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A Systematic Review of Non-Pharmacological Methods for Managing Acute Musculoskeletal Pain

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Abstract

This systematic review synthesizes evidence on non-pharmacological interventions for managing acute, non-traumatic musculoskeletal pain (<6 weeks) and summarizes findings across efficacy, safety, acceptability, and cost-related considerations. A structured literature search was conducted on 15 June 2025 across four databases (PubMed/MEDLINE, the Cochrane Library, Embase, and Scopus) for publications from 1 January 2021 to 15 June 2025, supplemented by targeted website screening, outreach to relevant organisations, and backward citation searching. Study selection followed PRISMA 2020 with deduplication, title/abstract screening, and full-text assessment; 18 studies meeting the acute <6 weeks criterion was included in the final evidence base and narratively synthesized. Across the included evidence, advice to remain active and graded mobilization were consistently represented as core components of care, while selected modalities (e.g., superficial heat and transcutaneous electrical nerve stimulation) demonstrated short-term symptom relief in some settings. Evidence for cryotherapy was inconsistent and generally of low certainty in acute sprain populations, and findings for manual therapy and complementary approaches were heterogeneous and often condition-specific. Psychoeducational approaches were associated with improvements in pain-related cognitions (e.g., catastrophizing) in limited pilot evidence. Overall, the literature supports a pragmatic multimodal approach that prioritizes early activity and function, complemented by short-acting physical/neuromodulatory modalities and brief psychoeducation when appropriate; however, heterogeneity of populations, intervention parameters, and outcomes limits definitive comparative conclusions, and longer-term trials of predefined combinations are needed. The article will be helpful to clinicians, physiotherapists, pain specialists, and researchers developing integrated models of non-pharmacological rehabilitation.

Keywords: acute musculoskeletal pain, non-pharmacological treatment, physiotherapy, transcutaneous electrical nerve stimulation, manual therapy, psychoeducation, neuromodulation, pain chronification, interdisciplinary rehabilitation

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1. Introduction

A global analysis in 2025 estimated MSDs affected 1.69 billion people, with an age-standardized point prevalence of 19.8 per 100,000 population. The number of people with MSDs has increased every year since 1990. For people over 50 years, DALYs were over 4,500 per 100,000 people. Acute musculoskeletal pain in people over 50 was a leading cause of disability globally (Liu et al., 2025).

They can be life-threatening, and without timely activation and adequate non-pharmacological support, about a third of patients have transitioned to a chronic form within three months, and more than 80% of patients have a chronic pain syndrome after six months. There is an increased risk of depression and decreased productivity at work for these patients (Burke et al., 2024). Population aging will increase the economic burden of progressive pain. Direct healthcare costs could double by 2035 as older patients require more rehabilitation and social support (Guan et al., 2025).

Pharmacotherapy has been the first-line treatment, but it has only transient effects and risks. In acute pain, the estimated rate of developing an opioid use disorder from short-term opioids is low (8%), and the proportion of fatal overdoses at doses above 100 mg morphine-equivalents/day is also low (Baumann et al., 2023). The findings have led to a reassessment of prescribing and control of treatment duration.

NSAIDs are not without risks. NSAID use has been associated with a high risk of gastrointestinal bleeding, even when used very short term, and doubling the risk of myocardial infarction in patients with cardiovascular risk factors (Hopkins et al., 2025). A 2024 systematic review also posited that inhibition of the inflammatory cascade by drugs early in the cascade might paradoxically lead to a chronic pain state because the physiological response to resolve the inflammation is also inhibited (Huo et al., 2023).

In light of the magnitude of the problem and limitations of available analgesic therapy, a reappraisal and commitment to effective nonpharmacological treatments for acute conditions affecting the musculoskeletal system is warranted.

2. Materials and Methodology

A literature search was conducted on 15 June 2025 and covered publications from 1 January 2021 to 15 June 2025 across PubMed/MEDLINE, the Cochrane Library, Embase, and Scopus. To ensure reproducibility, pre-specified search strategies were developed and adapted to the syntax of each database. The term subacute was retained in the search strings primarily to increase sensitivity and to avoid missing studies with mixed-duration cohorts; however, eligibility was restricted to acute, non-traumatic musculoskeletal pain of <6 weeks' duration, and records without an extractable acute subgroup were excluded at the full-text stage. In addition to database searching, supplementary identification was undertaken via other methods, including targeted website screening, outreach to relevant organisations, and backward citation searching of included studies and relevant systematic reviews. The overall synthesis was planned a priori as a cross-level mapping exercise, in which primary intervention studies were prioritized for clinical inference, while secondary and contextual sources were retained to support evidence mapping, triangulation of findings, and identification of gaps.

For PubMed, a combination of MeSH terms and free-text keywords was used: ("Musculoskeletal Pain"[Mesh] OR musculoskeletal pain OR low back pain OR neck pain OR shoulder pain) AND (acute OR subacute OR "<6 weeks") AND ("nonpharmacologic" OR "non-pharmacological" OR physiotherapy OR "exercise therapy" OR mobilization OR "manual therapy" OR manipulation OR "heat therapy" OR thermotherapy OR cryotherapy OR "cold therapy" OR "transcutaneous electrical nerve stimulation" OR TENS OR "electrical stimulation" OR education OR psychoeducation OR cognitive-behavioral). For the Cochrane Library (Trials/Reviews), the following strategy was applied: (musculoskeletal pain OR low back pain OR neck pain):ti,ab,kw AND (acute OR subacute):ti,ab,kw AND (nonpharmacologic OR physiotherapy OR exercise OR mobilization OR manual therapy OR heat OR thermotherapy OR cryotherapy OR TENS OR education OR psychoeducation OR cognitive):ti,ab,kw. For Embase, an Emtree-oriented strategy was used: ('musculoskeletal pain'/exp OR 'low back pain'/exp OR 'neck pain'/exp OR musculoskeletal pain:ti,ab) AND (acute:ti,ab OR subacute:ti,ab OR 'acute disease'/exp) AND ('non drug therapy'/exp OR physiotherapy:ti,ab OR 'exercise therapy'/exp OR mobilization:ti,ab OR 'manual therapy'/exp OR thermotherapy:ti,ab OR cryotherapy:ti,ab OR 'transcutaneous electrical nerve stimulation'/exp OR tens:ti,ab OR education:ti,ab OR psychoeducation:ti,ab OR 'cognitive therapy'/exp). For Scopus, the following query was employed: TITLE-ABS-KEY((musculoskeletal AND pain) OR "low back pain" OR "neck pain" OR "shoulder pain") AND TITLE-ABS-KEY(acute OR subacute OR "less than 6 weeks") AND TITLE-ABS-KEY(nonpharmacologic OR "non-pharmacological" OR physiotherapy OR "exercise therapy" OR mobilization OR "manual therapy" OR heat OR thermotherapy OR cryotherapy OR TENS OR "electrical stimulation" OR education OR psychoeducation OR cognitive-behavioral). In addition, reference lists of included studies and relevant systematic

reviews were hand-searched to minimize the risk of missing eligible primary research; this process was complemented by searches of relevant websites (n=10), consultation of relevant organisations (n=5), and structured citation searching (n=99) to broaden capture beyond bibliographic databases.

Study selection followed PRISMA 2020 and comprised deduplication, title/abstract screening, and full-text assessment. The initial identification via databases and registers yielded 1,186 records (databases n=1,180; registers n=6), of which 312 duplicates were removed prior to screening; a further 20 records were removed by automation tools and 34 were removed for other pre-specified reasons, resulting in 820 records screened at the title and abstract stage. During title and abstract screening, 746 records were excluded for not meeting eligibility criteria (irrelevant population, chronic pain, pharmacological interventions, non-reportable quantitative outcomes, or inappropriate study design), and 74 articles proceeded to full-text review; 2 full-text reports could not be retrieved. In parallel, 114 records were identified via other methods (websites n=10; organisations n=5; citation searching n=99), from which 6 reports were sought for retrieval and 1 report could not be retrieved; 5 reports from these sources were assessed for eligibility and subsequently excluded (conference abstract/insufficient data n=3; protocol only n=2). Following full-text assessment of database-derived reports, 54 articles were excluded: 20 for including chronic/subacute pain without a separable acute subgroup, 13 due to concomitant pharmacotherapy or inability to isolate the contribution of non-pharmacological methods, 9 for lacking standardized pain and/or functional outcomes, 7 for traumatic etiologies or postoperative cohorts, and 5 for non-rigorous designs or insufficient data for extraction. Eighteen studies were included in the final evidence base and incorporated into the synthesis, comprising primary intervention and observational studies eligible under the acute, non-traumatic <6 weeks criterion, alongside secondary and contextual sources (systematic reviews/meta-analyses, umbrella reviews, mechanistic modelling, and burden/cost analyses) that were retained for evidence mapping and triangulation rather than for estimating pooled intervention effects. Accordingly, the term ‘included evidence base’ is used throughout to denote all retained sources, whereas eligibility criteria related to acute, non-traumatic pain duration and quantitative outcomes applied specifically to primary clinical studies evaluating intervention effects. These sources addressed adults aged ≥18 years with acute, non-traumatic musculoskeletal pain of <6 weeks’ duration, no indicators of systemic disease, and quantitatively measurable pain and/or functional outcomes where primary intervention effects were evaluated. Two independent reviewers (the first author and a second rehabilitation specialist who had not participated in the initial search) conducted screening and full-text assessment; disagreements were resolved by consensus and, if necessary, adjudicated by a third expert. Reference management and deduplication were performed in EndNote, and blinded screening was conducted in Rayyan. The PRISMA flow diagram is shown in Figure 1.

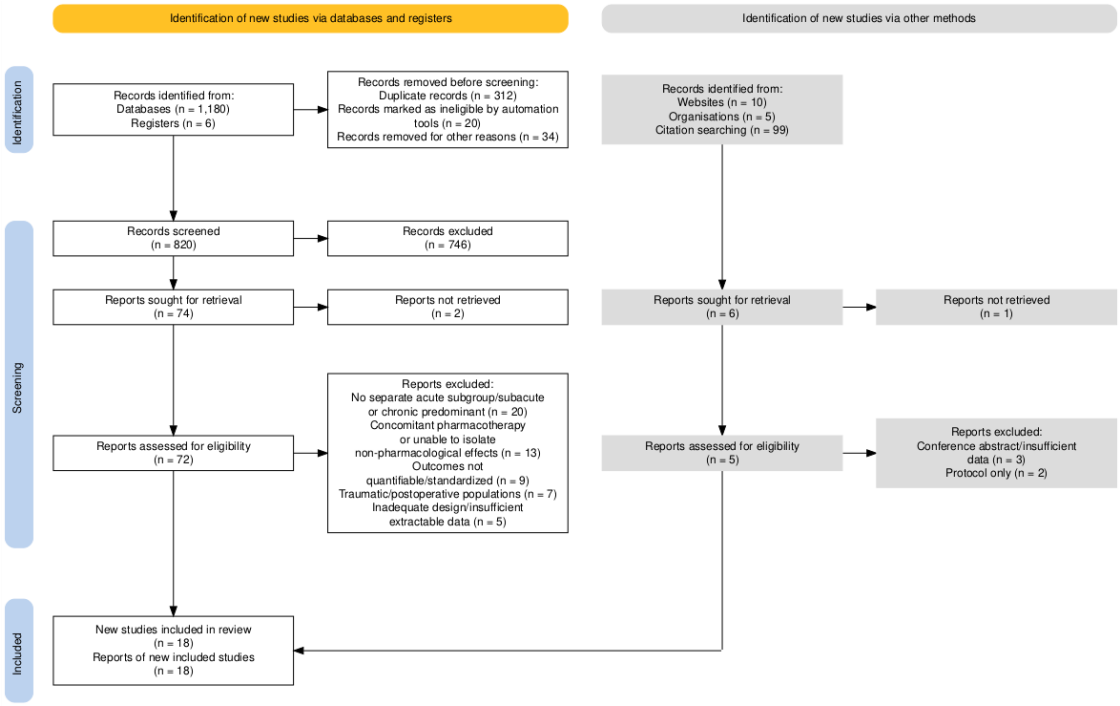

Figure 1. PRISMA Flow Diagram

Risk of bias appraisal and methodological quality assessment were integral components of the methodology to support evidence-based conclusions. For randomized controlled trials, the Cochrane Risk of Bias 2 (RoB 2) tool was applied across domains of the randomization process, deviations from intended interventions, missing outcome data, outcome measurement, and selective reporting. Overall risk of bias was categorized as low, some concerns, or high. Certainty of evidence for key outcomes (pain intensity and functional measures) was graded using GRADE, considering study limitations, inconsistency, indirectness, imprecision, and publication bias; the resulting ratings (high/moderate/low/very low) informed interpretation of comparative effects and synthesis conclusions. Systematic reviews and meta-analyses were assessed separately as part of evidence mapping (i.e., as secondary sources to contextualize the evidence base and identify gaps), using AMSTAR-2 to evaluate methodological quality and ROBIS to assess risk of bias at the review level; findings from this component were not included in the quantitative synthesis of primary studies but were used to support interpretation and triangulation against existing secondary evidence.

The characteristics of all included sources are summarized in Table 1, including author/year, study design, sample (where applicable), intervention/exposure, outcome measures, and the key findings used in the present synthesis. To facilitate interpretation, Table 1 lists both primary clinical studies and secondary/contextual sources, with study design explicitly indicated.

Table 1. Summary of included studies and key findings.

Author	Year	Study Type	Sample	Intervention	Outcome	Key Findings
Liu et al.	2025	Global burden analysis (GBD 2021)	Population-level (204 countries)	Not an intervention study (burden estimation)	Prevalence, DALYs	MSD burden increased since 1990; substantial disability, especially in older adults; supports need for scalable non-pharmacological care.
Burke et al.	2024	Prospective cohort	Community cohort (N not stated in paper extract)	Observational predictors of transition	Chronicity at follow-up, depression/productivity proxies	A meaningful proportion of acute LBP transitions to chronic pain; psychosocial factors contribute to risk and justify early multimodal management.
Baumann et al.	2023	Narrative/clinical review	Not applicable	Opioid exposure in acute pain (risk factors)	OUD risk factors	Short-term opioids carry non-zero risk; reinforces value of non-pharmacological first-line options when feasible.
Hopkins et al.	2025	Practice review	Not applicable	NSAID selection considerations	GI/CV adverse events	NSAIDs have clinically relevant GI/CV risks; strengthens rationale for non-drug analgesic strategies.
Huo et al.	2023	Systematic review & meta-analysis (RCTs)	Trials pooled (N not stated in paper extract)	NSAIDs/steroids in acute phase	Incident chronic pain	Early anti-inflammatory pharmacotherapy may be associated with higher chronic pain incidence in some settings; supports exploring non-pharmacological pathways.
Rizzo et al.	2025	Overview of Cochrane reviews	Multiple reviews	Non-pharm/non-surgical treatments (LBP)	Pain, function	Advice to stay active/avoid bed rest yields small but consistent benefits; best effects typically in packages of care.
IJzelenberg et al.	2024	Cochrane SR & meta-analysis (RCTs)	23 RCTs (N=2,674)	Exercise therapy vs placebo/usual care	VAS pain, function	Exercise alone shows minimal between-group pain differences in acute non-specific LBP; more useful as functional catalyst within multimodal programs.
Hartard et al.	2025	Randomized controlled trial (open-label)	Adults with non-specific back pain (N not stated in extract)	Heat therapy ± vibration	Pain intensity, short-term function	Heat wrap produced clinically meaningful short-term analgesia (immediate and 24 h); supports heat as a “priming” modality for activity.
Miranda et al.	2021	Systematic review (RCTs)	Acute ankle sprain trials	Cryotherapy vs control	Pain, swelling, ROM, function	Evidence quality very low; cryotherapy effects inconsistent and often not superior to active control.
Johnson et al. (meta-TENS)	2022	Systematic review & meta-analysis	381 RCTs (N=24,532)	TENS vs placebo/sham/usual care	Pain intensity (post-session), safety	TENS produced moderate-to-large immediate pain relief with few serious adverse events; supports neuromodulation as an adjunct to enable movement.

Carrière et al.	2025	Pilot interventional study	Workers with low back pain (N not stated in extract)	Single-session Empowered Relief (2 h) delivered by PTs	Catastrophizing, pain, anxiety	Large reductions in catastrophizing with concurrent short-term improvements in pain/anxiety; supports psychoeducation as a rapid "top-down" modulator.
Fink & Raffa	2025	Mechanistic/theoretical modeling paper	Not applicable	Updated gate-control modeling	Conceptual pathways	Frames pain modulation as coupled ascending/descending control loops; provides mechanistic rationale for combining peripheral, segmental, and cognitive interventions.
González-Iglesias et al.	2025	Umbrella review	Reviews of EIH literature	Single-session aerobic/resistance exercise	Pain threshold/tolerance	Exercise-induced hypoalgesia observed acutely (minutes–hours), with variable magnitude; best positioned as a facilitator of functional exposure.
Lin et al.	2024	Systematic review & meta-analysis	14 RCTs (N=2,106)	Acupuncture vs oral meds	Pain, responder rates	Acupuncture slightly outperformed oral analgesics on some outcomes, but effect sizes were small and protocols heterogeneous.
Trybulski et al.	2024	Randomized clinical trial	Combat sports athletes (N not stated in extract)	Cold vs heat vs contrast pressure	Microcirculation, recovery-related metrics, pain	Demonstrated acute physiological effects of thermal modalities; supports plausibility of "peripheral priming" before movement/loading.
Zhu et al.	2024	Systematic review & meta-analysis	25 studies (knee OA)	Manual therapy vs usual care	Pain (VAS), safety	Manual therapy improved pain in short-term observation; adverse events generally mild; relevance strongest for pain-limited movement windows.
Serrano-García et al.	2024	Systematic review & meta-analysis	Knee OA trials	Manual therapy + strengthening	VAS pain	Combined manual therapy and strengthening improved pain more than comparators over short intervals; supports "manual + active" pairing.
Guan et al.	2025	Global modeling (burden & costs)	204 countries (1990–2021)	Not an intervention study	Healthcare costs projections	Population ageing increases MSD burden and costs; supports cost-effectiveness focus for scalable non-pharm programs.

To further clarify the composition of the included evidence base, studies were classified by design and positioned within the intervention taxonomy used for synthesis. This study classification is presented in Figure 2 and provides an at-a-glance overview of how primary evidence clustered across randomized trials, observational designs, evidence syntheses, and mechanistic or modelling contributions, thereby supporting interpretation of consistency, applicability, and potential sources of heterogeneity.

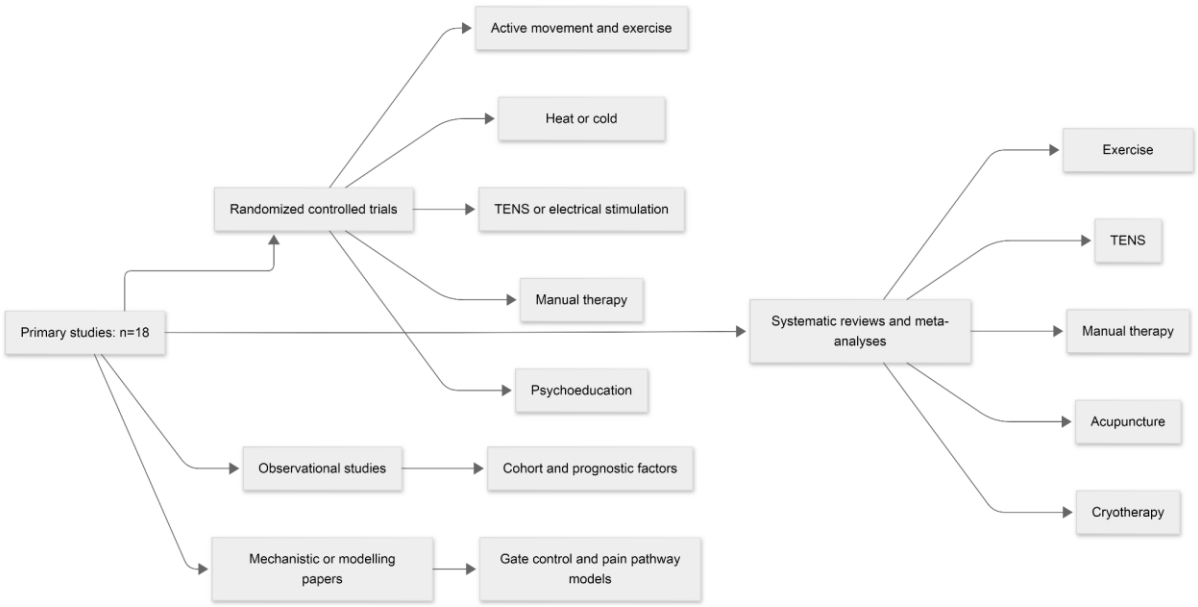

Figure 2. Study classification

The relationships between intervention categories and primary outcome domains identified in the included evidence base were summarized as an evidence map (Figure 3). The map provides a structured overview of how active, passive, neuromodulatory, manual, psychoeducational, and adjunct approaches link to pain, function, psychological mediators, safety, and feasibility outcomes, and it was used to guide the cross-level qualitative synthesis.

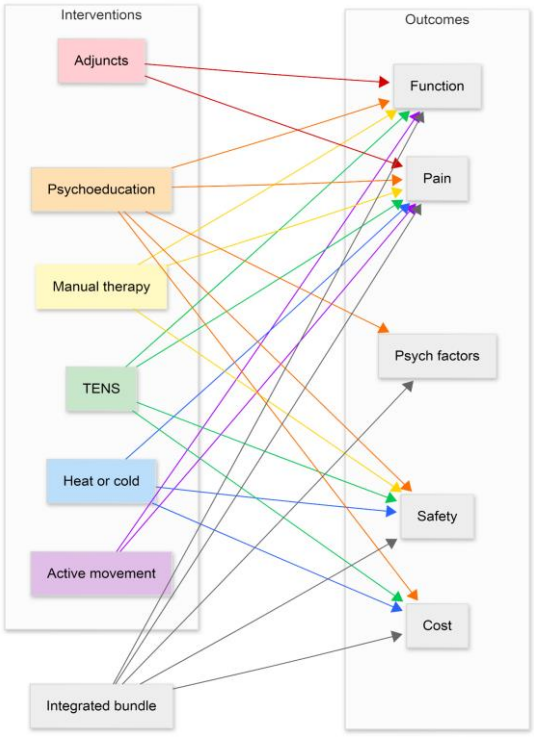

Figure 3. Evidence map

3. Results and Discussion

The included evidence indicates that non-pharmacological interventions for acute musculoskeletal pain are most often evaluated as multimodal packages, and that reported effects vary across intervention categories and outcomes. Active strategies (early mobilization, therapeutic exercise, and graded loading) were commonly represented in the included evidence and were frequently described as core components of care. A 2023 Cochrane review found evidence that simply telling people to move instead of rest reduced their pain and sped their recovery compared with bed rest, but that its absolute effects are small (Rizzo et al., 2025). A 2024 meta-analysis of 23 RCTs (N=2674) in which therapeutic exercise was compared with placebo found a between-group difference of a mean of -0.8 mm on the 100-mm VAS (95% CI -5.8 to 4.2) not likely to be clinically relevant, unless exercise was part of a package of care (IJzelenberg et al., 2024). Across the included evidence, isolated exercise showed minimal between-group differences in acute non-specific low back pain, whereas studies and reviews evaluating exercise within broader care packages more often reported clinically relevant improvements.

Such modulators include passive physical measures. In a 2025 randomized study, a single heat wrap application reduced pain by an average of 11 mm immediately and maintained a 10 mm effect at 24 hours, a magnitude described as potentially clinically meaningful in some settings (Hartard et al., 2025). For cryotherapy, a 2021 systematic review reported no reliable differences versus active control in acute ankle sprain, with very low certainty of evidence (Miranda et al., 2021). For TENS, the meta-TENS systematic review and meta-analysis reported an immediate post-session pain reduction versus placebo/sham/usual care (standardized mean difference –0.96) with few serious adverse events (Johnson et al., 2022). Manual therapy was associated with short-term pain reduction in knee osteoarthritis populations across meta-analyses, with effect estimates ranging from moderate to large depending on comparison conditions and follow-up duration (Zhu et al., 2024; Serrano-García et al., 2024).

Psychoeducational interventions were associated with improvements in pain-related cognitions (e.g., catastrophizing) and related short-term clinical outcomes in the included pilot evidence. The single-session Empowered Relief program demonstrated that, after 2 hours of structured training, 71% of participants achieved ≥50% reduction in catastrophizing, with a mean decrease of 28 points; these changes were accompanied by reductions in pain intensity and anxiety at 4 weeks (Carrière et al., 2025).

Complementary modalities were also represented in the included evidence base, although reported effects were generally small and heterogeneous. Acupuncture may improve outcomes for acute or subacute low back pain slightly more than oral analgesics (RR 1.11; 14 RCTs, 2106 patients), but the effect size is trivial and protocol heterogeneity is high (Lin et al., 2024). Other common modalities, such as kinesiotaping and massage, appear to provide mostly short-term benefits and typically do not have statistically meaningful benefits beyond one week following treatment. Such modalities are often described as adjuncts within multimodal care pathways.

In general, the included evidence suggests a multimodal framework for reducing risk factors associated with pain chronification: active movement supports functional recovery; passive physical stimuli and manual therapy decrease peripheral nociceptive drive; TENS improves segmental analgesia; and cognitive strategies target maladaptive beliefs and pain-related fear that may contribute to symptom persistence. Complementary techniques remain useful markers of personalization, but without core components such as graded activity and selected short-acting modalities, effects are more commonly short-term and context-dependent.

At the peripheral level, included physiological studies suggest with local physiological shifts: within 5 minutes of applying a heat compress, microcirculatory flow nearly doubles (19.45 ± 0.91 PU vs 9.79 ± 0.35 PU in controls), thereby abating cytokine noise and shortening the time to spontaneous reduction of afferent firing (Trybulski et al., 2024). These physiological changes may be relevant to subsequent symptom modulation.

At the segmental level, modelling work has described, a smoothly regulated interneuronal network, modeled in a 2025 updated pain-control framework as a self-learning negative-feedback loop linking the dorsal horn with the reticular formation (Fink & Raffa, 2025). Electrical modulation fits here as well: in a meta-analysis of 381 RCTs (24,532 patients), TENS reduced pain intensity immediately post-session by 0.96 standardized mean differences relative to placebo, independent of nosology and symptom duration (Johnson et al., 2022). Manual therapy may influence symptoms via mechanoreceptor-mediated and neurophysiological mechanisms: across 25

studies in gonarthrosis, it outperformed usual care, yielding an SMD of 2.04, with the best effects after 4 weeks of course-based loading (Zhu et al., 2024).

However, the segmental filter remains only half-open until ascending and descending cortical tracts intervene. Exercise may produce short-term hypoalgesic effects: an umbrella review in 2025 shows that a single aerobic session raises pain-sensitivity thresholds by 8–35% and sustains the effect for at least an hour, a classic instance of exercise-induced hypoalgesia (González-Iglesias et al., 2025). Nevertheless, for acute nonspecific low back pain, isolated exercise remains evidence-based neutral: a meta-analysis of 23 RCTs (2,674 patients) yielded an MD of –0.80 VAS, below the threshold of clinical significance (IJzelenberg et al., 2024). Thus, exercise should be regarded more as a catalyst of function than as an analgesic per se.

At the cognitive level, psychoeducational interventions may be associated with the entire tableau within seconds. A single two-hour Empowered Relief class in an initially anxious cohort reduced catastrophizing by 28 PCI points; 90% of participants achieved a clinically meaningful shift by week four (Carrière et al., 2025). These cognitive adjustments expand descending inhibition and multiply the effects of any somatic interventions.

Taken together, the included sources support a rationale for combining modalities that target different mechanisms (peripheral symptom relief, neuromodulation, and cognitive-behavioral factors). However, direct long-term comparative evidence remains limited, as it reduces central sensitization. Taken together, these sources support a rationale for multimodal sequencing. However, direct long-term comparative evidence remains limited, and effects on medication use are not consistently reported across studies.

Comprehensive programs combine multiple intervention components that may address pain and function through complementary pathways and compensate for the limitations of monotherapy. In clinical practice reports and reviews, multimodal programs are commonly described as combining early activation with thermal exposure or brief cooling, followed by low-threshold electrical stimulation. Adding a manual technique opens an additional window of pain-free movement, and a cognitive-behavioral session consolidates behavioral shift, reducing anxiety and catastrophizing. As a result, patients recover range of motion faster, seek fewer repeat consultations, and transition less often to chronicity. The effect proves more durable than with any method alone because the inflammatory cascade, segmental impulse transmission, and cortical expectations receive a coordinated signal to extinguish.

One commonly described sequencing approach is stepwise and progression-based. At baseline, pain mechanisms are explained, and supportive instruction in ADLs is provided; in the acute phase, modalities, including heat for chronic muscle spasm and cold for acute soft-tissue injury, may be applied to reduce peripheral hyperreactivity. After the peak pain has subsided, gradual loading, transcutaneous stimulation, and/or light manual mobilization permit an increased range of movement without pain. The tolerability of each step is tested, load intensity is adapted, and the cognitive element ensures motivation and self-regulation remain the glue that holds the rehabilitation together.

Across the included evidence, reported adverse effects were generally mild, while serious adverse events were rarely reported. Transient adverse effects include increased pain with unfamiliar exercise, localized erythema below the electrodes, and a mild thermal burn from a hot compress. Serious adverse effects are rare and are usually attributable to improper technique or failure to adhere to contraindications. Heat should not be applied over actively edematous tissue or over denervated tissue; cold should not be applied over vascularly reactive tissue; electrical stimulation should not be applied over a pacemaker; and vigorous mobilization should not be performed over fragile or brittle bone. Carefully selected patients, with stepwise titration, biofeedback, and the combination of modalities, reduce adverse effects and may create a synergistic rather than antagonistic effect.

The economic profile of non-pharmacological interventions revolves around a low barrier to entry. Single-use or reusable heat packs require only a basic textile cover and a heat source. Hot tap water may suffice, and the kit price is comparable to an over-the-counter analgesic package, without the added costs of managing adverse reactions. A portable transcutaneous electrical stimulator is a lightweight unit with electrodes, recharges from a standard adapter, and can function for years; the first shortened course of pharmacotherapy recoups its one-time purchase. Patient education costs can be reduced to brief nurse instruction or online videos, making the approach attractive even for small outpatient clinics. Manual interventions demand greater specialist involvement, yet when integrated into a streamlined physiotherapy practice, they can be distributed across

multiple patients without complex equipment procurement.

Potential organizational implications described in the literature include shortened disability periods and reduced hidden employer costs. A patient receiving a bundle of early movement, heat, and gentle neuromodulation is less likely to take prolonged sick leave, returns to work rhythms sooner, and requires fewer follow-up visits. For health systems, this translates into freed primary-care appointments and shorter queues to pain specialists. At the organizational level, there is less lost time at work, more optimal redistribution of work, and less employee turnover due to pain syndromes. The non-pharmacological approach is clinically and economically valid when considering that the risk of chronicity and opioid dependence is reduced in the long run.

At a minimum, to discuss without defense how the pain starts, radiates, and what aggravates or relieves it is vital. Red flags include experiencing a fever, feeling pain at night, and losing function following recent trauma. If alarming signs are absent, attention shifts to yellow flags, anxiety level, prior failed treatment, and expectations from the visit. At this stage, the core message is essential: acute pain rarely signifies damage requiring rest; far more often, it calls for movement, albeit graded.

An individualized cocktail of interventions is then formulated. In the hyperacute period, heat is used for muscular contracture or brief cold for soft-tissue edema to quiet peripheral receptor alarm. As soon as pain abates slightly, light activity is added: free walking, simplified range-of-motion drills, and elements of breathing exercises. If a pulsating background persists, the clinician introduces transcutaneous stimulation or gentle joint mobilization to expand the pain-free range of motion. In parallel, the patient receives a concise cognitive impulse, an explanation of purpose, and why temporary discomfort does not imply harm.

Success is indexed not by perfect absence of pain but by restoration of function: the ability to bend, to rotate the neck when driving, to walk a usual distance without stops. There may be evidence of improvement from session to session. For example, the clinician may note a gradual increase in the activity threshold for stopping rumination about pain. Suppose the program does not improve within a reasonable timeframe. In that case, someone modifies it: someone may increase the psychoeducational element, alter the movement intensity, or re-evaluate the mechanical stimulus. Such circular auditing prevents slippage into chronification.

For the patient, everything condenses into a laconic formula that is easy to retain. Move as frequently as comfort allows, avoiding complete immobility. Warm the area of muscle spasm and cool fresh swelling, if present. Stimulate the nervous system with simple means, from electrodes to self-massage, so it remembers its own inhibitory mechanisms. Learn to parse bodily signals and distinguish warning from false alarm. When these five links, shown in Figure 3, are assembled into a chain, the clinical pathway shortens, and pain becomes less dominant over behavior.

Despite accumulating data, the picture remains fragmented. As the existing trials are single-center, short-term, and heterogeneous with respect to outcomes, no definite conclusions can be drawn about the comparative effectiveness of therapy combinations in the long run across different populations. Large, multicenter, randomized trials need to be conducted involving active mobilization, heat, electric stimulation, and cognitive support at pre-defined doses and functional outcomes at 6 and 12 months as the primary outcomes. Beyond the clinical considerations, the broad economic aspects of direct healthcare costs, lost work, and family costs must be considered. Only thus can insurers and employers be persuaded to invest in non-pharmacological programs as readily as in pharmacology.

In parallel, opportunities are opening for digital tools once seen as hallmarks of sports medicine. Motion sensors in watches and bands can detect declines in activity before patients report recurrent pain, and shifts in heart-rate variability may indicate stress surges at the root of central sensitization. A mobile application linked to such sensors can adapt exercise plans in real time, remind users of heat or cold exposure, and offer brief relaxation modules. End-to-end integration of these data into electronic records will allow researchers to collect objective metrics without clinic visits, markedly increasing statistical power and enabling adaptive protocols in which treatment schemes evolve during the study. Vectors of future work point in two directions: classical methodology with rigorous randomization, and flexible digital cohorts in which algorithms learn from hundreds of thousands of steps, heartbeats, and subjective pain ratings, transforming disparate practices into a continuous ecosystem of recovery.

4. Conclusion

This review suggests that non-pharmacological approaches can play a meaningful role in the early management of acute musculoskeletal pain, particularly when interventions are combined in a structured, function-oriented program. Across the included literature, the most consistent signals of benefit were observed for strategies that promote continued activity and reduce pain-related fear, while selected modalities (e.g., heat and transcutaneous electrical nerve stimulation) may provide short-term symptom relief that can facilitate participation in movement-based rehabilitation. However, the magnitude of effects reported for several individual modalities was often small, and in some cases below thresholds commonly considered clinically important when applied as stand-alone treatments.

The available evidence remains heterogeneous with respect to clinical presentations, intervention parameters (dose, timing, sequencing), comparison conditions, outcome measures, and follow-up duration. Most studies emphasized short-term outcomes, limiting inference regarding sustained functional recovery and prevention of chronification. In addition, because this review did not perform a pooled quantitative meta-analysis of effect estimates across interventions, conclusions should be interpreted as a qualitative synthesis rather than definitive comparative effectiveness rankings.

Overall, the findings support a pragmatic, multimodal clinical approach in which graded activity and early mobilization are prioritized, complemented when appropriate by short-acting physical or neuromodulatory modalities and brief psychoeducational components to address maladaptive beliefs and catastrophizing. Future research should prioritize adequately powered, multicenter randomized trials that test predefined combinations and sequences of interventions, standardize core outcomes for pain and function, and extend follow-up to 6–12 months. Such work is needed to clarify which components contribute most to clinically meaningful improvement, for whom, and under what dosing and implementation conditions.

Conflict of Interest

The author declares no conflicts of interest related to this work.

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This research received no external funding.

Data Availability

All data analysed during this study are included in this published article and its references. The search strategies and study selection counts are reported in the Methods section and PRISMA flow diagram.

Registration

This systematic review was not registered.

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