Systematic Review Article

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A systematic review of patient-centered interventions for improving pain outcomes and reducing opioid-related risks in acute care settings

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Abstract

Objectives: This systematic review evaluates the literature for patient-oriented opioid and pain educational interventions that aim to optimize pain management using opioid-sparing approaches in the orthopaedic trauma population. The study protocol was registered with PROSPERO (CRD42021234006).

Data Sources: A review of English-language publications in CINAHL (EBSCO), MEDLINE through PubMed, Embase.com, PsycInfo (EBSCO), and Web of Science Core Collection literature databases published between 1980 and February 2021 was conducted using PRISMA guidelines.

Study Selection: Only studies implementing patient-oriented opioid and/or pain education in adult patients receiving acute orthopaedic care were eligible. Outcomes were required to include postinterventional opioid utilization, postoperative analgesia and amount, or patient-reported pain outcomes.

Data Extraction: A total of 480 abstracts were reviewed, and 8 publications were included in the final analysis. Two reviewers independently extracted data from selected studies using a standardized data collection form. Disagreements were addressed by a third reviewer. Quality of studies was assessed using the Cochrane Risk of Bias Tool.

Data Synthesis: Descriptive statistics characterized study findings, and content analysis was used to discern themes across studies.

Conclusion: Our findings indicate the merit for patient-centered educational interventions including verbal/written/audio–visual trainings paired with multimodal approaches to target opioid-sparing pain management and reduce short-term pain scores in urgent and acute care settings after acute orthopaedic injuries. The scarcity of published literature warrants further rigorously designed studies to substantiate the benefit of patient-centric education in reducing prolonged opioid utilization and associated risks after orthopaedic trauma.

Level of Evidence: Therapeutic level III.

Keywords: orthopaedic trauma, opioids, pain management, patient-centered intervention, outcomes

1. Objectives

Providing adequate analgesia is a critical component of patient care after orthopaedic injury. Opioids have a vital role in the acute orthopaedic trauma setting because they have been the mainstay of primary analgesia for most surgical patients.[1] However, opioid prescribing for patients undergoing orthopaedic procedures has historically been identified as a major contributor to the opioid epidemic.[2,3] Moreover, given the pain management needs of patients, orthopaedic surgeons are among the top 3 specialties for opioid prescription frequency and volume.[4–6] This has prompted prescriber-oriented interventions including increased legislative oversight and physician education addressing stewardship.[7–9] Still, deaths related to opioid use are increasing.[10] Although the overall prescribing rate in the United States has undergone a relative decrease of 16.9% from 2015 to 2017,[11] prescribing among orthopaedic surgeons remains elevated.[2] These data speak to the complex pain management needs of orthopaedic surgical patients regardless of prescribing policies and present opportunities to implement interventions that optimize pain management and address opioid safety. This can also be visualized by the stark contrast in opioid

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utilization and prescribing practices in Europe, where no evidence suggests a current or emerging opioid crisis in larger western European countries, including Germany, France, the United Kingdom, and the Netherlands, when using the same indicators as in the United States.[12] However, in the presence of alarming exceptions of regional spikes, authorities ought to remain vigilant.[12,13]

Previous reviews have illustrated the utility of patient education on curbing opioid-related risks or improving pain outcomes, yet, to date, no reviews have examined the utility of interventions on both opioid utilization and pain outcomes after orthopaedic trauma. In a systematic review of patient education interventions for prescription opioids, Kadakia et al[14] found that methods to educate patients about opioid medications have varying effects on patient knowledge of the medications and opioid-related medication adherence. Importantly, efforts to implement education on opioid safety offer a significant opportunity to incorporate patient-centered pain management education, which has been shown to improve pain outcomes and reduce opioid consumption for some orthopaedic surgical patients.[15] However, designing effective interventions that are feasible to implement in the fast-paced environment of orthopaedic trauma care, a setting with high opioid prescribing and complex pain, remains challenging.[16] Among studies evaluating knowledge retention after patient education on opioid use, there is a paucity of research investigating the impact of patient education (and corresponding health literacy) on prescription opioid use in the acute care setting.[14] Moreover, scientific evidence on this topic dwindles when examining the patient population at highest risk for opioid misuse, namely the orthopaedic trauma patient.[17] Nevertheless, amid the abundance of clinical interventional studies examining the efficacy and impact of multimodal pain control, Horn and colleagues[18] determined in a systematic review that lower levels of postsurgical acute pain resulted in fewer opioid prescriptions. In turn, the postsurgical pain level exhibited a significant correlation with preemptive and preventative pain psychoeducation.[18] This underscores the need to design and implement patient-centered educational interventions that can improve both patients' understanding of pain management and opioid safety.

This systematic review aims to identify the components necessary for effective patient-oriented interventions toward improving pain outcomes and preventing or reducing long-term opioid use in fast-paced care settings among orthopaedic trauma surgical patients. We hypothesize that effective patient-oriented interventions for optimizing pain management and mitigating excess opioid utilization share key elements in their methodology and application, including, but not limited to, type and format of educational information and its application, and timing and/or duration of supplemental interventions.

2. Study Selection

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) recommendations were used to guide this review. The study protocol was registered with PROSPERO (CRD42021234006).

2.1. Inclusion Criteria

2.1.1. Participants. Studies were considered eligible if they included participants who were 18 years or older and who presented to a trauma unit, emergency department, or acute care center with orthopaedic trauma. Studies were excluded if they included participants younger than 18 years, were conducted at outpatient clinics or nonacute care settings, required intensive care unit admission for polytrauma, or targeted participants with substance use disorders.

2.1.2. Intervention. Studies were included if they evaluated interventions focused on patient-oriented opioid education, pain education, or both.

2.1.2. Outcomes. Studies were considered if they captured postinterventional opioid use, postoperative analgesia and amount (eg, morphine milligram equivalents), discharge analgesia and amount, or pain outcomes.

2.1.3. Types of Studies. This review considered experimental, quasiexperimental, and nonexperimental designs including randomized controlled trials (RCTs), nonrandomized controlled trials, prestudies and poststudies, and qualitative studies. Conference abstracts or proceedings, opinion papers, study registries, and dissertations were not included.

2.2. Search Strategy and Selection Criteria

A comprehensive literature search was undertaken to identify relevant eligible articles. The search strategy was developed and conducted by an experienced health sciences librarian (S.L.) with input from all research team members. Five bibliographic databases were searched to identify potential records (CINAHL, Embase.com, PsycInfo, MEDLINE through PubMed, and Web of Science Classic Core Collection). Peer-reviewed studies published in the English language between January 1, 1980, and February 28, 2021, were considered for inclusion. No geographic region was excluded or limited. The searches combined controlled vocabulary supplemented with keywords related to the concepts of trauma centers, opioid use, and patient education. Search strategies for each database are presented in Appendix 1.

The databases were searched on February 17, 2021, and again on November 24, 2021. A total of 642 articles were identified through the database searches and exported into EndNote x20 (Clarivate, 2020). Duplicates (114) were excluded, leaving 528 articles to be assessed in the title/abstract screening phase. These records were uploaded to Covidence, a web-based program to facilitate systematic review (www.covidence.org). Two reviewers (J.S.U.A. and A.P.) independently selected studies for possible inclusion, excluding 517 records. A third reviewer (N.G.) resolved conflicts in cases of disagreement between the 2 reviewers. Eleven studies met the criteria for full-text review. During full-text review, 3 articles were excluded, leaving 8 articles that met all the eligibility criteria for inclusion in this study. A search of the bibliographies of the included studies failed to yield any additional citations. Fig. 1 shows the flow diagram.

2.2.1. Data Collection Process. Data extracted included study design and methodology, participant demographics and baseline characteristics, numbers of events and measures of effect, type of patient-oriented pain/opioid education interventions, and the measured effect on opioid utilization.

2.2.2. Risk of Bias (Quality) Assessment. Risk of bias was assessed by 2 reviewers (J.S.U.A. and A.P.) using the Cochrane

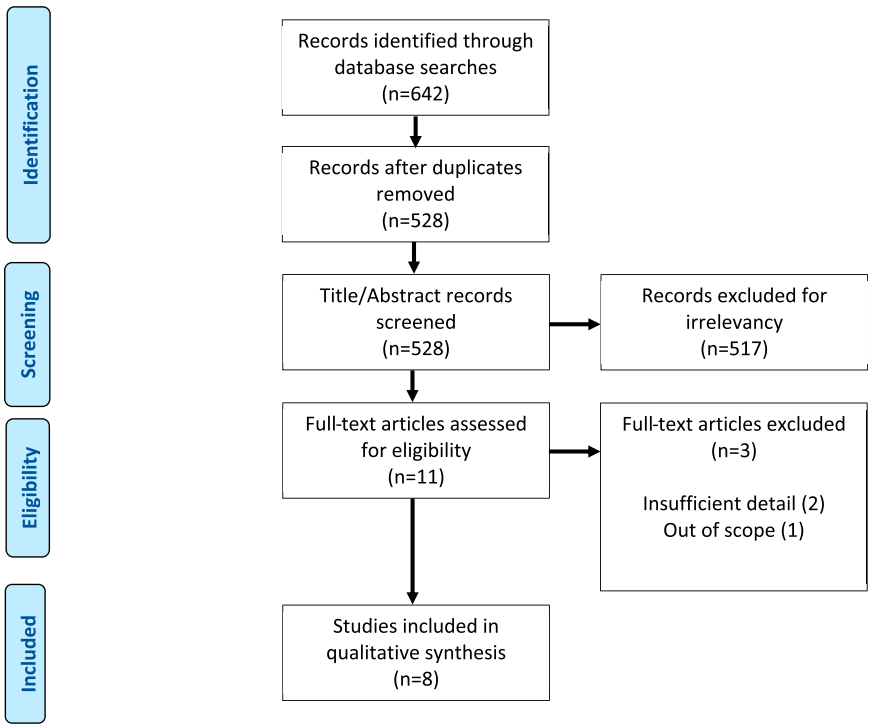

FIGURE 1. Flow diagram of literature search.

Risk of Bias Tool for risk of bias in RCTs and Risk Of Bias In Nonrandomized Studies—of Interventions (ROBINS-I) for all others. Any disagreements between the 2 reviewers were resolved by a third reviewer (N.G.). Quality was determined to be good, fair, or poor based on the assessments.

2.2.3. Strategy for Data Synthesis. A statistical meta-analysis of the data was not possible because of the heterogeneity of the study populations, interventions and comparators, outcome measurements, and data analyses across the studies. Therefore, descriptive statistics were reported using predefined data fields for demographics, interventions, study methods, and outcomes. The findings of all the studies have been presented and discussed in narrative form (Table 1).

The study was deemed exempt from Institutional Review Board and Animal Use Committee Review.

3. Data Extraction

3.1. Study Characteristics

Eight studies met inclusion: 4 RCTs,[19–22] 2 retrospective cohort studies,[23,24] and 2 quasiexperimental studies.[25,26] All articles were in English and conducted between 1984 and 2020 in the United States[19–24] and China.[25,26]

3.2. Patient Population

A total of 4552 participants were in the studies, of which 2231 received some form of patient-centered intervention. Of those, 1444 were patients with orthopaedic trauma, of which 703 received patient-centered intervention. The mean age of participants ranged between 41 and 81.3 years, and all studies reported no significant differences in age distribution, sex, race, or ethnicity regarding their respective study groups.

3.3. Setting

All investigations took place in an acute care setting for musculoskeletal injuries, with 4 studies in the orthopaedic trauma setting,[22,23,25,26] 3 studies in the ED and urgent care setting,[19–21] and 1 study conducted within the orthopaedic surgery department with orthopaedic trauma listed as a subgroup, containing 130 and 90 participants in the preintervention and postintervention groups, respectively.[24] Patients in 6 investigations underwent surgical fixation of an orthopaedic injury, while in 3 studies, patients were recruited in the ED, where they were treated for orthopaedic injuries, including whiplash.[19–21]

3.4. Interventions and Timing of Implementation

All interventions were primarily patient-centered educational approaches directed toward pain management. In 1 retrospective cohort study, patient education on pain and opioid utilization was encompassed within a novel policy implementation that also included adjusted narcotic prescription guidelines and restrictions for prescribers when compared with preimplementation.[24] In another RCT, prescriber-facing components included (1) a provider medication alert reminding the prescribing physician to counsel the patient about safe use of opioids, (2) an inbox message delivered to the primary care outpatient provider informing them of the new prescription and pill quantity and requesting that they follow-up with the patient to provide additional counseling about safe use, and (3) a request to the dispensing pharmacist to counsel the patient about safe use (printed automatically on the paper prescription requisition).[19]

TABLE 1

Summary of Included Studies

Author/Year/ Country	Study Design	Participants and Setting	Intervention	Results			Quality*
				Pain (VAS/VRS)	Time of Measurement	Opioid Utilization	
McCarthy et al[19] 2019, the United States	RCT	Emergency department (n = 6520	Written and spoken explanation of information sheet about hydrocodone–acetaminophen + daily educational text messages: side effects, dangers of combination with medication and substances, mechanism of action. Intervention included provider-targeted measures: alert to counsel patient about safe use, reminder to primary care/ outpatient provider to counsel patient about safe use of new prescription, request dispensing pharmacist on counsel about safe use.	Not applicable	Phone call 7–14 days after emergency department visit	Safe use Intervention arms demonstrated safe use compared with control $P < 0.025$, OR 2.46 (1.19–5.06) Knowledge Intervention (education + SMS) demonstrated increased knowledge compared with control $P < 0.025$ OR 0. 57 95% CI: (0.09–1.06)	Good
Mears et al[24] 2019, the United States	Retrospective cohort study	Orthopaedic surgery department (n = 2654)	Preoperative patient education on pain and opioid utilization Part of policy implementation which also included procedure-based narcotic prescription allocation (small procedure 20 tablets, moderate procedure 40 tablets, large procedure 60 tablets) and only 1 narcotic per prescription.	Not applicable	30 days postdischarge	Tablets per prescription (Percocet): 47.2 (pre) versus 39.2 (post) $P < 0.0001$ Mean MME prescribed: 354 (pre) versus 265 (post) $P < 0.0001$ Avg. prescription: 1.76 (pre) versus 1.34 (post) *no P value* # Of refills 949 (pre) versus 404 (post) *no P value* 30-day readmission rate 6.2% (pre) versus 4% (post) *no P value*	Good
McCarthy et al[20] 2015, the United States	RCT	Emergency department (n = 220)	Written and spoken explanation of information sheet about hydrocodone–acetaminophen: side effects, dangers of combination with medication and substances, mechanism of action, risk of addiction.	4.7 (control) versus 5.1 (intervention)	Phone call 4–7 days after emergency department visit	Average number of tablets taken per day at home 2 (control) IQR 1–2 versus 2 (intervention) IQR 1–3, $P = 0.83$ Retained knowledge Precautions related to taking additional acetaminophen: 38%, 95% CI = 28.3%–47.7% (intervention) versus 18.2% (control) 95% CI = 10.9%–25.5%, $P < 0.05$	Good

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TABLE 1
(*continued*)

Author/Year/ Country	Study Design	Participants and Setting	Intervention	Results			Quality*
				Pain (VAS/VRS)	Time of Measurement	Opioid Utilization	
						Side effects: Median 2 (intervention) IQR 1–2 versus 1 (control) IQR 0–2, $P < 0.001$ Driving within 6 h after taking hydrocodone: 3% (intervention) CI = −0.3%–6.3% versus 13.6% (control) 95% CI = 7.2%–20%, $P < 0.05$	
Wong et al[25] 2014, China	Quasiexperimental	Orthopaedic surgery department (n = 152)	Preoperative 20-minute brief educational intervention: enhance knowledge on stress and anxiety coping Reduce anxiety and gain self-efficacy.	3.0 (control) versus 2.3 (intervention)	Days 2, 4, 7 (inpatient)	Not applicable	Good
Holman et al[23] 2014, the United States	Retrospective cohort study	Orthopaedic surgery department (n = 613)	Preoperative counseling by physician: length of the prescription (only 6 weeks), side effects of opiates and possibility of dependency, acknowledging the discomfort and pain they may experience.	Not applicable	6, 12 weeks	Patients who received counseling were more likely to stop opioid use by 6 weeks post operatively (73% vs. 64%) ($P = 0.012$); at 12 weeks, the likelihood that patients had stopped opioid use was equal (80% and 80%) ($P = 0.90$)	Good
Wong et al[26] 2010, China	Quasiexperimental	Orthopaedic surgery department (n = 125)	Preoperative 30-minute education: pain, coping strategies, breathing relaxation exercises.	Decreased throughout inpatient stay (intervention)	Inpatient, 1 month, 3 months	Increased analgesic request at day 2	Good
Oliveira et al[21] 2006, the United States	RCT	Emergency department (n = 126)	Psychoeducational video in ED: pathophysiology of whiplash, symptomatology within 48 h (including pain), medical treatment, symptomatology after 48 h (including pain), recovery time, nonmedical alternatives (including breathing techniques and relaxation).	5, 4.5, 4.80 (control) versus 1.5 1.25 0.57 (video), LR 15.6 at 6 months	Phone call at 1, 3, 6 months	Taking narcotics: 32%, 36%, 36% (control) versus 2%, 2%, 4% (video) < 0.001	Good
Ceccio et al[22] 1984, the United States	RCT	Orthopaedic surgery department (n = 20)	Perioperative Jacobson Relaxation technique: tongue and jaw exercises, coordinated rhythmic breathing, and a lack of attention to thoughts, words, and speech.	5.6 (control) versus 3.9 (intervention)	Within 24 h postoperatively (inpatient)	Intramuscular meperidine mg: 135.0 ± 39.441 (control) versus 87.5 ± 44.488 (intervention) $P < 0.05$	Fair

* Quality assessment based on Cochrane Risk of Bias Tool for risk of bias in RCTs and Risk Of Bias In Nonrandomized Studies of Interventions (ROBINS-I0).
CI, confidence interval; IQR, interquartile range; LR, likelihood ratio; MME, morphine milligram equivalent; VAS, visual analog scale; VRS, visual rating scale.

3.5. Operative Setting

Among the 6 studies in the operative setting,[22–27] 4 studies (66.7%) implemented preoperative intervention.[24–26] The 4 preoperative interventions consisted of (1) a 30-minute education session led by a researcher on pain, coping strategies, and breathing relaxation exercises, based on the self-efficacy theory by Bandura et al and DeGood & Shutty et al[26,28–30]; (2) patient education on pain and opioid utilization by the treating physician[24]; (3) a preoperative 20-minute brief educational intervention and breathing exercises led by a researcher to enhance knowledge of coping and to reduce anxiety and gain self-efficacy[25]; and 4) preoperative counseling (standardized discussion) by the treating surgeon, including pain education and acknowledgement of the patient's pain, discussing pain reduction with oral opiates and their significant potential side effects (including physical dependence and withdrawal symptoms), as well as the limited postoperative duration of narcotic provision (6 weeks).[23] Two studies implemented a perioperative intervention. Ceccio et al administered the intervention in 3 phases: phases 1 and 2 preoperatively and phase 3 postoperatively.[22] This intervention

taught the Jacobson Relaxation technique, involving the tongue and jaw, coordinated rhythmic breathing, and lack of attention to thoughts, words, and speech.[31] In phases 1 and 2, this technique was delivered by the investigator with verbal and written instructions and teaches back method, respectively. Phase 3 used postoperative coaching of the technique. The other perioperative intervention study included client-centered therapy,[32–34] which was administered by a trainee counselor immediately after patient allocation and twice per week for 45 minutes during hospitalization.[27]

3.6. Nonoperative Setting

Participants in the 3 nonsurgical studies (ED and urgent care setting) received (1) a 12-minute psychoeducational video,[21] (2) written and spoken explanation of information sheets,[20] and (3) plain language medSheets about hydrocodone–acetaminophen, "Take–Wait–Stop" patient-centered medication labeling changes made to print prescription requisition, and daily educational text messages focused on safe use, side effects, and safe behaviors related to prescription opioids for 7 days.[19] Of note, the latter 2 studies were conducted by the same group.

3.7. Outcome Measures

The interval of measurement time points across all studies ranged from preoperative (baseline measurements) to 6 months. Five studies recorded pain as an outcome measure,[20–22,26,35] 4 of which also recorded opioid utilization as an outcome measure.[20–22,26] All pain scores were recorded on a visual analog scale or verbal rating scale of 0–10. The remaining 3 studies investigated the effect of patient intervention on opioid utilization without reporting pain scores.[19,23,24] The studies classified opioid utilization as (1) average prescription per patient, tablets per prescription, and morphine milligram equivalents (MME)[24]; (2) analgesic use[26]; (3) safe use of opioids[19,20]; (4) narcotic use[21]; (5) intramuscular meperidine injections in milligrams[22]; and (6) duration and time of cessation of opioid use after discharge.[23]

3.8. Timing of Measurement

Two studies[22,25] recorded the outcome measures for pain and opioid utilization during inpatient hospitalization at days 2, 4, 7, and only within the first 24 hours, respectively. Two studies implemented additional follow-up measurement time points at 1 and 3 months postoperatively, respectively.[26,27] In 2 studies, the pain responses[20] and responses to opioid utilization[20] were elicited through phone interview 1 to 2 weeks after discharge from the ED. In the third study within the ED setting, data on pain and opioid utilization were also collected through phone calls at 1, 3, and 6 months after discharge. In the 2 retrospective cohort studies, data were collected at 6 and 12 weeks[23] and during an unspecified postdischarge period.[24]

3.9. Effect of Interventions on Pain

Four of 5 studies (80%) listing pain levels as outcome measures demonstrated significantly improved pain scores in the intervention group when compared with the respective control group ($P < 0.05$).[21,22,25,26] McCarthy et al in 2019 found that participants exposed to their verbal and written educational intervention had improved pain scores compared with participants in the control arm; although statistically significant, the improvements were not clinically meaningful given the marginal improvement of ~0.4 points.[20] Wong et al[26] in 2014 found that pain levels recorded in the inpatient setting were significantly better up to 3 days after surgery with preoperative education on pain and coping strategies, including breathing exercises, when compared with the control group ($P < 0.001$). In a separate study, Wong et al[25] in 2010 also found a significant difference in average pain scores of ~0.4 after implementing a 20-minute brief educational intervention focusing on anxiety reduction and self-efficacy, when compared with the control group 7 days after surgery ($P < 0.05$). Oliveira et al[21] in 2006 observed markedly lower pain scores at 1, 3, and 6 months after patients watched a psycho-educational video ($P < 0.001$). Ceccio et al in 1984 observed significantly lower pain scores of ~1.7 on a visual analog scale within 24 hours after surgery in participants who were taught relaxation techniques ($P < 0.05$).[22,31]

3.10. Effect of Intervention on Opioid Utilization

Of the studies assessing opioid utilization as a main outcome, 71% (N = 5) demonstrated significant reduction in opioid utilization or dosage and all 3 studies that solely focused on the outcome of opioid utilization after patient education showed a significant improvement.[19,23,24] McCarthy et al in 2019 observed a significant increase in safe use and medication knowledge after written and spoken explanation of an informational sheet about hydrocodone–acetaminophen in the ED, coupled with daily educational text messages after 1 to 2 weeks postdischarge ($P < 0.025$).[19] Mears et al[24] in 2019 noted a significant decrease in tablets per prescription and mean MME prescribed ($P < 0.001$), while also observing a decrease in the number of refills and average filled prescription per patient. Holman et al[23] in 2014 recorded that patients who received preoperative physician counseling were more likely to stop opioid use by 6 weeks ($P = 0.012$), but the likelihood that patients had stopped opioid use at 12 weeks was equal to patients receiving no educational intervention ($P = 0.90$).

In the 4 studies evaluating combined pain and opioid utilization, 1 study recorded significantly reduced narcotic use at 1, 3, and 6 months ($P < 0.001$)[21]; 1 study reported decreased intramuscular meperidine application in the 24-hour postoperative period ($P < 0.05$)[22]; 1 study reported increased analgesic requests during inpatient stay on day 2 among the intervention group ($P > 0.001$)[26]; and 1 study did not observe a significant difference in the average number of tablets taken per day ($P = 0.83$). However, the latter did record a significant increase in retained knowledge and safe use.[20]

4. Data Synthesis

This systematic review illustrates that patient-oriented interventions are associated with improvements in postoperative pain and opioid pain utilization when implemented in the orthopaedic acute care setting. Of the interventions included in this review, there was a concentration of interventions focused on reminding clinicians to engage in patient-centered pain management education and opioid safety at the time of prescribing or dispensing opioids, delivering both audio–visual and written education materials to patients immediately before or after surgery, or counseling patients on multimodal pain management approaches. Most studies that examine pain scores as an outcome measure demonstrated significantly improved pain outcomes after participants were exposed to an intervention in the acute care setting. Among the studies assessing opioid utilization as a main outcome, most studies demonstrated significant reduction in opioid utilization or dosage and all 3 studies that solely focused on the outcome of opioid

utilization after patient education showed a significant post-interventional degree of improvement. However, researchers should be cautioned to distinguish statistical and clinical significance when reviewing results of these prior studies, as not all studies consistently demonstrated clinical improvement in pain or opioid utilization. This review also highlights the paucity of high-level evidence on patient-centric interventions to reduce opioid utilization in the orthopaedic trauma setting.

No study implemented combined verbal/written/audio–visual trainings paired with multimodal opioid-sparing pain management approaches to synergistically target both pain and opioids after acute orthopaedic injuries. However, these interventional components were effective in their respective setting. All studies that included surgical patients implemented preoperative and, in some cases, perioperative interventions, which resemble successful results from similar designs in the elective surgery population.[36–39] As such, opportunities to design and implement hybrid interventions that incorporate both verbal/written and audio/visual education materials should be considered in acute care settings where patients with orthopaedic trauma injuries are seen. This review highlights the utility of both educational approaches and counseling on nonpharmacological approaches on pain and opioid outcomes. The improvement of pain scores was not constant and predominantly short term. Future longitudinal research incorporating both modalities is needed. Furthermore, investigators should strive to report whether clinically meaningful improvements are noted among participants receiving interventions in future studies.

Owing to the small number of studies on this topic, the synthesized data are primarily limited by the heterogeneity of study settings, clinical samples, and varying durations of observations. Although all studies included acute injuries that may require orthopaedic consults, not all outcome measures were discernably attributable to the orthopaedic trauma patient in studies with a mixed population.[19,20,24,40,41] Given the lack of consensus on how pain and opioid utilization were assessed across studies in this review, it was not feasible to examine aggregate effect sizes. The small volume provided insufficient statistical power to use a vote counting approach. Finally, although all included studies were evaluated for reporting bias during quality assessment, they were not specifically assessed for publication bias. However, readers ought to be cognizant of the small number of included studies, diminishing the relevancy of meaningful statistical analysis for publication bias (ie, funnel plots). Despite these limitations, this review is among the first to synthesize the potential benefits of patient-centered interventions that can be applied in orthopaedic trauma care settings to improve pain outcomes and mitigate opioid utilization.

5. Conclusions

The urgent and acute care setting presents a challenge for delivery of preemptive and timely pain management and opioid education to orthopaedic trauma patient populations. Because the current lack of evidence averts meaningful conceptualization of a well-rounded framework for optimal patient-centric intervention recommendations to mitigate long-term opioid-related risk, the findings of this systematic review indicate the merit for succinct multipronged patient-centered educational interventions. Integrating both multimodal pain management and opioid utilization education may safely aid in reducing acute pain presentations and opioid utilization after orthopaedic injuries.

Funding

This study received no funding.

Ethical Approval/Informed Consent Requirements

The manuscript is exempt from ethical approval/informed consent requirements because it does not involve human or animal subjects.

Conflict of Interest

All authors declare no personal, financial, or nonfinancial conflicts of interest.

APPENDIX 1. Supplemental Materials

Final Database Search Strategies
Searched February 28, 2021, Chrome browser
582 references retrieved, minus 102 duplicates. Final number = 480

CINAHL via EBSCO = 13 (25 minus 12 duplicates)

(MH "Emergency Medicine" OR MH "Trauma Centers" OR Trauma OR MH "Critical Care" OR MH "Acute Care" OR MH "Emergency Patients" OR “Orthopedic Trauma” OR “Orthopaedic Trauma”) **AND** MH "Musculoskeletal System" OR orthopedic* OR orthopaedic* OR “musculoskeletal injury” OR “musculoskeletal surgery” OR musculoskeletal OR “orthopedic surgery” OR MH "Orthopedic Surgery") **AND** ((MH "Analgesics, Opioid" OR MH "Narcotics" OR MH "Pain Management" OR MH "Postoperative Pain" OR "Opiates" OR Opioid* OR “narcotic analgesic*” OR “opioid analgesic*” OR "Opioid-Related Disorders” OR “postinterventional opioid“ OR “opioid misuse” OR “opioid use” OR “opioid abuse” OR pain OR "Postoperative Pain” OR “postoperative opioid use” OR "Acute Pain" OR "Musculoskeletal Pain") **AND** (MH "Patient Education" OR "Patient Education” OR MH "Preoperative Education" OR MH "Prehabilitation" OR prehabilitation OR prehabilitation OR “preoperative education” OR “preoperative patient education” OR “preoperative counseling” OR “preoperative intervention” OR “preoperative opioid education” OR “opioid-related education” OR “Preemptive psychoeducation” OR “education intervention” OR “educational intervention” OR preintervention OR preintervention OR “pain education” OR “perioperative education”))

Limiters - Publication Year: 1990-2020, English

Embase via Embase.com = 210 (211 minus 1 duplicate)

(Trauma OR ’hospital emergency service’/exp OR ’emergency care’/exp OR emergency OR “critical care” OR “acute care” OR ’orthopedic trauma’/exp OR “Orthopaedic Trauma” OR “Orthopedic Trauma”) **AND** (‘orthopedics’/de OR ’orthopedic surgery’/exp OR ’musculoskeletal injury’/exp "Musculoskeletal surgery" OR orthopedic* OR orthopaedic* OR musculoskeletal) **AND** ((’opiate’/exp OR ’opiate’/exp/dd_dt OR “narcotic analgesic” OR “opioid analgesic” OR ‘narcotic analgesic agent’/exp/dd_dt OR ’opiate addiction’/exp OR ’opiate addiction’/exp/dm_pc OR ’pain’/exp/dm_dt,dm_pc OR ’acute pain’/exp/dm_dt,dm_pc OR “post-interventional opioid“ OR “opioid misuse” OR “opioid use” OR

"opioid abuse" OR 'postoperative pain'/exp/dm_dt,dm_pc OR "postoperative opioid use" OR "pain management" OR 'musculoskeletal pain'/exp/dm_dt,dm_pc) **AND** ('patient education'/exp OR 'preoperative education'/exp OR "preoperative patient education" OR "preoperative counseling" OR "preoperative intervention" OR "opioid education" OR "opioid-related education" OR 'psychoeducation'/exp OR "Preemptive psychoeducation" OR prehabilitation OR prehabilitation OR "education intervention" OR "educational intervention" OR preintervention OR preintervention OR 'pain education'/exp OR "perioperative education")) **AND** [english]/lim **AND** [1990-2021]/py

PsycInfo via EBSCO = 30 (35 minus 5 duplicates)

(DE "Emergency Medicine" OR "Trauma Centers" OR "Trauma unit" OR "trauma center" OR "Trauma units" OR emergency OR "critical care" OR "acute care" OR DE "Injuries" OR DE "Surgical Patients" OR DE "Surgery" OR "Orthopedic Trauma" OR "Orthopaedic Trauma") **AND** (DE "Musculoskeletal System" OR orthopedic* OR orthopaedic* OR musculoskeletal OR "musculoskeletal injury" OR "orthopedic surgery" OR "musculoskeletal surgery") **AND** ((DE "Opioid Use Disorder" OR DE "Opiates" OR Opioid* OR "narcotic analgesic" OR "opioid analgesic" OR "Opioid-Related Disorders" OR "postinterventional opioid" OR "opioid misuse" OR "opioid use" OR "opioid abuse" OR Pain OR "Postoperative Pain" OR "postoperative opioid use" OR DE "Pain Management" OR "pain management" OR DE "Acute Pain" OR "Musculoskeletal Pain") **AND** (DE "Client Education" OR "Patient Education" OR "preoperative education" OR "preoperative patient education" OR "preoperative counseling" OR "preoperative intervention" OR "preoperative opioid education" OR "opioid-related education" OR "Preemptive psychoeducation" OR prehabilitation OR prehabilitation OR "education intervention" OR "educational intervention" OR preintervention OR preintervention OR "pain education" OR "perioperative education"))

Limiters - Publication Year: 1990-2020, English

PubMed.gov = 130 (146 minus 16 duplicates)

("Trauma Centers"[Mesh] OR "Trauma unit"[tw] OR "trauma center"[tw] OR "Trauma units"[tw] OR "trauma centers"[tw] OR "Emergency Service, Hospital"[Mesh] OR emergency[tw] OR "Critical Care"[Mesh:NoExp] OR "critical care"[tw] OR "acute care"[tw] OR "Orthopaedic Trauma"[tw] OR "Orthopedic Trauma"[tw]) **AND** ("Orthopedics"[Mesh] OR "Orthopedic Procedures"[Mesh] OR "Musculoskeletal System/surgery"[Mesh] OR orthopedic*[tw] OR orthopaedic*[tw] OR musculoskeletal[tw] OR "musculoskeletal injury"[tw]) **AND** ((Opioid*[tw] OR Analges*[tw] OR "narcotic analgesic"[tw] OR "opioid analgesic"[tw] OR "Opioid-Related Disorders/prevention and control"[Mesh] OR "Opioid-Related Disorders/psychology"[Mesh] OR "Analgesics, Opioid/administration and dosage"[Mesh] OR "Analgesics, Opioid/supply and distribution"[Mesh] OR "Analgesics, Opioid/therapeutic use"[Mesh] OR "Analgesics, Opioid/adverse effects"[Mesh] OR "postinterventional opioid"[tw] OR "opioid misuse"[tw] OR "opioid use"[tw] OR "opioid abuse"[tw] OR "Pain, Postoperative/drug therapy"[Mesh] OR "postoperative opioid use"[tw] OR Pain[tw] OR "Pain Management"[Mesh] OR "pain management"[tw] OR "Acute Pain/prevention and control"[Mesh] OR "Acute Pain/drug therapy"[Mesh] OR "Musculoskeletal Pain/drug therapy"[Mesh] OR "Musculoskeletal Pain/prevention and control"[Mesh]) **AND** (Education*[tw] OR "Patient Education as Topic"[Mesh:NoExp] OR "preoperative education"[tw] OR "preoperative patient education"[tw] OR "preoperative counseling"[tw] OR "preoperative intervention"[tw] OR "opioid education"[tw] OR "opioid-related education"[tw] OR "Preemptive psychoeducation"[tw] OR prehabilitation[tw] OR prehabilitation[tw] OR "Preoperative Care/education"[Mesh] OR "education intervention"[tw] OR "educational intervention"[tw] OR preintervention[tw] OR preintervention[tw] OR "pain education"[tw] OR "perioperative education"[tw])) **AND** Eng[lang] **AND** ("1990/01/01"[PDAT] : "2021/02/28"[PDAT])

Web of Science Core Collection (SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC) = 97 (165 minus 68 duplicates)

TS=(Trauma OR "hospital emergency service" OR "emergency care" OR emergency OR "critical care" OR "acute care" OR "orthopedic trauma" OR "Orthopaedic Trauma")

AND

TS=(orthopedics OR "orthopedic surgery" OR "musculoskeletal injury" "Musculoskeletal surgery" OR orthopedic* OR orthopaedic* OR musculoskeletal)

AND

TS=(opiate OR opioid OR "narcotic analgesic" OR "opioid analgesic" OR "opiate addiction" OR pain OR "acute pain" OR "postinterventional opioid" OR "opioid misuse" OR "opioid use" OR "opioid abuse" OR "postoperative pain" OR "postoperative opioid use" OR "pain management" OR "musculoskeletal pain")

AND

TS=(Education OR "patient education" OR "preoperative education" OR "preoperative patient education" OR "preoperative counseling" OR "preoperative intervention" OR "opioid education" OR "opioid-related education" OR "psychoeducation" OR "Preemptive psychoeducation" OR prehabilitation OR prehabilitation OR "education intervention" OR "educational intervention" OR preintervention OR preintervention OR "pain education" OR "perioperative education")

Limits of English language and publication date range from 1990-2021.

REFERENCES

1. Philip BK, Reese PR, Burch SP. The economic impact of opioids on postoperative pain management. *J Clin Anesth*. 2002;14:354–364.
2. Boddapati V, Padaki AS, Lehman RA, et al. Opioid prescriptions by orthopaedic surgeons in a medicare population: recent trends, potential complications, and characteristics of high prescribers. *JAAOS - J Am Acad Orthop Surg*. 2021;29:e232–e237.
3. Flanagan CD, Joseph NM, Benedick A, Vallier HA. Five-year trends in opioid prescribing following orthopaedic trauma. *JAAOS Glob Res Rev*. 2020;4:e2000134.
4. Volkow ND, McLellan TA, Cotto JH, et al. Characteristics of opioid prescriptions in 2009. *JAMA*. 2011;305:1299–1301.
5. Ruder J, Wally MK, Oliverio M, et al. Patterns of opioid prescribing for an orthopaedic trauma population. *J Orthop Trauma*. 2017;31:e179–e185.
6. Koehler RM, Okoroafor UC, Cannada LK. A systematic review of opioid use after extremity trauma in orthopedic surgery. *Injury*. 2018;49:1003–1007.
7. Dowell D, Haegerich TM, Chou R. CDC guideline for prescribing opioids for chronic pain–United States, 2016. *JAMA*. 2016;315:1624–1645.
8. Hsu JR, Mir H, Wally MK, Seymour RB. Clinical practice guidelines for pain management in acute musculoskeletal injury. *J Orthop Trauma*. 2019;33:e158–e182.

9. Soffin EM, Waldman SA, Stack RJ, Liguori GA. An evidence-based approach to the prescription opioid epidemic in orthopedic surgery. *Anesth Analg*. 2017;125:1704–1713.
10. Rudd RA, Seth P, David F, Scholl L. Increases in drug and opioid-involved overdose deaths - United States, 2010-2015. *MMWR Morb Mortal Wkly Rep*. 2016;65:1445–1452.
11. Guy GP, Jr., Zhang K, Schieber LZ, et al. County-level opioid prescribing in the United States, 2015 and 2017. *JAMA Intern Med*. 2019;179:574–576.
12. van Amsterdam J, Pierce M, van den Brink W. Is Europe facing an emerging opioid crisis comparable to the U.S. *Ther Drug Monit*. 2021;43: 42–51.
13. Baker DW. The joint commission and the opioid epidemic-reply. *JAMA*. 2017;318:92.
14. Kadakia NN, Rogers RL, Reed JB, et al. Patient education interventions for prescription opioids: a systematic review. *J Am Pharm Assoc (2003)*. 2020;60:e31–e42.
15. Gaudin D, Krafcik BM, Mansour TR, Alnemari A. Considerations in spinal fusion surgery for chronic lumbar pain: psychosocial factors, rating scales, and perioperative patient education-A review of the literature. *World Neurosurg* 2017;98:21–27.
16. Platts-Mills TF, Hollowell AG, Burke GF, et al. Randomized controlled pilot study of an educational video plus telecare for the early outpatient management of musculoskeletal pain among older emergency department patients. *Trials*. 2018;19:10.
17. Holman JE, Stoddard GJ, Higgins TF. Rates of prescription opiate use before and after injury in patients with orthopaedic trauma and the risk factors for prolonged opiate use. *The J bone Jt Surg Am volume*. 2013;95: 1075–1080.
18. Horn A, Kaneshiro K, Tsui BCH. Preemptive and preventive pain psychoeducation and its potential application as a multimodal perioperative pain control option: a systematic review. *Anesth Analg*. 2020;130:559–573.
19. McCarthy DM, Curtis LM, Courtney DM, et al. A multifaceted intervention to improve patient knowledge and safe use of opioids: results of the ED EMC(2) randomized controlled trial. *Acad Emerg Med*. 2019;26:1311–1325.
20. McCarthy DM, Wolf MS, McConnell R, et al. Improving patient knowledge and safe use of opioids: a randomized controlled trial. *Acad Emerg Med*. 2015;22:331–339.
21. Oliveira A, Gevirtz R, Hubbard D. A psycho-educational video used in the emergency department provides effective treatment for whiplash injuries. *Spine (Phila PA 1976)*. 2006;31:1652–1657.
22. Ceccio CM. Postoperative pain relief through relaxation in elderly patients with fractured hips. *Orthop Nurs*. 1984;3:11–19.
23. Holman JE, Stoddard GJ, Horwitz DS, Higgins TF. The effect of preoperative counseling on duration of postoperative opiate use in orthopaedic trauma surgery: a surgeon-based comparative cohort study. *J Orthop Trauma*. 2014;28:502–506.
24. Mears SC, Shnaekel A, Wilkinson J, et al. A departmental policy can reduce opioid prescribing after orthopedic surgery. *J Opioid Manag*. 2019;16:41–47.
25. Wong EM, Chair SY, Leung DY, Chan SW. Can a brief educational intervention improve sleep and anxiety outcomes for emergency orthopaedic surgical patients?. *Contemp Nurse*. 2014;47:132–143.
26. Wong EM, Chan SW, Chair SY. Effectiveness of an educational intervention on levels of pain, anxiety and self-efficacy for patients with musculoskeletal trauma. *J Adv Nurs*. 2010;66:1120–1131.
27. Gambatesa M, D'Ambrosio A, D'Antini D, et al. Counseling, quality of life, and acute postoperative pain in elderly patients with hip fracture. *J Multidiscip Healthc*. 2013;6:335–346.
28. Bandura A, ed. *Social Foundations of Thought and Action: A Social Cognitive Theory*. Englewood Cliffs, NJ: Prentice-Hall; 1986;35–48.
29. Bandura A, ed. *Self-Efficacy: The Exercise of Control*. New York: W.H. Freeman; 1997;21–59.
30. DeGood D, Shutty M (1992) *Assessment of Pain Beliefs, Coping, and Self-Efficacy. Handbook of Pain Assessment* (Turk DC & Melzack R, eds), pp. 214–234, New York, Guiford Press.
31. Jacobson E. *Progressive Relaxation*. 3rd ed. Chicago: University of Chicago Press; 1974.
32. Rogers CR. *Client-Centered Therapy: Its Current Practice, Implications and Theory*. London, UK: Constable; 1951.
33. Rogers CR. *On Becoming a Person*. Boston, MA: Houghton Mifflin; 1961.
34. Rogers CR. *A Way of Being*. Boston, MA: Houghton Mifflin; 1980.
35. Wong EM, Chair SY, Leung DY, Chan SW. Can a brief educational intervention improve sleep and anxiety outcomes for emergency orthopaedic surgical patients?. *Contemp Nurse*. 2014;47:132–143.
36. Tedesco D, Gori D, Desai KR, et al. Drug-Free interventions to reduce pain or opioid consumption after total knee arthroplasty: a systematic review and meta-analysis. *JAMA Surg* 2017;152:e172872.
37. Smith DH, Kuntz JL, DeBar LL, et al. A randomized, pragmatic, pharmacist-led intervention reduced opioids following orthopedic surgery. *Am J Manag Care*. 2018;24:515–521.
38. Sabesan VJ, Chatha K, Koen S, et al. Innovative patient education and pain management protocols to achieve opioid-free shoulder arthroplasty. *JSES Int*. 2020;4:362–365.
39. Andelman SM, Bu D, Debellis N, et al. Preoperative patient education may decrease postoperative opioid use after meniscectomy. Arthrosc sports med rehabil 2020;2(1):e33-e38.
40. Bannister G, Amirfeyz R, Kelley S, Gargan M. Whiplash injury. *J Bone Joint Surg Br*. 2009;91:845–850.
41. McCabe E, Jadaan M, Jadaan D, McCabe JP. An analysis of whiplash injury outcomes in an Irish population: a retrospective fifteen-year study of a spine surgeon's experience. *Ir J Med Sci*. 2020;189:211–217.