

KNOWLEDGE OF PAIN NEUROSCIENCE IN PATIENTS WITH CHRONIC MUSCULOSKELETAL PAIN: A NARRATIVE REVIEW

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Abstract

Chronic musculoskeletal pain (CMP) is a major contributor to disability and reduced quality of life worldwide. Patients with persistent pain often demonstrate limited understanding of the neurobiological and neurophysiological mechanisms underlying pain perception. Knowledge of pain neuroscience has been identified as an important psychosocial construct influencing pain-related beliefs, coping strategies, and engagement in rehabilitation. This narrative review synthesizes current evidence regarding baseline levels of pain neuroscience knowledge in individuals with chronic musculoskeletal pain, its association with clinical and psychosocial outcomes, and the effectiveness of educational interventions aimed at improving this knowledge. Cross-sectional studies, randomized controlled trials, and systematic reviews were examined to explore measurement tools, determinants of pain knowledge, and its potential role as a mediator of treatment response. The findings indicate that most patients exhibit inadequate baseline understanding of pain mechanisms, which is consistently associated with higher levels of catastrophizing, fear-avoidance behavior, and functional disability. Educational interventions, particularly pain neuroscience education, reliably improve knowledge scores and psychosocial outcomes, although translation into sustained reductions in pain intensity and disability remains variable. The review highlights methodological limitations in the current literature, including heterogeneity of measurement tools, short-term follow-up, and limited cultural adaptation, and emphasizes the need for standardized assessment frameworks and long-term, high-quality trials.

Keywords: Pain neuroscience knowledge, chronic musculoskeletal pain, biopsychosocial model, patient education, fear-avoidance, catastrophizing

I. INTRODUCTION

Chronic musculoskeletal pain (CMP), defined as pain persisting for more than three months, represents a leading cause of long-term disability and healthcare utilization worldwide [1]. Common conditions such as chronic low back pain, neck pain, shoulder disorders, and widespread musculoskeletal pain impose a significant burden on individuals and society by affecting physical function, psychological well-being, work participation, and overall quality of life.

Traditional biomedical models of pain emphasize structural pathology and tissue injury as the primary sources of symptoms. However, extensive research has demonstrated a weak correlation between imaging findings and pain severity in chronic conditions [2]. This mismatch has contributed to a shift toward the biopsychosocial model, which conceptualizes pain as a multidimensional experience influenced by biological, psychological, and social factors.

Within this framework, patient understanding of pain mechanisms has gained increasing attention. Knowledge of pain neuroscience refers to an individual's comprehension of the neurobiological and neurophysiological processes involved in pain perception, modulation, and persistence. This includes awareness of central sensitization, neural plasticity, and the role of cognitive and emotional factors in shaping pain experiences. Improving such knowledge is believed to facilitate reconceptualization of pain, reduce maladaptive beliefs, and promote active participation in rehabilitation.

This narrative review aims to synthesize current evidence on pain neuroscience knowledge in individuals with chronic musculoskeletal pain, focusing on its measurement, baseline levels, relationship with clinical and psychosocial outcomes, and the effectiveness of educational interventions.

II. CONCEPTUAL FRAMEWORK

A. Definition of Pain Neuroscience Knowledge

Pain neuroscience knowledge can be defined as a patient's cognitive understanding of how pain is generated and processed by the nervous system rather than being a direct indicator of tissue damage. This includes the distinction between nociception and pain, the role of the central nervous system in interpreting sensory input, and the influence of psychological and environmental factors on pain perception.

B. Biopsychosocial Perspective

The biopsychosocial model posits that pain is the result of dynamic interactions among biological processes (e.g., inflammation, neural sensitization), psychological factors (e.g., beliefs, emotions, coping strategies), and social influences (e.g., work environment, family support, cultural norms). Inadequate or inaccurate pain knowledge may increase threat perception and contribute to maladaptive behaviors such as activity avoidance and dependence on passive treatments.

C. Pain Reconceptualization

Pain reconceptualization refers to a cognitive shift in the way individuals interpret pain, moving from a damage-focused understanding toward a nervous system-centered perspective. This shift is considered a central mechanism through which improved pain knowledge may influence fear, self-efficacy, and functional engagement.

III. MEASUREMENT OF PAIN NEUROSCIENCE KNOWLEDGE

A. Assessment Instruments

Several questionnaires have been developed to measure pain neuroscience knowledge in clinical and research contexts. The most commonly used tools include:

- Neurophysiology of Pain Questionnaire (NPQ)
- Revised Neurophysiology of Pain Questionnaire (RNPQ)
- Condition-specific pain knowledge questionnaires

These instruments typically consist of true/false or multiple-choice items designed to assess understanding of central and peripheral pain mechanisms, neuroplasticity, and psychosocial influences on pain.

B. Psychometric Properties

The Revised Neurophysiology of Pain Questionnaire has demonstrated improved internal consistency and construct validity compared to the original NPQ, making it a preferred instrument in recent studies [3]. However, psychometric performance varies across populations and languages, highlighting the importance of cross-cultural adaptation and validation.

C. Limitations of Measurement Tools

Common challenges include limited sensitivity to small changes in knowledge, potential ceiling effects in highly educated populations, and misalignment between questionnaire content and educational interventions. These limitations underscore the need for ongoing refinement of assessment tools.

IV. BASELINE KNOWLEDGE IN CHRONIC MUSCULOSKELETAL PAIN POPULATIONS

A. General Findings

Cross-sectional studies consistently report that individuals with chronic musculoskeletal pain demonstrate limited baseline understanding of pain neuroscience. Many patients maintain beliefs that persistent pain reflects ongoing tissue damage or structural deterioration, even in the absence of clear pathological findings.

B. Sociodemographic Determinants

Education level, health literacy, and prior exposure to healthcare information are commonly associated with pain knowledge. Higher levels of formal education are generally linked to better baseline knowledge; however, misconceptions about pain mechanisms remain prevalent across demographic groups.

C. Cultural and Contextual Influences

Cultural beliefs regarding illness, pain expression, and treatment expectations influence how individuals interpret pain-related information. In settings where biomedical explanations dominate, acceptance of nervous system-based explanations of pain may be limited.

V. RELATIONSHIP BETWEEN PAIN KNOWLEDGE AND CLINICAL OUTCOMES

A. Pain and Disability

The association between pain neuroscience knowledge and pain intensity is generally weak to moderate. In contrast, stronger relationships are often observed between knowledge levels and functional outcomes or disability measures, suggesting that improved understanding may primarily influence activity participation rather than nociceptive processing.

B. Psychosocial Outcomes

Consistent associations have been reported between higher pain knowledge and lower levels of pain catastrophizing, fear of movement, and emotional distress. Improved knowledge is also associated with greater pain self-efficacy and confidence in symptom management.

C. Healthcare Utilization

Limited evidence suggests that inadequate pain knowledge may be associated with increased healthcare-seeking behavior and reliance on passive treatment modalities. Improved understanding may support shared decision-making and adherence to active rehabilitation strategies.

VI. EFFECTIVENESS OF EDUCATIONAL INTERVENTIONS

A. Pain Neuroscience Education

Pain neuroscience education (PNE) is the most widely studied intervention aimed at improving patient knowledge of pain mechanisms. It employs structured explanations, metaphors, and visual materials to communicate complex concepts in accessible language.

B. Impact on Knowledge Scores

Randomized controlled trials consistently demonstrate significant improvements in pain knowledge scores following PNE compared to standard care or traditional biomedical education [4]. Knowledge gains are typically observed immediately after intervention and may persist in the short to medium term.

C. Translation to Clinical Outcomes

While improvements in knowledge are robust, translation into sustained reductions in pain intensity and disability is variable. Many studies report stronger and more consistent effects on psychosocial outcomes, which may mediate longer-term functional improvements.

VII. MECHANISMS LINKING KNOWLEDGE TO FUNCTIONAL CHANGE

Improved pain knowledge is hypothesized to reduce perceived threat associated with pain, leading to more adaptive cognitive appraisals. This cognitive shift may decrease fear-avoidance behaviors and facilitate engagement in physical activity and rehabilitation. Behavioral activation and increased self-efficacy are considered key pathways through which knowledge influences functional outcomes. Neurophysiological mechanisms, such as modulation of central pain processing through top-down pathways, remain largely theoretical and require further investigation.

VIII. APPLICATION ACROSS MUSCULOSKELETAL CONDITIONS

Most research on pain neuroscience knowledge has focused on chronic low back pain populations. Emerging studies in neck pain, shoulder disorders, and widespread pain conditions suggest similar patterns of limited baseline knowledge and responsiveness to educational interventions. However, heterogeneity in study designs and outcome measures limits generalizability across conditions.

IX. LIMITATIONS OF CURRENT EVIDENCE

The current literature is characterized by several limitations, including the predominance of cross-sectional designs, short-term follow-up in interventional studies, inconsistent use of assessment tools, and limited representation of diverse cultural and socioeconomic populations. These factors restrict causal inference and reduce the strength of evidence.

X. IMPLICATIONS FOR CLINICAL PRACTICE

Assessment of baseline pain knowledge should be integrated into comprehensive biopsychosocial evaluations. Targeted educational strategies can address misconceptions and align patient understanding with contemporary pain science. Combining education with active rehabilitation and graded exposure may enhance adherence, self-management, and long-term functional outcomes.

XI. FUTURE RESEARCH DIRECTIONS

Future research should prioritize the development of standardized and culturally adapted pain knowledge assessment tools, large-scale randomized controlled trials with long-term follow-up, and investigation of mediators and moderators of treatment response. Qualitative studies may further elucidate patient perspectives and barriers to pain reconceptualization.

XII. CONCLUSION

Knowledge of pain neuroscience is a critical psychosocial factor in the experience and management of chronic musculoskeletal pain. Evidence consistently demonstrates limited baseline understanding among patients and significant associations between knowledge levels and psychosocial and functional outcomes. Educational interventions, particularly pain neuroscience education, effectively improve patient knowledge and related psychosocial variables. However, further high-quality research is needed to clarify the mechanisms of action and optimize the translation of knowledge gains into sustained clinical improvement.

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