

# The Association Between the Patient Self-Report Survey for the Assessment of Fibromyalgia with Pain Sensitivity and Psychological Factors in Individuals with Musculoskeletal Pain

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**Purpose:** The Patient Self-Report Survey for the Assessment of Fibromyalgia may potentially be a method for subgrouping patients with musculoskeletal pain who have a nociplastic pain presentation. Limited research has explored the convergent validity of this questionnaire against psychophysical measures of pain sensitivity and psychological factors in individuals with musculoskeletal pain. Therefore, the purpose of this study is to examine the strength of the association between total scores on the Patient Self-Report Survey for the Assessment of Fibromyalgia with clinical, pain sensitivity, and psychological factors.

**Patients and Methods:** As a secondary analysis of a cross-sectional study, participants with shoulder ( $n = 20$ ) or low back pain ( $n = 20$ ) completed Quantitative Sensory Testing (QST), pain-related psychological questionnaires, and the Patient Self-Report Survey for the Assessment of Fibromyalgia. A Spearman correlation determined the association between total scores on the Patient Self-Report Survey for the Assessment of Fibromyalgia with psychological factors and pain sensitivity behaviorally assessed with QST.

**Results:** Negative psychological factors demonstrate moderate to strong positive associations with the Patient Self-Report Survey for the Assessment of Fibromyalgia ( $\rho$  range = 0.36–0.80), suggesting greater negative psychological factors were observed in patients with higher severity of fibromyalgia symptoms. Pain sensitivity factors demonstrated weak to moderate negative associations with The Patient Self-Report Survey for the Assessment of Fibromyalgia (PPT  $\rho$  range = -0.36– -0.41), suggesting that elevated pain sensitivity was observed in individuals with higher severity of nociplastic pain symptoms.

**Conclusion:** Collectively, this supports the convergent validity of the Patient Self-Report Survey for the Assessment of Fibromyalgia with psychological and pain sensitivity factors in patients with musculoskeletal pain.

**Keywords:** pain measurement, pain threshold, nociplastic pain, central sensitization

## Introduction

Approximately 5–15% of the general population experiences nociplastic pain,<sup>1</sup> a mechanistic classification for pain reflecting a change in nociception without a link to tissue damage.<sup>2</sup> Consistent with the biopsychosocial model for pain, nociplastic pain is impacted by changes in the nervous system processing of noxious stimuli and psychological factors. In individuals with nociplastic pain, an amplification of nociceptive transmission<sup>3</sup> and activity in parts of the brain responsible for processing pain and emotions are observed.<sup>4</sup> Negative psychological factors are also heightened in this population, with greater levels of catastrophizing and depression reported.<sup>5,6</sup> Heightened sensory and negative psychological factors are demonstrated in patients with nociplastic pain.<sup>7–10</sup>

Quantitative Sensory Testing (QST) is the systematic application of sensory stimuli for the purpose of behaviorally assessing somatosensory function or dysfunction.<sup>11</sup> QST may be used to examine local and widespread hypersensitivity<sup>12–15</sup> as well as modulatory capacity. Elevated pain sensitivity is demonstrated in individuals with nociplastic pain conditions compared

to healthy controls.<sup>16–20</sup> A similar pain sensitivity pattern is observed in subgroups of individuals experiencing musculoskeletal pain with a nociplastic presentation (mixed pain conditions) as hyperalgesia is observed in patients with moderate-to-severe chronic low back pain.<sup>21</sup> Alterations in pain sensitivity behaviorally measured by QST may be one component that helps distinguish individuals with a nociplastic pain presentation. While QST is included in clinical criteria to identify patients with musculoskeletal pain and a nociplastic pain presentation,<sup>22</sup> laboratory-based QST is often difficult to apply in clinical practice due to its expense and limitations in interpreting the results.<sup>11,23</sup>

Psychological factors, including emotional distress and depression, are predictors in the transition to persistent musculoskeletal pain<sup>7</sup> and a risk factor for chronic widespread pain.<sup>24</sup> In individuals with low back pain who have a nociplastic pain presentation, negative pain-related psychological factors<sup>25</sup> and catastrophizing<sup>26</sup> are significantly higher. Elevated negative pain-related psychological factors are also present in patients with nociplastic pain conditions, such as fibromyalgia. Higher rates of depression are observed in this population,<sup>5</sup> and nociplastic pain is associated with higher levels of anxiety and negative mood.<sup>27</sup> Collectively, elevated sensory-related and psychological factors are present in nociplastic pain conditions.<sup>16</sup>

A current challenge in clinical practice is the lack of a gold standard for identifying individuals with nociplastic pain (or central sensitization). Clinicians report being able to identify central sensitization in viewpoint articles and clinical practice<sup>28–30</sup> based on a patient's history of widespread pain and additional clinical symptoms.<sup>31</sup> However, this approach lacks standardization in identifying central sensitization (or a nociplastic pain presentation). Self-report questionnaires including The Central Sensitization Index (CSI)<sup>32</sup> are standardized approaches that may be efficiently administered in a clinical setting. The CSI helps reliably quantify central sensitization symptoms in patients with chronic pain.<sup>32–34</sup> However, the CSI lacks validity against QST<sup>35,36</sup> and high rates of false positives are observed in patients with negative psychological factors.<sup>34,35,37</sup>

The Patient Self-Report Survey for the Assessment of Fibromyalgia (also called the 2011 Fibromyalgia Survey) was originally developed as a method for identifying the prevalence of fibromyalgia in population-based studies<sup>38,39</sup> and has been used to categorize a nociplastic pain presentation in musculoskeletal pain populations.<sup>13,25,40</sup> The Patient Self-Report Survey for the Assessment of Fibromyalgia measures the severity of fibromyalgia-related symptoms and number of pain locations. Given that fibromyalgia is generally considered a primary example of a nociplastic pain condition, a questionnaire measuring the severity of fibromyalgia symptoms has the potential to serve as a proxy measure for identifying clinically important subgroups of patients with nociplastic pain affecting the musculoskeletal system. Twenty-two percent of patients receiving physical therapy for low back pain meet the threshold for fibromyalgia, and therefore a nociplastic pain presentation, based on the Patient Self-Report Survey for the Assessment of Fibromyalgia.<sup>25</sup> When applying the threshold from this questionnaire to distinguish patients with low back pain with and without a nociplastic pain presentation, catastrophizing and depression are significantly higher in those with a nociplastic pain presentation.<sup>13,25,40</sup>

Collectively, the Patient Self-Report Survey for the Assessment of Fibromyalgia may be a promising questionnaire to assist in identifying a nociplastic pain presentation in patients with musculoskeletal pain. However, the validity of this questionnaire against pain sensitivity and psychological factors in individuals with musculoskeletal pain has been minimally investigated. Therefore, the purpose is to examine the strength of the association between total scores on the Patient Self-Report Survey for the Assessment of Fibromyalgia with clinical presentation, psychological factors, and pain sensitivity behaviorally assessed with QST. We aim to test the convergent validity of this questionnaire by examining whether the Patient Self-Report Survey for the Assessment of Fibromyalgia may be able to quantify pain sensitivity and psychological factors and, therefore, be a clinically useful measure to give insight into the presence of a nociplastic pain presentation in patients with musculoskeletal pain.

## Methods

This is a secondary analysis of a cross-sectional observational study in individuals with shoulder ( $n = 20$ ) or low back pain ( $n = 20$ ). Participants attended one testing session in which they completed self-report questionnaires (pain-related psychological factors and the Patient Self-report Survey for the Assessment of Fibromyalgia) and underwent Quantitative Sensory Testing (QST). All study procedures were approved by the University of Central Florida's Institutional Review Board and participants provided written informed consent. Additionally, this study complies with the Declaration of Helsinki.

## Participants

Participants between 18 and 75 years old with shoulder or low back pain intensity rated at least a 3/10 (0 = no pain, 10 = worst pain imaginable) within the past 24 hours of testing were eligible to participate in the study. Participants were excluded if pain was due to fibromyalgia, surgery, or fracture within the past six months, or myelopathy. Participants were also excluded for safety during QST if they reported any medical conditions that affected sensation, blood clotting disorders, or contraindications to the application of ice.

Participants provided demographic information (age, sex, race, ethnicity) using a standard intake form. Shoulder or low back pain intensity was reported with the 101-point Numerical Pain Rating Scale (NPRS) in which 0 = no pain and 100 = worst pain imaginable. Participants provided their current, best, and worst pain intensity within the past 24 hours. These values were averaged, and the average pain intensity was analyzed. Pain-related disability was self-reported with the Oswestry Disability Index for individuals with low back pain<sup>41,42</sup> and QuickDASH for individuals with shoulder pain.<sup>43,44</sup>

## Patient Self-Report Survey for the Assessment of Fibromyalgia

The Patient Self-report Survey for the Assessment of Fibromyalgia (also called the 2011 Fibromyalgia Survey) is a five-item self-report questionnaire that measures widespread pain index and symptom severity.<sup>38</sup> Participants check the number of locations of pain on a body diagram (up to 19 locations), rate the severity of three symptoms (fatigue, trouble thinking, and waking up tired), and report if they have experienced any of the following three somatic symptoms (pain/cramps abdomen, depression, headache) (up to 12 points for symptom severity and somatic symptoms). These items are scored according to the guidelines of the questionnaire with possible scores ranging from 0 to 31. A higher total score indicates greater widespread pain and severity of symptoms.<sup>38</sup> A score of 13 or higher on this measure indicates fibromyalgia,<sup>38</sup> but this threshold has been used to categorize a nociplastic pain presentation in musculoskeletal pain research.<sup>13,25,40</sup> Participants also report if there is another disorder that could potentially explain these symptoms and if the symptoms have been present for over 3 months.

## Psychological Factors

Participants completed several self-report questionnaires examining the following pain-related psychological factors: depression, fear of pain, pain catastrophizing, fear avoidance beliefs, kinesiophobia, pain-related anxiety, and pain self-efficacy.

### Center for Epidemiologic Studies – Depression (CES-D)

The CES-D is a 20-item self-report measure in which participants rate the frequency of depression-related symptoms over the past week.<sup>45</sup> The total score is the sum of the 20 questions. Scores may range from 0 to 60 with a higher score indicating a greater frequency of depression-related symptoms. Total scores were used in the analysis. The CES-D is a valid and reliable measure of depression.<sup>46</sup>

### Fear of Pain Questionnaire-9 (FPQ-9)

The FPQ-9 is a shortened 9-item self-report measure in which participants rate the amount of fear associated with activities that would elicit pain, such as breaking your arm, from 1 = not at all to 5 = extreme. The total score ranges from 9 to 45 with higher scores indicating greater fear of pain.<sup>47</sup> The FPQ-9 demonstrates concurrent, convergent, and divergent validity.<sup>47</sup>

### Pain Catastrophizing Scale (PCS)

The PCS is a 13-item self-report measure in which participants rate the degree of catastrophic thinking during a painful episode from 0 = not at all to 4 = all the time. The total score ranges from 0 to 52 with higher scores indicating greater pain catastrophizing.<sup>48</sup> The PCS demonstrates concurrent and predictive validity.<sup>49</sup>

### Fear-Avoidance Beliefs Questionnaire (FABQ)

The FABQ is a 16-item self-report measure that includes a work (W) and physical activity (PA) sub-section. Participants rate how fear-avoidance beliefs may have contributed to their pain from 0 = completely disagree to 6 = completely agree.

The FABQ-PA subscale ranges from 0 to 24 and FABQ-PA subscale ranges from 0 to 42. Higher scores indicate greater fear-avoidance beliefs.<sup>50</sup> The FABQ is reliable and valid in patients with shoulder pain and low back pain.<sup>51</sup>

### Tampa Scale of Kinesiophobia-II (TSK-II)

The TSK-II is a shortened version of the TSK that includes 11 items that measure the degree of fear of movement. Participants rate the degree to which they agree with statements relating to fear of movement from 1 = strongly disagree to 4 = strongly agree. Total scores range from 11 to 44 with higher scores indicating greater fear of movement.<sup>52</sup> The TSK-II has good reliability, responsiveness, and predictive validity.<sup>52</sup>

### Pain Anxiety Symptoms Scale-20 (PASS-20)

The PASS-20 is a shortened, self-report measure of pain-related anxiety in which participants rate the frequency of anxiety during a painful episode from 0 = never to 5 = always. Total scores range from 0 to 100 with higher scores indicating greater anxiety related to pain.<sup>53</sup> The PASS-20 has construct validity in a sample of patients receiving physical therapy for musculoskeletal pain.<sup>54</sup>

### Pain Self-Efficacy Questionnaire (PSEQ)

The PSEQ is a 10-item self-report measure of confidence in doing activities despite pain (self-efficacy). Participants rate their confidence from 0 = not confident at all to 6 = completely confident. Total scores range from 0 to 60 with higher scores indicating greater self-efficacy.<sup>55</sup>

### Quantitative Sensory Testing (QST)

QST was conducted in a laboratory setting with a standard temperature. Participants were trained on rating pain using the 101-point Numerical Pain Rating Scale (NPRS) in which 0 = no pain and 100 = worst pain imaginable and completed a familiarization task with each of the pain sensitivity tests. All QST (except temporal summation and conditioned pain modulation) were performed in three locations: 1) deltoid muscle belly, 2) medial to posterior superior iliac spine (PSIS), and 3) tibialis anterior muscle belly on the same side as the patient's shoulder or low back pain. Two trials were performed at each site with the average threshold analyzed. Three sites were selected as a measure of local and widespread changes in pain sensitivity in individuals with shoulder or low back pain. QST was performed in the following order: Cold Pain Threshold (CPT), Heat Pain Threshold (HPT), Temporal Summation (TS), Pressure Pain Threshold (PPT), and Conditioned Pain Modulation (CPM).

### Static Pain Sensitivity Tests

#### Cold Pain Threshold (CPT)

A 2 × 1 inch thermode attached to a Thermal Cutaneous Stimulator-II (TCS-II) (QST.Lab, Strasbourg, France) was applied to the skin. The thermode decreased from a baseline of 32°C at a rate of 1°C/second to a maximum of 0°C. Participants indicated when the temperature changed from a “comfortable cold to slightly unpleasant pain” by pressing a button. Participants then rated the pain intensity at threshold using the 101-point NPRS. CPT was recorded in °C and a higher CPT temperature indicated a higher pain sensitivity.

#### Heat Pain Threshold (HPT)

A 2 × 1 inch thermode attached to a TCS-II was applied to the skin. The thermode increased from a baseline of 32°C at a rate of 1°C/second to a maximum of 50°C. Participants indicated when the temperature changed from a “comfortable warmth to slightly unpleasant pain” by pressing a button. Participants then rated the pain intensity at threshold using the 101-point NPRS. HPT was recorded in °C and a lower HPT temperature indicated a higher pain sensitivity.

#### Pressure Pain Threshold (PPT)

A digital computerized pressure algometer (Algomed, Ramat Yishai, Israel) with a 1 cm rubber tip was applied at a constant rate. Participants indicated when the sensation changed from “comfortable pressure to slightly unpleasant pain” by pressing a button. Pain intensity was then rated at threshold using the 101-point NPRS. PPT was recorded in

kilopascals (kPa) and a lower PPT indicated a higher pain sensitivity. PPT is reliable and able to distinguish between individuals with and without musculoskeletal pain.<sup>56–58</sup>

### Dynamic Pain Sensitivity Tests

#### Temporal Summation (TS)

A 2 × 1 inch thermode attached to a Thermal Cutaneous Stimulator-II (TCS-II) (QST.Lab, Strasbourg, France) delivered a train of 10 heat pulses that increased from 41°C to 49°C at a rate to maintain the desired inter-stimulus interval. Individuals with persistent low back pain demonstrate significantly higher TS and aftersensations compared to healthy controls, suggesting this measure may distinguish these populations.<sup>59</sup>

#### Conditioned Pain Modulation (CPM)

CPM consisted of three steps.<sup>60</sup> First, PPT was applied to the web space of the foot opposite the side of the patient's shoulder or low back (testing stimulus #1). Second, participants immersed the hand on the same side as their shoulder or low back pain into a cold water bath set to a temperature of 8°C for men and 10°C for women for one minute (conditioning stimulus). Third, PPT was re-applied to the web space of the foot allowing for examination of immediate changes in testing stimulus after the application of a painful conditioning stimulus. CPM efficiency was calculated using the following formula: pre-testing stimulus – post-testing stimulus. A negative value indicates a pain inhibitory process (efficient CPM).<sup>60</sup> A larger proportion of patients with a less efficient CPM are observed in individuals with persistent pain relative to healthy controls.<sup>61</sup>

### Statistical Analysis

IBM SPSS software version 28 (Armonk, NY) was used for data analysis. Tests of normality indicated scores on the Patient Self Report Survey for the Assessment of Fibromyalgia (Kolmogorov–Smirnov  $p < 0.01$  and Shapiro–Wilk  $p = 0.02$ ) were not normally distributed. Visual inspection of the scatterplot indicated that a positive monotonic relationship was observed. Because bivariate normality assumptions were not met, Spearman correlation was used to determine the association between total scores on the Patient Self-report Survey for the Assessment of Fibromyalgia and clinical features, psychological factors, and pain sensitivity behaviorally assessed with QST. Magnitude of associations was interpreted with the following thresholds for the correlation coefficient: 0.3 = weak, 0.5 = moderate, and 0.8 = strong.<sup>62</sup> A  $p$ -value less than 0.05 indicated statistical significance.

Clinical features associated with the Patient Self Report Survey for the Assessment of Fibromyalgia included pain duration (weeks), average pain intensity, QuickDASH for individuals with shoulder pain, and ODI total score for individuals with low back pain. Psychological factors associated with the Patient Self Report Survey for the Assessment of Fibromyalgia included CES-D, FPQ-9, PCS, FABQ, TSK-11, PASS-20, PSEQ. QST associated with the Patient Self Report Survey for the Assessment of Fibromyalgia included CPT, HPT, PPT applied to the deltoid, low back, and tibialis anterior, pain ratings during CPT, HPT, PPT, TS, and CPM efficiency.

## Results

### Demographic and Clinical Factors of Participants

Forty participants ( $n = 20$  with low back pain,  $n = 20$  with shoulder pain) were included in this analysis. Participants were mean  $\pm$  standard deviation (SD) age = 26.00  $\pm$  10.62 years old and 60.00% were female, 71.80% were white, 5.10% were African American, 12.80% were Asian, 10.20% indicated other for race and 35.00% were Hispanic.

Mean  $\pm$  SD total scores on the Patient Self-report Survey for the Assessment of Fibromyalgia = 7.45  $\pm$  4.13. Participants were experiencing low to moderate intensity of pain at the time of testing. For the total sample, mean  $\pm$  SD pain intensity on the 101-point NPRS = 33.83  $\pm$  19.84. Individuals with low back pain reported total ODI scores = 7.50  $\pm$  5.82. Individuals with shoulder pain reported quickDASH scores = 55.00  $\pm$  25.88. Average pain duration in weeks of the total sample = 92.79  $\pm$  134.49.

The Patient Self-Report Survey for the Assessment of Fibromyalgia demonstrated a weak, non-significant association with the average pain intensity ( $\rho = -0.03$ ,  $p = 0.86$ ) and pain duration ( $\rho = -0.04$ ,  $p = 0.82$ ). A weak to moderate

non-significant association was demonstrated for quickDASH scores ( $\rho = 0.36$ ,  $p = 0.12$ ) and a moderate significant association was observed for ODI scores ( $\rho = 0.57$ ,  $p = 0.01$ ). The Patient Self-Report Survey for the Assessment of Fibromyalgia was not associated with pain intensity or chronicity. However, the Patient Self-Report Survey for the Assessment of Fibromyalgia displayed a moderate positive association with pain-related disability in individuals with low back pain, suggesting that higher severity of fibromyalgia-related symptoms is associated with higher pain-related disability. Correlation coefficients by anatomical location of pain are presented in Table 1.

## Psychological Factors

For the total sample, the Patient Self-report Survey for the Assessment of Fibromyalgia demonstrated a significant, strong positive association with depression ( $\rho = 0.80$ ,  $p < 0.01$ ). A significant, moderate to strong negative association was observed with self-efficacy ( $\rho = -0.58$ ,  $p < 0.01$ ). Pain anxiety ( $\rho = 0.57$ ,  $p < 0.01$ ) demonstrated a moderate to large significant association with the Patient Self-Report Survey for the Assessment of Fibromyalgia. Collectively, this suggests higher depression and lower self-efficacy are strongly associated with the Patient Self-Report Survey for the Assessment of Fibromyalgia. Pain-related anxiety is moderately to strongly associated with the Patient Self-Report Survey for the Assessment of Fibromyalgia.

Kinesiophobia ( $\rho = 0.47$ ,  $p < 0.01$ ), fear of pain ( $\rho = 0.36$ ,  $p = 0.02$ ), and catastrophizing ( $\rho = 0.41$ ,  $p < 0.01$ ) demonstrated moderate associations with The Patient Self-Report Survey for the Assessment of Fibromyalgia. This suggests that higher kinesiophobia, fear of pain, and catastrophizing were positively associated with The Patient Self-Report Survey for the Assessment of Fibromyalgia scores with a moderate to strong correlation.

Fear-avoidance beliefs were not associated with The Patient Self-report Survey for the Assessment of Fibromyalgia (work subsection  $\rho = 0.32$ ,  $p = 0.06$ ; physical activity  $\rho = 0.13$ ,  $p = 0.43$ ).

Correlation coefficients by anatomical location are presented in Table 1.

**Table 1** Spearman Correlation Coefficients for Clinical and Psychological Factors by Anatomic Location of Pain

	Low Back Pain (n = 20)	Shoulder Pain (n = 20)
<b>Clinical Factors</b>		
Pain duration (weeks)	0.04	-0.10
NPRS	0.01	-0.14
<b>Psychological Factors</b>		
CES-D	0.83*	0.85*
FPQ-9	0.47*	0.31
PCS	0.37	0.45*
FABQ-W; PA	0.41; 0.12	0.17; 0.20
TSK-11	0.54*	0.29
PASS-20	0.47*	0.58*
PSEQ	-0.59*	-0.55*

**Notes:** Correlation coefficients for the association between the listed factors and the Patient Self-report Survey for the Assessment of Fibromyalgia are presented. \*Statistical significance,  $p < 0.05$ .

**Abbreviations:** NPRS, 101-point Numerical Pain Rating Scale; CES-D, Center for Epidemiologic Studies-Depression; FPQ-9, Fear of Pain Questionnaire-9; PCS, Pain Catastrophizing Scale; FABQ, Fear Avoidance Beliefs Questionnaire; W, work subsection; PA, physical activity subsection; TSK-11, Tampa Scale of Kinesiophobia-11; PASS-20, Pain Anxiety Symptom Scale 20; PSEQ, Pain Self-Efficacy Questionnaire.

## Pain Sensitivity

### Static Pain Sensitivity

#### Thermal Pain Sensitivity

HPT applied to the low back trended toward being significantly associated with the Patient Self-Report Survey for the Assessment of Fibromyalgia ( $\rho = -0.29$ ,  $p = 0.06$ ). HPT applied to deltoid ( $\rho = -0.24$ ,  $p = 0.14$ ) and tibialis anterior ( $\rho = -0.24$ ,  $p = 0.13$ ) displayed a weak to moderate non-significant correlation. Pain ratings at HPT were significantly associated with The Patient Self-Report Survey for the Assessment of Fibromyalgia (low back:  $\rho = -0.40$ ,  $p = 0.01$ ; deltoid  $\rho = -0.41$ ,  $p = 0.01$ ; tibialis anterior  $\rho = -0.35$ ,  $p = 0.03$ ). A negative weak to moderate association was observed, suggesting individuals with higher severity of fibromyalgia symptoms provided lower pain ratings at threshold. Collectively, individuals with higher severity of fibromyalgia symptoms appear to demonstrate significantly lower pain ratings.

CPT was also applied to the shoulder, low back, and leg. CPT was not associated with The Patient Self-report Survey for the Assessment of Fibromyalgia with the exception of pain ratings during CPT at the back (weak to moderate association,  $\rho = -0.43$ ,  $p = 0.02$ ). Correlations ranged from 0.17 to 0.27.

#### Pressure Pain Sensitivity

PPT applied to the low back was significant, and a small to moderate negative association was observed ( $\rho = -0.36$ ,  $p = 0.03$ ), indicating people with higher severity of fibromyalgia symptoms have lower PPT. PPT applied to the deltoid ( $\rho = -0.49$ ,  $p < 0.01$ ) and tibialis anterior ( $\rho = -0.41$ ,  $p = 0.01$ ) displayed a weak to moderate negative association with The Patient Self-Report Survey for the Assessment of Fibromyalgia. Pain ratings at threshold were significantly associated with scores on the Patient Self-report Survey for the Assessment of Fibromyalgia (low back  $\rho = -0.45$ ,  $p = 0.01$ ; deltoid  $\rho = -0.40$ ,  $p = 0.01$ ; tibialis anterior  $\rho = -0.39$ ,  $p = 0.01$ ) with a weak to moderate effect. Collectively, individuals with higher severity of fibromyalgia symptoms appear to demonstrate significantly lower PPT applied to the extremities with lower pain ratings.

#### Dynamic Pain Sensitivity

Thermal temporal summation was not associated with the Patient Self-Report Survey for the Assessment of Fibromyalgia ( $\rho = -0.03$ ,  $p = 0.87$ ). CPM efficiency was not associated with the Patient Self-Report Survey for the Assessment of Fibromyalgia ( $\rho = -0.13$ ,  $p = 0.43$ ).

Correlation coefficients by anatomical location of pain are presented in [Table 2](#).

## Discussion

This study aimed to examine the convergent validity of the Patient Self-Report Survey for the Assessment of Fibromyalgia in patients with shoulder and low back pain by correlating the total score of this questionnaire with measures of pain sensitivity and psychological factors. Psychological factors demonstrate moderate to strong positive associations with the Patient Self-Report Survey for the Assessment of Fibromyalgia, suggesting greater negative psychological factors are observed in patients with higher severity of fibromyalgia symptoms. Pain sensitivity factors demonstrate weak to moderate negative associations with The Patient Self-Report Survey for the Assessment of Fibromyalgia, suggesting that elevated pain sensitivity may be observed in individuals with higher severity of nociplastic pain symptoms. Collectively, this supports the convergent validity of the Patient Self-Report Survey for the Assessment of Fibromyalgia with psychological and pain sensitivity factors important to the development of nociplastic pain in patients with musculoskeletal pain. These findings are clinically significant because they suggest the Patient Self-Report Survey for the Assessment of Fibromyalgia may be useful in providing insight into the presence of nociplastic pain in patients with shoulder or low back pain.

## Psychological Factors

Higher depression, anger, anxiety, kinesiophobia, fear of pain, and catastrophizing were associated with higher scores on the Patient Self-Report Survey for the Assessment of Fibromyalgia and, therefore, severity of nociplastic pain symptoms.

**Table 2** Correlation Coefficients for Pain Sensitivity Factors by Anatomic Location of Pain

	Low Back Pain (n = 20)	Shoulder Pain (n = 20)
Pain Sensitivity		
CPT		
Deltoid	0.21	0.09
Low Back	0.30	0.11
Tibialis Anterior	0.49	0.29
HPT		
Deltoid	-0.14	-0.25
Low Back	-0.31	-0.29
Tibialis Anterior	-0.15	-0.41
PPT		
Deltoid	-0.44	-0.54
Low Back	-0.44*	-0.28
Tibialis Anterior	-0.36	-0.46
TS	-0.38	0.12
CPM	0.07	-0.29

**Notes:** Correlation coefficients for the association between the listed factors and the Patient Self-Report Survey for the Assessment of Fibromyalgia are presented. \*Statistical significance,  $p < 0.05$ .

**Abbreviations:** CPT, Cold Pain Threshold; HPT, Heat Pain Threshold; PPT, Pressure Pain Threshold; TS, Temporal Summation; CPM, Conditioned Pain Modulation.

A lower self-efficacy was associated with higher scores on the Patient Self-Report Survey for the Assessment of Fibromyalgia. A preliminary study from our research group found patients receiving physical therapy for low back pain categorized as having symptoms consistent with fibromyalgia (and therefore a nociplastic pain presentation) based on this questionnaire had significantly higher depression, catastrophizing, and anxiety.<sup>25</sup> The results from these separate studies from our group are consistent. The results of this study are further supported in the work by Brummett et al<sup>40</sup> and Aoyagi et al.<sup>13</sup> Patients with spine pain who have a fibromyalgia-like phenotype have significantly higher levels of depression,<sup>13,40</sup> anxiety,<sup>13,40</sup> and catastrophizing.<sup>13</sup> Assessment of multiple pain-related psychological domains can be important to separate clinical depression that requires medical treatment from overlapping frustration of having chronic pain for long periods of time. We add to this body of literature by now demonstrating that higher kinesiophobia and fear of pain are moderately to strongly associated with greater severity of nociplastic pain symptoms.

## Pain Sensitivity Factors

Associations between pain sensitivity and the Patient Self-report Survey for the Assessment of Fibromyalgia are weak to moderate and appear to be modality dependent. The Patient Self-report Survey for the Assessment of Fibromyalgia was significantly correlated with PPT at all sites. This result is corroborated by prior research in patients with knee osteoarthritis demonstrating the 2011 fibromyalgia survey criteria (Widespread Pain Index and Symptom Severity Score) were significantly correlated with pressure pain sensitivity in women.<sup>63</sup> Widespread hyperalgesia was observed in patients with higher fibromyalgia survey criteria scores, suggesting these questionnaires may help identify patients with central sensitization.<sup>63</sup> The results of our study confirm these findings and provide support for the convergent validity of the Patient Self-Report Survey for the Assessment of Fibromyalgia questionnaire as a self-report measure of



widespread sensitization. The Patient Self-Report Survey for the Assessment of Fibromyalgia is clinically feasible to administer, and emerging evidence supports that this questionnaire may be capable of identifying nociplastic pain in a subgroup of patients with musculoskeletal pain.

The results of this study indicate that individuals with greater severity of nociplastic pain symptoms display greater sensitivity to pressure stimuli at all sites and heat stimuli along the spine. Given that our sample was in individuals with shoulder or low back pain, this suggests widespread elevations in pain sensitivity were observed in patients with higher scores on this questionnaire. Consistent with our findings, total scores on the 2011 Fibromyalgia criteria were significantly associated with PPT in individuals with low back pain<sup>13</sup> and knee osteoarthritis.<sup>63</sup> However, we add to the body of literature by demonstrating that there may be site-specific and modality-specific considerations in individuals with nociplastic pain presentation, as indicated on The Patient Self-Report Survey for the Assessment of Fibromyalgia. Consistent with prior research, patients with fibromyalgia are more sensitive to heat but not pressure stimuli.<sup>19</sup> Pressure stimuli activate deep mechanoreceptors responsive to noxious stimuli and heat stimuli activate cutaneous thermal receptors responsive to noxious stimuli. The results of this study also concur with prior systematic reviews that patients with chronic low back pain demonstrate significantly lower PPT.<sup>12</sup> Pain ratings at threshold were significantly associated with scores on The Patient Self-Report Survey for the Assessment of Fibromyalgia with a weak to moderate effect, suggesting patients with a nociplastic pain presentation are more sensitive to experimentally induced stimuli compared to other pain conditions.<sup>21</sup> The results of our study indicate weak, non-significant associations are demonstrated between self-report measures of central sensitization and dynamic measures of pain sensitivity (temporal summation, conditioned pain modulation). The CSI and Pain Sensitivity Questionnaire also show weak or no correlations with temporal summation and conditioned pain modulation.<sup>64</sup>

Symptoms of persistent pain conditions may overlap even though the pathoanatomical location of pain differs. Prior studies have viewed musculoskeletal pain symptoms along a continuum rather than as a discrete condition and applied measures of sensitization, such as the CSI or Patient Self-Report Survey for the Assessment of Fibromyalgia, to measure severity of nociplastic pain symptoms.<sup>13,40</sup> Widespread pain occurs in a subgroup of individuals with musculoskeletal pain.<sup>13</sup> However, a challenge in clinical practice is identifying subgroups of patients with mixed pain conditions or those with musculoskeletal pain who also have a nociplastic pain presentation. Biopsychosocial factors may represent neurophysiological mechanisms contributing to a nociplastic pain presentation. The Patient Self-report Survey for the Assessment of Fibromyalgia has the potential to be used in research as a surrogate measure for nociplastic pain presentation in other chronic pain conditions. The results of this study are clinically relevant as they support the convergent validity of this questionnaire with the underlying biopsychosocial mechanisms of nociplastic pain in patients with musculoskeletal pain.

There are important considerations when applying this questionnaire to individuals with musculoskeletal pain. The 2011 American College of Rheumatology authors caution that the use of modified criteria based on self-report symptoms should only be used for research and not for a clinical diagnosis of fibromyalgia.<sup>38,39,65</sup> In 2010, the tender point criteria was removed due to difficulty in performing the examination.<sup>65</sup> The 2010 criteria moved to counting the number of painful regions, the widespread pain index, and symptom severity scale.<sup>65</sup> In 2011, the criteria then introduced the fibromyalgia severity score to reflect fibromyalgia can be along a continuum of symptoms similar to other nociplastic pain conditions.<sup>38</sup> Therefore, the fibromyalgia symptom severity score may be useful to determine the severity of fibromyalgia symptoms and may serve as a measure of the level of fibromyalgia type symptoms.<sup>39</sup> More recently, the 2016 criteria introduced a generalized pain criterion based on pain in at least 4 of 5 regions.<sup>39</sup> The 2016 criteria also support the use of the fibromyalgia symptom scale when fibromyalgia is viewed as a continuum of symptoms and recommend reporting this as a measure of symptom severity.<sup>39</sup>

## Limitations

As a secondary analysis, the limitation of our study is the small sample size and that we did not specifically recruit for patients with a nociplastic pain presentation. Future trials may aim to recruit a larger sample of individuals with chronic pain. Our intent was to examine if this questionnaire was capable of potentially being used to screen for a nociplastic pain presentation. As a result, we did not specifically recruit a sample of individuals with chronic pain. Additionally, we did

not administer any additional self-report measures of central sensitization including the CSI. As a result, it is unknown if pain sensitivity and psychological factors would be associated with the CSI in this sample. Future studies may aim to apply this questionnaire in a larger sample of individuals with nociplastic pain.

## Conclusion

The Patient Self-Report Survey for the Assessment of Fibromyalgia demonstrates convergent validity with pain sensitivity and psychological factors in patients with shoulder or low back pain. Moderate to strong correlations between negative psychological factors and severity of nociplastic pain symptoms were observed. Weak to moderate correlations between pain sensitivity and severity of nociplastic pain symptoms were observed. As a result, this questionnaire may have future application in clinical research.

## Disclosure

The authors report no conflicts of interest in this work.

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