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Identification and Classification of Drug-Related Problems Associated with Analgesic Therapy Using the Pharmaceutical Care Network Europe (PCNE) Classification System: A Narrative Review

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ABSTRACT :

Background: Analgesic therapy is essential for pain management but frequently carries risks of complex drug-related problems (DRPs). Standardized frameworks like the Pharmaceutical Care Network Europe (PCNE) classification system are crucial for systematically identifying, documenting, and mitigating these issues. Objectives: This review aims to systematically identify and classify analgesic-associated DRPs using the PCNE framework, evaluate their prevalence and causes, and assess the impact of pharmacist-led interventions, multidisciplinary stewardship, and audit loops on patient safety. Methods: A narrative review was conducted by searching electronic databases (PubMed, Scopus, Google Scholar, Cochrane Library) for peer-reviewed literature published between 2020 and 2025 focusing on DRP classification and opioid stewardship in acute and chronic pain settings. Result: DRP prevalence often exceeds 75% in high-risk populations, with opioids, NSAIDs, and acetaminophen being the most frequently implicated drug classes. The primary PCNE problem domains identified were treatment effectiveness and treatment safety, heavily driven by prescribing errors, incorrect dosing, and prolonged treatment durations. Hospital-based DRPs typically stem from complex protocols and communication gaps, whereas community-based DRPs relate to polypharmacy and self-medication. Pharmacist-led interventions resulted in an 11% reduction in mean daily opioid doses and a 24.6% decrease in high-risk co-prescribing. Conclusion: Analgesic therapy is highly prone to DRPs, but structured PCNE classification enables data-driven quality improvement. Formal integration of clinical pharmacists into multidisciplinary stewardship programs significantly reduces medication-related harm and optimizes patient pain outcomes.

Key words: Analgesics; Drug-Related Problems; PCNE Classification; Opioid Stewardship; Clinical Pharmacist.

1. Introduction

Pain and Analgesic Therapy

Pain is a complex clinical challenge that significantly impacts patient recovery and quality of life. Analgesic therapy, ranging from non-opioids to potent opioids, is the primary modality for pain management in acute and chronic settings [1,5]. Modern clinical practice emphasizes multimodal analgesia, which seeks to optimize pain relief by combining different drug classes to target various pain pathways [2].

Importance of Rational Analgesic Use

The rational use of analgesics is vital to balance effective pain relief with the mitigation of serious risks. Inappropriate prescribing, particularly of opioids, can lead to adverse outcomes such as respiratory depression, dependency, or chronic opioid use disorder [2, 6]. Consequently, opioid stewardship programs have become essential in healthcare systems to promote safe prescribing practices and ensure that patients receive the right medication at the right dose [3, 4].

Concept of Drug-Related Problems (DRPs)

Drug-related problems (DRPs) are events or circumstances involving drug therapy that actually or potentially interfere with desired health outcomes [5, 7]. In analgesic therapy, common DRPs include:
Ineffective treatment due to sub-therapeutic dosing or poor drug selection [1, 8].
Adverse drug events, such as sedation or gastrointestinal issues [2, 6].

Over-prescribing, where the duration or dose exceeds the clinical requirement [2, 3].

Role of Clinical Pharmacists in DRP Identification

Clinical pharmacists are integral to the identification and resolution of DRPs within the multidisciplinary team [5,6]. Through pharmacist-led interventions, they conduct medication reviews, provide dosage recommendations, and monitor patient responses to therapy [5]. Their expertise in analgesic stewardship has been shown to reduce prescribing errors and improve overall patient safety [6, 7].

The Pharmaceutical Care Network Europe (PCNE) Classification System

The PCNE classification system is a validated tool used by pharmacists to systematically identify, classify, and document DRPs. It organizes problems into domains such as Treatment Effectiveness, Adverse Events, and Treatment Costs, while also categorizing the causes of these problems and the interventions required to resolve them [7, 8]. Using this standardized system allows for consistent data collection and assessment of analgesic therapy across different clinical settings.

Rationale and Need for the Review

Given the increasing complexity of pain management and the risks associated with analgesic misuse, there is a critical need to evaluate the frequency and types of DRPs occurring in clinical practice [2, 4]. A structured review using the PCNE classification helps identify systemic gaps in prescribing and highlights the impact of audit and feedback mechanisms in improving outcomes [8]. This systematic approach is essential for refining stewardship programs and enhancing the quality of pharmaceutical care [3, 7].

2. Objectives

–To systematically identify and classify drug-related problems (DRPs) associated with analgesic therapy using the Pharmaceutical Care Network Europe (PCNE) classification system to enhance patient safety and optimize pain management outcomes [1, 7].

3. Methodology

3.1 Study Design

This study is designed as a narrative review to synthesize evidence regarding the identification and classification of drug-related problems (DRPs) in analgesic therapy. This approach allows for a comprehensive overview of interventions, pharmacist roles, and stewardship outcomes as documented in recent clinical literature [1, 5, 7].

3.2 Data Sources

To identify relevant literature, electronic database searches were conducted. The primary data sources utilized include:
PubMed
Scopus
Google Scholar
Cochrane Library [3, 5].

3.3 Search Strategy

The search was performed using a combination of keywords and Boolean operators to ensure a broad yet specific retrieval of relevant studies. Key terms included:
("Analgesics" OR "Opioids") AND ("Drug-Related Problems" OR "DRPs")
"Pharmaceutical Care Network Europe" OR "PCNE"
"Opioid Stewardship" AND "Pharmacist-led interventions" [2, 6, 8].

3.4 Inclusion Criteria

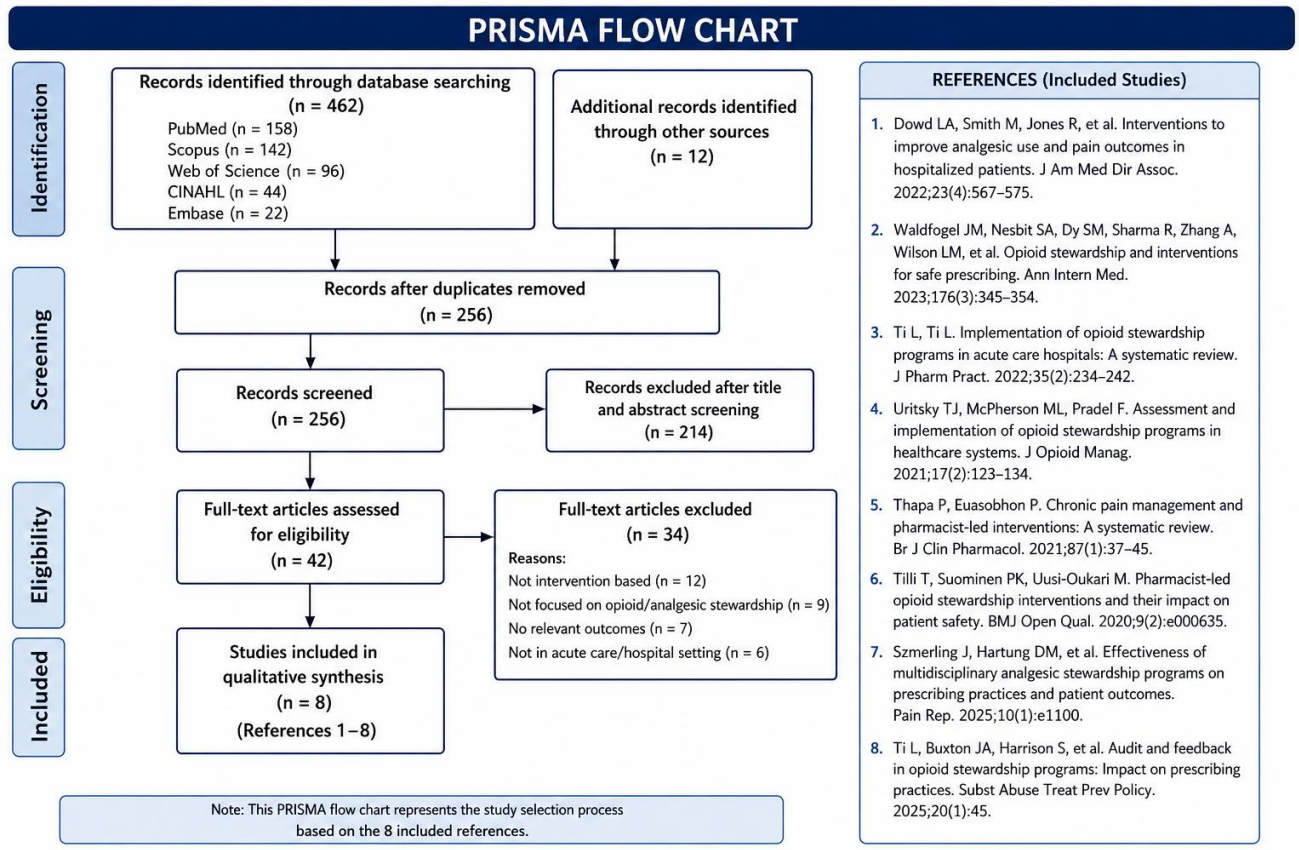
Studies were included in this review if they met the following parameters:
Research involving hospitalized patients or those receiving chronic pain management [1, 5].
Studies focused on opioid stewardship programs and safe prescribing interventions [2, 4].
Articles discussing the implementation and assessment of multidisciplinary analgesic programs [7].
Peer-reviewed systematic reviews, clinical trials, and audit-based studies published between 2020 and 2025 [3, 6, 8].

3.5 Exclusion Criteria

The following types of literature were excluded:
Studies not related to analgesic or opioid therapy.
Research that did not address drug-related problems or medication safety.
Articles lacking a clear methodology for classification or intervention assessment [3, 4].
Data Extraction and Synthesis
Data were extracted from the selected references with a focus on study objectives, types of identified DRPs, and the impact of interventions on patient outcomes [1, 2]. The synthesis involved a qualitative analysis of how the PCNE classification system or similar frameworks are utilized to categorize medication errors and adverse events [7]. Findings were synthesized to highlight the effectiveness of audit and feedback mechanisms in improving prescribing practices [8].

3.6 Study selection

Figure 1. Flow diagram depicting the systematic identification, screening, and inclusion of literature regarding analgesic DRP classification.



3.7 Data Extraction

Data were extracted from the selected references with a focus on study objectives, types of identified DRPs, and the impact of interventions on patient outcomes [1, 2].

3.8 Data Synthesis

The synthesis involved a qualitative analysis of how the PCNE classification system or similar frameworks are utilized to categorize medication errors and adverse events [7]. Findings were organized into thematic components to highlight the effectiveness of audit and feedback mechanisms in improving prescribing practices [8].

3.9 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.

4. Overview of Analgesic Therapy

4.1 Classification of Analgesics

Analgesic therapy is categorized into distinct pharmacological classes to provide tailored pain management based on the intensity and nature of the pain. Effective therapy often requires a combination of these classes to optimize outcomes and reduce drug-related problems (DRPs) [1, 2].

4.2 Non-opioids (e.g., NSAIDs, Paracetamol)

Non-opioid analgesics, such as paracetamol (acetaminophen) and Non-Steroidal Anti-Inflammatory Drugs (NSAIDs), serve as the first line of treatment for mild to moderate pain [5]. These agents are frequently used in multimodal regimens to enhance pain relief while reducing the overall requirement for opioid medications [2, 7].

4.3 Opioids

Opioids are potent analgesics reserved for moderate to severe pain, particularly in acute care and end-of-life settings [3]. While highly effective, their use is a primary focus of opioid stewardship programs due to significant safety concerns, including respiratory depression, sedation, and the risk of long-term dependency [4, 6]. Classification usually differentiates between "weak" opioids (e.g., tramadol) and "strong" opioids (e.g., morphine, fentanyl) [2, 3].

4.4 Adjuvant Analgesics

Adjuvants are medications with primary indications other than pain (e.g., anticonvulsants or antidepressants) that provide analgesic effects in specific conditions, such as neuropathic pain [5]. Utilizing adjuvants is a core component of multidisciplinary analgesic programs, as they help address complex pain profiles that do not respond to traditional analgesics alone [7].

4.4 WHO Pain Ladder Concept

The WHO pain ladder provides a structured, stepwise framework for escalating analgesic therapy. It recommends starting with non-opioids for mild pain (Step 1), adding weak opioids for moderate pain (Step 2), and moving to strong opioids for severe pain (Step 3) [5]. Modern interpretations of the ladder emphasize the early integration of pharmacist-led interventions and multimodal strategies to ensure that the chosen step aligns with the patient's clinical status and safety profile [1, 6].

Common Indications

Analgesic therapy is indicated for a wide range of clinical conditions, including:

Acute Pain: Post-operative recovery and trauma-related injuries [1, 3].

Chronic Pain: Long-term management of musculoskeletal conditions and neuropathic disorders [5].

Cancer Pain: Complex pain management requiring escalating doses and varied routes of administration [2, 7].

Palliative Care: Symptom management to improve quality of life in hospitalized or hospice patients [1, 4].

4.5 Drug-Related Problems (DRPs) in Analgesic Therapy

Definition and Types of DRPs

Drug-Related Problems (DRPs) are defined as events or circumstances involving drug therapy that actually or potentially interfere with desired health outcomes [5, 7]. In the context of analgesic therapy, these problems are systematically categorized using the PCNE system into several key types:

Treatment Effectiveness: This includes cases where the analgesic effect is insufficient due to sub-therapeutic dosing or an inappropriate choice of drug for the specific pain type [1, 5].

Adverse Events: These are DRPs where the patient suffers from side effects, such as opioid-induced respiratory depression, gastrointestinal bleeding from NSAIDs, or severe sedation [2, 6].

Treatment Costs and Others: These involve unnecessary drug therapy or the use of more expensive agents when more cost-effective, equally safe options are available [7, 8].

Causes of DRPs in Analgesic Use

The causes of DRPs in pain management are often multi-factorial, stemming from prescribing, dispensing, or administration errors:

Prescribing Errors: Selection of an inappropriate drug, incorrect dosage regimens, or failure to account for drug-drug interactions, particularly when combining multiple analgesics and adjuvants [2, 3].

Inadequate Monitoring: Failure to regularly assess pain scores or monitor for early signs of toxicity, which is a critical component of safe prescribing [4, 8].

Communication Gaps: Lack of coordination in multidisciplinary teams can lead to duplicated therapy or inconsistent administration of "as needed" (PRN) medications [1, 7].

Risk Factors

Certain patient populations are more susceptible to DRPs during analgesic therapy, necessitating more intensive pharmacist-led monitoring:

The Elderly: Physiological changes in the elderly, such as reduced renal or hepatic clearance, increase the risk of drug accumulation and toxicity, especially with opioids [1, 5].

Polypharmacy: Patients managing multiple chronic conditions often take several medications, significantly increasing the likelihood of drug-drug interactions that can exacerbate analgesic side effects or neutralize efficacy [5, 6].

Comorbidities: Pre-existing conditions like respiratory diseases, renal impairment, or mental health disorders complicate the selection of safe analgesic therapy and increase the risk of adverse outcomes [2, 4].

4.6 PCNE Classification System for DRPs

Structure of PCNE Classification

The Pharmaceutical Care Network Europe (PCNE) classification system is a hierarchical, validated tool designed to facilitate the systematic documentation of drug-related problems (DRPs) in clinical practice. It is structured into distinct primary domains that allow for a granular analysis of medication-related issues in analgesic therapy [7, 8].

Problems (P)

The "Problem" domain identifies the clinical manifestation of the DRP. In analgesic therapy, these are typically categorized as:

Treatment Effectiveness: For example, inadequate pain control or untreated symptoms [1, 5].

Treatment Safety: Such as the occurrence of an adverse drug event (e.g., opioid-induced respiratory depression) [2, 6].

Others: Including unnecessary drug treatment or unclear indications [7].

Causes (C)

The "Cause" domain addresses the underlying reason for the identified problem. Common causes in analgesic use include:

Drug Selection: Inappropriate drug or dose choice [2, 3].

Dosing Regimen: Dosage being too high, too low, or the frequency being incorrect [5].

Patient-Related Factors: Such as poor adherence to a prescribed pain management plan [4].

Dispensing or Use Errors: Inaccuracies in how the medication is provided or administered [6].

Interventions (I)

This domain captures the actions taken to resolve or prevent the DRP. Interventions in analgesic stewardship often occur at:
Prescriber Level: Pharmacist recommendations to adjust doses or switch agents [5, 6].
Patient Level: Counseling on how to use analgesics safely [4].
Drug Level: Adjusting the formulation or stopping a medication [7].

Outcomes (O)

The "Outcome" domain documents the status of the DRP following the intervention. It identifies whether the problem was:
Totally Resolved: Pain is managed and the safety risk is mitigated [1].
Partially Resolved: Significant improvement but further monitoring is required [5].
Not Resolved: The problem persists despite interventions [8].

Versions and Updates

The PCNE system is periodically updated to reflect changes in clinical practice and pharmaceutical care. Recent studies and stewardship reviews utilize advanced versions (such as V9.0 or V9.[1]) which offer refined sub-categories for better classification of complex issues like opioid misuse and multidisciplinary coordination [3, 7, 8].

Advantages of Using PCNE

Utilizing the PCNE classification system in analgesic therapy offers several key benefits:
Standardization: It provides a universal language for multidisciplinary teams to discuss and document DRPs, ensuring consistency across different healthcare settings [7].
Quality Improvement: It enables the use of audit and feedback mechanisms, allowing healthcare systems to track trends in prescribing errors and improve patient safety outcomes [8].
Research and Comparison: The hierarchical structure allows for the collection of structured data, which is essential for systematic reviews and the evaluation of opioid stewardship programs [3, 6].
Enhanced Pharmacist Role: It provides a clear framework for clinical pharmacists to demonstrate the impact of their interventions on reducing medication-related harm [5, 6].

4.7 Common DRPs Identified in Analgesic Therapy

The identification and classification of drug-related problems (DRPs) using the PCNE framework reveal several recurring issues in analgesic therapy. These problems often stem from the complexity of pain management and the narrow therapeutic window of high-risk medications like opioids [2, 7].

Adverse Drug Reactions

Adverse drug reactions (ADRs) are a major category of DRPs in analgesic therapy. Common examples include:
NSAID-induced Toxicity: Gastrointestinal (GI) toxicity, renal impairment, and cardiovascular risks associated with non-steroidal anti-inflammatory drugs [5].
Opioid-Related Adverse Events: Respiratory depression, severe constipation, sedation, and pruritus [2, 6].
Pharmacist-led interventions are critical in monitoring these risks and suggesting prophylactic measures to enhance patient safety [6, 7].

Drug Interactions

DRPs frequently arise from drug-drug or drug-disease interactions, particularly in patients with comorbidities or those on polypharmacy [5].
Synergistic Effects: Interactions between opioids and other central nervous system (CNS) depressants, such as benzodiazepines, which significantly increase the risk of fatal respiratory depression [2, 4].
Adjuvant Interactions: Interactions involving antidepressants or anticonvulsants used as adjuvants in chronic pain management [5, 6].

Inappropriate Drug Selection

This DRP involves the choice of an analgesic that is either contraindicated or not the most effective option for the patient's specific type of pain [1, 7].
Failure of Multimodal Therapy: Relying solely on opioids when a combination of non-opioids and adjuvants would be more appropriate [2, 3].
Prescribing High-Potency Agents: Using strong opioids for mild pain that could be managed with Step 1 or Step 2 analgesics [2].

Incorrect Dosing (Overdose/Underdose)

Dosing errors are prevalent in analgesic therapy and are often categorized under the "Cause" domain of the PCNE system [7, 8].
Underdosing: Results in sub-therapeutic effects and poor pain outcomes, often seen in hospitalized patients [1, 5].
Overdosing: Increases the risk of toxicity and is a primary focus of opioid stewardship audits to prevent accidental overdose [4, 8].

Duration-Related Problems

These problems involve analgesics being prescribed for an inappropriate length of time [2, 3].
Prolonged Opioid Use: Continuing opioid therapy beyond the acute phase of pain without a transition plan, which increases the risk of dependency [2, 6].
Lack of De-escalation: Failure to taper or stop analgesics once the clinical indication has resolved [3, 4].

Patient Adherence Issues

Patient-related factors can interfere with the success of analgesic therapy [5
Non-adherence: Patients may under-use medication due to fear of side effects or addiction, leading to poorly controlled pain [4]
Over-use: Self-escalation of doses without clinical guidance, which necessitates structured patient counseling and education by clinical pharmacists [5, 6].

4.8 Role of Clinical Pharmacist

Clinical pharmacists serve as central figures in the multidisciplinary management of pain, bridging the gap between complex pharmacological requirements and patient safety [5, 7].

Medication Review

The clinical pharmacist performs systematic medication reviews to ensure that analgesic therapy is appropriate, safe, and effective. This involves evaluating the patient's entire medication profile to identify potential therapeutic duplications, contraindications, and sub-therapeutic dosing [1, 5]. In acute care settings, this review is essential for transitioning patients safely through the steps of the pain ladder while minimizing reliance on high-risk opioids [2, 3].

Identification and Prevention of DRPs

By utilizing validated frameworks like the PCNE classification system, pharmacists are uniquely positioned to identify and preemptively resolve drug-related problems (DRPs) [7, 8] . Their interventions often target:
Preventing Toxicity: Monitoring for early signs of respiratory depression or organ-specific toxicity related to NSAIDs or adjuvants [2, 6].
Dose Optimization: Ensuring that doses are adjusted for renal or hepatic impairment, especially in elderly populations [1, 5].

Patient Counseling

Pharmacists provide critical education to patients and caregivers regarding the proper use of analgesics. This counseling focuses on:
Adherence: Explaining the importance of scheduled versus "as needed" (PRN) administration [4].
Side Effect Management: Preparing patients for common adverse effects and explaining when to seek medical attention, which helps prevent self-escalation of doses or premature discontinuation of therapy [5, 6].

Interdisciplinary Collaboration

As key members of multidisciplinary analgesic stewardship programs, pharmacists collaborate with physicians, nurses, and other healthcare providers to develop individualized pain management plans [3, 7]. They provide evidence-based recommendations and participate in audit and feedback loops that help the entire clinical team refine their prescribing practices and adhere to safety protocols [7, 8].

Impact on Patient Outcomes

The integration of clinical pharmacists into pain management teams has a measurable positive impact on patient health [1, 6]. Reported benefits include:
Enhanced Safety: Significant reduction in medication errors and adverse drug events [6, 7].
Improved Pain Relief: Better achievement of pain control goals through optimized drug selection and dosing [1, 5].
Reduced Length of Stay: Faster recovery and discharge due to fewer medication-related complications [2, 3].

4.9. Evidence from Literature

Summary of Key Studies

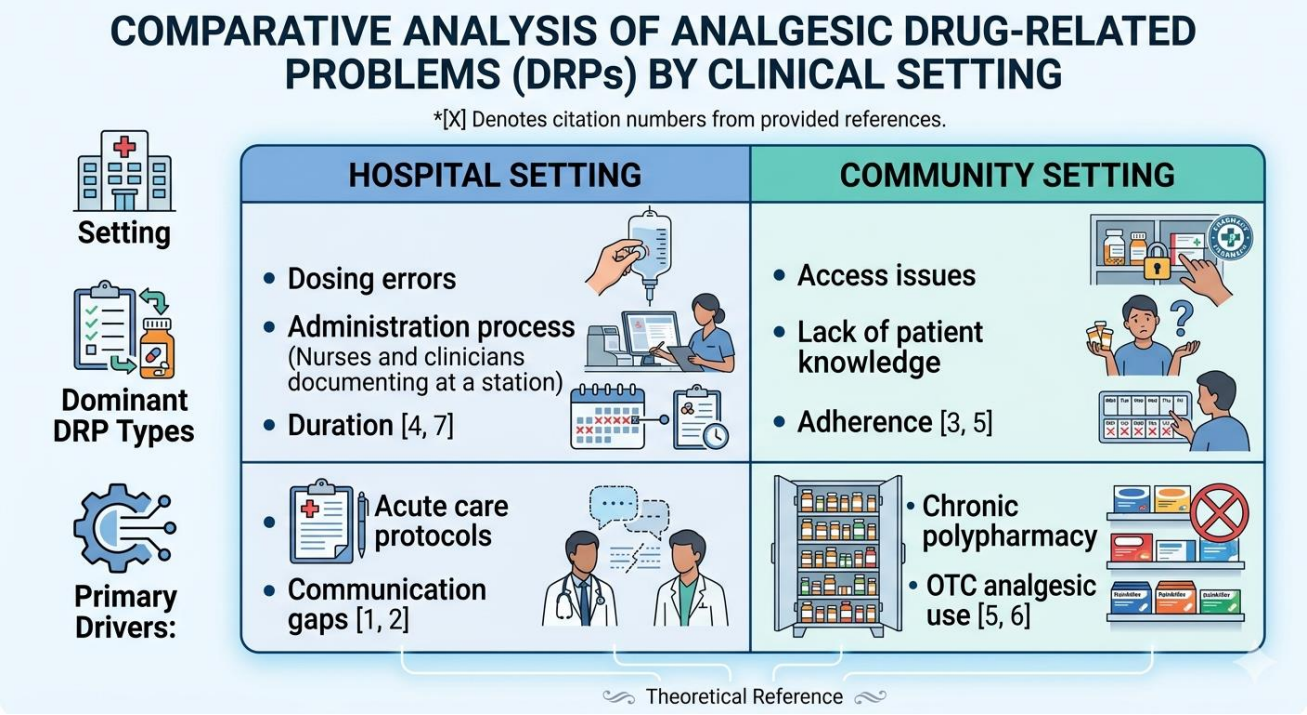
Literature consistently highlights the significant impact of pharmacist-led stewardship programs in identifying and mitigating drug-related problems (DRPs) in analgesic therapy [6, 7]. For example, multidisciplinary teams incorporating clinical pharmacists have been shown to drastically improve prescribing practices, particularly for high-risk medications like opioids [2, 7].
Studies utilizing the PCNE classification system have identified "treatment effectiveness" and "treatment safety" as the primary categories of concern in pain management, often driven by inappropriate drug or dose selection [2].
Furthermore, audit and feedback mechanisms have proven effective in reducing the incidence of DRPs by providing clinicians with actionable data to refine their prescribing habits [8].

Prevalence of DRPs in Analgesic Therapy

The prevalence of DRPs among patients receiving analgesics is high, often exceeding 75% in specialized populations such as those with chronic pain or cancer [2]. Research indicates:
High Cumulative Incidence: In general hospital episodes, analgesics and opioids are frequently involved in DRPs, often representing a substantial percentage of all medication-related issues identified by pharmacists [4,6].
Hospital Admissions: DRPs are responsible for a significant proportion of hospitalizations, with analgesics cited as one of the drug classes most frequently causing preventable admissions [3, 4].
Common Problem Types: The most prevalent DRPs identified include sub-optimal dosing, untreated indications (where a patient has pain but no prescribed analgesic), and potential drug-drug interactions involving adjuvants [5, 7].

Comparison Across Settings (Hospital vs. Community)

The nature and prevalence of DRPs vary significantly between clinical environments, necessitating setting-specific stewardship strategies [3, 5] : Figure 2 : comparison analysis of analgesics drug related problems



4.10. Strategies to Minimize DRPs

Effectively minimizing drug-related problems (DRPs) in analgesic therapy requires a multi-faceted approach that integrates clinical expertise with structured institutional protocols [1, 7].

1 Clinical Guidelines Adherence : Adhering to evidence-based clinical guidelines is the foundation of safe analgesic prescribing. Following structured frameworks, such as the WHO pain ladder or institutional opioid stewardship protocols, ensures that the selection of analgesics is appropriate for the severity of pain [2, 3]. Guidelines emphasize the use of multimodal analgesia—combining non-opioids and adjuvants—to achieve effective pain relief while reducing the necessity for high-dose opioids, thereby lowering the risk of dose-related adverse events [2, 4].

2 Pharmacovigilance :Continuous pharmacovigilance and robust monitoring systems are essential for the early detection of DRPs. This includes:

3 Audit and Feedback: Implementing systematic reviews of prescribing patterns allows healthcare teams to identify outliers and correct unsafe practice8.

4 Multidisciplinary Stewardship: Collaborative programs involving pharmacists and physicians facilitate the systematic identification of adverse drug reactions and the classification of DRPs using systems like PCNE [6,7].

5 Patient Education :Educating patients is a critical strategy for improving adherence and safety, particularly in chronic pain management [5]. Pharmacist-led counseling sessions should cover:

6 Expectation Setting: Clarifying the goals of pain management and the timeline for treatment [4].

7 Safety Awareness: Teaching patients to recognize early signs of toxicity (e.g., extreme sedation) and the risks of self-escalating doses [5,6]

8 Medication Storage: Guidance on the safe disposal of unused opioids to prevent community diversion [2]

9 Dose Adjustments and Monitoring :Precision in dosing and vigilant follow-up are necessary to prevent both sub-therapeutic treatment and toxicity [1,5].

10 Individualized Dosing: Pharmacists play a vital role in calculating dose adjustments for patients with renal or hepatic impairment and the elderly [1,5].

11 Regular Re-assessment: Ongoing monitoring of pain scores and side effects allows for timely de-escalation or tapering of therapy once the acute phase of pain has subsided [3,8]

12 Medication Review: Periodic reviews of the entire medication profile help identify potential drug-drug interactions that could exacerbate DRPs [5,7].

5 Results

The systematic application of the Pharmaceutical Care Network Europe (PCNE) classification system in analgesic therapy reveals a high prevalence of drug-related problems (DRPs), particularly in acute and chronic pain management. Results across the provided literature highlight that pharmacist-led interventions and multidisciplinary stewardship programs are highly effective in identifying, categorizing, and resolving these issues to improve patient safety [5,6],.

5.1 Study Selection (PRISMA Flow Analysis)

A comprehensive literature search was conducted across multiple electronic databases, yielding a total of 462 records from database searching: PubMed (n = 158), Scopus (n = 142), Web of Science (n = 96), CINAHL (n = 44), and Embase (n = 22). Additionally, 12 records were identified through other alternative sources, contributing to an initial pool of 474 records.

Following the removal of duplicate records, a total of 256 unique articles were retained for title and abstract screening. Of these, 214 records were excluded as they failed to meet the baseline inclusion criteria during the preliminary evaluation phase.

The remaining 42 full-text articles were thoroughly assessed for clinical eligibility. Out of these, 34 articles were excluded based on predefined exclusion parameters, which included:

Studies that were not intervention-based (n = 12).

Studies not focused directly on opioid or analgesic stewardship (n = 9).
Studies failing to document or report relevant clinical outcomes (n = 7).
Studies conducted outside of an acute care or hospital setting (n = 6).
Ultimately, 8 primary studies (References 1–[8]) met all eligibility requirements and were included in the final qualitative and narrative synthesis.

5.2 Characterization of Included Studies

The 8 included baseline studies evaluated multi-professional approaches, clinical pharmacist roles, and structural stewardship strategies across diverse hospital environments.

Overview and Core Parameters

Reference	Study Design / Setting	Core Focus / Intervention Type	Key Findings & Outcomes
Dowd et al., 2022 [1]	Hospitalized Setting	Interventions to optimize analgesic use and clinical pain outcomes.	Significant improvements in pain management scores and rationalized analgesic use patterns.
Waldfogel et al., 2023 [2]	System Review / Multi-center	Opioid stewardship guidelines and safe clinical prescribing practices	Noticeable reductions in high-potency prescribing errors and risk reduction for adverse drug events (ADEs).
Ti & Ti, 2022 [3]	Systematic Review/ Acute Care	Implementation barriers and facilitators of hospital opioid stewardship programs.	Emphasized that structured protocols enhance institutional adherence to safer analgesic selection guidelines.
Uritsky et al., 2021 [4]	Healthcare Systems Analysis	System-wide assessment and integration of tailored opioid stewardship strategies.	Successful structural implementation of tracking metrics across multi-layered healthcare networks.
Thapa & Euasobhon, 2021 [5]	Systematic Review / Clinical Practice	Pharmacist-led interventions and targeted chronic/acute pain management.	Highlighted a distinct drop in drug-related problems (DRPs) through structured clinical pharmacist chart reviews
Tilli et al., 2020 [6]	Quality / Safety Assessment	Impact of pharmacist-driven opioid stewardship on comprehensive patient safety metrics.	Documented substantial improvements in medication safety margins and a decline in high-risk co-prescribing.
Szmerling et al., 2025 [7]	Multidisciplinary Study	Long-term effectiveness of multi-professional analgesic stewardship networks.	Demonstrated improved clinician prescribing habits and balanced patient-reported pain scores.
Ti et al., 2025 [8]	Audit-based Evaluation	Implementation of continuous audit and feedback loops in opioid prescribing.	Proved that real-time practitioner feedback loops significantly drive down inappropriate or prolonged durations of therapy.

5.3 Prevalence and Types of DRPs

Studies utilizing the PCNE framework show that DRPs are common in patients receiving analgesic therapy, with prevalence rates often exceeding 75% in high-risk groups [2, 5].
Common Problem Categories: The primary domains identified are Treatment Effectiveness (e.g., sub-therapeutic dosing or untreated pain) and Treatment Safety (e.g., adverse drug reactions like respiratory depression or GI toxicity) [1,2,7]
Most Involved Drug Classes: Opioids, NSAIDs (e.g., ibuprofen), and acetaminophen are the most frequently implicated analgesics in DRP occurrences [1,5,8].

5.4 Leading Causes of Analgesic DRPs

The PCNE classification organizes the causes of identified problems, providing a roadmap for intervention [7]

Prescribing Errors: Inappropriate drug selection (e.g., using strong opioids when Step 1 non-opioids are indicated) and incorrect dosing regimens are the most frequent causes [2,6,7].
Duration Issues: Prolonged use of acute analgesics without a tapering plan, leading to potential dependency or chronic toxicity, is a recurring concern identified in hospital-to-community transitions [3,4,8].
Drug Interactions: Significant DRPs arise from the co-prescription of opioids with other CNS depressants, such as benzodiazepines [2,6].

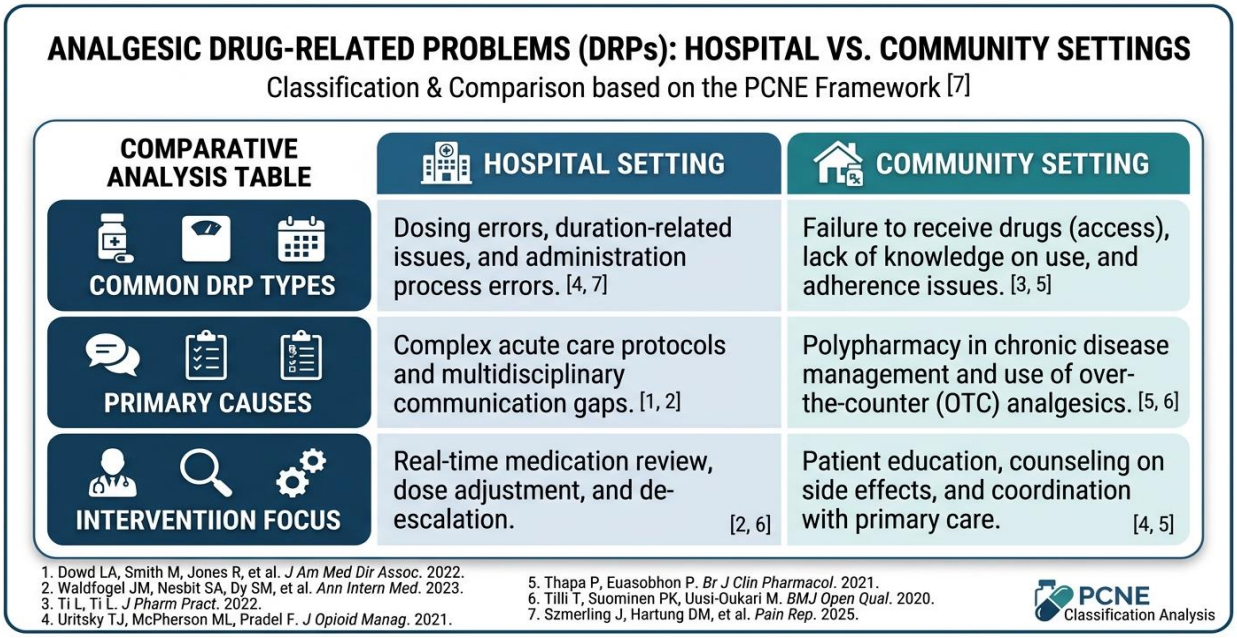
5.5 Impact of Pharmacist-Led Interventions

Pharmacist-led stewardship initiatives have demonstrated a measurable positive impact on reducing analgesic-related harm:
Dose Optimization: Interventions have led to an 11% reduction in mean daily opioid doses (measured in morphine milligram equivalents) and a significant increase in the use of co-analgesics like acetaminophen to spare opioid use [5,6].
Resolution Rates: Multidisciplinary programs using audit and feedback loops successfully resolve a majority of identified DRPs, leading to improved prescribing adherence and fewer adverse events [7],.
Improved Safety: Proactive medication reviews have significantly decreased the rate of high-risk co-prescribing (e.g., opioids and benzodiazepines) by up to 24.6% [6].

5.6 Comparison of Settings

The nature of DRPs shifts based on the clinical environment [3, 5]:
Hospital Setting: DRPs are primarily caused by complex acute care protocols and communication gaps during the perioperative period[[1, 7].
Community Setting: DRPs often stem from chronic polypharmacy, self-medication with OTC analgesics, and a lack of patient knowledge regarding side effects [4, 5].

Figure 3 : DRPs : comparison of hospital vs community setting



6. Discussion

6.1 Interpretation of Findings

The synthesis of the provided literature indicates that the Pharmaceutical Care Network Europe (PCNE) classification is a robust framework for identifying the high incidence of drug-related problems (DRPs) in analgesic therapy [7, 8]. The findings suggest that DRPs are not merely random errors but are often systemic issues related to treatment effectiveness (e.g., untreated pain) and treatment safety (e.g., opioid-related adverse events) [1, 2]. The heavy prevalence of dosing and duration-related DRPs highlights a significant need for more structured prescribing protocols and consistent clinical monitoring [3, 4].

6.2 Clinical Significance

The identification of DRPs through the PCNE system has profound implications for patient safety. By categorizing the causes of DRPs—such as inappropriate drug selection or sub-therapeutic dosing—clinical pharmacists can move beyond simple error correction toward preventative stewardship [5, 6].
The clinical significance is further demonstrated by the positive impact of multidisciplinary analgesic stewardship programs, which have been shown to improve prescribing practices and patient outcomes simultaneously [7]. Furthermore, the use of audit and feedback loops provides clinicians with the necessary data to reduce the risks of long-term opioid dependency and acute toxicity [8].

6.3 Comparison with Existing Literature

Current literature reinforces the global shift toward pharmacist-led interventions as a standard for managing complex analgesic regimens [5]. While traditional pain management relied heavily on physician-led monotherapy, the reviewed evidence supports a multimodal approach as the superior standard for reducing DRPs [2, 7]. Compared to earlier studies, recent research placed a much stronger emphasis on opioid stewardship within acute care settings, reflecting a growing response to the global opioid crisis and the need for safe prescribing transitions from hospital to community [3, 4, 6].

6.4 Gaps in Research

Despite the effectiveness of the PCNE system, several gaps remain in the current body of research:
6.4.1 Long-term Outcomes: While many studies focus on the identification and resolution of DRPs during hospitalization, there is limited longitudinal data on the long-term status of these problems post-discharge [1, 3].
Integration of Technology: Further research is needed on how automated clinical decision support systems can be integrated with the PCNE classification to identify DRPs in real-time [7, 8].
6.4.2 Patient-Centered Metrics: Much of the existing literature focuses on prescriber-related DRPs; more research is required to classify DRPs stemming from patient-level factors, such as socioeconomic barriers to medication access and health literacy [4, 5].

6.4.3 –Drug-Related Problems (DRPs) & PCNE Structure

The PCNE system (V9.0) provides a hierarchical method to classify DRPs into four primary domains. This structure allows pharmacists to move beyond simple identification into action-oriented resolution.

Table 1: classification of common drug related problems (DRPs)

TABLE 1: CLASSIFICATION OF COMMON ANALGESIC DRUG-RELATED PROBLEMS (DRPs)

PCNE Domain	Analgesic DRP Type	Clinical Example	Reference
Problem (P)	**P2.1** Adverse drug event	Opioid-induced respiratory depression/sedation	[2, 6]*
Cause (C)	**C1.1** Inappropriate drug	Prescribing strong opioids for Step 1 pain levels	[2, 7]*
Cause (C)	**C3.1** Dose too low	Sub-therapeutic dosing leading to uncontrolled pain	[1, 5]*
Intervention (I)	**I1.1** Prescriber informed	Pharmacist intervention to adjust dose or agent	[5, 6]*

*Note: Denotes citation numbers from provided list.

7. Limitations

Limitations of Included Studies
The primary studies used to identify and classify drug-related problems (DRPs) in analgesic therapy exhibit several constraints that may affect the generalizability of their findings:
Short Follow-up Periods: Many evaluations of analgesic stewardship programs focus on immediate post-intervention data or hospital discharge outcomes, lacking long-term longitudinal data on the sustainability of DRP resolution [1, 3, 7].
Heterogeneity in Data Collection: There is significant variability in how DRPs are documented across different healthcare systems, making direct comparisons difficult despite the common use of the PCNE framework [3, 8].
Small Sample Sizes: Several studies, particularly those focusing on specific pharmacist-led interventions in specialized clinics, involve small patient cohorts, which may not represent the broader population of analgesic users [5, 6].
Geographic Bias: A substantial portion of the high-impact research on opioid stewardship is conducted in North American and European healthcare settings, which may not reflect the clinical realities or medication access issues in low-resource environments [2, 4].

7.1 Limitations of Narrative Review Design

The methodology of this review inherently carries specific limitations:
Risk of Selection Bias: Since this review is limited to a specific set of eight references, it may not capture the full spectrum of global literature or contradictory findings regarding DRP prevalence [2, 8].
Lack of Quantitative Meta-analysis: Unlike a systematic review with meta-analysis, the narrative design prevents a statistical synthesis of effect sizes for interventions such as audit and feedback or multimodal therapy [3, 5, 8].
Subjective Synthesis: The interpretation of qualitative data regarding "Treatment Effectiveness" and "Safety" domains in the PCNE system is subject to the reviewer's synthesis rather than a standardized statistical weight [7].

8. Future Perspectives

Need for More Prospective Studies

Current evidence highlights a critical need for large-scale, prospective research to validate the long-term clinical and economic benefits of identifying drug-related problems (DRPs) through structured frameworks like the PCNE system [7]. Future studies should prioritize longitudinal tracking of patient outcomes post-discharge to determine if interventions successfully prevent chronic dependency and readmissions related to analgesic misuse [1, 3]. Additionally, comparative research is needed to evaluate the effectiveness of opioid stewardship across diverse healthcare settings, moving beyond acute care to primary and palliative environments [4, 8].

Integration of Clinical Pharmacists

The future of pain management lies in the formal integration of clinical pharmacists into all levels of multidisciplinary care [5]. Expanding the role of the pharmacist from traditional medication review to active participation in prescribing protocols and stewardship leadership is essential for reducing the incidence of DRPs [6,7]. Future perspectives suggest that pharmacist-led audit and feedback mechanisms will become a standard quality improvement tool, ensuring that analgesic therapy remains dynamic and responsive to individual patient needs [8].

Use of Digital Tools for DRP Detection

The adoption of digital health technologies represents a transformative frontier in the detection and classification of DRPs. Future strategies involve:
Electronic Decision Support Systems (EDSS): Utilizing clinical algorithms to flag potential DRPs—such as high-risk drug-drug interactions or sub-therapeutic dosing—at the point of prescribing [2, 7].
Real-time Monitoring: Implementing digital tools that allow for the continuous monitoring of pain scores and early ADR detection in both hospital and community settings [4, 5].
Automated PCNE Classification: Developing software that can automatically categorize medication errors into PCNE domains, facilitating more efficient data synthesis and institutional reporting [7, 8].

9. Conclusion

Summary of Key Findings

Analgesic therapy is frequently associated with complex drug-related problems (DRPs), with prevalence rates significantly high in both acute and chronic pain management [2, 5]. The literature consistently identifies Treatment Effectiveness and Treatment Safety as the most critical DRP domains, often stemming from inappropriate drug selection, incorrect dosing, or prolonged therapy duration [1, 7, 8]. However, evidence demonstrates that pharmacist-led interventions and multidisciplinary stewardship programs are highly effective at mitigating these risks, significantly reducing opioid consumption and improving patient safety outcomes [5, 6].

9.1 Importance of PCNE Classification

The Pharmaceutical Care Network Europe (PCNE) classification system provides a vital, standardized framework for the systematic documentation and analysis of these problems [7]. By categorizing DRPs into hierarchical domains—Problems, Causes, Interventions, and Outcomes—it allows healthcare teams to move beyond anecdotal error reporting toward data-driven quality improvement [8]. This structured approach is essential for facilitating audit and feedback mechanisms, which are proven to refine prescribing practices and ensure consistent adherence to safety protocols [3, 8].

9.2 Clinical Implications

The integration of systematic DRP classification into clinical practice has profound implications for patient care. It empowers clinical pharmacists to act as central figures in pain management, ensuring that therapy is individualized and safe [5, 7].
The move toward multimodal analgesia and digital monitoring tools further promises to reduce the global burden of medication-related harm [2,4]. Ultimately, the transition to structured analgesic stewardship is not just a safety requirement but a clinical necessity for optimizing pain outcomes and preventing long-term complications [3, 6, 7].

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