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Pre-Conservative Optimisation in Musculoskeletal Physiotherapy: A Narrative Review of Biomechanical, Psychological, and Systemic Readiness

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Abstract- Background: Musculoskeletal (MSK) conditions are a leading cause of global disability, with conservative management as the primary intervention. However, standard physiotherapy protocols often overlook baseline readiness, leading to poor adherence, high dropout rates, and suboptimal outcomes. While prehabilitation is established in surgical contexts, "pre-conservative optimisation "preparing patients prior to conservative care remains underexplored. Methods: This narrative review synthesised literature from PubMed, Embase, and CINAHL (January 2014–August 2026) using search terms related to musculoskeletal disorders, conservative management, patient readiness, and optimisation. Studies were thematically analysed to identify key factors influencing rehabilitation success prior to routine care. Results: Three critical dimensions of pre-conservative readiness were identified: 1) Biomechanical Readiness, establishing baseline load tolerance to prevent "boom-bust" cycles; 2) Psychological Readiness, leveraging Pain Neuroscience Education (PNE) and shared decision-making to reduce catastrophising and build self-efficacy; and 3) Systemic Readiness, optimising nutritional status for tissue healing and pain modulation. Integrating these dimensions creates a stable foundation for progressive therapeutic loading. Conclusion: Pre-conservative optimisation represents a vital paradigm shift in orthopaedic physiotherapy. Prioritising baseline readiness before standard protocols can enhance adherence, minimise symptom flares, and improve long-term outcomes. Future research should develop standardised assessment tools and evaluate the cost-effectiveness of this model.

Keywords: Musculoskeletal Physiotherapy; Pre-conservative Care; Patient Readiness; Pain Neuroscience Education; Load Tolerance; Narrative Review.

I. INTRODUCTION

Multifactorial prehabilitation significantly improves post-operative functional outcomes and reduces complications in surgical populations [1]. In patients undergoing knee and hip replacement, it also enhances pain relief, long-term function, and health-related quality of life and muscle strength. [2,3], while umbrella-level evidence indicates potential benefits for those undergoing cancer surgery [4]. While this preparatory model is well-established in surgery, conservative musculoskeletal (MSK) management relies primarily on physical activity and exercise as universally recommended first-line interventions to improve pain and physical function [5, 6], though long-term benefits are contingent upon sustained patient adherence [6].

Despite the proven efficacy of these conservative protocols, achieving optimal recovery is heavily dependent on treatment adherence, which is strongly influenced by psychological factors such as self-efficacy, self-motivation, and social support [7, 8].

Currently, no synthesized framework exists for applying preparatory 'readiness' principles to conservative MSK care prior to initiating formal therapy. Therefore, this narrative review aims to explore the concept of pre-conservative optimisation in musculoskeletal physiotherapy by synthesising existing evidence on baseline load tolerance, pain neuroscience education, nutritional readiness, and shared decision-making to propose a framework for optimising patient readiness before standard conservative care protocols.

II. METHODS

Search Strategy and Selection Criteria

A structured narrative review was conducted across PubMed, CINAHL, and Embase for articles published between January 2014 and August 2026. Search terms included: "musculoskeletal," "osteoarthritis," "prehabilitation," "readiness," "pain neuroscience education," "shared decision making," "exercise adherence," "nutritional prehabilitation," and "load tolerance."

Inclusion Criteria and Evidence Hierarchy

Literature selection followed a predefined hierarchy of evidence to prioritize high-level synthesis while allowing original interventional and observational data where systematic reviews were lacking. The criteria were structured as follows:

Primary Priority (Level I Evidence): Systematic reviews, meta-analyses, and umbrella reviews examining conservative MSK interventions, pain neuroscience education (PNE), exercise adherence, or digital health.

Secondary Priority (Level II/III Evidence): Observational designs, prospective cohorts, and randomized controlled trials evaluated when systematic reviews were unavailable or lacked specific protocol parameters.

Tertiary Priority (Level IV Evidence / Expert Guidelines): Narrative reviews, cross-sectional surveys, and clinical guidance included to address contextual parameters, regional adherence barriers, or conceptual frameworks.

Study Selection Criteria:

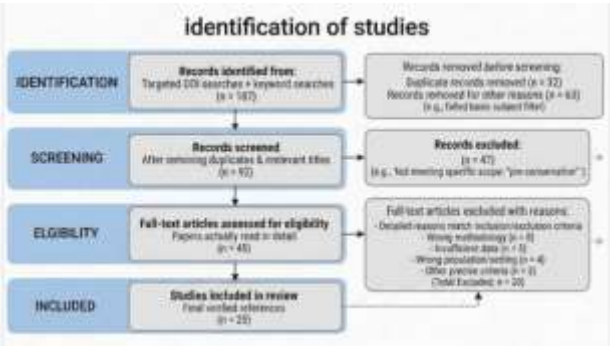
Inclusion: Peer-reviewed English-language articles published between January 2014 and August 2026 involving adult human populations (≥18 years) receiving conservative musculoskeletal care or prehabilitation. Surgical prehabilitation studies were included strictly for comparative, parallel-concept evaluation.

Exclusion: Non-English publications, case reports, editorials, narrative commentaries, studies lacking full-text availability, and protocols without reported outcomes.

Flow Diagram of Search Strategy

The search strategy yielded a total of 240 initial records (PubMed: 110; Embase: 85; CINAHL: 45). After removing 45 duplicates, 195 records were screened by title and abstract. A total of 140 records were excluded at this stage due to irrelevant topic (n=80), surgical-only populations without conservative parallels (n=35), or pediatric/non-human studies (n=25). Fifty-five full-text reports were sought for retrieval; 3 were unavailable due to paywall restrictions. The remaining 52 full-text articles were assessed for eligibility, and 27 were excluded for non-English language (n=8), case reports/editorials/narrative commentary (n=11), and lack of relevant outcomes or standardized protocol data (n=8). Ultimately, 25 studies were included in the final narrative synthesis.

The detailed process of literature identification and screening is summarized in the flowchart



Keywords

Key search strings included: ("musculoskeletal disorders" OR "orthopaedic physiotherapy" OR "conservative management") AND ("prehabilitation" OR "patient readiness" OR "optimisation" OR "optimization") AND ("exercise therapy" OR "pain neuroscience education" OR "shared decision making").

Data Synthesis

A narrative synthesis approach was adopted. Literature was thematically categorised into three primary domains: Biomechanical and Physical

Readiness, Psychological and Educational Readiness, and Lifestyle and Systemic Readiness.

As Thematic Synthesis of Pre-Conservative Optimization Evidence shown in the Table-1

III. RESULTS: THEMATIC FINDINGS

Table 1: Thematic Synthesis of Pre-Conservative Optimization Evidence

Thematic Domain	Key Concept	Supporting Evidence (Author, Year)	Clinical Relevance to Pre-Conservative Care
Biomechanical Readiness	Physical Activity in OA	Zampogna et al. (2020) [5]	Establishes activity as the primary conservative intervention requiring baseline readiness.
	Exercise Prescription Variables	Arora et al. (2024)[9]	Defines how dose/frequency impacts pain outcomes before formal rehab.
	Biopsychosocial Exercise Approach	Booth et al. (2017)[10]	Frames early movement to reduce fear-avoidance and improve tolerance.
Psychological Readiness	Pain Neuroscience Education (PNE)	Watson et al. (2019)[11] Cuenca-Martínez et al. (2023) [12]	Reduces threat perception and catastrophizing prior to loading tissues.
	Shared Decision-Making (SDM)	Hacquebord et al. (2025);[13] Rose et al. (2017) [14]	Enhances adherence and self-efficacy through collaborative goal-setting.
Systemic Readiness	Nutritional Prehabilitation	Skořepa et al. (2024) [15]	Ensures biochemical readiness for tissue repair and anabolic response to exercise.
Implementation & Future	Telehealth Delivery	Guida et al. (2024) [16]	Offers scalable solutions for delivering pre-conservative modules remotely.

Table-I categorises key domains required for baseline patient preparation before initiating conservative care. It emphasises the integration of physical readiness, psychological reframing, systemic support, and modern delivery models to establish a foundation for formal rehabilitation. Table is originally synthesised by author from available reference literature.

Biomechanical and Physical Readiness

While physical activity serves as a universally recommended first-line conservative treatment for conditions like hip and knee osteoarthritis [5], its clinical efficacy is not automatic but strictly contingent upon precise individualised dosing [6]. Bennell et al emphasize that because exercise benefits are comparable to pharmacological interventions yet carry fewer side effects, prescription must be Patient- centred and tailored to specific assessment findings to ensure safety and adherence [6] Recent systematic review evidence demonstrates that exercise prescription variables including frequency, intensity, volume, and progression rate must be individually calibrated to achieve meaningful pain reduction and functional improvement, as generic protocols frequently fail to account for patient-specific dose-response thresholds [9].

Furthermore, effective exercise prescription for chronic musculoskeletal pain requires a biopsychosocial approach that simultaneously addresses physical capacity, psychological barriers such as fear-avoidance beliefs, and social determinants of engagement [10]. Furthermore, viewing exercise through the lens of a polypill for chronic disease underscores that generic recommendations are insufficient. Instead, clinicians must establish baseline conditioning and exclude contraindications before initiating formal progressive rehabilitation [17]. This approach ensures that the dosage, which encompasses frequency, intensity, and volume, is optimized for the individual physiological capacity. Doing so

maximizes long term functional gains while minimizing the risk of adverse events or symptom exacerbation [6, 17].

Pre-Conservative Biomechanical Optimization Strategies as shown in Table-2

Table- II: Pre-Conservative Biomechanical Optimization Strategies

Strategy	Mechanism of Action	Clinical Application in Pre-Conservative Phase	Supporting Evidence
Individualized Exercise Prescription	Matches tissue capacity to prevent overload	Establishes safe baseline load tolerance before formal rehab	Arora et al.[9]
Biopsychosocial Framing	Addresses fear-avoidance alongside physical capacity	Reduces kinesiophobia during early movement exposure	Booth et al.[10]
Sub-threshold Activity	Prevents acute flare-ups	Stabilizes daily activity; breaks the "boom-bust" cycle	Zampogna et al.[5]
Movement Re-education	Corrects compensatory patterns	Ensures efficient force transfer before heavy strengthening	Luan et al.[17]

Table-II Summarises targeted physical strategies designed to safely increase tissue tolerance and correct dysfunctional movement patterns prior to heavy exercise loads. Focuses on minimising flare-ups, building baseline capacity, and overcoming movement-related fear through structured, sub-threshold exposure. Table is originally synthesised by author from available reference literature.

Psychological readiness determines whether patients successfully engage with conservative care. Pain neuroscience education (PNE) has demonstrated efficacy in reducing musculoskeletal pain, disability, pain catastrophizing, and kinesiophobia in the short to medium term when integrated with exercise-based or multimodal interventions [11, 12], though evidence for PNE as a standalone intervention remains inconclusive [12]. Teaching patients about pain provides a practical, evidence-based tool for clinicians to reduce threat perception and reconceptualised symptoms [18].

Furthermore, shared decision-making (SDM) is an essential component of modern physiotherapy practice, bridging the gap between clinical evidence and patient values [13, 19]. Integrating SDM facilitates collaborative goal-setting, which is critical for aligning patient expectations, enhancing treatment adherence, and fostering the self-efficacy required before the demands of formal therapy begin [14].

Despite the clinical importance of psychological readiness, validated measurement tools specifically for conservative care remain limited. Existing assessment frameworks such as the Patient Attitudes and Beliefs Scale (PABS) and self-efficacy measures from the pain self-efficacy questionnaire (PSEQ) may serve as proxies until context-specific readiness scales are developed. Future research should prioritize developing composite readiness batteries that integrate validated psychological and physical assessment components [20].

Lifestyle and Systemic Readiness

"Given the significant impact on shortening length of stay and reducing severe complications, prehabilitation should be encouraged in frail, older and high-risk adult patients undergoing major abdominal surgery [15].Addressing systemic readiness ensures the patient's body is biochemically and physiologically prepared to respond to the mechanical stimuli of physiotherapy, maximising the anabolic response to exercise.

As Systemic Readiness Screening and Interventions shown in Table-3

Table- III: Systemic Readiness Screening and Interventions

Systemic Factor	Screening Method	Pre-Conservative Intervention	Expected Rehabilitation Benefit	Supporting reference(S)

Nutritional Status	Brief dietary recall or screening tool	Guidance on protein timing and hydration	Optimized muscle hypertrophy and tissue repair	Skořepa et al. (2024)[15].
Readiness to Change	Motivational interviewing	Collaborative goal-setting	Enhanced adherence to home exercise programs	Rose et al. (2017)[14], Hacquebord et al. (2025)[13]
Health Literacy	Teach-back method	Simplified PNE and SDM discussions	Reduced catastrophizing and improved self-efficacy	Louw & Riera-Gilley (2024)[18], Cuenca-Martínez et al. (2023)[12]

Table-III shows Details screening modalities and non-pharmacological interventions aimed at addressing underlying metabolic, behavioural, and educational factors. Optimising these systemic variables prior to therapy enhances patient engagement, self-efficacy, and long-term tissue repair outcomes. Table is originally synthesised by author from available reference literature.

IV. DISCUSSION

The synthesis of current literature reveals that standard conservative care success is often limited by unaddressed readiness deficits. Long-term clinical benefits of exercise in conservative musculoskeletal management are contingent upon sustained patient adherence, as evidence demonstrates that symptomatic improvements decline significantly within six months of program cessation when regular participation is not maintained. Exercise programs must be individualised through shared decision-making, taking into account specific barriers and facilitators to long-term adherence for each patient [6].

In community rehabilitation settings, high-quality shared decision-making (SDM) was reported in only 26.4% of patient-provider dyads, with functional goal setting remaining similarly low—19.6% of patients set no care goals, and only 11.4% established goals tied to meaningful life roles. Furthermore, engagement in SDM was socioeconomically stratified, showing a positive clinical association with higher total family income ($p=0.045$), while lower patient-perceived SDM quality directly correlated with reduced recognition of patient preferences during treatment [21]

Although physiotherapists generally view shared decision-making (SDM) favourably, a significant gap exists between these positive attitudes and actual clinical practice due to a widespread lack of prior knowledge. Consequently, most practitioners continue to rely on a predominantly paternalistic approach in routine care. To bridge this gap, targeted efforts are needed across research, clinical practice, and health policy to integrate SDM into physical therapy [22]. Even though advanced practice physiotherapists and first contact physiotherapists of Uk have good knowledge and practice of SDM, barriers like time constraints, lack of patient education resources, limited access to decision aids, and treatment pathway restrictions affects its implications [23].

To improve accessibility, Technology-delivered prehabilitation significantly improved preoperative function, reduced fall risk, and decreased postoperative stiffness and pain in candidates awaiting knee or hip replacement [16]. Mechanisms underlying PNE involve the modulation of central pain processing and reduction of threat values [12]. Clinically, this reconceptualisation of pain is hypothesized to serve as a cognitive primer that enhances engagement with subsequent physical interventions, though direct mechanistic validation of this sequencing effect remains an area for future research [24].

Long-term benefits of conservative care are heavily dependent on addressing known adherence barriers such as treatment burden, low self-efficacy, and negative illness beliefs early in the therapeutic process [8]. and utilising broader digital health interventions where appropriate [25]. Finally, evaluating adherence barriers within specific regional contexts is essential to tailor interventions

to local resources; for example, recent evidence from India identifies economic constraints, poor health literacy, and cultural obligations as key factors driving non-compliance with active physiotherapy guidelines [26].

Clinical Implications

Clinicians should consider introducing a structured "readiness phase" during the waiting period between referral and the first formal appointment. This phase would incorporate baseline load tolerance exercises, brief PNE sessions, and collaborative goal-setting. This approach aligns with biopsychosocial models and may reduce early ropout by building self-efficacy before formal therapy begins.

Proposed Pre-Conservative Optimization Screening Algorithm:

Step 1: BIOMECHANICAL SCREENING

- Assess baseline load tolerance using standardized functional tests
- (sit-to-stand, step test, walking distance)
- Screen for symptom fluctuation patterns (boom-bust cycles) [6, 17]
- If deficits present → Proceed to Step 2

Step 2: PSYCHOLOGICAL READINESS ASSESSMENT

- Administer brief PNE screening (5-minute educational video or handout)
- Assess pain catastrophizing using Pain Catastrophizing Scale (PCS) or abbreviated version [12]
- Evaluate shared decision-making readiness via collaborative goal-setting interview [13, 19]
- If psychological barriers present → Initiate targeted PNE and goal alignment

Step 3: SYSTEMIC/LIFESTYLE SCREENING

- Screen nutritional status (brief diet history, protein intake) [15]
- Assess sleep quality and psychosocial stressors
- Identify socioeconomic barriers to adherence [26]
- Clinical Decision Rule:

If 2 or more domains show readiness deficits → Implement 2–4-week pre-conservative phase before standard therapy initiation. If 0-1 domain affected → Proceed with standard care with selective readiness enhancements.

Implementation Barriers to Address:

- **Time constraints:** Use brief screening tools (5-10 minutes maximum)
- **Resource availability:** Develop template-based readiness assessments
- **Training needs:** Provide physiotherapists with 2-hour SDM workshop
- **Patient acceptability:** Frame readiness phase as "preparation for success," not delay

Study bias

This narrative review synthesizes evidence from diverse study designs, including systematic reviews and observational studies. Several potential biases warrant consideration. First, extrapolation bias exists when applying surgical prehabilitation findings to conservative MSK care. Second, heterogeneity bias is evident in PNE literature due to varied protocols. Third, reporting bias may influence SDM studies relying on self-reported clinician attitudes. Acknowledging these limitations ensures a transparent scientific reasoning process and highlights the need for future high-quality RCTs in this specific population.

Limitations and Future Scope

- **Limitations of this Review**

As a narrative review, this study does not provide a quantitative meta-analysis. The heterogeneity of the included literature limits definitive causal conclusions regarding the magnitude of benefit for pre-conservative optimisation. Additionally, the concept of "readiness" lacks universally validated measurement tools in conservative care settings, making it difficult to compare findings across different studies directly.

Future Scope of Research

To advance this field, future research should prioritize the following areas:

Development of Validated Screening Tools: There is an urgent need to develop and validate brief, clinically feasible "Readiness Assessment Batteries" that integrate biomechanical, psychological, and lifestyle factors into a single composite score.

Randomized Controlled Trials (RCTs): High-quality RCTs are required to compare standard conservative care against a "Pre-Conservative Optimisation + Standard Care" model, measuring adherence rates and long-term pain scores.

Telehealth Integration: Given the rise of digital health, future studies should explore the efficacy of delivering pre-conservative optimisation modules via telehealth platforms to improve accessibility and scalability in busy outpatient settings.

Regional Context: Further research is needed to evaluate patient readiness and adherence barriers in specific healthcare settings to tailor interventions to local resource availability.

V. CONCLUSION

Pre-conservative optimisation represents a significant paradigm shift in musculoskeletal physiotherapy. By prioritising biomechanical load tolerance, psychological readiness, and systemic health before initiating standard conservative protocols, clinicians can enhance patient adherence, improve functional outcomes, and potentially reduce the burden of chronic musculoskeletal disability. Further research should standardize readiness assessments and evaluate the cost-effectiveness of this model in diverse clinical settings.

REFERENCES

1. McIsaac DI, Kidd G, Gillis C, et al. Relative efficacy of prehabilitation interventions and their components: systematic review with network and component network meta-analyses of randomised controlled trials. BMJ 2025; 388: e081164.
2. Punnoose A, Claydon-Mueller LS, Weiss O, et al. Prehabilitation for Patients Undergoing Orthopedic Surgery. JAMA Netw Open 2023; 6: e238050.
3. McIsaac DI, Gill M, Boland L, et al. Prehabilitation in adult patients undergoing surgery: an umbrella review of systematic reviews. Br J Anaesth 2022; 128: 244–257.
4. Vervullens S, Meert L, Baert I, et al. Prehabilitation before total knee arthroplasty: A systematic review on the use and efficacy of stratified care. Ann Phys Rehabil Med 2023; 66: 101705.
5. Zampogna B, Papalia R, Papalia GF, et al. The Role of Physical Activity as Conservative Treatment for Hip and Knee Osteoarthritis in Older People: A Systematic Review and Meta-Analysis. J Clin Med 2020; 9: 1167.
6. Bennell KL, Dobson F, Hinman RS. Exercise in osteoarthritis: Moving from prescription to adherence. Best Pract Res Clin Rheumatol 2014; 28: 93–117.
7. Jack K, McLean SM, Moffett JK, et al. Barriers to treatment adherence in physiotherapy outpatient clinics: A systematic review. Man Ther 2010; 15: 220–228.
8. Essery R, Geraghty AWA, Kirby S, et al. Predictors of adherence to home-based physical therapies: a systematic review. Disabil Rehabil 2017; 39: 519–534.
9. Arora NK, Donath L, Owen PJ, et al. The Impact of Exercise Prescription Variables on Intervention Outcomes in Musculoskeletal Pain: An Umbrella Review of Systematic Reviews. Sports Medicine 2024; 54: 711–725.
10. Booth J, Moseley GL, Schiltenwolf M, et al. Exercise for chronic musculoskeletal pain: A biopsychosocial approach. Musculoskeletal Care 2017; 15: 413–421.
11. Watson JA, Ryan CG, Cooper L, et al. Pain Neuroscience Education for Adults With Chronic Musculoskeletal Pain: A Mixed-Methods Systematic Review and Meta-Analysis. J Pain 2019; 20: 1140.e1-1140.e22.
12. Cuenca-Martínez F, Suso-Martí L, Calatayud J, et al. Pain neuroscience education in patients with chronic musculoskeletal pain: an umbrella review. Front Neurosci; 17. Epub ahead of print 24 November 2023. DOI: 10.3389/fnins.2023.1272068.

13. Hacquebord S, Kiers H, van der Wees P, et al. Shared Decision-Making in Physical Therapist Care for People With Shoulder Problems: An Observer-Based Analysis of Audio-Recorded Consultations. Phys Ther; 105. Epub ahead of print 2 June 2025. DOI: 10.1093/ptj/pzaf047.
14. Rose A, Rosewilliam S, Soundy A. Shared decision making within goal setting in rehabilitation settings: A systematic review. Patient Educ Couns 2017; 100: 65–75.
15. Skořepa P, Ford KL, Alsuwaylihi A, et al. The impact of prehabilitation on outcomes in frail and high-risk patients undergoing major abdominal surgery: A systematic review and meta-analysis. Clinical Nutrition 2024; 43: 629–648.
16. Guida S, Vitale JA, Swinnen E, et al. Effects of Prehabilitation With Advanced Technologies in Patients With Musculoskeletal Diseases Waiting for Surgery: Systematic Review and Meta-Analysis. J Med Internet Res 2024; 26: e52943.
17. Luan X, Tian X, Zhang H, et al. Exercise as a prescription for patients with various diseases. J Sport Health Sci 2019; 8: 422–441.
18. Louw A, Riera-Gilley V. Pain Neuroscience Education: Teaching People About Pain. J Pain Palliat Care Pharmacother 2024; 38: 292–301.
19. Hoffmann TC, Lewis J, Maher CG. Shared decision making should be an integral part of physiotherapy practice. Physiotherapy 2020; 107: 43–49.
20. Takasaki H, Hall T. A Japanese version of the Patient Attitudes and Beliefs Scale for patients with musculoskeletal disorders. Physiother Theory Pract 2020; 36: 1438–1446.
21. Topp J, Westenhöfer J, Scholl I, et al. Shared decision-making in physical therapy: A cross-sectional study on physiotherapists' knowledge, attitudes and self-reported use. Patient Educ Couns 2018; 101: 346–351.
22. Manhas KP, Olson K, Churchill K, et al. Measuring shared decision-making and collaborative goal setting in community rehabilitation: a focused ethnography using cross-sectional surveys in Canada. BMJ Open 2020; 10: e034745.
23. Thompson JH, Thompson J, Bailey S. Shared decision-making in advanced physiotherapy and first contact physiotherapy management of adults with musculoskeletal disorders in the United Kingdom: An online cross-sectional survey. J Eval Clin Pract 2024; 30: 1297–1308.
24. Sánchez-Robalino A, Sinchi-Sinchi H, Ramírez A. Effectiveness of Pain Neuroscience Education in Physical Therapy: A Systematic Review and Meta-Analysis. Brain Sci 2025; 15: 658.
25. Valentijn PP, Tymchenko L, Jacobson T, et al. Digital Health Interventions for Musculoskeletal Pain Conditions: Systematic Review and Meta-analysis of Randomized Controlled Trials. J Med Internet Res 2022; 24: e37869.
26. Ganesh GS, Khan A, Khan A. Factors contributing to non-compliance with active physiotherapy guidelines among chronic low back pain patients in India. Arch Physiother 2024; 155–169.