hypotheses were supported in that older perceived age was associated with negative factors such as higher BMI, negative affect, and high-impact pain. Further, more NHBs were represented in the high-impact pain group compared to NHWs, suggesting that NHBs with OA experience greater levels of pain and disability. Combined, these sociodemographic characteristics may exacerbate chronic pain, and as chronic pain fluctuates and/or progressively worsens, perceived age likely becomes less temporally stable and more prone to increases.[8]

More importantly, we found evidence to suggest that high-impact pain is a predictor of perceived age. Chronic pain associated with greater severity and more disability could activate a greater sense of awareness of the aging process and make age more salient to individuals suffering. Choi and colleagues reported that individuals only within the 70–79 age group compared to 65–69 and 80+ age groups were more likely to feel older due to experiencing more pain and functional impairments.[18] It is possible that chronic pain primes individuals to feel older or that societal stereotypes of chronic pain drive individuals to assume poorer perceived health and perceptions of age. Theoretical conceptualizations suggest that perceived age varies across the lifespan and contextually across domains and levels of physiological and psychological function,[8,10] and is driven by multiple cognitive, functional, and social predictors.[20,30,46] Therefore, high-impact pain may produce psychological and biological burdens that alter cognition, thereby facilitating negative self-perceptions and evaluations of aging. Kotter-Grühn and colleagues presume that persons who report younger subjective ages may be biologically or functionally more youthful and be subjected to less or slower adverse aging and weathering experiences.[8] This aspect of self-concept may be indicative of the incongruence between chronological age and perceived age that is accelerated by the demands of high-impact chronic pain. The demands of chronic pain may further exhaust the cognitive, emotional, and spiritual resources necessary to refrain from negative internalization of chronic pain and to adequately control pain, further depleting coping reserves and the ability to maintain functioning, health, and a younger age identity.[47] Thus, perceived age, in the context of chronic pain, may lend powerful insight into subjective weathering, which contends that aging, or older perceptions of self, is a key element of the stress process.[47–48] This aspect of aging warrants attention because recent research shows a high correlation between mortality and poorer pain outcomes,[49–50] but furthermore, perceived age may be a robust “biomarker of aging” or proxy therein to predict mortality (and/or survival) especially in individuals with higher perceived ages.[15–16,51] Together, older perceived age and greater pain impact may synergistically increase risk for mortality.[14]

We hypothesized that positive and negative psychological factors would anchor perceived age in a direction-dependent manner. Correlations revealed that older perceived age was associated with greater negative affect and pain catastrophizing and was inversely associated with trait resilience and positive affect. Cruz-Almeida and colleagues demonstrated through cluster analysis that individuals with knee OA with high optimism had low pain and disability, negative affect, and pain vigilance whereas those with low optimism exhibited more negative outcomes – low positive affect, more pain vigilance, pain and disability, and greater pain sensitivity.[19] Interestingly, positive affect was the only psychological variable shown to be a key predictor of lower perceived age in our study (also shown by Choi et al. [18]), even after controlling for sociodemographic characteristics and pain impact. This supports our view that positive affect and better psychological well-being may serve as a protective mechanism or a positive outcome of perceived age in response to positive stereotypes[8,18] and better self-perceived health, as operationalized by less disabling chronic pain. It is plausible that greater positive affect has a stronger effect on perceived age given that older adults tend to prefer processing positive information (positivity effect) as compared to negative stimuli.[26] This positive affect bias may be better explained according to Fredrickson's Broaden-and-Build Theory of Positive Emotions which purports that positive emotions can broaden a person's momentary range of thoughts-actions-behaviors and increase their capacity for building resources that mitigate negative age-related perceptions.[25] As a result, positive affect may facilitate the utilization of cognitive and mental resources that result in positive health-related behaviors.[52] In contrast, feeling older may decrease overall psychological well-being and limit an adult's ability to engage in key activities necessary to control high-impact pain and prevent intrusion of pain on daily life. For instance, older adults are more likely to feel significantly younger on days when they have a greater sense of control over events in their lives.[53] In so, on days when adults feel older, they may also experience greater pain and less positive affect.

We posit that lower perceived age is advantageous for aging adults, and interventions to optimize positive factors may benefit older adults. Mitigating high-impact chronic pain will require multi-level interventions that address physical and psychological well-being. Although psychological interventions have small effects in reducing pain and pain catastrophizing in older adults,[54] cognitive-behavioral interventions might uniquely benefit from focusing on attenuating negative perceptions of aging and enhancing positive affect. Intervening on these factors to reduce the burden attached to pain may also require manipulation and re-framing of self-perceptions and perceptions/expectations of pain.[8] Future research should also consider testing resilience-based interventions in older adults with high-impact knee OA pain. Given our findings that positive affect is uniquely associated with perceived age, important next steps will be to determine if positive factors contribute above and beyond negative factors. More specifically, a crucial directive will be to examine the interactions, potential mediators, and neuropsychosocial mechanisms between select demographic factors, perceived age and pain, and psychological outcomes in individuals with low- and high-impact pain.

Strengths and Limitations

Several strengths and limitations are worth noting. The examination of perceived age is a relatively untapped area of pain research and contributes novel and foundational evidence about a multi-factor problem affecting aging individuals, that being high-impact chronic pain. Our analysis was exploratory and based on cross-sectional data which limit our interpretations. Second, our study population consisted of NHBs and NHWs who were primarily female; therefore, it is unclear whether results are generalizable to other racial/ethnic and gender groups with knee pain associated with OA. In particular, men and other racial/ethnic groups with diverse cultural beliefs may perceive age/aging and psychological well-being differently,[55] warranting different intervention approaches to reduce the impact of pain. Next research steps may also include examining differences across a range of demographics. Furthermore, our ability to characterize participants by pain impact was limited to one self-report measure of pain and disability. More objective measures of activity limitation and restriction may help characterize the level of functional limitations and disability. In the present study, we were unable to determine the effect of temporal changes in perceived age and subsequent influence on high-impact pain. A longitudinal study could better assess daily and/or momentary variation in perceived age and its associations with health predictors using ecological momentary assessment.

Conclusion

In sum, this is the first study to examine an increasingly recognized public health problem (high-impact pain) in the context of perceived age, and our findings highlight the importance of and strong association between positive affect and self-perceptions of aging. Given the dearth of literature in this area, future research is warranted to identify potential mediators of perceived age and chronic pain impact. Overall, this research may serve as a catalyst for isolating the mechanisms that promote positive evaluations of age identity and could facilitate the development of more targeted therapeutic treatments that optimize pain management among older adults.

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Table 1.

Demographic characteristics of the sample

	All (N=227)	Controls (N=57)	Low Impact (N=92)	High Impact (N=78)	Group Comparison
Characteristics	**M or N (SD or %)**	**M or N (SD or %)**	**M or N (SD or %)**	**M or N (SD or %)**	**p**
Chronological Age (years)	57.9 (8.2)	57.9 (9.1)	59.6 (8.0)	55.8 (7.3)	.009**
Sex					.951
Female	148 (65.2)	38 (66.7)	59 (64.1)	51 (65.4)	
Male	79 (34.8)	19 (33.3)	33 (35.9)	27 (34.6)	
Race					.002**
Black/African American	106 (46.7)	20 (35.1)	37 (40.2)	49 (62.8)	
White/Caucasian	121 (53.3)	37 (64.9)	55 (59.8)	29 (37.2)	
Income[1]					<001**
<$20,000	81 (35.7)	12 (21.1)	23 (25.0)	46 (59.0)	
$20,000– 39,999	43 (18.9)	12 (21.1)	19 (20.7)	12 (15.4)	
$40,000– 59,999	39 (17.2)	12 (21.1)	21 (22.8)	6 (7.7)	
$60,000– 99,999	35 (15.4)	12 (21.1)	13 (14.1)	10 (12.8)	
>$100,000	26 (11.5)	9 (15.8)	14 (15.2)	3 (3.8)	
Education					.003**
Some High School	12 (5.3)	1 (1.8)	2 (2.2)	9 (11.5)	
High School Degree	83 (36.6)	14 (24.6)	38 (41.3)	31 (39.7)	
Associates or Bachelors	90 (39.6)	26 (45.6)	33 (35.9)	31 (39.7)	
Graduate/Professional	42 (18.5)	16 (28.1)	19 (20.7)	7(9.0)	
Marital Status[1]					<001**
Married	85 (37.4)	27 (47.4)	44 (47.8)	14 (17.9)	
Not Married	139 (61.2)	28 (49.1)	47 (51.1)	64 (82.1)	
Employment					.004**
Employed	106 (46.7)	34 (59.6)	47 (51.1)	25 (32.1)	
Not Employed	121 (53.3)	23 (40.4)	45 (48.9)	53 (67.9)	
BMI (kg/m^2)	31.4 (7.4)	29.5 (7.3)	30.8 (7.0)	33.5 (7.6)	.006**
Testing Site					.392
UF	146 (64.3)	35 (61.4)	64 (69.6)	47 (60.3)	
UAB	81 (35.7)	22 (38.6)	28 (30.4)	31 (39.7)	
GCPS					
Characteristic Pain Intensity	42.8 (29.6)	6.5 (10.6)	42.9 (20.0)	69.2 (18.1)	<001**
Disability Score	35.1 (33.1)	1.4 (4.6)	25.3 (19.4)	71.2 (21.9)	<001**
Grading Chronic Pain Grade					<001**
Grade 0 (no pain)	34 (15.0)	34 (59.6)	—	—	
Grade I (low pain intensity)	80 (35.2)	23 (40.4)	57 (62.0)	—	
Grade II (high pain intensity)	35 (20.6)	—	35 (38.0)	—	

	All (N=227)	Controls (N=57)	Low Impact (N=92)	High Impact (N=78)	Group Comparison
Characteristics	**M or N (SD or %)**	**M or N (SD or %)**	**M or N (SD or %)**	**M or N (SD or %)**	**p**
Grade III (moderate disability)	50 (29.4)	—	—	50 (64.1)	
Grade IV (high disability)	28 (16.5)	—	—	28 (35.9)	

Note.

* p < .05

** p < .01.

[1] Some data not reported.

N=sample size; M=mean; SD=standard deviation; BMI=body mass index; UF=University of Florida; UAB=University of Alabama at Birmingham; GCPS=Graded Chronic Pain Scale. Ethnicity is non-Hispanic for both race groups.

Table 2.

Bivariate associations between study variables

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	Chronological Age	—													
2.	Sex	−.11	—												
3.	Race	.18**	−.02	—											
4.	Income	.16*	.11	.18**	—										
5.	Education	.17**	.02	.21**	.45**	—									
6.	Marital Status	−.09	.05	−.19**	−.42**	−.19**	—								
7.	Employment	−.35**	.17*	−.04	.40**	.20**	−.11	—							
8.	BMI	−.23**	.18**	−.18**	−.11	−.07	.10	.05	—						
9.	Perceived Age	−.36**	.00	−.12	−.03	−.12	.08	.09	.21**	—					
10.	Trait Resilience	.21**	−.03	.02	.27**	.15*	−.24**	.10	−.09	−.25**	—				
11.	Positive Affect	.21**	.04	−.01	.17*	.12	−.13*	.07	−.12	−.29**	.49**	—			
12	Negative Affect	−.34**	.04	−.11	−.28**	−.16*	.23**	−.10	.18**	.24**	−.55**	−.34**	—		
13.	Pain Catastrophizing	−.25**	.02	−.30**	−.38**	−.32**	.30**	−.14*	.25**	.26**	−.41**	−.22**	.55**	—	
14.	Pain Impact	−.11	−.01	−.22**	−.32**	−.19**	.26**	−.22**	.21**	.23**	−.20**	−.13	.28**	.50**	—

Note.

* $p \leq .05$

** $p \leq .01$.

Race coded: 0=Black/African American, 1=White/Caucasian; Income coded: 0=<$20,000, 1=≥$20,000; Education coded: 0=≤high school degree, 1=college degree; Marital coded: 0=married, 1=not married; Employment coded: 0=not employed, 1=employed; BMI=body mass index.

Table 3.

Descriptive and inferential statistics for study variables across pain impact group

		Unadjusted					Adjusted				
	All (N=227)	Controls (N=57)	Low Impact (N=92)	High Impact (N=78)			Controls (N=57)	Low Impact (N=92)	High Impact (N=78)		
	M (SD)	M (SD)	M (SD)	M (SD)	*F*	η_p^2	M (SD)	M (SD)	M (SD)	*F*	η_p^2
Perceived Age	−10.3(10.2)	−12.9(11.4)	−11.4(9.1)	−7.0(9.8)	6.74**	0.06	−12.4(11.2)	−11.2(8.8)	−7.3(9.6)	3.07*	0.03
Trait Resilience	3.8(0.7)	4.0(0.7)	3.8(0.7)	3.6(0.8)	4.79**	0.04	4.0(0.7)	3.8(0.7)	3.6(0.8)	1.94	0.02
Positive Affect	35.1(7.8)	36.8(7.4)	34.8(7.7)	34.2(8.1)	1.96	0.02	36.8(7.3)	34.6(7.7)	34.1(8.1)	1.57	0.01
Negative Affect	15.8(6.5)	13.7(4.8)	14.9(5.1)	18.3(8.2)	10.25**	0.08	13.7(4.8)	15.0(5.2)	18.3(8.2)	1.97	0.02
Pain Catastrophizing	1.1(1.2)	0.3(0.5)	0.8(0.9)	1.8(1.4)	38.60**	0.26	0.3(0.5)	0.8(0.9)	1.8(1.4)	14.59**	0.12

Note.

* $p \leq .05$

** $p \leq .01$.

N=sample size; M=mean; SD=standard deviation. Adjusted models controlled for chronological age, BMI, and the following dummy-coded variables: race, income, education, marital status, employment, and study site.

Table 4.

Hierarchical linear regression predicting perceived age

	Step 1				Step 2				Step 3					
	b	SE	β	p	b	SE	β	p	b	SE	β	p	R^2	ΔR^2
Step 1													.181	—
Chronological Age	–0.39	0.09	–0.32	<.001	–0.37	0.09	–0.30	<.001	–0.29	0.09	–0.24	.002		
Race	0.34	1.32	0.02	.795	0.85	1.32	0.04	.524	0.37	1.31	0.02	.779		
Income	1.38	1.72	0.07	.425	1.97	1.73	0.10	.256	2.39	1.70	0.12	.161		
Education	–1.94	1.42	–0.10	.174	–1.96	1.43	–0.10	.172	–1.92	1.42	–0.10	.178		
Marital	0.36	1.42	0.02	.800	–0.09	1.42	–0.01	.948	–0.68	1.40	–0.03	.627		
Employment	–1.43	1.50	–0.07	.343	–0.74	1.52	–0.04	.627	–0.03	1.50	–0.00	.984		
BMI	0.08	0.09	0.08	.221	0.08	0.09	0.06	.385	0.06	0.09	0.04	.498		
Study Site	4.10	1.35	0.20	.003	4.14	1.34	0.20	.002	3.80	1.33	0.19	.005		
Step 2													.204	.023*
Pain Impact (Low)[a]					1.82	1.59	0.09	.255	1.00	1.58	0.05	.529		
Pain Impact (High)[b]					4.37	1.78	0.21	.015	3.99	1.85	0.19	.032		
Step 3													.258	.054**
Trait Resilience									–1.30	1.05	–0.10	.219		
Positive Affect									–0.25	0.09	–0.20	.006		
Negative Affect									–0.01	0.13	–0.01	.947		
Pain Catastrophizing									–0.09	0.70	–0.01	.903		

Note.

* $p \leq .05$

** $p \leq .01$.

Race coded: 0=Black/African American, 1=White/Caucasian; Income coded: 0=<$20,000, 1=≥$20,000; Education coded: 0=≤high school degree, 1=college degree; Marital coded: 0=married, 1=not married; Employment coded: 0=not employed, 1=employed; Study Site coded: 0=UF, 1=UAB; b=unstandardized beta; SE=standard error; β=standardized beta; BMI=body mass index.

[a] =Dummy-coded pain impact variable (0=Controls, 1=Low Pain Impact)

[b] =Dummy-coded pain impact variable (0=Controls, 1=High Pain Impact)