DOI: https://doi.org/10.54393/pjhs.v6i4.2450

PAKISTAN JOURNAL OF HEALTH SCIENCES
(LAHORE)
https://thejas.com.pk/index.php/pjhs
ISSN (E): 2790-9352, (P): 2790-9344
Volume 6, Issue 04 (April 2025)

Systematic Review

OPEN ACCESS

Investigating the Impact of Patient Education and Self-Management Programs in Reducing the Burden of Chronic Postoperative Pain

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ARTICLE INFO

Keywords:
Chronic Postoperative Pain, Self-Management Programs, Patient Education, Pain Management

How to Cite:
Aziz, M., Iftikhar, M., Haider, S., Siddique, S., Barkat, M., Munawar, S., Ejaz, M., & Ahsan, S. (2025). Investigating the Impact of Patient Education and Self-Management Programs in Reducing the Burden of Chronic Postoperative Pain: Patient Education and Self-Management Programs in CPSP. Pakistan Journal of Health Sciences, 6(4), 303-312. https://doi.org/10.54393/pjhs.v6i4.2450

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Received date: 21st October, 2024
Revised daate: 10th April, 2025
Acceptance date: 18th April, 2025
Published date: 30th April, 2025

ABSTRACT

Chronic postsurgical pain (CPSP) remains a significant clinical challenge, as many patients experience severe pain after surgery and find conventional management strategies inadequate.These complications adversely affect patients' quality of life, underscoring the need for effective self-management methods. **Objectives:** To investigate the impact of Patient Education and Self-Management Programs in reducing the burden of chronic postoperative pain. **Methods:** A systematic review was conducted of all studies currently published between 2013 and 2023 examining various patient education and self-management interventions for chronic postoperative pain.Data were extracted from relevant studies to assess the effectiveness of these programs across different surgical procedures and follow-up periods. **Results:** The review indicates that interventions such as structured patient education, relaxation exercises, device-assisted therapies, and telehealth applications show promise in reducing CPSP. Compared to control groups, participants who received these interventions reported superior health outcomes and lower levels of discomfort. The benefits were observed across diverse surgical contexts and timeframes. **Conclusions:** It was concluded that tailored patient education and self-management programs play a crucial role in alleviating chronic post-surgical pain, enhancing patient satisfaction, and reducing healthcare costs.

INTRODUCTION

Postoperative pain, enduring the typical healing timeframe, is an adverse consequence of any surgery and is mainly the reason for re-hospitalization [1]. Acute Pain experienced post-surgery is routinely treated with temporarily prescribed opioid medication [2], and may advance to become prolonged discomfort and cause the onset of continuous surgical pain, termed chronic postoperative pain (CPOP) [3].Other possible causes of pain were not considered, including infection and cancer recurrences [4]. CPOP can pose a significant nuisance to patients with a negative impact on patients' QoL [5]. It induces functional limitations and physiological trauma that contribute to healthcare strains and also imposes challenges for surgical teams, eliciting cognitive discomfort [1]. The median occurrence of CPSP is 20-30% post-surgery at 6 to 12 months with a modest decline over time [6]. A significant number of patients, ranging from 10 to 30%, may experience moderate to severe persistent pain a year post-surgery. This figure rises to around 40% for those who undergo thoracic procedures [7].The

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broader spectrum of chronic post-surgical pain affects between 10 and 50% of patients, with a substantial subset of 2 to 10% enduring significant pain [8]. Now, due to technological advancement in surgical settings, patients are discharged sooner after surgery [9]. consequently increasing responsibility on patients for their self-care symptoms that occur post-surgery, such as pain. Insufficient pain management following surgery can result in chronic pain syndromes, hindering physical function and prolonging the healing process [10]. Existing approaches to managing postsurgical pain extensively rely on opioid regimes [11]. However, prolonged opioid use for pain management poses a significant risk of opioid use disorder and fatal overdose. Implementing targeted interventions during and after surgery can reduce the likelihood of transitioning from acute postoperative pain to chronic pain and the subsequent negative consequences of persistent opioid use [12]. The non-pharmacological approach includes preoperative patient education and self-management programs for postoperative pain management. These programs minimize reliance on opioid use, averting adverse effects, and also help patients manage their pain after surgery and maintain good surgical outcomes [13]. Empowering patients through education is a vital component of effective pain management. Surgical patients, in particular, benefit significantly from acquiring the knowledge and skills necessary for self-care, including strategies to alleviate post-operative pain [14]. Based on research, the implementation of patient educational interventions involves a patient treatment plan, information on pain management strategies, and techniques to cope with pain, which are crucial in decreasing postsurgical discomfort and supporting behaviour changes [13]. Self-management programs are important for the improvement of physical function and pain reduction [15]. Implementation of self-management programs encompassing mindfulness-based intervention, Cognitive behavioural therapy, and relaxation techniques provides education on ways to manage pain, medication use, physical therapy, and pain coping skills, equipped with tools to improve chronic pain post-surgery [16]. Moreover, the study is essential to evaluate the influence of patient education and self-management programs and addresses the gaps in existing literature including limited long-term follow-up, heterogeneity in the duration, intervention, and population size. This review provides a comprehensive examination of the effectiveness of different patient education and self-management programs implemented in different surgeries specifically targeting chronic postoperative pain. Additionally, findings from this systematic approach will offer valuable insights to healthcare professionals, and researchers about effective interventions in mitigating the chronicity of postsurgical pain to enhance patient quality of life. While studies have shown promise in reducing postoperative pain through various interventions, inconsistencies in research methodologies and follow-up periods highlight the need for further investigation. This is essential to definitively establish the efficacy and enduring benefits of these programs in managing postoperative pain.

This study aimed to address the following research question: How effective are patient education and self-management programs in reducing the burden of chronic postoperative pain and improving long-term patient-reported outcomes? More precisely, the review will assess the efficacy of such non-pharmacological interventions in minimizing chronic pain, diminishing opioid use, and promoting living well in different surgical populations. Through systematically analyzing existing literature and eliminating shortcomings such as inadequate long-term follow-up or interference in intervention procedures, this research aims to provide definitive evidence not only for how well these programs work but also for their enduring impact. It hopes to influence clinical practice guidance on postoperative pain management and future research into this field.

METHODS

A comprehensive literature search was conducted using electronic databases (e.g., PubMed, Google Scholar) to identify relevant studies published between January 2014 and December 2023.The search strategy adhered to the PRISMA guidelines and focused on original research examining patient education and self-management programs for postoperative pain.Reference lists of the initially identified articles were also reviewed to capture any additional eligible studies.Studies were included or excluded based on predefined criteria ensuring that only high-quality, methodologically sound, and contextually relevant articles were retained. Following the initial database search, 221 studies were retrieved.After screening titles and abstracts for relevance, 131 articles remained. Of these, 81 underwent further evaluation for eligibility, during which duplicated records (n=40) were removed.Ultimately, 41 unique studies were assessed in full, and 27 were excluded for not directly addressing the impact of patient education and self-management interventions on postoperative pain. As a result, 14 studies met the final inclusion criteria and were included in this qualitative synthesis.A systematic and structured approach was then implemented to ensure data accuracy and consistency. Two reviewers independently extracted pertinent information such as study design, sample size, interventions, and outcome measures using a standardized spreadsheet developed for this review.To enhance reliability, the reviewers conducted a calibration

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exercise on a subset of the included studies, resolving any discrepancies through discussion or, when necessary, consulting a third reviewer. Periodic cross-checks against the original articles further minimized the risk of data extraction errors. This rigorous process aimed to reduce bias and improve the reproducibility of the review's findings. The PRISMA flowchart provides a visual summary of the selection process described above, detailing the transition from the initial search results to the final pool of 14 included Identification of studies via databases studies (Figure 1).

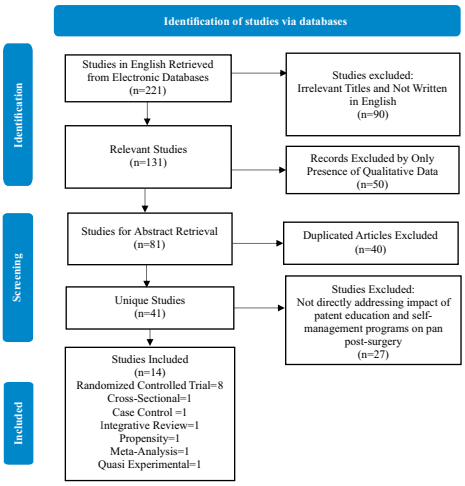

Figure 1: Identification of Studies via Database

RESULTS

The results show the impact of different patient education and self-management programs on CPOP in different surgeries (Table 1).

Table 1: Summary of Different Patient Education and Self-Management Programs' Impact on Chronic Postoperative Pain

Type	Participants groups	Intervention	Surgery	Postoperative Pain Score	Pain Measuring	Key outcomes	Study Type	References
Patient Education	CON = 40	Standard educational information to CON	Lumbar Spinal	Lower in the INT group	VAS	Effective	Randomized trial with blocK design	[17]
	INT = 42	A booklet with rich information for INT				Reduced postoperative pain and anxiety in the INT group		
Patient Education	200 INT/CON	No intervention to CON	Cardiac	Lower in the INT group/ higher in the CON	NRS	Effective	Pilot randomized trial	[18]
		Informational booklet to INT				Reduced postoperative pain in the INT group		
Patient Education	NR	Preoperative patient education	Elective	Lower in the INT group/ higher in the CON	NR	Reduced intensity and severity of post-operative pain in the INT group	Integrative review	[19]
						Reduced opioid consumption in the INT group		
						Higher satisfaction level in the INT group		
						INT group gain a higher knowledge of pain management		

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Patient Education/Self-management	HC = 71 INT = 51	APS to INT group No APS to CON	Cytoreductive surgery	Lower in the INT group/ higher in the CON	Post-operative days 0-3	Reduced opioid consumption in the INT group by 50% Pain management	Propensity-matched retro-spective	[20]
Pain Education	CON = 40 / INT = 42	Usual care /education session to CON HREI to INT group Call before surgery	Hernia repair surgery	Lower in INT group / Higher in CON	VAS,NRS	Improve patient pain and function	Randomized controlled trial	[21]
Patient Empowerment/ Patient Education	CON = 326 INT = 326	Standard information to CON Informational booklet & diary for INT group	Oncologic surgery	Lower in the INT group/ higher in the CON	Post-operative day 01	Enhance the quality of care in terms of pain after surgery	Randomized controlled trial	[22]
Communication in pain management	CON = 66 /INT = 69	No education to CON /filled hydrocodone Visual/ oral/ written education to INT group Education on body response to pain How endorphins relieve pain Negative effects of narcotics INT group declined hydrocodone	Outpatient surgery	Lower pain and shorter duration in the INT group as compared to the CON	Days/D Duration	Effective Reduced post-operative narcotic analgesia	Case-control	[23]
Self-management	CON = 62 /INT = 65	Usual care to CON MBSR with qualified MBSR facilitator to INT group 8-week-long program before surgery 2.5-hour weekly session and 7.5-hour session for a full day Booster day workshop after 3 months of surgery	Hip and knee arthroplasty	Reduction in pain Units in the INT group at 12 months after surgery	WOMAC / 3 and 12 months	Improve patient post-operative pain and function at 12 months post-operative.	Single-site randomized trial	[24]
Self-management	CON = 39 /INT = 79	Usual care to CON Mob to INT group Divert attention from towards pleasant sensations /120 min session.	Hip and knee arthroplasty	Reduction in pain Units in the INT group on days 14, 21, 28	A numeric rating scale of 0 to 10	Effective Mob decreased pain score before surgery. Both Mop & Mob reduced opioid use.	Single-site randomized trial	[25]
Self-management	CON/INT	Cognitive Behavioral Therapy	Arthroplasty	No difference at ≤12 months	NRS.VAS WOMAS	Improve the quality of life to some extent.	Systematic review and analysis	[26]
Self-management	60	Relaxation Exercise	Abdominal surgery	Reduced pain levels	VRS	Reduced pain levels after relaxation exercise 71.1% had less pain	Cross-sectional	[27]

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Self-management	CON = 26 /INT = 26	Novel device use / Navimed	Gynaecological	Higher	NR	Higher pain score on the device than reported to nurses 80% of patients found the device useful	Pro-spective-randomized	[28]
Patient Education/Self-management	CON = 99 /INT = 114	Telemedicine Day-to-day postoperative education for four weeks	Total knee replacement	Lower in the INT group	Pain at night Pain during activity Pain at rest	Deceased level of pain Improved mobilization	Multicenter randomized	[29]
Self-management	CON = 40 /INT = 40	Muscle relaxation technique	Abdominal surgery	Lower in the INT group	VAS	Reduced or absent pain intensity in the INT group	Quasi-experimental	[30]

Abbreviations: VAS, Visual Analog Scale; NRS, Numerical Rating Scale; INT, Intervention; CON, Control; NR, Numeric rating; MBSR, Mindfulness-based reduce stress; VRS, Verbal Rating Scale; Western Ontario and McMaster Universities Osteoarthritis Index, WOMAC; NR, not reported

Findings contrast the two non-pharmacological intervention approaches evaluated in our review. The left panel of Patient Education encompasses perioperative education (timing and content of pain management information before and after surgery), medication management guidance, neuroscience education on pain mechanisms, collaborative goal-setting, scheduled follow-up contacts, coping-strategy training, e.g. breathing exercises, distraction techniques, and patient–provider communication skills. Whereas, the right panel of the Self-Management Program builds on education and goal setting by adding structured communication and emotional support, medication management review, cognitive behavioural therapy (CBT), mindfulness-based stress reduction (MBSR), relaxation techniques, use of monitoring or therapeutic devices, ongoing follow-up, and broader self-care approaches, e.g. tailored exercise or activity planning (Figure 2).

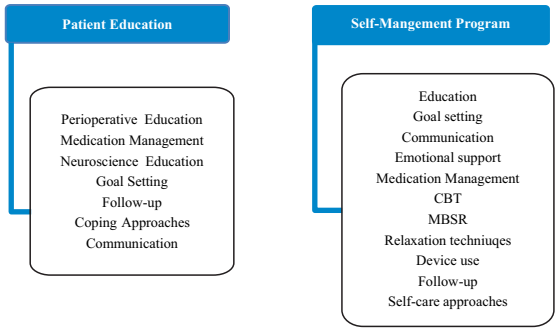

Figure 2: Components of the Patient Education and Self-Management Program Intervention

In Darville-Beneby *et al.*, study [13], postoperative pain outcomes were drawn from multiple primary studies that uniformly used validated patient-reported scales, chiefly the Visual Analogue Scale (VAS) and the Numeric Rating Scale (NRS) administered at defined postoperative intervals, e.g., 24, 48, and 72 hours. A smaller number of studies also employed multidimensional instruments such as the Brief Pain Inventory (BPI) to capture both pain severity and its interference with function.A detailed literature review examined how effective patient education or self-management is in reducing chronic postoperative pain [17-30].These studies compared the effects on treatment groups who received specific interventions with those on control groups who had standard care.The main outcome measures included pain variables such as severity, duration and functional improvement. Additionally, almost all the studies adopted standardized tools for measuring pain levels, among them the Visual Analog Scale (VAS), the Numerical Rating Scale (NRS) and on a couple of occasions the Verbal Rating Scale (VRS) or Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) for various postoperative time points. VAS was used to monitor the change in pain intensity from baseline to postoperative follow-ups by multiple studies [17, 19, 22] and, within 48 hours in many cases, produced results that were at least markedly reduced. Only a small number of studies [20, 23, 29] have reported the use of NRS to quantify pain severity and improvements in functional mobility.These studies all found that their intervention groups reported lower pain scores.Less frequent were VRS- and WOMAC-compatible scenarios with outputs on pain perception or joint function [21, 24].When using these scales, subjects also demonstrated meaningful clinical improvement in the self-management intervention group.

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Six studies covering topics such as spinal surgery to cardiac surgery indicated that preoperative counseling, tailored written materials and regulated postoperative guidance (whether measured with VAS or NRS) made early postoperative pain significantly less severe for patients then continuing to need pain pills regularly elsewhere in their recovery program [17, 18, 19, 21, 22, 23].Six studies employing interventions such as Mindfulness-Based Stress Reduction (MBSR), Cognitive-Behavioural Therapy (CBT), telemedicine and relaxation exercises all indicate that pain scores (VAS or NRS) generally decline at various intervals [24, 25, 26, 27, 28, 30].MBSR has also been shown to provide benefits over a longer period, with sustained 12-month pain relief [24, 25].As for CBT, it works well in controlling the pain of the short term but has had mixed outcomes long term. In particular, it has been of benefit for abdominal surgery, with dropping pain scores and fewer analgesics prescribed [27, 30].Combined Approaches: Two studies mixed patient education with self-management strategies, and both reported significantly better pain control as well as functional results (NRS, WOMAC) when compared to allowing patients to follow their rehabilitation entirely on their own [20, 29].The authors measured pain using a self-administered questionnaire that captured patient-reported pain intensity via a Likert-type scale at multiple postoperative time points.This systematic review has interpreted these outcomes as valid subjective assessments of pain, consistent with similar studies, and has clarified this approach in the revised Results section.Many trials explicitly combined various interventions before surgery along with teachings on relaxation techniques, or they included follow-up care by telecommunication [21, 28].The result was that these measures typically yielded greater overall reductions in pain scores (VAS, NRS) and self-reported functionality for patients.Importantly, patients who received comprehensive, multimodal interventions typically followed the faster recovery trajectory and took fewer analgesics. In addition, quality of life comparisons were in favor of this group compared with those receiving only single interventions.These findings support the conclusion that multimodal strategies combining regard for psychological treatment (eg CBT, MBSR), patient education and extra technologies may offer better short- and long-term pain relief backed up by reliable clinical results. Overall, the results across these studies underscore the importance of using validated pain measurement tools to track improvements accurately, highlight the added value of self-management programs in postoperative care, and provide evidence that a multimodal approach yields significant benefits for chronic postoperative pain relief and enhanced patient outcomes.

DISCUSSION

The systematic review was conducted to assess the effectiveness of various interventions in mitigating chronic postoperative pain across different surgical procedures. A randomized controlled trial (RCT) by Lee *et al.*, explored the impact of patient education on postoperative pain and anxiety at Chung Shan Medical Hospital, Taiwan, between April and December 2012 [17]. The study compared the intervention and control groups undergoing spinal surgery.Standard information was provided to CON (n=42), whereas the Booklet, composed of information on spinal structure, type of spinal diseases, fusion surgery, and anesthesia) Before one day of surgery was provided to the INT group (n=40).The findings of the study reported positive results 30 min before surgery (t=3.45 and 2.30) in both groups and were highly significant pain reduction after one day of surgery (t=2.68 and 4.81, p<0.001) measured on the VAS scale.The results are similar to another randomized trial conducted by Sinderovsky *et al.*, in which a Booklet was given to the INT group to provide information on pain and no intervention was provided to the CON group (total = 200) who underwent cardiac surgery [18].The findings reported a reduction in the average 48-hour pain score in the INT group (NRS scale), the INT group (IQR 35-6.00) compared to the CON group (IQR 51.0-73.0; p<0.001). At the Australian College of Perioperative Nurses Australia, an integrative review was conducted encompassing 21 studies published after 2016 was executed by Adam *et al.*, to evaluate the patient education impact on postsurgical pain in elective surgery [19].The results of the study demonstrated the reduction in pain severity and intensity post-surgery in the intervention group using the NR scale, increased satisfaction, and knowledge of patients regarding pain management.This study also reported that the healthcare professional who had training in pain management effectively managed the patient's pain, and results comparable with the study of Bonkowski *et al.*, determined that continuous pain management training improved the nurse's ability to manage pain post-surgery [31].Sawhney *et al.*, designed and implemented a randomized controlled trial (RCT) that took place in Southern Ontario, Canada and assessed the impact of the Hernia Repair Education Intervention (HERI) on postoperative pain [21].Hernia repair is notorious for giving people lasting pain; up to 54% of patients still report moderate to severe discomfort 72 hours after their operations [32, 33].In this study, the control group (n=40) received standard verbal and written information about surgical procedures, postoperative care, and pain control. The intervention group received, in addition to this, a full, detailed booklet, a face-to-face teaching session and two further phone calls: one before surgery and another 24 hours after the operation. The results showed a significant reduction in the pain intensity in 2 days after surgery (POD-2) and less use of opioid analgesics in the intervention

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group than in the control group. Pain intensity was measured with the Numerical Rating Scale (NRS). A striking reduction in the worst movement-related 24-hour pain score was seen in the intervention group (4.7, p=0.0001) as compared to the control group (7.2). Although at 7 days' post-surgery, there were no significant differences in pain intensity between groups, most participants still reported their pain as mild or non-existent both at rest and on movement, indicating that effective implementation of this therapy takes effect over an extended period.At a hospital affiliated with an Australian university, Dowsey *et al.*, conducted a single randomized controlled trial between September 2017 and May 2018 [24].The primary objective was to find out how much an MBSR (Mindfulness-Based Stress Reduction) program can affect pain outcomes for patients who undergo hip and/or knee arthroplasty.A total of 127 patients who had both osteoarthritis and bilateral knee pain were chosen and then randomized into two groups by the regional medical ethics committee:An Intervention group (INT, n=65) and a Control group (CON). The INT group attended an eight-week MBSR program including weekly 2.5-hour sessions.Patients in the CON group received standard care.The primary measure for both groups was pain intensity, as assessed using the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) pain sub-score.At 12 months, the INT group reported a significantly greater reduction in pain intensity when compared to the CON group (mean difference: -10.2 points, 95% confidence interval [CI] -1.3 to -19.2, p=0.025). A parallel group randomized controlled trial conducted by Hanley *et al.*, in an orthopaedic centre in Utah, evaluated the efficacy of Mindfulness-Based Stress Reduction (MBSR) in lowering chronic postoperative pain following hip and knee arthroplasty [25].Given that total joint arthroplasty is a common surgical procedure in the United States, often accompanied by prolonged postoperative pain and opioid use [34, 35], this study aimed to investigate an alternative approach to pain control.While the control group received standard care, the treatment group received an eight-session course of MBSR on mindfulness. The intervention began three weeks before surgery with mindfulness of breath (Mob) and before a two-hour preoperative education session on pain management, anesthesia options, drug treatment, and hypnosis therapy. The results of the study demonstrated that the use of MBSR in this population is practicable.In addition, they disclosed a movement in preoperative pain with Mob ($F_{2,89}=5.28$, p=0.007) and consequential decrease of postoperative pain using Mop ($F_{8,94}=3.21$, p=0.003) at 14, 21 and 28 days following the operation.A systematic review and meta-analysis conducted by Zhang *et al.*, in China investigated the efficacy of Cognitive Behavioural Therapy (CBT) in managing postoperative pain following arthroplasty [26]. By pooling data from nine randomized controlled trials, the study revealed a significant reduction in pain intensity, as measured by the CPS, NRS, and VAS scales, within the first three months' post-surgery in the CBT group compared to the control group.However, this effect was not sustained beyond 12 months.In a separate randomized controlled trial, Chen *et al.*, explored the impact of CBT on postoperative pain and psychological distress in elderly patients (aged 70 years and older) who underwent arthroplasty [36].While no significant difference in pain intensity was observed between the CBT and control groups, the CBT group exhibited reduced anxiety levels on the 7th and 14th postoperative days and decreased depression on the 3rd postoperative day.Topcu *et al.*, conducted a cross-sectional study to assess the effectiveness of relaxation exercises in mitigating postoperative pain in patients who underwent upper abdominal surgery [27].The study, conducted at Trakya University in Turkey, involved 60 participants who were asked to rate their pain levels using a verbal rating scale before and after performing relaxation exercises which resulted in a lowering of pain.The present systematic review has been constrained by small sample sizes, irregular and short periods of follow-up, and various intervention methodologies that change between studies. Hence, future research aimed at validating the effectiveness and benefits over time of patient education and self-management for CPSP needs to emphasize making the intervention techniques and study design standardized, targeting larger populations which may also be more diverse, while follow-up periods also aim to be longer.Overall, the findings of this review show that patient education, self-management programs and behavioural intervention (e.g., CBT, MBSR) can significantly reduce postoperative pain and associated psychological distress. This result is consistent with previous large-scale studies [26], which demonstrated that non-pharmacological methods are ideal for enhancing immediate pain relief in conjunction with standard care.At the same time, however, some studies differ as to whether these interventions cause lasting effects. For example, when Zhang *et al.*, [26] reported reduced efficacy 12 months later, other researchers like Dowsey *et al.*, [24] noted sustained improvements in pain outcomes at the one-year mark.This discrepancy shows that standard protocols and follow-up periods are necessary, as it can lead to mixed results if study design, sample characteristics, and specific components of each intervention differ.Additionally, the disparity in the magnitude of pain relief across studies [18, 21, 36] indicates that patient-specific factors, such as baseline health status, comorbidities or cultural influences, may moderate the effectiveness of these interventions.Taken together, these observations align with the broader literature that emphasizes a tailored, multifaceted approach to treatment approach to persistent post-operative pain. But they also underline the need for further larger clinical trials conducted with

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consistent methodology over extended periods so that the durability of such benefits can be clarified and any conflicting results in the present research resolved.

This systematic review is limited by the heterogeneity of included studies in terms of intervention types, patient populations, surgical procedures, and outcome measurement tools, which restricts direct comparison and generalizability of findings. Many studies also had small sample sizes and relatively short follow-up durations, making it difficult to assess the sustained impact of interventions on chronic pain outcomes. Additionally, variability in reporting standards and lack of uniform pain assessment protocols further reduce methodological consistency. Future research should focus on large-scale, multicenter randomized controlled trials with standardized intervention frameworks and validated outcome measures, along with extended follow-up periods. Integration of digital health technologies and personalized multimodal approaches should also be explored to enhance long-term effectiveness and clinical applicability in postoperative pain management.

CONCLUSIONS

It was concluded that this systematic review demonstrates that a multimodal approach can be very effective for relieving chronic postoperative pain while at the same time enhancing clinical outcomes. A multimodal approach should combine preoperative patient education, and self-management programs including cognitive-behavioural therapy, mindfulness-based stress reduction, relaxation exercises, advanced device utilization and telehealth. Future research should include extended follow-up periods and explore innovative digital health tools to optimize long-term effectiveness and applicability in clinical practice.

Authors' Contribution

Conceptualization: SA, ME
Methodology: MA, SS
Formal analysis: SH
Writing and Drafting: MI, MB, SM
Review and Editing: MI, MB, SM

All authors approved the final manuscript and take responsibility for the integrity of the work

Conflicts of Interest

All the authors declare no conflict of interest.

Source of Funding

The author received no financial support for the research, authorship and/or publication of this article.

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