

What do patients value learning about pain? A mixed-methods survey on the relevance of target concepts after pain science education

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Abstract

Pain education is a popular treatment approach for persistent pain that involves learning a variety of concepts about pain (ie, target concepts), which is thought to be an important part of recovery. Yet, little is known about what patients value learning about pain. A mixed-methods survey was conducted to identify pain concepts that were valued by people with persistent pain who improved after a pain science education intervention. An online survey was distributed to 123 people who were treated for persistent pain with a pain science education approach; responses of participants who self-identified as “improved” were analysed. Open-ended survey questions were analysed using reflexive thematic analysis and close-ended questions were analysed for frequency of responses. Each question-type was analysed separately, before integration for complementarity. We analysed the data of 97 participants. We constructed 3 themes from the open-ended questions. *Pain does not mean my body is damaged* (theme 1) captured the importance of abandoning preexisting ideas that pain indicated damage. *Thoughts, emotions and experiences affect pain* (theme 2) captured the value of recognising multifactorial influences on pain. *I can retrain my overprotective pain system* (theme 3) captured the importance of conceptualising pain as a heightened protective response that could be lessened. Responses from close-ended questions confirmed that the target concepts represented by these themes are among those most valued, although divergence with the qualitative data suggests differences between patient and clinician language. These data offer patient-centred conceptualizations and language that could assist in further refining pain education interventions.

Keywords: Pain education, Pain science, Patient perspective, Mixed-methods, Chronic pain

1. Introduction

Education is recommended as first-line care for a variety of persistent pain conditions.^{2,22,34} Education may, in part, be used to address misconceptions about pain. People with persistent pain commonly hold misconceptions about pain, for example, the belief that pain is always a sign of tissue damage.^{9,45,50} Such misconceptions about pain are problematic because they are associated with poor outcomes⁵³ and may conflict with advice to stay active and engage in psychological therapies. Education may play an important role in framing why recommended therapies for pain, such as exercise, are sensible strategies.³⁶

Pain science education is an approach that aims to challenge preexisting beliefs around a biomedical explanation for pain and

introduce pain as a biopsychosocial phenomenon with an adaptive, protective role.³⁷ Pain science education operates within a theory of conceptual change,³⁸ which assumes that learners hold beliefs that are “in conflict” with to-be-learned concepts;¹² education does not simply involve *adding* new knowledge, but rather *changing* prior knowledge. Meta-analyses indicate that pain science education has clinical benefit.^{48,54,55} Yet, patient and clinician feedback suggests that pain science education interventions could be more concise and simplified⁴⁴ and that group-delivered education can lack personal relevance.^{29,43} One way to address these concerns is to provide tailored, individualised education, as is recommended in best practice guidelines for musculoskeletal pain.³⁴ Another approach is to create briefer educational interventions, targeted at the concepts that are considered important to people with persistent pain.

Pain education interventions consist of learning objectives, herein referred to as *target concepts*. The majority of these target concepts have been developed in a top-down manner, that is, relying largely on conceptual models and formulated by clinicians and researchers.^{31,44,51} Currently, we do not know which target concepts in pain education interventions are most important to those who live well with persistent pain, or that they attribute as key to their improvement. Mixed-methods research is particularly well suited to exploring this area. Mixed-methods approaches have been used in extant clinical pain research, for example, to evaluate patient perspectives on the value of interventions.^{1,41} A mixed-methods approach draws on the strengths of qualitative and quantitative data, combining them to provide a more

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complete understanding of a research problem than either approach alone.²⁷ For example, quantitative data can be used to compare and contrast the relative importance of target concepts, whereas qualitative data can be used to more deeply investigate patient perspectives about the value of target concepts and how they conceptualize those target concepts in their own words. Therefore, the overall aim of this study was to use a convergent mixed-methods approach to investigate *which* target concepts are important to people who self-identify as improved after a pain science education intervention for persistent pain, and *why*.

2. Methods

2.1. Study design

This study used a convergent mixed-methods approach, whereby 2 types of data (qualitative and quantitative) were collected and analysed independently, and then integrated for interpretation (Fig. 1).¹⁴ We used an “intra-method”^{23,26} technique in which data are collected using a single method (ie, a survey) to produce qualitative (open-ended questions) and quantitative (closed-ended questions) data. This study is reported in accordance with the Strengthening the Reporting of Observational studies in Epidemiology checklist for cross-sectional studies⁵² and the Standards for Reporting Qualitative Research.³⁹

2.2. Participants

Adults who consulted a physiotherapist (G.L.M.), between 2016 and 2019, for treatment of persistent pain (ie, pain that had lasted for 3 months or longer³⁵) were eligible for this study. To be included, participants had to be at least 16 years of age, be able to read and write in English, and have access to the Internet. Because the original impetus for the survey was for audit and feedback purposes, not research, ethical approval was sought after the data collection period. All participants provided informed consent for their data to be used in research but were not advised as to the specific question or analysis method of that research. Ethical approval for retrospective analysis of the clinical data for this study was granted by the University of South Australia Human Research Ethics Committee (#202696).

Treatment sessions with the primary clinician (G.L.M.) focussed on pain science education with the aim of reconceptualising pain, and development and implementation of a study program to restore function via goal-oriented physical activity. Interventions were tailored to participant’s specific needs and therefore differed in respect to specific learning objectives, physical and functional exposure/upgrading, and referral to other clinicians. Pain science education formed an initial and foundational component of interventions for all participants, and all interventions were grounded in and centred around enabling and empowering patients to use contemporary rehabilitation strategies, broadly involving active and psychological strategies aimed at increasing functional and physical engagement, and self-management skills. Treatment sessions involved between 1 and 6 face-to-face sessions and between 2 and 8 telephone or video calls. The final treatment date was decided by the primary clinician, when they determined that the expertise and assistance that they could offer had been exhausted. Following this, many participants proceeded with a self-management plan; others proceeded their journey with other clinicians. Further details of the pain science education intervention using the Template for

Intervention Description and Replication (TIDieR) checklist²⁴ are provided in the Supplementary material (S1, available at <http://links.lww.com/PAIN/B313>).

2.3. Procedure

At each patient’s final treatment session, the clinician asked if the patient consented to receiving an email including a link to an online survey. They were informed that the survey examined their perceptions of treatment components. For those who verbally consented to receiving an email, the clinician scheduled an automated email to be sent from a dedicated email address, either 6, 12, or 18 months after the final treatment session, using Apple Inc.’s *Automator* application. Timing of the automated email was randomised using a randomisation sequence generated in Microsoft excel. We randomised over this period in case there was clear evidence that the endorsement of certain target concepts was delayed. The email included a reminder that the potential participant had opted in to receive an anonymous survey, and a link to the online survey (hosted on SurveyMonkey). Participants who opened the link, but did not complete the survey, were sent an automated email reminder to complete the survey 5 days after opening the link (a function of SurveyMonkey software that maintains anonymity). The survey included provision of informed consent for data to be used for research purposes. Data collection took place between June 2016 and February 2020. The treating clinician read none of the survey responses during the data collection period.

2.4. Survey

The survey was designed and hosted on an online survey software program (Survey Monkey) and piloted on 13 participants, which led to the addition of 2 items and several item responses, and rewording of several item responses. These pilot data are not included in the final results. The average time to complete the survey during this pilot period was 13 minutes. The final survey consisted of multiple-choice questions regarding demographic information (age, sex, and highest level of educational attainment), pain status (pain diagnosis, pain duration, and improvement), and activities since consultation (time since treatment and engagement with other treatments). In this study, we included data from (1) an open-ended question that asked participants to describe the concepts they learnt that were most important to their recovery, and (2) a close-ended question that presented participants with a list of 11 predefined pain target concepts used clinically and in research^{10,38} and asked them to rate their perceptions on the importance of each of these target concepts using a 6-point Likert scale. The full survey is provided in Supplementary materials (S2, available at <http://links.lww.com/PAIN/B313>).

2.5. Data analysis

Data analysis was led by an investigator uninvolved in the clinical interactions or data collection (H.B.L.). Response rate to the survey was calculated as the number of participants who completed the survey divided by the number of participants who were emailed the survey. Participant data were excluded from analysis when only demographic data were provided. As our research questions only related to those who reported improvement, further data were not analysed for those participants who answered the question “*How are things now compared to when you first saw [clinician]?*” with “about the same,” “worse,” or

“much worse.” Qualitative data were analysed using NVivo (version 12.0),⁴² and quantitative data were analysed using SPSS (version 22.0).²⁵

2.6. Qualitative analysis

Qualitative data from the free-text response questions (Q9, 12; Supplementary 2, available at <http://links.lww.com/PAIN/B313>) were analyzed using reflexive thematic analysis.³ In a series of steps, the primary investigator (H.B.L.) first became familiar with the data by repeated and active reading of the survey responses. The data were then coded using a recursive coding approach wherein codes were generated then returned to, improved upon, and iteratively revised. Codes were then clustered together into candidate themes. Codes, candidate themes, and illustrative quotes were collaboratively discussed and iteratively reviewed by 2 authors (H.B.L. and L.C.H.). Finally, candidate themes were refined to determine final themes. Data extracts that illustrate the themes are reported. Considering that survey data can sometimes provide a lower volume of data than other qualitative methods such as interviews, we present a higher ratio of extracts when reporting data descriptively, in line with previous research.⁴⁹

A primarily inductive approach to thematic analysis was used, whereby codes and themes were developed from the data content.^{3,5,49} The analysis focused on both semantic and latent features of the data. Semantic focus (also known as data-driven) indicates coding and reporting on *explicitly* stated ideas, concepts, meanings, and experiences. For example, if participants talked about the importance of learning how to exercise, and we developed a theme around “learning how to exercise,” this would be a semantic theme. Latent focus (also known as researcher-derived) invokes the researchers’ conceptual and theoretical frameworks to identify *implicit* meanings within the data that underpin what is explicitly expressed.⁴ We took a critical realist ontological perspective and a post-positivist epistemological view when analysing the data. The notion of interrater reliability is at odds with the post-positivist positioning of our analysis and thus was not performed.³ Collaborative analysis (ie, discussion between researchers H.B.L. and L.C.H.) was used to develop a richer, more nuanced reading of the data, rather than to seek a consensus on meaning. Qualitative data were edited only for major spelling and grammatical errors (eg, capitalisation of sentences). Quality was addressed in our work through the use of Braun and Clarke’s⁶ 20-question guide to assessment of thematic analysis research quality.

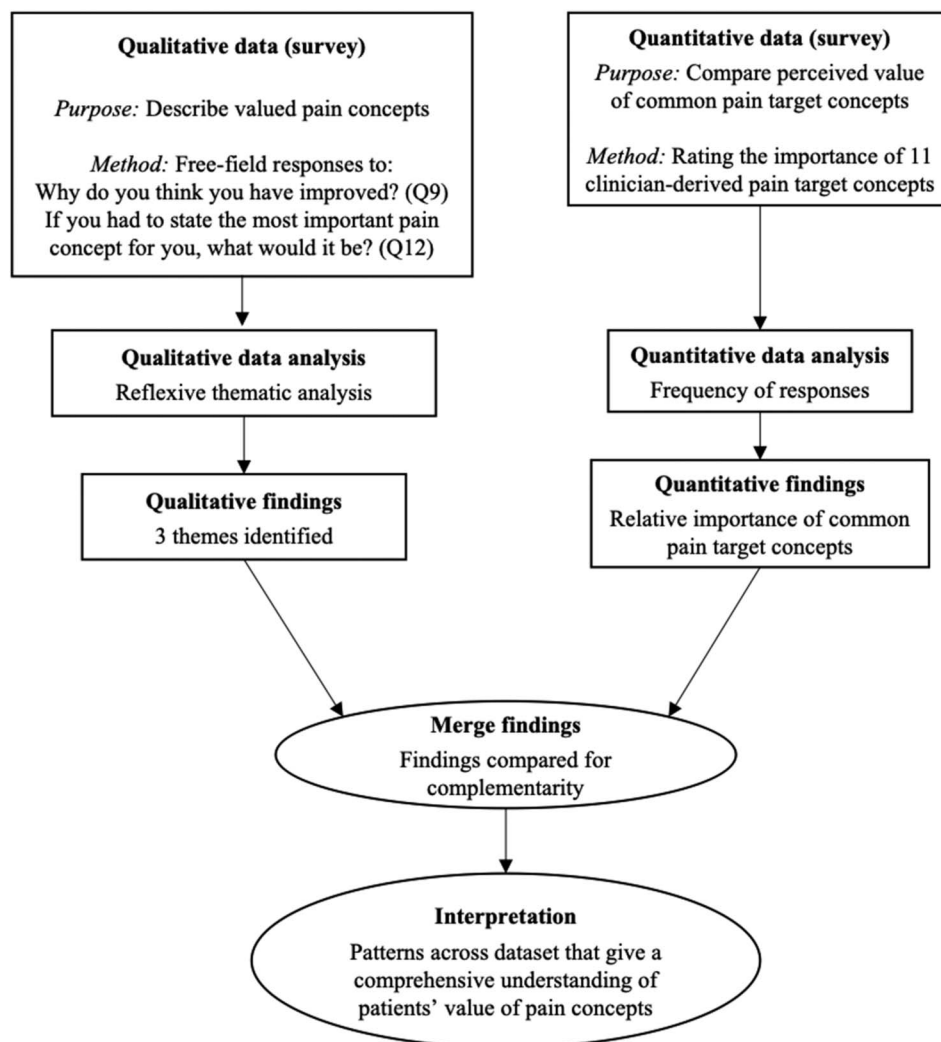


Figure 1. The convergent mixed-methods design.

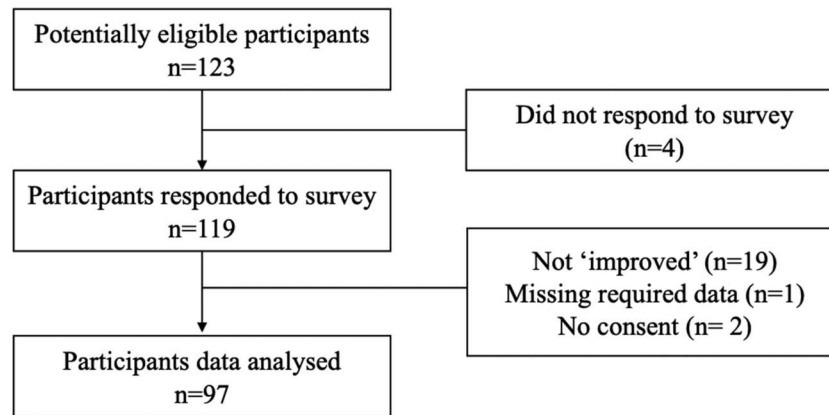


Figure 2. Data collection flowchart.

2.7. Quantitative analysis

Descriptive statistics were used to analyse the frequency and distribution of responses to the Likert questions in the survey; data were converted to percentages and displayed graphically using stacked bar charts.

2.8. Integration

Central to the effectiveness of a mixed-methods study is integration to draw insights beyond the information gained from the separate quantitative and qualitative results. In this study, the primary rationale for integrating data was complementarity²⁰ with the secondary purpose of explanation and illustration.⁷ That is, we sought to use the qualitative findings to identify and provide explanation for the importance of certain concepts identified by participants and the quantitative data to corroborate or contrast with the qualitative findings. Data were integrated after analysis at the interpretation phase through use of joint displays, whereby representative quantitative and qualitative data were juxtaposed in a single table.²¹ Meta-inferences were provided in the table, whereby an overall understanding of the full data set was developed through integrating the findings from the qualitative and quantitative data.⁴⁷

3. Results

An email was sent to 123 eligible participants, inviting them to complete the survey; 119 participants responded (response rate = 96.8%). Twenty-two participants did not meet inclusion criteria and were thus excluded from further analysis. Specifically, 19 participants indicated that they had not improved (ie, responded to the survey question “*How are things now compared to when you first saw [clinician]?*” with “about the same” [n = 11] or “worse” [n = 9]), one participant did not respond to questions required for inclusion (ie, only answered questions regarding demographics), and 2 participants indicated at the end of the survey that their data should not be used. Thus, the final sample contained 97 participants (Fig. 2). Demographic characteristics of participants are displayed in Table 1.

3.1. Qualitative results

Ninety-seven participants answered both questions relevant to the qualitative analysis. The average length of responses to these questions were 26 words (median = 18, range = 1-131), with 82% of responses at least 10 words in length. An example of our

thematic coding procedure is provided in Supplementary materials (S3, available at <http://links.lww.com/PAIN/B313>). Three themes, representing overarching concepts identified by participants as important for their recovery, were generated from reflexive thematic analysis of the data: (1) pain does not mean my body is damaged, (2) thoughts, emotions, and experiences affect pain, and (3) I can retrain my overprotective pain system.

3.2. Theme 1: Pain does not mean my body is damaged

The first theme captured the value that participants described in learning that pain does not always signify damage to their body. Of these accounts, some participants dissociated pain from *actual* damage, whereas others dissociated pain from *potential* damage.

“Understanding that even though it hurts it is not a sign of damage” (P32, back/widespread pain)

“... pain doesn’t mean I am about to snap my hammy.” (P88, leg/foot pain)

Another way that participants expressed that their pain does not mean damage was by describing their body as “safe” despite pain. Yet, the idea of a safe but painful body was seen as counterintuitive and required practice.

“My body is actually safe even though it feels so painful. I still have to tell myself this sometimes because it is a totally foreign concept.” (P65, arm/hand pain)

A few participants explained that a compelling rationale for this target concept was made by learning about the science of the body—specifically, the process by which tissues heal after injury. In practice, a clinician may contrast the predictable, linear process of tissue healing against experiences of fluctuating pain that persists over time. This technique was convincing for the following participant, who noted that:

“... although it feels like I am injuring myself when my pain ramps up, it is a trick. One of the most compelling arguments [clinician] made was actually about how scientists now understand in great detail how body tissue strengthens when loaded, repairs when injured.” (P18, back pain)

Several participants described changes in their emotional state in response to learning that their pain did not indicate damage. For example, some participants described that they had less fear

Table 1
Baseline characteristics of participants.

Sample (n = 97)	n (%)
Age	16-18 = 11 (11.3%)
	18-24 = 12 (12.4%)
	25-34 = 13 (13.4%)
	35-44 = 29 (29.9%)
	45-55 = 19 (19.6%)
	55-64 = 8 (8.2%)
Gender	65+ = 5 (5.2%)
	Male = 31 (32.0%)
	Female = 62 (63.9%)
Highest level of education	Rather not say = 4 (4.1%)
	Primary school = 14 (14.4%)
	Some high school = 25 (25.8%)
Primary pain condition	High school diploma = 16 (16.5%)
	Some university, but no degree = 6 (6.2%)
	Bachelor's degree = 14 (14.4%)
	Postgraduate degree = 13 (13.4%)
	A trade = 9 (9.3%)
	Back pain = 10 (10.3%)
Duration of pain at time of treatment	Back and leg pain = 8 (8.2%)
	Widespread pain = 30 (31.0%)
	Complex regional pain syndrome = 26 (26.8%)
	Neck pain = 1 (1.0%)
	Leg or foot pain = 5 (5.2%)
	Arm or hand pain = 4 (4.1%)
	Neck and arm pain = 6 (6.2%)
	Pelvic pain = 6 (6.2%)
	Abdominal pain = 1 (1.0%)
	Time since first treatment session
Change since treatment	6-12 mo = 3 (3.1%)
	1-2 y = 5 (5.2%)
	3-5 y = 17 (17.5%)
	5-10 y = 35 (36.1%)
	>10 y = 36 (37.1%)
	About 6 mo = 6 (6.2%)
Interventions with other clinicians* concurrent to, or after treatment	About a year ago = 33 (34.0%)
	About 18 mo ago = 35 (36.1%)
	About 2 y ago = 15 (15.5%)
	More than 2 y ago = 8 (8.2%)
	Better = 23 (23.7%)
Change since treatment	Much better = 47 (48.5%)
	Completely better—I have recovered = 27 (27.8%)
	None = 12 (12.4%)

and worry about the health of their body and their ability to function in the future.

“I learnt that I was scared my pain was a sign of something terrible but this is unlikely to be the situation actually.” (P85, *widespread pain*)

“I have stopped worrying as much because I can see I am not injuring myself.” (P23, *pelvic pain*)

Beyond changes in their emotional state, participants also described changes in their activity level as a consequence of adopting this concept. Several participants said that knowing their pain did not indicate damage justified them moving their body and doing valued activities despite pain.

“I forced myself to use it despite the pain. But I think knowing it was safe even though it felt very not safe was important.” (P9, *complex regional pain syndrome [CRPS]*)

“Because I have been doing the things I love to do knowing that they won't damage me. And they are still hurting but less and less all the time!” (P64, *back/widespread pain*)

Some participants described fully embracing engaging in movement and activity despite pain as a consequence of endorsing this concept. For others, this translation from understanding to behaviour was more caveated. For example, one participant described that movement while in pain was only safe if movement progressed slowly, indicating the nuances of this concept.

“I am safe to move even if it hurts as long as I don't increase the amount too quickly.” (P96, *back pain*)

Taken together, this first theme captures participants' perspectives of how they learnt that pain does not signify damage, and that the learning triggered behavioural changes. Participants described that the importance of this knowledge was that it alleviated fears regarding the current and future health of their body and removed barriers to engaging in valued activities, despite feeling pain.

3.3. Theme 2: Thoughts, emotions, and experiences affect pain

The second theme captured that participants described learning that a variety of things can influence pain, beyond tissue damage. A central aspect of this theme is that participants acknowledged that pain is multifactorial, rather than the result of a single (biomedical) cause.

“The pain system is about many more things than the body tissues ...” (P18, *back pain*)

“Pain can be protecting you from anything not just an injury.” (P94, *CRPS*)

Participants commonly described that emotions could influence pain, such as “worry or stress” (P34), or things that made them feel “tired or angry or scared” (P5). One participant explained that emotions influenced pain by making the pain system more sensitive.

“My pain system is being too sensitive because of all the stress and illness in my life and worry” (P74, *back/widespread pain*)

Another way that participants described the influence of psychological factors on pain was by acknowledging the value of psychological therapies.

Table 1 (continued)

Sample (n = 97)	n (%)
	Psychology = 20 (20.6%)
	Surgery = 0 (0%)
	Pain management program at a hospital = 2 (2.1%)
	Online pain coaching = 23 (23.7%)
	Physiotherapy = 53 (54.6%)
	Other = 7 (7.2%)

* More than one could be selected.

“taking psychology more seriously ...” (P93, pelvic pain)

“I am slowly doing more but managing my stress better which makes my CRPS work.” (P94, CRPS)

Rather than identifying factors that contribute to pain, one participant identified that thoughts and beliefs create pain. This suggests that this participant considered that thoughts and beliefs play a causal role in their pain.

“All my thoughts and beliefs can make pain” (P82, widespread pain)

Not all participants were specific when outlining the things that could influence their pain. One participant broadly described that anything that threatened their safety had the capacity to change their pain.

“My pain can be affected by anything related to my safety.” (P87, back/widespread pain)

Similar to the participant who noted that their pain was influenced by safety cues, another participant described that their

pain was influenced by things that were dangerous. This participant said it was valuable to identify these “threats” that could influence their pain. In this case, “threats” were described as “DIMS”—an acronym for “Dangers In Me”—which reflects the specific educational approach with which these participants engaged.³⁸

“I have learnt my DIMS and why they matter to my pelvic pain even though they are not related to my pelvis!” (P8, pelvic pain)

Another participant described that it is difficult to identify the things that influence pain because these things change. The language this participant used insinuates that their pain system operates independently from them, itself perhaps anthropomorphised “with a mind of its own.”

“Pain is protecting me from things but what things it is protecting me from change and can be sneaky.” (P93, pelvic pain)

Taken together, this second theme captures that participants valued learning that a range of things, other than the health of body tissue, had the capacity to influence or cause their pain. Specifically, participants identified emotions, thoughts, and beliefs, and events that signify danger or safety as influencing their pain.

3.4. Theme 3: I can retrain my overprotective pain system

The final theme centred around descriptions that the pain system can become overprotective, but that this overprotection can be reduced. This concept was key to participants’ explanations of why their pain had persisted for so long, and how they approached rehabilitation. Central to this theme is that participants explained that the function of pain is protection.

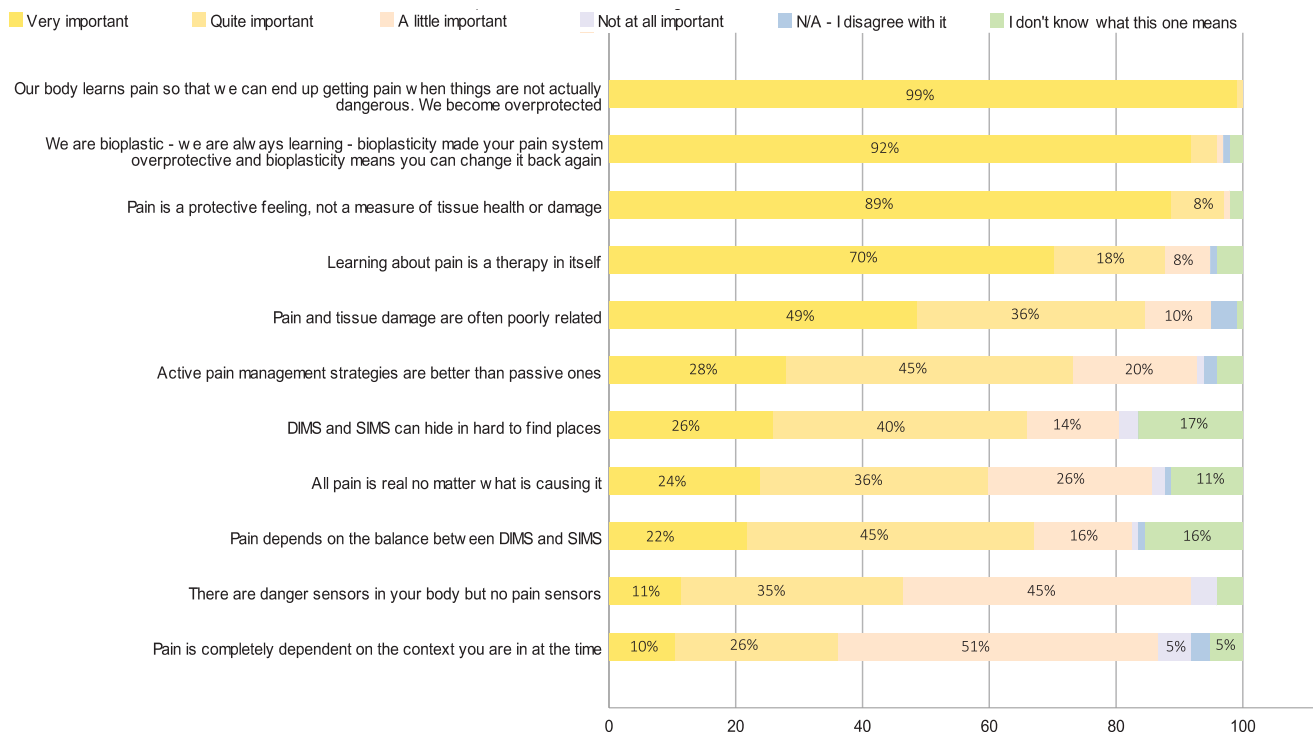


Figure 3. Distribution of ratings of perceived importance of pain education concepts, from people with persistent pain who have improved after a pain science education intervention (n = 97). Where a shaded value is not quantified, it represents less than 5% of responses.

“I think the biggest thing is this idea that pain is always looking to protect you and actually keep you safe from injury.” (P41, neck/arm pain)

Several participants expanded on this idea by conceptualizing pain as a result of unnecessary or “faulty” protection. The terminology of “overprotection” was common across the data set.

“My CRPS is a faulty protection response to things that are actually safe.” (P89, CRPS)

“Chronic pain is overprotective and you are actually safe, not in danger.” (P33, neck pain)

For one participant, conceptualizing pain as overprotection provided an explanation for why pain fluctuates across time, presumably despite a lack of changes in tissue damage or bodily state.

“Without doubt it was learning that my pain system is oversensitive - overprotective. This was the aha moment because it meant fluctuations in pain were fluctuations in my pain system.” (P14, back/widespread pain)

Some participants went further to describe that their pain system, rather than just the pain response, was problematic or broken, and that this system-level issue resulted in overprotection. The brain and the nervous system were commonly identified by participants as locations at fault for overprotection. Some participants seemed to value identifying a part of their anatomy as at fault for persistent pain, especially as a replacement for blaming their painful body part.

“CRPS is a problem in your nervous system not your leg.” (P68, CRPS)

“I think the most important concept for me was learning that my brain was the problem not my arm.” (P47, CRPS)

Several participants invoked the use of metaphor in describing what they valued learning about pain, suggesting that metaphors may be a helpful tool to deliver target concepts in pain science education. For example, 2 participants described the nervous system using a metaphor of an electrical system (ie, “electrics”, “wiring”).

“The pain is because of dodgy electrics so your brain is thinking there is danger when there is not danger” (P66, back pain)

“The pain is not coming from injured body parts but is being produced inside my wiring, like an overprotective guard dog.” (P86, widespread pain)

Several participants described that the goal of treatment for persistent pain was to make their “overprotective” pain system, less protective. Frequently, the task of doing this was termed “retraining.” The following participant provided an example of changing beliefs about the goal of therapy, from improving strength to reducing overprotection.

“But shifting my idea of what I was doing from trying to get strong, or get pain relief, to coaxing and training, little by little, a fired-up protection device, now that was a game breaker for me. So, the most important pain concept I guess was that I have learnt to be very, very good at producing pain but I could retrain my protection device.” (P30, back pain)

Some participants explained that retraining an overprotective pain system was a strategy that made sense. The following quotes speak to this and indicate that a rehabilitation strategy that makes conceptual sense is important for participants to engage with that recovery approach.

“The idea of training my pain back to normal makes a lot of sense and I think learning how to do that has led to my improvement so far.” (P16, neck/arm pain)

“I am on the road to recovery. I think this is because finally something made sense. I know my brain is clever and I am getting better at retraining it!” (P1, CRPS)

Some participants described that retraining the pain system provided them with a sense of agency over their recovery.

“I realised that it was really up to me and I had to retrain how my brain was working.” (P20, CRPS)

“Although I was accustomed to hearing about the miraculous effects of new treatments and then being disappointed, [clinician] had a different message. That message was like a call to action to me personally—there is nothing anyone else can do here but you (me!) have all the resources to retrain your system. So, I think that is why I have improved.” (P63, CRPS)

Beyond a simple sense of agency, a few participants felt they had a right to know that their pain could be retrained. They were angry at clinicians for withholding this information.

“I learnt what my pain was and that it could be retrained. I am not 100% yet but I think I will make it. Why wasn’t I told this 20 years ago?!? That makes me angry still.” (P72, back/widespread pain)

Believing that the pain system could be retrained did not necessarily mean believing that this retraining would occur quickly. On the contrary, participants acknowledged that changes were slow. Some participants expressed disappointment that changes were slow, suggesting that they expected it would be faster. Others placed value in developing patience, for example:

“Patience, persistence and courage will eventually retrain this pesky pain system!” (P48, back/widespread pain)

“It is possible to teach your pain system to go back to normal sensitivity and it won’t happen overnight and there is no magic cure ...” (P61, widespread pain)

As evident in the quote above, a few participants valued learning that it was possible for their pain to change. For some participants, learning that the pain system could change provided a sense of hope:

“That we learn pain and that we can unlearn pain. This was the most important thing for me. I even got this put in a frame on my kitchen wall and reminded me and [partner] about it every day.” (P40, back/leg pain)

Taken together, this third and final theme highlights the value that participants described in learning that their pain was overprotective, but that this overprotection could be lessened or reversed. Participants described that conceptualising pain in this way provided hope that change was possible. Retraining an overprotective pain system over time was seen by participants as a therapeutic goal that made sense.

3.5. Quantitative results

Ratings for the perceived importance of pain target concepts are displayed in **Figure 3**. There was no clear evidence of an effect of the self-reported duration since first appointment on the quantitative ratings of clinician-derived target concepts (see Supplementary 4-8, available at <http://links.lww.com/PAIN/B313>). Overall, the majority of participants rated each target concept as at least “a little important”; however, there was variation in the relative importance of each target concept. The target concept rated as “very important” by the largest number of participants (99%) described pain as overprotective, followed by a target concept relating to the changeability of an overprotective pain system (92%). Target concepts that dissociated pain from damage were also rated as highly important, including a target concept that described pain as a sign of protection, not damage (89% rated as “very important”) and a target concept that pain and tissue damage were poorly related (49% rated as “very important”).

3.6. Integration

The aim of integration in this study was complementarity, in which the quantitative data was used to corroborate or contrast with the qualitative findings. To do this, we have provided a joint display of the 2 data sets, juxtaposing the themes from the qualitative data against related target concepts from the quantitative data (**Table 2**). For the following concepts, the 2 data sets converged and meta-inferences suggest an explanation for why these concepts were valued. First, participants valued learning target concepts that dissociated pain from tissue damage because these target concepts were associated with less fear about the current and future health of their body and justified engaging in movement and valued activities despite pain. Target concepts that framed pain as overprotection, and emphasised that overprotection could be lessened, were described by participants as important because they provided an explanation for ongoing pain, provided hope for recovery, and outlined a therapeutic goal that made sense. There was divergence between data sets in the value participants ascribed to learning the target concept that thoughts, emotions, and experiences affect pain. Meta-inferences suggest that this discrepancy highlights that clinicians and participants use different languages to explain similar constructs. For example, the predefined target concepts note the critical importance of “context” on pain; participants said that they valued learning that their pain could be influenced by thoughts, emotions, and experiences, but they did not collectively refer to these as “context.”

3.7. Discussion

This mixed-methods study identified, characterized, and illustrated core concepts that adults receiving a pain science education intervention believed were important for their improvement from persistent pain. Three themes, representing valued pain concepts, were identified: (1) pain does not mean my body is damaged, (2) thoughts, emotions, and experiences affect pain, and (3) I can retrain my overprotective pain system. Integration of these themes with quantitative ratings of established pain concepts highlights convergence and divergence with clinician- and patient-centred conceptualization and language. We discuss valued pain concepts in greater detail below, as well as their relevance for understanding how pain science education works and could be improved upon.

3.8. Central pain target concepts

Learning that pain does not indicate tissue or bodily damage was important to people who had improved from persistent pain. The value of this concept appeared to be its association with less fear of injury and less avoidance of (painful) movements and behaviours. Others have observed a similar pattern: people with persistent pain often believe that pain indicates tissue damage^{9,45,50} and make judgements about engaging in physical activity based on concerns about creating more tissue damage.¹⁶ Our findings are consistent with the fear-avoidance model, which proposes that individuals who believe their pain is a sign of a damage (ie, serious injury or pathology) may become fearful and avoid activity.¹⁵ Yet, it seems learning this concept was at times difficult. For example, a few participants acknowledged that it was counterintuitive to conceptualize their body as safe while feeling pain. This likely reflects that the concept “pain does not indicate damage” goes against personal experience whereby injuries result in pain, and cultural norms whereby you need to rest when in pain to promote healing. Our findings also suggest that despite embracing the concept, there may still be effort required by an individual in translating this knowledge into approaching a (feared) behaviour. It is reasonable to consider pairing pain science education with interventions that can assist in engaging with feared behaviours. Meta-analyses indeed suggest that greater effects on pain and disability are found when pain science education is combined with another intervention (eg, exercise⁴⁰) than when it is delivered in isolation.⁵⁴

People who had improved from persistent pain valued learning that a variety of factors can influence pain. Notably, several participants identified the influence of psychological factors, such as emotions, thoughts, and beliefs. Pain science education provides a biological explanation for how emotions (eg, stress) can initiate hormonal responses, which in turn can sensitize neural processes that are involved in pain.¹⁰ Providing a coherent biological pathway to explain how emotions influence pain may validate this interaction, which in turn may help to frame psychological therapy, or pain science education, as a sensible strategy for pain. However, experts suggest that it is important for people with persistent pain to understand that a number of physical, emotional, and environmental factors influence pain, so that they can be addressed.¹⁸ In our study, participants acknowledged that a variety of factors influence pain, but a relatively low number of participants rated the target concept that “context” influences pain as very important. There are many potential explanations for this discrepancy. First, people with persistent pain might not value the target concept that pain is “entirely dependent” on contextual factors because they consider pain as *influenced* by contextual factors, rather than *contingent* on them. Second, people with persistent pain may acknowledge that contextual factors influence pain, but specifically value learning about psychological factors. Finally, semantic differences may exist in that, although clinicians may use the term “context” to encompass a variety of factors including psychological and environmental influences, patients do not. Future initiatives to develop pain science education interventions will likely be optimised by drawing from the current data as well as including patient partners at the development phase to ensure language is aligned appropriately.

Participants valued framing pain as an overprotective response that could be lessened. For some, this provided hope that their pain condition could change. Qualitative research indicates that perceptions of the nature and course of low back pain can shape notions of hope.¹³ Restoring hope has been identified as a differentiating factor between groups of people who improve after pain management and those who do not.⁵⁰ Framing pain as

Table 2

Joint display of quantitative, qualitative, and mixed-methods meta-inferences.

Theme	Qualitative excerpts	Quantitative finding (% rating as “very important”)	Meta-inferences’ complementarity
Pain does not mean I am hurt	<i>“I have stopped worrying as much because I can see I am not injuring myself.”</i> (P23, pelvic pain)*. <i>“Because I have been doing all the things I love doing knowing that they won’t damage me. And they are still hurting but less and less all the time.”</i> (P64, back/widespread pain)*	Pain is a protective feeling, not a measure of tissue health or damage (89%). Pain and tissue damage are often poorly related (49%)	Reduced fear and worry. Justified why it was safe to move despite pain.
Thoughts, emotions, and experiences affect pain	<i>“Pain can be protecting you from anything not just an injury.”</i> (P94, CRPS)†. <i>“My pain system is being too sensitive because of all the stress and illness in my life and worry”</i> (P74, back/widespread pain)†. <i>“All my thoughts and beliefs can make pain.”</i> (P82, widespread pain)†. <i>“My pain can be affected by anything related to my safety.”</i> (P87, back/widespread pain)†	Pain is completely dependent on the context you are in at the time (10%). Pain depends on the balance between DIMs and SIMs (22%)	Acknowledged that many things influence pain, but did not use the language of “context.” Acknowledged that pain “depends” on many factors, but not that pain was “entirely dependent” on them.
I can retrain my overprotective pain system	<i>“Chronic pain is overprotective and you are actually safe, not in danger.”</i> (P33, neck pain)†. <i>“The idea of training my pain back to normal makes a lot of sense and I think learning how to do that has led to my improvement so far.”</i> (P16, neck/arm pain)*. <i>“That we learn pain and that we can unlearn pain. This was the most important thing for me. I even got this put in a frame on my kitchen wall and reminded me and [partner] about it every day.”</i> (P40, back/leg pain)†	Our body learns pain so that we can end up getting pain when things are not actually dangerous. We become overprotected (99%). We are bioplastic—we are always learning—bioplasticity made your pain system overprotective and bioplasticity means you can change it back again (92%)	Provided an explanation for ongoing pain. Justified why it was safe to move despite pain. Instilled hope that change was possible. Provided a goal for recovery that “made sense”; to reduce the protection level of the pain system.

* Q9 (why do you think you have improved?).

† Q12 (if you had to state the most important pain concept to you, what would it be?).

CRPS, complex regional pain syndrome; DIM, Dangers In Me; SIM, Safety In Me.

“overprotection” also encompassed the idea that overprotection can be “retrained.” Learning this provided some participants with a sense of agency over their rehabilitation. In the context of pain, agency often shifts from the person with pain to others (eg, health professionals), which may be interpreted as a threat to the “social self”.²⁸ Retraining an overprotective system was also described as a strategy that made conceptual sense. This is particularly important in the context of persistent idiopathic pain, in which the absence of a cognitive representation to make sense of pain and recovery can lead to fear.⁸ Finally, some participants perceived injustice in having not been informed of these concepts earlier. This is potentially important because perceptions of injustice are linked to poor rehabilitation outcomes in people with pain.⁴⁶ People with pain may have a history of seeing different clinicians and receiving inconsistent explanations and advice for their pain,³³ which could cause mistrust in the medical system. This may well be an important issue to anticipate and address in pain science education.

3.9. Communicating target concepts for pain

Findings from this study support the fact that pain science education operates within a conceptual change model whereby education involves changing preexisting beliefs.³⁸ For example,

participants described abandoning existing concepts that pain indicates damage and adopting new concepts that pain indicates (over) protection. Some participants described the instruction they received that assisted them in changing their concept of pain. For example, one participant described abandoning their model that “pain indicates damaged tissue” after contrasting it against a model for the physiology of tissue healing (ie, “damaged tissue repairs over time”). Introducing contradictory information is an instruction method that aims to create *cognitive conflict*—that is, a discrepancy between a learners’ preexisting model for pain and external information.³² This conflict can motivate *knowledge revision*, a conceptual change process whereby a learner detects misunderstandings in their current concept, and then seeks to revise their knowledge to remove the contradiction.¹⁹ Although some participants may have benefited from this approach, cognitive conflict strategies do not consistently lead to conceptual change.¹⁷ Developing a better understanding of strategies that motivate conceptual change for pain-related concepts could improve pain science education interventions. In addition, assessing the extent of reconceptualization of pain target concepts may assist to evaluate how well concepts have been adopted. Previous qualitative studies have found ‘partial and patchy’ reconceptualization of pain concepts after group education.^{29,30,43} Future studies may explore the extent of

reconceptualization when pain science education prioritises concepts deemed important by people with pain.

3.10. Strengths and limitations

Major strengths of this study include the use of a mixed-methods design that provided an opportunity for an in-depth exploration of our research question, and the high survey response rate (96.8%). This study also has limitations. First, although qualitative analysis of free-text responses is a common data analysis technique in health research,¹¹ alternative data collection methods (eg, interviews) might have provided more enriched information. Second, the sampling strategy involved recruiting patients who were treated by the same clinician. It is entirely likely that the concepts represented in the themes of this study are not an exhaustive list and reflect, at least in part, the concepts considered important by the educator. On the other hand, confining data to that from a single clinician's cohort also reduced the possibility that participant responses reflected differences in the clinicians' educational skills. Third, although the pain target concepts used for quantitative analysis were generated via an iterative interdisciplinary process, they were not formally vetted by a wider sample of clinicians (eg, via Delphi or similar methods). Fourth, participants viewed a list of pain management strategies before answering questions about pain concepts and these may have influenced their answers. In addition, participants were able to move back through the survey and thus could have amended their open-ended responses after viewing the list of pain concepts; we are unable to assess if or how frequently this occurred. Nonetheless, this limitation did not preclude our aim of assessing how patients conceptualized the pain target concepts in their own language. Finally, it is critical to remember that the current study design does not allow conclusions as to whether conceptual change, or self-rated improvement, was due to the education or other component of care—this would require a controlled trial. Similarly, it is not possible to determine whether self-rated improvement was due to reconceptualization, although participants clearly thought this was the case.

4. Conclusion

This mixed-methods study identified, characterized, and illustrated core pain concepts that were valued by people with persistent pain who improved after a pain science education intervention. Themes were constructed from the qualitative data, representing valued pain concepts; these were integrated with quantitative data rating the value of established pain concepts. Across qualitative and quantitative data, valued pain concepts were (1) pain does not mean my body is damaged, (2) thoughts, emotions, and experiences affect pain, and (3) I can retrain my overprotective pain system. These results provide a foundation for refining pain science education interventions to focus on pain concepts deemed most valuable to people with pain and to use patient-centered language to best communicate these concepts.

Conflict of interest statement

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Appendix A. Supplemental digital content

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