

## Original Report

# “I don't have chronic back pain anymore”: Patient Experiences in Pain Reprocessing Therapy for Chronic Back Pain

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**Abstract:** In a recently published randomized controlled trial, two-thirds of the patients receiving a novel psychological treatment, pain reprocessing therapy (PRT), reported elimination or near-elimination of chronic back pain. The mechanisms of PRT and related treatments remain poorly understood but are hypothesized to center on pain reappraisal, fear reduction, and exposure-potentiated extinction. Here, we investigated treatment mechanisms from the participants' perspective. A sample of 32 adults with chronic back pain who received PRT completed semi-structured posttreatment interviews about their treatment experiences. The interviews were analyzed with multiphase thematic analysis. The analyses identified 3 major themes reflecting participants' understanding of how PRT led to pain relief: 1) reappraisal to reduce fear of pain, which included guiding participants to relate to pain as a helpful indicator, overcoming pain-related fear and avoidance, and reconceptualizing pain as a “sensation;” 2) the link between pain, emotions, and stress, which included gaining insight into these connections and resolving difficult emotions; and 3) social connections, which included patient-provider alliance, therapist belief in the treatment model, and peer models of recovery from chronic pain. Our findings support the hypothesized mechanisms of PRT centered on pain reappraisal and fear reduction, but also highlight additional processes from the participants' perspective, including a focus on emotions and relationships. This study underscores the value of qualitative research methods in illuminating the mechanisms of novel pain therapies.

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**Perspective:** This article presents participants' perspectives on their experience engaging in a novel psychotherapy for chronic pain, PRT. Through pain reappraisal, linking pain, emotions, and stress, and connecting with their therapist and peers, many participants reported an elimination or near-elimination of their chronic back pain with therapy.

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A substantial body of research documents the key role played by psychosocial factors in the development, maintenance, and severity of chronic pain.<sup>1-7</sup> This recognition has spurred the development of several psychological/behavioral chronic pain treatments, including widely studied treatments like cognitive behavioral therapy (CBT), acceptance and commitment therapy, and mindfulness-based therapies.<sup>8-10</sup> Randomized controlled trials support the efficacy of these treatments in reducing pain and disability, but meta-analyses indicate that effect sizes are small compared to no treatment or usual care, and even smaller when compared to active controls.<sup>9,11,12</sup> Specifically, full recovery from chronic pain is rarely reported with these leading treatments.

Yet, emerging pain neuroscience suggests that substantially reducing or eliminating chronic pain may be possible, at least for some people. Recent models highlight a subtype of chronic pain, often termed primary or nociplastic pain, in which pain is driven primarily by central nervous system processes in the absence of peripheral tissue injury.<sup>13,14</sup> For this subtype, pain may be a learned signal that reflects anticipated or perceived threat, reinforced by fear and avoidance behaviors.<sup>6,15-17</sup> This dovetails with recent models emphasizing that emotion and other affective experiences are actively “constructed” by distributed brain processes, guided by appraisals of the meaning and threat value of stimuli, and suggests that the pain experience (especially primary chronic pain) can be constructed mainly by supraspinal processes.<sup>15</sup> This suggests the possibility that some cases of primary chronic pain can be reversed by changing appraisals of the meaning and threat value of pain, targeting pain-related affective processes, and disrupting fear-avoidance learning processes—though more evidence is needed.<sup>18,19</sup>

Pain reprocessing therapy (PRT) is a recently developed psychological therapy for primary (nociplastic) chronic pain, which aims to reduce or eliminate pain. Theoretically, PRT does so by accomplishing 2 core change processes: first, PRT helps patients reattribute the causes of their pain from their bodies to their brains; and second, PRT helps patients reduce fearful avoidance of their pain, learning that it is not dangerous.<sup>20,21</sup> This therapy builds on existing evidence-based interventions, including pain neuroscience education<sup>22,23</sup> and pain exposure therapy.<sup>24</sup> It uses a core technique of “somatic tracking” of pain and fear/anxiety while patients engage in behaviors that elicit pain (eg, walking, bending, lifting). This technique, when coupled with a clear message that their bodies are not

damaged but that their brains have learned to activate the “pain alarm,” is designed to help patients shift their attributions of the cause and meaning of pain and reduce fear of pain and bodily damage.

PRT includes several points of difference from leading evidence-based psychological treatments, such as CBT, acceptance and commitment therapy, and mindfulness-based therapies. These evidence-based treatments typically view all chronic pain as stemming from a complex, unknown interaction of peripheral tissue problems and psychosocial/brain processes, and do not aim to subtype patients. These treatments further view pain as something that can be *modulated* by psychosocial factors, but typically not *generated* by the brain in the absence of injury. The goal of these treatments is typically to help patients live more adaptively with their pain, but not to eliminate pain. For example, a widely used CBT manual states that “since chronic pain can typically not be cured but only managed, it must be viewed as an illness... [and] the focus of [treatment] is to improve the individual’s quality of life and functioning.”<sup>25</sup> It is possible that how these leading treatments approach chronic pain may limit their efficacy relative to treatments like PRT, which are based on a distinct perspective.

PRT was recently tested in a 3-arm clinical trial with adults with chronic back pain.<sup>20</sup> Participants randomized to PRT experienced large reductions in pain intensity: 66% were pain-free or nearly so at posttreatment. Gains were largely maintained over the 1-year follow-up. Effects of PRT on pain intensity were mediated by large reductions in fearful pain beliefs. Accompanying changes in brain function were observed using longitudinal functional magnetic resonance imaging (fMRI), with reduced prefrontal responses to evoked pain and increased prefrontal-somatosensory functional connectivity for PRT versus control conditions. Such impressive clinical outcomes motivate the need to better understand how PRT accomplished such pain reduction or elimination, and quantitative data alone (ie, self-report rating scales of the therapy process and outcomes) do not tell the full story of patients’ experiences during an intervention.<sup>26</sup> To complement the previously published quantitative results, we report here results from a qualitative analysis conducted on posttreatment interviews with participants who received PRT.

Qualitative methods provide an important window into treatment mechanisms. They allow researchers to learn from participants what *they* think led to change. Only a handful of qualitative studies have been conducted on pain interventions<sup>27-31</sup> and no qualitative

studies of PRT have been conducted. Thus, the primary objective of the current study was to understand the core change processes of PRT from the perspective of the patients. A secondary objective was to explore pretreatment beliefs and expectations regarding the treatment process, as it has been suggested that many people with pain will not be open or willing to engage with treatment models presenting pain as brain-generated. To address these objectives, we conducted a multiphase thematic analysis of interviews conducted with participants randomized to PRT in the previously described trial.<sup>32</sup>

## Methods

### The PRT Trial

Full details of the original trial design, sample, procedures, interventions, and outcomes are presented in Ashar et al<sup>20</sup>; key points are noted here. Adults with chronic back pain were recruited from the community. They were eligible if they were between 21 and 70 years old, had back pain worse than leg pain, and had an average pain intensity of at least 4 (on a 0–10 scale) during the past week, with pain on at least half the days over the previous 6 months. A total of 50 patients were randomized to PRT, 5 of whom did not initiate PRT, leaving 45 who started treatment; 44 of these patients completed the treatment. PRT was provided by 2 experienced PRT therapists with degrees in social work, 1 male (A.G.) and 1 female (C.U.), with all patients completing an initial assessment and education session with a physician experienced in this treatment approach (H.S.). This study was approved by the institutional review board (IRB) of the University of Colorado Boulder, and informed consent was obtained from each participant.

### Posttreatment Interviews

Following the completion of PRT, patients were invited to participate in a semi-structured interview about their experiences during treatment. Interviews were added to the trial after it commenced, and participants who had already completed the trial were invited back to participate in the interview. Interviews were provided by 32 patients (73% of the 44 patients who completed PRT), who constitute the current sample. Eight of the 32 interviewed patients had completed treatment several weeks or months prior to the interview, whereas the other 24 patients completed the interview within 1 week of the end of PRT. Twelve participants did not respond to requests to return for an interview. Participants were not compensated separately for being interviewed, outside of the compensation received for the study participation as a whole.

In-person, semi-structured interviews were completed in a behavioral testing room on the University of Colorado campus and lasted an average of 14.2 minutes (SD = 8.19). Interviews were conducted by research assistants and included questions about back pain history and treatment,

### Table 1. Interview Guide

1. How long have you had chronic back pain?
2. What have you previously tried to alleviate the back pain?
3. What was your initial expectation at the start of the study?
4. Did you expect the treatment to help you?
5. Has this study changed your relationship to your chronic back pain?
  - a. Prompt: (If the treatment helped them): What about the treatment do you think was most helpful?
6. How much pain are you in right now?

pretreatment expectations, and the impact of PRT (see Table 1 for the interview guide). Interviews were video recorded and transcribed by artificial intelligence, followed by an accuracy review by a professional transcriptionist. In the Results section, we have detailed the participants' identification number (ID), age, gender, and pre- and posttreatment pain rating when providing quotes to provide readers with a better sense of each participant (eg, ID 132, 28F, pain<sub>pre</sub> = 5, pain<sub>post</sub> = 1).

### Analysis of Interview Data

The analysis of interview data was based on qualitative descriptive methodology, as our goal was to inquire naturally about participant experiences during an intervention study.<sup>33</sup> A multiphase thematic analysis using the methodology of Braun and Clarke<sup>34</sup> was used to identify the core themes and change processes during PRT. Coding was completed by 2 researchers (authors H.T. and J.H.) using NVivo 12 qualitative analysis software (QSR International, Burlington, Massachusetts). These coders were selected as they had little prior contact with or knowledge of the PRT model, were not associated with the original clinical trial, and therefore served as relatively objective parties with limited prior conceptions of PRT mechanisms.

Analysis began with a thorough reading of all 32 interview transcriptions followed by the 2-phase analysis. Phase 1 used a theoretical analysis or deductive approach, which identified interview content directly related to the treatment processes proposed a priori by PRT therapists and researchers. That is, we examined how participant experiences mirrored, or diverged from, the processes that the PRT creators believe elicit change. Phase 2 went back to the original transcripts and analyzed all of the interview data utilizing an inductive, data-driven approach to identify any underlying content that was not necessarily related to the researchers' a priori hypotheses. The 2 coders subsequently conferred to discuss the identified codes, condense overlapping areas, and consider areas of disagreement. Overall, there was substantial agreement between the 2 coders, establishing the intercoder agreement. The multiple-coder process facilitated discussion among members of the research team, who critically interpreted the preliminary results. The research team helped to organize, define, and refine the themes by grouping and collapsing the codes, including discussing differing opinions on the theme categorizations,<sup>35</sup> and agreed on a final set. These

#### 4 The Journal of Pain

analytic procedures aim to ensure a complete, thorough, and rigorous analysis while minimizing researcher biases.<sup>36</sup>

In the **Results** section, we first present participants' experiences with pain before treatment and their pre-conceptions about what to expect from PRT. We then present participant reflections on their experiences with PRT, which is the primary focus of our analyses. We include the frequency of participants who are represented in each theme. Although reporting such quantitative data is not traditionally included in qualitative research, we believe that these data will better illuminate and represent participant experiences of PRT in this trial.

## Results

### Participant Characteristics

The 32 interviewees ranged in age from 23 to 68 years ( $M = 48.13$ ;  $SD = 15.08$ ), the sample was 50% female and primarily White (93.6% White; 5.3% Asian or Pacific Islander; 1.1% other), and the average pain duration was 11.68 years ( $SD = 11.26$ ). The average baseline pain intensity of the interviewees was 4.13 (0–10 numerical rating scale,  $SD = 1.66$ ) and the average posttreatment rating was 1.19 ( $SD = 1.26$ ). Interviewees reported an average pain intensity decrease of 2.94 points from baseline to post-treatment (ie, mean pain reduction of 71%). At post-treatment, 24 of the 32 participants (75%) were "pain-free or nearly pain-free," operationalized as reporting an average pain intensity for the past week of 0 or 1.

To investigate potential bias in our sample, we compared the 32 interviewed participants to the 12 PRT completers who were not interviewed on several demographic and pain-related variables. Participants who were interviewed tended to be older (48.1 vs 37.0 years) and more likely to be male (75% vs 50%) than those who were not interviewed. Interviewees and non-interviewees were similar in baseline pain duration ( $M = 11.68$  vs  $10.83$  years), posttreatment pain intensity ( $M = 1.19$  vs  $M = 1.17$ ), pain interference ( $M = 1.00$  vs  $.95$ ), depression ( $M = 11.88$  vs  $13.17$ ), and anxiety ( $M = 14.75$  vs  $15.75$ ). Additionally, the percentage who were "pain-free or nearly pain-free" posttreatment was the same, 75%, in both groups. Thus, the interviewees did not differ with respect to treatment outcomes compared to the full sample of participants who received PRT, though some demographic differences were present.

### Life Before Treatment

The majority of participants described pain that interfered with daily life, with constant efforts to alleviate the pain that provided only "momentary relief." Participants discussed numerous back surgeries, physical therapy, pilates, and steroid injections, and disclosed taking "huge doses of narcotics," which "numbed" the

pain temporarily but "it never really went away." Participants described how pain negatively impacted not just the ability to physically engage in daily activities, but also the enjoyment of activities that were favored before the onset of pain: "I lost the ability to hike and bike and dance and engage in things that gave my life meaning and that brought me joy" (ID 113, 59F,  $\text{pain}_{\text{pre}} = 7$ ,  $\text{pain}_{\text{post}} = 4$ ). Many participants described seeking multiple opinions and treatment from medical professionals without relief, leading some individuals to reach a place of pain acceptance—"So that was the point where I was just like, well, I guess I'm just gonna deal with pain for the rest of my life and that's the way it is" (ID 312, 25M,  $\text{pain}_{\text{pre}} = 3$ ,  $\text{pain}_{\text{post}} = 1$ ). A sense of hopelessness was communicated, as participants felt as though their pain would never subside and, therefore, the only path forward was to learn how to "coexist" with it.

### Treatment Expectations

When the participants learned of a study offering a novel psychological treatment aiming to eliminate pain, they responded with a range of emotions and expectations. The majority ( $n = 20$ ; 62.5%) of participants expressed *mixed attitudes* about the treatment, such as a "healthy skepticism" and being "cautiously optimistic." For many participants, it was the first time they were told that the cause of the pain was not in the periphery (ie, not in their back), which led to feelings of doubt about the study and research team because most participants had previously received explanations related to back pathology and magnetic resonance imaging (MRI) findings. Additionally, this study was the first time many individuals heard of the idea of psychological treatment for pain reduction. Although there was initial hesitancy about the relationship between psychology and bodily pain, this novel treatment idea elicited optimism, as participants spoke about how they were "willing to learn and try anything" (ID 1036, 58F,  $\text{pain}_{\text{pre}} = 2$ ,  $\text{pain}_{\text{post}} = 1$ ) to alleviate their pain because prior attempts had been unsuccessful.

The other 12 participants (37.5%) were split evenly: 6 expressed only positive expectations about the treatment, including approaching it with an open mind, healthy curiosity, and a willingness to participate. In contrast, 6 participants (18.8%) disclosed only hesitancy and skepticism about the treatment, stating they were "not very hopeful" (ID 113, 59F,  $\text{pain}_{\text{pre}} = 7$ ,  $\text{pain}_{\text{post}} = 4$ ) that a psychological treatment would ease the physical pain that had been interfering with their daily lives for so long. These latter participants were suspicious of a psychological approach; 1 described it as "pseudoscience" (ID 774, 27M,  $\text{pain}_{\text{pre}} = 5$ ,  $\text{pain}_{\text{post}} = 1$ ), and another said that the thought of psychology alleviating physical pain seemed "very fishy" (ID 39, 23F,  $\text{pain}_{\text{pre}} = 3$ ,  $\text{pain}_{\text{post}} = 0$ ). These 6 were also hesitant to believe that any new treatment (psychological or medical) would provide pain relief, as "nothing else

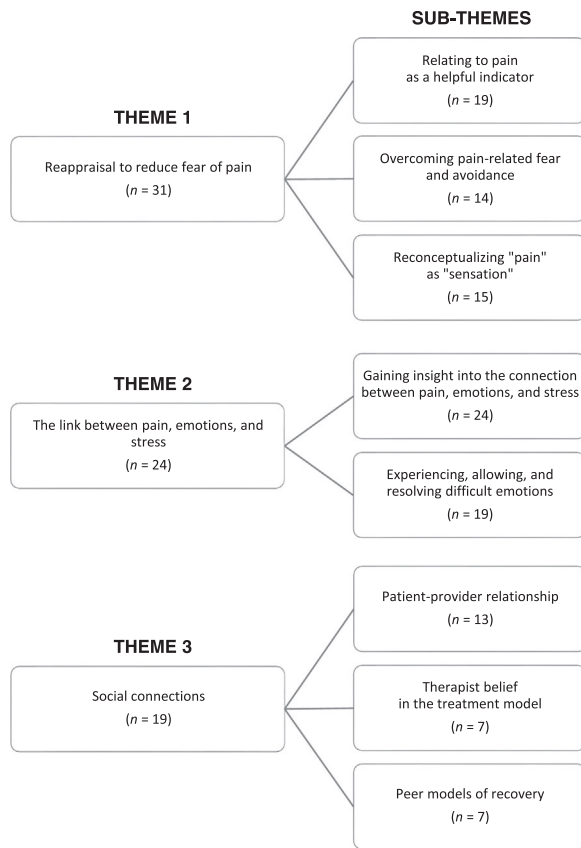


Figure 1. Qualitative themes and subthemes.

has worked so I don't know why this one would" (ID 1160, 50M, pain<sub>pre</sub> = 5, pain<sub>post</sub> = 3). Despite these initial hesitations, these participants proceeded with treatment.

### Major Themes and Subthemes of PRT as Experienced by Participants

A total of 30 codes were identified during the multiphase thematic analysis. These were collapsed into 3 themes, representing the core change processes that participants perceived as responsible for PRT's benefits. The themes were 1) reappraisal to reduce fear of pain; 2) the link between pain, emotions, and stress; and 3) social connections. Under each theme lies subthemes (see Fig 1), which represent participants' views on the specific therapeutic components in each core process, with representative quotes displayed in Tables 2 to 4.

#### Theme 1: Reappraisal to Reduce Fear of Pain

The first core change process identified was the participants' recognition that the experience of physical pain is not a signal of danger (ie, tissue damage). Aligning with the concept of pain reattribution—one of the key components of PRT—all participants but one (n=31) described a shift in their perceptions of pain. This shift, from believing that pain is caused by a dangerous physical ailment to believing that pain is a

Table 2. Representative Quotes From Theme 1: Reappraisal to Reduce Fear of Pain

#### Sub-theme 1: Relating to Pain as a Helpful Indicator

1. That's the work I want to continue doing, is, if I have a severe pain burst, finding a way to really see it as an opportunity and a gift as opposed to something that's going to take me down a downward spiral. (ID 1036, 58F, pain<sub>pre</sub> = 2, pain<sub>post</sub> = 1)
2. I became aware that the pain, for me, was a signal that I'm stressed out, or not taking care of myself. That instead of resisting it and me being fearful about it, that I really changed my attitude about it, and can really now see it as this signal. (ID 575, 59F, pain<sub>pre</sub> = 3, pain<sub>post</sub> = 0)

3. Now, I kind of go, "Oh! Thank you!" Instead of, "Oh, I wanna resist this, this is awful, it's this debilitating thing, I can't get out of bed, it's so painful if I put my foot on the floor in the morning." It's gone from that to, "Oh, okay, thank you for sharing. I want to understand what you're trying to tell me," and kind of just check in on what situation is occurring in my life that is making my body have a fear response. (ID 575, 59F, pain<sub>pre</sub> = 3, pain<sub>post</sub> = 0)

#### Sub-theme 2: Overcoming Pain-Related Fear and Avoidance

1. It really has made me less frightened of the pain. I mean, it used to be every time I started out on a hike...I would be worried, I would be concerned. I'd take painkillers, I'd do what it took to be able to do that without it. Just because I was frightened that I was gonna have pain, it was not gonna be a fun experience. Now...if I get a little bit of pain, I deal with it. It's not like it's killing the hike. In fact, it goes away frequently. It's like 'eh, don't worry about this, this is really not a problem.' And by the end of the hike I'm feeling great. (ID 1084, 66M, pain<sub>pre</sub> = 1, pain<sub>post</sub> = 1)
2. I think the fear in relation to stress, anxiety, your expectations that pain is gonna be there. That's the fear. The fear that it's not gonna go away or it's just gonna get worse...Not ever be able to exercise again or just constantly be that grouchy, anxious person. (ID 814, 44M, pain<sub>pre</sub> = 5, pain<sub>post</sub> = 0)

#### Sub-theme 3: Reconceptualizing "Pain" as "Sensation"

1. Sensations can come on, they're temporary, they're not dangerous. (ID 1036, 58F, pain<sub>pre</sub> = 2, pain<sub>post</sub> = 1)
2. I'm paying attention to where I'm feeling something and it's not bad sensations. It's just sensations. (ID 1087, 64F, pain<sub>pre</sub> = 4, pain<sub>post</sub> = 3)

nonthreatening brain process that can be altered, led the participants to respond in new and adaptive ways to physical discomfort. The following 3 subthemes describe how this change process was achieved by participants: 1) relating to pain as a helpful indicator, 2) learning how to overcome pain-related fear and avoidance, and 3) using novel language to describe pain (see Table 2 for representative quotes).

#### Subtheme 1: Relating to Pain as a Helpful Indicator

All but 3 participants (90.6%) described different thought processes when they noticed an increase in pain. This "change in mindset" meant that they began to view pain as a "signal" to "reflect on what's going on right now" (ID 113, 59F, pain<sub>pre</sub> = 7, pain<sub>post</sub> = 4) psychologically or within the environment, rather than responding to pain as if it were a sign of injury or bodily problems. This shift, for example, led 1 participant to acknowledge how she thanks her pain for communicating important messages (eg, about her emotional state) during painful moments. One man stated that he learned how to view his pain as sending him a message, leading him to question—rather than resent—his pain: "What's going on? Did something just happen? Or is there something that's bothering me in life?" (ID 324, 61M, pain<sub>pre</sub> = 6, pain<sub>post</sub> = 1). One woman discussed the importance of realizing that when she experiences an increase in pain, her pain is signaling to her body that it

needs proper attention and care: “When I feel my pain, I take it as a signal to get up, move around, do something else, do something nice for myself. So, instead of cringing every time it comes on, I think of something nice to do” (ID 38, 57F, pain<sub>pre</sub> = 6, pain<sub>post</sub> = 1).

### Subtheme 2: Overcoming Pain-Related Fear and Avoidance

Participants described how they learned to overcome their pain-related fear and avoidance, which is also a main focus of PRT. To achieve this, participants discussed how they were guided through physical movements that were previously avoided due to fear that they would cause pain or injury, only to find that these movements were not as painful as they anticipated and did not cause further injury—rather, participants described a sense of safety when performing them. Fourteen participants (43.8%) acknowledged this process of reduced fear and enhanced feelings of safety as an important step in therapy. During these movements, participants were asked to describe painful sensations objectively and reappraise sensations as safe, which subsequently helped to reduce pain catastrophizing and pain-related vigilance. The positive benefits of in vivo exposure translated to the ability to engage in, rather than avoid, valued activities, which led to feelings of empowerment. As 1 participant commented, “When I do have some pain...I’m more like, ‘Bring it on.’ This is nothing I’m not in any danger. I’m not afraid. If it stays, it stays. If it doesn’t, great, but it doesn’t intimidate me” (ID 1027, 68F, pain<sub>pre</sub> = 4, pain<sub>post</sub> = 1).

Participants (n = 12, 37.5%) also described learning how to mindfully attend to and reappraise pain sensations as safe, a PRT practice labeled “somatic tracking.” Participants recalled being asked to observe the variance of sensations traveling throughout the body, and then verbalizing the sensations aloud (eg, “Is it burning? Is it spreading? Where do you feel it?” [ID 113, 59F, pain<sub>pre</sub> = 7, pain<sub>post</sub> = 4]), while reminding themselves that the sensations are non-dangerous, brain-generated “false alarms.” As one man described:

I think I was always trying to make it go away...I think what [my PRT therapist] did more is have me try to feel and analyze the pain, and then see if it changed or not by...just focusing on it... I noticed that I would feel pain in one place, and then it would change a little bit. It would get even more intense or less intense just by thinking about it. So that was a revelation (ID 102, 61M, pain<sub>pre</sub> = 6, pain<sub>post</sub> = 3).

Participants found that shifting their focus toward their pain and observing what was happening in their bodies helped to reduce pain. One participant learned to “look at the pain...and with your mind, you can sort of make it shrink, make it move, or make it go away” (ID 38, 57F, pain<sub>pre</sub> = 6, pain<sub>post</sub> = 1). This process of attending to bodily sensations, in turn, helped

participants realize that the onset of pain did not signal the presence of peripheral tissue damage.

Another example of how participants learned to overcome pain-related fear and avoidance is by having the nature or causes of their pain challenged by the therapists, or “breaking down what didn’t make sense” by drawing attention to contradictions when the participants discussed their pain. For example, 1 participant shared that her therapist brought attention to “the things that don’t quite line up: I have trouble sitting in class for long periods of time, yet I’m a competitive power lifter. How can those two things co-exist?” (ID 29, 23F, pain<sub>pre</sub> = 3, pain<sub>post</sub> = 0). Being challenged led to an understanding that painful sensations are not dangerous and are brain-generated experiences. As 1 participant said, “I absolutely think that my brain was the majority of my pain...at the very least it was controlling at least 90% of the pain” (ID 1234, 37F, pain<sub>pre</sub> = 6, pain<sub>post</sub> = 3). This was a pivotal point in the therapeutic process, when participants described a shift in their pretreatment perceptions that a medically based treatment would be the only approach to improve their pain.

### Subtheme 3: Reconceptualizing “Pain” as “Sensation”

Nearly half of the interviewees (n = 15; 47%) reported using novel language when describing their pain, which promoted changes in mindset. The most common shift was no longer referring to physical discomfort as “pain,” but rather describing it as a “painful sensation” or simply a “sensation.” As 1 participant explained, “If I get sensations, I call them sensations, I don’t call them pain. If I get sensations, I can pay attention to them and work with them, and I don’t have to be terrified about them. I know now that they’re temporary, that they come and go, and they can go” (ID 1036, 58F, pain<sub>pre</sub> = 2, pain<sub>post</sub> = 1). Conversely, he implied that identifying sensations as “pain” means he is less able to deal with their onset because his initial response is fear, a more challenging emotion to cope with. The overarching idea is that “sensations are temporary,” whereas “pain” is viewed as more permanent and detrimental. This novel way of viewing and responding to discomfort helped participants change how they perceived their familiar pre-treatment pain.

## Theme 2: The Link Between Pain, Emotions, and Stress

The second major theme involves participants’ realizations that their pain and emotions are connected and that this reciprocal relationship impacts their daily lives (see Table 3 for representative quotes).

### Subtheme 1: Gaining Insight into the Connection Between Pain, Emotions, and Stress

Participants described important revelations throughout treatment that involved recognizing, and then processing, the connection between pain and other emotions and thoughts. The connection of pain

### Table 3. Representative Quotes From Theme 2: The Link Between Pain, Emotions, and Stress

#### Sub-theme 1: Gaining Insight into the Connection Between Pain, Emotions, and Stress

1. I think I just was so overwhelmed emotionally. The coping strategies I was using, I just couldn't do it anymore. And it had to go somewhere and it went to my hip. (ID 113, 59F, pain<sub>pre</sub> = 7, pain<sub>post</sub> = 4)
2. I think it's just knowledge that everyone should have. That you have this amplifier, or potentially linked to your pain, and your perceptions, or the fears, or the dangers around what might be going on in your body can contribute to that pain, or headaches, or anxieties, or probably all kinds of other things. (ID 1141, 35M, pain<sub>pre</sub> = 5, pain<sub>post</sub> = 1)
3. I still do have moments of genuine pain. I actually, sort of, re-injured myself a couple of weeks ago doing a stupid thing power lifting. But, looking from the perspective of realizing that my pain does get worse with anxiety, I almost feel like I've been able to distinguish different kinds of pain. (ID 29, 23F, pain<sub>pre</sub> = 3, pain<sub>post</sub> = 0)
4. I learned how connected my emotional state was with this pain. And recognizing that some of the emotions that I've tended to repress within my life were a huge component to that pain... (ID 312, 25M, pain<sub>pre</sub> = 3, pain<sub>post</sub> = 1)

#### Sub-theme 2: Experiencing, Allowing, and Resolving Difficult Emotions

1. We kind of went back to my childhood and sort of looked at my...my vulnerability, my incredible shyness and social anxiety...and the messages I got growing up about caregiving from my mother and productivity from my father, and how those all sort of came together as a child to sort of cause me to develop a way of coping in the world. And coping with my anxiety that really put the needs of others ahead of my own. (ID 113, 59F, pain<sub>pre</sub> = 7, pain<sub>post</sub> = 4)
2. ...be willing to engage with the emotions or things that you haven't wanted to deal with in your life. It's really...hard, but it's worth it. (ID 312, 25M, pain<sub>pre</sub> = 3, pain<sub>post</sub> = 1)
3. Allowing myself and giving myself permission to feel and experience those emotions has been big. (ID 312, 25M, pain<sub>pre</sub> = 3, pain<sub>post</sub> = 1)
4. The principles just build on each other and I never would have guessed that childhood issues could be affecting the way I feel in my physical body today. (ID 605, 44F, pain<sub>pre</sub> = 5, pain<sub>post</sub> = 0)

with emotions and stress was discussed by 24 participants (75%), who described how feelings of depression, anxiety, anger, and generalized stress exacerbated the pain. Most of these participants developed insight into this relationship during treatment, discussing a new awareness that pain and emotional experiences are more deeply connected than they had originally realized. For example, some participants reported that if they do not effectively cope with uncomfortable emotions, the emotions manifest as physical discomfort because they "have to go somewhere" and therefore "create this pain." Additionally, participants described this new awareness as giving them the ability to distinguish between 2 types of pain: pain that is caused by peripheral tissue conditions and pain that results from emotional discomfort or maladaptive thought patterns.

### Subtheme 2: Experiencing, Allowing, and Resolving Difficult Emotions

Discussing emotional experiences—for example, feelings of sadness, anger, shame, and anxiety that often had been present long before the onset of pain—was mentioned by 19 participants (59.4%) as an important aspect of the therapy. Ten participants (31.3%) reported addressing uncomfortable emotions, prior trauma, and "psychological pain from my childhood" (ID 1113, 66F, pain<sub>pre</sub> = 3, pain<sub>post</sub> = 1) that had continued to negatively impact their lives. Through the

therapeutic process, participants "dug deep" into emotions. For example, a female participant discussed her longtime struggle with feelings of shame:

I'm very shame-bound...The most concrete way is I'll kind of say my inner bully starts shaming me for being afraid and shaming me for not being able to overcome the pain, and then I get more afraid... [My therapist] and I worked on this quite a bit during the psychotherapy. For me, the manifestation of the inner bully related to pain is pretty intense (ID 1036, 658F, pain<sub>pre</sub> = 2, pain<sub>post</sub> = 1).

Participants not only discussed emotions, but also learned how to give themselves "permission" to feel emotional discomfort that they had otherwise learned was unsafe or inappropriate to experience. As one participant stated, it is

...like that 5-year-old kid that has these things that they want to express but they just can't. And that other voice is pretty much just telling it to shut up...So it's been like tapping into that other voice that wants to be heard...It's all, I think, tied to vulnerability. Being willing to be vulnerable because I was just very closed off (ID 312, 25M, pain<sub>pre</sub> = 3, pain<sub>post</sub> = 1).

Participants described this therapeutic element as a difficult process, though they acknowledged that they felt safe with their therapist and the emotional work was crucial in their healing process.

Participants discussed reductions in negative emotions and increases in positive emotions that resulted from engaging in these emotional processes, most commonly, reductions in anxiety, stress, and anger. All participants who discussed positive emotions identified happiness as being more prevalent in their daily lives following treatment. This happiness was expressed as both internal ("[Treatment] has actually made me a happier person" [ID 319, 48M, pain<sub>pre</sub> = 6, pain<sub>post</sub> = 0]) and external ("I'm sure I'm a lot happier to be around" [ID 575, 59F, pain<sub>pre</sub> = 3, pain<sub>post</sub> = 0]) changes. Additionally, 6 individuals (18.8%) described their enhanced awareness of emotional experiences in general, and their perceived safety to identify, feel, and process these experiences. One participant eloquently described this change:

So, it was being present with that pain but also being present with my emotions, the emotions that we label as negative because those are also very much part of me or who I am. So, allowing myself and giving myself permission to feel and experience those emotions has been big. It's still a challenge. But it's like leaning into that instead of running from it... (ID 312, 25M, pain<sub>pre</sub> = 3, pain<sub>post</sub> = 1).

### Theme 3: Social Connections

This final theme discusses content related to the therapist and pain peers, which participants described

## 8 The Journal of Pain

**Table 4. Representative Quotes From Theme 3: Social Connections**

*Sub-theme 1: The Patient-Provider Relationship*

1. I got really comfortable with her and just sort of let myself get into it and not feel intimidated or embarrassed or anything like that. It was really helpful. (ID 38, 57F, pain<sub>pre</sub> = 6, pain<sub>post</sub> = 1)
2. He's very open. He's vulnerable, himself, so he's easy to trust. He's very passionate about this work. It's all very authentic. It's a very caring and trusting environment. (ID 575, 59F, pain<sub>pre</sub> = 3, pain<sub>post</sub> = 0)
3. And I think he then went a little bit deeper and he did that in such a way that was really so skilled...He was firm and consistent and always believed that this pain is something that I could soothe and quiet. But he didn't discount why I was struggling. (ID 113, 59F, pain<sub>pre</sub> = 7, pain<sub>post</sub> = 4)

*Sub-theme 2: Therapist Belief in the Treatment Model*

1. [The physician] and [therapist] were so positive that my pain would disappear. They were 100% sure. I was like, "Well this is definitely going to work, it's going to work and I've got to do everything I can to make sure that it works." So I was totally committed to making it happen. (ID 1027, 68F, pain<sub>pre</sub> = 4, pain<sub>post</sub> = 1)
2. Once I had a conversation with [my therapist]...That's when it started to hit me... once I understood like from just a purely intellectual standpoint, then I knew, "okay I'm gonna do this. This totally makes sense to me." And then I was in, all in after that. (ID 893, 45M, pain<sub>pre</sub> = 5, pain<sub>post</sub> = 0)

*Sub-theme 3: Peer Models of Recovery*

3. So I actually, looking back, think I needed one of those experiences of doubt, like severe doubt, about this whole thing, because after that is when he put me in touch with two [former patients], and I got to hear what they had experienced. (ID 1036, 58F, pain<sub>pre</sub> = 2, pain<sub>post</sub> = 1)
3. And the other thing was I talked to a guy that had been through it and [he was] a former football player, so I came into it thinking I think this might actually work. (ID 893, 45M, pain<sub>pre</sub> = 5, pain<sub>post</sub> = 0)

as valuable in adopting the new model of pain and maintaining their motivation to engage in treatment (see Table 4 for representative quotes).

### Subtheme 1: The Patient-Provider Relationship

Thirteen participants (40.6%) identified the therapeutic alliance as enhancing participation treatment motivation and engagement. This ranged from commenting on the therapist's "soothing voice" and ability to put the participant at ease to acknowledging the therapists' prominent role in their treatment outcomes. Some participants identified a process of the therapist first guiding the participant through the treatment components and then empowering the participant to individually implement the techniques: "At first I felt like [my therapist] is the one who's making me do it, but now I'm feeling like I'm the one, I've been empowered to do it for myself...[My therapist] helped me get there" (ID 1027, 68F, pain<sub>pre</sub> = 4, pain<sub>post</sub> = 1). Participants also discussed the emotional bond and comfort they felt with their therapist, which developed initially for some ("I clicked like I've never clicked with another therapist" [ID 38, 57F, pain<sub>pre</sub> = 6, pain<sub>post</sub> = 1]) and over time for others after they discovered they could trust and felt safe with their therapist.

### Subtheme 2: Therapist Belief in the Treatment Model

Seven participants (21.9%) identified their therapists' belief in the PRT model and in participants' ability to change as key components that drove initial treatment engagement and influenced participant expectations of

how treatment would impact their lives and pain. Participants described the pre-treatment conversation with the physician and the therapists' presentation of PRT as "convincing," saying they presented as positive and confident and clearly communicated their positive perceptions of the treatment modality and belief that it would change the lives of participants. This, in turn, left participants feeling committed to treatment and believing it would effectively reduce their pain. As 1 participant said, "This is definitely going to work" (ID 1027, 68F, pain<sub>pre</sub> = 4, pain<sub>post</sub> = 1).

### Subtheme 3: Peer Models of Recovery

Participants identified talking with former PRT patients as a therapeutic element that enhanced engagement. The therapists encouraged some participants to connect and discuss treatment with successful patients from prior clinical work (not study participants). We interpret this as a form of therapeutic modeling, generating hope and social norms of recovery from pain. Seven participants (21.9%) described helpful therapist-initiated connections, especially for participants who expressed skepticism at various points during treatment. As one participant described:

I got really skeptical...and talking to two previous [patients] actually made a huge difference for me... I got to hear real people talk about, "Wow, here's what I had before, here's how it shifted for me," et cetera, and that made the study feel possible (ID 1036, 58F, pain<sub>pre</sub> = 2, pain<sub>post</sub> = 1).

Participants who were put in touch with former patients discussed their desire to have someone "back up" the therapists' claims to fully "buy in" to the therapy. These participants expressed the desire for confirmation that this novel therapy would be beneficial to others with back pain. The perceived effectiveness of talking with other patients suggests that peer support and connection can have a powerful impact on treatment perceptions and motivation to engage in treatment.

### Ancillary Findings

Nine participants (28.1%) described discussing their PRT experiences with friends, family, and others outside of the study. As 1 participant stated: "I'm telling all my friends that I know who have chronic pain that they need to go work with this kind of process. It's been a real gift, absolutely" (ID 1036, 58F, pain<sub>pre</sub> = 2, pain<sub>post</sub> = 1). These discussions ranged from general recommendations to others, to attempting to use specific tools learned in therapy to help others. For example, 1 participant mentioned sharing the "lists of things" learned from his therapist with friends with back pain and making attempts to "convince" others that his success can be replicated. We viewed these participant reports as indicators of treatment satisfaction rather than as reflections of change processes, and therefore did not include them in the model of mechanisms presented above.



## Conclusions

The current study explored participant-reported mechanisms of change in PRT, a promising novel therapy for chronic pain.<sup>20</sup> The analyses revealed 3 major themes describing how participants understood PRT to be helpful in treating their pain. Overall, some participants' perceptions of the mechanisms of PRT support the original hypothesized model of this therapy, whereas other perceptions were not emphasized or even included in the original hypothesized model.

The first core change process derived from interview data was the participants' recognition that the experience of physical pain is not a signal of danger (ie, tissue damage). Participants' focus on the reattribution of the source of the pain as a key change process (Theme 1) strongly aligns with the hypothesized model of PRT.<sup>20</sup> The PRT model is based on the idea that participants typically attribute pain to tissue damage or other peripheral/bodily anomalies, but this attribution is incorrect—in cases of primary (nociceptive) pain, mind and brain processes are the primary drivers of pain. PRT aims to correct this misattribution. This is closely related to pain neuroscience education-based interventions and other “brain retraining” interventions, which also produce changes in pain beliefs and promote an increased appreciation for brain influences on pain, with positive benefits on pain severity, interference, pain catastrophizing, and kinesiophobia.<sup>32,22,30,31</sup>

A main goal of reattribution in PRT is fear reduction: an understanding of the pain as brain-generated indicates that it is not an indicator of bodily threat. Participants reported that with guidance, they learned how to respond to pain not with fear, but with mindful reappraisal of pain as nondangerous. The fear reduction was further supported by relating to pain as a helpful indicator of one's emotional or psychological state (eg, a sign of feeling stressed), by psychotherapeutic techniques promoting mindful reappraisal of pain sensations (“somatic tracking”), and by relabeling pain as “just a sensation.”

A second major theme reported by participants is the value of addressing a range of emotional issues during PRT (Theme 2). This aspect is often presented as a peripheral/secondary treatment element in PRT; our results show that it may be more central than previously appreciated. PRT focuses on reducing the emotion of fear related to pain and movement, and the value of differentiating pain from anxiety. Targeting patients' emotional experiences more generally may have helped to facilitate the shift to viewing pain as not indicating dangerous bodily harm, thereby reflecting a synergy between Themes 1 and 2. Addressing the broad range of emotional experiences, such as feelings related to one's sense of self (eg, shame), emotional challenges experienced in relationships with others, and even emotional memories stemming from life adversity or trauma, is not a focus of the original PRT model. Prior research has shown that emotional expression is a powerful predictor of effective therapy outcomes in general,<sup>37</sup> and even cognitive-behavioral therapies are

more effective when they focus on underlying, core emotional processes and emotion-laden cognitions.<sup>38</sup> Despite a therapy's intended clinical targets, patients often will move in needed directions, and skilled clinicians, such as those who provided PRT in this trial, will facilitate such processes. It is noteworthy that PRT shares its historical development and elements of its underlying model with Emotional Awareness and Expression Therapy (EAET), which emphasizes the processing of the trauma and emotional conflict driving chronic pain.<sup>39,18,40</sup>

The third major theme that was reported by participants is the importance of relationships, both with their therapists and with peers (Theme 3). Specifically, they discussed the importance of a safe patient-provider relationship in creating a safe and supportive environment to address their fears and beliefs about their pain as well as other emotional issues. Their reports reflect the well-replicated value of a positive therapeutic alliance.<sup>41</sup> The specific attributes that participants described of their therapists (eg, warmth, friendliness, respectfulness, trustworthiness, support) are classic aspects of a positive alliance,<sup>41,42</sup> and these factors may have increased participants' motivation and comfort to engage in this challenging work.

Interestingly, participants also spoke about the ongoing motivation facilitated by therapists, both of whom had a strong belief in the PRT treatment model, which helped participants adopt that belief as well and overcome initial doubts about treatment. Although considered somewhat of a background rather than a core feature of PRT, therapists were persuasive about the possibility of recovery from pain stemming, in part, from their own personal experiences of pain recovery as well as from having helped numerous patients recover. Indeed, a surprising observation, one not planned as a part of PRT originally, is that some participants in the PRT trial were connected by their therapists to prior patients (from the therapists' practices) who had experienced positive outcomes. The combination of a strong therapeutic alliance, high therapist commitment to and belief in the model, and connections with prior patients who had recovered from pain using similar techniques likely augmented PRT outcomes in this study, as noted from the participant perspective, such that the safe and convincing environment created by therapists and the support of peers laid a solid foundation for participants and contributed to the reappraisal of pain, exploration of emotions, and subsequent reduction in pain.

Many providers fear that patients will balk if mind or brain processes are identified as causing or amplifying physical symptoms. Our results indicate that most participants (reflecting retrospectively) recount being at least somewhat open to this notion, though there was also substantial initial skepticism—this aligns with prior studies on pain neuroscience education, implying that early skepticism is quite common for patients who have otherwise been told by providers that their pain is solely the result of tissue damage or bodily anomalies.<sup>31</sup> In this study, participants who were initially relatively skeptical also described a shift in their thinking throughout the course of the intervention, and many were pain-free or

nearly so after treatment and expressed belief in the PRT treatment model. This is encouraging.

In sum, this study provides support for the hypothesized core change processes of PRT—changing fear-based beliefs of the origins of pain from the body to the brain—but also highlights additional processes dealing with emotions and the therapeutic relationship that occurred in PRT as actually practiced. It should not be surprising, we think, that a complex process like individual therapy involves both targeted and unexpected processes or emphases. Identifying these elements can help researchers and clinicians more thoroughly understand what actually occurs in PRT—at least from the perspective of the patients—and it will be important to study empirically whether these processes are indeed active mechanisms of positive treatment outcomes. If so substantiated, these elements could be added to future versions of PRT and included in PRT training.

More generally, we think that the findings here point to the need for a broader integrative pain treatment based on the “brain-generated pain” model that includes key elements of PRT, EAET, pain neuroscience education, pain exposure therapy, and perhaps other approaches, while also attending to the importance of having interpersonally skilled therapists who are committed to the model and creative in the ways that they help patients shift in their beliefs about pain and address their pain-related and other fears. One such integrative pain assessment and treatment model has been proposed.<sup>18</sup>

To address the connection between emotional experiences and pain, we recommend that clinicians, regardless of the specific model they are using (PRT, EAET, or others), be trained in how to help patients successfully recognize these connections and process or work through, rather than avoid, their important emotional experiences. Additionally, peer models of recovery may be important, which can be incorporated by conducting PRT and related therapies in a group format and providing patients with access to recovery stories (eg, through podcasts or connecting current patients with prior patients who volunteer for this peer model role). Additionally, therapist self-disclosure of recovery may be beneficial for PRT patients, especially those who find themselves skeptical of the model before or during treatment.

There are several limitations of this work. First, participants’ recall of therapeutic processes depended on

the interview questions, which were relatively general, broad, and could be viewed as somewhat leading. We did not ask about parts of treatment that participants did not like or respond well to, which would have provided us with more refutational data. Second, participants were questioned about their pre-treatment beliefs and expectations after completing treatment, which presents the risk of recall bias in reflecting on their pre-treatment beliefs. We also acknowledge variability in the quality and length of the interviews, which could be strengthened in future work by making the interview guide more substantive and providing in-depth interview training for research assistants. We acknowledge the potential for bias in the interpretation of the data; although the 2 coders of the interviews were not knowledgeable or vested in PRT, the other authors are involved with PRT’s development and implementation. Additional study limitations include the generalizability of the sample, which was largely highly educated and White. Finally, although the majority of PRT participants were interviewed, and those who were interviewed had similar outcomes as those who were not interviewed, it would have been ideal to interview all participants.

In future research, it would be of interest to know how participants’ recollections and impressions align with those of the therapists and what would be found in a third-party review of actual session recordings. For example, it would be valuable to know how often participants engaged in certain behaviors, such as disclosing prior traumas, and how often the therapist used certain techniques, such as purposely evoking pain in session, referring participants to speak with others who have recovered from pain, or using humor to create a positive mood. Triangulation of such approaches, combined with empirical associations with treatment outcomes, would reveal key aspects of effective change techniques and mechanisms.

The personal and lived experiences of PRT that we identified from interview data were not captured by the study’s quantitative measures, highlighting the importance of utilizing qualitative methods in intervention research. Our qualitative analyses help identify key change processes in PRT that can guide future treatment refinement and advancement as well as training of therapists to use this treatment.

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