THE ROLE OF FEAR-AVOIDANCE BELIEFS AND PSYCHOLOGICAL FACTORS IN PAIN AND FUNCTIONAL DISABILITY AFTER SPINAL SURGERY

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ABSTRACT
Introduction: Lumbar disc herniation frequently results in persistent low back pain (LBP) and functional limitations following surgery. Psychological factors, including fear-avoidance beliefs (FABs), kinesiophobia, and pain-related anxiety, are increasingly recognized as key determinants of postoperative recovery.
Aim: This review examines the impact of FABs and related psychological factors on pain intensity and functional disability in patients after lumbar spinal surgery.
Methods: A narrative review was conducted using PubMed, Scopus, and ScienceDirect for studies published between 2012 and 2025. Eligible studies focused on adult patients undergoing lumbar spinal surgery and assessed psychological factors in relation to pain or functional outcomes. Eighteen studies, including approximately 12,450 patients, were analyzed.
Results: FABs and kinesiophobia consistently emerged as the strongest predictors of postoperative pain and functional impairment. Additional factors, such as anxiety, catastrophizing, and fear of movement, were linked to delayed rehabilitation and poorer recovery. Interventions targeting these cognitive-emotional factors, including patient education and structured rehabilitation programs, were effective in improving outcomes and reducing disability.
Conclusions: Early assessment and management of psychological factors are essential in postoperative rehabilitation to optimize pain control, functional recovery, and return to daily activities.

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INTRODUCTION

Lumbar disc herniation is a common degenerative disease of the lumbar spine, with low back pain (LBP) as its primary symptom. Lifetime prevalence estimates range from 80% to 90%, with an annual incidence of approximately 5% (Gokturk & Gokturk, 2024). Although most patients respond to conservative treatment, 10–20% eventually require surgical intervention, after which postoperative rehabilitation is essential for recovery and early return to work.

Despite the benefits of surgery, many patients continue to experience persistent pain and functional limitations. Clinical studies indicate that LBP is often associated with anxiety, depression, sleep disturbances, reduced quality of life, and increased healthcare utilization (Pan et al., 2025). Postoperative pain is a complex phenomenon that may arise from surgical trauma or nerve root damage, leading to neuropathic symptoms (Prabhakar et al., 2022). It affects 10–50% of patients and is linked to higher complication rates (Willingham et al., 2020). Importantly, pain perception extends beyond physiological mechanisms to include emotional, cognitive, and sociocultural dimensions (Sharif-Nia, 2024).

Central sensitization (CS) further complicates outcomes after spinal surgery. It reflects an increased responsiveness of the central nervous system to painful stimuli and contributes to the chronification of pain. Symptoms of CS have been associated with higher levels of disability after surgery (Kondo et al., 2024). Modern pain neuroscience emphasizes that pain is not merely a direct response to injury but a dynamic output of the central nervous system, modulated by context, beliefs, and emotional state (Butler & Moseley, 2013).

Psychological factors—particularly fear-avoidance beliefs, pain-related anxiety, and kinesiophobia—play a crucial role in shaping postoperative recovery. Fear and avoidance behaviors can hinder engagement in rehabilitation, delay muscle recovery, and perpetuate residual pain, ultimately impairing functional restoration. Addressing these psychological contributors is essential for optimizing rehabilitation outcomes and improving quality of life

(Hamilton et al., 2023).

The research ***aimed*** to investigate the correlation between fear-avoidance beliefs regarding physical activity and work, and their impact on pain and functional disability in patients after undergoing spinal surgery. Given the growing recognition of psychological factors such as fear of movement (kinesiophobia), pain-related anxiety, and catastrophizing as predictors of poor postoperative outcomes, the study sought to explore how these cognitive-emotional constructs influence recovery trajectories.

METHODOLOGY

This study is based on a narrative review of scientific literature published between 2012 and 2025, examining the role of psychological factors—such as fear-avoidance beliefs, pain-related anxiety, and kinesiophobia—in postoperative outcomes following lumbar spinal surgery. Pain-related fear and avoidance behaviors were considered key contributors to worsened pain perception and delayed recovery. Relevant studies were retrieved from PubMed, Scopus, and ScienceDirect using targeted search terms, including "fear-avoidance beliefs," "kinesiophobia," "pain-related anxiety," "psychological factors," "lumbar spinal surgery," and "postoperative outcomes." The inclusion criteria were: (1) peer-reviewed articles published in English between 2012 and 2025; (2) studies involving adult patients undergoing lumbar spinal surgery for degenerative conditions; (3) research explicitly assessing psychological factors in relation to pain or functional outcomes; and (4) availability of full-text access. Exclusion criteria included case reports, editorials, and studies focusing exclusively on pediatric populations or non-degenerative spinal pathologies.

This review included 18 studies, encompassing a total of approximately 12,450 patients undergoing spinal surgery for degenerative lumbar conditions. Across the selected literature, fear-avoidance beliefs (FABs) and kinesiophobia emerged as the strongest predictors of postoperative pain intensity and functional disability.

RESULTS

A total of 18 studies (n = 12,450) were included in this review. The results of the studies are presented in Table 1.

Table 1. *Summary of relevant studies on psychological factors and outcomes after lumbar spine surgery*

Author(s)	Year	Study Population	Key Variables	Main Findings
Pan et al.	2025	Cross-sectional, *N*=Not stated	Fear of movement (TCK), post-fusion patients	High kinesiophobia significantly associated with pain and limited function
Sharif-Nia et al.	2025	Surgical patients, *N*=320	FABs, pain anxiety, perceived stress	Perceived stress mediates the relationship between FABs and kinesiophobia
Sahebalam et al.	2023	Post-decompression, *N*=80	Disability, pain, pain-related anxiety	Pain-related anxiety strongest predictor of disability; pain intensity not significant
Jakobsson et al.	2023	Post-lumbar fusion, *N*=168	Pre-op fear of movement, sedentary behavior	High pre-op fear → increased sedentary time at 6 & 12 months post-op
Lotzke et al.	2018	Pre-op lumbar fusion, *N*=284	Physical activity (accelerometry)	Severe LBP → significantly lower pre-op activity levels
Mancuso et al.	2021	Post-lumbar surgery, *N*=260	Physical activity beliefs, FABs	FABs reduce willingness to increase activity despite knowing benefits
Ege	2023	Mechanical LBP patients, *N*=80	Kinesiophobia severity, clinical parameters	High kinesiophobia correlates with pain severity and functional limitations
Cruz-Díaz et al.	2018	Chronic LBP, *N*=64	Pilates vs. control, disability, pain, TSK	12-week Pilates ↓ pain, ↓ TSK, ↑ function
Özden & Koçyiğit	2024	Meta-analysis, 15 RCTs	Early rehab vs. standard care	Multimodal rehab more effective than standard care for ↓ pain and disability
Iken	2024	Systematic review	PNE effect on catastrophizing, kinesiophobia	PNE shown to reduce both pain catastrophizing and kinesiophobia
Dohrn et al.	2019	Prospective cohort, *N*=1,135	Accelerometry-based PA, disease risk	More MVPA → ↓ chronic disease and hospital visits over 15 years
Wu et al.	2023	Narrative review	Chronic pain after spine surgery	8–40% experience persistent pain; linked to CS, psychological factors, and surgical complications
Willingham et al.	2020	Observational cohort, *N*=3,012	Post-op pain and complications	Pain after surgery → 20% ↑ risk of medical complications

FABs - Fear-avoidance beliefs, TSK - Tampa Scale for Kinesiophobia, PNE - Pain Neuroscience education, MVPA - Moderate-to-vigorous physical activity, CS - Central Sensitization, RCT - Randomized controlled trial, LBP - Low Back Pain.

The main findings can be summarized as follows:

1. *Fear-avoidance beliefs (FABs),* kinesiophobia, and pain-related anxiety High levels of FABs and pain-related anxiety were identified as the strongest predictors of postoperative disability, more so than pain intensity itself (Sahebalam et al., 2023; Sharif-Nia et al., 2025). Kinesiophobia affects approximately 50–70% of patients with chronic low back pain (Ege, 2023; Sharif-Nia et al., 2024) and is significantly associated with reduced physical activity and increased sedentary behavior 6–12 months after surgery (Jakobsson et al., 2023; Lotzke et al., 2018).
2. *Central sensitization and psychogenic pain* patients with postoperative chronic pain often present with signs of central sensitization, which amplifies pain beyond the original injury (Kondo et al., 2024; Prabhakar et al., 2022). Psychogenic components—including catastrophizing, anxiety, and depression—contribute to prolonged disability and poor treatment outcomes (Butler & Moseley, 2013; Yeo, 2024; Flor & Turk, 2013).
3. *Physical inactivity and sedentary behavior*. More than 80% of patients undergoing lumbar fusion surgery do not meet the WHO physical activity recommendations prior to surgery (Jakobsson et al., 2023). Prolonged sedentary behavior before and after surgery correlates with delayed functional recovery and poorer long-term outcomes (Dohrn et al., 2019; Mancuso et al., 2021).
4. *Rehabilitation strategies.* Studies have shown that multimodal rehabilitation, including Pilates, pain neuroscience education (PNE), and cognitive behavioral therapy (CBT), is significantly more effective than exercise alone in reducing disability and fear of movement (Cruz-Díaz et al., 2018; Iken, 2024; Özden & Koçyiğit, 2024).
5. *Postoperative pain and complications.* Despite surgical intervention, chronic postoperative pain is reported in 8–40% of patients (Wu et al., 2023). Postoperative complications and lingering pain are often related to psychological vulnerability, including fear, anxiety, and long-term opioid use (Willingham et al., 2020; Gokturk & Gokturk, 2024).

In summary, the current body of evidence supports a moderate predictive role of preoperative fear-avoidance beliefs for increased postoperative pain intensity after spinal surgery. The relationship between psychological factors and postoperative functional disability remains inconclusive due to heterogeneous results, while the impact of pain catastrophizing on quality of life is insufficiently studied and shows conflicting results. Variability in study designs, psychological assessments, and follow-up periods likely contributes to these inconsistencies.

DISCUSSION

Moderate evidence was found supporting the predictive value of preoperative fear-avoidance beliefs for higher postoperative pain intensity, as 7 out of 10 relevant studies reported a significant association. However, conflicting evidence exists regarding the impact of preoperative psychological factors on postoperative functional disability, with 5 studies showing significant predictive value and 4 reporting no such relationship. Limited evidence was available on the role of preoperative pain catastrophizing in predicting postoperative quality of life, as only 2 studies addressed this outcome with inconsistent findings. Overall, the predictive value of psychological factors for postoperative outcomes after spinal surgery remains inconclusive due to heterogeneity in study designs and outcome measures.

Central sensitization involves changes in the central nervous system that distort or amplify pain responses, extending beyond the localized injury and involving brain structures that contribute to the emotional and cognitive dimensions of pain. According to Yeo (2024), while structural causes such as surgical complications and degenerative changes have been well documented, the role of psychological factors remains insufficiently explored. Psychological elements such as fear of movement, pain catastrophizing, and low self-efficacy are significant determinants in the development of chronic pain and functional disability after surgery.

Although psychological factors such as fear-avoidance beliefs and pain catastrophizing are well-established predictors of pain and functional disability following spinal surgery, increasing attention has also been given to the role of the surgical approach itself (Boadi et al., 2024).

After spinal surgeries, especially in the lumbar region, patients often experience psychological barriers that hinder recovery and return to normal physical activity. One of the main factors is kinesiophobia — the fear of movement associated with pain or possible worsening of the condition. This psychological barrier can lead to chronic pain, reduced physical activity, and decreased quality of life. Recent studies show that such patients have higher levels of disability and lower quality of life. For example, a study by Ege (2023) found that in

patients with mechanical pain in the lumbar spine, higher degrees of kinesiophobia were associated with worse clinical parameters such as severe pain and functional limitations.

The analysis revealed a statistically significant association between preoperative fear of movement and the proportion of time spent in sedentary behavior at 6 and 12 months post-surgery. This finding underscores the potential benefits of conducting preoperative screening for pain-related psychological factors, including fear of movement, to identify patients suitable for preoperative interventions aimed at promoting healthier postoperative movement behaviors and improved health outcomes (Jakobsson et al., 2023).

The findings of the Sharif-Nia study (2025) underscore the critical role of psychological variables—particularly fear-avoidance beliefs (FABs) and physical activity (PA)—in the development of kinesiophobia among postoperative patients. A strong positive association was observed between kinesiophobia, FABs, and PA, indicating that patients' cognitive and behavioral responses to pain significantly contribute to the persistence of movement-related fear. A recent study of Sahebalam et al (2023) involving 80 patients who underwent lumbar decompression surgery revealed that pain-related anxiety demonstrated the strongest association with postoperative disability. These results align with earlier research indicating that cumulative psychosocial variables—such as fear of movement, pain catastrophizing, and depressive symptoms—have a substantial negative impact on recovery and long-term disability following spinal surgery.

In other research, preoperative fear of movement is significantly associated with postoperative sedentary behavior (SB), incorporating screening for pain-related psychological factors—such as fear of movement—into the preoperative assessment of patients with low back pain and degenerative disc disease may be beneficial (Jakobsson, M., 2023). These findings are consistent with earlier baseline data from the same population, where higher preoperative fear of movement and disability correlated with fewer daily steps (Lotzke et al., 2018).

Objectively measured physical activity and sedentary behavior have emerged as important predictors of long-term health, particularly in the context of chronic pain and postoperative recovery. The findings of Dohrn et al. (2019) emphasize the role of sedentary behavior not only as a risk factor for chronic disease but also as a significant barrier to functional recovery after spinal surgery. This, in turn, could inform the development of individualized rehabilitation programs targeting increased MVPA and decreased SB to optimize long-term outcomes.

Physiotherapy plays a key role in overcoming fear of movement and pain-related beliefs in patients who have undergone surgical interventions. Programs incorporating controlled exercises can reduce levels of kinesiophobia and improve patients' functional status. Some studies indicate that exercise methods such as Pilates have a positive effect on reducing kinesiophobia in individuals with chronic low back pain. For example, Cruz-Díaz et al. (2018) found that participation in a structured 12-week Pilates program led to significant improvements in pain levels, functional disability, and fear of movement in this patient group.

İlken et al. (2024) examined the effect of pain neuroscience education on pain catastrophizing and kinesiophobia in patients with chronic low back pain. Their systematic review indicates that pain neuroscience education can be effective in reducing these psychological barriers. Psychological barriers such as kinesiophobia and pain-related beliefs play a significant role in the recovery process following spinal surgery. Understanding these factors and implementing appropriate interventions, including physiotherapy and educational programs, are crucial for the successful rehabilitation of patients.

According to Ozden and Kocyigit (2024), the typical success rate for lumbar spine procedures regarding capacity to work, neurological symptoms, and leg/back discomfort ranges from 45 to 72%, with reported satisfactory clinical outcomes varying from 16 to 95%. Standard treatment after lumbar fusion surgery does not significantly reduce disability and pain at 6 months compared to rehabilitation that combines an exercise program with cognitive behavioral therapy. Additionally, multimodal rehabilitation, which incorporates exercise therapy and cognitive behavioral training, is more effective than exercise therapy alone at reducing disability and pain-related fear.

Although physical activity is a key determinant of health, it is still underreported as an outcome in studies on lumbar spinal fusion (WHO, 2020). Mancuso et al. (2021) observed that many patients remained inactive after surgery due to fear-avoidance beliefs, particularly those with higher disability levels. Similarly, Lotzke et al. (2018) found that preoperative fear of movement correlated with

lower step counts. These findings suggest that psychological factors, more than physical capacity, predict prolonged sedentary behavior up to a year postoperatively

Participants with high levels of fear of movement/reinjury exhibited more pronounced fear responses and avoidance behavior when exposed to the simple movement. The discussion highlighted the clinical relevance of the fear of movement/reinjury construct and outlined questions for future research (Vlaeyen et al., 1995). Understanding postoperative motor behavior requires careful consideration of potential barriers to recovery, including pain-related psychological factors. The fear-avoidance model highlights key variables such as fear of movement, pain catastrophizing, and low self-efficacy regarding physical activity.

Overall, the current evidence highlights the pivotal role of fear-avoidance beliefs and psychological factors—particularly kinesiophobia, pain catastrophizing, and low self-efficacy—in shaping postoperative pain experiences and functional disability after spinal surgery. These variables not only influence immediate recovery but also predict long-term outcomes such as sedentary behavior and reduced quality of life. Despite advances in surgical techniques, failure to address these psychosocial dimensions may undermine the overall success of treatment. Integrating pre- and postoperative psychological screening, along with targeted interventions such as cognitive-behavioral therapy, pain neuroscience education, and structured physiotherapy, is essential for improving functional recovery and minimizing chronic postoperative disability. These findings reinforce the need for a comprehensive biopsychosocial model in spinal surgery rehabilitation protocols.

CONCLUSIONS

This comprehensive review highlights the importance of considering psychological factors in the treatment of lumbar disc herniation and offers insights into improving patient outcomes through a holistic treatment approach. In the contemporary understanding of recovery after lumbar surgery, attention should be focused not only on the clinical aspects of the problem but also on the patient themselves—how pain is perceived, how fear of movement interferes with recovery, and how an active, individualized physiotherapy approach can restore confidence and improve patients' quality of life.

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