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Review Article

# Healthcare delivery gaps in pain management within the first 3 months after discharge from inpatient noncardiac surgeries: a scoping review

Janny X. C. Ke[1,2,3,*,†], Maya de Vos[2,†], Katarina Kojic[1,2,‡], Mark Hwang[4,‡], Jason Park[5,6], Heather Stuart[5,6], Jill Osborn[1,2], Alana Flexman[1,2], Lindsay Blake[7] and Daniel I. McIsaac[8]

[1]Department of Anesthesia, Providence Health Care, Vancouver, BC, Canada, [2]Department of Anesthesiology, Pharmacology and Therapeutics, Faculty of Medicine, University of British Columbia, Vancouver, BC, Canada, [3]Department of Anesthesia, Pain Management & Perioperative Medicine, Dalhousie University, Halifax, NS, Canada, [4]Undergraduate Medical Education Program, Faculty of Medicine, University of British Columbia, Vancouver, BC, Canada, [5]Department of Surgery, Faculty of Medicine, University of British Columbia, Vancouver, BC, Canada, [6]Department of Surgery, Vancouver General Hospital, Vancouver, BC, Canada, [7]University of Arkansas for Medical Sciences Library, Little Rock, AK, USA and [8]Department of Anesthesiology and Pain Medicine, University of Ottawa, Ottawa, ON, Canada

*Corresponding author. E-mail: janny.ke@ubc.ca, @jannyke
[†]Co-first authors.
[‡]Co-second authors.

## Abstract

**Background:** Poor pain control during the postoperative period has negative implications for recovery, and is a critical risk factor for development of persistent postsurgical pain. The aim of this scoping review is to identify gaps in healthcare delivery that patients undergoing inpatient noncardiac surgeries experience in pain management while recovering at home.

**Methods:** Searches were conducted by a medical librarian in PubMed, MEDLINE, EMBASE, EBSCO CINAHL, Web of Science, and Cochrane Database of Systematic Reviews for articles published between 2016 and 2022. Inclusion criteria were adults (≥18 yr), English language, inpatient noncardiac surgery, and included at least one gap in care for acute and/or persistent pain management after surgery within the first 3 months of recovery at home. Two reviewers independently screened articles for inclusion and extracted data. Quotations from each article related to gaps in care were synthesised using thematic analysis.

**Results:** There were 4794 results from databases and grey literature, of which 38 articles met inclusion criteria. From these, 23 gaps were extracted, encompassing all six domains of healthcare delivery (capacity, organisational structure, finances, patients, care processes and infrastructure, and culture). Identified gaps were synthesised into five overarching themes: education (22 studies), provision of continuity of care (21 studies), individualised management (10 studies), support for specific populations (11 studies), and research and knowledge translation (10 studies).

**Conclusions:** This scoping review identified health delivery gaps during a critical period in postoperative pain management. These gaps represent potential targets for quality improvement and future research to improve perioperative care and longer-term patient-centred outcomes.

**Scoping review protocol:** Open Science Framework (https://osf.io/cq5m6/).

**Keywords:** gaps in care; health delivery; pain management; persistent postsurgical pain; post-discharge; postoperative pain; transitional pain service

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### Editor's key points

- Poorly controlled postsurgical pain has significant implications, including persistent postsurgical pain.
- In this scoping review, the authors examined delivery gaps in pain management during the 3 months after discharge following inpatient noncardiac surgery. The gaps included common themes of education, continuity of care, individualisation, support for patient populations, and research and knowledge translation.
- Anaesthetists can work with stakeholders to help better understand and manage pain during this critical period of acute pain control and chronic pain development.

Globally, more than 312 million surgeries were performed in 2012, a rate that is expected to increase.[1] After surgery, more than 80% of patients experience pain, with 80% of these patients rating their pain as moderate, severe, or extreme.[2] Poorly controlled pain after surgery can have significant implications on recovery and quality of life, including morbidity, disability, readmission, and prolonged opioid use.[3–8] Many patients with poorly controlled acute surgical pain also develop persistent postsurgical pain (also known as chronic postsurgical pain), which is defined as 'pain that develops or increases in intensity after a surgical procedure and persists beyond the healing process', typically greater than 3 months.[3,9,10] Studies show that moderate to severe persistent postsurgical pain is common after inpatient surgeries, including hip replacement (7–23%), hernia repair (5–35%), Cesarean section (10–21%), hysterectomy (5–32%), mastectomy (20–50%), thoracotomy (61–70%), limb amputation (30–81%), and cholecystectomy (3–56%).[3,11] In fact, a year after surgery, 12% of patients still report moderate to severe persistent postsurgical pain, with more severe pain correlating with greater functional impairment.[8] Persistent postsurgical pain also has societal implications as a result of lost work and increased healthcare resource utilisation.[2,12,13] For example, patients with persistent postsurgical pain after lumbar spine surgery experienced £5000, £10,000, and £14,000 higher healthcare costs at 2, 5, and 10 yr postoperatively, respectively, than patients without persistent pain.[14]

Experiencing more severe acute pain is associated with a greater risk of persistent postsurgical pain; for every 10% increase in duration of severe pain on postoperative day 1, the incidence of persistent postsurgical pain increases by 30% at 1 yr.[8] Although anaesthetists, surgeons, and allied health professionals are involved in the management of acute and chronic pain, a substantial gap exists in research and clinical care for pain management during the transition from acute hospitalisation to home and before the diagnosis of chronic pain can be made.[15] Currently, we lack evidence-based pharmacological therapies to prevent persistent postsurgical pain.[16] Furthermore, after discharge, patients are often expected to manage their own pain with little professional support.[15] Transitional Pain Services are recent innovations seeking to address gaps in care between discharge and the development of chronic pain, and are associated with improved patient knowledge, function, and pain scores while reducing long-term opioid prescribing.[15] However, Transitional Pain Services are not widely accessible outside of tertiary centres. These issues are exacerbated by variability in postoperative analgesic prescribing[17] as well as the push towards shorter hospital stays,[18] where patients spend a greater proportion of their recovery without pain management support.

Although most pain management research and care focus on the individual patient level, a better understanding of pain management needs from a health services perspective may reveal opportunities to mitigate the transition from acute pain to persistent postsurgical pain. According to the Agency for Healthcare Research and Quality's (AHRQ) Effective Health Care Stakeholders Group Delivery Systems Committee, the delivery of healthcare can be conceptualised using a framework of six domains: capacity, organisational structure, finances, patients, care processes and infrastructure, and culture.[19] By identifying gaps, which are discontinuities in care,[20] we can unveil areas of vulnerability for research and quality improvement. The objective of this scoping review is to identify gaps in healthcare delivery that patients undergoing inpatient noncardiac surgeries experience in pain management within the first 3 months of their recovery at home.

## Methods

A scoping review was conducted according to Joanna Briggs Institute methodology for scoping reviews[21] and reported using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for scoping reviews (PRISMA-ScR).[22] The protocol was registered on May 26, 2022, in the Open Science Framework (https://osf.io/cq5m6/).

### Search strategy

The search strategy was codeveloped with an experienced medical librarian (LB) and included articles published in PubMed MEDLINE, EMBASE, EBSCO CINAHL, Web of Science, and Cochrane Database of Systematic Reviews (Supplementary material 1). The database search was performed on June 2, 2022 and updated to December 31, 2022. The grey literature search was done according to published methods[23] involving a search of pre-print and grey literature databases, a Google search, a search within websites of Canadian foundations for surgical patients, and a review of included article references for further articles (Supplementary material 1). The grey literature search was performed between June 1 and 4, 2022.

### Definition of gaps

We defined gaps in care based on the existing patient safety literature, which defines gaps as discontinuities in care that 'may appear as losses of information or momentum or interruptions in delivery of care' and may occur 'with organisational and institutional boundaries that mark changes in responsibility or authority, different roles of professionals, or formal divisions of labour' or as a side-effect of systems change.[20] We approached the definition as inclusively as possible, and included any problems, issues, challenges, and/or barriers in healthcare delivery. A gap was operationalised in the search strategy using both broad Medical Subject Headings ("Continuity of Patient Care," "Root Cause Analysis," "Professional Practice Gaps," or "Preventive Health Services") as well

as keyword search terms (gap, barrier, problem, issue, or challenge) (Supplementary material 1).

### Inclusion and exclusion criteria

We included studies involving adults (≥18 yr), English language, inpatient noncardiac surgery, and published within the past 6 yr to obtain contemporary perspectives (2016–22). Articles must have included at least one gap in care for acute and/or persistent pain management after surgery within the first 3 months of recovery at home. We chose 3 months postoperatively since postsurgical pain beyond 3 months in duration would be considered persistent, which opens a new dimension of logistical and disease considerations for health delivery that would be beyond the scope of this study. Also, focusing on the period prior to 3 months allows for in-depth exploration of gaps that contribute to the transition from acute to persistent pain. To obtain a broad perspective and acknowledging that experimental research relevant to the research question would be limited, all types of published full-text articles (including experimental and observational study designs, reviews, commentaries, editorials, and study protocols) were included. Cardiac surgeries and surgeries without overnight hospital stay were excluded as these have unique considerations in terms of health system structures and processes.

### Article selection

After removal of duplicates, articles were uploaded into Covidence (Veritas Health Information, Melbourne, VIC, Australia). Titles and abstracts were screened by two independent reviewers based on the study inclusion and exclusion criteria. Articles selected for potential inclusion were retrieved in full-text and assessed by two independent reviewers against the inclusion/exclusion criteria to select studies for data extraction. Disagreements between reviewers for both the title/abstract and full-text screening were resolved through discussion. If not resolved, additional reviewers were involved in the discussion until a consensus was achieved.

### Data extraction

Two independent reviewers extracted data from each article using a standardised Microsoft Excel (Microsoft Corporation, Redmond, WA, USA) form developed in accordance with the Joanna Briggs Institute methodology for scoping reviews.[21] The data extraction form (Supplementary material 2) included details about the participants (population characteristics), methodology of the study, and all text that discusses gaps in postsurgical pain management within the first 3 months after discharge from inpatient surgery. If conflict arose between the reviewers, they were resolved through discussion and if necessary, additional reviewers were involved to help reach a consensus.

### Scoping review data analysis and presentation

Text from each article related to gaps in care underwent thematic analysis using a six-step process of familiarisation, initial codes, search for themes, review themes, define and name themes, and report.[24] During inductive analysis, the text data were reviewed to generate a preliminary coding structure. Similar codes were grouped together by consensus amongst the study team to create a summarised list of gaps. Then, common themes amongst similar gaps were generated as potential targets for further research and intervention. We subsequently applied a deductive framework of six domains as defined by the AHRQ. These were capacity, 'the physical assets and their ownership, personnel, and organizational characteristics of a delivery system that determine the number of individuals and breadth of conditions for which the system can provide care'; organizational structure, 'the components of an organisation, both formal and informal, that describe functional operations in terms of hierarchy of authority and the flow of information, patients, and resources'; finances, 'mechanisms by which a healthcare delivery system is paid for its services and the financial arrangements and practices of the system and organizations within the system to allocate those funds, as well as the system's financial status'; patients, 'demographic characteristics, as well as wants, needs, and preferences of individuals and families of individuals who receive healthcare services from a healthcare delivery system'; care processes and infrastructure, 'the methods by which a healthcare delivery system provides healthcare services to its customers and patients as well as the degree of coordination of those methods'; and culture, 'shared values, beliefs, and assumptions that influence behaviour, attitudes, and meaning in an organization'.[19]

## Results

### Study characteristics

The search, screening, inclusion, and exclusion process is reported in Figure 1. After removal of duplicates, 3740 results were screened for potential inclusion, with 36 included studies (20 from databases, 16 from grey literature search). A search of the references of these included articles revealed an additional two articles that met criteria, for a total of 38 studies. The results from the grey literature search are detailed in Supplementary material 3.

The characteristics of the included studies are detailed in Table 1. Sixteen countries were represented, though representation from low-income countries was limited: USA (17 studies), Canada (five studies), Brazil (two studies), Germany (two studies), and single reports from Belgium, China, Columbia, Denmark, Finland, France, Japan, Netherlands, Norway, Pakistan, Spain, Sweden, and UK. There were three systematic reviews, 13 narrative reviews, eight cohort studies (five prospective and three retrospective), five interview and/or focus group studies for patients, two conference summaries, and one each of cross-sectional survey, interview study for physicians, book chapter, editorial, expert interview, quality standards, and study protocol. Seventeen studies focused on specific subtypes of surgery, predominantly hip and/or knee arthroplasty ($n$=8), total joint arthroplasty ($n$=2), with single studies in colorectal cancer, general and plastic, general only, major upper abdominal, major oncological, orthopaedic trauma, spine, and thoracic surgeries. Further patient and surgical characteristics are detailed in Supplementary material 4.

### Gaps and themes

Supplementary material 5 summarises the quotations regarding gaps in health delivery identified in the care of postoperative pain management for adult patients undergoing

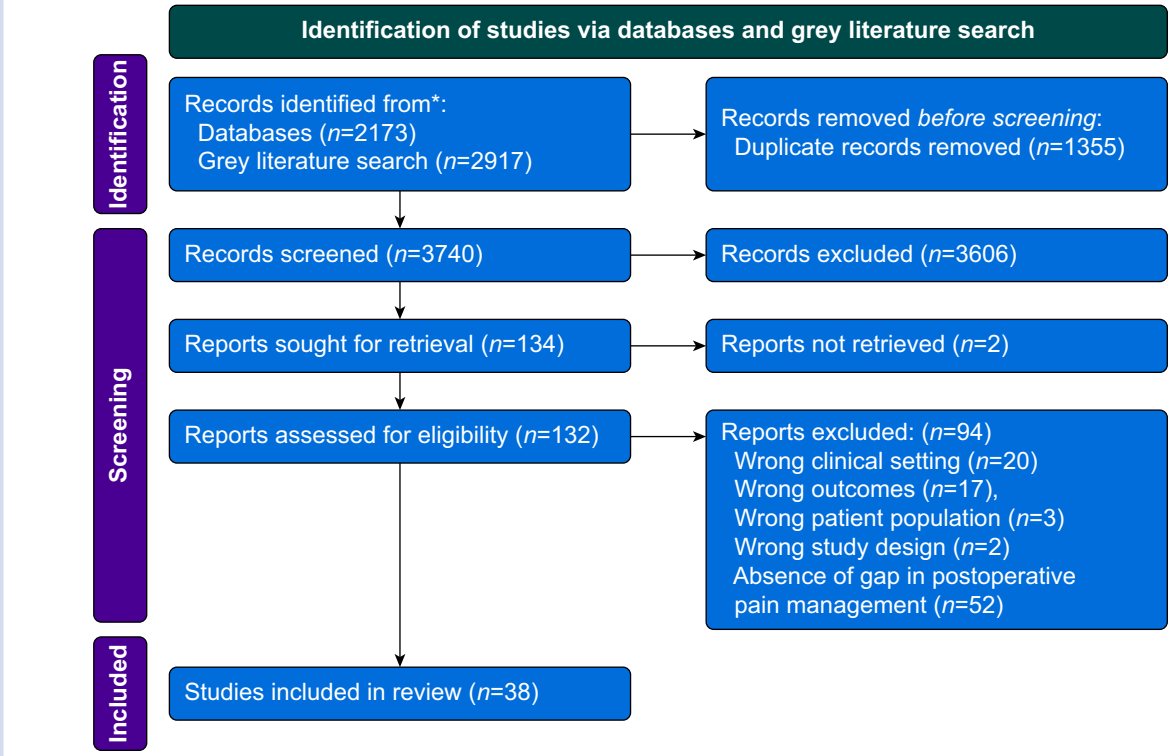


Fig 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram.

noncardiac surgery. From these, 23 gaps were extracted (Table 2), which encompassed all six AHRQ domains of healthcare delivery: care processes and infrastructure (19 gaps), patients (seven gaps), organisational structure (three gaps), capacity (two gaps), finances (two gaps), and culture (four gaps). Five overarching themes emerged (Table 2): education (22 studies), provision of continuity of care (21 studies), individualised management (10 studies), support for specific populations (11 studies), and research and knowledge translation (10 studies).

### Education

The most frequently mentioned gaps were related to education. Included studies reported that there was insufficient patient education on self-management of opioid and non-opioid pain medications, including purpose, adherence, perception, administration, weaning, disposal, and side-effects in an evidence-based, understandable format.[15,27,30,32,33,35,38,40–44,46,49,50,53–55] Lack of patient comprehension was prevalent, with one study[32] reporting that 70% (114 out of 147) 'could not accurately reproduce their pain medication regimen, regardless of age, employment status, income level, education level, and time between surgery and follow-up'. In a cross-sectional survey of 155 patients, Nasir and Ahmed[46] found that 'Excellent and good knowledge [about postoperative pain and its management] were observed in 11.61% and 21.94% [of] patients, respectively, whereas fair and poor knowledge were seen in 42.58% and 23.87%, respectively. Inadequate knowledge was more marked regarding analgesic side-effects and addiction risk'. Similarly, Lemay and colleagues[42] found that '44% of 1609 patients reported that they did not receive or received unhelpful information regarding postoperative pain self-management options for surgical knee or hip pain'.

Patients also appeared to have limited understanding about expected levels of postoperative pain and risk of persistent postsurgical pain.[15,27,38–40,50,53,55] Patients and providers reported negative perception of pain medications, including fear of opioids.[43,44,46,49,50,57,58] Communication gaps existed amongst providers and patients, including the reporting of pain and what to do when there are pain issues.[27,33,43,44,55,57] The issues in patient education were compounded by provider knowledge gaps including facilitating behaviour change, sharing tools for pain management, care coordination and treatment for patients with or at high risk of opioid dependence, appropriate perioperative opioid therapy and tapering, multimodal management options, and cultural competency.[30,33,35,39,43,45,57,58]

### Provision of continuity of care

According to Lopes and colleagues,[43] 'it is acknowledged that there is a period of subacute pain during which its management has been neglected' and 'this pain can last for several weeks, have a negative psychological impact, contribute to the process of central sensitisation, and is associated with hospital readmission and delayed postoperative recovery'. Through interviews of eight patients within the first 12 weeks after hip and knee surgery, Specht and colleagues[54] reported that patients had difficulty managing their pain at home. Patients expected 'more interaction with staff once they had gone home, to ask questions about their pain and pain medication

Table 1 Characteristics of included studies. N/A, not applicable.

| Author and year | Country | Specific surgical group | Study design | Study aim | Sample size |
|---|---|---|---|---|---|
| Andrés and colleagues, 2017[25] | Netherlands | N/A | Conference session summary and case report | To summarise the quality of acute pain management systems in Europe. | N/A |
| Beloeil and Sulpice 2016[26] | France | N/A | Narrative review | To discuss the risk factors, management, and consequences of perioperative pain. | N/A |
| Bleicher and colleagues, 2021[27] | USA | General surgery | Patient interviews | To understand patients' perspectives on postoperative pain management education. | 30 |
| Cata and colleagues, 2019[28] | USA | Major oncological procedures | Narrative review | To summarise challenges in acute postoperative pain management in patients with cancer. | N/A |
| European Federation of National Association of Orthopaedics and Traumatology 2019[29] | Belgium | Hip and knee arthroplasty | Expert interview | To improve postoperative pain management and improve postoperative outcomes relating to orthopaedic surgical practice. | 1 |
| Esses and colleagues, 2020[30] | USA | N/A | Narrative review | To discuss prevention and management of postoperative pain in patients aged >65 yr living with frailty. | N/A |
| Finnegan and colleagues, 2017[31] | USA | Hip and knee arthroplasty | Retrospective cohort | To characterise emergency department visits in the acute postoperative period after total knee and hip arthroplasty. | 152 782 |
| Gan 2017[2] | USA | N/A | Narrative review | To provide an update on the issues surrounding poorly controlled postoperative pain. | N/A |
| Gangavalli and colleagues, 2017[32] | USA | Orthopaedic trauma surgery | Prospective cohort | To identify patients who are at risk of non-compliance and misunderstanding in regards to their postoperative pain management. | 147 |
| Garcia and colleagues, 2017[33] | Brazil | N/A | Narrative review | To discuss issues in acute postoperative pain management and identify potential solutions. | N/A |
| Hadlandsmyth 2021[34] | USA | Total joint replacement | Study protocol | An RCT to study the efficacy of a perioperative pain self-management program to prevent the development of chronic postsurgical pain and prolonged opioid use. | N/A |
| Health Quality Ontario 2018[35] | Canada | N/A | Quality standards | To summarise recommendations for improving opioid prescribing for acute pain, including postsurgical pain. | N/A |
| Jackman and colleagues, 2019[36] | USA | N/A | Narrative review | To discuss challenges in postoperative pain management in patients with chronic pain and opioid dependence. | N/A |
| Joseph and colleagues, 2022[37] | USA | N/A | Systematic review | To evaluate the quality and availability of postoperative pain management measures. | 19 pain quality measures; 206 publications |
| Kennedy and colleagues, 2017[38] | Canada | Hip and knee arthroplasty | Patient focus groups and interviews | To explore patients' experiences and areas for improvement following hip and knee arthroplasty. | 32 (6 focus groups and 7 phone semi-structured interviews) |
| Klueh and colleagues, 2019[39] | USA | N/A | Physician interviews | To identify opportunities for improvement in transitions of care in postoperative opioid prescribing. | 10 surgeons and 10 primary care physicians |

Continued

Table 1 Continued

| Author and year | Country | Specific surgical group | Study design | Study aim | Sample size |
|---|---|---|---|---|---|
| Kojic and Clarke 2021[15] | Canada | N/A | Editorial | To discuss key considerations in the transition from acute to persistent postsurgical pain. | N/A |
| Kuusniemi and Pöyhiäk 2016[40] | Finland | N/A | Conference summary | To discuss challenges and propose solutions to improve postoperative pain management. | N/A |
| Lemay and colleagues, 2019[41] | USA | Total joint replacement | Patient interviews | To summarise postoperative pain management education needs after elective joint replacement. | 27 |
| Lemay and colleagues, 2017[42] | USA | Hip and knee arthroplasty | Prospective cohort | To evaluate the patient perspective of postoperative pain management education after elective joint replacement. | 1609 |
| Lopes and colleagues, 2021[43] | Brazil | N/A | Narrative review | To review postoperative pain prevention, diagnosis, and treatment. | N/A |
| Makimoto and colleagues, 2020[44] | Japan | Hip and knee arthroplasty | Systematic review | To explore patients' experiences in the first 6 weeks after total hip or knee arthroplasty. | 253 (16 qualitative studies) |
| Meissner and Zaslansky 2019[45] | Germany | N/A | Narrative review | To review postoperative pain management, and identify areas for improvement. | N/A |
| Nasir and Ahmed 2020[46] | Pakistan | Major upper abdominal surgery | Cross-sectional survey | To evaluate patients' knowledge of postoperative pain and its management. | 155 |
| Nguyen and colleagues, 2022[47] | USA | Total knee arthroplasty | Retrospective cohort | To investigate the relationship between limited English proficiency and requests for postoperative opioid prescription refills up to 90 days after hospital discharge for total knee arthroplasty. | 2148 |
| Pogatzki-Zahn and Lavandhomme 2021[48] | Germany, Belgium | N/A | Narrative review | To review the prevention of chronic postsurgical pain. | N/A |
| Rahman and colleagues, 2021[49] | USA | Spine surgery | Prospective cohort | To assess patients' knowledge and barriers to appropriate use of opioids postoperatively. | 174 |
| Reaza-Alarcón and Rodríguez-Martín 2019[50] | Spain, Ireland | N/A | Systematic review | To evaluate the benefits of nurse education in managing postoperative pain. | 12 studies |
| Simpson and Jackson 2017[51] | UK | N/A | Narrative review | To review methods for managing postoperative pain in opioid-tolerant patients. | N/A |
| Sjøveian and Leegaard 2017[52] | Norway | Hip and knee arthroplasty | Patient interviews | To assess patients' experiences with postoperative pain management after hip and knee arthroplasty. | 12 |
| Smith and colleagues, 2018[53] | Sweden | Colorectal cancer surgery | Prospective cohort | To explore stressful events and management strategies in the 4–6 weeks after colorectal cancer surgery. | 105 |
| Specht and colleagues, 2018[54] | Denmark | Hip and knee arthroplasty | Patient interviews | To explore patients' experiences in the first 12 weeks after hip and knee arthroplasty. | 8 |
| Sugar and colleagues, 2018[55] | Canada | N/A | Retrospective cohort | To describe emergency department visits within 6 weeks of surgery and explore issues of continuity of care. | 248 |
| Tawfic and colleagues, 2017[56] | Canada | N/A | Narrative review | To discuss prevention of chronic postsurgical pain, focusing on early identification of at-risk patients. | N/A |
| Thakur 2018[57] | USA | General and plastic surgery | Book chapter | To discuss the barriers to management of acute postoperative pain. | N/A |

*Continued*

Table 1 Continued

| Author and year | Country | Specific surgical group | Study design | Study aim | Sample size |
|---|---|---|---|---|---|
| Wang and colleagues, 2017[58] | China | Thoracic surgery | Prospective cohort | To describe postoperative pain follow thoracotomy and video-assisted thoracic surgery. | 262 |
| Yelton and Jildeh 2023[59] | USA | N/A | Narrative review | To highlight some of the disparities [of pain management and rehabilitation] while emphasising the importance of cultural competency in pain control and rehabilitation, particularly within the orthopaedic field. | N/A |
| Zaccagnino and colleagues, 2017[60] | USA | N/A | Narrative review | To describe the role of a comprehensive perioperative pain service to reduce costs and improve outcomes for surgical patients. | N/A |

and other concerns'.[54] We delineated five gaps in continuity of care. First, there is a need for multidisciplinary patient follow-up after hospital discharge, including assessment, adequate treatments, and referral.[26,29,31,35,39,43,44,52,54–56,58] Second, there was a gap in communication and care coordination amongst healthcare providers.[25,39,44,55,56] There needs to be a better understanding of the division in responsibility of care in pain management.[25,39] Funding and operational resources are required to develop effective specialised pain services that are accessible.[15,29,39,45,56,60] Another gap lies in equity in access especially for racial and ethnic minorities, including transportation, availability of primary care, and affordability.[31,33,35,47,57,59] Meissner and Zaslansky[45] remarked 'there remain gaps between outcomes obtained in [randomised controlled trials] as opposed to the clinical routine. Questions remain such as how to set up effective specialized pain services in many different settings, worldwide'.[45] Lastly, there was a lack of standardised practice protocols to provide consistent pain management.[40,58]

### *Individualised pain management*

The need for individualised pain management was clearly identified, including difficulty in accurate patient stratification of the expected degree and trajectory of postsurgical pain.[25,45,48,56] Next, pain management strategies and education are often not tailored to patient and surgical risks of postsurgical pain, including increased follow-up for high-risk patients.[15,43,48,55,56] There was also a gap in individualised discharge planning and education on pain management, rehabilitation, and contact.[44,52,54–56] As Specht and colleagues[54] summarised, 'there is a need to develop in partnership with each individual patient a post-discharge plan of care and rehabilitation to meet their individual needs, preferences, and mode of motivation'.

### *Support for specific patient populations*

There were challenges unique to certain populations that need to be addressed. Patients with opioid tolerance[28,36,43,51,56] 'have higher rest and dynamic pain scores, greater opioid use, and require frequent prescription alterations compared with opioid-naive patients'.[51] Similarly, patients with chronic pain may have 'tolerance to opioid medications, coexisting depression and anxiety, and higher levels of postoperative pain [which] all add to the difficulty of adequately treating [postoperative] pain'.[36] In particular, patients with chronic pain related to cancer may struggle with 'preoperative pain (i.e. rapidly growing tumours and painful neuropathies), opioid tolerance, and contraindications to non-opioid analgesics or regional anesthesia', with a rate of persistent postsurgical pain ranging from 5% to 59%.[28] The increased risk of persistent postsurgical pain (40%) was also present in older surgical patients, which may be an underestimate as a result of underreporting of pain in older individuals.[30] The physiology, comorbidity, cognition, and polypharmacy considerations in older individuals necessitated the 'need for a careful and nuanced approach to treating both acute pain and chronic postsurgical pain in this population'.[30] Furthermore, there were disparities in pain management and experience among underrepresented demographic subgroups[31,35,47,57,59]: 'there are fractures along the lines of racial, ethnic, and gender divisions', and 'the groups that are at most risk for inadequate pain relief are racial and ethnic minorities'.[57]

Table 2 Themes, gaps, and health delivery domains. Details of each gap and example quotations are listed in Supplementary material 5.

| Themes | Gap and number of studies | Healthcare delivery domain[19] |
|---|---|---|
| Education (*n*=22) | Patient education on self-management of pain medications (*n*=18)[15,27,30,32,33,35,38,40–44,46,49,50,53–55] | Care processes and infrastructure |
| | Setting patient expectation on postoperative pain (*n*=8)[15,27,38–40,50,53,55] | Care processes and infrastructure |
| | Negative perception of pain medication by patients and providers (*n*=7)[43,44,46,49,50,57,58] | Culture |
| | Communication amongst providers and patients (*n*=6)[27,33,43,44,55,57] | Care processes and infrastructure |
| | Provider knowledge on pain management and cultural competence (*n*=8)[30,33,35,39,43,45,57,58] | Organisational structure |
| Provision of continuity of care (*n*=21) | Multidisciplinary patient follow-up after hospital discharge (*n*=12)[26,29,31,35,39,43,44,52,54–56,58] | Care processes and infrastructure |
| | Communication and care coordination amongst healthcare providers (*n*=5)[25,39,44,55,56] | Care processes and infrastructure |
| | Clear division of responsibility of care with regards to postoperative pain management (*n*=2)[25,39] | Care processes and infrastructure |
| | Resources to facilitate access to effective specialised pain services (*n*=6)[15,29,39,45,56,60] | Finances, capacity, and organisational structure |
| | Equity in access to quality and efficient healthcare (*n*=6)[31,33,35,47,57,59] | Patients, capacity, finances, care processes and infrastructure, culture |
| | Standardised practice protocols (*n*=2)[40,58] | Care processes and infrastructure |
| Individualised pain management (*n*=10) | Accurate patient stratification of the degree and trajectory of postsurgical pain (*n*=4)[25,45,48,56] | Care processes and infrastructure, patients |
| | Pain management strategies and education tailored to patient and surgical risks of postsurgical pain (*n*=5)[15,43,48,55,56] | Care processes and infrastructure, patients |
| | Individualised discharge planning and education (*n*=5)[44,52,54–56] | Care processes and infrastructure |
| Support for specific patient populations (*n*=11) | Patients with opioid tolerance (*n*=5)[28,36,43,51,56] | Care processes and infrastructure |
| | Patients with chronic pain (*n*=2)[36,56] | Patients, care processes and infrastructure |
| | Patients with chronic cancer pain (*n*=1)[28] | Patients, care processes and infrastructure |
| | Older surgical patients (*n*=1)[30] | Patients, care processes and infrastructure |
| | Underrepresented demographic subgroups (racial and ethnic minorities, non-English speakers, gender, insurance status) (*n*=5)[31,35,47,57,59] | Patients, care processes and infrastructure, culture |
| Research and knowledge translation (*n*=10) | Research and development for effective pharmacologic and non-pharmacological strategies to prevent or treat persistent postsurgical pain (*n*=6)[2,30,34,35,48,56] | Organisational structure |
| | Translation of evidence-based findings into clinical practice and patient education (*n*=3)[35,40,45] | Care processes and infrastructure |
| | Evidence-based quality measures to guide and promote postoperative pain management (*n*=1)[37] | Care processes and infrastructure |
| | Research involving underrepresented demographic subgroups (racial and ethnic minorities, gender, insurance status) (*n*=1)[59] | Care processes and infrastructure, culture |

### *Research and knowledge translation*

Included studies identified a lack of evidence-based pharmacologic and non-pharmacologic strategies to prevent or treat persistent postsurgical pain.[2,30,34,35,48,56] Moreover, gaps in knowledge translation were apparent, as differences exist between research findings and what is delivered via clinical practice and patient education.[35,40,45] As Tawfic and colleagues[56] remarked, 'not only do we have a limited grasp on when to treat, but we are also uncertain about what is both effective and safe', and 'well-designed clinical trials are required to identify the role of the current pain pharmacological agents, in addition to focusing on internal factors (such as psychological factors) in preventing and treating [chronic postsurgical pain]'. Moreover, we lack quality indicators to assess the delivery of pain management care. A systematic review of quality measures found only three on postoperative pain management: multimodal analgesia, limiting opioid use in opioid-naïve patients, and monitoring opioid refills.[37] Importantly, more studies need to be performed in underrepresented groups.[59]

## Discussion

Acute and chronic pain after surgery are prevalent and expensive problems, with inadequate management contributing to negative recovery trajectories and the development of persistent postsurgical pain.[3] This scoping review of pain management in the first 3 months after discharge following inpatient noncardiac surgeries identified and synthesised gaps that spanned all domains of health delivery. Despite substantial variations across healthcare systems, we identified five common themes: education, provision of continuity of care, individualised pain management, support for patient

populations, and research and knowledge translation. With limited pharmacologic options to prevent the development of persistent postsurgical pain,[16] these health delivery gaps represent potential targets for future process design and research aimed at mitigating the transition from acute pain to persistent postsurgical pain. Anaesthetists have an opportunity to play leadership roles in multidisciplinary perioperative pain management beyond the hospital setting to help better understand and manage pain during a critical and vulnerable period of acute pain control and chronic pain development.

This scoping review highlights several areas that deserve further attention from quality improvement and research. Firstly, anaesthetists and perioperative care providers need to more frequently engage with patients, caregivers, and health providers in pain education, using verbal and written approaches with checks for understanding and reviews at multiple time points.[41,61] Tailored patient education, counselling, and shared decision-making can reduce postoperative opioid use and pain scores, anxiety, length of hospital stay, and emergency room visits, and improve patient satisfaction and physical function.[42,55,62–66] For example, a systematic review found that psychoeducation about surgery and pain reduced the duration of hospitalisation by 1–3 days.[64] Involvement of patients and caregivers in the design of perioperative patient education may help increase engagement and feasibility. Educating healthcare providers is also important to optimise pain control and avoid delays in treatment. In addition, health providers need to be conscientious of potential biases and disparities in pain management, including race, ethnicity, and gender.[57,67–69] To address this, more education about pain management and cultural competence must be incorporated into the curriculums of health science faculties and continuing education.[59,70]

Secondly, health systems need to create standardised, patient-centred care pathways to provide continuity of care in pain management. Access to transitional pain services should be expanded. Postoperative pain medication management follow-up should be in place for patients who continue to have pain beyond 7 days,[35] with coordinated multidisciplinary management of pain medication tapering and timely referral to chronic pain specialists.[39] Electronic health records (EHRs) order sets optimised for each surgery may help reduce unnecessary discharge opioid prescriptions.[71]

Thirdly, we need to better understand and provide individualised postoperative pain management. This needs to start with developing accessible and accurate tools to assess pain and function,[72] particularly in outpatient settings. The increasing availability of data from EHRs and consumer devices may help bridge the data gap of pain experiences in the outpatient setting, and shed light on the transition between acute and chronic pain. Moreover, a population cohort involving genome-wide analysis may reveal genetic factors associated with acute and chronic postoperative pain.[73]

Fourthly, patients with chronic opioid medications, cancer pain, and older individuals deserve further clinical and research attention in post-discharge pain management. Health systems need to be adaptable to facilitate equitable, tailored strategies for vulnerable clinical and demographic populations including race, ethnicity, and gender.[57,67–69]

Finally, we identified important gaps in research and knowledge translation. Healthcare providers have limited data and understanding of the best approaches to pain management to mitigate the transition from acute to persistent postsurgical pain in and out of hospital. The knowledge gap is intricately linked to many of the above themes. For example, the difficulty in delivering individualised care is closely related to the lack of evidence-based risk stratification tools and the dearth of studies in underrepresented groups. As health system resources are finite, we need data-driven strategies to optimise resource allocation and provide consistent pain management at both population and individual levels.

Although similar gaps exist in diverse health systems, health providers and administrators must review the gaps and design tailored strategies that would be feasible for their respective milieu, and increase knowledge sharing to help integrate best practices in low-income countries. Cost analysis research demonstrated that preoperative patient education is associated with decreased overall healthcare expenditures in elective spine and hip arthroplasty surgeries.[74,75] Similarly, a national cohort study showed that hip fracture care adhering to a bundle of performance measures that included systematic pain assessment translated into cost savings within 1 yr after surgery.[76] Thus, the costs of intervening on the gaps must be viewed in the context of potential cost savings and increased efficiency of the overall health system. Importantly, our review showed that the potential solutions to many of the gaps (e.g. education and provider communication) need not be resource-intensive, but would require working with stakeholders to redesign post-discharge pain management to align with patients' journey and priorities of recovery.

## Strength and limitations

There are several strengths of this review. The search was comprehensive, providing a contemporary synthesis of the literature. Both inductive and deductive analyses were performed to delineate gaps and themes to provide tangible targets for intervention. There was diversity in geographic location of the included papers, representing perspectives from around the world. Several limitations also exist. The operationalisation of the term 'gap' can be subjective, although we were as inclusive as possible during screening and data extraction. We applied an inductive and deductive framework to the categorisation of the gaps, but there may be alternative schemes of organisation. Half of the studies were on specific surgical populations, which may limit the generalisability of our findings in other surgeries. This review may not have captured gaps from all types of health systems globally because of potential publication bias, limited research in low-income countries, and the inclusion of only English-language articles. Moreover, because of the variations in health delivery around the world, it may be difficult to ascertain the root cause of the gaps (e.g. lack of implementation of best practices and provision of existing services, *vs* insufficient resources and pathways). Nevertheless, our findings highlight the multifactorial, interlinked nature of health delivery gaps and provide a starting point to guide further research and quality improvement. More qualitative and quantitative studies across diverse healthcare systems, surgery types, and demographics would be helpful in elucidating health delivery needs. Importantly, although there is an assumption that the identified gaps are important to address, further research is needed to conclude whether intervention of many of the identified gaps would improve or worsen patient outcomes.

### Conclusions

This scoping review revealed gaps during a critical period in postoperative pain management spanning all domains of health delivery. These gaps represent targets for care improvement and research to improve perioperative care and longer-term patient-centred outcomes. Anaesthetists have an opportunity to play a leadership role to facilitate individualised, streamlined pain management during the first few months after surgery.

## Authors' contributions

Study design: all authors
Data extraction: JK, MD, KK, MH
Data analysis: JK, MD, KK, MH, DM
Search strategy and article management: LB
Interpretation: JK, MD, KK, MH, DM, JP, HS, JO, AF
Manuscript first draft: JK, MD, KK, MH, DM
Manuscript revisions: all authors

## Declarations of interest

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## Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.bja.2023.08.006.

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