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RESEARCH ARTICLE



Perceived factors influencing the success of pain neuroscience education in chronic musculoskeletal pain: a meta-synthesis of qualitative studies

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ABSTRACT

Purpose: We aimed to identify the factors influencing the success of Pain Neuroscience Education (PNE) in chronic musculoskeletal (MSK) pain from the perspective of those experiencing PNE first-hand.

Materials and Methods: We conducted a meta-synthesis of qualitative studies. Articles were found on MEDLINE *via* Pubmed, EMBASE, Cochrane Library, CINAHL, and PsycINFO up to April 2023. Eligible qualitative studies focussed on adults (>16 years old) with a diagnosis of chronic primary or secondary MSK pain who performed PNE. Thematic synthesis by Thomas and Harden was followed. The Critical Appraisal Skills Programme (CASP) tool ensured the quality of the studies, while the Confidence in Evidence from the Reviews of Qualitative Research (CERQual) approach facilitated data confidence assessment.

Results: Nine studies were included (188 participants). Three analytical themes were developed: (i) "Efficient Communication of Information", emphasising the importance of accurate content transmission; (ii) "Emotional Support and Well-being", recognising emotional aspects as integral to treatment; and (iii) "Empowerment Promotion", focusing on information retention and personal transformation. The studies showed good quality, with moderate confidence in the evidence.

Conclusions: The perceived factors influencing the success of PNE are intricately related to the domain of communication, the emotional dimension of personal experience, and the capacity to be empowered.

> IMPLICATIONS FOR REHABILITATION

- Tailoring interventions to pain experiences, preferences, and emotions is key for the success of pain neuroscience education;
- A personalised approach is crucial for effective pain neuroscience education, emphasising the need to understand and address the specific aspects of each patient's pain journey.

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Background

Chronic musculoskeletal (MSK) pain stands as a leading disabling condition worldwide [1]. The International Association for the Study of Pain (IASP) defines chronic pain as pain that persists or recurs for more than three months [2]. Chronic MSK pain can then be categorised into primary and secondary MSK pain. Primary MSK pain is a condition in its own right and not explained by any specific classified disease [3]. Chronic secondary MSK pain is a symptom that arises from an underlying disease classified elsewhere but persists over time [3]. Chronic MSK pain globally affects approximately 20–30% of the population, significantly burdening individuals, society and the economy [4]. Moreover, chronic MSK pain negatively impacts individuals' psychological sphere, leading to anxiety, anger, frustration, and depressed mood [5,6]. These

negative psychological states can further exacerbate the experience and persistence of pain [7,8].

Clinical practice guidelines (CPGs) for managing chronic MSK pain recommend exercise, self-management strategies and educational programmes [9–11]. The educational programmes revolve around goal setting, skill building, self-management strategies to cope with pain and Pain Neuroscience Education (PNE) [9–12]. PNE aims at educating individuals on the neurobiology and neurophysiology of pain, underlying the mechanisms involved in pain perception [13–15]. PNE is posited to help individuals reconceptualise their pain experience, highlighting that pain is the nervous system's interpretation of injury threat rather than a measure of injury severity [16–18]. PNE seemed to motivate people to engage in movement and exercise and adhere to treatment regimens [14]. However, research on PNE has yielded varied and controversial

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results about its effectiveness based on high heterogeneity and low-quality evidence [19]. A recent study by Cuenca-Martínez F. et al. revealed significant variation in PNE outcomes, emphasising the necessity for refining studies before clinical application [20]. Thus, enhancing our understanding of the factors influencing PNE efficacy is crucial. A pivotal step towards achieving this goal involves outlining the perceived factors that can improve PNE, starting with those with first-hand experience.

Watson et al. conducted a mixed-methods systematic review underscoring the importance of PNE in helping individuals reconceptualise their pain perception and cope with their condition [21]. However, this review relied on four qualitative studies, indicating the need for more qualitative evidence [21]. Since then, more qualitative studies have been published [22–24]. Hence, this study aimed to synthesise qualitative evidence concerning the experience of PNE in individuals with chronic MSK pain through a meta-synthesis of qualitative studies to highlight factors influencing the success of PNE.

Material and methods

Synthesis methodology and approach to research

We performed a pre-planned (comprehensive search strategies to retrieve all available evidence) meta-synthesis of qualitative studies [25]. A meta-synthesis is a systematic review and integration of findings from qualitative studies [26]. The synthesis of the qualitative evidence can help to establish how an intervention works, for whom and in which contexts, and to understand how best to implement it [27]. Specifically, this meta-synthesis aimed to answer the following research question: “What factors influence the success of PNE from the patients’ perspective?” We followed the “Cochrane Handbook for Systematic Reviews for Interventions” [28] and the “Cochrane Qualitative and Implementation Methods Group Guidance” series to conduct the meta-synthesis [27,29]. We followed the “Enhancing transparency in reporting the synthesis of qualitative research” (ENTREQ) to report this meta-synthesis [25].

Inclusion criteria

Types of study

We included qualitative and mixed/multi-method studies written in English and published in the last 21 years since the first article on PNE as an intervention for chronic pain was written (2002–2023) [30]. In the case of mixed-method studies, we only collected the qualitative data. We excluded studies not written in English with a quantitative design (e.g. randomised controlled trials and observational studies).

Participants

We considered all the studies that included adults (age > 16 years) with chronic primary or secondary MSK pain (persistent or recurrent for longer than three months) [2,3] who received PNE - without restrictions on the sex assigned at birth and gender identification. We excluded individuals with acute MSK pain and other types of pain, such as visceral pain or secondary to neurological pathologies.

Types of evaluation

We included studies focusing on the experience of PNE in people with chronic MSK pain. We excluded studies that only concentrated on caregivers or physicians or in which participants had

only received other types of education (e.g. self-management strategies and goal setting).

Data sources

We conducted the research on the databases MEDLINE via Pubmed, EMBASE, Cochrane Library, Cumulative Index of Nursing and Allied Health Literature (CINAHL), and PsycINFO up to April 2023. To choose the databases, we adopted the recommendations from the “Cochrane Handbook for Systematic Reviews for Interventions” [28], suggesting MEDLINE via Pubmed, EMBASE, and Cochrane Library as the bare minimum requirement and adopted other sources based on the specific topic of the review. Therefore, we also consulted CINAHL and PsycINFO as they are specific databases of primary qualitative studies.

Electronic search strategy

Three authors, SB, GB and FC, conducted the search strategy using the SPIDER tool for qualitative evidence synthesis: Sample, Phenomenon of Interest, Design, Evaluation, and Research type [31]. The search strings are reported in Appendix (Appendix A). The authors have also manually searched the reference lists of the included articles.

Study screening methods

We uploaded the articles obtained from the research to Covidence (Covidence systematic review software, Veritas Health Innovation, Melbourne, Australia. Available at www.covidence.org). Covidence is a web-based collaboration software platform that streamlines the production of systematic and other literature reviews. After duplicate removal, two authors (FC and GB) read the studies’ titles and abstracts, selecting those based on the abovementioned inclusion and exclusion criteria. Then, the same authors (FC and GB) read the full texts of the included abstracts. A third author (SB) was consulted in case of disagreement in both stages.

Data extraction

Two authors (FC and MC) independently extracted the data from each study by following the Cochrane indications [27] using a standardised Excel template. The authors extracted from each study: reference (author, year, title), country, study design and analysis, sampling strategy, population’s pain, and clinical and descriptive characteristics. Then, the two authors independently collected themes and subthemes from primary studies in a second Excel template, and they compared their documents, merging them into a definitive one. A third author (SB) resolved any disagreements in the data collection by either a consensus process or consultation.

Rationale for appraisal and appraisal items

Two authors independently (LFM and GB) assessed the studies for critical appraisal with the Critical Appraisal Skills Programme (CASP) tool as recommended by the “Cochrane Qualitative and Implementation Group’s recommendations” [27]. CASP is commonly used for quality appraisal in health-related qualitative syntheses, and it consists of ten questions investigating the use of appropriate methodology in the research, to which researchers can answer

“yes,” “no” or “I can’t tell.” For each question, it is possible to report why specific answers were given in the “comments” box [27].

The Confidence in Evidence from Reviews of Qualitative Research (CERQual) was used by two authors (FC and MC) to evaluate the certainty of the results. This approach includes the methodological limitations, relevance, coherence and adequacy of the data [30]. The methodological limitations were based on the previous evaluation with the CASP by LFM and GB. FC and MC assessed the relevance as the extent to which the context or inclusion criteria of the primary studies supporting the review findings applied to the context specified in the review question; coherence referred to the fit existing between the primary study data and the synthesised findings in the review, while data adequacy was determined based on the degree of richness and quantity of data supporting a review finding [30].

Data synthesis

Thematic synthesis by Thomas and Harden was employed to synthesise the findings of this review [32]. In this method, descriptive themes are first generated, staying faithful to the primary study findings. Subsequently, the process progresses to developing analytical themes which transcend the interpretations found in the primary studies, providing more profound and comprehensive explanations [32]. The objective of the analytical themes was to answer our research question: “What factors influence the success of PNE from the patients’ perspective?” The participants’ quotes from primary studies were coded line-by-line by FC and GB. Most codes represented semantic features of the data, while others captured more latent aspects. Following the Thematic Synthesis process, the codes were systematically and inductively organised to generate descriptive themes that closely reflected the data of the primary studies [32]. Subsequently, these descriptive themes were subject to interpretation to construct analytical themes, which provided comprehensive responses to our research question, extending beyond the original study findings [32]. This iterative process involved ongoing refinement and revision of codes and potential themes as the analysis progressed. Codes and theme creation were reviewed and perfected several times, with the definitive themes determined through collaborative discussion between FC, GB, IC, and SB. No software was used to perform the data synthesis.

It is fundamental to state our theoretical assumptions as researchers as our reflections are built upon them. For this study, we adopted an experiential qualitative framework to reflect the perception of the social reality we analysed (individuals with chronic MSK pain) [33]. We adhered to a constructionist epistemology as the meaning and meaningfulness of themes were considered more important than their recurrency in answering our research question [33,34]. The use of thematic synthesis in this study was majorly inductive, as we took the dataset as the starting point for our data analysis [34]. Thus, the data were not coded according to a pre-existing coding framework [34]. Finally, we reported the characteristics of those authors who generated the themes. FC is a physiotherapist with an MSc in Health Professional Rehabilitation Sciences. GB is a physiotherapist, PhD student in “Neurosciences” and temporary lecturer in “Physiotherapy.” SB is a physiotherapist with a joint PhD in “Neurosciences” and “Medial Science.” The three of them are all specialised in RMD rehabilitation. IC is a social psychologist with a PhD in “Migrations and intercultural processes.” These authors are trained in qualitative methodologies and are proficient in conducting qualitative studies. FC and IC identified as women; GB and SB identified as men.

Results

Study selection

We retrieved 9655 articles after duplicate removal. We excluded 9619 studies after reading titles and abstracts. We read the full texts of the remaining 36 articles, and 27 were excluded for the following reasons: wrong language, wrong outcomes, wrong intervention, wrong study design, wrong patient population, and no full text available (after request). We finally included nine articles [22–24,35–40]. Appendix B reports the excluded studies, thoroughly explaining why they were excluded. The PRISMA flow diagram documents the study selection process (Figure 1) [41].

Study characteristics

The nine studies included in the research counted 188 participants. We did not report the data of seven participants in these studies as they were not diagnosed with chronic MSK pain. Specifically, we did not report the data of two individuals with unspecified pain, one with “nerve pain,” one with multiple sclerosis [23], one with abdominal pain [24], one with abdominal pain, and one with abdominal and rib pain [40]. The study characteristics (title, country, study design and analysis, sampling strategy, population, intervention, pain and clinical characteristics) and the different themes and subthemes present in the primary articles are reported in Table 1.

Appraisal results

The evaluations of the included articles with the CASP are collected in Table 2. In general, all the studies were considered valuable and of medium-to-high quality.

Results of the synthesis

Six descriptive themes were developed to synthesise the findings of the included primary studies. The six descriptive themes were then clustered to answer the research question “What factors influence the success of PNE from the patients’ perspective?” into three analytical themes that provided higher-order explanations. These three themes can be conceptualised as a sequential pathway, commencing with the effective communication of information by the clinician to the individual. This pathway then passes by the individual’s emotional response, culminating in the promotion of a constructive shift in their cognitive perspective and lived experience of pain. Figure 2 shows the descriptive and analytical themes graphically.

Descriptive and analytical themes

Analytical theme 1 – efficient communication of information. The first analytical theme highlighted how to transmit PNE effectively. It was generated from the descriptive themes “Relationship and Communication,” “Delivery Methods” and “Relevant Content and Topic.”

Descriptive theme 1 – relationship and communication. The first descriptive theme was related to the therapist-patient communication and relationship. In the primary studies, they highlighted the importance of clear and effective communication [35,40] characterised by appropriate wording [22,23] and active listening [40]. Furthermore, they reported appreciation towards the health professionals who delivered PNE [35,40] so much so that all professionals working with pain-related conditions should receive PNE training [22,39].

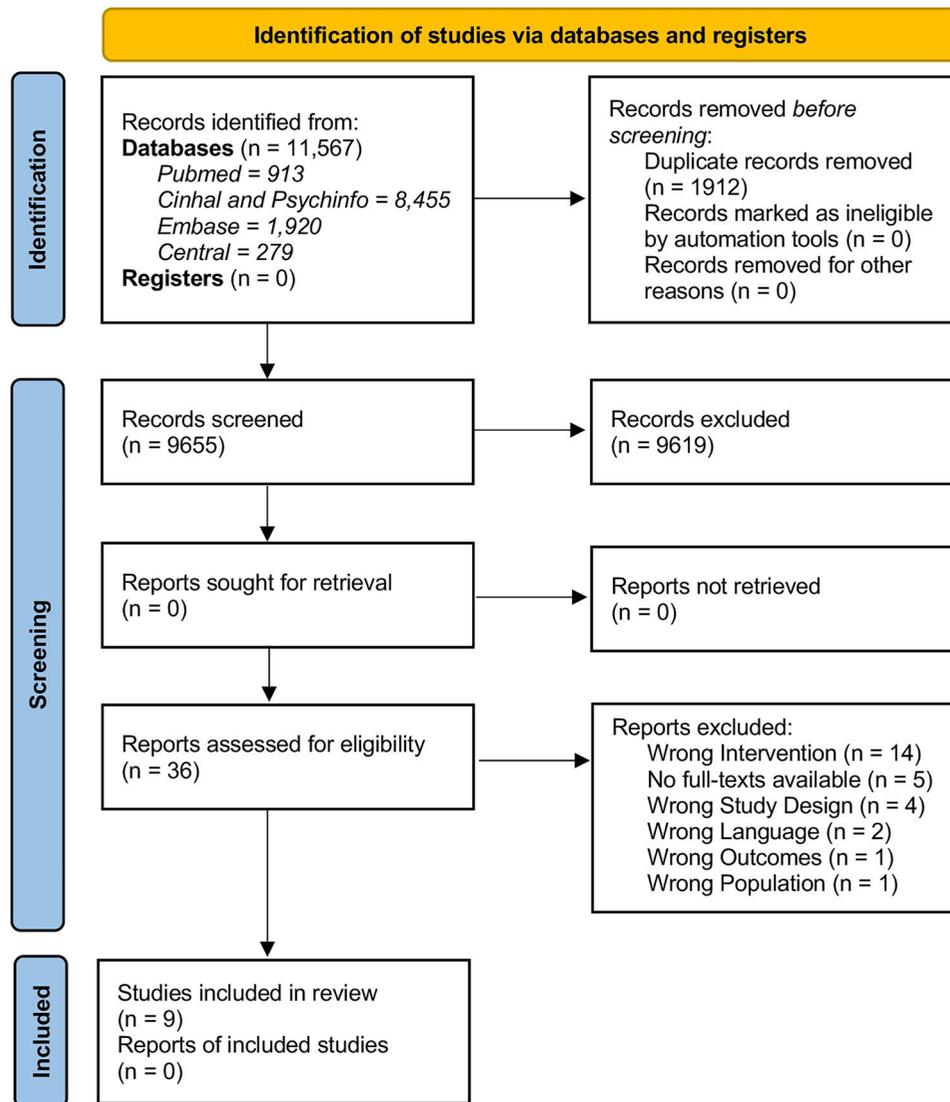


Figure 1. Prisma flow diagram with the study selection.

[The Physiotherapist] was great (...). All the steps were made, and everything was made clear to me all the way through. (*Rotator cuff-related shoulder pain*) [35]

They are very clear and... How do I explain that? They stand behind their opinion. (*Neck, back, and hip pain*) [40]

I think the word 'protection' was maybe one that I was trying to think, or like mentally grasp. (*Fibromyalgia*) [23]

I was able to tell from my own perspective how something feels, because I felt heard. I felt that I was taken seriously. And when I get that feeling, the other one (healthcare professionals) can get a clearer image of me. (*Widespread pain*) [40]

Descriptive theme 2 – delivery methods. This descriptive theme dealt with the methods used to provide PNE and its contents. As per the methods, positive and negative considerations emerged from the studies. Participants found videos helpful in delivering PNE, with mixed about digital animations, as they saw the animations to facilitate understanding but also dehumanising [22]. Furthermore, the diary writing activity proposed in one of the studies helped promote awareness of their situation. Still, it was also found challenging to keep a personal diary about the pain [35].

It [drawings] made it easier to understand I guess. By having it you know drawn out...it just made it easier to understand by the way they did it...they made this nice and simple. (*Chronic MSK Pain*) [22]

I mean it [the diary] became a bit of a pain to be honest, filling it out all the time. (*Rotator cuff-related shoulder pain*) [35]

Descriptive theme 3 – relevant content and topic. The following descriptive theme, "Relevant Content and Topic," was created to show the extent to which the materials and information provided through PNE were found relevant and useful for the participants. The participants expressed general approval of the contents and topic of the PNE [22,35,37,40], which allowed them to understand their pain condition better [22,35,37].

...it did help to, if you like, allay any, I was going to say fears, but it's not so much fears, it's more concerns that I had in many ways, I'm going round the twist. (*Chronic Low back pain*) [37]

They explained it very well, because at the general practitioner I got a blue booklet about chronic pain. About nerves and how it all works. That your body is actually a burglar alarm set incorrectly. That one I remember, when people ask me how I am doing and what was discovered, I tell them that. It [the metaphor] appeals to the imagination. (*Neck, back, and hip pain*) [40]

Table 1. Descriptive data.

References	Country	Study design and analysis	Sampling strategy	Population	Intervention	Pain and clinical characteristics	Themes and subthemes
Acker et al. (2023) "Thinking about pain in a different way: Patient perspectives of a neuroscience-informed physiotherapy programme for rotator cuff-related shoulder pain."	New Zealand (NZ)	Semi-structured interviews analysed with General Inductive Approach.	Participants were recruited from the local community in Dunedin and Christchurch, via newspaper advertisements, flyers in physiotherapy and general practice clinics, sports and recreation facilities, and social media.	Number: 10 Age (range): 46–75 y Sex: • 50% (n = 5) F, • 50% (n = 5) M Ethnicity: • 90% (n = 9) New Zealand European, • 10% (n = 1) Maori Pathology: RCRSP	Type: PNE (shoulder pain specific) + physiotherapy PNE: PowerPoint slides and videos. The physiotherapist explored the content of the materials with each participant, and they could ask the physiotherapist further questions in the subsequent sessions. Data collection: after intervention via Zoom	Pain Duration (range): 0.42–25 y Pain Type: • 100% (n = 10) RCRSP Pain Outcome Measure: • SPADI: Count or Mean (SD): 35.3 (17.7) at Baseline; 16.8 (14.0) at Discharge • PSEQ: Count or Mean (SD): 49.1 (8.7) at Baseline; 56.2 (5.9) at Discharge	1. Patient Beliefs a. I just thought that would be my lot b. Preconceptions about Physiotherapy treatment c. Influence of the Health Care Providers 2. Rapport and Relationship a. Appreciation of the Physiotherapist b. Communication by the physiotherapist 3. Perspective and understanding of the resources a. Informative and Reaffirming b. Joining the dots c. My pain just wasn't the same 4. Empowerment: my shoulder into the future a. Reassurance and Hope b. I am not afraid of the pain c. The tools to self-manage my pain
Dannecker et al. (2022) "Perspectives of patients with chronic pain about a pain science education video."	Columbia (USA)	Individual interviews that included closed-ended and open-ended questions analysed with qualitative content analysis within an interpretive theoretical perspective	Participants were recruited from an academic health centre's pain management clinic	Number: 15 Age (range): 23–76 y Sex: • 73% (n = 11) F, • 27% (n = 4) M Ethnicity: 100% Non-Hispanic Caucasian Pathology: Chronic pain	Type: PNE PNE: video "Understanding Pain and What to Do About It" Data collection: after PNE	Pain Duration (range): 0.29–17.5 y Pain Type: • 33% (n = 5) Spine pain; • 7% (n = 1) Arthritis; and Spine pain; • 26% (n = 4) Arthritis and Spine pain; • 13% (n = 2) Fibromyalgia and Spine pain; • 7% (n = 1) Ehlers Danlos Syndrome; • 7% (n = 1) Shoulder Pain; • 7% (n = 1) Spine, knee, shoulder and pelvic pain. Pain Outcome Measure: NRS	1. Importance of understanding the causes of pain; 2. Video's trustworthiness; a. Video's purpose was to educate people about pain and how to self-manage pain b. Video's animations were helpful c. Video's animations were dehumanising d. Video was trustworthy because it was easy to understand, made sense, and seemed evidence-based and participants could relate to the information in the video 3. Participant's agreement and disagreement with the video; 4. Video's educational value; a. New information in the video was the association between the pain and the brain b. Learning that pain comes from the brain instead of other anatomical structures was interpreted as advocating that participants' pain was not real c. New information in the video was the connection of emotion and stress to pain d. Video provided no new information e. Video could facilitate conversations about pain with HCPs if the HCPs also watched it f. Unmet educational goal was how to decrease or eliminate pain g. Video inadequately explained the causes of some participants' pain h. Unmet educational goal was the causes of pain i. Video did not clarify how exercise should be performed 5. Recommendations for the video's use and improvement a. Video was a beneficial supplement to visiting participants' HCPs b. If HCPs asked participants to watch the video, it would indicate caring c. Video would be improved by including more information on the association between the pain and the brain d. Video would be improved by including more information on the association between the pain and mental health e. Video would be improved by including more diverse people

(Continued)

Table 1. Continued.

References	Country	Study design and analysis	Sampling strategy	Population	Intervention	Pain and clinical characteristics	Themes and subthemes
Keen et al. (2021), "Exploring how people with chronic pain understand their pain: a qualitative study."	United Kingdom (UK)	Semi-structured, individual interviews analysed using TA	Participants were recruited through local and national networks of people with chronic pain.	Number: 12 Age (range): 20–89 y Gender: • 67% (n = 8) Women, • 25% (n = 3) Men, • 8% (n = 1) Non Binary Ethnicity: • 50% (n = 6) White British, • 25% (n = 3) White European, • 8% (n = 1) British Caribbean, • 17% (n = 2) White Pathology: Chronic pain	Type: PNE PNE: online article (by Moseley et al., 2020) Data collection: after reading the article	Pain Duration (range): 5–43 y Pain Type: • 17% (n = 2) Unspecified, • 8% (n = 1) Nerve Pain, • 25% (n = 3) Musculoskeletal, • 34% (n = 4) Fibromyalgia, • 8% (n = 1) CRPS arthritis, • 8% (n = 1) Multiple Sclerosis Pain Outcome Measure: NA	1. Communicating pain 2. Explaining pain 3. Living with pain 1. Less to say 2. Echoing the interview 3. Confirmed beliefs 4. Interesting science 5. Little disagreement 6. But what next?
King et al. (2016) "An exploration of the extent and nature of reconceptualisation of pain following pain neurophysiology education: A qualitative study of experiences of people with chronic musculoskeletal pain."	United Kingdom (UK)	Semi-structured interviews analysed with TA within an IPA framework.	Participants were recruited from an NHS pain clinic.	Number: 7 Age (range): >18 y Sex: • 71% (n = 5) F, • 29% (n = 2) M Ethnicity: NA Pathology: Chronic Musculoskeletal Pain	Type: PNE (they read the book <i>Explain pain</i> by Moseley) + usual care PNE: 2h didactic group-lecture, delivered within routine pain management by an experienced senior physiotherapist Data collection: three week after PNE	Pain Duration (range): 2–26 y Pain Type: • 14% (n = 1) Lower back and legs, • 14% (n = 1) Lower back and leg pain, • 14% (n = 1) Lower back, • 14% (n = 1) Lower back and right thigh pain, • 14% (n = 1) Thoracic spine and throat, • 14% (n = 1) Complex Regional Pain Syndrome, • 14% (n = 1) Neck and shoulder pain. Pain Outcome Measure: NA	1. Varying degrees of reconceptualization 2. Prior beliefs as facilitators and barriers to reconceptualisation 3. The influence of reconceptualisation on clinical benefits of PNE
King et al. (2018) "Pain Reconceptualisation after Pain Neurophysiology Education in Adults with Chronic Low Back Pain: A Qualitative Study."	United Kingdom (UK)	Semi-structured interviews analysed using TA	Participants were recruited from an NHS pain clinic.	Number: 12 Age (range): 25–72 y Sex: • 58% (n = 7) F, • 42% (n = 5) M Ethnicity: NA Pathology: CLBP	Type: PNE (they read the book <i>Explain pain</i> by Moseley) + routine usual care PNE: group session, delivered by two experienced, pain specialist physiotherapists Data collection: 3 weeks after PNE	Pain Duration (range): 0.7–26 y Pain Type: 1. 100% (n = 12) CLBP Pain Outcome Measure: NA	1. Degrees of reconceptualisation 2. Personal relevance 3. Importance of prior beliefs 4. Perceived benefit of PNE

Table 1. Continued.

References	Country	Study design and analysis	Sampling strategy	Population	Intervention	Pain and clinical characteristics	Themes and subthemes
Leake et al. (2021) "What do patients value learning about pain? A mixed-methods survey on the relevance of target concepts after pain science education."	Australia (AU)	Open-ended survey questions analysed with RTA	Participants were recruited from a physiotherapist by an email including a link to an online survey instrument.	Number: 97 Age (range): 16 - 65 y Gender: • 64% (n = 63) Women, • 32% (n = 32) Men, • 4% (n = 5) Rather not say Ethnicity: NA Pathology: Chronic Pain	Type: PNE + • Psychology • Physiotherapy • Other PNE: face-to-face sessions and video calls Data collection: 6, 12, or 18 months after the final treatment session	Pain Duration (range): 0.5–10 y Pain Type: • 10.3% (n = 10) Back pain, • 8.2% (n = 8) Back and leg pain, • 31% (n = 30) Widespread pain, • 26.8% (n = 26) Complex regional pain syndrome, • 1% (n = 1) Neck pain, • 5.2% (n = 5) Leg or foot pain, • 4.1% (n = 4) Arm or hand pain, • 6.2% (n = 6) Neck and arm pain, • 6.2% (n = 6) Pelvic pain, • 1% (n = 1) Abdominal pain Pain Outcome Measure: NA	1. Pain does not mean my body is damaged 2. Thoughts, emotions and experiences affect pain 3. I can retrain my overprotective pain system
Robinson et al. (2016) "A qualitative exploration of people's experiences of pain neurophysiological education for chronic pain: The importance of relevance for the individual."	United Kingdom (UK)	Individual semi-structured interviews analysed with IPA	Participants were recruited from an NHS pain clinic. Sex: • 40% (n = 4) F, • 60% (n = 6) M Ethnicity: NA Pathology: Chronic Musculoskeletal Pain	Number: 10 Age (range): 28–64 y PNE: group education setting, in a single, 2-h session, using a combination of verbal communication, PowerPoint slides, prepared diagrams and free hand drawing. Data collection: 2 weeks after PNE session	Pain Duration (range): 2–32 y Pain Type: • 10% (n = 1) Total body pain, • 10% (n = 1) Neck and shoulder, • 10% (n = 1) Ribs, arm, leg and low back pain, • 10% (n = 1) Neck, thoracic and low back pain, • 10% (n = 1) Knee, elbow and wrist pain; • 10% (n = 1) Shoulder and arm pain; • 40% (n = 4) Low back pain. Pain Outcome Measure: NA	1. Perceived relevance for the individual participant; 2. Perceived benefits for the individual participant; 3. Evidence of reconceptualisation	

(Continued)

Table 1. Continued.

References	Country	Study design and analysis	Sampling strategy	Population	Intervention	Pain and clinical characteristics	Themes and subthemes
Sole et al. (2020) "Perspectives of participants with rotator cuff related pain to a neuroscience-informed pain education session: an exploratory mixed method study."	New Zealand (NZ)	Individual semi-structured interviews analysed with the General Inductive Approach.	Participants were recruited from the local community via newspaper advertisements, flyers placed in physiotherapy and general practitioner clinics, sports and fitness centres, and posts on Facebook.	Number: 10 Age (range): 47-68 y Sex: • 50% (n = 5) F, • 50% (n = 5) M Ethnicity: NA Pathology: Chronic Rotator Cuff-Related Pain	Type: PNE PNE: 1h individual face-to-face pain education session, using Power Point slides and a pamphlet Data collection: after PNE session	Pain Duration (range): 0.3-2 y Pain Type: • 100% (n = 10) Chronic Rotator Cuff-Related Pain Pain Outcome Measure: SPADI: Median (range) change: -9.2 (-26.9 to 7.7) FABQ: Median (range) change: for physical activity (PA) -2.5 (-6 to 1) and work (W) -3.5 (-10 to 1)	1. Understanding the Whole a. Re-conceptualising the anatomical perspective b. Neuroscience understanding c. General well-being 2. Mindful self-awareness 3. Taking charge 4. "The pain is still there" 5. Integrating neuroscience with pathoanatomical knowledge 6. Educating other health care and sports professionals
Wijma et al. (2018) "What is important in transdisciplinary pain neuroscience education? A qualitative study."	Netherlands (NL)	Individual semi-structured interviews analysed with Grounded Theory.	Participants were recruited by theoretical purposive sampling from a transdisciplinary outpatient treatment centre.	Number: 15 Age (range): 18-62 y Sex: • 53% (n = 8) F, • 47% (n = 7) M Ethnicity: N.A. Pathology: Non Specific Chronic Pain	Type: PNE alone or in adjunction to other treatments (e.g., physiotherapy, psychotherapy etc.) PNE: The general practitioner gives verbal information about the predominant pain mechanism(s), supported by a booklet based on the Dutch book Pain Education, then the patient and partner participate in a one-hour PNE session provided by the psychologist and physiotherapist. Data collection: after PNE	Pain Duration (range): 0.5-23 y Pain Type: • 13% (n = 2) Back pain; • 13% (n = 2) Neck and shoulder pain; • 13% (n = 2) Widespread pain; • 7% (n = 1) Abdominal pain; • 7% (n = 1) Hip and leg pain; • 7% (n = 1) Buttock and leg pain; • 7% (n = 1) Knee pain; • 7% (n = 1) Groyne and Upper leg pain; • 7% (n = 1) Abdominal and rib pain; • 13% (n = 2) Neck, shoulder, arm pain; • 7% (n = 1) Neck, back, and hip pain. Pain Outcome Measure: NA	1. The pre-Pain Neuroscience Education phase a. A broad intake b. The healthcare professionals 2. A comprehensible Pain Neuroscience Education a. Understandable explanation b. Interaction between the physiotherapist and psychologist 3. Outcomes of Pain Neuroscience Education a. Awareness b. Insight into symptoms c. Consciousness of their body d. Gaining self-control e. Finding peace of mind f. Fewer symptoms 4. Scepticism a. Doubt towards the diagnosis and Pain Neuroscience Education b. Disagreement with diagnosis and Pain Neuroscience Education c. Pain Neuroscience Education can be confronting

Legend: PNE: pain neuroscience education; y: years; F: female; M: male; RCRSP: Rotator cuff-related shoulder pain; PSEQ: Pain Self-Efficacy Questionnaire; SD: Standard Deviation; NRS Numerical Rating Scale; TA: Thematic Analysis; NA: Not Available; IPA: Interpretive Phenomenological Analysis; CLBP: Chronic Low Back Pain; RTA: Reflexive Thematic Analysis; FABQ: Fear-Avoidance Beliefs Questionnaire.

Table 2. Methodological quality of the included studies.

	Acker et al. (2023)	Dannecker et al. (2022)	Keen et al. (2021)	King et al. (2016)	King et al. (2018)	Leake et al. (2021)	Robinson et al. (2016)	Sole et al. (2020)	Wijma et al. (2018)
<i>Item 1.</i> Was there a clear statement of the aims of the research?	CT (The authors state "The present study aimed to explore the perspectives of a sub-group of those participants of their experiences and the usefulness of the PNE-informed pragmatic physiotherapy," but they do not report information on the importance and relevance of this study.)	Y	Y	Y	Y	Y	Y	Y	Y
<i>Item 2.</i> Is a qualitative methodology appropriate?	Y	Y	Y	Y	Y	Y	Y	Y	Y
<i>Item 3.</i> Was the research design appropriate to address the aims of the research?	CT (The design of this work seems appropriate however, the researchers did not justify and report why they chose this study design.)	CT (The research design seems appropriate but not enough discussed by the authors.)	CT (The research design seems appropriate but not enough discussed by the authors.)	Y	Y	Y	Y	Y	N (Researchers did not explain why they choose grounded theory)
<i>Item 4.</i> Was the recruitment strategy appropriate to the aims of the research?	Y	Y	CT (Participants were recruited through local and national networks for people with chronic pain without specifying who made the diagnosis. It is unclear whether patients recruited in this way would be appropriate for research)	CT (The characteristics of the participants are thoroughly outlined; however, their rationale is not sufficiently motivated.)	Y	Y	Y	CT (Participants were recruited from the local community via newspaper advertisements, flyers placed in physiotherapy and general practitioner clinics, sports and fitness centres, and posts on Facebook. Although inclusion and exclusion criteria were specified, it is unclear how they were applied.)	Y
<i>Item 5.</i> Was the data collected in a way that addressed the research issue?	Y	Y	Y	Y	Y	Y	Y	Y	Y
<i>Item 6.</i> Has the relationship between researcher and participants been adequately considered?	N (It is not clearly specified how the relationship was managed or considered by the authors)	N (It is not clearly specified how the relationship with the participants was managed or considered by the authors)	Y	CT (This detail is never addressed anywhere in the article.)	N (It is not clearly specified how the relationship with the participants was managed or considered by the authors)	N (It is not clearly specified how the relationship with the participants was managed or considered by the authors)	N (It is not clearly specified how the relationship with the participants was managed or considered by the authors)	N (It is not clearly specified how the relationship with the participants was managed or considered by the authors)	Y
<i>Item 7.</i> Have ethical issues been taken into consideration?	Y	CT (The study protocol was approved by our Institutional Review Board and registered on clinical-trials.gov (NCT03538353).)	Y	Y	Y	Y	Y	Y	N

(Continued)

Table 2. Continued.

	Ackler et al. (2023)	Dannecker et al. (2022)	Keen et al. (2021)	King et al. (2016)	King et al. (2018)	Leake et al. (2021)	Robinson et al. (2016)	Sole et al. (2020)	Wijma et al. (2018)
Item 8. Was the data analysis sufficiently rigorous?	Y	Y	Y	Y	Y	Y	Y	Y	Y
Item 9. Is there a clear statement of findings?	Y	Y	Y	Y	Y	Y	Y	Y	Y
Item 10. How valuable is the research?	Yes. The researchers evaluated the contribution this study brings to the topic by correlating it in discussions with other articles by the authors and other research groups. transferability to other populations was also evaluated despite the fact that an ethnic selection bias was present	Yes, the researchers have analysed the contributions that this article brings to the literature and the practical implications that result from it.	Yes, the researchers have analysed the contributions that this article brings to the literature and the practical implications that result from it.	Yes, the researchers have analysed the contributions that this article brings to the literature and the practical implications that result from it.	Yes, the researchers have analysed the contributions that this article brings to the literature and the practical implications that result from it.	Yes, the researchers have analysed the contributions that this article brings to the literature and the practical implications that result from it.	Yes, the researchers have analysed the contributions that this article brings to the literature and the practical implications that result from it.	Yes, the researchers have analysed the contributions that this article brings to the literature and the practical implications that result from it.	Yes, the researchers have analysed the contributions that this article brings to the literature and the practical implications that result from it.

Legend. Y: yes; N: no; CT: Can't tell.

It would be to give people hope that are in debilitating pain. That there is a way out ... to at least some of you, there is hope of cutting through some of that and still gaining some if not all of your life back. (*Chronic Musculoskeletal Pain*) [22]

However, participants also reported widespread dissatisfaction with the content and materials of PNE [22,37–39]. They indicated that they felt the content did not contribute anything new to their knowledge of pain [22,23,36,37]. Important topics had not been addressed, such as the causes of pathology or specific indications (e.g. the type of diet in fibromyalgia) [22]. Others would like more information on the mechanical aspect of the problem [22,39] and considered the contents tedious [23,35], not understanding the purpose of the PNE content [22,23,35]. Others considered PNE insufficient [22,38,39] or were sceptical about its content [22,23,37,40].

It is essentially what [...] this physio or whatever explained. Although it would've been nice if they'd, like, given me this, rather than make me sit in a room for like five hours. (*Fibromyalgia*) [23]

More on the mechanical side of it, I would have thought would be more helpful, because when you're talking about how the brain connects to your pain, and stuff like that, it sort of felt like it was maybe you haven't got a sore shoulder. (*Rotator cuff-related pain*) [39]

Okay, so it's chronic pain. That is also reassuring in a sense that there is nothing going on. It's really double! Because neurologically there is nothing wrong, somehow you don't trust that you've not had scans made and no real medical examinations were done. On the other hand, it's comforting to hear that there is nothing serious going on. (*Neck, back, and hip pain*) [40]

Other participants reported a lack of relevance and usefulness resulting from the little personalisation of the PNE content to their specific situation [22,35–38].

I can imagine how that would work for someone who had um, constant pain or (...) long periods of pain, but for me with my shoulder pain (...), mine is just related to doing a certain activity, so as soon as I stop that activity the pain will stop (...) my pain isn't an ongoing pain (...). So, using this technique of um, just relaxing with the pain isn't really something I've had to do. (*Rotator cuff-related shoulder pain*) [35]

For me personally I didn't think it was any good for the symptoms that I have...I said how can you help people with physio on their throat and what I was suffering? And the two ladies that were doing the session basically couldn't answer my question. So I said well I wouldn't want to come back to this ...I was sort of lost with the session...Just wasn't for me...I was belching and gurgling and everything and it wasn't covered about that, it didn't help me at all...it was for more for people with different parts of the body pain and not the one I have. (*Thoracic spine and pain*) [36]

...it just didn't do nowt [nothing], and I explained at the end I thought it was a waste of time? So were there any parts of the talk that you found kind of useful. [Interviewer] No not at all, no. (*Thoracic spine pain*) [36]

Analytical theme 2 – emotional support and well-being. Another perceived factor influencing the success of PNE was the individual's emotional apparatus, which led us to generate the second analytical theme, "Emotional Support and Well-Being," starting from the descriptive theme "Emotions and Feelings."

Descriptive theme 4 – emotions and feelings. This theme includes participants' emotions and feelings after the PNE intervention. They reported a sense of reassurance, understanding, relief, and, in general, greater awareness and reflexivity about the situation [22,24,35,37,39].

I was kinda like, 'My God somebody is getting it'. I kind of had a sense of relief. (*Chronic MSK Pain*) [22]



Figure 2. Descriptive and analytical themes.

And the reassurance (...), I felt reassured that it wasn't an injury as such. And by moving I wasn't going to make it worse (...) Cos I sort of had been living like that, protecting, gets sore and then you stop doing what you're doing because it's sore. Where he, sort of gave me the confidence to look at pain in a different way. (*Rotator cuff-related shoulder pain*) [35]

However, in two studies, negative emotions and feelings such as frustration, misunderstanding, or insecurity emerged. These emotions were due to personal needs that have not been satisfied, such as the reassurance regarding the integrity of the painful structure, the belief of not being able to use the indicated strategies or the little understanding that healthcare professionals convey of the painful situation of the patient. [22,40].

The reassurance is, at least that's how I interpreted it, that there is pain but no damage. And that I don't know, I don't know if there is no damage. I'm still in doubt. (*Neck, shoulder, arm pain*) [40]

Analytical theme 3 – empowerment promotion. The third analytical theme is placed towards the end of the treatment process, closer to achieving the objective of PNE, which is to bring the individual to greater awareness of their condition and to give them the tools to deal with the chronic pain situation. The efficacy of PNE is intrinsically linked to the extent of individual empowerment after PNE, which can be defined as granting agency, enabling the effective management of chronic pain within specific circumstances. This empowerment is intricately tied to acquiring effective coping strategies and changing beliefs and mindsets by reconceptualising chronic pain mechanisms. Hence, this analytical theme was generated by the descriptive themes "Reconceptualisation of the Pain Mechanisms" and "Beliefs, Mindset and Coping Strategies."

Descriptive theme 5 – reconceptualisation of the pain mechanisms. This theme discussed how the information received changed participants' ideas about pain mechanisms, the factors affecting pain, and how they are linked to CNS. More precisely, the prevailing insights among participants about the fundamental principles of chronic pain, wherein it is not invariably indicative

of physical injury, exhibits a frequently tenuous association with specific tissues, and the underlying causative factors may extend beyond the localised region of pain perception [22–24,38,39].

I don't know why I didn't know that pain is 100% of the time produced by the brain. If somebody stabs you in the leg, I would think it's like you just got stabbed (it) would be the (leg). But I guess it all comes from your brain. I'd like to tell my brain to just ignore my neck. I've been healed. (*Chronic Musculoskeletal Pain*) [22]

I think the most important concept for me was learning that my brain was the problem not my arm. (*CRPS*) [24]

However, participants also showed a low degree of reconceptualisation and were still anchored to the idea that pain only results from structural damage [22,36–38].

I don't know the facts. Well I really don't know if there's tissue damage and you know what I'm saying? I was thinking with the video, you know, in all my years of practicing keyboard, I bent my head a certain way and maybe that's part of this problem...you can't be rolling your head around and trying to read music...maybe years and hours sitting at an organ or piano bench, maybe that's where this comes from. It's a thought, isn't it? (*Chronic Musculoskeletal Pain*) [22]

Participants generally understood that chronic pain has a multifactorial origin and that emotions and stress have a crucial role in its maintenance [22,24,36].

My pain system is being too sensitive because of all the stress and illness in my life and worry (*back/widespread pain*) [24]

If I am mentally worried about something it will set it off...It's [PNE] confirmed it [the stress - pain link]...so I understand it. (*Lower back and leg pain*) [36]

However, they have also reported they did not fully understand the mechanisms of chronic pain and maintenance [22,38].

It was just basically stubbing your toe...I don't want to know about my toe. I've stubbed my toe, fair enough, and I know it lasts 3 or 4 days. But I want to know about why I've got the constant pain in my spine. And it just didn't materialise. (*Low back pain*) [38]

In many of the studies included, participants demonstrated a good understanding of the CNS alteration present in chronic pain, reporting concepts such as a state of constant excitement of the system [24,36,38], hypersensitivity to pain [24,36–38], mismatch between signals coming from the tissues and pain [24,36,39].

Basically I've got a build-up of chemicals around the nerves in the damaged area, I can't remember exactly, I think its cortisone, I can't remember? but basically what it's doing it's exciting the nerve but at the same time it's clinging to the gates on the bottom of your nerves so it's not allowing them to shut properly, so my brain's reacting by saying what the hell's going on. So therefore it's creating more gates, creating more branches of nerves, to try to understand all of the information. And if I've understood it alright this is basically hyper exiting it more so they're in a constant state of excitement...It was just really interesting because like I say it was something that I was vaguely aware of but not in that much detail. (CRPS) [36]

However, contrasting opinions were found regarding the protective function of pain. For some, pain has a positive protective function related to safety, while others showed doubts about this function or believed it was useless [24].

I think the biggest thing is this idea that pain is always looking to protect you and actually keep you safe from injury. (Neck/arm pain) [24]

My CRPS is a faulty protection response to things that are actually safe. (CRPS) [24]

Descriptive theme 6 – beliefs, mindset and coping strategies. After the PNE intervention, many participants reported the ability of PNE to shift their beliefs about chronic pain, leading to a change in their pain-related coping strategies. Most participants introduced new strategies into their daily lives to improve the management of chronic pain, such as not limiting themselves in activities but pacing them, not being afraid of pain, trying to control pain by doing exercises instead of taking drugs, adopting a proactive attitude, being positive [22,24,35–40].

It [the knowledge] has given me a better sense of control over it [the pain]. I didn't know we could manage it [the pain] before. I thought it either hurt or it didn't, and it was external to anything I could do. (Rotator cuff-related pain) [39]

...when I was walking quite briskly I just slowed down. I thought, oh calm down you've got plenty of time to get there...where before I would have just carried on... (Chronic low back pain) [37]

The changes in beliefs impacted people's mindset as they felt more optimistic and would receive PNE sooner [22–24,35–39].

It also reassured me that I wasn't going barmy...it [PNE] explained that I'm not. What I am experiencing is real and it explained why, without something necessarily being wrong...things like the sensitivity is a kind of new thing that no one had offered before. (Lower back and legs pain) [36]

...so when I finally understood the physiology of why, it answered so many questions, and even though there's no quote unquote cure, it was a huge lift off my shoulders... (Chronic MSK Pain) [22]

However, participants did not consider the explanations provided sufficient to change their beliefs about pain, or they had difficulty believing in what they were told if the proposed strategies did not convince them, or they were negatively influenced by the previous beliefs [22,37–39].

No [I don't view my pain any differently after PNE] because I sat in the room for 2 hours and I came out none the wiser...It just went straight over my head. I didn't have a clue half the time. (Low back pain) [38]

It's just exactly the same. The same things triggered it, resting helps it now, that sort of thing and obviously try and not extend it, extend yourself to make it worse...I guess I've got a preconceived idea of the

problem and it just seems to be like it's just not going to go away. (Rotator cuff-related pain) [39]

Moreover, participants also reported that the strategies proposed by PNE might not be very applicable in everyday life and do not give precise indications on how to deal with pain [22,23,37,39].

It's [the pain education session] not been a lot [helpful] really (...), so therefore there's been no guidance in what I can do to alleviate the problem I've got. (Rotator cuff related pain) [39]

I read everything there is on chronic pain and fibromyalgia. But then [...] I've just got to live my life [...] I don't read that and really go, 'Ooh, let's look into that [...] there's not gonna be a change in how you do stuff. (Fibromyalgia) [23]

Certainty of evidence

The evaluation of the analytical themes with the certainty of quality evidence (CerQual) approach is reported in Table 3. All the study findings were assessed as moderate confidence, which meant a good level of certainty because of minor concerns regarding the methodological limitations, the coherence and adequacy of data within and across all studies included, and substantial concerns regarding the relevance.

Discussion

This meta-synthesis shed some light on the perceived determinants of the success of PNE in chronic MSK pain. Upon concluding this synthesis, three key analytical themes were generated, underscoring the factors influencing an "Efficient Communication of Information," the significance of "Emotional Support and Well-being," and the pivotal role of "Empowerment Promotion" in placing individuals at the heart of their care process. Hence, our review has provided fresh insights into people's experiences with PNE, advancing beyond the earlier review by Watson et al. [21].

The first theme, "Efficient Communication of Information," revolved around the importance of communication, spanning from the interaction between healthcare professionals and individuals with chronic MSK pain to the significance of the adopted communication styles. As highlighted by the participants, the quality of the therapeutic relationship established between healthcare professionals and individuals with chronic MSK pain assumed paramount significance. Specifically, the healthcare professionals' adoption of an active listening approach and the individual's positive perception of the healthcare professional emerged as two pivotal factors influencing the reception of PNE. Furthermore, the healthcare professional's commitment to employing a clear and coherent communication style, exemplified by providing slides, well-founded explanations with distinct objectives, and disseminating encouraging and hopeful messages, was instrumental in shaping the individuals' perspective. Moreover, PNE content and topics should be relevant and tailored to individual needs, offering novel and comprehensive information without lapsing into tedium or redundancy. The perception of the utility of specific modalities, such as instructional videos, remains highly subjective and should align with the individuals' preferences. Therefore, individuals valued a clear and coherent communication style, emphasising the need for personalised information delivery methods. Personalisation extended not only to the chosen delivery methods but also to tailoring PNE content to enhance personal relevance. Relevance can be described as the perception that certain information is valuable and applicable in the present moment, serving as the bridge between what we communicate and the specific

Table 3. Certainty of evidence (CerQual).

Review finding	Studies contributing to the review finding	Assessment of methodological limitations	Assessment of relevance	Assessment of coherence	Assessment of adequacy of data	Overall CerQual assessment of confidence	Explanation of judgement
Efficient Communication and Information	Acker et al. (2023), Dannecker et al. (2022), Keen et al. (2021), King et al. (2016), King et al. (2018), Robinson et al. (2016), Sole et al. (2020), Wijma et al. (2018)	Minor methodological limitations (two studies with no limitations, five with minor limitations on research design and recruitment strategy, one study with moderate methodological limitations on research strategy)	Substantial concerns about relevance (two studies included only Caucasian people, one study included Maori, five studies did not report this information)	Minor concerns about coherence (data reasonably consistent within and across all studies)	Minor concerns about adequacy (eight studies that offered together moderately rich data overall)	Moderate confidence	This finding was graded as moderate confidence because of minor concerns regarding methodological limitations, coherence and adequacy though substantial concerns about relevance.
Emotional Support and Well-being	Acker et al. (2023), Dannecker et al. (2022), King et al. (2016), Leake et al. (2021), Sole et al. (2020), Wijma et al. (2018)	Minor methodological limitations (one study with no limitations, four with minor limitations on research design and recruitment strategy, one study with moderate methodological limitations on research strategy)	Substantial concerns about relevance (one study included only Caucasian people, one study included Maori, four studies do not report this information)	Minor concerns about coherence (data reasonably consistent within and across all studies)	Minor concerns about adequacy (six studies that offered together moderately rich data overall)	Moderate confidence	This finding was graded as moderate confidence because of minor concerns regarding methodological limitations, coherence and adequacy though substantial concerns about relevance.
Empowerment Promotion	Acker et al. (2023), Dannecker et al. (2022), Keen et al. (2021), King et al. (2016), King et al. (2018), Leake et al. (2021), Robinson et al. (2016), Sole et al. (2020), Wijma et al. (2018)	Minor methodological limitations (three studies with no limitations, five with minor limitations on research design and recruitment strategy, one study with moderate methodological limitations on research strategy)	Substantial concerns about relevance (two studies included only Caucasian people, one study included Maori, six studies do not report this information)	Minor concerns about coherence (data reasonably consistent within and across all studies)	Minor concerns about adequacy (nine studies that offered together moderately rich data overall)	Moderate confidence	This finding was graded as moderate confidence because of minor concerns regarding methodological limitations, coherence and adequacy though substantial concerns about relevance.

interests of our audience [42]. Healthcare professionals should tailor PNE to suit the unique characteristics of the individuals they work with, ensuring that the information provided is relevant. Different strategies have been proposed to make the educational content relevant. These strategies include personalising content using various communication modes, designing educational experiences that engage the individuals, demonstrating the personal usefulness of the content for achieving individual goals, fostering identification with the material, creating a sense of relatedness to significant people in the individuals' life, and emphasising the perceived value of proposed changes [42]. These strategies align with our review, as individuals expressed their appreciation for the utilisation of diverse communication formats (such as videos and slides), demonstrating the personal relevance of the content of the therapeutic goals, fostering an understanding of the value associated with suggested changes (e.g. dietary modifications and exercise recommendations), and nurturing a positive clinician-patient relationship. When clinicians fail to make PNE relevant, the content is reported to be less engaging, leading to individual dissatisfaction. PNE often employs stories and metaphors, but these narratives must resonate with the individual in their unique context [43,44]. A deep understanding of the individual's history is essential for tailoring treatment [45]. This perspective aligns with current literature that underscores the significance of personalised PNE based on a patient-centred approach, recognising the experiences of each individual and the need to comprehend and address their unique pain experience [46].

Consequently, a pivotal determinant for the success of PNE lies in the customisation of the intervention. However, this process

must also consider people's emotions while experiencing pain, thus the next analytical theme. Our second theme, "Emotional Support and Well-being," highlighted the importance of investigating the emotional aspect of individuals with chronic MSK pain while applying PNE. An analytical theme was dedicated to this topic, as the participants of the primary studies perceived that clinicians often underestimate or overlook it. After PNE, individuals experienced a broad array of different emotions as they felt reassured by the information they received about their condition, relieved by feeling understood by the clinician and realising that they were going in the right direction, more positive and hopeful in the way they think and act, and more aware in the manage of pain in daily life. However, other participants were disappointed, as they did not fully believe in the information received, were frustrated, unable to follow the advice provided, and did not feel their pain situation to be understood by the healthcare staff even though they studied it in books. Therefore, clinicians need to consider the emotional aspect of the educational process, investigating and listening to the individuals' feelings after PNE. Extensive research has emphasised the relationship between chronic pain and emotions, backing the importance of considering this relationship in the care process [47,48]. Recent research highlighted that responses to pain, such as catastrophising, helplessness, hopelessness and thought suppression, are implicated in the relationship between chronic pain and depression [47-49]. Moreover, it is known that maladaptive cognitive and emotional factors (e.g. pain catastrophising) are associated with the activation of several brain regions involved in chronic pain [47].

Addressing the emotional needs of individuals is pivotal for enhancing the quality of the relationship between healthcare providers and consumers and improving the individuals' overall condition [50]. Moreover, emotional safety through reciprocal trust between healthcare providers and consumers is essential to achieve behavioural change [51–53]. In our review, this second theme served as a bridge between the other two as it is impossible to consider individuals' emotions without utilising an effective communication style and creating a secure therapeutic environment is a fundamental step in empowering those under our care, motivating them to change how they cope with pain.

Our third theme, "Promoting Empowerment," is intricately linked to personal change. Here, "Empowerment" stands for the individuals' ability to confront their pain after undergoing PNE [54]. Empowerment is manifested in adopting a proactive stance, acquiring the skills to manage pain without succumbing to fear, pacing activities judiciously without undue restrictions, and mastering the ability to pre-empt the escalation of symptomatic manifestations. Furthermore, regarding the changes of beliefs, the success of PNE is contingent upon the clinician's adeptness in guiding the individual towards a paradigm shift in their perception of pain. This shift necessitates providing cogent responses to queries and imparting valid strategies for addressing the condition. This process involves understanding and internalising the information received to make the individual more aware of the role of pain through its reconceptualisation. By doing so, the clinicians can help the individuals understand the mechanisms of pain: first, pain does not always mean structural damage; secondly, to know the factors that contribute to the origin and maintenance of pain, which are not always fully understood; thirdly, the effects that pain has on the CNS, especially regarding overprotection and hypersensitivity. Therefore, PNE should empower individuals to make effective changes by tapping into their meaning and capacity for transformation. One of the primary objectives of PNE is to assist individuals in reimagining their experience of pain. Watson et al. in their review, underscored the pivotal role of pain reconceptualisation in facilitating individuals' ability to cope with their condition [21]. However, the goal of PNE goes beyond merely informing individuals about pain. It strives to stimulate the application of acquired knowledge to effect changes in behaviour [55,56]. As a result, PNE has the potential to improve self-management and self-efficacy in individuals with chronic MSK pain [57]. However, the impact of PNE on a complex, dynamic system like chronic pain is limited when delivered in isolation. Evidence indicates that PNE is most effective when incorporated into a comprehensive treatment plan that integrates all available treatment options (e.g. nutrition, sleep, meditation, exercise, manual therapies, etc.) to convey a cohesive message of hope [14]. Accepting the idea of complexity in chronic pain, which results from intricate, dynamic, and highly individual interactions between various factors within the broader system, suggests that all these treatment interventions can work symbiotically [58]. Hence, the ultimate goal of chronic MSK pain management should revolve around a respectful and genuine approach that supports individuals in their journey towards change and autonomy. As mentioned above, recent studies have brought to the forefront a possible lack of effect of PNE in reducing pain levels [59,60]. Future studies should test whether or not these results might change after applying a PNE-based intervention that aligns with the guidelines we created following individuals' experiences. Without an adequate personalisation of the intervention, the risk is to give general information that the individual does not perceive as relevant, which makes the intervention meaningless.

Some limitations of this study need to be acknowledged. Firstly, the studies incorporated various qualitative approaches, from interpretative phenomenological analysis to grounded theory. This diversity in qualitative methodologies is a recognised challenge in the synthesis of qualitative research [61]. To mitigate this issue and enhance the rigour of our study, we took several steps, including formulating a precise research question, applying specific criteria for study selection that aligned with our research goals, and consistently adhering to established guidelines for conducting qualitative research [27,29]. Secondly, we had a heterogeneous sample of people with chronic MSK pain in terms of diagnosis and demographic characteristics. For future studies, it might be interesting to investigate whether there are any trends, for example regarding socioeconomic or demographic characteristics, that relate to patients' perception of PNE. Besides, most studies did not perfectly explain the diagnostic criteria to determine chronic pain. However, we tried to exclude all pathologies that were not strictly of MSK origin (e.g. abdominal pain). As per the strengths, we found studies that represented the main conditions of chronic MSK pain. Regarding analysing and elaborating the descriptive and analytical themes, we collaborated with various professionals (for example, physiotherapists and psychologists) to extract results. We strictly followed the guidelines for synthesising qualitative studies reported by the Cochrane group and assessed the certainty of the evidence of our findings with CerQual [27,29,32,62].

Conclusions

This study conducted a comprehensive synthesis of existing qualitative evidence around the perceived determinants influencing the efficacy of PNE. It identified three main dimensions: effective communication and rapport between healthcare professionals and individuals with chronic MSK pain, the emotional and personal aspects of the individual, and empowerment capacity. These dimensions underscored the need for tailored treatments that consider individuals' emotional well-being to promote empowerment. Our findings should inform future quantitative studies aimed at refining PNE delivery to test its effectiveness.

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