Physiotherapy Pain Association

*Pain and Rehabilitation*
Volume 54 Issue 1 2025

# Exploring the impact of metaphors and pain neuroscience education on adults with chronic musculoskeletal pain.

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**Abstract**
**Background:** Chronic musculoskeletal pain (CMP) is a significant global health concern. Metaphors are frequently used by people with CMP and form an integral component of pain neuroscience education (PNE). While numerous studies have explored metaphors, PNE and chronic pain, research specifically focusing on CMP remains limited.
**Objectives:** This study aimed to (1) identify the use and impact of metaphors in individuals with CMP, (2) critically evaluate the literature on the effectiveness of PNE in this population, and (3) explore how PNE influences individuals with CMP.
**Data Sources:** Nine online databases including Google Scholar, EMBASE, CINAHL, and ScienceDirect were searched from inception to 31 May 2022. Additionally, reference lists were manually searched for relevant studies.
**Study Selection:** Included studies comprised of randomised controlled trials (RCTs), systematic reviews, and qualitative research.
**Study Appraisal and Synthesis:** The selected studies were critically appraised using CASP checklists.
**Results:** A total of 24 studies were analysed, consisting of six systematic reviews, 11 RCTs, and seven qualitative studies. Metaphors were found to facilitate the expression and narration of pain experiences amongst individuals with CMP. The effectiveness of PNE varied depending on participants' specific conditions. Strong evidence supported PNE's ability to reduce pain, disability, catastrophising, and kinesiophobia in individuals with chronic low back pain (CLBP). However, the evidence for its effectiveness in non-spinal pain conditions was limited and inconclusive. Reconceptualisation of pain was identified as a critical process for PNE to be effective.
**Conclusions:** PNE should be considered an essential intervention in the management of CLBP. Further RCTs are warranted to evaluate PNE's efficacy in non-spinal CMP conditions and to determine its optimal delivery format.

**Keywords**
Chronic pain, Musculoskeletal Pain, Metaphors, Pain Neuroscience education, Chronic Low Back Pain.

## Introduction

### *Background*

Musculoskeletal pain is a significant global health concern. The Global Burden of Disease study in 2019 estimated that approximately 1.71 billion people have musculoskeletal disorders [1]. Chronic musculoskeletal pain (CMP) affects around 26% of adults [2]; it is complex to manage due to the multiple biopsychosocial factors involved.

Metaphors are fundamental to our communication. In everyday speech, it is estimated that people use six metaphors a minute [3]. Metaphors are frequently employed by people in pain because they convey pain intensity and suffering coherently with imagery, such as "stabbing" pain [4]. This observation led to the development of the McGill Pain Questionnaire, which encourages patients to consider which pain metaphors match their symptoms to help communicate their pain experience [5].

Healthcare professionals also utilise metaphors; they can be used with patients to overcome barriers to understanding and strengthen the therapeutic relationship [6]. Unfortunately, metaphors used by clinicians can also be negatively interpreted by patients and cause lasting damage [7]. Neilson [8] echoed these sentiments when he reported that metaphors used in medicine are usually related to damage and weaponry. This reductionism may be harmful to people in pain who, above all, are seeking reassurance.

A range of interventions is available for CMP, including drug therapy, exercise-based therapy, psychotherapy,

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and pain education [9]. Pain neuroscience education (PNE) is increasingly used, which aims to change a person's understanding of pain from an indicator of tissue damage to a measure of perceived threat [10]. This conceptual change is termed reconceptualisation. Metaphors are used in PNE to convey complex pain neurophysiology concepts to patients in a way they can easily understand. Gallagher, McAuley and Moseley [11] investigated the effects of metaphorical stories covering pain neuroscience concepts versus a chronic pain advice booklet. They found a notable reduction in catastrophising after the metaphorical stories were administered but no changes in pain or disability. This suggests that the metaphorical stories may be beneficial but should not be used alone as they are unlikely sufficient for conceptual and behavioural changes.

There are few studies regarding metaphor use specific to CMP. Despite numerous studies investigating the effectiveness of PNE and multiple studies exploring the use of metaphors in people with chronic pain, there has been no review combining both elements. Watson *et al.* [12] conducted a mixed-method systematic review and meta-analysis evaluating the effectiveness of PNE in people with CMP and exploring their experiences of PNE. Nevertheless, this review did not examine how people with CMP use metaphors as the focus was PNE alone.

A better understanding of how metaphors can be used or elicited during consultations would improve the assessment and management of people with CMP. It is also important to elucidate the evidence for PNE in this population. Therefore, by examining the current published literature, this narrative review aimed to investigate the use and effects of metaphors and the effectiveness of PNE in people with CMP.

### *Objectives*

The objectives of this narrative review were:

1. To identify the use and impact of metaphors in individuals with CMP
2. To critically evaluate the literature on the effectiveness of PNE in individuals with CMP
3. To explore how PNE influences individuals with CMP.

## Methods

### *Study Design*

A narrative review was conducted to evaluate the current published literature on metaphor use and PNE in people with CMP.

### *Search Strategy*

The following nine online databases were searched: Google Scholar, CINAHL, EMBASE, Cochrane Library, The Nursing & Allied Health database, PubMed, Scopus, ScienceDirect, and Proquest Psychology Journals. The search was restricted to articles in the English Language and adults whenever these options were available. In addition, reference lists of systematic reviews were manually searched to find other studies.

PNE has several alternative names, so the search strategy was broadened to reflect this. The main search terms utilised were: "metaphor", "chronic pain", "explain pain", "therapeutic neuroscience education", "pain biology education" and "pain neuroscience education". The results were initially screened for relevancy and duplicates were identified for removal. A second screening was performed where abstracts were read in detail, so potentially relevant studies were selected for full-text retrieval using the selection criteria. After obtaining the full text of the selected studies, they were again screened for eligibility using the inclusion and exclusion criteria described below.

### *Inclusion Criteria*

- Published in the English language.
- Adults aged 18 or over with CMP, i.e. musculoskeletal pain lasting at least three months.
- Studies published from inception to 31 May 2022.
- Studies which were RCTs, systematic reviews or qualitative studies.

### *Exclusion Criteria*

- Publications in languages other than English.
- Pilot, preliminary and feasibility studies.
- Other types of chronic pain such as complex regional pain syndrome and chronic neuropathic pain.
- Chronic widespread pain syndromes such as fibromyalgia.
- Studies about children and adolescents.
- Grey literature, including conference abstracts, reports, government documents and white papers.

*Study Selection*

The process of finding and selecting suitable studies is outlined in Figure 1.

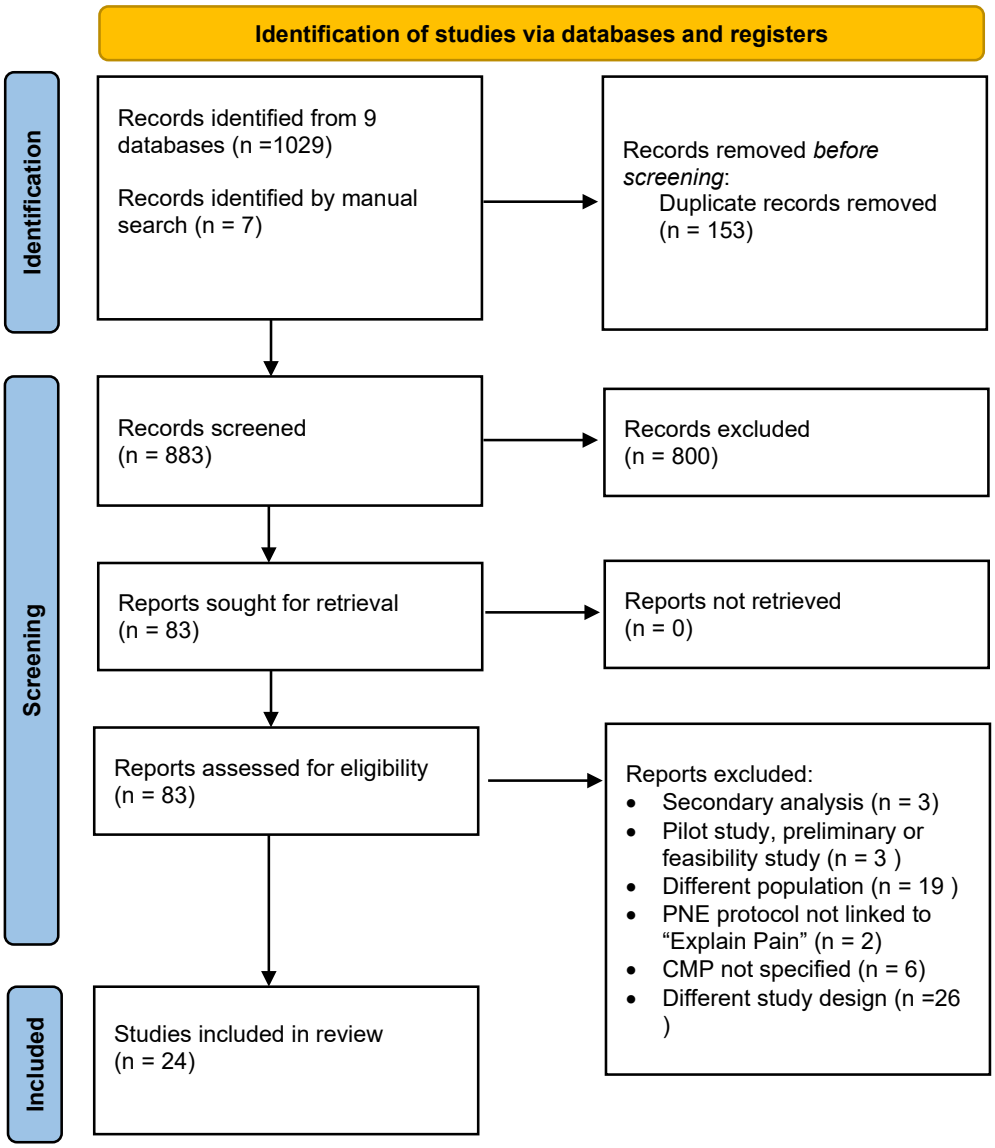


**Figure 1:** PRISMA flow diagram of the study selection process, adapted from [13].

*Data Extraction*

Twenty-four studies were identified for inclusion in the review, which consisted of six systematic reviews, eleven RCTs and seven qualitative studies. Data was extracted by a single reviewer and input into tables. Tables 1-3 illustrate the information gathered from the included studies.

*Data Analysis*

The 24 selected studies were critically evaluated using the relevant checklists from the Critical Appraisal Skills Programme (CASP) [14] for RCTs, systematic reviews and qualitative studies.

*Ethical Approval*

This research was deemed as low risk and as such was reviewed by the Low-Risk Ethical procedure at University of South Wales and granted approval.

**Findings**

The findings of this review have been structured into three sections to address each of the objectives:

1. To identify the use and impact of metaphors in individuals with CMP
2. To critically evaluate the literature on the effectiveness of PNE in individuals with CMP
3. To explore how PNE influences individuals with CMP.

**Table 1:** Characteristics and main findings of the Qualitative studies.

| Name of author (s) | Year | Study design | Participants | Objective(s) | Intervention/ Control | Main findings/ conclusions |
|---|---|---|---|---|---|---|
| **Crowe et al. [15]** | 2010 | Qualitative Semi-structured interviews | 64 adults with chronic low back pain (CLBP). 31 females and 33 males | To explore people's experiences of the impact of CLBP. | N/A | Four themes were identified regarding the impact of CLBP: pain is unpredictable, vigilance is required, disconnection from their body and an altered self image. The main metaphor was "listening to the body and talking to oneself", which were strategies to manage impact of CLBP. Metaphors were also used to describe alteration to self "my life's not as full" and "only do a small fraction of the things". This showed that they felt their lives had worsened due to CLBP. |
| **Hunt and Day [16]** | 2017 | Qualitative Narrative interviews | 10 patients with chronic pain who participated in sport. Five females and five males | To explore the experiences of people who continued to participate in sport, despite chronic pain after an injury. | N/A | All participants used the metaphor of "imprisonment" to describe the experience of chronic pain with social and environmental restrictions. Metaphors were frequently used in their narratives: "feeling drained", "I was back to square one", "I felt trapped" and "it was a wear and tear injury". Metaphors are valuable in enabling people to narrate their pain stories. |
| **King et al. [17]** | 2016 | Qualitative 2 Semi-structured interviews - before and after PNE. | Seven adults with CMP. Five females and two males | To examine the degree of reconceptualisation of people with CMP after PNE. | PNE – 2-hour didactic group lecture based on 'Explain Pain'. | Variable degrees of reconceptualisation were found in study participants. Prior beliefs were found to be facilitators or barriers to reconceptualisation. Individuals with signs of reconceptualisation had greater clinical benefit from PNE than those without. |
| **King et al. [18]** | 2018 | Qualitative 2 Semi-structured interviews - before and after PNE. | 12 adults with CLBP. Seven females and five males | To examine the degree of reconceptualisation of people with CLBP after PNE. | PNE – A group PNE session based on 'Explain Pain'. | Variable degrees of reconceptualisation were found in study participants, most showed partial reconceptualisation. Prior beliefs and personal relevance of the information was associated with the degree of perceived benefit of PNE. One participant became upset during PNE and the interview afterwards. |
| **Robinson et al. [19]** | 2016 | Qualitative Semi- | 10 adults with CMP. Four females and six males | To explore the experience of PNE in people with CMP and to | PNE – 2-hour didactic group | Three themes were identified: relevance of PNE to the participants, participants' reported benefits and the observed degree of reconceptualisation. |

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| | | structured interviews | | observe if their understanding of their pain after PNE changed. | session based on 'Explain Pain'. | Most participants found PNE relevant to them and beneficial, but two participants did not. Four participants showed some degree of reconceptualisation. Group PNE sessions may not be suitable for all patients. |
| **Sharma, Pathak and Jensen [20]** | 2016 | Qualitative Interviews | 101 Nepalese adults with CMP. 73 females and 28 males | To determine how language and culture can affect the validity of pain quality measures by comparing pain descriptors used by people in Nepal with those used in the USA. | N/A | Metaphors were used much more frequently in people from Nepal than the USA. A specific category of pain descriptor for physical state was often used in people from Nepal. These findings suggest that direct translations of pain outcome measures from one country may not be content-valid in another country or culture and adaptations may be necessary. |
| **Thomson and Collyer [21]** | 2017 | Qualitative interviews | Nine patients with CLBP treated at the British School of Osteopathy. six females and three males | To investigate how LBP patients comprehend the language used by student osteopaths regarding their diagnosis and how this affects their attitudes and beliefs about LBP. | N/A | "Feeling engaged" was the core component of the narratives and there were four subcategories: the use of jargon, metaphors and analogies, expressing emotions and caring for the person. Metaphors were used frequently by participants e.g. "light at the end of the tunnel" and "take it into my own hands". The type of language used was fundamental to patients understanding their pain and engaging in their own care. There was evidence that the language used had a positive or negative effect on engagement. |

*The use and effects of metaphors in people with CMP*

Of the four studies found in this area, three investigated the use of metaphors by people with CMP, Sharma, Pathak and Jensen [20], Hunt and Day [16] and Crowe *et al.* [15]. One study examined how the language used by student osteopaths affected people with CMP, Thomas and Collyer [21]. Table 4 summarises the findings of these studies and a critique of the papers.

*The effectiveness of PNE for people with CMP*

In relation to this objective, 18 studies were found which included 11 RCTs and seven systematic reviews. 16 of the studies involved primarily participants with chronic spinal pain. However, Ordoñez-Mora, Morales-Osorio and Rosero [35] focused on people with knee osteoarthritis and Ponce-Fuentes *et al.* [29] had participants with chronic shoulder pain who had undergone arthroscopic rotator cuff surgery.

The pyramid (Figure 2) reflects the available evidence for the effectiveness of PNE for different CMP conditions. This shows that chronic low back pain has the most research to support the use of PNE.

Table 5 summarises the findings of these studies

*The impact of PNE on people with CMP*

Three qualitative studies were found, Robinson *et al.* [19], King *et al.* [17] and King *et al.* [18] explored the experiences and reconceptualisation of people with CMP, who had participated in PNE. These studies were all performed by the same research team at an NHS pain clinic. Table 6 outlines the findings of these studies.

**Table 2:** Characteristics and main findings of the RCTs.

| Name of author (s) | Year | Study design | Participants | Objective | Intervention/ Control | Main findings/ conclusions |
|---|---|---|---|---|---|---|
| **Galan Martin *et al* . [22]** | 2020 | Quantitative Multicentre RCT with 12 primary care centres. | 170 adults with chronic non-specific spinal pain (CNSP). Intervention group = 89 (65 females, 24 males) and control group = 81(71 females, 10 males). | To investigate the effectiveness of a PNE and physical exercise (PE) programme versus usual physiotherapy for CNSP. | Intervention - 2 x 1.5-hour group PNE sessions for 2 weeks, group PE – 3 x 1-hour sessions for 6 weeks with PNE reinforcement, a 2-hour group PNE session and a 2-hour reinforcement PNE session 3 months after treatment. Control – 15 x 1-hour sessions of thermotherapy, electrotherapy and prescribed exercises | The findings showed the intervention group had significantly greater improvements in health-related quality of life, kinesiophobia, central sensitisation score, disability score, catastrophising and pain intensity than the control. The intervention group had large effect sizes for these groups. |
| **Javandeh *et al* [23].** | 2021 | Quantitative Multicentre RCT with participants from 2 rehab centres. | 72 adults with chronic neck pain. Therapeutic exercises (TE) = 24 (10 females & 14 males) TE and PNE = 24 (13 females & 11 males) & control = 24 (12 females & 12 males). | To determine how patients with chronic neck pain were affected by the addition of PNE to TE in terms of catastrophising, fear avoidance behaviour, pain self-efficacy and pain-disability index. | TE group - 3 x 30-40 minute exercise sessions for 6 weeks TE and PNE group - TE as above & PNE with slides. Initial 1-hour PNE session & 5 weekly 30-45 minute sessions. Control group – no treatment during intervention period. | Both intervention groups had significant improvements in pain, disability, fear avoidance behaviour, catastrophising and pain self-efficacy. The TE and PNE group had better outcomes than the TE group alone. The TE and PNE group had large effect sizes generally. |

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| **Malfiet *et al.* [24]** | 2018 | Quantitative Multicentre RCT – 2 university hospitals | 120 people with CNSP. Intervention group = 60 (38 females & 22 males) & control = 60 (35 females & 25 males). | To investigate whether blended learning PNE was able to reduce kinesiophobia, disability, negative illness perceptions and catastrophising in people with CNSP. | Intervention – 1st session PNE based on 'Explain Pain' with group ~ 30-60 minutes, 2nd session online e-learning module with 3 videos, 3rd session – 1 on 1 session discussing material from 2nd session.<br>Control – Same number and format of sessions as intervention, but given biomedical knowledge on neck and LBP. | The intervention group had significant reductions in kinesiophobia and negative illness perceptions. Neither group had significant changes in the pain disability index. |
| **Matias *et al.* [25]** | 2019 | Quantitative Single centre RCT held at a university. | 53 university students with chronic neck pain. Intervention group = 25 (22 females and three males)<br>& control = 27 (21 females and six males). | To investigate the effectiveness of PNE and exercises versus exercises alone on pain intensity in university students with chronic idiopathic neck pain. | Intervention – PNE and exercises. PNE based on "Explain Pain" with duration of 5-30 minutes. A booklet with activities was given with 'homework'. Strengthening exercises for scapular stabilisers, neck flexors and extensors were prescribed. Sessions were 30 minutes a week for 4 weeks. 1st session was PNE alone. Other sessions were mix of PNE and exercise.<br>Control – exercises alone, 4 x 30-minute sessions. | Both groups had similar and significant improvements in disability, catastrophising, kinesiophobia and neck extensor endurance. The intervention group improved in pain neurophysiology knowledge but the control group did not. Neither intervention affected pressure pain threshold, pain intensity or scapular stabilisation. |
| **Moseley, Nicholas and Hodges [26]** | 2004 | Quantitative Multicentre RCT with three rehab clinics. | 58 adults with CLBP. Intervention group = 31 (18 females & 13 males)<br>& control = 27 (15 females & 12 males). | To evaluate the effects of an intensive neurophysiology education (NE) session on people with CLBP. | Neurophysiology education (NE) group – 1-to-1 session of 3 hours about pain neurophysiology according to Wall and Melzack. Workbook was given and returned within 15 days of session.<br>Control group – same format as NE group, but focused on lifting advice, principles of exercise and spinal anatomy and physiology. | The NE group showed a reduction in catastrophising and an improvement on physical performance tests with normalisation of attitudes and beliefs towards pain. The largest effect was on the brief Survey of Pain Attitudes (revised). The effect on perceived disability was not clinically significant. |

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| **Pardo *et al.* [27]** | 2018 | Quantitative Multicentre RCT – four private clinics and a university. | 56 adults with chronic LBP. Intervention group = 28 (22 females and six males) & control = 28 (22 females and six males). | To investigate the effectiveness of a pain neurophysiology education (PNE) and therapeutic exercises (TE) versus TE alone on pain intensity in people with CLBP. Also to evaluate the effects on disability and other outcome measures. | PNE and TE group – 2 x 30-50 minute group PNE sessions based on "Explain Pain" & a leaflet for reinforcement. TE consisted of lumbar motor control exercises with stretching and aerobic exercises. Exercises were demonstrated and practiced in 1st session and a month later the exercises were checked. Control group – TE alone, as above. | The PNE & TE group had significantly greater improvements in pain intensity, disability, physical performance, catastrophising and fear of movement compared to the control. There were large effect sizes for the intervention group. |
| **Pires, Cruz and Caeiro [28]** | 2015 | Quantitative Single centre RCT at outpatient clinic. | 62 adults with chronic LBP. Intervention group = 30 (20 females & 10 males) & control = 32 (20 females & 12 males). | To evaluate the effectiveness of pain neurophysiology education (PNE) & aquatic exercises versus aquatic exercises alone on pain, disability and kinesiophobia in CLBP patients. | Intervention group – 2 x 90- minute group PNE sessions based on "Explain Pain" with metaphors and pictures. Followed by aquatic exercise programme was 12 x 30-50 minute biweekly group sessions with 3 phases: warm up, specific exercises and warm down. Control – aquatic exercises as above only. | The results showed the intervention group had a significantly greater reduction in pain intensity and functional disability than the control at 3 months. |
| **Ponce-Fuentes *et al.* [29]** | 2022 | Quantitative Single centre RCT at a private rehab clinic. | 29 adults with chronic shoulder pain who had arthroscopic rotator cuff repair (ARCR). Intervention group = 16 (nine females and seven males) & control = 13 (nine females and four males). | To evaluate the effectiveness of PNE versus biomedical education (BME) after ARCR for chronic shoulder pain. | All participants had exercise therapy of 3 weekly sessions for 8 weeks and 4 individual 30 -minute educational sessions for initial 4 weeks. Intervention – PNE based on "Explain Pain". 4 weekly 30-minute 1-to-1 sessions. Control – BME consisted of shoulder anatomy and biomechanics with focus on rotator cuff. 4 weekly 30-minute 1-to-1 sessions. | Both PNE and BME had similar effects in improving pain intensity, catastrophising, kinesiophobia, disability and quality of life. The PNE group had a significantly greater effect on pain on movement than the control group. |

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| **Rizzo *et al.* [30]** | 2018 | Quantitative Single centre RCT with participants at university physical therapy clinic. | 100 adults with chronic non-specific low back pain (CNLBP). Intervention group =50 (44 females & 6 males) & control = 50 (36 females & 14 males). | To determine the effectiveness of pain education (PE) plus clinical hypnosis (CH) on people with CNLBP. | All participants received PE based on "Explain Pain" in 4 x 1-hour biweekly group sessions. A workbook was given to reinforce concepts.<br>Intervention – CH given over 4 classes in 2 weeks with a total duration of 2 hours 15 minutes. PE content was used with hypnotic suggestions and a hypnosis workbook was given.<br>Control – PE sessions alone | Both groups had improvements in pain intensity, patient-specific-function scale, global perceived effect scale, disability and catastrophising. The CH and PE group had significantly greater reductions on the worst pain intensity and catastrophising. |
| **Saracoglu *et al.* [31]** | 2020 | Quantitative Single centre RCT at physio department. | 35 adults with CLBP. Intervention group =17 (nine females and eight males) & control = 28 (eight females and 10 males). | To compare the short-term effects of neuroscience pain education (NPE) combined with manual therapy (MT) versus traditional patient education (TPE) plus MT in patients with CLBP. | All participants had MT, 8 x 40-45 minute sessions in 4 weeks.<br>Intervention – NPE 4 x weekly 45-50 minute 1-to-1 sessions about pain neurophysiology.<br>Control – one 45-50 minute TPE session prior to MT, about back anatomy, biomechanics and function. | Both groups had improvements in pain severity and physical function. The NPE group had a greater effect on these outcomes than the control. Effect sizes were moderate/ large for both groups. |
| **Saracoglu *et al.* [32]** | 2022 | Quantitative Single centre RCT at physio department. | 69 adults with CLBP. Group 1 = 20 (12 females and nine males), Group 2 =19 (10 females & 11 males) & control = 18 (10 females & 10 males). NB/ likely errors in participant characteristics. | To evaluate the short and medium-term effects of PNE plus MT and a home exercise programme (HEP) on pain, disability, kinesiophobia and back function in adults with CLBP. | Intervention group 1- Had PNE, MT and HEP.<br>PNE – 4 x weekly 40-45 minute 1-on-1 sessions.<br>MT - 8 x 30-minute sessions over 4 weeks. Individualised treatment.<br>HEP – explained by physio initially and performance checked at 4 weeks.<br>Intervention group 2- Had MT and HEP as above.<br>Control – HEP only | The PNE, MT and HEP group showed clinically significant improvements in pain, disability, back performance and kinesiophobia; the outcomes were better than the other groups for kinesiophobia and pain intensity alone. The MT and HEP group had improvements in pain and disability greater than the control. Back performance improved in both groups. |

**Table 3: C**haracteristics and main findings of the systematic reviews.

| Name of author (s) | Year | Study design | Participants | Objective | Intervention/ Control | Main findings/ conclusions |
|---|---|---|---|---|---|---|
| **Bonatesta *et al.* [33]** | 2022 | Quantitative Systematic review and meta-analyses of RCTs | 8 RCTs of adults with chronic non-specific spinal pain (CNSP). | To investigate the effectiveness of pain science education (PSE) and exercise therapy on adults with CNSP on pain, disability, catastrophising and kinesiophobia. | Most PSE protocols were based on "Explain Pain". Exercise therapy consisted of supervised sessions of aerobic, strengthening and stretching exercises. | Generally, PSE combined with exercise therapy led to better short (< 3 months) and medium-term (3-12 months) outcomes regarding pain, disability, kinesiophobia and catastrophising than other interventions like exercise therapy alone or multimodal interventions. The NNT was estimated at 4-6 for PSE with exercise. |
| **Louw *et al.* [34]** | 2011 | Quantitative – systematic review of all experimental studies. | Eight experimental studies of adults with CMP. Most studies on CLBP. | To appraise the evidence of the effectiveness of neuroscience education on pain, anxiety and stress on adults with CMP. | Neuroscience education (NE) was generally delivered verbally with pictures, drawings and metaphors. Two studies gave patients a workbook.<br>Control groups had varied modalities e.g. education and exercises. | The studies were heterogeneous so results could not be pooled. There was evidence that NE reduced pain levels, perceived disability and catastrophising. Physical performance also improved in some studies. |
| **Ordoñez-Mora , Morales-Osorio and Rosero [35]** | 2022 | Quantitative - Systematic review | Four studies of adults with knee osteoarthritis (OA). | To investigate the effectiveness of cognitive educational interventions for pain management in knee OA. | PNE was delivered by a physiotherapist with sessions of 30-60 minutes, using metaphors and images to explain pain.<br>Control groups had varied modalities e.g. education. | A reduction in pain was found in most groups with PNE, but may be due to pharmacological effects. PNE led to improvements in kinesiophobia in two studies. |
| **Sidall *et al.* [36]** | 2021 | Quantitative - Systematic review and meta-analysis. | Five RCTs of adults with CMP. | To investigate the effectiveness of combined PNE and exercise programmes versus exercise alone in people with CMP. | PNE was based on "Explain Pain" and varied in duration from 5-120 minutes. Most were group sessions.<br>Exercise sessions varied from 20-60 minutes from daily to once weekly. Aerobic, mobility, motor control, strengthening and aquatic exercises were used. | PNE with exercise led to significant reductions in pain intensity, disability and kinesiophobia. The outcomes were better for PNE with exercise than those for exercise alone in the short-term (<12 weeks). |

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| **Watson *et al.* [12]** | 2019 | Quantitative - Mixed – methods systematic review and meta-analysis | 12 RCTs and four qualitative studies of adults with CMP. | To investigate the effectiveness of PNE in people with CMP. To explore patients' experiences of PNE and their perceptions of its effectiveness. | PNE varied between studies. Four studies had a single session/ point of contact and eight studies had multiple sessions. Duration also varied between the studies and in one study only written booklets were given. Control groups had varied modalities e.g. education and exercises. | The review found that PNE reduced disability, pain, catastrophising and kinesiophobia in the short-to medium-term. The reduction in pain and disability were not clinically significant, but there were significant changes for kinesiophobia and catastrophising. The findings from qualitative studies emphasised how allowing the patient to tell their story improved the effects of PNE by improving reconceptualisation. |
| **Wood and Hendrick [37]** | 2019 | Quantitative - Systematic review and meta-analysis | Eight studies of adults with CLBP | To determine the effectiveness of PNE on pain and disability in adults with CLBP. | PNE varied in format, duration and number of sessions amongst the studies found. Control groups had varied modalities e.g. education and exercises. | PNE likely improves disability in the short-term and when combined with physiotherapy, results are clinically significant. PNE led to slight improvements in kinesiophobia and pain, but the results were not clinically significant. There was no evidence to show long-term improvements in pain or disability. |

**Table 4:** Summary table of studies investigating metaphor use in people with CMP.

| Author and study | Findings | Limitations |
|---|---|---|
| Sharma, Pathak and Jensen (2016) [20] | Metaphors were used much more frequently in people from Nepal compared to the USA.<br>A specific category of pain descriptor for sensory states was used exclusively in people from Nepal.<br>Direct translations of pain outcome measures from one country may not be content-valid in another country or culture and adaptations may be necessary. | Only one researcher coded and translated the participants' responses.<br>Most participants were from the community and were not seeking pain treatment.<br>The US data was from previous studies a few years earlier. There were significant differences between the participants e.g. US sample had people with fibromyalgia but the Nepalese sample did not. |
| Hunt and Day (2017) [16] | All participants used an "imprisonment" metaphor to describe the experience of chronic pain with social and environmental restrictions.<br>Metaphors were frequently used in their narratives: "feeling drained", "I was back to square one", "I felt trapped" and "it was a wear and tear injury".<br>Metaphors were valuable in enabling people to narrate their pain stories. | Two out of the ten participants were included who no longer participated in sport, but had an active lifestyle. This does not fit with the inclusion criteria stated.<br>Sample size was small.<br>There were some omissions in the methodology e.g. it was not clear where the participants were recruited from and how.<br>There was no discussion of saturation of data so it is unknown if this was reached in the study. |

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| Crowe *et al.* (2010) [15] | Themes of the impact of CLBP: the unpredictability of symptoms, vigilance being necessary, the body being externalised and an alteration to sense of self.<br>Two main metaphors describing impact were "listening to the body" and "talking to oneself".<br>Metaphors to describe alteration to self "my life's not as full" and "only do a small fraction of the things". | There was some missing information in the methodology such as the interview setting.<br>Saturation of data was not discussed so it is unknown if this was reached in the study.<br>There was no discussion of potential bias during data collection or formulation of the research questions. |

**Table 5:** Summary table of the studies investigating the effectiveness of PNE in people with CMP.

| Study Author(s) & Date | Main Points | Limitations of Results |
|---|---|---|
| Louw *et al.* (2011) [34] | Heterogeneous studies so results could not be pooled.<br>There was evidence that NE reduced pain levels, perceived disability and catastrophising.<br>Physical performance also improved in some studies. | Only 8 studies were included with lower level evidence.<br>Most participants had CLBP so limited carryover to other CMP conditions.<br>Controls were varied so difficult to make strong conclusions.<br>High level of heterogeneity. |
| Watson *et al.* (2019) [12] | PNE reduced disability, pain, catastrophising and kinesiophobia in the short-to medium-term.<br>The reduction in pain and disability were not clinically significant, but they were for kinesiophobia and catastrophising.<br>Allowing the patient to tell their story improved the effects of PNE by improving reconceptualisation. | 3 of the 4 qualitative studies were from the authors' research team.<br>High level of heterogeneity in condition, control, PNE format and outcome measures.<br>Non-English studies were not included. |
| Sidall *et al.* (2022) [36] | PNE with exercise led to significant reductions in pain intensity, disability and kinesiophobia.<br>The outcomes were better for PNE with exercise than those for exercise alone in the short-term (<12 weeks). | Only 5 studies were included.<br>High level of heterogeneity and wide confidence intervals.<br>Subgroup analyses limited by number of studies. |
| Malfiet *et al.* (2018) [24] | The intervention group had significant reductions in kinesiophobia and negative illness perceptions.<br>Neither group had significant changes in the pain disability index. | Effect sizes were small to moderate.<br>Only 3 sessions of PNE were given which may be insufficient for some people. |
| Galan-Martin *et al.* (2020) [22] | The findings showed the intervention group had significantly greater improvements in health-related quality of life, kinesiophobia, central sensitisation score, disability score, catastrophising and pain intensity than the control.<br>The intervention group had large effect sizes for these groups. | The control group had mainly passive treatment and no education, while the PNE group had active interventions with education and exercises. |

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| | | The experimental group had 13 hours more treatment time. |
| Bonatesta *et al.* (2022) [33] | Generally PSE combined with exercise therapy led to better short (< 3 months) and immediate term (3-12 months) outcomes regarding pain, disability, kinesiophobia and catastrophising than other interventions like exercise therapy alone or multimodal interventions. The NNT was estimated at 4-6 for PSE with exercise. | Only 8 studies were included.<br>Most of the studies had small sample sizes and participants of a limited age range. |
| Pardo *et al.* (2018) [27] | The PNE & TE group had significant greater improvements in pain intensity, disability, physical performance, catastrophising and fear of movement compared to the control.<br>There were large effect sizes for the intervention group. | No control group without an intervention.<br>Possible selection bias as participants responded to an advert.<br>No sociodemographic factors were recorded.<br>The PNE and TE group had more treatment time generally. |
| Saracoglu *et al.* (2022) [32] | The PNE, MT and HEP group showed clinically significant improvements in pain, disability, back performance and kinesiophobia; the outcomes were better than the other groups for kinesiophobia and pain intensity alone.<br>The MT and HEP group had improvements in pain and disability greater than the control.<br>Back performance improved in both groups. | Adherence to HEP was not measured.<br>The PNE, MT and HEP group received extra information on the role of exercise.<br>MT was individualised to each participant.<br>All interventions were delivered by the same unblinded physiotherapist, who was one of the researchers.<br>The therapist and the patients were not blinded. |
| Pires, Cruz and Caeiro (2015) [28] | The intervention group with PNE had a significantly greater reduction in pain intensity and functional disability than the control at 3 months. | Recruitment was limited to 1 clinic.<br>Small sample size.<br>No blinding of physiotherapists delivering the interventions.<br>All participants had low levels of functional disability and fear of movement. |
| Moseley, Nicholas and Hodges (2004) [26] | The NE group showed a reduction in catastrophising and an improvement on physical performance tests with normalisation of attitudes and beliefs towards pain.<br>The largest effect was on the brief Survey of Pain Attitudes (revised). The effect on perceived disability was not clinically significant. | Sample size was small and no power calculation was performed.<br>External validity reduced because participants were moderate to highly disabled. |
| Saracoglu *et al.* (2020) [31] | Both groups had improvements in pain severity and physical function. The NPE group had a greater effect on these outcomes than the control. Effect sizes were moderate/ large for both groups. | The study did not include a control group with MT only.<br>The NPE group had three more sessions than the TPE group.<br>The therapist and the patients were not blinded. |

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|---|---|---|
| Rizzo *et al.* (2018) [30] | Both groups had improvements in pain intensity, patient-specific- function scale, global perceived effect scale, disability and catastrophising.<br>The CH and PE group had significantly greater reductions on the worst pain intensity and catastrophising. | The intervention group had over two hours more treatment time for hypnosis than the control.<br>The same person delivered all the interventions.<br>The therapist and the patients were not blinded. |
| Wood and Hendrick (2019) [37] | PNE likely improves disability in the short-term and when combined with physiotherapy, results are clinically significant.<br>PNE led to slight improvements in kinesiophobia and pain, but the results were not clinically significant. There was no evidence to show long term improvements in pain or disability. | High level of heterogeneity.<br>Some of the studies had small sample sizes. |
| Matias *et al.* (2019) [25] | Both groups had similar and significant improvements in disability, catastrophising, fear of movement and neck extensor endurance.<br>The intervention group improved pain neurophysiology knowledge but the control group did not.<br>Neither intervention affected pressure pain threshold, pain intensity or scapular stabilisation. | The participants had relatively low baseline levels of disability, fear of movement, pain intensity and catastrophising.<br>The sample size was not adequately powered to detect changes in secondary outcomes.<br>Low external validity because the sample was restricted to students at a particular university |
| Javandeh *et al.* (2021) [23] | Both intervention groups had significant improvements in pain, disability, fear avoidance behaviour, catastrophising and pain self-efficacy.<br>The TE & PNE group had better outcomes than the TE group alone. The TE & PNE group had large effect sizes generally. | The PNE and TE group having several more hours of treatment compared to the TE group.<br>Small sample size.<br>Short duration of 6 weeks only.<br>No control group with PNE alone. |
| Ponce-Fuentes *et al.* (2022) [29] | Both PNE and BME were found to be equally effective in improving pain intensity, catastrophising, kinesiophobia, disability and quality of life.<br>The PNE group had a significantly greater effect on pain on movement than the control group. | Confidence intervals were not presented, so the precision of the group differences is unknown.<br>No control of contextual factors such as beliefs, type of surgery and expectations. |
| Ordoñez-Mora, Morales-Osorio and Rosero (2022) [35] | A reduction in pain was found in most groups with PNE, but may be due to pharmacological effects.<br>PNE led to improvements in kinesiophobia in 2 studies. | Conclusions were for osteoarthritis in general, but only studies relating to knee osteoarthritis included.<br>High level of heterogeneity. |

**Table 6:** Summary table of the studies investigating the impact of PNE in people with CMP.

| Study Author(s) & Date | Main Points | Limitations of Results |
|---|---|---|
| Robinson et al (2016) [19] | 3 themes were identified: perceived relevance to the individual, perceived benefit to the individual and evidence of reconceptualisation. Positive and negative experiences were present for each theme.<br>Most participants found PNE relevant to them and beneficial, but 2 participants did not.<br>4 participants showed some degree of reconceptualisation.<br>Group PNE will not be suitable for all patients. | The sample consisted of people of the same ethnicity, similar age and living in the same area. This would affect external validity.<br>Only one group PNE session was delivered so further sessions may have been required for some participants to benefit.<br>Social-desirability bias may have been present as the participants were aware that the interviewer worked at the pain clinic.<br>No data saturation. |
| King *et al.* (2016) [17] | Variable degrees of reconceptualisation were found in study participants.<br>Prior beliefs were found to be facilitators or barriers to reconceptualisation.<br>Reconceptualisation was associated with greater clinical benefit. | Only one group PNE session was given which may have been insufficient for reconceptualisation in some participants.<br>The sample consisted of people of the same ethnicity and living in the same area. This would affect external validity.<br>No data saturation.<br>Social-desirability bias may have been present as the participants were aware that the interviewer worked at the pain clinic. |
| King *et al.* (2018) [18] | Variable degrees of reconceptualisation were found in study participants, most showed partial reconceptualisation.<br>Prior beliefs and personal relevance of the information were associated with the degree of perceived benefit of PNE.<br>One participant had an adverse effect due to PNE. They became upset during PNE and the interview after the session. | The sample consisted of people of the same ethnicity, similar age and living in the same area. This would affect external validity.<br>Lack of follow-up long term.<br>No data saturation.<br>Only one group PNE session was given which may have been insufficient for reconceptualisation in some participants. |

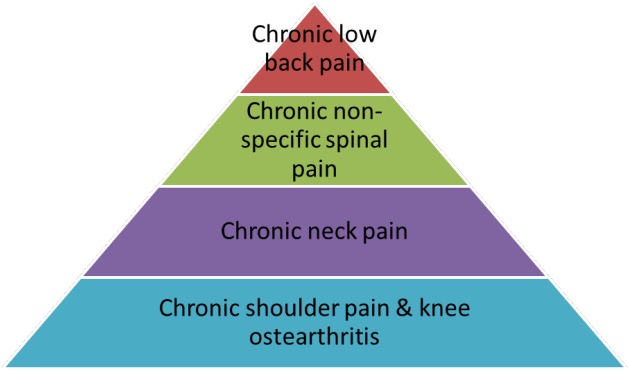


**Figure 2:** Hierarchy pyramid of the effectiveness of PNE for different CMP conditions.

**Discussion**

This narrative review examined studies to explore the role and effects of metaphors, evaluate the effectiveness of PNE, and assess its impact on individuals with CMP. The findings from the eleven RCTs and six systematic reviews revealed that the effectiveness of PNE varied depending on the participants' specific conditions. Strong evidence demonstrated that PNE significantly reduced pain, disability, catastrophising, and kinesiophobia in individuals with CLBP. However, evidence regarding its impact on conditions such as knee osteoarthritis, chronic neck pain, and shoulder pain remained inconclusive.

Qualitative studies provided valuable insights into metaphor use among individuals with CMP. Four studies highlighted that metaphors enabled individuals to articulate and narrate their pain experiences, with notable variations observed across different cultural contexts. Additionally, metaphors used by clinicians were generally found to enhance patient engagement, though occasional negative effects were reported.

Three studies focused on patient experiences with PNE emphasized that successful pain reconceptualization was pivotal to achieving clinical benefits. These findings underscore the importance of tailoring PNE approaches to foster meaningful shifts in patients' understanding of pain.

The following sections will discuss these findings in detail, corresponding to the objectives of this review.

*The use and effects of metaphors in people with CMP*

The type of metaphors and language used by people with CMP can vary with different cultures as demonstrated by Sharma, Pathak and Jensen [20]. This cultural variation means that pain outcome measures in one country may not be content valid in another country. Lakoff and Johnson [38] assert that primary metaphors tend to be similar worldwide due to common human experiences, but complex metaphors may vary considerably between cultures.

This review found that metaphors have a pivotal role for people with CMP in enabling them to describe and narrate their pain experiences. Biro [39] concurs with this finding and argues that metaphors are the only way that pain can be expressed. People with CMP often use "imprisonment" metaphors to describe how their condition restricts their life, as found by Hunt and Day [16].

In two studies participants used the metaphor of "listening to the body" to explain how they adapted to their condition [15,16]. This metaphor is indicative of people with CMP becoming more vigilant in an attempt to control their symptoms.

Stewart and Ryan [40] found that metaphors may be useful therapeutically to promote communication, self-efficacy and empowerment. They did not find any negative effects of metaphors in in their systematic review; however, this review found that some metaphors used by clinicians were deemed unhelpful by patients such as a disc being a jam-filled doughnut [21]. This highlights the importance of choosing words carefully when communicating with patients.

*The effectiveness of PNE for people with CMP*

This review found some evidence that PNE, either alone or with other modalities, reduces pain intensity, disability, catastrophising and kinesiophobia in the short term in people with CMP. The amount of evidence supporting an intervention can be graded; Louw *et al.* [34] define the four levels of evidence as below:

- Strong evidence - Several RCTs of high quality with consistent results.
- Moderate evidence - One high-quality RCT and several low-quality RCTs with consistent results.
- Limited evidence - One high-quality RCT or several low-quality RCTs with consistent results.
- Inconclusive evidence - One low-quality RCT, RCTs with contradictory results or no RCTs.

Using the above criteria, there was strong evidence that PNE was effective for people with CLBP. Clarke, Ryan and Martin [41] conducted a systematic review of PNE in people with CLBP and only found two relevant

RCTs involving the same author who published the main PNE manual. They concluded there was very low-quality evidence that PNE leads to improvements in pain and function. In contrast, this review found six RCTs investigating the effectiveness of PNE in people with CLBP that met the set criteria. This illustrates how research in this area has expanded significantly in recent years.

There was moderate evidence that PNE reduced kinesiophobia and negative illness perceptions in people with chronic non-specific spinal pain. However, Bonatesta *et al.* [33] advised that these positive findings for PNE should be read with caution because most of the RCTs had a high risk of bias. This was primarily due to a lack of blinding of participants, treating clinicians and outcome assessment. It would be difficult to employ blinding in these trials especially as most pain outcome measures are self-reported. In addition, most RCTs had small sample sizes which lowered the certainty of evidence.

For chronic neck pain alone, the findings were inconclusive as the two RCTs had contradictory results. Javandeh *et al.* [23] found that the PNE group had greater reductions in pain, disability, fear-avoidance behaviour and catastrophising than the other two groups. However, Matias *et al.* [25] found similar improvements in their control and experimental groups of university students with chronic neck pain.

The evidence that PNE was effective for chronic shoulder pain after arthroscopic surgical rotator cuff repair was inconclusive as there was only one low-quality RCT. Likewise, there was only one low-quality systematic review for knee osteoarthritis so the findings were also unconvincing. This shows that the evidence supporting the use of PNE in people with CMP is predominantly focused on people with chronic spinal pain.

### *The impact of PNE on people with CMP*

This review found that the clinical benefits of PNE are mediated by the level of reconceptualisation attained by participants. As mentioned in table 6, three studies reported that after a single PNE session, participants reached varying levels of reconceptualisation including some who had no signs of reconceptualisation. This is compatible with the findings of Wijma *et al.* [42] who interviewed 15 participants with various types of chronic pain, a month after receiving PNE. Some participants reported that PNE helped them to understand their pain, which improved their self-management. However, two respondents reported that PNE did not apply to them as they believed there was a physical cause for their condition.

Participants' prior beliefs before PNE were found to be either a facilitator or barrier to reconceptualisation. Those who did not achieve reconceptualisation had firm beliefs that their pain had a structural cause, which negated them accepting alternative explanations. Wijma *et al.* [42] acknowledged that encountering scepticism initially with PNE is common as often these people have heard many explanations for their pain.

### *Clinical Relevance*

Both group-based and individual PNE sessions were demonstrated to be effective, with greater clinical improvements observed when PNE was combined with other modalities, such as structured exercise programmes. Reconceptualisation emerged as a pivotal mechanism through which PNE achieves clinical benefits. Prior beliefs and attitudes of patients were identified as factors that could either facilitate or hinder the process of reconceptualisation, highlighting the importance of personalised approaches.

Given the potential benefits of PNE, it should be an integral part of the management strategy for individuals with CMP. Healthcare organisations are encouraged to allocate funding for PNE training and delivery to ensure accessibility. While group-based PNE sessions may be more cost-effective for healthcare systems, individual sessions should also be available to accommodate patients who are uncomfortable in groups.

### *Strengths of This Review*

This review offers several notable strengths. The mixed-method approach provided unique insights into both the use of metaphors and the implementation of PNE for individuals with CMP by synthesizing qualitative and quantitative findings.

Key methodological strengths include:

- A systematic and reproducible search strategy that ensured comprehensive identification of relevant studies.
- Clear inclusion and exclusion criteria, which focused on studies specifically addressing CMP, enhancing the relevance of findings.

- Inclusion of three distinct study designs (randomised controlled trials, systematic reviews, and qualitative studies), enabling a multidimensional evaluation aligned with the review's objectives.

### *Limitations of This Review*

Despite its strengths, this review is not without limitations. First, due to time and project constraints, a single reviewer conducted the literature search, study selection, and critical appraisal, which may have introduced selection bias. However, strict adherence to predefined criteria and the use of a recognized appraisal tool mitigated this risk to some extent.

Second, studies that included metaphors but did not exclusively focus on individuals with CMP were excluded, potentially overlooking valuable insights.

Finally, the review was limited to three specific study designs. While this provided methodological focus, it may have excluded significant research employing alternative methodologies, such as cohort analyses, that could have enriched the findings

### *Recommendations for Further Research*

This review identified that there should be more qualitative studies exploring metaphor use in people with CMP specifically, so clinicians can be trained to elicit and use metaphors therapeutically with this population.

There is insufficient evidence that PNE is effective for non-spinal CMP conditions such as knee osteoarthritis. Further studies need to incorporate a wider range of outcome measures that are pertinent to people with CMP such as sleep, medication use and psychological measures.

Future research is required to compare different PNE delivery methods to ascertain which format is most effective. There should also be studies that compare the cost-effectiveness of PNE compared to other modalities. The costs associated with CMP amount to billions for the NHS so interventions must be cost-effective.

In addition, studies should be planned that look at long-term outcomes, for example a year or longer after the PNE intervention.

### *Conclusion*

There were few studies examining the use and effects of metaphors in people with CMP. However, the findings demonstrated the value of metaphors in enabling patients to narrate their stories and describe their pain experiences. Accordingly, clinicians should encourage patients to express their pain with metaphors for example using the McGill Pain Questionnaire.

The evidence for the effectiveness of PNE varied according to condition. There was strong evidence that PNE reduces pain, disability, kinesiophobia and catastrophising in the short term in people with CLBP. There was no conclusive evidence that PNE is useful for people with knee osteoarthritis and chronic shoulder pain after rotator cuff repair.

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