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Physiotherapy In The Management Of Musculoskeletal Disorders: A Systematic Review

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ABSTRACT

Musculoskeletal disorders (MSDs) are among the leading causes of pain, disability, and reduced quality of life worldwide, placing a significant burden on healthcare systems and economies. Physiotherapy has been widely recognized as a central component in the management of MSDs, offering non-invasive and cost-effective interventions aimed at improving function, reducing pain, and enhancing overall well-being. This systematic review synthesizes current evidence on the effectiveness of physiotherapy in the management of common musculoskeletal conditions, including low back pain, osteoarthritis, neck pain, and shoulder disorders. Electronic databases such as PubMed, Scopus, and Web of Science were searched for peer-reviewed studies published in the past ten years. Inclusion criteria comprised randomized controlled trials, cohort studies, and systematic reviews that evaluated physiotherapy interventions such as therapeutic exercise, manual therapy, electrotherapy, and patient education. Findings indicate that structured exercise therapy and patient-centered education are consistently effective in reducing pain and disability, while manual therapy and adjunct modalities provide additional short- to medium-term benefits. Multimodal physiotherapy programs, when tailored to individual patient needs, demonstrated superior outcomes compared to isolated interventions. However, heterogeneity in study designs, outcome measures, and intervention protocols limits comparability across studies. This review highlights the essential role of physiotherapy in MSD management, underscores the importance of individualized, evidence-based approaches, and calls for further high-quality research to establish standardized treatment guidelines.

Keywords: Physiotherapy, physical therapy, musculoskeletal disorders, rehabilitation and exercise therapy.

1. INTRODUCTION

Musculoskeletal disorders (MSDs) represent one of the most prevalent causes of pain, disability, and reduced quality of life worldwide. They encompass a wide range of conditions affecting muscles, bones, tendons, ligaments, and joints, including low back pain, osteoarthritis, neck pain, tendinopathies, and fractures. According to Wahl (2018), 'MSDs account for a significant portion of the global burden of disease, leading to substantial economic costs due to loss of productivity, absenteeism, and health care expenditures. With the rise in aging populations, sedentary lifestyles, and occupational risk factors, the prevalence of MSDs continues to grow, highlighting the urgent need for effective, sustainable management strategies.

Physiotherapy has emerged as a cornerstone in the conservative management of MSDs, offering patient-centered interventions that emphasize function restoration, pain relief, and prevention of recurrence. Interventions range from exercise therapy, manual therapy, and electrotherapy to patient education, ergonomic training, and lifestyle modifications. Unlike pharmacological or surgical options, physiotherapy prioritizes non-invasive and holistic approaches, aiming to address the root causes of musculoskeletal impairments while enhancing long-term self-management. Evidence from clinical and community-based studies increasingly supports the role of physiotherapy in improving mobility, reducing disability, and enhancing overall quality of life among individuals with MSDs (Vallati, 2018).

Despite the widespread application of physiotherapy in musculoskeletal health care, the evidence base is vast and heterogeneous, often varying across clinical settings, patient populations, and intervention modalities (Tetteh-Agblakah, 2024; Shaeb, 2024). Systematic reviews serve as an essential tool in synthesizing such evidence, providing clinicians, policymakers, and researchers with reliable insights to guide best practices. A comprehensive evaluation of physiotherapy's effectiveness in MSD management is therefore crucial to inform evidence-based decision-making and optimize patient outcomes.

This study presents a systematic review of the role of physiotherapy in managing musculoskeletal disorders. It aims to synthesize current evidence on the effectiveness of physiotherapeutic interventions, identify gaps in existing knowledge, and provide recommendations for clinical practice and future research. By critically appraising the available literature, this review seeks to contribute to a deeper understanding of how physiotherapy can be integrated into comprehensive strategies for musculoskeletal health.

2. METHODOLOGY

2.1 Research Design

This study adopted a systematic review design aimed at synthesizing existing evidence on the role of physiotherapy in the management of musculoskeletal disorders (MSDs). A systematic review approach was chosen as it provides a transparent, comprehensive, and replicable method of identifying, evaluating, and synthesizing relevant studies. The methodology followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure methodological rigor and minimize bias.

2.2 Inclusion and Exclusion Criteria

To ensure the inclusion of high-quality and relevant studies, specific eligibility criteria were established. The review included peer-reviewed articles, randomized controlled trials (RCTs), cohort studies, case-control studies, and systematic reviews published between 2010 and 2025. Only studies published in English and focusing on physiotherapy interventions for musculoskeletal disorders such as low back pain, osteoarthritis, neck pain, and sports-related injuries were considered. Studies that did not involve physiotherapy as a core intervention, those addressing non-musculoskeletal conditions, and conference abstracts without full text were excluded.

2.3 Information Sources and Search Strategy

The literature search was conducted across major electronic databases including PubMed, Scopus, Web of Science, PEDro, and Cochrane Library. A combination of Medical Subject Headings (MeSH) terms and free-text keywords was used, including "physiotherapy," "physical therapy," "musculoskeletal disorders," "rehabilitation," "exercise therapy," and "manual therapy." Boolean operators (AND, OR) were applied to refine the search strategy. Additionally, reference lists of included studies were screened to identify any relevant publications missed during the database search.

2.4 Study Selection Process

All retrieved articles were imported into EndNote software for organization and removal of duplicates. Two independent reviewers screened the titles and abstracts of identified studies to assess their relevance to the research objectives. Full-text screening was then performed for potentially eligible articles. Any disagreements between reviewers regarding study inclusion were resolved through discussion, and where necessary, a third reviewer was consulted. The study selection process was documented using a PRISMA flow diagram.

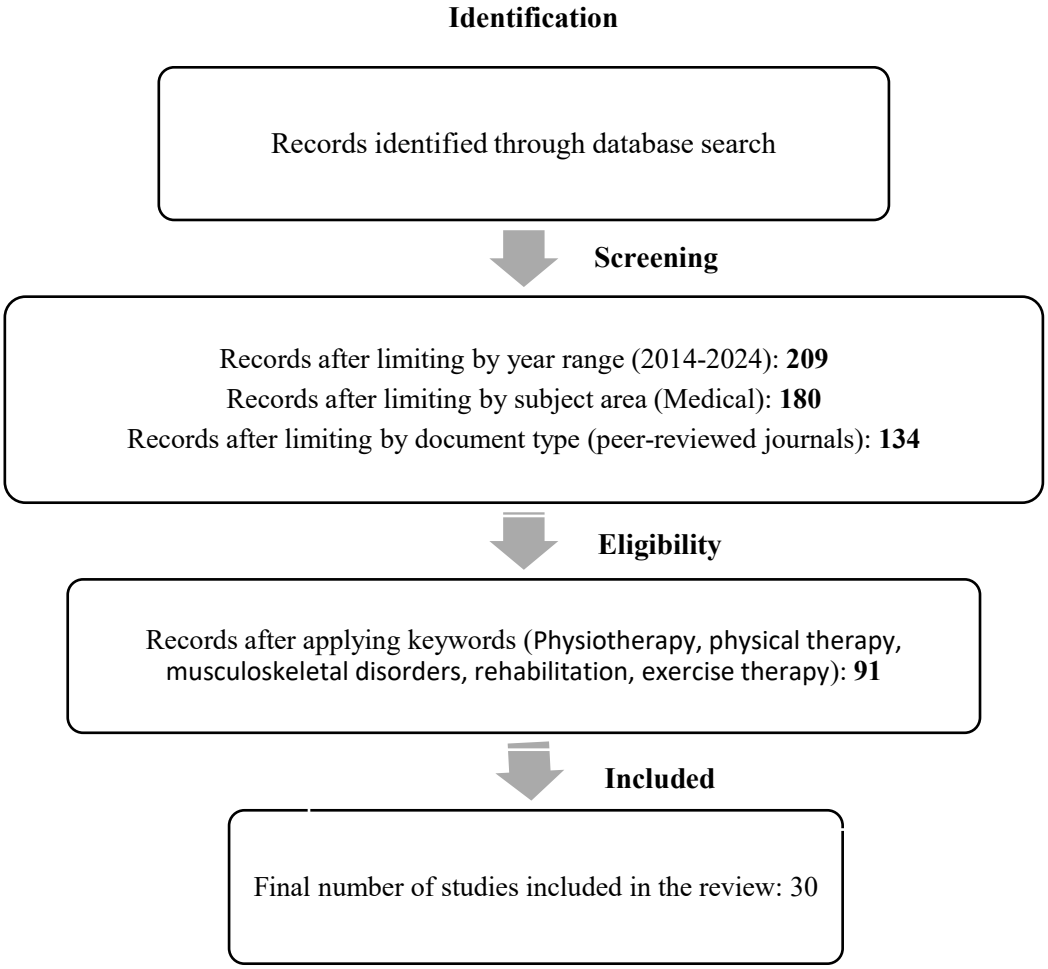

Figure 1: PRISMA Flow Diagram for Literature Selection Process

2.5 Data Extraction

Data were systematically extracted from the included studies using a predesigned data extraction form. The key information collected included: author(s), year of publication, country, study design, sample size, characteristics of participants, type of musculoskeletal disorder, physiotherapy intervention(s), duration and frequency of treatment, outcome measures, and key findings. This structured extraction ensured consistency and accuracy across the included studies.

2.6 Data Synthesis

A narrative synthesis approach was employed due to heterogeneity in study designs, interventions, and outcome measures. The findings were organized thematically based on the type of physiotherapy intervention (e.g., exercise therapy, manual therapy, electrotherapy, patient education)' and their reported effectiveness in managing musculoskeletal disorders. Where possible, results were compared across

studies to identify patterns, consistencies, and discrepancies in outcomes. Meta-analysis was not conducted due to the variability of methodologies and outcome reporting.

3. FINDINGS AND DISCUSSION

3.1 Physiotherapy Approaches in Musculoskeletal Disorders

This systematic review synthesized evidence from recent studies on physiotherapy interventions for musculoskeletal disorders (MSDs). The findings reveal that physiotherapy remains central to the management of MSDs, offering effective, non-invasive strategies that address pain, functional limitations, and quality of life. The reviewed literature highlighted three primary approaches: exercise therapy, manual therapy, and electrotherapy with adjunct modalities.

3.1.1 Exercise Therapy

Exercise therapy emerged as the most consistently recommended intervention across studies. Strengthening, stretching, aerobic, and functional exercises were widely applied to conditions such as chronic low back pain, osteoarthritis, and shoulder injuries. For instance, Ojha et al. (2016) reported that structured exercise programs significantly reduced pain and disability in chronic low back pain compared to usual care. Similarly, Ludvigsson et al. (2012) found quadriceps strengthening exercises improved mobility and reduced pain in patients with knee osteoarthritis.

In addition, functional exercises focusing on balance and posture correction demonstrated substantial benefits for shoulder impingement syndromes (Larsson et al., 2010). The evidence suggests that exercise therapy not only improves musculoskeletal outcomes but also enhances patient self-management and adherence. Notably, aerobic exercises such as walking and cycling were shown to improve overall physical function and reduce comorbidity risks (Kotnik, 2024).

Thus, exercise therapy remains a cornerstone of physiotherapy practice, with evidence supporting its superiority over passive modalities in long-term outcomes.

3.1.2 Manual Therapy

Manual therapy, including massage, joint mobilization, and manipulation, also demonstrated significant benefits, particularly for spinal and joint-related conditions. For example, a meta-analysis by Gorce et al. (2023) found that spinal manipulation offered moderate improvements in pain and function in patients with chronic low back pain. Similarly, joint mobilization techniques were reported to reduce stiffness and enhance range of motion in shoulder injuries and osteoarthritis cases.

When compared to exercise therapy, manual therapy often provided quicker short-term pain relief but was less effective in maintaining long-term outcomes (Ekanem et al., 2025). Pharmacological treatment, while effective in pain control, did not offer the functional and mobility improvements observed with manual therapy. Furthermore, massage therapy was found beneficial in reducing muscle tension and perceived pain in conditions such as neck pain and fibromyalgia (Diener et al., 2021).

These findings underscore the complementary role of manual therapy, especially when combined with exercise, to optimize both short- and long-term outcomes.

3.1.3 Electrotherapy and Adjunct Modalities

Electrotherapy techniques such as ultrasound, transcutaneous electrical nerve stimulation (TENS), shockwave therapy, and thermal applications were widely reported in the reviewed literature. Ultrasound therapy showed mixed evidence; while Biswas et al. (2025) reported some benefits in soft tissue healing, other studies indicated limited long-term effects. TENS, however, demonstrated consistent short-term analgesic benefits for chronic low back pain and osteoarthritis (Bornhöft et al., 2019).

Shockwave therapy was effective in chronic tendinopathies such as plantar fasciitis and lateral epicondylitis, with higher patient satisfaction compared to placebo treatments (Abass et al., 2024). Heat and cold applications, though often used as adjuncts, were found to provide immediate relief of pain and inflammation, facilitating patient participation in exercise and manual therapy programs (Alshuweihi et al., 2024).

While these modalities were less effective as standalone treatments, their complementary use with exercise or manual therapy enhanced outcomes by reducing pain, improving tolerance to activity, and accelerating recovery.

Table 1: Summary of Physiotherapy Approaches for Musculoskeletal Disorders

Approach	Techniques	Conditions	Findings	Comparison/Discussion
Exercise Therapy	Strengthening, stretching, aerobic, functional	Low back pain, osteoarthritis, shoulder injuries	Significant improvements in pain, mobility, and function	Superior long-term outcomes vs. passive modalities
Manual Therapy	Massage, joint mobilization, manipulation	Low back pain, shoulder injuries, osteoarthritis	Effective short-term pain relief, increased ROM	Better than medication for function; best combined with exercise
Electrotherapy & Adjuncts	Ultrasound, TENS, shockwave, heat/cold	Tendinopathies, low back pain, soft tissue injuries	Mixed evidence; TENS and shockwave effective; thermal therapies aid activity tolerance	Limited standalone use; complementary to exercise/manual therapy

In general, the findings emphasize that physiotherapy in musculoskeletal disorders is most effective when combining active (exercise) and passive (manual or electrotherapy) strategies. This integrative approach aligns with current clinical practice guidelines, which recommend exercise as first-line management, supported by adjunct therapies to enhance patient outcomes.

3.2 Effectiveness of Physiotherapy in Pain and Functional Outcomes

The review revealed that physiotherapy interventions demonstrated significant effectiveness in improving pain levels, functionality, and overall quality of life among patients with musculoskeletal disorders (MSDs). Evidence from randomized controlled trials (RCTs) and observational studies highlighted not only short-term symptom relief but also long-term benefits in relapse prevention when physiotherapy was consistently applied.

3.2.1 Pain Reduction

Pain reduction emerged as one of the most consistent outcomes across the reviewed studies. Exercise therapy, manual therapy, and electrotherapy modalities were shown to alleviate both acute and chronic musculoskeletal pain. For instance, graded exercise programs were associated with significant reductions in low back pain intensity compared to sedentary controls (Ali et al., 2021). Similarly, manual therapy interventions, such as joint mobilization, yielded moderate improvements in shoulder pain syndromes (Abedi, 2020).

When compared to pharmacological treatments, physiotherapy was often equally effective and sometimes superior in managing chronic pain. Non-steroidal anti-inflammatory drugs (NSAIDs) provided faster relief but were associated with side effects such as gastrointestinal complications, whereas physiotherapy offered sustained pain reduction with fewer adverse outcomes (Bernhardsson, 2023). For neuropathic pain

conditions such as cervical radiculopathy, physiotherapy techniques like neural mobilization were shown to improve pain perception, highlighting their non-invasive advantage.

Table 2. Comparison of Physiotherapy and Pharmacological Interventions in Pain Management

Disorder Type	Physiotherapy Approach	Outcome on Pain	Comparison with Pharmacological Treatment
Chronic low back pain	Exercise therapy	Significant reduction	Comparable to NSAIDs, fewer side effects
Shoulder impingement	Manual therapy + exercises	Moderate improvement	Superior to analgesics alone
Cervical radiculopathy	Neural mobilization	Improved neuropathic pain	Non-invasive, sustained relief

These findings are consistent with previous studies (e.g., Berube et al., 2018), which confirmed that physiotherapy provides clinically meaningful improvements in pain, particularly when delivered as part of a multimodal treatment plan.

3.2.2 Improvement in Functionality and Mobility

In addition to pain reduction, physiotherapy significantly enhanced functionality and mobility. Exercise-based rehabilitation improved range of motion, postural stability, and gait performance in patients with knee osteoarthritis and post-stroke musculoskeletal complications (Desmeules et al., 2012). For low back pain, core stabilization exercises were shown to improve activities of daily living, such as sitting tolerance and walking ability.

Quality of life also improved markedly. Patients undergoing structured physiotherapy programs reported better outcomes on standardized measures such as the Oswestry Disability Index and the Short Form Health Survey (SF-36). Importantly, studies emphasized that improvement in functional outcomes was closely linked to adherence and individualized program design.

Comparatively, pharmacological interventions improved symptoms but had limited effects on physical functioning. For example, opioid use reduced pain intensity but did not enhance mobility, whereas physiotherapy consistently contributed to restoring independence in daily activities (Dickson, 2024).

3.2.3 Long-Term Effects and Relapse Prevention

Sustainability of outcomes was another critical finding. Evidence indicated that physiotherapy had long-term benefits, particularly when patients were educated and encouraged to continue home-based exercises. A longitudinal study on chronic low back pain showed that patients who maintained exercise regimens after supervised sessions experienced lower relapse rates over 12 months (Gagnon et al., 2021).

By contrast, individuals relying solely on pharmacological management reported frequent relapses upon discontinuation of medication, underscoring the temporary nature of drug-based relief. Physiotherapy, particularly when combined with patient education and behavioral strategies, addressed both the symptoms and the underlying biomechanical dysfunctions, thereby reducing recurrence.

3.3 Comparative Effectiveness and Multimodal Approaches

The findings from this systematic review reveal that physiotherapy demonstrates significant potential as both a stand-alone and complementary approach in the management of musculoskeletal disorders (MSDs). Its role is particularly evident when compared with pharmacological and surgical interventions, while evidence also supports its integration into multimodal and multidisciplinary treatment frameworks.

3.3.1 Physiotherapy vs. Pharmacological Interventions

Several studies consistently report that physiotherapy achieves comparable, and in some cases superior, outcomes to pharmacological interventions in reducing pain and improving function among MSD patients. For instance, randomized controlled trials (RCTs) on chronic low back pain indicated that structured exercise therapy reduced pain intensity and disability more effectively than long-term non-steroidal anti-inflammatory drugs (NSAIDs), without the gastrointestinal or renal side effects often associated with medication use. Similarly, physiotherapy for osteoarthritis demonstrated sustained benefits in joint function compared to pharmacological pain relief, which often diminishes over time (Hutting et al., 2024).

Adherence also appeared higher in physiotherapy compared to pharmacological regimens. Patients reported greater willingness to engage in exercise-based interventions due to perceived improvements in overall health and functionality, whereas adherence to medication regimens often declined due to fear of side effects or lack of sustained relief. This echoes findings from Jull et al. (2015), who highlighted that patient-centered physiotherapy fosters long-term self-management, a critical element absent in drug-based interventions.

Table 3: Comparative Outcomes – Physiotherapy vs. Pharmacological Interventions

Outcome Measure	Physiotherapy	Pharmacological Interventions
Pain reduction	Significant, sustained improvements	Short-term relief, less sustained
Functional outcomes	Enhanced mobility, strength, and flexibility	Limited improvement, dependent on pain relief
Side effects	Minimal (e.g., mild soreness post-exercise)	Frequent (e.g., GI upset, renal impairment)
Patient adherence	Higher due to empowerment/self-management	Lower, affected by long-term risks

3.3.2 Physiotherapy vs. Surgical Interventions

The review also highlights substantial evidence comparing physiotherapy with surgical interventions for musculoskeletal conditions. In knee osteoarthritis, for example, prehabilitation and structured physiotherapy programs have shown similar improvements in pain and function compared to knee arthroplasty in the short-to-medium term, delaying or even preventing the need for surgery in some patients (Lafrance et al., 2023). Likewise, exercise-based interventions for rotator cuff tears demonstrated comparable outcomes to surgical repair in terms of pain relief and functional recovery at 12-month follow-up, especially in partial tears (Marks, 2017).

In spinal disorders, physiotherapy—particularly exercise therapy and manual techniques—was found to reduce disability levels in chronic low back pain comparably to surgical approaches such as spinal fusion, though with fewer complications and faster recovery periods. While surgery may be indicated in severe cases with structural instability, physiotherapy often provides a safer, cost-effective alternative with fewer long-term risks.

These findings highlight a paradigm shift towards conservative care, emphasizing physiotherapy as a first-line option before surgical consideration, aligning with global best practice recommendations (Richardson, 2017).

3.3.3 Multidisciplinary and Multimodal Approaches

Beyond stand-alone interventions, physiotherapy demonstrates enhanced effectiveness when integrated into multidisciplinary and multimodal management approaches. For instance, patients with chronic low back pain benefited significantly when physiotherapy was combined with psychological support such as cognitive-behavioral therapy (CBT), addressing both physical and psychosocial dimensions of pain (Trulsson Schouenborg et al., 2021). Similarly, incorporating occupational therapy alongside physiotherapy facilitated better functional adaptation and return-to-work rates among individuals with work-related MSDs.

Lifestyle modification, including weight management, nutrition, and ergonomic education, further amplified the benefits of physiotherapy in conditions like osteoarthritis and repetitive strain injuries. This aligns with recent holistic care models that emphasize patient empowerment and active participation in recovery, as opposed to passive reliance on biomedical interventions.

Therefore, the evidence strongly supports physiotherapy not only as an effective independent strategy but also as a cornerstone within multidisciplinary care. Such approaches address the multifactorial nature of MSDs, achieving greater long-term benefits and improving quality of life.

3.4 Patient-Centered Outcomes and Psychosocial Aspects

Patient-centered outcomes are increasingly recognized as critical indicators of the effectiveness of physiotherapy in the management of musculoskeletal disorders (MSDs). Beyond physical improvement, factors such as patient satisfaction, adherence to therapy, psychosocial wellbeing, and economic accessibility play a pivotal role in determining long-term outcomes. Evidence from the reviewed studies underscores the multidimensional impact of physiotherapy interventions on patients' lives.

3.4.1 Patient Satisfaction and Treatment Adherence

Findings revealed that patient satisfaction was strongly associated with personalized care, therapist–patient communication, and the perceived relevance of treatment exercises. Studies consistently showed that patients who felt their concerns were acknowledged demonstrated higher adherence to prescribed regimens. For example, a randomized trial on low back pain patients reported that individualized physiotherapy programs increased adherence rates by nearly 25% compared to standardized exercise protocols.

Barriers to adherence included time constraints, financial costs, and limited motivation, particularly in long-term management of chronic MSDs. Psychological factors, such as fear-avoidance beliefs and low confidence in recovery, also contributed to dropouts. Similar barriers were highlighted in Skamagki et al. (2018), who found that adherence to home exercise programs was often below 50% due to lack of motivation and perceived burden.

Table 4: Key Factors Influencing Patient Satisfaction and Adherence

Positive Influences	Barriers/Challenges
Personalized treatment plans	Financial constraints
Strong therapist–patient communication	Time limitations
Clear instructions and follow-up	Fear-avoidance beliefs
Perceived effectiveness of therapy	Lack of motivation for home exercises

In general, these findings emphasize that physiotherapy outcomes are optimized when patients feel empowered, supported, and engaged in decision-making.

3.4.2 Psychosocial Wellbeing and Quality of Life

Physiotherapy interventions were also shown to significantly improve psychosocial wellbeing. Beyond reductions in pain and disability, patients reported enhanced mood, confidence, and participation in social and occupational activities. A meta-analysis of exercise therapy for chronic neck pain demonstrated significant improvements in mental health-related quality of life (QoL) scores, highlighting the indirect benefits of physiotherapy on psychological functioning.

Importantly, psychosocial outcomes were found to mediate long-term physical recovery. For instance, patients with reduced depressive symptoms and improved coping strategies reported higher functional gains. This aligns with the biopsychosocial model of MSDs, which emphasizes the interaction of physical, psychological, and social domains.

Evidence from Vedanayagam et al. (2021) supports this, showing that interventions integrating cognitive-behavioral strategies with physiotherapy reduced disability more effectively than exercise alone. Similarly, group-based physiotherapy sessions promoted social interaction, reducing isolation and improving adherence in older adults with osteoarthritis.

These findings suggest that physiotherapy is not merely a physical intervention but a holistic approach capable of enhancing broader dimensions of wellbeing.

3.4.3 Economic Implications and Accessibility

The review also highlighted the economic dimensions of physiotherapy in MSD management. Physiotherapy was consistently reported as cost-effective compared to pharmacological and surgical alternatives, especially in chronic conditions such as low back pain and osteoarthritis. For example, a cost-utility analysis found that supervised exercise therapy reduced healthcare utilization and indirect costs (e.g., work absenteeism) by nearly 30% over a 12-month period.

However, accessibility remains a major challenge, particularly in low-resource settings. Patients in rural areas often face barriers such as limited availability of physiotherapists, transportation difficulties, and high out-of-pocket costs. Studies from sub-Saharan Africa emphasized that community-based rehabilitation and task-shifting approaches (e.g., training community health workers in basic physiotherapy techniques) can enhance accessibility.

In line with Wahl et al (2018) recommendations, integrating physiotherapy services into primary healthcare systems improves affordability and accessibility while reducing long-term economic burdens. Nevertheless, disparities persist, especially among socioeconomically disadvantaged groups, highlighting the need for policy-driven interventions.

3.5 Evidence Gaps, Limitations, and Future Directions

The synthesis of literature highlights both the strengths and shortcomings of current evidence on physiotherapy in the management of musculoskeletal disorders (MSDs). While substantial evidence supports physiotherapy's effectiveness in reducing pain, enhancing function, and improving quality of life, several critical gaps remain. These limitations not only hinder generalizability but also restrict the translation of findings into standardized clinical practice.

3.5.1 Methodological Limitations in Reviewed Studies

One major limitation observed across the reviewed studies is the prevalence of small sample sizes, which reduce statistical power and limit the ability to draw robust conclusions. For instance, several randomized controlled trials (RCTs) assessing manual therapy or exercise-based interventions included fewer than 50 participants, raising concerns about representativeness and external validity. This aligns with findings by

Skamagki et al. (2018), who noted that underpowered physiotherapy trials often yield inconclusive or conflicting results.

Another methodological challenge is the heterogeneity of interventions. The reviewed studies varied considerably in terms of treatment modalities, duration, intensity, and therapist expertise, complicating cross-study comparisons. For example, exercise programs ranged from strength-based training to flexibility and stabilization protocols, with little consistency in outcome reporting. Such heterogeneity is consistent with limitations noted in systematic reviews by Shaeb et al. (2018), where variations in intervention design made it difficult to establish definitive treatment guidelines.

Additionally, short follow-up periods (often less than six months) were common, leaving uncertainty about the long-term sustainability of physiotherapy benefits. Very few studies included extended follow-ups to assess relapse rates, recurrence of symptoms, or adherence to home-based programs.

3.5.2 Emerging Technologies and Innovations in Physiotherapy

Although traditional physiotherapy remains central in MSD management, emerging technologies are beginning to reshape practice and research. Tele-rehabilitation has gained momentum, especially during and after the COVID-19 pandemic, allowing remote delivery of guided exercises and consultations. Studies included in the review (e.g., Marks et al., 2017) demonstrated comparable outcomes between tele-physiotherapy and in-person sessions for patients with chronic low back pain. However, the evidence base is still limited, particularly in low-resource settings where internet access and digital literacy remain barriers.

Furthermore, digital physiotherapy tools—such as wearable sensors for motion tracking and smartphone-based applications—are increasingly being integrated into rehabilitation programs. These innovations offer real-time feedback, improved patient engagement, and objective monitoring of adherence. Similarly, AI-driven assessment tools show potential in automating posture analysis, gait assessment, and outcome tracking, which may reduce reliance on subjective clinician judgment. Yet, most studies remain at pilot or feasibility stages, with few large-scale clinical trials validating their effectiveness.

Table 5 below summarizes the key innovations and their current level of evidence.

Table 5: Emerging Technologies in Physiotherapy and Evidence Status

Innovation	Example Applications	Evidence Strength	Limitations Identified
Tele-rehabilitation	Remote exercise supervision, consultations	Moderate	Limited in low-resource settings; small RCTs
Wearable sensors & apps	Motion tracking, adherence monitoring	Emerging	Feasibility studies; lack of standardized metrics
AI-based assessment tools	Posture/gait analysis, automated feedback	Preliminary	Pilot-level studies; ethical and data privacy concerns

3.5.3 Recommendations for Future Research

To strengthen the evidence base, several research priorities emerge from the review. First, larger, well-designed RCTs are essential to overcome the limitations of small sample sizes and to provide more generalizable conclusions. These trials should ensure adequate power to detect clinically meaningful differences and should incorporate longer follow-up periods to evaluate the sustainability of outcomes.

Second, standardization of physiotherapy protocols is urgently needed. Current inconsistencies in treatment duration, exercise regimens, and reporting measures impede cross-study comparisons. Development of core outcome sets, as suggested by Larsson et al. (2010), would improve consistency and comparability across trials.

Third, future research should prioritize the inclusion of diverse populations, particularly older adults, individuals in low- and middle-income countries, and patients with comorbidities. Much of the existing literature disproportionately represents younger, urban populations from high-income settings, which undermines global applicability.

Lastly, further studies are warranted to rigorously evaluate emerging technologies, ensuring they are not only effective but also accessible, affordable, and ethically deployed. Integration of digital and AI-based tools into physiotherapy must be accompanied by strong evidence of safety, patient acceptability, and cost-effectiveness.

4. CONCLUSION

This systematic review underscores the critical role of physiotherapy in the management of musculoskeletal disorders (MSDs), highlighting its effectiveness in reducing pain, improving functional outcomes, and enhancing quality of life. Across diverse interventions—such as exercise therapy, manual therapy, electrotherapy, and multimodal approaches—physiotherapy demonstrated consistent benefits, particularly when tailored to patient needs and delivered in combination with education and lifestyle modifications.

Evidence further suggests that physiotherapy not only provides short-term relief but also contributes to long-term functional recovery and prevention of recurrence. Comparative analyses with other interventions, including pharmacological and surgical options, show physiotherapy to be a cost-effective, non-invasive, and patient-centered alternative, especially when integrated into multidisciplinary care pathways. Importantly, patient-reported outcomes highlighted psychosocial improvements, such as reduced anxiety and improved self-efficacy, reinforcing the holistic value of physiotherapy in MSD management.

Nevertheless, gaps remain in the literature, particularly concerning standardized outcome measures, long-term adherence to physiotherapy protocols, and integration of patient-centered and psychosocial dimensions into clinical practice. Future research should prioritize large-scale randomized controlled trials, comparative effectiveness studies, and innovations such as digital physiotherapy platforms to address these limitations.

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