



Pain management after amputation

A literature review

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Abstract

Amputation is the surgical removal of a body part, typically an extremity, aimed at alleviating symptoms, enhancing functionality and improving patient quality of life. Despite its therapeutic benefits, amputation is often complicated by severe post-operative pain, emphasizing the critical role of nurses in management post-amputation pain.

The aim of this study was to review existing literature on evidence-based nursing intervention effective in reducing post amputation pain. Data were collected using the following databases: CINAHL, MEDLINE combine and PUBMED. The search gave rise to 7 articles that were analyzed using conventional content analysis. Three main categories emerged: Pharmacological Interventions, Physiological Interventions and psychological Interventions.

Conclusively, the evidence underscores the vital role nurses play in post-amputation pain management. By Integrating multimodal analgesia, regular pain assessment, frequent repositioning, desensitization, wound care and psychological support, nurses significantly improve patient outcomes, reduce opioid consumption and enhance quality of life.

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Keywords/tags (subjects)

See Project Reporting Instructions, section 4.1.2 <https://oppimateriaalit.jamk.fi/raportointiohje/4-opinnaytetyon-rakenne/4-1-opinnaytetyon-alkuosa/4-1-2-kuvailulehti/>

Miscellaneous (Confidential information)

For example, the confidentiality marking of the thesis appendix, see Project Reporting Instructions, section 4.1.2

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1 Introduction

Amputation is the surgical removal of body parts and components, commonly an extremity. It is a life-altering procedure aimed at alleviating symptoms, enhancing functionality and improving a patient's quality of life. This transformative process is frequently accompanied by a debilitating and complex phenomenon: pain (Hinkle & Cheever, 2018).

The sudden and traumatic separation from a body part triggers a cascade of physiological and psychological responses, leading to acute and chronic pain. This multifaceted pain experience encompasses not only physical discomfort but also emotional distress, anxiety and depression. The loss of a limb can evoke feelings of grief, identity disruption and loss of autonomy.

Post-amputation pain affects approximately 80% of individuals, with 50% experiencing chronic pain that persists beyond the initial healing period (Ephraim et al., 2005). Phantom limb pain, residual limb pain and stump pain are common manifestations, each presenting unique characteristics and management challenges. Pain sensation is known as Phantom limb pain, for instance, in the absent limb, while residual limb pain affects the remaining portion of the limb (Kuffler, 2018).

Effective pain management is crucial to enhancing quality of life, facilitating rehabilitation and promoting overall well-being. A holistic approach, integrating multidisciplinary care, evidence-based interventions and patient-centered strategies, is essential. Healthcare providers must consider the physical, emotional, and psychological dimensions of pain to deliver optimal care.

Understanding the pathophysiology assessment and management of post-amputation pain is vital. Clinical settings should recognize the interplay between psychological, biological and social factors influencing pain perception. A comprehensive evaluation, incorporating standardized pain assessment tools and patient-reported outcomes, informs personalized treatment plans (Darter et al., 2018).

Evidence-based interventions, such as multimodal analgesia, nerve blockade, and cognitive-behavioural therapy, can significantly reduce post-amputation pain. Innovative technologies, including

prosthetic advancements and virtual reality, also hold promise. (Hinkle & Cheever, 2018). By tracking the complexities of post-amputation pain, nurses and other healthcare providers can empower patient families and friends to reclaim their lives after amputation. Patients require a collaborative effort involving patient families and healthcare professionals to develop recovery pain management plans to promote healthy recovery and prevent complications.

2 Background

2.1 Amputation

Neil (2016) says the international accurate numbers of limb amputations performed are complicated to estimate as no recognized database or organization is collecting this information. However, according to Yuan et al., global incidence and prevalence of traumatic amputation increased from 11.7 million and 370.25 million in 1990 to 13.23 million and 552.45 million in 2019, with a rise of 16.4% and 49%, respectively. According to Deans et al. (2023), 57.7 million people were living with limb amputation due to traumatic causes as of 2027. Amputation Remains a commonly performed surgical procedure, with 5500 lower limb amputations carried out worldwide every year. Amputation of the limb is one of the oldest recorded surgical procedures written in Sanskrit texts dating from 1800 to 3500 BC.

At the regional level, South Asia had the highest incidence number, with 2.68 million traumatic amputations, while Australasia had the highest ASIR, 640.09 per 100,000 population in 2019. East Asia had the lowest ASIR, 101.01 per 100,000 population for traumatic amputation in 2019. The only regions where ASIR increased were North Africa and the Middle East, with an average annual increase of 1.39%.

In Finland, between the years 1990 and 2018, a total of 75,230 patients underwent 149,492 lower limb revascularizations and amputations, and 60% of the patients were men. The incidence of all endovascular lower limb revascularizations expanded by 159%, while the prevalence of lower limb amputations increased by 25%. The most notable increase occurred in the toe (84%) and foot (107%) amputation, while the incidence of transfemoral amputation remains steady and transtibial amputation decreased by 53% (Ponkilainen et al., 2022).

Amputation is the removal of a body part, usually an extremity. It relieves symptoms, improves functions and improves patients' quality of life (Hinkle & Cheever, 2018). The primary cause of amputation varies from region to region, although peripheral vascular disease (PAD) and diabetes have become the most important causes in developed countries (Ahmed et al., 2014). However, in developing countries, trauma is still the main cause (Mousavi, 2012).

Trauma injuries (falls, road traffic accidents, occupational accidents or combat injuries) account for about 45% of all amputations. About 54% of all surgical amputations result from complications of vascular disease or conditions that affect blood cancer-related amputations, accounting for less than 2% (Shores, 2024). The pain after amputation surgery, also known as chronic post-surgical pain (CPSP), is predicted to be severe between 30% and 80% up to 20 years after the amputation (Luo & Anderson, 2016).

The recovery process after amputation can be lengthy and challenging. Its typical tasks involve combinations of physical therapy, occupational therapy, pain management and psychological support. The duration and success of the recovery process can vary from patient to patient (Darter et al., 2018). The primary goals are to manage pain, promote healing, prevent complications like infection and deep vein thrombosis (DVT), strengthen the remaining limb and improve mobility, facilitate the use of a prosthetic limb, as well as address the psychological impact of amputation. Emotional support and counselling play a crucial role in helping patients cope with the loss of a limb and the associated changes in their lifestyle and body image, as well as adjust to their new circumstances (Fernandez, 2024; Herlihy et al., 2021; Joe et al., 2020)

In addition to physical and psychological impacts, amputation, social and financial, will also be part of patients' challenges in the future. These may include changes in employment, social relationships, and overall quality of life. (Calabrese et al.,2023). Beyond physical and psychological impacts, amputation patient is likely to have serious challenges in their social and financial status, including:

- Changes in employment and vocational opportunities
- Mobility and transportation challenges
- Social relationship and community integration difficulties
- Overall quality of life and well-being (Calabrese et al., 2023)

Therefore, for patients who have gone through amputation surgery, their financial burden can be substantial, including costs related to prosthetic devices, rehabilitation services, and ongoing medical care (Kurichi et al., 2019).

Additionally, it is essential to consider patients and their families comprehensive needs during the recovery process (Loiselle et al., 2016)

2.2 Pain management after amputation

Pain after amputation is known as phantom limb pain and residual limb pain. Experience of this type of pain depends on the person. (Warner et al., 2015). says that the sensation of this type of pain is known to be sharp, shooting pain, burning sensations, cramping, or tingling in the removed limb. Acute pain following amputation can be challenging to treat due to multiple underlying mechanisms and variable clinical responses to treatment. (Döring et al., 2021). Furthermore, they say poorly controlled preoperative pain is a risk factor for developing chronic pain. While in the residual pains, some patients experience throbbing or sharp pain at spots of the amputation. (Wang et al., 2022) The potency and unpleasantness of phantom limb pain were reviewed as

severe in approximately 40% of the experiences of people who survived the earthquake. According to Seering (2020), residual limb pain (stump pain) is localized in the remaining affected body segment and can be present for years, which can be due to stump neuroma, infection and heterotopic ossification. (Horne et al., 2018). In their words, it can be in many different modalities, such as deep tissue, pain superficial incision pain, and neuropathic pain. Neuropathic pain was defined as an electric and burning type of pain by (Seering et al., 2020). Some patients may even become hyperalgesia or have allodynia on the stump site. She went on to say that patients may also experience difficulties in the fitting of prosthetics; this type of pain mainly occurs during their early recovery from amputation surgery.

Amputation patients have a variety of different pain reactions considering their treatment in the postoperative clinical settings. The broad, wide concept of this pain is post-amputation pain. Furthermore, they are categorized into four types of pain and stages to help a better understanding of categories of pain and how it originates. These four types of pain are acute postoperative pain, residual limb pain, phantom sensations, and phantom limb pain (HSU & Cohen, 2013; Srivastava, 2017).

Acute pain management is a key priority in the management of patients who are undergoing amputation, according to a recent NCEPOD report. Pain is an elusive and complex phenomenon. According to the International Association for the Study of Pain (IASP, 2014), pain is uncomfortable sensation that carries sensory and emotional experience that is linked to the actual potential tissue damage, and it describes it in terms of such damage. Margo McCaffery (1998) Pain is defined as “whatever the experiencing person says it is and whenever the experiencing person says it does”.

Acute postoperative pain is the pain that most surgical patients experience after any surgery. Following the early days of the postoperative amputation phase, wounds from the surgery are very prevalent. It is readily identifiable and confined to the surgical site. It is sharp, aching, and severe, and about 10% of patients will go on to experience this persistent stump pain for several weeks, although some studies quote a far higher incidence. A new study by the Rhode Medical Journal in 2020. It was estimated that 95% of people with amputations experience pain, and it was found that phantom limb pain is the most common kind of post-amputation pain. Occurring in 45% to

85% of patients (Kuffler, 2018; Kent et al., 2016). The pain after amputation surgery, also known as chronic post-surgical pain (CPSP), is predicted to be severe between 30% and 80% up to 20 years after the amputation (Luo & Anderson, 2016). The pains are described as if the amputated limb is still present; it typically diminishes over time for most patients, and episodes gradually become less frequent; however, some patients continue to experience phantom limb pain as long as 2 years after the amputation (Pirowska et al., 2014).

The patient can also note temperature changes, position changes and the missing limb. This has also been noticed in mastectomies, dental extractions, enucleation and spinal cord injuries. Many of these phantom sensations are mild and decline, but some patients have some degree of persistent sensations that are indefinite. There are few patients in whom these sensations progress to severe pain and become problematic, leading to residual limb pain or phantom limb pain. There are reports of phantom sensations that do fade away and they appear to do this in a progressive fashion called telescoping. This is most common in upper extremity amputation, where the phantom sensation continues to decrease, such that eventually, the patient is left with a sensation of the hand on the stump alone instead of distal (HSU & Cohen, 2023). Phantom limb pain was first described in 1462 by French surgeon Ambrose Pare (Weeks et al., 2010). However, it was not until 1871 that Silas Weir Mitchell, a Civil War surgeon, called this phenomenon "phantom limb" (HSU and Cohen, 2013; Weeks et al., 2010).

Medication plays an important role in managing both chronic and acute pain conditions, serving as a key component of comprehensive pain management plans. (Institute of Medicine, 2011) While medications can be highly effective as standalone treatments, they are often used in conjunction with other therapies, such as physical therapy, lifestyle modifications, and alternative interventions, as part of a multimodal approach to analgesia. (Chou et al., 2016). To ensure safe and optimal use. It is essential to use medications judiciously and under the guidance of healthcare professionals, carefully weighing the protocols and guidelines in preventive measure against risks and side effects. By doing so, individuals can minimize adverse outcomes and maximize the therapeutic benefits of their pain management regimen. Also, regular monitoring and adjustments to the treatment plan can help to optimize pain relief and improve overall quality of life.

Perioperatively, the patient may be managed with acetaminophen and non-steroidal anti-inflammatory drugs (NSAIDs). Gabapentinoid, gabapentin, and pregabalin. Anti-epileptic drugs are used to treat pain caused by damage to nerves (neuropathic pain). Opioid analgesics are effective in relieving post-amputation pain (examples are Oramorph, MST, Oxycontin and Tramadol), often prescribed immediately after amputation to be taken either by mouth or through a vein (morphine patient-controlled analgesia pump). Ketamine infusion is also used as an anaesthetic drug and painkiller and is most effective in neuropathic pains. Epidural and perineural catheter analgesia may be used during and immediately after the surgery (Colquhoun et al., 2019 & Kent et al., 2016). Salmon calcitonin is a protein that has been shown to reduce a range of nerve-type (neuropathic) Pains, including phantom limb pain. It is given as a short course (5 days) of injections under the skin. In addition, beta-blockers relieve dull burning discomfort; anticonvulsants control stabbing and cramping pain. Tricyclic antidepressants not only alleviate phantom limb pain but also improve mood and coping ability.

Non-pharmacologic treatment includes mirror therapy, massage, biofeedback, acupuncture, repositioning (TENS), transcutaneous electrical nerve stimulation, guided imagery, and virtual reality (Amputee Coalition, 2015; Pirowska et al., 2014). Mirror therapy (MT) is a technique that represents movements, such as motor imagery and movement observation. Using the reflection of voluntary movements in a mirror performed by the intact limb consists in creating the visual illusion of non-painful movement in the phantom limb. By way of this representation of the imaginary movement, the aim is to obtain the restoration of its projection in the corresponding cortical motor and sensory areas and thus to reduce the pain linked to the breaking-off sensory information (Deconinck et al., 2015). Spinal cord stimulation (SCS) is obtained through an implantable device that stimulates transdural dorsal columns of the spinal dorsal columns of the spinal cord. It is often effective for phantom limb pain (Aaron et al., 2024).

Acupuncture is an effective intervention used in managing many pain conditions, but little is known about the acupuncture strength for the phantom limb pain treatment, its effectiveness has not been widely reported and updated with most of the literature consisting of case reports. The two databases that identified a nonrandomized controlled trial that evaluates the effectiveness of acupuncture. The literature review including English, Chinese and Korean databases (Deara et al., 2013; Hu et al.; Mannix et al., 2013)

Biofeedback is a technique that can be used to manage pain in amputees. A 2013 study in the *Journal of Rehabilitation Research and Development* found that biofeedback was effective in reducing phantom limb pain in amputees. The study found that it has increased the patient's awareness of their body and decreased the perception of pain. Studies also show that massage therapy was effective in reducing phantom limb pain and improving sleep quality in amputees. The study found that massage therapy reduced the frequency and intensity of phantom limb pain and improved sleep quality.

Physiological research suggests that transcutaneous electrical nerve stimulation (TENS) inhibits second-order nociceptive neurons (Sdrulla, 2015). Increases blood flow and reduces muscle spasms therapy relieving pain after amputation. These technologies are used to transport pulsed electrical into the intact surface of the skin to stimulate the peripheral nerve (Johnson, 2014). It is principally used to relieve pain and is administered using a standard TENS device that consists of a battery-powered portable machine that generates electrical currents; it is safe, inexpensive and can be self-administered. TENS is contraindicated for patients with the electronic implants, cardiac pacemakers and implantable cardioverter defibrillators and precautions include pregnancy, epilepsy active malignancy, deep-vein thrombosis, and frail or damaged skin (Houghton, 2010). Precautions for TENS use include pregnancy, epilepsy, active malignancy, deep-vein thrombosis and frail or damaged skin.

3. Aim, purpose and research question.

This literature review aims to incorporate existing evidence to identify effective nursing interventions for managing postoperative pain after amputation in patients who have undergone amputation surgery. The purpose of this study is to contribute to advanced nursing knowledge and information on the development of care protocols for individuals with post-amputation pain. The findings will provide valuable insights to support nurses and nursing students in delivering high-quality, patient-centred care to amputees during the postoperative period.

The research question guiding this study is: What evidence-based nursing interventions are effective in reducing postoperative pain in patients who have undergone amputation surgery?

4. Methods

4.1 Literature Review

According to Wakefield (2014), a literature review is essential in scientific research; it critically assesses, summarises, evaluates, and reviews existing literature (articles or books, etc.). Also, extract facts to challenge the established posits or stimulate scientific conversations on a topic and help identify research gaps for future studies and investigations.

According to Kraus et al. (2022), a review of literature is essential in scientific research because it critically evaluates previous work in a field and, by so doing, can challenge established posits or facts, stimulate scientific conversations on a topic and help identify research gaps for future investigation. The potential benefits of a literature review include the facilitation of theory development, the provision of evidence for scientific case-building and the establishment of scientific assumptions for reference in future research (Synder, 2019)

The following steps are the steps to follow when reviewing related literature.

- Identify the topic of the literature review and define the scope of research.
- Conduct a comprehensive search of relevant literature, including academic journals, books, and databases.
- Select and evaluate the articles that are relevant to your topic. This may involve assessing the quality and validity of the research.
- Organize the literature into categories based on the key themes and concepts.
- Write the literature review, summarizing and synthesizing the information from the literature.

This academic study employs a comprehensive literature review to explore the research topic of

“pain management after amputation” and its relevance to existing knowledge in nursing. By synthesizing findings from multiple selected articles, the study aims to provide evidence-based information on effective nursing interventions for reducing postoperative pain in patients who have undergone amputation surgery. The literature review serves as a vital tool for connecting past and future knowledge, bridging gaps in existing research and contributing to future inquiries (Matney, 2018). In healthcare, literature reviews are essential for identifying better ways to improve performance and interventions, answering complex questions, and informing evidence-based practice (Wong, 2016; Jaffe & Cowell, 2014).

The literature review process begins with identifying a topic of interest and formulating a research question, which guides the search for relevant articles. In this study, the research question is: “What evidence-based nursing interventions are effective in reducing postoperative pain in patients who have undergone amputation surgery?” To ensure accurate selection and analysis of articles, the author employed the PICOS framework, which focuses on the target group, problem, and inclusion of all essential elements (Brandit & Faber, 2018).

4.2 Literature selection process

The literature selection process commenced with a search for and examination of studies relevant to the search topic by using the PICOS search strategy by Methley et al. (2014), which defines PICOS as one of the modified versions of the PICOS tool to identify and collate clinical evidence for literature review. PICOS letters have an acronym for a search component whose value would help determine the specificity of the sensitivity of results returned from the database search P denotes patient, I denote interest, C denotes comparison, O denotes outcomes, and S denotes study type (Methley et al., 2014). See the PICOS process criteria in Table 1 below.

Table 1. Picos criteria

| Picos | Criteria |
|---------------|--|
| P(Population) | Patients who have undergone amputation surgery |
| I(Interest) | “Nursing interventions OR nursing management OR Nurse's + Role”. |
| C(Context) | “Postoperative pain management” |

| | |
|-------------|---|
| O(Outcome) | Reduction of postoperative pain /pain after surgery |
| S (Studies) | Full texts access to JAMK students, English language and Peer-reviewed research articles published between 2014-2024. |

The literature review approach was adopted using the inclusion and exclusion criteria to obtain the relevant studies. The parameters adopted served as filters to sort the results of search terms and retrieve only studies that satisfied the review's scope. Table 2 below. Shows the Exclusion and Inclusion criteria used in selecting articles

Table 2. Inclusion criteria and Exclusion criteria

| Parameter | Inclusion Criteria | Exclusion Criteria |
|-------------------------------|---|---|
| Databases | Cinahl, Medline and Pubmed | |
| Language of publication | English language only | All publications in a first language other than English |
| The time frame of publication | Start from January 2014-December 2024 | All studies published before January 1 2014 |
| Journal type | Peer-reviewed publication | Non-peer review publications |
| Articles | Articles that satisfy research questions. Articles with abstract and references, access to JAMK students, articles relevant to the study and" full text available". | Articles not relevant to the research question. |

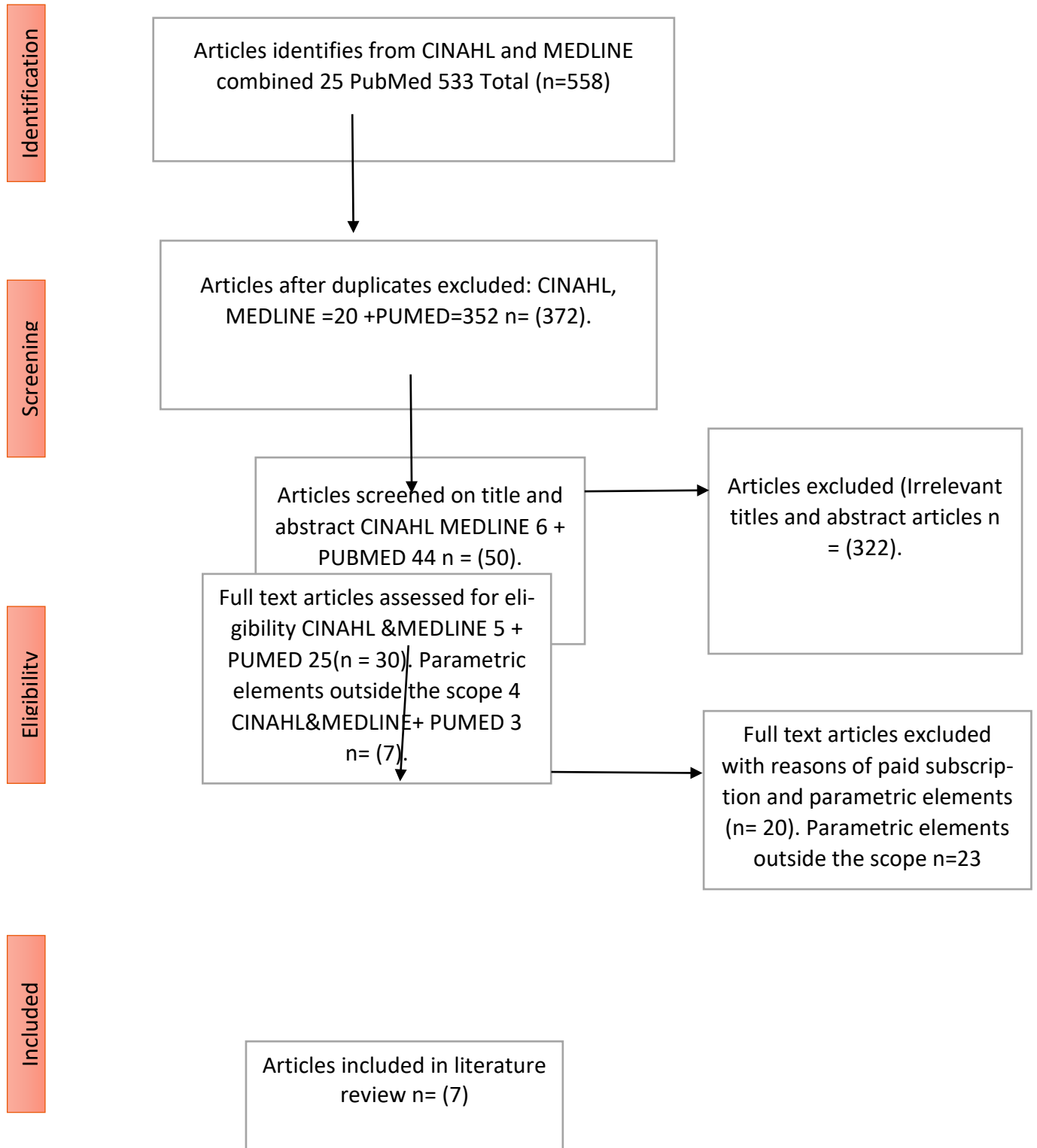
The databases used in selecting articles for this literature review include CINAHL, PUBMED, and MEDLINE. Using input chosen for each parameter, a scientific literature review search was performed in the above-mentioned databases to retrieve studies most relevant to the research question. The keywords phrases and Boolean operators used in the search were "AND" (to combine search terms) "and OR" (to include synonyms), the literature review was "pain management, pain relief," "nursing interventions, nurses care," "for amputation or limb loss and postoperative surgery".

Table 3. Key terms used in the search

| Database | Key terms |
|---|---|
| Cinahl and Medline (combined search) 25 | (pain management OR pain relief OR pain control OR pain reduction OR pain) AND (nursing or nurse or nursing care or nursing practice or nursing intervention) AND (amputation or amputee or amputees or limb loss or limb amputation) AND (post-operative or post-operative or postoperative or post-surgery) |
| Pubmed -533 | Nursing or nurses or nursing care or nursing practice or nursing intervention AND amputation or amputee or amputees or limb loss or limb amputation) AND post-operative or post-operative or postoperative or post-surgery |

The initial search yielded a total of 558 studies, from CINAHL and Medline combined 25 from PUBMED 533. These articles were first screened and duplicates were excluded. The remaining 372 studies were left after the exclusion of the duplicates. When the first screening step was done, the screening of the titles and abstracts removed 322 articles and yielded 50 articles. The second phase of the screening has 50 articles after the exclusion of the articles, titles and abstracts. The screening continued with the full-text assessment, where possible, to determine relevance to the search topic and suitability with PICOS parameters and inclusion criteria. After the 20 articles were screened out because they required a paid subscription before the assessment, 30 articles were left. Twenty-three articles were removed because they contained parametric elements outside the scope of the study. This final assessment returned to 7 studies for review. PRISMA flowchart table 3 below shows the data selection: summaries of all selected articles can be viewed in the appendices.

Table 4. Prisma chart Article selection



4.4 Data analysis

Content analysis is a method which researchers use to achieve a comprehensive understanding of the study. The Researcher employed conventional content analysis to describe the process of collecting articles that answer the research question. Data were collected from the selected articles and examined using content analysis to categorize and code the data, identifying themes and patterns related to postoperative pain management. This approach enabled the Researcher to gather direct information from the study without imposing preconceived categories, thereby preventing bias (Elo & Kyngas, 2014)

The Researcher meticulously read and re-read the selected articles, highlighting key concepts and making notes on thoughts and impressions. Selected data from the article were Codes then labelled and categorized, into samples, subcategories and main categories, with similar codes grouped and those with slight variations assigned new codes. This coding process facilitated the identification of relationships among categories and their relevance to the research question (Graneheim & Lundman, 2014). These findings have significant implications for improving postoperative pain management practices, highlighting the importance of a comprehensive and patient-centered approach to care. This study, is examines effectiveness of pain management and the strategies after amputation. See Table 5 below show which Data analysis

Table 5. Data analysis process

| Raw material and Source | Themes and Tools from the research articles | Subcategories | Main categories |
|--|---|---|---|
| The Brief Pain Inventory - 11-item tool assessing pain intensity and interference over the past 24 hours (Scher et al. 2020) | Used valid tools to assess pain | Utilizing of assessment Tools | Physiological interventions and accurate time |
| Nurses completed their pain assessment within minutes of patients' self-assessment, suggesting recall bias was unlikely to explain this lack of agreement. (Wooldridge et al 2019) | SF-MPO and VAS Questions | Nurses' Roles | |
| Recent studies corroborate the idea that this model helps decrease post-operative pain beyond the standard monotherapy opioid regimen (Sampognaro, 2023) | Multimodal analgesia protocol and corroboration | Nurses' Implementing Evidence-based guideline in Medication | Pharmacological intervention and Multimodal Analgesia strategies to reduce pain |
| After the adoption of the multimodal analgesia approach for a colorectal ERAS pathway, most patients used less opioids while in the hospital and many did not need opioids after hospital discharge, although approximately 50% of patients received some opioids during their stay. (Wick et al.2017) | Adoption of the multimodal analgesia approach | Multimodal Analgesia | |
| Functional abilities (e.g. the Western Ontario and McMaster Universities Osteoarthritis Index [WOMAC]) (Majid et al. 2015) | Health survey (SF-36 and Short Form (36) | Coping strategies | Psychological Intervention, wound care and coping strategies |

| | | |
|---|---|---------------------|
| All the participants who completed the feasibility questionnaire (n 5 12) agreed or strongly agreed that the Intervention was easy to use. (Horne et al.2017) | desensitization intervention and pain reduction | Self-management |
| The most important benefit of this trial was that wounds healed and patients learned to walk simultaneously and without delay. (Van ross et al.,2009) | Wound care protocol | Wound care protocol |

5. Results/Findings

The analysis of the seven articles yielded three main categories related to evidence-based nursing intervention effective in reducing perioperative pain in patients who have undergone amputation. The three main categories are Physiological Intervention and accurate time, Pharmacological Intervention and multimodal analgesia strategies to relieve pain, psychological intervention wound care and coping strategies. Table 6 below shows a tabular representation of the three main themes that emerged and their subcategories.

Table 6: Main categories and subcategories

| Main Categories | Subcategories |
|---|---|
| Physiological interventions and accurate time | <ul style="list-style-type: none"> Utilizing of Assessment Tools Nurse' roles |
| Pharmacological intervention and Multimodal Analgesia strategies to reduce pain | <ul style="list-style-type: none"> Nurses' Implementing evidence-based guideline in medication Multimodal analgesia |
| Psychological intervention wound care and coping strategies | <ul style="list-style-type: none"> Coping strategies and Self-management Wound care protocol |

5.2 Physiological interventions and accurate time

5.2.1 Utilizing of assessment tools

Regular time monitoring tools, as highlighted by Scher et al. (2020) and Wooldridge et al. (2020), helps nurses assess pain utilizing valid tools to reduce patient pain and discomfort. The tools are used over time to monitor patient pain levels, assess pain before and after medication administration and enable nurses to make decisions and adjust treatment plans for pain management when needed. Regular time monitoring improved patient pain and ensured that patients received the right Intervention. Evidence-based practice tools are used by nurses to monitor and evaluate pain to ensure the safety of patients and promote a healthy life. This is a standardized and reliable way of pain management in healthcare settings and other healthcare providers. Scher et al (2020)

Nurses use communication tools to relate with their patients. Numerical Rating Scale (NRS) These tools are effective in the nurses-patient relationship, where pain is rated from 0 to 10 and they facilitate coordination in the treatment plan. This enables patient nurses to ask questions and also gives the patient the leverage to explain how she or he feels about the pain. This will enable nurses will to know how to make care plans for their patients' further treatment. Scher et al.2020)

5.2.2 Nurse' roles

Nurses effectiveness in pain assessment and accurate time plays a vital role in reducing post-amputation pain Researchers have consistently demonstrated that regular and precise pain assessments by nurses significantly improve pain management outcomes. (Wooldridge & Branney, 2020)

A study published in (2020) acknowledge that nurse utilizing assessment tools, such as the Numeric pain rating scale, resulted in improved pain management and reduced post-amputation pain (Scher et al., 2020). The study highlighted the importance of nurse pain assessments in identifying patient pain levels and adjusting treatment plans accordingly. Similarly, a study demonstrated that nurses' regular pain assessments and timely interventions reduced post-amputation pain and improved patient satisfaction Wooldridge & Branney, (2020).

The study emphasized the need for nurses to prioritize pain assessment and management in their daily practice to identify patients at risk of developing chronic post-amputation pain and Intervention to prevent long-term pain complications.

5.3 Pharmacological interventions and multimodal analgesia strategies to reduce pain

5.3.1 Nurses' Implementing evidence-based guideline in medication

Evidence-based practice, Nurses Implement evidence-based guidelines in practice to ensure the safety of patients and professional skills to ensure that pain management strategies are followed and effective. The guidelines are the usage of a combination of opioid-sparing medications and non-pharmacological methods of reducing pain and supporting the fast recovery the patients.

(Sampognaro & Harrell, 2023)

The nurse's pharmacological interventions include monitoring the patient's pain level before administration of pain medication, monitoring the potential side effects after administration and reporting to the medical team if any concerns arise. Nurses' role in pain assessment, Patient centered-education monitoring of medication safety is key to satisfied patient outcomes, less opioid use and promoting patient quick recovery after surgery (Sampognaro & Harrel (2023) and Wick et al. (2017)5.3.2 Multimodal analgesia

Nurses play an important role in administering multimodal analgesia, as they are often the primary healthcare providers responsible for pain management. The administration of multimodal analgesia has been consistently shown to be effective in reducing post-amputation pain. Multimodal analgesia involves the use of multiple medications with different mechanisms of action to target various pain pathways (Sampognaro &Harrell, 2023).

Effective administration of multimodal analgesia by nurses involves assessing pain regularly using standardized tools, selecting appropriate medications and doses as prescribed by the physician, and to monitor adverse effects for adjustment of treatment plans when needed. It was found that multimodal analgesia significantly reduced post-amputation pain and improved functional out-

comes (Wick et al. 2017). In conclusion, the administration of multimodal analgesia is a crucial aspect of post-amputation care. By providing effective pain management, nurses can improve patient outcomes, reduce opioid consumption, and enhance quality of life.

5.4 Psychological Interventions, wound care and coping strategies

5.4.1 Coping strategies and self management

Effective management of post-amputation pain requires a combination of coping strategies and self-management skills. Nurses teach patients deep breathing exercises, progressive muscle relaxation and visualization techniques to reduce pain and promote relaxation.

Patients also benefit from mindfulness meditation, journaling and social support to manage pain and emotions. Cognitive-behavioural therapy (CBT) can help patients modify negative thought patterns and behaviors, while physical and occupational therapy can improve mobility and daily functioning (Falgares et al., 2019).

The same study outlined self-management skills, such as medication management, use of assistive devices, and engagement in leisure activities, are also crucial for effective pain management. Additionally, prioritizing self-care, including rest, nutrition, and overall well-being, is essential for managing post-amputation pain. Nurses and patient relationships play a vital role in educating patients on coping strategies and self-management skills and providing ongoing support to ensure successful pain management.

5.2.2 Wound care protocol

Nurses who used desensitization techniques, such as gentle massage and light touch, to promote nerve regeneration and improve skin sensation reported lower levels of pain in patients following amputation (Rossbach, 2017). Meanwhile, the importance of proper wound care was highlighted in a study by Vandross et al, (2009), where nurses who emphasized thorough and frequent wound cleaning and dressing changes reported lower levels of pain in patients' post-amputation.

In addition to reducing pain, desensitization and wound care interventions can also improve wound healing outcomes, prevent risk of complications, such as infection and amputation, enhance patient satisfaction and promote functional recovery (Rossbach, 2017).

By providing regular desensitization and wound care protocol, nurses can reduce post-amputation pain, improve wound healing outcomes, and enhance overall patient outcomes.

6. Discussion

This is at line with the research question, "What evidence-based nursing intervention is effective in managing post-amputation pain?" A comprehensive review of seven articles sheds light on the main categories nurses can execute to alleviate post-amputation pain. The findings underscored the significance of Physiological interventions and accurate time, pharmacological interventions and multimodal analgesia strategies to reduce pain and psychological Intervention, wound care

and coping strategies. These studies come from Scher et al. (2020), Wooldridge et al. (2019), Sampognaro & Harrell (2023), Wick et al. (2017), Majid et al. (2015), Vandross et al. (2009), Horne et al. (2017). highlighting the importance utilizing of assessment tools to reduce pain, nurses' roles, implementing of evidence-based guidelines in medication, multimodal analgesia, coping strategies and self-management and wound care protocol.

Nurses perform regular pain assessments using standardized tools, this is to enable them to identify patients' special needs, develop tailored interventions to reduce pain and improve patient outcomes (Wooldridge & Branney, 2020). Equally, frequent monitoring of pain and documenting of changes and Mobility intervention help alleviate pressure-related pain and enhance comfort and reduce anxiety (Vandross, Johnson & Abbott, 2009). Utilizing standardized tools like the Numeric Rating Scale (NRS) or Visual Analogue Scale (VAS) supports objectivity and boosts effective communication between the patient and nurses. Additionally, ongoing training for nurses' ways of interpreting pain scales and understanding their patients' verbal and written cues is essential. Wooldridge and Branney (2020). Utilizing assessment tools and effectiveness of communication, Nurses can be able to assess and managed postoperative pain accurately to patient satisfaction and good outcomes.

Nurses need to utilize these tools for early mobilization routine practice to improve and promote interventions in pain evaluation in early mobilization. Scher et al. (2020) did not focus only on pain assessment but also captured the efficiency of physical, emotional, and social aspects of pain. Nurses use the Brief Inventory (BPI) or McGill Pain Questionnaire to acquire comprehensive knowledge of their patients' experience towards their treatment. They support and encourage patients to cope and express their pain level and fear in detail, encourage and support patient family members and provide them with valid information in pain management and care plan education to promote psychological well-being.

Sampognaro and Harrell (2023) and Wick et al. (2017) highlight the importance use of pharmacological Intervention to reduce pain and then go ahead to say that it is the cornerstone of pain management. These interventions help in reducing pain intensity and enhance patient outcomes. Nurses' administration of multimodal analgesia has emerged as a critical aspect of post-amputation care. Implementing patient education and monitoring processes to ensure effectiveness and

patient safety are mainly nurses role. This approach involves Regular pain assessment using standardized tools, selecting appropriate medications and doses as prescribed by physicians, monitoring for adverse effects and adjusting treatment plans as needed. The Researcher demonstrated that multimodal analgesia significantly reduced post-amputation pain and improved patient functional outcomes (Wick et al., 2017). By adopting this approach, healthcare providers optimize pain management, mitigate opioid-related risks and enhance quality of life.

Additionally, nurses employ desensitization techniques to reduce stump sensitivity and they also perform wound care protocol, principles of debridement and drainage, provide a moist clean environment and clear irrigated wounds with normal clean saline to promote healing, educating patients and involving them in the role of pain and assessment protocol, minimize pain and shared decision-making (Vanross, 2017)

Psychologically, the studies revealed that nurses provide comprehensive educational and psychological support to amputates in order to empower them in managing pain effectively, coping strategies with emotional distress and adapting to lifestyle changes. Patient education is not only effective in postoperative pain management. These nurses also prepare patients with self-efficacy and coping skills for patients' overall well-being. This step emphasizes the significance of reducing fear in patient emotions and promotes healing outcomes (Majid, Lee & Plummer, 2015). Therefore, an effective patient education approach helps to reduce emotional stress, enhance mental health and improve coping strategy outcomes. Nurses and other Healthcare workers can help the patient to reduce their fear and anxiety through patient education on aspects of their emotions and their recovery coping strategies, which promotes effective healing and stress-free.

Tailored education is considered to focus on patient needs and concerns. According to Majid et al. (2015), this is a holistic approach to patient education with psychological and physiological interventions to care, ensuring freedom for patients to experience a good care transition to the changes in their lifestyle. Patient education did not finish at the hospital, but continuing after discharge from the hospital, the Multidisciplinary team and nurses will continue to give their support, home care and information that will help patients and families to navigate the barriers. The patients who received education or formation about their health outcome before embarking on the

surgery will prepare themselves emotionally and physically for the challenges ahead of time and score all their support and information that may help them cope with the new life challenges.

Conclusively, the evidence underscores nurses' vital role in post-amputation pain management. By integrating utilizing of assessment tools, implementing evidence-based guidelines in medication and multimodal analgesia, regular pain assessment, coping strategies and self-management education, wound care protocol and psychological support, nursing interventions significantly improve patient outcomes, reduce opioid consumption and enhance quality of life.

Ethical considerations

Research ethics provide the foundation for maintaining integrity and morality in scientific inquiry. As emphasized by Smith et al., (2022), these guidelines and principles steer researchers toward acceptable practices, preventing misconduct and ensuring the reliability of findings.

In conducting this literature review, strict adherence to ethical standards was paramount. The study followed JAMK University of Applied Science's ethical principles (2020), guaranteeing informed consent from participants and hospital management, the respect for dignity, privacy, autonomy, and confidentiality as stated by the authors of the reviewed articles. Transparency and accountability were also prioritized, with proper citation and referencing employed to avoid plagiarism (APA, 2022). The literature review process involved a meticulous search strategy utilizing three databases, yielding articles published between 2010 and 2024. To ensure clinical reliability, the study applied rigorous inclusion and exclusion criteria. Validity and reliability were paramount, with the study aiming to measure what is supposed to be measured (Kimberlin & Winterstein, 2018) and demonstrate consistency in findings when retested. Despite methodological strengths, limitations were acknowledged. The study's reliance on three databases and full-text articles available to JAMK students restricted the scope of inquiry. Additionally, single authorship by an inexperienced researcher may have impacted the thoroughness of methodology and content analysis.

Future researchers should address these limitations by expanding database searches, incorporating diverse article sources and collaborating with experienced researchers. By upholding the highest ethical standards and methodological rigour, researchers can ensure the integrity and validity of their findings, contributing meaningfully to the scientific community.

Conclusion

The research study has addressed the knowledge gap by describing the evidence-based nursing intervention effective in reducing post-amputation pain. In the analysis of data, it is concluded that nurses employ more than three approaches in the management of postoperative pain in amputees. It was revealed that effective post-amputation care relies on nurses' skills, utilizing assessment tools, administration of multimodal analgesia, a comprehensive approach that optimizes pain management and patient outcomes. Research supports its efficacy in minimizing pain and enhancing functional outcomes while reducing opioid risks and improving quality of life. Also, nurses play a vital role, practicing with evidence-based and using standardized assessments to tailor interventions to individual needs. They alleviate pressure-related pain and anxiety through coping strategies and mobility interventions, promote healing through self-management and wound care protocol and provide psychological support and education. This integrated approach underscores nurse's critical role in post-amputation pain management, yielding improved outcomes, reduced opioid consumption, and enhanced well-being. To sum up, further studies could be done on exploring the barriers to implementing evidence-based Intervention for pain management amputees in the clinical practice.

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Appendices

Appendix 1. Summary of review articles

| No | Autors, years, country and Titles | Aim and purpose of the study | Research Methods, data collection and analysis | Sample (n) | Main Results and Key Findings | Critical appraisal (Hawker et al., (2002) Total. |
|----|--|--|---|--|--|--|
| 1 | Sampognara & Harrell, Year 2023. Country- USA. Title- Multimodal Postoperative Pain control after Orthopaedic surgery. | To review the different drug classes utilized for managing pain with multimodal pain control, specifically in the orthopedic post-operative patient. | The study employed a prospective, observational cohort design, recruiting patients undergoing elective orthopaedic surgery. Data collection included demographic and clinical information, pain assessments (Numeric Rating Scale and Faces Pain Scale), and multimodal pain management strategies. Pain assessments were conducted preoperatively and at 24, 48, and 72 hours postoperatively. Descriptive and inferential statistics (ANOVA, chi-squared test and multivariate regression) were used for data analysis. SPSS, R, or SAS software was utilized for statistical analysis. | A sample size of 100 patients was estimated to provide sufficient power to detect significant differences in pain scores | This study corroborate the idea that this model helps decrease postoperative pain beyond the standard monotherapy opioid regimen. This leads to less opioid use and therefore, less risk to the patient. | 40 |
| 2 | Wick, C.E, Grant, C. M., Christopher L., Wu. Year 2017. Country USA | The goal of this article was to outline important components of | This study employed a retrospective cohort design, analyzing electronic health records of patients undergoing surgery. Data collection in- | 1,041 patients undergoing elective surgical procedures. This provided sufficient statistical power to | The study found that a multimodal pain management approach using nonopioid analgesics and techniques significantly reduced | 42 |

| | | | | | | |
|---|---|--|---|---|--|----|
| | Title: Postoperative Multimodal Analgesia Pain Management with Nonopioid. Analgesia and Techniques. | opioid-sparing analgesic regimens. | cluded patient demographics, surgical procedures, pain management strategies and pain outcomes (numeric rating scale scores). Descriptive statistics, chi-squared tests and multivariate regression analysis were used to examine associations between strategies and outcomes. | examine the effectiveness of multimodal pain management strategies and identify significant associations between nonopioid analgesics and improved pain outcomes. | postoperative pain intensity and opioid consumption. Specifically, the use of gabapentin, acetaminophen, and regional anesthesia was associated with improved pain outcomes and reduced opioid related adverse effects. | |
| 3 | Scher C., Petti E., Meador, L., Van Cleave J. H., Liang, E, Reid M.C. Year, 2020, Country, USA Title- Multidimensional pain assessment Tools for Ambulatory and inpatient nursing practice. | To identify brief multidimensional pain assessment tools that nurses can use in both ambulatory and acute care setting | Six observational studies and one quasi experimental study that met the inclusion criteria. | The sample consisted of 303 patients aged 18 and above from various clinical specialties ensuring a representative and generalizable population for nursing practice. | They identified seven multidimensional assessment tools, all of which measured sensory or affective qualities pain and its impact on functioning. Most tools measured impact of pain on affective functioning, mood, or enjoyment of life. One tool used ecological momentary assessment via a web-based app to assess pain symptoms. Time to administer the varying tools ranged from less than 2 minutes to 10 minutes, and evidence of validity was reported for seven tools. | 40 |
| 4 | Wooldridge S, Branney J. Year-2020. Country – Britian. | This literature review aimed to identify how congruent | The study employed a quantitative, cross sectional design, collecting data through structured interviews | 120 nurses patient dyads, comprising 120 patients | The findings from these studies were summarised under two themes: nurses | 41 |

| | | | | | | |
|---|---|--|---|--|---|----|
| | Title- Congruence between nurses and patients assessment of post-operative pain: | nurses assessment of pain were with patients self reporting | and numerical rating scales (NRS) from 120 nurses- patient dyads, and analyzed using descriptive statistics, paired t-tests and intraclass correlation coefficients (ICC) to examine concordance between nurses and patients pain assessment. | and their corresponding nurse in post-operative seeings. | underestimation of patients pain and nurses knowledge and understanding of pain assessment. Some nurses pain management knowledge was deemed inadequate, with evidence of negative attitudes towards managing pain in certain groups of patients. | |
| 5 | Vanross, E.R., Johnson, S., Abbott, C. A. Year-2009 Country- Manchester. Title- Effects of early mobilization on unhealed dysvascular transtibial amputation stumps: A clinical trial. Arch Phys Med Rehabil. | To observe the effects of early mobilization on unhealed transtibial (TT) amputation stump wounds of dysvascular etiology least 3 weeks after surgery. | Observational cohort study. | Six-six consecutive new TT amputees (age 62.8+/-10.8y) of dysvascular etiology (diabetes 50%) with unhealed stumps were recruited. | Patients with large unhealed TT stump wounds can simultaneously undergo walking training by using a prosthesis and can achieve wound healing. Seventy-four percent of subjects achieved full wound healing. The small minority of patients who did not heal were current smokers whose TcPO ₂ levels did not improve throughout the trial. | 42 |
| 6 | Horne, E.E., Engelke, M. K., Schreier, A., Swanson, M., Crane, P.B. Year-2018. Country. Australia: Title-Effects of Tactile Desensitiza- | The purpose of this study was to test the efficacious use and effects of tactile desensitization in managing acute post-operative | The study employed a randomized controlled trial (RCT) design, collecting data through patient-reported surveys. | Sample size of 40 patients undergoing amputation surgery, randomly assigned to either a tactile desensitization intervention group | The findings support a reduction in pain intensity score using pain medication coupled with tactile desensitization. | 42 |

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|---|--|---|---|---|--|----|
| | tion on post-operative pain after amputation Surgery. | pain after lower amputation. | | (n=20) or a control group (n=20). | | |
| 7 | Majied N, Lee S, Plummer V. Year,2015 Country - USA. Title- The effectiveness of orthopedic patient education in improving patient outcomes: A literature review protocol. | The objective of this review is to identify the effectiveness of patient education for orthopedic surgery patients. | A systematic review methodology, collecting data from electronic databases (CINAHL ,MEDLINE and PUBMED) with grey literature, and analysing studies using PRISMA guidelines, Cochrane Risk of Bias Tools and narrative synthesis to evaluate the effectiveness of orthopedic patient education on patient outcomes. | Review of 22 studies, involving a total 2,433 patients, who underwent various orthopedic procedures and received patient education interventions. | This study found that the implementation of patient education has positive impact upon patient satisfaction especially in managing pain. | 40 |

Appendix 2. Critical appraisal of the articles

| No | Author | Abstract and Titles | introduction | Method and data collection | Sampling | Data analysis | Ethics and bias | Results/ Findings | transferability | Implication/ usefulness | Total |
|----|--|---------------------|--------------|----------------------------|----------|---------------|-----------------|-------------------|-----------------|-------------------------|-------|
| 1 | Sampognara & Harrell. | 5 | 5 | 4 | 3 | 4 | 5 | 5 | 4 | 5 | 40 |
| 2 | Wick, C.E, Grant, C.M., Christopher, L Wu. | 5 | 4 | 5 | 5 | 4 | 5 | 5 | 4 | 5 | 42 |
| 3 | Scher C., Petti, E., Meador, L., Van Cleave J. H., Liang, E, Reid M.C. | 4 | 5 | 5 | 4 | 5 | 5 | 3 | 5 | 4 | 40 |
| 4 | Wool-dridge S, Branney | 5 | 4 | 5 | 4 | 5 | 5 | 4 | 5 | 4 | 41 |
| 5 | Vanross, E.R., Johnson, S., Abbott, C.A. | 5 | 5 | 4 | 4 | 5 | 5 | 5 | 4 | 5 | 42 |
| 6 | Horne, C.E., Engelke, M. K., Schreier, A., Swanson, M., Crane, P.B. | 5 | 5 | 5 | 4 | 5 | 5 | 4 | 4 | 5 | 42 |
| 7 | Majid N, lee S, | 5 | 5 | 4 | 5 | 4 | 5 | 3 | 5 | 4 | 40 |

