Patient Education and Counseling 120 (2024) 108123

Contents lists available at ScienceDirect

Patient Education and Counseling

journal homepage: www.journals.elsevier.com/patient-education-and-counseling

Are we educating patients about postoperative analgesics following orthopaedic surgery? A scoping review

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ARTICLE INFO

Keywords:
Education
Analgesics
Postoperative pain
Orthopaedic surgery
Opioid

ABSTRACT

Objectives: To identify interventions educating patients undergoing orthopaedic surgery about postoperative analgesics and explore their associated outcomes.
Methods: A scoping review using six databases was conducted. Eligible interventions were delivered to adult patients undergoing open orthopaedic procedures that could be feasibly implemented into any setting. Content, delivery methods and outcomes for interventions were described where available.
Results: Eleven studies were included. Content and delivery methods differed substantially. Eight studies aimed to reduce postoperative harm by reducing opioid consumption. Studies also explored pain control (n = 6) and patient satisfaction (n = 4). Health literacy was not assessed in any study. Previous surgical or analgesic experience was infrequently reported.
Conclusion: This is the first scoping review assessing globally adaptable interventions designed to educate orthopaedic patients about postoperative analgesics. A paucity of interventions was found, with a limited range of patient-centred outcomes assessed. Further research is required. Co-designed educational materials with patients is recommended.
Practice implications: Despite the unclear benefit, clinicians should consider providing postoperative analgesic education to patients. Well-designed education has the potential to improve quality of life at low cost with low risk. Educational material adapted to local health literacy levels and prior surgical and analgesic experience is recommended to maximise engagement and impact.

1. Introduction

Following surgery, up to 80 % of patients will experience acute pain, with greater than 70 % of these reporting this pain to be moderate-to-severe [1–3]. Effective management of acute postsurgical pain (APSP) is needed to reduce the risk of associated complications [4,5]. These include immobility, which can lead to increased venous thromboembolism, as well as delayed recovery, increased time spent in hospital and impaired engagement with rehabilitation [6]. Typically, APSP is expected to resolve with tissue healing, usually within three months [7]. Poorly managed APSP, however, may persist. Chronic postsurgical pain (CPSP) has an estimated prevalence of up to 60 % depending on the surgery. CPSP imparts significant burden to individuals and is associated with high societal and economic costs [8]. Ideally, good control of APSP should be established before patients are discharged from the supervised environment of hospital. However, research indicates many patients continue to report moderate-to-severe pain post-discharge [9,10].

There has been significant interest in developing strategies to reduce APSP to improve patients' experiences whilst reducing serious complications and costs [10–12]. To date, strategies have primarily involved advances in surgical and perioperative pharmacological techniques; however, no one strategy has been shown to be consistently effective [13,14]. Moreover, with a growing number of ambulatory surgical cases being performed more frequently and increased pressure on hospital bed availability, patients are being discharged earlier in their recovery [15,16]. Therefore, patients are required to take greater responsibility to self-manage their pain. Patients have been found to use analgesics inadequately, even when experiencing pain and have consistently indicated that they often feel ill-equipped to manage pain after discharge, thus affecting their postoperative recovery [12,15,17–21]. A recent meta-analysis found that up to 58 % patients who underwent surgery requiring at least one night stay in hospital continued to experience moderate-to-severe pain one to two weeks following discharge [22].

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https://doi.org/10.1016/j.pec.2023.108123
Received 8 June 2023; Received in revised form 12 December 2023; Accepted 15 December 2023
Available online 22 December 2023

Poor health literacy is a well-recognised barrier to optimal pain management, including self-management [23]. A lack of effective education from healthcare professionals can lead patients to seek their own resources. Concerningly, research indicates that patients frequently access online resources that present narrow, biased, or unscientific information that is difficult to understand [21,24]. There is potential for well-designed educational strategies to address this unmet need, both in the short and long term, empowering patients to manage their pain, and ensuring their expectations align with postoperative recovery [25–27].

Orthopaedic surgery often ranks amongst the most painful types of surgery and is associated with high rates of CPSP [28–30]. Consequently, it has been a common focus for education-based strategies for APSP, particularly following elective joint replacement surgery [31–33]. However, education for postoperative pain following orthopaedic procedures has focused predominantly on exercise and/or physiotherapy and psychological-based interventions, including pain neuroscience education, surgical preparation, and expectation management [25–27]. The role for education specifically for optimising the use of postoperative analgesics is less well studied.

This scoping review aimed to identify education interventions that have been trialled to inform patients about postoperative analgesics, and to describe the content and the delivery methods used. The potential for analgesic-based education to reduce postoperative pain-related outcomes was also explored, where applicable. Only interventions that could be feasibly implemented into any surgical setting, irrespective of the level of technological or specialist-training resources available, were of interest. This decision was based on the hypothesis that for education to benefit surgical populations worldwide, it would need to be easily incorporated into pre-existing healthcare systems without a significant resource impost.

1.1. Review questions

What educational interventions have been investigated to educate adults undergoing orthopaedic surgery about managing postoperative analgesics? What outcomes have been explored following delivery of this education?

2. Method

This review was conducted according to the Joanna Briggs Institute methodology for scoping reviews [34].

2.1. Search strategy

A systematic search of the Cumulative Index of Nursing and Allied Health Literature (CINAHL), Cochrane Database of Systematic Reviews, Excerpta Medical DataBASE (EMBASE), Medline, The United States National Library of Medicine (Pubmed) and Web of Science databases were performed. Article titles, abstracts and keywords were searched for controlled vocabulary and keywords, in consultation with a research librarian. The search strategy was applied to two databases initially to check for suitability. Following refinement of the terms, the search strategy was applied to each database and the search results were managed using Endnote®. Additional articles were identified from references lists of review articles. The search was repeated in mid-May 2023. The search strategy is available in Appendix Table A.1.

2.2. Eligibility criteria

Eligible studies were those that included only adults aged 18 years or older undergoing an open orthopaedic procedure in any hospital setting. Studies that included a mix of minimally invasive procedures and/or non-orthopaedic surgeries were included if at least 80 % of study participants underwent open orthopaedic surgery that required at least one night stay in hospital. The decision to exclude minimally invasive orthopaedic procedures was made as these techniques are generally associated with less postoperative pain [30,35]. Studies that included patients who were pregnant, undergoing treatment for substance abuse or with documented cognitive impairment were excluded.

Only educational interventions designed to include teaching patients about postoperative analgesics (e.g., use, risks, adverse effects, and/or safe storage and disposal) were included. Education interventions that required providers to undergo specialist training, or that incorporated specialised technology development in their implementation, were excluded due to their significant resource requirements. To assess content and design methods, only studies that described what topics were included in the education provided (content) and how this education was provided to participants (delivery method), were included. Authors were contacted for studies that did not have sufficient details to request additional information. If there was no response, the study was excluded. Details regarding any additional education topics, such as those relating to the surgical procedure or postoperative rehabilitation, as well as other strategies to manage postoperative pain, such as early mobilisation, were also recorded where available. Whether patients were involved with the development of education material was also noted, as was any assessment of health literacy levels.

Experimental and quasi-experimental study designs, including randomised and non-randomised controlled trials (RCT and non-RCT), analytical observational studies, and study protocols were eligible for inclusion. Reference lists of relevant articles were searched by hand to identify additional studies that met the inclusion and exclusion criteria. Systematic reviews were excluded; however, their references were also screened to identify any additional articles. Only studies available in English were included. Individual case reports were excluded. Studies published before 2010 were also excluded as the approach to postoperative pain management has evolved significantly due to the use of enhanced recovery after surgery (ERAS) protocols and other surgical advancements [15,36,37].

2.3. Data extraction

Search results were collated in Covidence®, a web-based collaborative platform [38]. Two authors (LC and FV) screened titles and abstracts for relevance and duplicates, and reviewed full texts independently. All discrepancies were reviewed and resolved by consensus. Fig. 1 presents the process used according to the PRISMA guidelines [39]. A standardised data extraction form was designed, revised, and piloted by LC. Data extraction was conducted by LC and checked for accuracy by FV or CM. The data extraction form collected study information, study characteristics, participant characteristics and intervention details, including specific content and delivery methods, as well as outcomes. The data extraction form is available from the authors on request.

2.4. Data synthesis and analysis

Data was categorised by education content and delivery methods, based on previous research (including unpublished research conducted by the authors) that investigated surgical patients' views on postoperative pain education [31,40]. Study methodologies were reviewed and independently categorised by LC and FV or CM, with any discrepancies resolved by consensus. The types of outcomes and differences between intra-study groups were also reviewed. Data analysis followed a narrative approach with categorisation of education content and delivery, as discussed below.

2.5. Quality assessment

Assessment of study quality for those included was conducted by LC and FV/CM using the Joanna Briggs Institute (JBI) Critical Appraisal

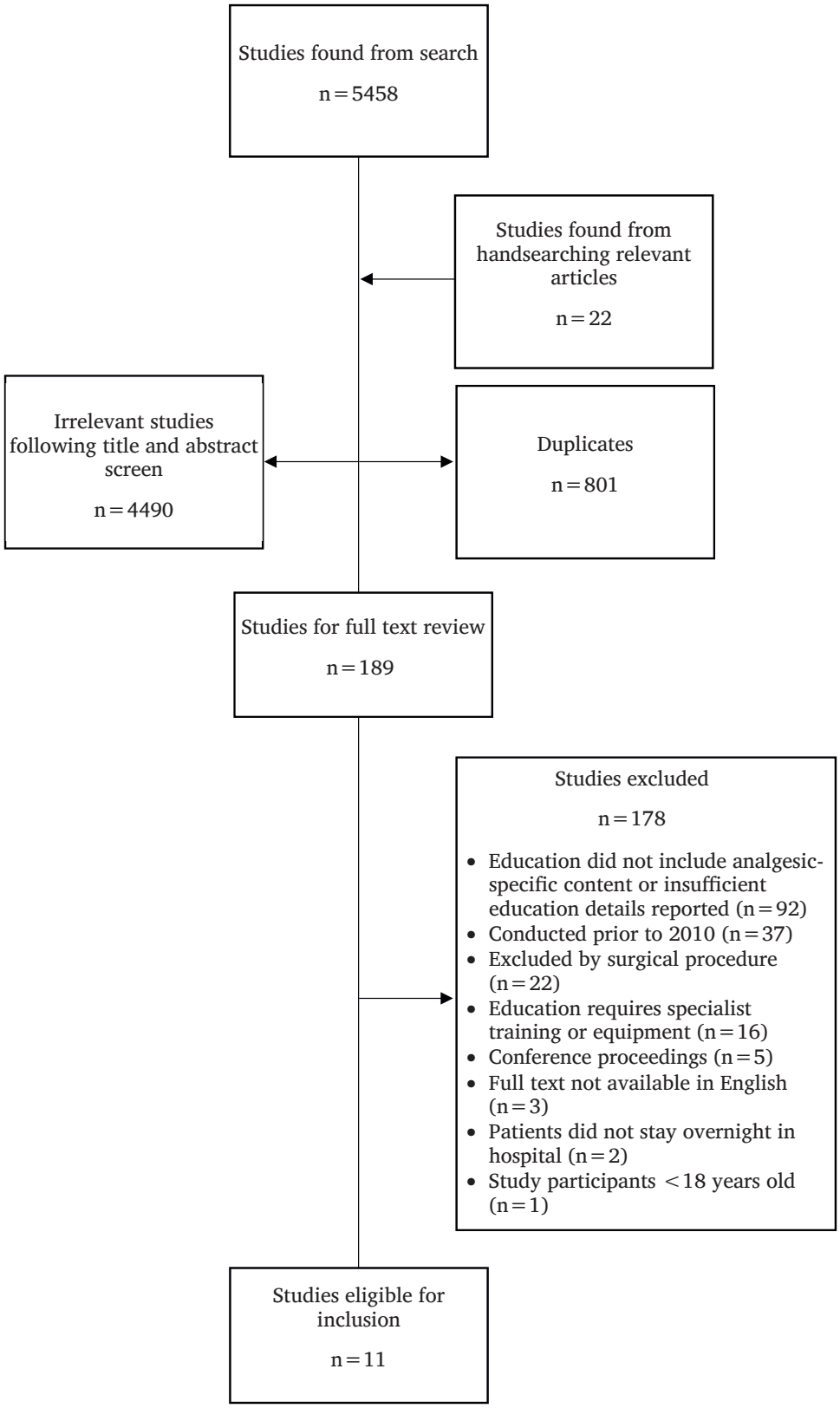

Fig. 1. PRISMA flowchart of search strategy.

Checklist for the relevant study design [41]. Any disagreements between reviewers were resolved by consensus. Overall risk of bias for individual studies was determined using three categories, as used previously [42]:

- Low risk: ≥ 70 % checklist answers were 'yes';
- Moderate risk: ≥ 50 to < 70 % checklist answers were 'yes';
- High risk: < 50 % checklist answers were 'yes'.

NB: The denominator was adjusted when questions within the JBI Checklist were not applicable to the paper. Studies were not excluded

based on methodological quality.

3. Results

A total of 5480 papers, including 22 studies from handsearching reference lists, were found. A total of 189 studies underwent full-text review (Fig. 1). Of these, 11 were deemed eligible for inclusion [43–53]. Education interventions that did not include analgesic-specific content, or reported insufficient details regarding their education intervention, was the most common reason for exclusion (n = 92). Studies were conducted in various states of the United States of America (n = 7) [43,45–47,49,51,52], Canada (n = 1) [50], Australia (n = 2) [48,53], and the Netherlands (n = 1) [44]. The majority were for joint arthroplasty (n = 10) [43–45,47–53], most commonly elective procedures (n = 8) [43–45,47–50,53]. The primary aim for most studies (n = 6) was reducing postoperative opioid prescribing or consumption [45,48,50–53], and/or increasing rates of proper disposal of unused opioids (n = 3) [43,49,50]. Two studies aimed to report patient satisfaction following education [46,48]. One of these assessed the efficacy of a pharmacist-run program designed to improve patient satisfaction with postoperative pain management [46]. Further study characteristics can be found in Table 1. Preoperative opioid use was reported in five of the 11 studies [45,46,48,52,53], with preoperative opioid consumption ranging from 7 % to 85 % in study groups. Prior surgery (including type of previous surgery) was reported in only one study [52]. Three studies excluded participants who were undergoing a revision surgical procedure [45,49,51].

3.1. Quality assessment

Evaluation details are presented in Appendices Tables A.2, A.3, A.4, A.5 and A.6. Of the RCTs, two studies were found to have a low risk of bias [49,52], and two had a moderate risk of bias [45,50]. The inability to blind participants and healthcare staff negatively affected the overall assessment for each study. A lack of detail regarding blinding of outcomes to assessors was also of concern. Issues with randomisation processes [45,50] and allocation concealment [50] were also noted. The quality assessment of quasi-experimental studies found two to be of low risk of bias [51,53] and two of moderate risk [43,46]. Concerns with participant characteristics between comparison groups, and outcome measurements and analyses were identified. The retrospective cohort study was of moderate risk of bias as analysis of historical deidentified data hindered the authors from addressing confounding factors and making comparisons between groups [47]. The observational case series was assessed as being of low risk of bias [48], as was the qualitative study that was found to have strong congruity between the methodology and study design details [44].

3.2. Education delivery styles and characteristics

Delivery style details were categorised by delivery format, setting, timing relative to surgery, duration, and number of sessions, along with categorisation of the healthcare staff involved. A summary for each study is shown in Table 2. Written material regarding use of postoperative analgesics was provided in six of the 11 studies [43,44,46,49,50,52] and for five of these, this was in combination with verbal delivery of analgesic education, either to the individual participant alone or as part of an education group class [43,44,46,49,52]. Education delivery via pre-recorded narration over a slideshow presentation was used in one study [45]; another used text messages sent to participants after discharge to reinforce preoperative education provided [49]. Group education classes were a common approach for delivering verbal education (n = 6) [43,45,47–49,52]. In three of these studies pain management education classes were delivered to intervention and control groups, with additional analgesic-specific education provided to the intervention group, e.g., regarding proper opioid disposal methods [43,45,47]. Analgesic-based education was provided as standard care for both intervention and comparison groups in two studies [49,52]. Only one study reported the size of group education sessions, reporting a maximum of 15 participants [49].

Preoperative education was the commonest timing for education delivery (n = 8) [43–49,52]; however, only one study reported how soon before surgery this was given [44]. Of these eight, five studies also provided postoperative education to at least some participants [46–49,52]. Only one study provided education only in the postoperative period [53]. Timing of provision in relation to surgery was not reported in two studies [50,51]. Duration of education sessions was reported in one study, reporting a duration of 1.5 h [47]. Participants were engaged in education once (n = 5) [43,45,50,51,53], twice (n = 4) [44,47,48,52], or more than two (n = 2) [46,49] times. Three studies did not report which member(s) of the healthcare team provided education [43,48,50]. Of the studies that did provide details, pharmacists were the most utilised healthcare provider (n = 4) [46,47,52,53].

3.3. Education content

Education content was categorised by analgesic-specific and other related topics (Table 3). The most common topic was the use of opioids for postoperative pain, including indication and dosing information (n = 7) [44,45,47,50–53], followed by information on opioid misuse and addiction (n = 5) [45,47,49–51], and proper disposal of unused opioid disposal (n = 4) [43,46,49,50]. Purpose and dosing directions for non-opioids was also included in four studies [47,48,51,53]. Other related topics for education included postoperative expectations, details regarding the surgical procedure and potential complications, how to prepare for surgery, general principles of acute pain management and the use of non-pharmacological strategies for managing postoperative pain.

Assessments of patient health literacy levels were not reported in any of the studies; however, two studies developed their education material in collaboration with patients [50,52]. For Rose *et al.* this also included a pilot of the education pamphlet with a preoperative and postoperative patient cohort to assess the appropriateness of the reading level [50]. Bemelmans *et al.* surveyed participants on the design, structure and usability of their education brochure and it was noted that they adjusted the material after receiving feedback from several study participants [44]. No other study reported collaboration with, or seeking feedback from, participants or other non-medically trained people to develop education materials; however, for two studies, tailored postoperative analgesic advice was provided to participants [46,53].

3.4. Study outcomes

The most common (n = 8) outcome of interest (either primary or secondary) related to opioid consumption, assessed as rates of patients taking postoperative opioids, cessation of opioids within a specified time frame or quantity of postoperative opioid consumed [45,46,48–53]. Outcomes and findings for all included studies are displayed in Table 1. Level of pain control, assessed using either pain severity scores or other functional score assessments, were assessed in six studies [45,47–51]. Rates of proper opioid disposal for unused opioids and whether repeat opioid prescriptions were obtained following discharge were also commonly investigated. Patient satisfaction with their postoperative pain control or education was of interest for four studies [46,48,50,53]. Few studies demonstrated statistically significant differences between groups for any outcome. Significant heterogeneity for those studies reporting statistically significant differences between groups did not allow for meaningful comparisons, and thus features of education that may be effective for improving pain could not be identified.

Table 1
Characteristics of included studies.

Author, date, country, study site[1]	Study design, surgery type, data period	Study aim(s)	Intervention	Study size, participant characteristics	Outcomes*
Aliory, 2021 United States, Phoenix AZ Mayo Clinic Arizona	Quasi-experimental – pre/post-test groups. Single centre. Elective: Yes - Total knee arthroplasty, n=NR - Total hip arthroplasty, n=NR Mid to late 2019	To determine whether provision of opioid disposal education would increase the percentage of participants who properly dispose of unused opioids.	*Intervention* – Verbal and written education on proper opioid disposal. – Preoperative education class. – Free medication deactivation bag offered. *Control* – Preoperative education class.	N=80 *Intervention* – n=40 – age, mean years (SD): 68.2 (9.9) – male sex, n (%): 23 (57.5) – preoperative analgesic use: NR – prior surgery: NR *Control* – n= 40 – age, mean years (SD): 70.3 (10.6) – male sex, n (%): 14 (35.0) – preoperative analgesic use: NR – prior surgery: NR	Rate of proper unused opioid disposal: – Higher reported rate for intervention group vs control (86.7% vs 65.5%). Rate of use of deactivation bag – NR.
Bemelmans, 2021 The Netherlands	Qualitative – case study using semi-structured individual interviews. Single centre. Elective: Yes – Unicompartmental knee arthroplasty, – n=5 – Total knee arthroplasty, n=3 Time period unclear.	To explore the experiences and opinions about an information brochure provided preoperatively to patients undergoing knee surgery. Included patients participated in interviews 6 weeks postoperatively to provide feedback on the use of the information brochure.	Brochure included information regarding: - surgical procedure and postoperative expectations regarding pain, - analgesia use and recovery.	N=8 – age, years range: 53-76 – male sex, n (%): 5 (62.5%) – preoperative analgesic use: NR – prior surgery: NR	Content and utility of education: – Brochure content was clear, understandable, and reliable. – Additional information requested regarding spinal and general anaesthesia used, postoperative expectations, exercising during rehabilitation, mobility options including crutches and walking frames. – Brochure was used by all patients. All patients recommended its use.
Carender, 2022 United States, IA	Non-blinded RCT – three arms. Single centre Elective: Yes – Knee arthroplasty, n=NR[2] – Hip arthroplasty, n=78 March 2019 to February 2020	To examine the efficacy of perioperative patient counselling to reduce the quantity and duration of opioid consumption.	*Intervention (Group 1)* – Pre-recorded video on appropriate opioid use. – Preoperative education class. – ACT via automated text-messages. *Intervention (Group 2)* – Pre-recorded video on appropriate opioid use. – Preoperative education class. *Control* – Preoperative education class – *No* pre-recorded video on opioid use or ACT.	N=183[3] *Group 1* – N=65 – Age, mean years (SD): 58 (9) – male sex, n (%): 25 (38.5) – preoperative analgesic use, n (%): • Opioids: 5 (8) • Non-opioids: NR – prior surgery: NR[4] *Group 2* – n=55 – age, mean years (SD): 59 (11) – male sex, n (%): 23 (41.8) – preoperative analgesic use, n (%): • Opioids: 4 (7) • Non-opioids: NR – prior surgery: NR[4]	*Postoperative opioid consumption: – Trend towards less mg OME for both intervention groups vs control at 14 days – *This trend reached statistical significance at six weeks for both the best and worst scenarios for Group 1 and 2 vs control. *Duration of postoperative opioid use: – Reduced days for groups 1 and 2 vs control (median 12 and 8 vs 14 days, respectively), $p<0.05$ for both. *Rate of patients obtaining postoperative opioid: – Reduced rate for groups 1 and 2 vs control (27% and 29% vs 44%, respectively). – *For Group 1 vs control only, $p<0.04$ Postoperative pain severity (VAS and PROMIS pain intensity scale): – NS between groups for all assessments

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Table 1 (*continued*)

Author, date, country, study site[1]	Study design, surgery type, data period	Study aim(s)	Intervention	Study size, participant characteristics	Outcomes*
				Control – n=63 – age, mean years (SD): 59 (11) – male sex, n (%): 24 (38.1) – preoperative analgesic use, n (%): • Opioids: unclear[5] • Non-opioids: NR – prior surgery: NR[4]	
Coulson, 2020 United States Large academic medical centre	Quasi-experimental – single-arm, no control group. Single centre Elective: Yes – Orthopaedic – joint, n=15 – Orthopaedic – spine, n=6 – Non-orthopaedic (vascular, oncology, general, gynaecology), n=5 Dec 2017-June 2018	To assess the effects of a pharmacist-run transitional pain service on patient (and referring provider) satisfaction following surgery.	– Pain pharmacist preoperative medication education. – Development of individualised perioperative pain management plan. – Postoperative follow-up information via telephone.	N=26 – age, years average: 57 – male sex, n (%): 14 (53.8) – preoperative analgesic use, n (%): • Opioids: 22 (85) • Non-opioids: NR – prior surgery: NR	Patient satisfaction / appreciation of pharmacist involvement: – Rated as 'appreciative' or 'very appreciative' by 92%. Rate of reported knowledge regarding proper disposal of unused opioid: – Proper disposal method reported by 92% Change in opioid consumption (from preoperative to postoperative): – 7 patients consumed less opioid, 5 consumed more, for 9 consumption was unchanged. Patient perspective on pharmacist involvement with education: – Examples reported: pharmacist was a knowledgeable resource and easy to talk to, pharmacist involvement made pain medication management smoother, nice to talk to someone about medications.
Hefti, 2017 United States, Cheektowaga NY Sisters of Charity Hospital, St Joseph Campus	Retrospective observational cohort study. Single centre Elective: Yes – Knee arthroplasty, n=NR – Hip arthroplasty, n=NR 2012-13	To measure the potential impact of pharmacist involvement in preoperative education programs on two HCAHPS questions (scored using 6-point Likert scale, 0=never, 5=always).	*Pharmacist education group* – MDT preoperative education class including pharmacist. *Non-pharmacist education group* – MDT preoperative education class with nurse, PT and discharge planner but *no* pharmacist.	N=NR[6] *Intervention* – n=253 (Q13) / 250 (Q14) – age: NR – male sex: NR – preoperative analgesic use: NR – prior surgery: NR *Control* – n=219 (Q13) / 220 (Q14) – age: NR – male sex: NR – preoperative analgesic use: NR – prior surgery: NR	Q13 – During this hospital stay, how often was your pain well controlled: – Higher mean score in post-test, for intervention group vs control (3.65 vs 3.54). *Q14 – During this hospital stay, how often did the hospital staff do everything they could to help you with their pain: – Higher mean score in post-test for intervention group vs control (3.80 vs 3.66), p=0.018.
Lin, 2023 Adelaide, Australia. South Adelaide Local Health Network	Prospective observational case series. Multi-centre (two sites) Elective: Yes – Knee arthroplasty n=918 – Hip arthroplasty n=527 January 2018 – October 2021	To assess efficacy of an opioid-sparing arthroplasty surgical protocol on long-term opioid use, patient satisfaction, and early recovery.	Preoperatively: – Preoperative education session four weeks prior to surgery. Postoperatively: – Advice and reinforcement to aim for opioid-free recovery, including daily review by the Acute Pain Service.	N=1444 Knee arthroplasty: – n=917 – age, median years (IQR): 73 (65-80) – male sex: 304 (33.2)	*Proportion of patients consuming opioids postoperatively: – Significantly reduced at 6 weeks, 6 months and 1 year postoperatively compared to preoperative use, p<0.0001 for all time points. *Postoperative function: – Median OKS and OHS significantly increased (better

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Table 1 (*continued*)

Author, date, country, study site[1]	Study design, surgery type, data period	Study aim(s)	Intervention	Study size, participant characteristics	Outcomes*
				– preoperative analgesic use, n (%): • Opioids: 232 (25) • Non-opioids: NR – prior surgery: NR Hip arthroplasty: – n=527 – age, median years (IQR): 73 (66-81) – male sex: 194 (36.8) – preoperative analgesic use, n (%): • Opioids: 187 (35) • Non-opioids: NR – prior surgery: NR	function) at 6 weeks, 6 months and 1 year postoperatively compared to preoperative function, p<0.0001 for all time points. Postoperative QoL compared to baseline (preoperative): – ED-5D-5L score: Significantly higher (better QoL) at 6 weeks, 6 months and 1 year postoperatively compared to preoperative QoL Patient satisfaction measured using a 5-point Likert scale.[7] – Improved at 6 weeks postoperatively compared to preoperative satisfaction and maintained up to 12 months postoperatively, p<0.0001 for all time points.
Nahhas, 2020 United States, Chicago IL Rush University Medical Centre	Blinded, RCT – three arm. Single centre Elective: Yes – Total knee arthroplasty n=293 – Unicompartmental knee arthroplasty n=87 – Total hip arthroplasty n=183 August 2018 – May 2019	To determine the impact of educational pamphlets and text messages on proper disposal of unused opioids.	*Intervention (Group 1)* – Preoperative education class on postoperative multimodal analgesia regime and risks associated with opioid use. – Pamphlet on opioid risks and proper disposal. – Text message reminders of proper opioid disposal. *Intervention (Group 2)* – Preoperative education class on postoperative multimodal analgesia regime and risks associated with opioid use. – Pamphlet on opioid risks and proper disposal. *Control* – Preoperative education class on multimodal analgesic regime and risks associated with opioid use.	N=563 *Group 1* – n=187 – age, mean years (SD): 62.6 (10.6) – male sex, n (%): 70 (37.4) – preoperative analgesic use, n (%): • Opioids: 28 (15) • Non-opioids: NR – prior surgery: NR[8] *Group 2* – n=229 – age, mean years (SD): 63.2 (10.9) – male sex, n (%): 126 (55.0) – preoperative analgesic use, n (%): • Opioids: 28 (12.2) • Non-opioids: NR – prior surgery: NR[8] *Control* – n=147 – age, mean years (SD): 64.7 (9.6) – male sex, n (%): 61 (41.5) – preoperative analgesic use, n (%): • Opioids: 23 (15.6) • Non-opioids: NR – prior surgery: NR[8]	*Rates of proper unused opioid disposal: – Higher reported rate for groups 1 and 2 vs control (38.4%, 32.8% vs 9% respectively), p<0.001 for both. Opioid consumption (mg OME) as an inpatient: – NS between groups Patients receiving an opioid refill within 6 weeks: – NS between groups Pain severity and function: – Multiple measures taken, NS for all Length of hospital stay (days): – NS between groups

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Table 1 (*continued*)

Author, date, country, study site[1]	Study design, surgery type, data period	Study aim(s)	Intervention	Study size, participant characteristics	Outcomes*
Rose, 2016 Canada, Vancouver BC University of British Columbia Hospital	RCT Single centre Elective: Yes – Total hip arthroplasty n=112 – Total knee arthroplasty n=60 August 2014-April 2015.	To determine whether introducing an opioid education pamphlet will increase rate of proper opioid storage and disposal, as well as safe opioid weaning practices.[9]	*Intervention* – Opioid education pamphlet. *Control* – No pamphlet.	N=226 *Intervention* – n=120 – completed survey[10], n=86 – age, mean years (SD): 64 (10) – male sex, n (%): 32 (37.2) – preoperative analgesic use: NR[9] – prior surgery: NR *Control* – n=106 – completed survey[10], n=86 – age, mean years (SD): 62 (10) – male sex, n (%): 40 (46.5) – preoperative analgesic use: NR[9] – prior surgery: NR	*Rate of proper unused opioid disposal: – Higher reported rate for intervention group vs control (27% vs 5%), p=0.005. Rate of safe opioid storage: – NS between groups Rate of stopping opioids within 4 weeks: – NS between groups Patient satisfaction with opioid and opioid-weaning information: – NS between groups Postoperative pain severity (VAS) at 4 weeks: – NS between groups. Development of withdrawal symptoms: – Less patients reported withdrawal symptoms for intervention group vs control (2% vs 8%).
Sabesan, 2020 United States, Weston FL Cleveland Clinic Florida	Quasi-experimental – pre/post-test groups. Single centre Elective: NR – Shoulder arthroplasty n=50 2017-2018	To evaluate whether patient education combined with multimodal pain management will achieve opioid-free postoperative recovery compared to traditional postoperative pain management.	*Intervention* – Education materials on alternative pain management protocols. – Discharge instructions on opioid crisis and non-opioid alternatives for postoperative analgesia. – Postoperative pain management plan. *Control* – Standard postoperative multimodal pain management.	N=50 *Intervention* – n=25 – age, years average: 72.4 – male sex, n (%): 16 (64.0) – preoperative analgesic use: NR[11] – prior surgery: NR[11] *Control* – n=25 – age, years average: 67.9 – male sex, n (%): 10 (40.0) – preoperative analgesic use: NR11 – prior surgery: NR11	Rate of patients consuming postoperative opioids: – At 48hr there were less intervention group patients who had consumed at least 1 rescue opioid dose vs control (24% vs 100% respectively). – By two weeks, no patients in the intervention group took opioids (0% vs 80%). *Postoperative pain severity: – VAS: Lower scores for intervention group vs control at 24h (5.0 vs 7.3, p-0.036) and 48h (3.0 vs 4.2, p=0.005). – ASES (pain): Higher score (lower pain severity) for intervention groups vs control at three months (47.8 vs 42.6), p=0.036. *Postoperative function: – Const: higher score (better function) at three months for intervention group vs control (30.1 vs 23.6, p=0.005). – NS between groups at three months for other functional assessments.
Smith, 2018 United States, Northwest OR & Southwest WA Kaiser Permanente Northwest	Partially blinded, pragmatic RCT. Single centre Elective: NR – Total hip arthroplasty n=225 – Total knee arthroplasty n=336 June 2015-April 2016	To determine whether a pharmacist-led education intervention on use of opioids and expectations for postoperative pain control will reduce opioid use in individuals predicted to be at risk of becoming persistent opioid users.[12]	*Intervention* – Access to full resources, including preoperative preparation class, including postoperative pain control, with handouts. – Brochure on opioid use and pain control. *Control* – Access to full surgical resources, including preoperative preparation class, including postoperative pain control, with handouts.	N=561 *Intervention* – n=275 – age, mean years (SD): 65.9 (8.9) – male sex, n (%): 109 (39.6) – preoperative analgesic use, n (%): • Opioids: NR • Non-opioids: NR[13] – prior surgery, n (%): 22 (8) *Control*	Postoperative opioid quantity dispensed (mg OME calculated as log values): – NS between groups. Mean counts of postoperative opioid or non-opioid dispensing: – NS between groups. Counts of postoperative office visits, telephone, or email encounters: – NS between groups Count of postoperative PT and OT visits: – NS between groups. Count of postoperative ED and urgent care centre visits: – NS between groups.

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Table 1 (*continued*)

Author, date, country, study site[1]	Study design, surgery type, data period	Study aim(s)	Intervention	Study size, participant characteristics	Outcomes*
				– n=286 – age, mean years (SD): 66.2 (9.5) – male sex, n (%): 115 (40.2) – preoperative analgesic use, n (%): • Opioids: NR • Non-opioids: NR[13] – prior surgery: 29 (9.8)	
Tran, 2022 Australia, Melbourne Austin Health	Quasi-experimental- pre/post-test groups. Single centre Elective: Yes – Total knee arthroplasty N=107 December 2017-July18; – January-July 2020.	To evaluate the impact of post-discharge pharmacist review on opioid use following total knee arthroplasty.	*Intervention* – Pharmacist contacted patients post-discharge to review analgesic usage and use of non-pharmacological strategies, provide education and advice about optimising both, and to develop an opioid management plan that was communicated to GP. *Control* – No contact by pharmacist post-discharge.	N=107 *Intervention* – n=44 – age, median years (IQR): 72.5 (64-79) – male sex, n (%): 19 (43.2) – preoperative analgesic use, n (%): • Opioids: 11 (25) • Non-opioids: NR – prior surgery: NR *Control* – n=63 – age, median years (IQR): 68 (62-74) – male sex, n (%): 21 (33.3) – preoperative analgesic use, n (%): • Opioids: 17 (27) • Non-opioids: NR – prior surgery: NR	*Patients taking postoperative opioids three weeks following discharge: Lower rate for intervention group vs control (29.5% vs 74.6%), p<0.001. Quantity opioid pills remaining 3 weeks following discharge: NS between groups (median of 0 for both). *Patients requiring opioid refill: Lower rate for intervention group vs control (36.4% vs 71.4%), p<0.001. *Patients felt they were given adequate opioid supply on discharge: Higher rate for intervention groups vs control (79.5% vs 47.6%), p=0.001. Opioid-naïve patients using opioids beyond 3 months from discharge: Lower rate for intervention vs control (0% vs 5.3%). Patient satisfaction with pharmacist review for those who could recall: All patients who could recall having pharmacist input (28/44, 63.6%) reported being 'extremely satisfied' or 'satisfied'.

*Indicates statistically significant finding.
[1]Specific study site location, city and/or state provided when reported, [2]Patients undergoing TKA was not reported, and the loss of some patients' details due to hardware failure made extrapolation impossible. [3]230 patients recruited but hardware failure led to only 183 being included in the analysis, [4]Patients undergoing revision surgery were excluded (n = NR), [5]Preoperative opioid use reported as n = 0 (14 %), [6]Total patients completing each survey question were available, however unable to determine how many patients completed both survey questions, [7]Satisfaction analysis conducted only for those who responded (total 564 and 240 patients undergoing knee and hip arthroplasty respectively), [8]Patients undergoing a revision surgery were excluded (n = 22), [9]Patients preoperatively consuming 30 mg OME or more daily were excluded, [10]Demographic analysis only for participants who completed survey, [11]Patients undergoing revision surgery or who received three or more opioid prescriptions in the three-month period prior to surgery were excluded (n = NR for each exclusion criteria), [12]Risk prediction model was developed by the authors in previous research and only patients with predicted risk in top 60 % (n = 561) were included, [13]Preoperative anticonvulsant, antidepressant, antianxiety and muscle relaxant medication use were reported but no information available on which of these may also be used for analgesia.
ACT, acceptance and commitment therapy; APCP, Arthroplasty Patient Care Protocol; ASES, American shoulder and elbow surgeons score; AZ, Arizona; BC, British Columbia; ED, emergency department; Const, Constant score; FL, Florida; GP, general practitioner; HCAHPS, hospital consumer assessment of healthcare providers and systems survey; IA, Iowa; IL, Illinois; MDT, multidisciplinary team; mg OME, milligrams converted to oral morphine equivalence; n, number; NR, not reported; NS, not statistically significant; NY, New York; OR, Oregon; OT, occupational therapist; OHS, Oxford Hip Score; OKS, Oxford Knee Score; PROMIS, patient-reported outcomes measurement information system; PT, physiotherapist; Q13, question 13 of HCAHPS; Q14, question 14 of HCAHPS; QoL, quality of life; RCT, randomised controlled trial; VAS, visual analogue scale; vs, versus; WA, Washington.

4. Discussion and conclusion

4.1. Discussion

To the authors' knowledge, this is the first review that has focused on the provision of analgesic-based education to patients undergoing orthopaedic surgery. Conducting a scoping review was appropriate given the heterogeneity of studies performed in this field to date, and the low quality of most. Until further robust RCTs have been conducted, higher level reviews (such as a systematic review) cannot evaluate whether there is benefit from educating patients on the use of post-operative analgesics.

Table 2
Education interventions: delivery methods.

Delivery method details		Aliory, 2021	Bemelmans, 2021	Carender, 2022	Coulson, 2020	Hefti, 2017	Lin, 2023	Nahhas, 2020	Rose, 2016	Sabesan, 2020	Smith, 2018	Tran, 2022
Format	In person - individual		✓		✓[3]		✓			✓		
	In person - group	✓		✓		✓	✓	✓			✓	
	Via telephone				✓[3]						✓[11]	✓
	Written materials	✓	✓		✓			✓	✓		✓	
	Other			Video				Text messages[9]		?[10]		
Setting	Hospital ward						✓					
	Outpatient facility	✓	✓	✓	✓	✓		✓				
	Other				✓[3]			✓			✓	✓[12]
	Not specified						✓[6]		✓	✓		
Timing	Preoperatively	✓	✓[1]	✓	✓	✓	✓	✓			✓	
	Postoperatively				✓	✓	✓	✓[9]			✓	✓
	Not specified								✓	✓		
Number of sessions	Once only	✓		✓				✓[9]	✓	?[10]	✓[11]	✓
	Twice		✓			✓	✓[7]				✓[11]	
	>Twice				✓			✓[9]				
Session duration	≤ 30 min											
	> 30 min					✓[4]						
	Not specified	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
Delivered by	Pharmacist				✓	✓[5]					✓	✓
	Nurse/doctor			✓				✓				
	MDT		✓			✓	✓[8]					
	Research team									✓		
	Not directly delivered by HCP		✓[2]					✓[9]				
	Not specified	✓					✓[8]		✓			

MDT, multidisciplinary team; HCP, health care professional; ?, unclear.
[1]6–8 weeks preoperatively (specific timing only reported in this study), [2]Orthopaedic operation room planner explained use of brochure, [3]Either in clinic or via telephone (not both), [4]Preoperative education class duration 1.5 h; additional postoperative education duration not specified, [5]Pharmacist provided analgesia-specific information during MDT education class, [6]Postoperative education provided in hospital ward but not specified where preoperative education was delivered, [7]Unclear how many times "daily" education was delivered postoperatively, [8]Providers of preoperative education class was not specified and postoperative education was provided by the Acute Pain Service and surgical team, [9]Control group and intervention groups 1 and 2 received preoperative education once only and intervention group 2 received three additional text messages postoperatively, [10]Reported as education materials provided but no further details regarding format or number of sessions provided, [11]Patients who refilled an opioid prescription after discharge also received a telephone call from the pharmacist, [12]Patients were contacted at home post-discharge.

Only 11 recent studies were identified that provided analgesic-based education to patients, either as a specific analgesic intervention or as part of broader education. Total joint arthroplasty in an elective surgical setting was the main surgical procedure performed in these studies. For many patients, this procedure is performed as a treatment for osteoarthritis. Such patients often have experience with using multimodal analgesia prior to surgery, yet preoperative analgesic use was reported in only five studies [45,46,48,52,53]. This information is relevant to understand participants' prior experiences and knowledge of analgesics and may allow education to be tailored to their educational needs. Similarly, previous surgical experience was reported in only one study. Notably, only four studies utilised pharmacists to provide analgesic-based education [46,47,52,53], despite their expertise in medication counselling [54]. Moreover, patients in the included studies appreciated pharmacists' involvement in education interventions.

Overall, studies that investigated patients' perspectives of education reported that they were appreciative and found the education to be useful [44,46,48,50,53]. This is unsurprising given previous studies have found that patients want to receive education, and that without it they feel unable to effectively manage pain, particularly post-discharge [12,18,55–57]. Unfortunately, few studies were able to demonstrate benefit in favour of education for key outcomes, including pain and function scores. Additionally, the risks of bias in the included studies, as well as significant heterogeneity between studies, make identifying aspects of education that warrant future research challenging. However, there were some observed trends that education reduced postoperative opioid consumption and improved patient satisfaction with pain management. This lends support to the hypothesis that education can empower patients to better utilise their postoperative analgesics. Further studies are required to identify how this could best be achieved. It is hypothesised that the co-design of educational materials with patients possessing a lived experience of orthopaedic surgery is important.

The majority of studies reviewed primarily aimed to reduce opioid consumption, prescribing, and/or increase proper opioid disposal rates. Interestingly, only six studies assessed whether patients who received education reported better pain control compared to those who did not, and only four studies explored patient satisfaction with the education or their pain management. Without question, reducing harm from opioids

Table 3
Education interventions: content.

Education topics		Aliory, 2021	Bemelmans, 2021	Carender, 2022	Coulson, 2020	Hefti, 2017	Lin, 2023	Nahhas, 2020	Rose, 2016	Sabesan, 2020	Smith, 2018	Tran, 2022
Analgesic-specific	Opioid indication, mechanism of action, dose directions		✓[1]	✓		✓			✓	✓	✓	✓
	Side effects of opioids (including alcohol and driving advice)					✓			✓		✓	
	Opioid safe handling and storage (including not to share with others)	✓			✓				✓			
	Proper disposal of unused opioids	✓			✓			✓	✓			
	Opioid misuse and/or the opioid epidemic			✓		✓		✓	✓	✓		
	Non-opioid analgesia indications and dose directions, including over-the-counter options					✓	✓			✓		✓
	Weaning or tapering guidance (opioids and non-opioid analgesia)								✓		✓	✓
	Development of tailored perioperative pain management plan				✓							✓
Other	Information on surgical procedure, potential surgical complications		✓				✓				✓	
	How to prepare for surgery and for home postoperatively		✓			✓						
	Postoperative expectations		✓		✓	✓	✓		✓	✓	✓	
	Overview / principles of acute pain management				✓	✓					✓	
	Non-pharmacological strategies to manage pain				✓	✓			✓			✓
	Contact information to seek additional help		✓				✓					
	Exercise or rehabilitation recommendations/ instructions		✓				✓				✓	
	Other, such as thrombosis prophylaxis, wound care		✓			✓						
	Other information given not specified	✓		✓				✓				

[1]Preoperative and postoperative medication protocol information provided to participants in brochure, however further detail about its content was not specified.

and minimising the risk of opioid addiction are important given the catastrophic outcomes that have been witnessed around the world [58, 59]. However, given the biopsychosocial nature of pain, other patient-centred outcomes, such as postoperative pain severity, functional ability, engagement with physiotherapy and enablement to return to work, are also important. There is a clear need for further research to develop and evaluate education strategies targeted at a range of patient-centred outcomes.

This review is limited by its reliance on publications and authors to provide details about their education strategies. It is possible that more studies may have met the inclusion criteria had further education details been made available. Nevertheless, the inconclusive results from this review are supported by similar findings in previous reviews investigating various surgical education topics [31–33]. They similarly concluded that further research is required to evaluate the effects of education on postoperative pain and recovery. For most studies, analgesic-based education focused on harm minimisation from opioids. This may be a result of the opioid epidemic that has been most acutely experienced in the United States of America (U.S.A), where most of the studies were conducted [60–62]. Cultural and socioeconomic factors unique to the U.S.A, (e.g., direct-to-consumer advertising, healthcare funding predominantly via insurance, and fee-for-service incentives for healthcare professionals) may limit the external validity of these interventions [59]. Additionally, some aspects of acute pain management education discussed in this review may be within the remit of other services in certain countries, such as postoperative rehabilitation in specialised centres. It is recognised these services are not universal, including in Australasia where the authors are from. The exploration of broader pain management education topics may thus not be relevant to all clinicians, who are advised to develop education materials according to their local context.

4.2. Conclusion

This review demonstrates the paucity of work exploring the use of analgesic-based education to assist patients with managing postoperative pain. Most studies aimed to reduce opioid consumption and/or improve proper opioid disposal. Ideally, analgesic education can empower patients to optimally utilise their postoperative analgesics, particularly in the post-discharge period. The most effective content and delivery methods required for such education are unclear. More robust research into the full potential for education to improve a range of patient-centred outcomes is needed.

4.3. Practice Implications

With increasing pressure on hospitals to discharge postoperative patients earlier, and a greater complexity of surgeries performed in an increasingly comorbid and ageing population [63], there is potential for analgesic-based education to improve postoperative patient-centred outcomes. This includes improving pain control and function, supporting engagement in rehabilitation, and increasing patient satisfaction, by empowering patients to optimise postoperative analgesic use. Patients recognise the need for this type of education, as without it they feel unable to adequately manage their pain, particularly following hospital discharge. This review has found few studies conducted that have included this type of intervention, and only a minority of these assessed the effect of education on pain control and patient satisfaction. Furthermore, there is insufficient evidence to identify any features of this type of education that may be particularly beneficial. Despite this, clinicians working in postoperative settings may consider implementing postoperative analgesic education given its potential benefit, relative low cost, and negligible risk of harm. In doing so, consideration of patient health literacy and prior surgical and/or analgesic knowledge is essential to maximise engagement to ensure education can effectively empower patients to self-manage postoperative pain.

CRediT authorship contribution statement

Chen Leah: Writing – review & editing, Writing – original draft, Validation, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Mirkazemi Corinne:** Writing – review & editing, Writing – original draft, Validation, Supervision, Methodology, Formal analysis. **Veal Felicity C.:** Writing – review & editing, Writing – original draft, Validation, Supervision, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

The authors acknowledge the help received from the University of Tasmania Research Librarians with regards to finalising the search strategy and Distinguished Professor Gregory Peterson at the School of Pharmacy and Pharmacology, University of Tasmania, for his guidance to prepare the final manuscript.

Appendices

Table A.1
Search strategy and search terms.

Concept 1	**Concept 3**	**Concept 4**
#1 Adult/	**3a**	#1 Education/
#2 Adults or adult.tw	#1 Postoperative pain/	#2 Patient education/
Concept 1: #1 OR #2	#2 Postoperative pain.tw	#3 Patient education.tw
	#3 Perioperative pain.tw	#4 Patient counselling.tw
Concept 2	#4 Postsurgical pain.tw	#5 Patient teaching.tw
#1 Orthopedic surgery/	**Concept 3a: #1 OR #2 OR #3 OR #4**	#6 Medication counselling.tw
#2 Orthopedic surgery.tw		#7 Medication education.tw
#3 Orthopedic procedure.tw	**3b**	#8 Preoperative education/
#4 Total joint replacement.tw	#5 Pain/	#9 Preoperative education.tw
#5 Arthroplasty.tw	#6 Pain.tw	#10 Postoperative education.tw
#6 ORIF OR open reduction internal fixation.tw	#7 Chronic pain/	#11 Discharge counselling.tw
#7 Bone surgery.tw	#8 Chronic pain.tw	#12 Discharge education.tw
#8 Joint surgery.tw	#9 Persistent pain.tw	Concept 4: #1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12
Concept 2: #1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8	#10 Acute pain/	
	#11 Acute pain.tw	**FINAL: Concept 1 AND Concept 2 AND Concept 3 AND Concept 4**
	#12 Subacute pain.tw	
	Concept 3b: #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12	
	3c	
	#14 Postoperative period/	
	#15 Postoperative period.tw	
	#16 Perioperative period.tw	
	#17 Postsurgical period.tw	
	#18 after OR post OR following **n5** surgery OR surgeries OR surgical.tw	
	#19 after OR post OR following **n5** operation OR operations OR operative.tw	
	Concept 3c: #14 OR #15 OR #16 OR #17 OR #18 OR #19	
	Concept 3bc: Concept 3b AND Concept 3c	
	Concept 3: Concept 3a OR Concept 3bc	

Table A.2
Risk of bias assessment for randomised controlled trials.

Critical appraisal checklist	Carender, 2022	Nahhas, 2020	Rose, 2016	Smith, 2018
1. Was true randomisation used for assignment of participants to treatment groups?	✗	✓	✗	✓
2. Was allocation to treatment groups concealed?	✓	✓	?	✓
3. Were treatment groups similar at baseline?	✓	✓	✓	✓
4. Were participants blind to treatment assignment?	✗	✗	?	?
5. Were those delivering treatment blind to treatment assignment?	✗	✗	✗	✗
6. Were outcomes assessors blind to treatment assignment?	?	?	?	✓
7. Were treatment groups treated identically other than the intervention of interest?	✓	✓	✓	✓
8. Was follow-up complete and if not, were differences between groups in terms of their follow-up adequately described and analysed?	✓	✓	✓	✓
9. Were participants analysed in the groups to which they were assigned?	✓	✓	✓	✓
10. Were outcomes measured in the same way for the treatment groups?	✓	✓	✓	✓
11. Were outcomes measured in a reliable way?	✓	✓	✓	✓
12. Was appropriate statistical analysis used?	✓	✓	✓	✓
13. Was the trial design appropriate, and any deviations from the standard RCT design accounted for in the conduct and analysis of the trial?	✓	✓	✓	✓
Overall risk assessment (% yes)	**Mod (69 %)**	**Low (77%)**	**Mod (62 %)**	**Low (85 %)**

Table A.3
Risk of bias assessment for quasi-experimental trials.

Critical appraisal checklist	Aliory, 2021	Coulson, 2020	Sabesan, 2020	Tran, 2022
1. Is it clear in the study what is the 'cause' and what is the 'effect'?	✓	✓	✓	✓
2. Were the participants included in any comparisons similar?	✗	N/A	✓	
3. Were the participants included in any comparisons receiving similar treatment/care, other than the intervention of interest?	✓	N/A	✓	✓
4. Was there a control group?	✓	N/A	✓	✓
5. Were there multiple measurements of the outcome both pre and post the intervention?	✗	✗	✓	✓
6. Was follow-up complete and if not, were differences between groups in terms of their follow-up described and analysed?	✓	✓	✗	✗
7. Were the outcomes of participants included in any comparisons measured in the same way?	✓	N/A	✓	✓
8. Were outcomes measured in a reliable way?	?	✓	✓	✓
9. Was appropriate statistical analysis used?	✗	✗	✓	✓
Overall risk assessment (% yes)	**Mod (55 %)**	**Mod (60%)**	**Low (89 %)**	**Low (78 %)**

Table A.4
Risk of bias assessment for cohort studies.

Critical appraisal checklist	Hefti, 2017
1. Were the two groups similar and recruited from the same population?	?
2. Were the exposures measured similarly to assign people to both exposed and unexposed groups?	✓
3. Was the exposure measured in a valid and reliable way?	✓
4. Were confounding factors identified?	✓
5. Were strategies to deal with confounding factors stated?	✗
6. Were the groups/participants free of the outcome at the start of the study (or at the moment of the exposure)?	✓
7. Were the outcomes measured in a valid and reliable way?	✓
8. Was the follow up time reported and sufficient to be long enough for outcomes to occur?	✓
9. Was follow up complete, and if not, were the reasons to loss to follow-up described and explored?	✓

(*continued on next page*)

Table A.4 (*continued*)

Critical appraisal checklist	Hefti, 2017
10. Were strategies to address incomplete follow-up utilised?	N/A
11. Was appropriate statistical analysis used?	✓
Overall risk assessment (% yes)	**73 % (Low)**

Table A.5
Risk of bias assessment for case-series.

Critical appraisal checklist	**Lin, 2023**
12. Were there clear criteria for inclusion in the case series?	✓
13. Was the condition measured in a standard, reliable way for all participants included in the case series?	✓
14. Were valid methods used for identification of the condition for all participants included in the case series?	✓
15. Did the case series have consecutive inclusion of participants?	✓
16. Did the case series have complete inclusion of participants?	✓
17. Was there clear reporting of the demographics for participants in the case series?	✓
18. Was there clear reporting of clinical information of the participants?	✓
19. Were the outcomes or follow-up results of cases clearly reported	✓
20. Was there clear reporting of the presenting site(s)/clinic(s) demographic information	✗
21. Was statistical analysis appropriate?	✓
Overall risk assessment (% yes)	**Low (90 %)**

Table A.6
Risk of bias assessment for qualitative studies.

Critical appraisal checklist	Bemelmans, 2021
1. Is there congruity between the stated philosophical perspective and the research methodology?	✗
2. Is there congruity between the research methodology and the research question or objectives?	✓
3. Is there congruity between the research methodology and the methods used to collect data?	✓
4. Is there congruity between the research methodology and the representation and analysis of data?	✓
5. Is there congruity between the research methodology and the interpretation of results?	✓
6. Is there a statement locating the researcher culturally or theoretically?	✗
7. Is the influence of the research on the research, and vice-versa, addressed?	✗
8. Are participants, and their voices, adequately represented?	✓
9. Is the research ethical according to current criteria or, for recent studies, and is there evidence of ethical approval by an appropriate body?	✓
10. Do the conclusions drawn in the research report flow from the analysis, or interpretation, of the data?	✓
Overall risk assessment (% yes)	**Low (70 %)**

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