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Higher self-perceived stress reactivity is associated with increased chronic pain risk

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Abstract

Introduction: Experiencing stress can contribute to unfavorable pain experiences, but outcomes vary across individuals. Evidence suggests that a person's specific reactivity to stressful events may influence pain responses. Previous studies measuring physiological stress reactivity have found associations with pain both clinically and in the laboratory. However, the time and cost required for testing physiological stress reactivity may limit clinical application.

Objective: Self-reported perception of one's own stress reactivity has been shown to correlate with physiological stress reactivity in relation to health outcomes and may represent a valuable tool in clinical pain assessment.

Methods: Using data from the Midlife in the US survey, we selected participants who did not have chronic pain at baseline (n = 1512) and who had data at follow-up 9 years later. Stress reactivity was assessed using a subscale of the Multidimensional Personality Questionnaire. We conducted a binary logistic regression to determine the odds of developing chronic pain, controlling for demographics and other health-related variables.

Results: Results indicate that higher reported stress reactivity at baseline increased the odds of developing chronic pain at follow-up (odds ratio (OR) = 1.085, 95% confidence interval (CI) (1.021, 1.153), $P = 0.008$), with the only other significant predictor being the number of chronic conditions (OR = 1.118, 95% CI (1.045, 1.197), $P = 0.001$).

Conclusion: Findings provide evidence for the predictive criterion validity of self-reported stress reactivity in the context of chronic pain risk. More generally, with increased need for virtual assessment and care, self-reported stress reactivity may be a useful, time-efficient, and cost-efficient tool for predicting pain outcomes in research and clinical contexts.

Keywords: Stress response, Self-assessment, Psychosocial pain, Pain and aging, Long-term health

1. Introduction

Stress pervades the daily lives of Americans and is a major contributor to unfavorable pain experiences.[1,2,22,50,55,63,66] Yet despite the prevalence of stress, not all people experience pain in response to stressful situations.[11,37] One potential factor that may differentially contribute to future pain outcomes in relation to stress is stress reactivity—the extent to which one responds to a stressor physiologically, cognitively, behaviorally, and/or emotionally.[3,21,26,56,57] Physiological measures of stress reactivity predict a range of negative health-related, and notably, pain experiences including recurrent abdominal pain, reduced condition pain modulation, and greater likelihood of musculoskeletal pain and pain severity.[3,13,14,19,37,46,56,64] However, prior research used laboratory-based assessments measured in response to an applied controlled stressor, which is time consuming and unfeasible in a clinical setting. One potential time-efficient and cost-efficient clinical alternative measure of stress reactivity is self-perceived stress reactivity (SPSR)—the personal appraisal of how and to what extent one cognitively and emotionally responds and reacts to stressors—which is associated with poor health and pain outcomes such as pain intensity and frequency among people with fibromyalgia and recurrent abdominal pain among children.[14,34,35,58,61,72,74] Importantly, SPSR correlates with physiological stress reactivity while also being distinguishable from the exposure to stressful experiences themselves.[14,17,25,31,33,39,43,57]

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

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Furthermore, addressing patient stress reactivity through mindfulness-based and cognitive behavioral therapy is recognized as a beneficial target for those with chronic pain, leading to a range of improved pain experiences.[6,10,12,23,51] However, the utility of SPSR as a predictive risk factor for chronic pain development has yet to be explored.

In this study, we conduct secondary analyses of the Midlife in the United States (MIDUS) national survey to test our hypothesis that greater SPSR would be associated with increased odds for the development of chronic pain.[52,53]

2. Methods

2.1. Participants

Data were taken from MIDUS waves 2 (2004–2005) and 3 (2013–2014) (chronic pain and SPSR questions were added at wave 2).[52,53] The MIDUS is an ongoing longitudinal study assessing sociodemographic, behavioral, and health data gathered through telephone surveys using random digit dialing and mailed questionnaires. Wave 2 contained 4963 participants; we selected only those who reported not having chronic pain at wave 2 and had data for all variables of interest at both waves, resulting in n = 1512. Participants' ages at wave 2 ranged from 30 to 83 years (M = 54.80 ± 11.30). The MIDUS assessed sex, racialized identity, education, and marital status using forced multiple choice items (**Table 1**).[53] This analysis of open-source data was determined exempt by Texas A&M University's Institutional Review Board.

Table 1

Participant demographics cross sectionally within wave 2 of the Midlife in the United States national survey for those without chronic pain.

Participant demographics	N (%)
Sex	
Female	806 (53.3)
Male	706 (46.7)
Racialized identity	
White	1423 (94.1)
Black	48 (3.2)
Native American/Alaska Native	5 (0.3)
Asian or Pacific Islander	7 (0.5)
Multiracial	11 (0.7)
Other	18 (1.2)
Educational attainment	
Professional degree	90 (6.0)
Master's degree	198 (13.1)
Some graduate school	63 (4.2)
Bachelor's degree	371 (24.5)
2-y degree	105 (6.9)
3+ y of college (no degree)	52 (3.4)
1–2 y of college (no degree)	230 (15.2)
High school graduate	344 (22.8)
High school equivalency credential (GED)	12 (0.8)
Some high school (no degree)	36 (2.4)
Junior high school	7 (0.5)
Some grade school or no school	4 (0.3)
Marital status	
Married	1120 (74.1)
Divorced	164 (10.8)
Widowed	86 (5.7)
Never married	123 (8.1)
Separated	19 (1.3)

2.2. Measures

2.2.1. Chronic pain

Chronic pain was assessed using the question "Do you have chronic pain, that is do you have pain that persists beyond the time of normal healing and has lasted from anywhere from a few months to many years?" Values were recoded from the MIDUS data sets so that odds ratios of >1 would reflect increased odds of developing chronic pain (ie, "yes" = 2, and "no" = 1).

2.2.2. Stress reactivity

Self-perceived stress reactivity was assessed using 3 items of its subscale of the Multidimensional Personality Questionnaire—Brief Form (MPQ-BF) included in the MIDUS.[48] Items (eg, "I sometimes get myself into a state of tension and turmoil as I think of the day's events") were scored on a scale of 1 (true of you) to 4 (false) but were reverse scored so that higher values represent greater endorsement of that domain (α = 0.722). Items were summed to create final SPSR scores.

2.2.3. Covariates

Self-rated physical health and mental health were separately reported ("In general, would you say your [physical health/mental or emotional health] is excellent, very good, good, fair, or poor?") on a scale of 1 (excellent) to 5 (poor). *Body mass index* was calculated within the MIDUS by dividing the participants' self-reported weight (recorded in lbs., converted to kilograms) from their self-reported height (recorded in inches, converted to meters squared). *Depression* was assessed using the World Mental Health Organization's Composite International Diagnostic Interview Short Form (WHO CIDI-SF) and was calculated as the accumulated "yes" responses to 7 questions assessing both depressed affect (eg, "During 2 weeks in the past 12 months, when you felt sad, blue or depressed, did you lose interest in most things?") and anhedonia (eg, "During 2 weeks in the past 12 months, when you lost interest in most things, did you have a lot more trouble concentrating than usual?").[32] Totals ranged from 0 to 7, with higher scores indicating greater depression. *Anxiety* was assessed using the WHO CIDI-SF, which measures the frequency of responses to 10 items (eg, "How often over the past 12 months you were restless because of your worry") using a scale of 1 (most days) to 4 (never). Anxiety scores were calculated as the total number of "most days" responses.[32] *Number of chronic conditions* was operationalized as the number of chronic conditions (eg, asthma, stroke, ulcers) from a list of 30 that participants experienced in the past 12 months.

2.3. Analysis plan

A binary logistic regression was conducted to determine the predictive value of SPSR at wave 2 on the development of chronic pain at wave 3 using SPSS (version 25; IBM Corp, Armonk, NY). Demographics and covariates were included in the equation along with SPSR, modeled after prior research.[7,15]

3. Results

The absolute risk of participants developing chronic pain from wave 2 to wave 3 was 25.3%. Results of binary logistic analysis showed that higher SPSR at wave 2 was associated with increased odds of developing chronic pain at wave 3 controlling for all other variables,

Table 2

Binary logistic regression with self-perceived stress reactivity, demographics, and covariates predicting the odds for the development of chronic pain between waves 2 and 3 of the Midlife in the United States national survey.

Odds ratios for the development of chronic pain					
Variables	**Mean (σ)**	**Range**	**OR**	**95% CI**	***P***
BMI	27.232 (4.946)	15.60–48.84	0.999	0.974, 1.024	0.930
Depression	0.44 (1.484)	0–7	1.025	0.944, 1.114	0.555
Anxiety	0.07 (0.611)	0–8	0.896	0.732, 1.098	0.290
Physical health	2.11 (0.868)	1–5	1.123	0.947, 1.332	0.181
Mental health	1.97 (0.844)	1–5	1.025	0.858, 1.223	0.788
# Chronic conditions	1.73 (1.933)	0–30	1.118	1.045, 1.197	**<0.001**
Stress reactivity	5.2 (1.05)	3–12	1.085	1.021, 1.153	**0.008**

Includes participant variable descriptive statistics for participants who reported not having chronic pain at wave 2 and who also had complete data at wave 3.
95% CI, 95% confidence interval; BMI, body mass index; OR, odds ratio. Bold values indicate significant predictors of chronic pain.

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including anxiety and depression (odds ratio (OR) = 1.085, 95% confidence interval (CI) (1.021–1.153), $P = 0.008$; **Table 2**). The number of chronic conditions was the only other significant predictor (OR = 1.118, 95% CI (1.045–1.197; $P = 0.001$).

4. Discussion

Stress is a common experience for people living in the United States and is a major contributor to unfavorable pain outcomes.[1,22,50,55,63,66] Stress reactivity—one component of the stress experience—has been shown to predict future health outcomes (including pain).[46,56,64] Physiological reactivity in response to laboratory-controlled stress predicts the presence, frequency, and severity of various types of pain among both healthy and chronic pain populations; however, administering these laboratory tests in a clinical setting has limited viability.[29,46,71] Here, we show that SPSR may be a clinically relevant tool for identifying who may be at risk for developing chronic pain.

There are several possible explanations for why higher SPSR might contribute to pain outcomes. Maintaining a prolonged cognitive and emotional focus on stressors may sustain underlying physiological responses that over time accumulate into allostatic load.[16,20,45,68] In turn, allostatic load and dysregulated immune response predict unfavorable pain outcomes.[8,9,59,60] High SPSR may also motivate coping behaviors such as smoking and alcohol consumption, which can impact health over time.[42,47,65,73] Poststressor rumination also affects sleep quality, a known risk factor for pain.[18,27,72]

Separately, self-perceptions are frequently associated with a range of health outcomes, particularly among older adults; negative self-perceptions of one's health and aging predict future mortality, physical functioning, and disability independent of objective health markers, such as the number of other chronic conditions.[4,5,31,41,44,54] Self-perceptions (eg, of self-worth and pain sensitivity) have also been shown to predict pain outcomes, including pain disability and intensity.[24,36,40,67] It is possible that self-perceptions reflect an interoceptive awareness of how one's body and mind react to various situations, tracking negative health processes and highlighting targets for intervention.

A notable limitation to the generalizability of the present results is the lack of racialized diversity in this large national sample. Racialized stressors that are associated with pain disparities are therefore underrepresented in this data set and may differentially influence stress reactivity.[15,28,30,38,69,70] In addition, recent or general experiences of stress were not assessed and controlled for; it is possible that those higher in SPSR encounter more stressors in their lives, influencing and overwhelming their vigilance for and response to stress. However, previous research demonstrates that perceptions of personal stress responses predict future health outcomes independently from the stressor itself, although outcomes are most likely among those who report both high levels of stress and SPSR.[31] A person's self-awareness of their stress response, regardless of the source of stress, may therefore differentiate levels of relative risk for future pain outcomes. Self-perceived stress reactivity was also assessed in the MIDUS using select items of its scale; using the full stress reactivity subscale of the MPQ-BF or the Perceived Stress Reactivity Scale may more accurately tap SPSR.[48,58] The type of chronic pain that participants developed was not measured, nor was the date of onset of that pain between waves; SPSR may differentially contribute to various pain conditions and do so over varying time frames, limiting the precision of the pain measurement used. Finally, this study relied upon subjective report; future work may include physiological measures in conjunction with SPSR to further assess discriminative and predictive validity in relation to pain outcomes.

Clinical approaches to chronic pain, such as cognitive behavioral therapy and mindfulness-based stress reactivity, have recognized the importance of reducing stress reactivity to relieve pain and promote mental health.[6,10,12,23,51] The current findings suggest that SPSR may also help contribute to preemptive risk assessment for chronic pain development. With increased need and use of virtual assessment and care, SPSR may be a time and cost-efficient tool for predicting pain outcomes in research and clinical contexts.[49,62]

Disclosures

The authors have no conflict of interest to declare.

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