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Effect of Analgesic Stewardship Interventions on Pain Intensity Outcomes Assessed Using Validated Pain Scales: A Narrative Review

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ABSTRACT

Background: Effective pain management remains a critical component of perioperative and postoperative care. However, conventional analgesic practices, particularly the overreliance on opioid medications, have raised concerns regarding adverse drug events, opioid dependence, and variability in prescribing practices. Analgesic stewardship has emerged as a multidisciplinary, evidence-based approach aimed at optimizing analgesic utilization while maintaining adequate pain control. This review examines the impact of analgesic stewardship interventions on patient-reported pain outcomes and related clinical measures.

Objective: To critically evaluate the available evidence regarding the effectiveness of analgesic stewardship interventions, including multimodal analgesia protocols and Enhanced Recovery After Surgery (ERAS) pathways, on pain intensity outcomes measured using validated assessment tools and related postoperative recovery parameters.

Methods: A narrative review was conducted using a comprehensive literature search of the PubMed database for studies published between January 2026 and April 2026. Search terms included combinations of pain management, analgesic stewardship, opioid stewardship, multimodal analgesia, ERAS, Visual Analogue Scale (VAS), Numeric Rating Scale (NRS), and pain intensity. Eligible studies evaluated protocol-based analgesic stewardship interventions and reported quantitative pain-related outcomes. Data were narratively synthesized according to intervention type and clinical impact.

Results: Eight studies met the inclusion criteria, encompassing retrospective cohort studies, randomized controlled trials, prospective observational studies, and implementation-based evaluations. The evidence consistently demonstrated that multimodal analgesia and ERAS-based stewardship interventions were associated with effective pain control, reduced opioid consumption, and improved postoperative recovery. Opioid-sparing strategies incorporating non-opioid analgesics and adjunctive therapies maintained or improved patient-reported pain outcomes while minimizing opioid-related burden. Implementation-focused studies highlighted the importance of protocol adherence, multidisciplinary collaboration, and continuous monitoring for the successful integration of stewardship practices. Although some adjunctive pharmacological interventions showed limited additional benefit within optimized ERAS pathways, the overall evidence favored structured, protocol-driven approaches to pain management.

Conclusion: Analgesic stewardship interventions, particularly multimodal analgesia protocols and ERAS pathways, represent effective strategies for optimizing pain management while promoting safer and more rational analgesic use. These approaches can improve patient-centered outcomes and reduce opioid reliance without compromising analgesic efficacy. Nevertheless, the current evidence base is limited by methodological heterogeneity and inconsistent outcome reporting. Future high-quality prospective studies employing standardized pain assessment tools are needed to strengthen the evidence and support the development of evidence-based analgesic stewardship guidelines.

Keywords: Analgesic stewardship; Multimodal analgesia; Enhanced Recovery After Surgery; ERAS; Opioid stewardship; Pain intensity; Visual Analogue Scale; Numeric Rating Scale; Postoperative pain; Narrative review.

1. INTRODUCTION

Pain remains one of the most common and clinically significant symptoms experienced by patients across a wide range of acute and chronic conditions, particularly during the perioperative period. Despite advances in pain management strategies and the availability of evidence-based clinical guidelines, inadequate pain control continues to affect a substantial proportion of patients, contributing to delayed recovery, prolonged hospitalization, increased healthcare costs, and reduced quality of life [1]. Effective analgesic therapy is essential for improving patient outcomes; however, considerable variation in prescribing practices persists across healthcare settings. Inappropriate analgesic use, including excessive reliance on opioid medications, may increase the risk of adverse drug reactions, medication-related harm, opioid dependence, and unnecessary healthcare utilization [2]. These challenges have highlighted the need for systematic approaches that optimize analgesic use while ensuring adequate pain relief.

In recent years, analgesic stewardship has emerged as a multidisciplinary, evidence-based strategy designed to promote the safe, effective, and rational use of analgesic medications. Similar to antimicrobial stewardship programs, analgesic stewardship integrates standardized prescribing protocols, multimodal analgesia, opioid-sparing approaches, enhanced recovery pathways, and continuous monitoring of treatment outcomes to improve the quality and safety of pain management [3,4]. An essential component of evaluating the effectiveness of analgesic stewardship interventions is the assessment of patient-reported pain outcomes. Validated instruments such as the Visual Analogue Scale (VAS) and the Numeric Rating Scale (NRS) are widely used to quantify pain intensity and facilitate standardized comparisons across different interventions and clinical settings [5]. These tools provide reliable and reproducible measures that reflect the patient's experience of pain and are therefore important indicators of the success of stewardship initiatives. Although numerous studies have reported the benefits of multimodal analgesia protocols, opioid stewardship programs, and enhanced recovery pathways, the evidence regarding their impact on pain intensity outcomes remains inconsistent. Variations in intervention components, patient populations, study designs, and methods of pain assessment have contributed to heterogeneous findings, making it difficult to establish the overall effectiveness of analgesic stewardship interventions [6].

Therefore, this narrative review aims to critically examine the available evidence on the impact of analgesic stewardship interventions on patient-reported pain intensity measured using validated assessment tools. The review seeks to identify patterns of effectiveness across different stewardship models, explore variations in reported outcomes, and discuss the implications of these findings for optimizing evidence-based pain management in clinical practice.

2. METHODOLOGY

2.1 Study Design:

This study was conducted as a narrative review to critically synthesize and interpret the available evidence regarding the impact of analgesic stewardship interventions on patient-reported pain intensity outcomes. The review focused on evaluating the effectiveness of protocol-based and multidisciplinary analgesic management strategies across various clinical settings.

2.2 Literature Search Strategy:

A comprehensive literature search was conducted using the PubMed database to identify relevant studies published between January 2026 and April 2026. The search strategy combined Medical Subject Headings (MeSH) and free-text terms using Boolean operators to maximize retrieval of relevant publications. The principal search syntax included the following combinations. [Table 1]

Table 1. Search terms and Boolean operators used for the identification of eligible studies.

pain management	analgesic stewardship OR opioid stewardship OR multimodal analgesia OR enhanced recovery after surgery OR ERAS
OR	VAS OR "Visual Analogue Scale" OR NRS OR "Numeric Rating Scale" OR "pain assessment tool*"
AND	
analges*	
OR	"pain intensity" OR "pain score" OR postoperative pain OR patient-reported pain outcome*
pain*	

Additionally, the reference lists of selected articles were manually screened to identify any potentially relevant studies not captured during the initial database search [9].

2.3 Eligibility Criteria

2.3.1 Inclusion Criteria:

Studies were included if they met the following criteria:

- Studies involving human populations undergoing pain management interventions, including adult and specialized surgical populations.
- Evaluated an analgesic stewardship intervention, including multimodal analgesia protocols, opioid stewardship programs, enhanced recovery after surgery (ERAS) pathways, or other multidisciplinary/system-level pain management strategies.
- Reported pain intensity outcomes using validated assessment tools, including the Visual Analogue Scale (VAS) and/or Numeric Rating Scale (NRS).
- Employed randomized controlled, quasi-experimental, prospective observational, or comparative pre–post study designs with clearly defined interventions and outcome measures.

2.3.2 Exclusion Criteria:

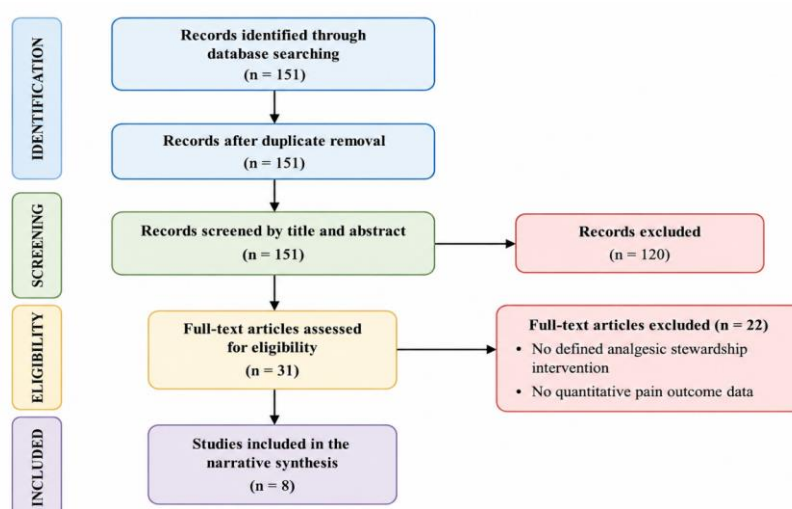
The following studies were excluded:

- Paediatric studies.
- Case reports, case series, editorials, conference abstracts, letters to the editor, and review articles.
- Studies lacking a defined analgesic stewardship intervention or quantitative pain outcome assessment.
- Animal studies and publications not available in the English language.

2.4 Study Selection:

All retrieved records were independently screened based on title and abstract for relevance. Studies meeting the preliminary eligibility criteria underwent full-text assessment. Articles were included if they described a structured analgesic stewardship intervention, incorporated a comparator group (control–intervention or pre–post evaluation), and reported measurable pain intensity outcomes. [Figure1]

Figure 1. Flow diagram depicting the identification, screening, eligibility assessment, and inclusion of studies evaluating the effect of analgesic stewardship interventions on pain intensity outcomes



2.5 Data Extraction:

Relevant information from the included studies was extracted using a standardized data collection template. The extracted variables included:

- Author(s) and year of publication.
- Study design and clinical setting.
- Sample size and study population.
- Type of analgesic stewardship intervention.
- Pain assessment instrument used (VAS, NRS, or equivalent).
- Key findings related to pain intensity and associated clinical outcomes.

2.6 Data Synthesis:

A narrative and thematic synthesis approach was employed to summarize the findings. Studies were grouped according to the primary stewardship strategy evaluated, including:

- Multimodal analgesia protocols,
- Opioid stewardship initiatives,
- Enhanced Recovery After Surgery (ERAS) pathways, and
- Structured postoperative pain management protocols.

The evidence was subsequently analyzed to identify common patterns, variations in intervention effectiveness, and their overall influence on patient-reported pain intensity outcomes. Particular emphasis was placed on the relationship between stewardship interventions and the balance between effective analgesia and reduced analgesic burden [10-12].

2.7 Ethical Considerations:

As this review was based exclusively on the analysis of previously published studies and did not involve direct participation of human subjects or access to identifiable patient data, institutional ethical approval was not required.

3. RESULTS

3.1 Study Selection:

A comprehensive literature search identified 151 records from the PubMed database. Following title and abstract screening, 120 articles were excluded because they were duplicates or did not meet the predefined eligibility criteria. Thirty-one full-text articles were subsequently assessed for eligibility. Of these, 22 studies were excluded due to the absence of a clearly defined analgesic stewardship intervention or the lack of quantitative pain intensity outcomes. Finally, eight studies were included in the narrative synthesis, of which four studies fulfilled the strict methodological criteria for detailed evaluation of analgesic stewardship interventions and pain intensity outcomes (Figure 1).

3.2 Characteristics of Included Studies:

The eight included studies comprised a combination of retrospective cohort studies, randomized controlled trials, prospective observational studies, and implementation-based clinical evaluations. The studies evaluated a range of analgesic stewardship interventions, including multimodal analgesia protocols, Enhanced Recovery After Surgery (ERAS) pathways, opioid-sparing strategies, standardized postoperative pain management protocols, and adjunctive non-pharmacological approaches. The study populations represented diverse surgical settings, including robotic cystectomy, cesarean delivery, bladder reconstruction, orthopedic surgery, pediatric dental procedures, and cosmetic surgery, with sample sizes ranging from 28 to 563 participants. The detailed characteristics and principal findings of the included studies are summarized in Table 2.

Table 2. Characteristics and principal findings of studies included in the narrative review.

S. No.	Author (Year)	Study Design	Study Population	Analgesic Stewardship / Intervention	Key Findings
1	Ajabshir et al.	Retrospective	563 patients	Non-opioid Enhanced	Median length of stay (LOS) was 4

S. No.	Author (Year)	Study Design	Study Population	Analgesic Stewardship / Intervention	Key Findings
	(2026)	cohort study	undergoing robotic cystectomy	Recovery After Surgery (ERAS) protocol incorporating multimodal analgesia	days, with an overall complication rate of 29.1%. The protocol facilitated efficient postoperative recovery with acceptable morbidity.
2	Zhang et al. (2026)	Retrospective cohort study	161 high-risk patients undergoing cesarean section	Multimodal analgesia protocol incorporating esketamine and dexmedetomidine	The incidence of postpartum depression (PPD) was significantly reduced (14.6% vs. 29.1%), opioid consumption decreased by 21.2%, and postoperative sleep quality improved.
3	Tabesse et al. (2026)	Retrospective cohort study	100 elderly postoperative patients	Implementation of a standardized postoperative pain management protocol	Only 17% of patients achieved full protocol adherence, highlighting significant gaps in prescribing practices and ongoing pain monitoring.
4	Yim et al. (2026)	Randomized, double-blind, placebo-controlled trial	132 patients undergoing radical cystectomy	Alvimopan in combination with an ERAS pathway versus placebo	No statistically significant differences were observed in gastrointestinal recovery (4.2 vs. 4.1 days), length of stay, or postoperative complication rates.
5	Michael et al. (2026)	Prospective comparative study	59 patients undergoing bladder reconstruction	Enhanced Recovery After Surgery (ERAS) pathway	No significant difference in hospital length of stay was identified; however, postoperative constipation was associated with an increased risk of complications (OR = 2.59).
6	Zhang et al. (2026)	Randomized controlled trial	104 pediatric dental patients	Modified cryotherapy during final irrigation versus standard care	Pain intensity scores were significantly lower in the intervention group at 6, 24, and 48 hours after treatment ($p < 0.001$).
7	Rzyska et al. (2026)	Prospective observational study	28 patients undergoing silicone breast augmentation	Standardized multimodal postoperative analgesic care	Mean pain intensity progressively decreased from 79 mm on postoperative day 1 to less than 15 mm by day 7, demonstrating effective pain control.
8	Multimodal Analgesia Strategy in Traumatology and Orthopedics (2026)	Prospective clinical study	Patients undergoing orthopedic and trauma surgery	Protocol-based multimodal analgesia strategy	Implementation of a multimodal analgesia protocol improved postoperative pain relief and reduced reliance on opioid analgesics.

Abbreviations: ERAS, Enhanced Recovery After Surgery; LOS, Length of Stay; PPD, Postpartum Depression; GI, Gastrointestinal; OR, Odds Ratio.

3.3 Synthesis of Evidence:

The studies included in this narrative review consistently demonstrate that analgesic stewardship interventions have the potential to improve both the effectiveness and safety of pain management, particularly when implemented through structured, evidence-based, and multidisciplinary approaches. Across a variety of surgical and clinical settings, stewardship strategies were associated with enhanced postoperative recovery, optimization of analgesic utilization, and maintenance or improvement of patient-reported pain outcomes. Importantly, these interventions not only focused on achieving adequate analgesia but also emphasized minimizing unnecessary opioid exposure and reducing medication-related complications. Although the specific interventions and patient populations differed among the included studies, a common underlying principle was the adoption of protocol-driven pain

management strategies that standardized analgesic prescribing and promoted multimodal approaches. The findings collectively suggest that stewardship interventions can improve the consistency and quality of pain management while facilitating a balance between effective pain relief and medication safety.

3.3.1 Multimodal Analgesia and Opioid-Sparing Strategies:

Multimodal analgesia protocols emerged as the most frequently investigated analgesic stewardship intervention and demonstrated consistently favorable effects on pain-related outcomes. These strategies are based on the principle of combining analgesic agents and techniques that act through different physiological pathways, thereby producing additive or synergistic analgesic effects while reducing the requirement for any single medication, particularly opioids. Such an approach aligns closely with the core objectives of analgesic stewardship, which seek to optimize pain control while minimizing treatment-related harm. Several studies included in this review reported that multimodal analgesic regimens were associated with improved postoperative pain control, reduced opioid consumption, and enhanced recovery profiles without compromising analgesic efficacy [1,2,8]. In the study by Ajabshir et al., the implementation of a non-opioid ERAS protocol incorporating multimodal analgesia facilitated efficient postoperative recovery, with a median hospital stay of four days and acceptable complication rates, demonstrating that effective pain management can be achieved using opioid-sparing strategies [1]. Likewise, the multimodal protocol evaluated by Zhang et al., which incorporated esketamine and dexmedetomidine, significantly reduced opioid consumption while also improving several patient-centered outcomes, including postoperative sleep quality and the incidence of postpartum depression [2]. These findings suggest that multimodal analgesia may provide benefits extending beyond pain relief alone, contributing to overall patient well-being and recovery. The evidence also highlights the growing role of non-opioid analgesics and adjuvant therapies within stewardship frameworks. Agents such as esketamine, dexmedetomidine, and regional anesthetic techniques may reduce opioid requirements by targeting alternative nociceptive pathways and attenuating central sensitization. By limiting opioid exposure, multimodal protocols may help decrease the risk of opioid-related adverse effects, including nausea, vomiting, sedation, constipation, respiratory depression, and the potential for long-term dependence. In the context of the ongoing global concerns regarding opioid overuse, these findings further reinforce the value of stewardship-based, opioid-sparing approaches in perioperative care. In addition to pharmacological interventions, the included evidence suggests that multimodal stewardship models may effectively integrate non-pharmacological measures. For example, modified cryotherapy evaluated by Zhang et al. significantly reduced postoperative pain intensity during the early recovery period, demonstrating that adjunctive non-drug interventions can complement conventional analgesic regimens and contribute to optimized pain management [6]. Similarly, the orthopedic and traumatology study emphasized that combining multiple analgesic modalities targeting different pain pathways improved postoperative pain relief while reducing dependence on opioid medications [8]. Taken together, the findings indicate that multimodal analgesia represents a cornerstone of contemporary analgesic stewardship. By integrating pharmacological and non-pharmacological interventions within standardized clinical pathways, these protocols promote effective pain control, reduce opioid burden, and support enhanced postoperative recovery. The consistency of these observations across diverse patient populations and surgical specialties underscores the broad applicability and clinical value of multimodal, opioid-sparing stewardship strategies.

3.3.2 Enhanced Recovery After Surgery (ERAS) Pathways :

Enhanced Recovery After Surgery (ERAS) pathways emerged as an important component of contemporary analgesic stewardship by integrating evidence-based perioperative interventions aimed at reducing surgical stress, optimizing pain control, and accelerating postoperative recovery. Rather than relying solely on pharmacological management, ERAS protocols incorporate a multidisciplinary approach that combines patient education, standardized perioperative care, multimodal analgesia, early mobilization, optimized nutrition, and opioid-sparing strategies. This integrated framework is designed to improve clinical outcomes while minimizing the adverse effects associated with conventional postoperative pain management. The studies included in this review suggest that ERAS-based interventions contribute to effective perioperative analgesia without compromising patient safety. Ajabshir et al. demonstrated that the implementation of a non-opioid ERAS protocol incorporating multimodal analgesia facilitated efficient postoperative recovery in patients undergoing robotic cystectomy, with a median hospital stay of four days and acceptable postoperative complication rates [1]. Similarly, Michael et al. reported that the use of an ERAS pathway in bladder reconstruction surgery maintained favorable recovery outcomes, although postoperative constipation remained an important predictor of adverse events [5]. Collectively, these findings indicate that standardized ERAS protocols can provide consistent pain control while supporting early recovery and reducing overall healthcare burden.

An important observation emerging from the current evidence is that the effectiveness of ERAS pathways may derive from the combined effect of multiple complementary interventions rather than any single pharmacological component. This concept is supported by the randomized controlled trial conducted by Yim et al., in which the addition of alvimopan to an established ERAS program did not significantly improve gastrointestinal recovery time, hospital length of stay, or postoperative complication rates compared with placebo [4]. The absence of additional benefit suggests that a well-designed, protocol-driven ERAS pathway may already optimize key aspects of perioperative recovery, thereby limiting the incremental impact of isolated adjunctive therapies.

From an analgesic stewardship perspective, these findings reinforce the value of standardized multimodal recovery pathways that emphasize opioid-sparing practices and coordinated multidisciplinary care. By integrating non-opioid analgesics, regional anesthesia techniques, and evidence-based perioperative management strategies, ERAS programs can reduce unnecessary opioid exposure while maintaining adequate analgesia and promoting functional recovery. The consistency of positive outcomes across diverse surgical populations further supports the incorporation of ERAS principles into routine clinical practice as a core component of effective analgesic stewardship.

3.3.3 Implementation of Analgesic Stewardship Programs

The findings of this review suggest that the success of analgesic stewardship initiatives depends not only on the availability of evidence-based interventions but also on the quality of their implementation and adherence within routine clinical practice. Protocols and guidelines alone may have limited impact unless they are supported by effective multidisciplinary collaboration, appropriate education of healthcare professionals, and continuous monitoring of prescribing and patient outcomes. Consequently, implementation science represents a critical component of analgesic stewardship, ensuring that recommended practices are translated into consistent and sustainable improvements in patient care.

The implementation-focused study by Tabesse et al. provides important insights into the practical challenges associated with analgesic stewardship programs. In their evaluation of postoperative pain management among elderly surgical patients, only 17% of patients achieved complete adherence to all protocol components, with frequent deficiencies identified in analgesic prescribing, administration, and documentation practices [3]. These findings demonstrate that gaps in protocol compliance can persist despite the existence of standardized guidelines and may compromise the effectiveness of otherwise well-designed stewardship interventions. The observed shortcomings also highlight the importance of establishing robust systems for ongoing audit, feedback, and quality improvement. Regular evaluation of prescribing patterns, adherence to pain management protocols, and patient-reported outcomes can help identify barriers to implementation and facilitate targeted corrective measures. Furthermore, multidisciplinary involvement, including surgeons, anesthesiologists, pharmacists, nurses, and pain specialists, is essential for ensuring that stewardship principles are applied consistently across the continuum of perioperative care.

Education and training also appear to be integral to the long-term success of analgesic stewardship initiatives. Continuous professional development programs and protocol-based clinical decision support can improve healthcare providers' understanding of multimodal analgesia principles, encourage evidence-based prescribing, and reduce variability in clinical practice. Such interventions may be particularly important in high-risk populations, including older adults and patients with multiple comorbidities, where inappropriate analgesic use may contribute to increased adverse events and poorer clinical outcomes.

Overall, the available evidence suggests that effective analgesic stewardship extends beyond the selection of appropriate analgesic regimens. Successful implementation requires the establishment of structured clinical pathways, multidisciplinary collaboration, regular performance monitoring, and continuous quality improvement processes. These elements collectively enhance adherence to best practices and maximize the clinical benefits of stewardship interventions while promoting safer and more rational analgesic use [3].

3.3.4 Adjunctive and Non-Pharmacological Interventions

In addition to multimodal pharmacological strategies and ERAS-based pathways, the included studies highlight the important role of adjunctive and non-pharmacological interventions in optimizing postoperative pain management. Contemporary analgesic stewardship increasingly recognizes that effective pain control is best achieved through a comprehensive approach that combines pharmacological therapies with supportive interventions targeting multiple dimensions of the patient's recovery experience. These measures may reduce analgesic requirements, improve patient comfort, and contribute to enhanced recovery while minimizing medication-related adverse effects.

One of the studies included in this review demonstrated the potential value of such approaches. Zhang et al. evaluated the use of modified cryotherapy during pediatric dental procedures and found that local irrigation with 0°C saline significantly reduced postoperative pain intensity at 6, 24, and 48 hours compared with standard care, although the difference between groups was no longer significant by postoperative day 7 [6]. These findings suggest that adjunctive non-pharmacological interventions may be particularly beneficial during the early postoperative period, when pain intensity is greatest and the need for rescue analgesics is highest. By improving short-term pain control, these approaches may complement conventional analgesic regimens and contribute to opioid-sparing pain management strategies.

The evidence further indicates that the benefits of analgesic stewardship extend beyond the choice of analgesic agents to include the organization and continuity of postoperative care. Studies evaluating structured postoperative follow-up and standardized recovery protocols demonstrated a progressive reduction in pain intensity over time, reflecting the importance of regular pain assessment, timely intervention, and individualized patient management [7]. In the prospective study by Rzymska et al., pain intensity decreased steadily from a mean Visual Analogue Scale (VAS) score of approximately 79 mm on the first postoperative day to less than 15 mm by day 7 following breast augmentation surgery [7]. Although postoperative pain is inherently influenced by several patient- and procedure-related factors, these findings support the role of structured monitoring and standardized care pathways in facilitating effective pain management throughout the recovery process.

Adjunctive interventions may also enhance patient engagement and satisfaction by promoting a more individualized approach to pain management. Regular assessment of pain intensity using validated instruments, patient education regarding expected postoperative symptoms, and early identification of barriers to recovery allow healthcare professionals to tailor analgesic therapy according to individual patient needs. Such patient-centered practices align closely with the principles of analgesic stewardship, which emphasize not only the safe and rational use of analgesics but also the optimization of overall clinical outcomes and quality of care.

Overall, the available evidence suggests that adjunctive and non-pharmacological interventions serve as valuable complements to pharmacological analgesic strategies. When integrated into standardized stewardship frameworks, these approaches may enhance early postoperative pain control, reduce

reliance on opioid medications, and support a more holistic model of perioperative patient care [6,7].

3.3.5 Overall Evidence Synthesis

Collectively, the evidence synthesized in this narrative review suggests that analgesic stewardship interventions have a positive impact on the quality, safety, and effectiveness of postoperative pain management. Although the included studies varied in design, patient population, and specific intervention components, a consistent pattern emerged in favor of structured, protocol-driven approaches that integrate multimodal analgesia, opioid-sparing principles, standardized perioperative care pathways, and continuous patient monitoring.

The findings indicate that multimodal analgesia forms the foundation of effective analgesic stewardship by combining complementary pharmacological and non-pharmacological strategies to achieve adequate pain control while minimizing opioid exposure. Across the reviewed studies, multimodal protocols were associated with lower pain intensity scores, reduced opioid consumption, and improvements in several patient-centered outcomes, including postoperative recovery and sleep quality [1,2,8]. Similarly, ERAS-based pathways demonstrated that coordinated multidisciplinary care can maintain effective analgesia while facilitating earlier recovery and reducing overall healthcare burden [1,4,5].

An important observation arising from this review is that the success of analgesic stewardship is not solely dependent on the introduction of new analgesic agents but rather on the implementation of comprehensive, evidence-based systems of care. The limited additional benefit observed with adjunctive pharmacological interventions in some studies suggests that well-established stewardship pathways may already optimize key components of postoperative recovery [4]. At the same time, implementation-focused evaluations highlight that the effectiveness of these programs relies heavily on protocol adherence, multidisciplinary collaboration, and ongoing quality improvement measures [3].

The inclusion of adjunctive and non-pharmacological interventions further broadens the scope of analgesic stewardship by emphasizing the importance of individualized patient management and supportive care measures. Together, these strategies contribute to a holistic approach that extends beyond pain reduction alone and seeks to improve functional recovery, minimize treatment-related complications, and enhance the overall patient experience.

Despite the generally favorable findings, several limitations within the current body of evidence should be acknowledged. The included studies exhibited considerable heterogeneity with respect to study design, intervention components, clinical settings, and outcome measures, limiting direct comparison across studies. Furthermore, many investigations focused primarily on short-term postoperative outcomes, and there remains a relative paucity of high-quality prospective studies specifically evaluating the long-term impact of formal analgesic stewardship programs on patient-reported pain outcomes and healthcare resource utilization.

Nevertheless, the available evidence supports the growing role of analgesic stewardship as an integral component of modern perioperative care. The integration of multimodal analgesia, ERAS principles, protocol-based prescribing, and structured follow-up appears to promote effective pain management while encouraging safer and more rational analgesic use. Future well-designed comparative studies and implementation research are warranted to further define best practices and strengthen the evidence base supporting widespread adoption of analgesic stewardship interventions in routine clinical practice [1–8].

4. DISCUSSION

This narrative review synthesized the available evidence regarding the impact of analgesic stewardship interventions on pain intensity outcomes, with a particular emphasis on multimodal analgesia protocols, Enhanced Recovery After Surgery (ERAS) pathways, and structured postoperative pain management systems. Overall, the findings indicate that protocol-based analgesic stewardship approaches can optimize analgesic utilization while maintaining or improving patient-reported pain outcomes. More importantly, the evidence suggests that effective pain management can be achieved without excessive reliance on opioid medications, supporting the growing transition toward opioid-sparing perioperative care. A consistent finding across the included studies was that reductions in opioid exposure were not associated with deterioration in pain control. Multimodal analgesia protocols, which combine agents with different mechanisms of action, demonstrated favorable outcomes in terms of pain intensity, postoperative recovery, and opioid utilization [1,2,8]. The incorporation of non-opioid analgesics and adjuvant therapies such as esketamine and dexmedetomidine not only reduced opioid requirements but also improved broader patient-centered outcomes, including postoperative sleep quality and psychological well-being [2]. These observations are consistent with current recommendations from international pain management guidelines, which advocate the routine use of multimodal analgesia to maximize analgesic efficacy while minimizing opioid-related adverse effects [11,12,13].

The findings of this review also reinforce the growing importance of opioid stewardship as an integral component of analgesic stewardship. The increasing recognition of opioid-related harms, including respiratory depression, gastrointestinal adverse effects, persistent postoperative opioid use, and the potential for long-term dependence, has prompted healthcare systems worldwide to re-evaluate traditional analgesic practices [10,13]. The studies included in this review suggest that opioid-sparing strategies can successfully maintain effective pain relief while reducing unnecessary opioid exposure. Such approaches align with the broader objectives of stewardship programs, which seek to ensure the right analgesic, at the right dose, for the right patient, while minimizing avoidable medication-related harm.

An important observation emerging from this review is the contribution of ERAS pathways to the success of analgesic stewardship interventions. ERAS programs represent a system-level approach that integrates multimodal analgesia with standardized perioperative care, early mobilization, optimized

nutrition, and evidence-based recovery practices. The studies by Ajabshir et al. and Michael et al. demonstrated that ERAS-based protocols were associated with effective pain control, acceptable complication rates, and improved postoperative recovery profiles [1,5]. Interestingly, the randomized trial by Yim et al. showed that the addition of alvimopan to an already established ERAS protocol did not result in significant improvements in gastrointestinal recovery or hospital stay [4]. This finding may indicate that once a comprehensive, evidence-based recovery pathway has been implemented, the incremental benefit of adding isolated pharmacological interventions may be relatively small. Rather than emphasizing the addition of individual agents, these observations highlight the importance of maintaining the integrity and consistency of the overall multimodal recovery framework.

The review also emphasizes that the effectiveness of analgesic stewardship depends not only on the selection of appropriate analgesic interventions but also on the successful implementation of stewardship principles within routine clinical practice. The implementation-focused evaluation conducted by Tabesse et al. revealed substantial gaps in adherence to standardized pain management protocols, with only a minority of patients receiving care fully aligned with recommended practices [3]. This finding is particularly relevant because it illustrates that evidence-based guidelines alone are insufficient unless accompanied by effective systems for education, audit, feedback, and multidisciplinary collaboration. Similar observations have been reported in stewardship literature, where sustained improvements in medication use are closely linked to continuous quality improvement initiatives and institutional support [10,14].

Another noteworthy finding is the potential contribution of adjunctive and non-pharmacological interventions to postoperative pain management. Modified cryotherapy and structured postoperative follow-up strategies demonstrated beneficial effects on early pain control and patient recovery [6,7]. Although these interventions may not replace conventional pharmacological analgesia, they complement multimodal pain management strategies by addressing different aspects of the pain experience. The integration of pharmacological and non-pharmacological modalities reflects the evolving concept of patient-centered analgesic stewardship, which recognizes that effective pain management extends beyond medication selection alone. The findings of this review also highlight the inherently multifactorial nature of pain perception and response to treatment. Pain outcomes are influenced not only by the analgesic regimen but also by patient-specific factors, including age, psychological status, comorbidities, type of surgical procedure, and previous pain experiences. The progressive reduction in postoperative pain observed in the prospective study by Rzymska et al. underscores the dynamic nature of recovery and the importance of individualized patient monitoring [7]. Consequently, while standardized stewardship protocols provide a valuable framework for optimizing analgesic use, they should be sufficiently flexible to accommodate patient-specific clinical needs and preferences.

Despite the generally favorable evidence supporting analgesic stewardship, several limitations within the current literature should be acknowledged. The included studies exhibited substantial heterogeneity with respect to study design, intervention characteristics, patient populations, and outcome assessment methods. In addition, many investigations focused on surrogate or short-term postoperative outcomes, with relatively limited evidence regarding long-term pain control, functional recovery, quality of life, or persistent opioid use. The predominance of retrospective and observational study designs further limits the ability to establish definitive causal relationships between stewardship interventions and clinical outcomes. These limitations highlight the need for future high-quality randomized controlled trials and prospective implementation studies evaluating standardized stewardship models across diverse healthcare settings.

From a clinical perspective, the findings of this review support the incorporation of analgesic stewardship principles into routine perioperative practice. Multidisciplinary collaboration among surgeons, anesthesiologists, pharmacists, nurses, and pain specialists is essential to ensure the development, implementation, and continuous evaluation of evidence-based analgesic protocols. Clinical pharmacists, in particular, may play an important role in optimizing analgesic prescribing, monitoring opioid utilization, identifying medication-related problems, promoting adherence to institutional protocols, and supporting patient education initiatives [12]. The integration of stewardship principles within established ERAS pathways may therefore represent an effective strategy for improving the safety, consistency, and quality of postoperative pain management.

Overall, the evidence synthesized in this review suggests that analgesic stewardship interventions provide a pragmatic and patient-centered approach to optimizing pain management. The combination of multimodal analgesia, opioid-sparing strategies, standardized recovery pathways, and structured implementation processes appears to facilitate effective pain control while reducing medication-related risks. Although further high-quality research is required to strengthen the evidence base and establish best practices, the current findings support the broader adoption of protocol-driven analgesic stewardship models as a key component of contemporary perioperative care.

5. Limitations and Critical Appraisal of the Evidence

Several limitations should be considered when interpreting the findings of this narrative review. First, the number of included studies was relatively small, and the literature search was limited to the PubMed database and English-language publications, which may have introduced publication and language bias. In addition, considerable heterogeneity existed across the included studies with respect to study design, patient populations, clinical settings, intervention characteristics, and outcome measures, limiting direct comparison and generalizability of the findings.

Another important limitation was the inconsistent reporting of pain-related outcomes. Although the review focused on pain intensity, only some studies directly assessed pain using validated tools such as the Visual Analogue Scale (VAS) or Numeric Rating Scale (NRS), whereas others primarily reported surrogate endpoints including opioid consumption, length of hospital stay, complication rates, and recovery indicators [1,4,5]. Consequently, improvements in these measures cannot always be interpreted as direct evidence of enhanced pain control.

Furthermore, a substantial proportion of the included studies employed retrospective or observational designs, making them susceptible to selection bias, confounding, and incomplete outcome reporting [3,7]. Variability in protocol adherence, particularly in implementation-based studies, may also have influenced the reported outcomes. The inclusion of specialized patient populations and surgical settings may further limit the applicability of the findings to broader clinical practice [1,5,6].

As a narrative review, this study provides a qualitative synthesis rather than a quantitative meta-analysis; therefore, pooled effect estimates and formal assessments of heterogeneity and publication bias were not performed. Despite these limitations, the available evidence supports the potential value of protocol-based analgesic stewardship interventions, particularly multimodal analgesia and ERAS pathways, in optimizing pain management. Future well-designed prospective studies employing standardized pain assessment tools and uniform reporting of patient-centered outcomes are needed to strengthen the evidence base and facilitate meaningful comparisons across interventions.

6. CONCLUSION

The findings of this narrative review indicate that analgesic stewardship interventions, particularly multimodal analgesia protocols and Enhanced Recovery After Surgery (ERAS) pathways, play an important role in optimizing contemporary pain management practices. By integrating evidence-based, protocol-driven, and multidisciplinary approaches, these interventions can maintain or improve patient-reported pain outcomes while reducing unnecessary reliance on opioid-based analgesia. The available evidence suggests that multimodal and opioid-sparing strategies enhance the effectiveness and safety of pain management by combining complementary pharmacological and non-pharmacological modalities. Similarly, ERAS-based pathways contribute to improved perioperative care through standardized clinical protocols that support effective analgesia, facilitate postoperative recovery, and promote more rational analgesic utilization.

Although the current literature generally supports the clinical value of analgesic stewardship, the evidence base remains limited by methodological heterogeneity, variability in outcome reporting, and differences in protocol implementation across studies. The consistent application of validated pain assessment tools, such as the Visual Analogue Scale (VAS) and Numeric Rating Scale (NRS), together with standardized reporting of patient-centered outcomes, will be essential for strengthening future evidence and enabling meaningful comparisons across interventions.

Overall, the integration of analgesic stewardship principles into routine clinical practice appears to offer a practical and effective strategy for improving the quality, safety, and consistency of pain management. Continued research and the development of standardized evidence-based stewardship frameworks may further support the adoption of these approaches, ultimately contributing to enhanced patient outcomes and safer, more rational use of analgesic therapies.

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