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## GENERAL SECTION

### Original Research Article

# A Qualitative Examination of Pain Centrality Among Veterans of Iraq and Afghanistan Conflicts

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### Abstract

**Objective.** Centrality of pain refers to the degree to which a patient views chronic pain as integral to his or her life or identity. The purpose of this study was

to gain a richer understanding of pain centrality from the perspective of patients who live with chronic pain.

**Methods.** Face-to-face interviews were conducted with 26 Veterans with chronic and disabling musculoskeletal pain after completing a stepped care intervention within a randomized controlled trial. Qualitative data were analyzed using an immersion/crystallization approach. We evaluated the role centrality plays in Veterans' lives and examined whether and how their narratives differ when centrality either significantly decreases or increases after participation in a stepped care intervention for chronic pain.

**Results.** Our data identified three emergent themes that characterized pain centrality: 1) control, 2) acceptance, and 3) preoccupation. We identified five characteristics that distinguished patients' changes in centrality from baseline: 1) biopsychosocial viewpoint, 2) activity level, 3) pain communication, 4) participation in managing own pain, and 5) social support.

**Conclusions.** This study highlights centrality of pain as an important construct to consider within the overall patient experience of chronic pain.

**Key Words.** Chronic Pain; Veterans; Qualitative Research; Pain Centrality; Pain Cognitions

### Introduction

Pain centrality [1] is the degree to which an individual views chronic pain as a principal feature of his or her life, experience, or identity. Pain centrality is a distinct concept from the neurological condition of central pain syndrome [2] and from pain centralization, which describes the movement of pain from peripheral to proximal [3]. The construct of pain centrality was conceptualized in response to clinical observations that what differentiates patients with poor versus adequate

pain control is how much pain “takes over” their lives. The Centrality of Pain Scale (CoPS) [1] is a self-report questionnaire developed to understand the overall clinical experiences of patients with uncontrolled non-malignant chronic pain in an academic internal medicine clinic. Instrument authors asked patients with chronic pain, primary care providers, and pain specialist physicians what was different when pain was either well or poorly controlled. Responses revealed that pain intensity, pain-related disability, pain interference, or functioning were not the most critical elements. Instead, how *central* pain is in the patient’s life emerged as the distinguishing characteristic of well-managed pain. Successful pain control was marked by pain that no longer dominating patients’ thoughts and activities.

Pain centrality was developed as an outcome of pain management efforts. That is, it was designed to serve as an indicator of the degree to which patients believe that their chronic pain is controlled [1]. As such, pain centrality represents a summary of the myriad influences on one’s experience of chronic pain, including biological, psychological, and social variables associated with pain [4]. Pain centrality has been conceptualized by other authors as a potential predictor of pain outcomes, with demonstrated associations of pain centrality with pain severity, pain-related disability, and pain interference [5,6]. The nature of the relationship between pain centrality and pain coping remains unknown. It may be the case that working with chronic pain patients to reduce the predominant focus of pain in their lives would lead to improved adjustment to chronic pain, and it is perhaps equally as likely that increasing pain coping skills would lower pain centrality. As a relatively new concept in the pain literature, the construct of pain centrality warrants further examination of its utility and application.

This study seeks to gain a more nuanced understanding of pain centrality by giving voice to individuals living with chronic pain. Since qualitative research is useful for a new area of inquiry [7], we used this approach to examine patients’ narrative accounts of their pain experiences. We analyzed interviews of patients with chronic musculoskeletal pain who completed the intervention of a randomized controlled trial. Interviews were conducted to understand patients’ experiences with the intervention; questions were not specifically designed to ask about pain centrality. However, during the interviews, narratives unfolded that spoke to the degree to which pain was central in patients’ lives. Centrality themes emerged from the data and focused our analyses on two research questions: 1) What role does pain centrality play in patients’ accounts of their chronic pain experiences, and 2) How do these patients’ accounts differ when centrality changed after completion of the intervention?

## Methods

### Participants

Participants (N = 26) of the current study were enrolled in the intervention arm of a randomized controlled trial [8], which tested a stepped-care approach to the management of chronic musculoskeletal pain in Operation Enduring Freedom/Operation Iraqi Freedom (OEF/OIF) Veterans (ESCAPE: Evaluation of Stepped Care for Chronic Pain). Details and results of the trial are reported elsewhere [8]. Briefly, step 1 of the intervention included optimizing analgesic treatment, according to an evidence-based algorithm [9], over 12 weeks. In addition, patients learned pain self-management strategies (exercises, goal setting, relaxation techniques, and communication skills) tailored to their needs and preferences. Step 2 involved six sessions of brief cognitive behavioral therapy (CBT) over the next 12 weeks. A nurse care manager, supervised by two study physicians, delivered the intervention over the telephone. This stepped-care approach was found to be more effective than usual care to on primary outcomes of pain-related disability, pain severity, and pain interference [8].

*Inclusion Criteria.* All patients enrolled in the intervention arm of the ESCAPE trial who had indicated willingness to be contacted after completing the trial were eligible to participate in the current study. Veterans eligible to participate in the ESCAPE trial had served in either Iraq or Afghanistan; reported musculoskeletal pain in the low back, cervical spine, or extremities (hip, knee, or shoulder) that had persisted for  $\geq 3$  months; and experienced moderate functional impairment as defined by a disability score  $\geq 7$  on the Roland-Morris Disability Questionnaire [10], a low-back pain measure adapted for additional sites of musculoskeletal pain. Patients were excluded if they had active psychoses or suicidal ideation, schizophrenia, prior or pending back surgery, current substance dependence, severe medical conditions (e.g., class III or IV heart failure) that precluded participation, severe hearing or speech impairment, or were pregnant/trying to become pregnant.

*Sampling.* For the ESCAPE trial, 242 Veterans were recruited from five VA primary care clinics. Half (N = 121) were randomized to the intervention arm, half to usual care. Patients for the current study were sampled from the intervention arm of ESCAPE, using a purposive strategy based on treatment response to the intervention (sampling details available elsewhere [11]). The initial trial and follow-up study were both approved by the university’s institutional review board and VA medical center’s research and development committee. Twenty-six participants who participated in the intervention arm and indicated a willingness to participate in follow-up were interviewed. Interviews occurred after the 9-month follow-up assessments.

Measures

**Qualitative Interviews.** Face-to-face interviews were conducted, audio recorded, professionally transcribed, and verified for accuracy. The interview began with the question, “Why did you participate in ESCAPE?” Patients were then asked about which portion(s) of the intervention (analgesic management, self-management strategies, brief CBT, follow-up phone calls) were the most and least helpful, and why. Questions also included patients’ challenges and successes with pain management and any changes in their pain that occurred since ESCAPE participation. Finally, those who did not complete the study were asked why they withdrew from the trial and what would have motivated them to remain in the study. The complete interview guide is available in a previously published paper [11].

**Centrality of Pain Scale.** The CoPS is a 10-item self-report instrument. Responses are measured on a 5-point Likert scale that range from “strongly disagree” to “strongly agree.” In its original validation study, the scale demonstrated high internal consistency (Cronbach’s

$\alpha = 0.90$ ) [1]. Scores range from 10 to 50 where higher scores indicate greater centrality. See Table 1 or a list of all items. The questionnaire was administered at baseline, 3 and 6 months after randomization, and at 9-month follow-up. We compared baseline and 9-month centrality scores for the current analysis.

The CoPS [1] was developed by vetting potential items through the Chronic Pain Special Interest Group of the Society of General Internal Medicine (a national medical society of 3,000 physicians who are the primary internal medicine faculty of every medical school and major teaching hospital in the United States) as well as local colleagues (at the Oregon Health and Science University) and patients with chronic pain. Cognitive interviewing was conducted to assess construct validity, which was found to be adequate. The CoPS demonstrated excellent internal reliability (Cronbach’s  $\alpha = 0.90$ ) and adequate convergent and divergent validity based on correlations with related concepts [1]. Additional research has demonstrated that higher pain centrality (i.e., viewing pain as more central to one’s life or identity) is associated with greater pain severity, more pain-related

**Table 1** Centrality of pain scale items with examples

Item*	CoPS item [1]	Participant quotes representative of pain centrality*
1	Pain controls my life.	“I feel that I have a say so in it, but I’m not really in charge” of the pain (P16)
2	I am able to live a full life despite my pain.**	Learned “not to let the pain rule your life, not to let it affect the things that you enjoy doing” (P1)
3	My pain defines who I am.	“That was my mindset. . .I’m no good to anybody like this.” (P6)
4	I have control over my pain most of the time.**	“It’s a little bit easier now because I just accept it and I just do the things that I gotta do. . .I’m being more proactive now” (P17)
5	I think about my pain all the time.	“When I’m really hurting, it’s hard to think about anything but the fact that I’m just kind of miserable because my back hurts” (P19)
6	My pain consumes all of my energy.	“The constant pain is a big challenge, trying to live with pain all the time. It gets depressing at times. . .realizing it’s something you’re gonna have all the time” (P6)
7	My life revolves around my pain.	“It’s kind of a burden on my soul” (P15)
8	Pain is a constant struggle for me.	“It wears on you; it’s like a nagging toothache that just keeps on going” (P1)
9	I can deal with my pain.**	“I just have to try to use some of the things that I did during the study to help cope with it rather than expect it to go away” (P17)
10	Pain greatly interferes with my life.	“I just deal with it because I know it’s something that’s not gonna go away” (P18)
		“Pain caused me to not only neglect you know these people trying to help me, but you know it, it also causes me to miss school or my internship” (P16)
		“I pretty much limited myself before and still really don’t do a whole lot anymore” (P2)

\*These 10 items collectively represent a single, unified construct.

\*\*Reverse coded items.

disability, and higher levels of depression and anxiety [5]. The measure was validated with a sample of Veterans with chronic pain (N=178) wherein results demonstrated strong internal consistency and confirmed a single factor of all items [8].

### Data Analysis

First, qualitative interview data were analyzed using an immersion/crystallization approach, described by Borkan [12]. The three-member analytic team conducted “deep reads” of individual transcripts to become familiar with the data. Second was the initial coding phase, in which the team worked independently, labeling data line-by-line. The team met to compare and reach consensus on these initial codes. The third step involved focused coding. In this phase, the most salient codes from the initial coding phase were applied to all of the transcripts [13]. Through this process, the team became more familiar with the data and the emerging analysis and accordingly modified, added, or deleted codes as necessary. In addition, the team sought out negative cases that might call into question initial interpretations of the data [14]. Constant comparative methods [15], which involve looking for similarities and differences within and across interviews, were employed throughout analysis. During the analytic process, the team kept working memos (e.g., provisional themes, questions to be further pursued) based on consensus discussions and individual transcript readings. NVivo, version 9, software (QSR International, Cambridge, MA) facilitated data analysis.

*Thematic Analysis.* After coding was completed, two authors (MM, SO) culled through the data and independently identified codes that reflected pain centrality, using CoPS items to guide this work. The authors achieved consensus on the codes that were most closely associated with centrality, and then identified all sections of transcripts that had been tagged with these codes. Next, authors independently wrote memos for each code to summarize how centrality of pain was reflected in the code across all participants. Team members then compiled profile memos to create an account of how each patient described the experience of pain centrality. Each team member was assigned half of the transcripts (13 of the 26) and, in addition, 10 randomly selected transcripts were read independently by both team members. The memos and profiles from each of these 10 patients were compared to assure consistency in memo development and interpretation across patients. Discrepancies were resolved through discussion until consensus was reached.

We examined qualitative profiles to address the first research question: What role does pain centrality play in patients’ accounts of their chronic pain experiences? Profiles were analyzed by comparing them to CoPS items and attending to patterns both within and across patients. We searched for instances where one or more of the CoPS items appeared in participants’ words. For

example, “I think my outlook is not necessarily having to fight it; I don’t have to struggle with it” (P25) reflects CoPS item #8, “Pain is a constant struggle for me.” When necessary, we returned to the original coded transcripts to verify the context of comments related to centrality.

*Dichotomization by Centrality Change Scores.* After codes and profiles were developed and consensus reached, we addressed the second research question: How do patients’ accounts differ when centrality changed after completion of the intervention? Research team members were blinded to CoPS scores during thematic analysis and later examined participants’ CoPS scores at baseline (time 1) and 9 months after randomization (time 2), noting the change from time 1 to time 2. To facilitate comparison of maximum differences, we grouped participants into: 1) those with *significant* decreases in centrality scores, versus 2) those with *any* increases in centrality scores from time 1 to time 2. To be consistent with other chronic pain literature on clinically important change, significant decreases were operationalized as at least 30% drop in scores from baseline to 9-month follow-up. This benchmark was selected based on research on pain-related disability that denotes 30% change (from pre- and post-treatment) as clinically significant improvement and a standard to identify “responders” relative to “nonresponders” [16]. We were unaware of any similar benchmark to delineate significant worsening over time, so decided to classify all participants with centrality increases into the same group. We independently read the profiles of each group and then identified which themes described commonalities or distinctions between the two groups.

## Results

Twenty-six participants completed interviews following participation in the intervention arm of ESCAPE. Mean age was 38.6 years (SD = 12.43) and most participants were male (N = 22, 84.6%), White (N = 20, 76.9%), married (N = 14, 53.9%), and had completed at least some college (N = 20, 76.9%). Baseline centrality of pain scores ranged from 13 to 42 with a mean of 25.9 (SD = 7.50). The mean centrality score at follow-up was 23.5 (SD = 6.97) with a range of 10–37 points. Centrality of pain scores from baseline to follow-up significantly decreased (i.e., by at least 30%) for six participants, decreased by less than 30% for nine patients, increased for 10 participants, and saw no change for one participant.

### *Emergent Themes of Pain Centrality*

Notably, without specific interview questions or prompts about the centrality of pain, Veterans talked about the degree to which chronic pain was central in their lives. Many comments reflected items from the CoPS instrument; Table 1 presents exemplary participant quotes related the CoPS, though there is not a direct one-to-one mapping of items to quotes. Additionally, three key

themes related to pain centrality emerged: control, acceptance, and preoccupation with chronic pain.

*Control.* Patients frequently made statements about pain and control: either pain having control over their lives, or participants having control over pain. These comments reflect the content of CoPS items #1 and #4. Many participants perceived changes in their control over pain as a result of participating in the ESCAPE intervention. One stated, “Well, it’s not always going to rule my life, and that’s the thing I had to start thinking about. Am I going to let this thing bother me or am I going to take control of this?” (P12). The sense of powerlessness that comes with not having control seemed to play a major role for these patients; those who talked about pain as controlling their lives expressed feeling defeated by pain. When patients noticed a growing ability to take control of the pain, they reported relief. For example, a Veteran stated, “If you feel you can do something about it when you first start the [ESCAPE] program, you kind of think, ‘I don’t know if I can really do much about it.’ But then as you go through the program, you get to understand that yes, you can do a little of that to make yourself feel better. I mean there’s things you can do, so yeah, it changes your whole way of thinking about the pain” (P21). Another commented, “Before [the study intervention] I thought I was just going to be miserable the rest of my life. I do still have some pain, but it’s manageable” (P13). Being able to take action to manage pain reduced the sense that pain was in control and allowed this patient to think differently about his pain.

*Acceptance.* As participants recounted their struggle with chronic pain (which relates to CoPS item #8), statements reflecting acceptance emerged. Some Veterans discussed developing an acceptance of the chronicity of their pain whereas others demonstrated lack of acceptance. Lack of acceptance was inferred, for example, when participants insisted on “finding answers” from their doctors, criticized that the study did not identify the source of their pain, or asserted that their goal was to completely eliminate or “cure” the pain. However, many participants spoke of developing acceptance of their chronic pain, which they found helpful. For example, one participant stated, “I’m gonna be dealing with this from now to the day they put me six feet under” (P24) in the context of feeling hopeful about learning new ways to manage his pain. He continued with comments about the intervention, “it’s helped me learn to look at it (pain) differently, think about it differently, and came up with a few things I hadn’t already tried” (P24). Others talked about acceptance by acknowledging that their pain was unlikely to go away: “Pain’s something I’m going to have to live with probably the rest of my life and it’s not something that’s going to stop me from being an active member of my family and community” (P6). Another Veteran indicated an understanding that “fighting” against pain adds to his struggle: “I have to accept and...I think my outlook is not necessarily having to fight it; I don’t have to struggle with it” (P25). He later referred to his

“suffering” from chronic pain as alleviated since the intervention as a result of becoming “more self-aware” (P25). Others talked about acceptance as raising their awareness to the benefit of actively manage their pain: “You know it’s not gonna magically go away but I’m just coping with it better” (P20).

*Preoccupation.* For some respondents, centrality was indicated by the frequency of their pain-related cognitions (i.e., they spoke of thinking of pain all the time) and identified these thoughts as all-consuming or the most salient. Items #5 and #6 of the CoPS refer to thoughts and energy being dominated by chronic pain. One patient denied being able to think differently about pain after the intervention, but stated that he learned how not to “fixate” on thoughts of pain and that has helped him feel that it no longer “consumes” him (P1). From his perspective, the content of his thoughts about pain did not change, but he learned not to dwell on them. Many participants spoke of the encompassing nature of their pain-related thoughts.

### Themes Differentiating Changes in Pain Centrality

While identifying and analyzing emergent themes, we noticed reports of changes in participants’ relationships with pain. These observations prompted us to examine post-intervention centrality changes and analyze potential distinguishing characteristics between those whose centrality scores significantly decreased versus those whose score increased.

Blinded to group category, we examined transcripts to search for elements that uniquely defined each group. As with our previous analysis, the core themes of control, acceptance, and preoccupation differentiated the two groups. That is, those who spoke of gaining control over pain, learning to accept their pain, and/or reducing their preoccupation with pain cognitions were represented in the group with significant decreases in centrality scores. On the contrary, those in the group with increased centrality spoke of having less control of their pain, indicated a strong desire to “push” the pain away, and appeared preoccupied with maladaptive pain cognitions, such as catastrophic thoughts about their pain.

In addition, specific and distinguishing patterns emerged within each group; these themes are summarized in [Table 2](#) and reflect how participants with significantly decreased centrality of pain expressed their understanding of their chronic pain compared to those with increased centrality. One differentiating factor was the adoption or rejection of the biopsychosocial model of chronic pain. Although there was no explicit discussion of the model, participants whose centrality improved indicated adoption of the biopsychosocial model by their reference to connections between chronic pain and emotions, relationships, and social activities. For example, one patient commented on learning the impact of anger on chronic pain: “When you’re in pain, it makes you mad, but learning to control that really helps” (P6). By contrast, those with increased

**Table 2** Defining characteristics of centrality change groups

	Increased centrality (N = 10)	Significantly decreased centrality* (N = 6)
Biopsychosocial perspective	<p>CBT was least helpful part of the intervention and a “waste of time”, adding: “I know I can think differently about the pain and all that but it doesn’t change the pain” (P2).</p> <p>“I don’t think there’s anything in my mind that would have changed my pain level” (P26).</p>	<p>“You know the medicine and the exercises help, but there’s also that thing called your head. You know, sometimes you think the mind works but the body don’t. Well, sometimes you can train your mind, you can use your mind to train your body” (P12).</p> <p>“Helped me realize that life’s not over because you have pain constantly and you can learn to deal with your pain, cope with it you know, getting it under control and mentally realizing you know, the stress that pain causes you and how to diffuse that stress” (P6).</p>
Activity level	<p>“I pretty much limited myself before and I still really don’t do a whole lot anymore” (P2).</p> <p>With regard to daily activities: “I would say I’m not changing really” (P23).</p> <p>“I used to be interested in, you know, water sports and things like that. I just can’t do that anymore” (P26).</p>	<p>“It’s manageable to where I’m not in agonizing pain. I can actually do things now that I didn’t used to do” (P6).</p>
Pain communication	<p>“In the military you don’t really talk about those kind of things cuz it’s not career builders, and you get used to not doing that” (P21).</p> <p>“I usually, for the most part, I usually keep to myself and try to deal with it” (P23).</p>	<p>The study helped him “learn to deal with it and talk it through. . . talk to your family and friends and tell them what kind of pain you’re in to help them understand” (P6).</p>
Participation in managing own pain	<p>“If I get pain I want it to go away right away as soon as possible, so that’s kind of frustrating” (P23).</p> <p>Exclusively focused on analgesic cream as only means of managing pain (P23).</p> <p>Response to how he deals with pain flares: “Um, stop. You know, just pain meds and resting” (P2).</p>	<p>“If you feel like you’re not up to it [using pain management strategies], but you have to fight through that. . . you can’t let pain control you. You have to control the pain” (P10).</p> <p>“The medical field can’t always help people if they don’t help themselves” (P12).</p>
Social support	<p>Response to who offers support: “I would really like to say my husband but I usually handle it if I’m in pain” (P23).</p> <p>Interviewer: “What sources of support have you found for your pain management? Do you have family or friends that help support you?”</p> <p>Participant: “No”</p> <p>Interviewer: “No? No one supports you?”</p> <p>Participant: “No” (P18).</p>	<p>“My wife is always supportive in all areas but usually she knows if I’m hurting or whatever she’ll kind of try and get me up and maybe do something to keep my mind off of it. . . we’ve been talking about it more now” (P19).</p> <p>“Sometimes you don’t notice, and sometimes it takes an eye-opening experience for you to realize that, you know, there are certain friends and your family that are always going to be there for you no matter what” (P12).</p>

\*Defined as at least 30% decrease in centrality scores from baseline to 9-month follow-up.



centrality discussed their expectations of the medical system to cure their pain and mentioned their reliance on medication instead of self-management strategies; taken together, these findings indicate a biomedical viewpoint of chronic pain within this group.

The two groups differed by understanding of pain as biopsychosocial, activity level, pain communication, participation in one's own pain management, and social support. Those with centrality scores that decreased by at least 30% noted increased activity in a variety of aspects in their lives (e.g., stretching, walking, swimming, yard work, household chores, playing with grandchildren, recreational activity), whereas those with increased centrality referred to continued inactivity. Patients with significantly decreased centrality scores indicated communicating about pain with others (including spouses, friends, family members, co-workers, and doctors) more frequently than before the intervention, but those with higher post-intervention scores demonstrated a reluctance to communicate about their pain. Those with markedly lower centrality scores at follow-up talked of participating actively in their own pain management, whereas those with increased scores spoke of expectations that external factors (i.e., a provider, medication, or surgery) would manage their pain. There were differences in how the two groups talked about the social support they received in relation to their chronic pain. For example, those with significantly decreased centrality talked about more frequent positive interactions in soliciting and receiving support from significant others with regard to their pain and having a solid support network in general. On the other hand, those with increased centrality appeared to have few resources for emotional support or healthy conversation about their pain. Representative quotes are presented in [Table 2](#).

## **Discussion**

To our knowledge, this is the first study that uses qualitative analysis to characterize and deepen our understanding of pain centrality. In particular, this study emphasized how centrality manifests in patients' own experiences of chronic pain. When patients talked about their participation in a chronic pain treatment trial, pain centrality frequently emerged. Through these patient accounts, we identified three core themes that exemplified centrality of pain: 1) control, 2) acceptance, and 3) preoccupation. Five features characterized patients with improvements (decreases) in pain centrality: 1) adoption of the biopsychosocial model of chronic pain, 2) increased activity level, 3) frequency or effectiveness of pain communication, 4) engagement in pain self-management, and 5) better social support.

As a newer construct, there is a paucity of literature on pain centrality to date. However, other qualitative research in pain has identified themes similar to and consistent with centrality of pain. For example, studies have reported that patients constantly think about their chronic pain [17], that pain permeates all domains of an

individual's life [18] in an intrusive and unrelenting manner [19], and that a person's identity is changed by the experience of pain [20,21]. Additionally, pain centrality has been theoretically discussed in relation to psychotherapy treatment models for chronic pain. A prominent cognitive therapy treatment manual for chronic pain [22] discusses the idea that pain often becomes a primary focus of one's identity, wherein an individual adopts the identity of a *pain patient* and consequently begins to see chronic pain as synonymous with disability. Similarly, the acceptance and commitment therapy literature [23] refers to patients *fusing* to a particular belief about pain, thereby keeping it central and amplifying the suffering associated with chronic pain. Two empirical studies have examined the relationships between centrality and pain characteristics. In a study of the *centrality* of stressful life events wherein persistent pain was considered a stressful life event, higher centrality scores were associated with more severe pain, greater pain interference, and more psychological distress [24]. In the preliminary validation study of the CoPS, higher pain centrality was associated with more severe pain, poorer physical and emotional functioning, lower quality of life, and more depression [1]. Our results are consistent with those previous findings given that patients with increased centrality scores discussed maladaptive adjustment to chronic pain and those with significantly decreased centrality spoke of more adaptive features of their pain experience.

Our results suggest that centrality of pain may function as a pain-relevant cognition that reflects and may also impact the overall pain experience. Pain cognitions are a crucial component of the biopsychosocial model, which is the most widely accepted theoretical framework of chronic pain [25]. The way a person thinks about chronic pain has been shown to impact the individual's overall experience [22,26,27]. These thoughts serve to make meaning of the pain experience and contribute to emotional reactions, pain severity, and disability [25]. Pain-relevant cognitions that have been discussed in the literature include pain catastrophizing, disability beliefs, kinesiophobia, fearful interpretations of pain, sense of control, self-efficacy, acceptance, and cognitive coping [28–33]. Pain centrality adds to this literature as a potential cognition with specific focus on a how a patient's life, identity, and activities may be dominated by pain.

This study is limited in that it focused exclusively on treatment-seeking patients who were willing to participate in a clinical trial and had just completed a stepped care intervention for chronic pain. It is plausible that patients with chronic pain who have not participated in such a trial and/or not completed this intervention might report different themes relevant to pain centrality. Future studies may further examine the centrality of pain in larger and more diverse samples to gain a more representative picture of how centrality functions among patients with chronic pain. Additionally, our sample was predominantly male and exclusively Veterans; future

studies of pain centrality among non-Veteran samples and women are warranted. Furthermore, the study is limited by small samples, especially in our comparison groups of significant decreases (N=6) and increases (N=10) in centrality. Although it is not possible to generalize to broader samples from these results, these qualitative findings provide a unique description of how patients with chronic pain experience pain centrality.

Another limitation is that our interpretation of results may have been biased by our interest in the construct of pain centrality. We believe this bias is mitigated by our coding methods, but we acknowledge that this influence may remain. It is also plausible that study participants may have been primed to think of pain centrality by having received the CoPS during baseline and follow-up assessments. We are unable to directly test this and accept that our data may have been impacted by this priming effect; however, this possibility is mitigated by the fact that interviews were conducted several weeks to months after completion of the study's final assessments. We find it noteworthy, and consistent with previous literature, that participants discussed chronic pain as predominant in their lives without being asked about pain centrality.

Despite these limitations, the findings of this study further highlight the utility and significance of pain centrality and have implications for future research in this area. Pain centrality merits further exploration in its relationship to treatment effectiveness; it is plausible that high pain centrality functions as a barrier to treatment engagement and/or treatment responsiveness among chronic pain patients. Centrality of pain should be tested as a potential mediator or moderator of treatment effect in chronic pain treatment trials. Additionally, the results of this study have implications for future clinical research regarding psychological treatment of chronic pain. Cognitive behavioral therapy (CBT) is recommended as an empirically supported treatment for chronic pain [27] with an emphasis on restructuring maladaptive cognitions to be more constructive. The results of this study suggest pain centrality as an important cognition in a patient's overall pain experience and thus should be considered when assessing and treating chronic pain. Centrality of pain may, therefore, represent a crucial target in the treatment of chronic pain and future research is warranted to develop and test centrality-specific cognitive interventions as a component of CBT for chronic pain.

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