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Holistic Aromatherapy Applications in Postoperative Pain Management by Nurses: A Narrative Review

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Abstract

Background: Postoperative pain remains a significant clinical challenge, with conventional pharmacological management often leading to adverse effects like sedation, respiratory depression, and potential for dependency. This has accelerated the search for complementary and integrative therapies. Aromatherapy, the controlled use of essential oils for therapeutic purposes, is increasingly employed by nurses as a non-pharmacological intervention to manage acute pain, leveraging the nursing profession's holistic model of care. **Aim:** This narrative review aims to synthesize and critically evaluate the current evidence on the application of holistic aromatherapy by nurses for postoperative pain management. **Methods:** A comprehensive literature search was conducted using PubMed, CINAHL, Scopus, and PsycINFO for articles published between 2013 and 2024. Keywords included "aromatherapy," "essential oils," "postoperative pain," "nursing," "non-pharmacological intervention," and "integrative medicine." **Results:** The findings indicate that aromatherapy, particularly using oils like lavender, bergamot, and peppermint, shows promise in reducing self-reported pain intensity and anxiety, and in decreasing the requirement for rescue analgesics. The primary proposed mechanisms involve the olfactory system's connection to the limbic system and the modulation of pain pathways. However, the evidence is limited by methodological heterogeneity, small sample sizes, and challenges in blinding. Nursing assessments for patient suitability and adherence to safety protocols are identified as critical for successful implementation. **Conclusion:** Aromatherapy represents a valuable, low-risk adjunct to conventional postoperative pain management within the nursing scope of practice. To solidify its place in evidence-based practice, future research must prioritize rigorous, large-scale randomized controlled trials with standardized interventions and objective outcome measures.

Keywords: aromatherapy, postoperative pain, nursing care, paramedics, essential oils, non-pharmacological intervention

Introduction

Postoperative pain is an almost universal experience for surgical patients, representing a complex physiological and emotional response to tissue trauma. Despite advances in analgesic protocols, inadequate pain relief persists as a major clinical problem, contributing to patient suffering, delayed mobilization, increased risk of complications such as pneumonia and deep vein thrombosis, prolonged hospital stays, and the potential development of chronic pain states (Gan, 2017; Haskins et al., 2021). The cornerstone of postoperative pain management remains pharmacological, utilizing a multimodal approach with opioids, non-steroidal anti-inflammatory drugs (NSAIDs), and local anesthetics. However, the reliance on these agents, particularly opioids, is fraught with significant drawbacks, including nausea, vomiting, constipation, sedation, respiratory depression, tolerance, and the risk of misuse and dependency (Benyamin et al., 2008). This iatrogenic risk profile has catalyzed a paradigm shift towards integrating non-pharmacological interventions (NPIs) as adjuvants to enhance analgesia and mitigate opioid-related adverse effects.

Within this evolving landscape, nursing practice is uniquely positioned to lead the integration of holistic care modalities. The nursing metaparadigm, which emphasizes the care of the whole person—incorporating physical, psychological, social, and spiritual dimensions—aligns seamlessly with the principles of integrative medicine (Jo Kreitzer et al., 2022). Nurses, as the healthcare professionals who spend the most continuous time with patients, are instrumental in assessing pain, administering analgesics, and evaluating their effectiveness. It is within this therapeutic relationship that complementary therapies find their natural home.

Aromatherapy, defined as the therapeutic use of essential oils extracted from plants to promote physical and psychological well-being, has emerged as a prominent NPI within nursing practice (Czarnecki et al., 2022). Essential oils are volatile,

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aromatic compounds that can be administered through inhalation (via diffusers or direct inhalation) or topical application (always diluted in a carrier oil). The holistic nature of aromatherapy addresses not only the sensory component of pain but also the attendant anxiety, stress, and emotional distress that invariably amplify the pain experience. For a postoperative patient, the clinical environment itself can be a source of anxiety, which can lower pain thresholds and increase analgesic requirements (Laufenberg-Feldmann et al., 2018; Tadesse et al., 2022).

The scientific rationale for aromatherapy's analgesic and anxiolytic effects is rooted in neuroanatomy and neurophysiology. Inhaled aromatic molecules travel through the olfactory epithelium to the olfactory bulb, which has direct neuronal connections to the amygdala, hippocampus, and other limbic system structures—the brain's epicenter for emotion, memory, and stress response (Herz, 2016). This pathway is believed to modulate the emotional and cognitive interpretation of pain. Furthermore, some essential oil constituents are thought to interact with neurotransmitter systems, such as GABA, and may exert peripheral effects on pain receptors when applied topically (Lakhan et al., 2016).

Despite its growing popularity, the integration of aromatherapy into mainstream postoperative care is not without controversy. Questions regarding the robustness of the evidence base, standardization of essential oil quality and dosage, and the implementation of safe practice protocols remain. Therefore, this narrative review aims to synthesize and critically appraise the current evidence on the holistic application of aromatherapy by nurses for postoperative pain management. It will explore the mechanisms of action, review the clinical efficacy for various surgical populations, detail the practical aspects of nursing implementation, discuss safety considerations, and identify future directions for research and practice.

Theoretical Foundations and Mechanisms of Action

Several interconnected physiological and psychological theories support the therapeutic application of aromatherapy. Understanding these mechanisms is crucial for nurses to apply the modality knowledgeably and effectively, moving beyond anecdotal evidence to an evidence-informed practice.

The most well-established pathway is the olfactory-limbic pathway. When volatile aromatic molecules from essential oils are inhaled, they bind to olfactory receptors in the nasal cavity. These receptors transmit signals directly to the olfactory bulb, which has extensive and rapid connections to the limbic system, including the amygdala (which processes emotions like fear and anxiety) and the hippocampus (involved in memory) (Herz, 2016). This direct neural connection explains why scents can instantly evoke powerful emotions and memories. In the context of pain, this pathway is critical because the emotional state significantly influences pain perception. By promoting limbic-induced relaxation and reducing anxiety, aromatherapy can effectively decrease the affective component of pain, thereby reducing the overall pain experience (Chen et al., 2021). For example, the calming effect of lavender oil is believed to occur through this pathway, mitigating the cycle of pain-anxiety-tension that often exacerbates postoperative suffering.

Beyond the central nervous system, certain essential oil components are hypothesized to exert direct pharmacological effects. Some constituents, such as linalool and linalyl acetate found in lavender, are thought to have modulating effects on GABAergic and glutamatergic neurotransmission, producing sedative and anxiolytic effects similar to, but much milder than, pharmaceutical agents (Lakhan et al., 2016; Mohammadi-Dashtaki et al., 2023). For pain specifically, essential oils like peppermint, which contains menthol, may act on peripheral sensory receptors. Menthol is a known agonist of the transient receptor potential melastatin 8 (TRPM8) channel, which mediates the sensation of cold. This activation can create a cooling sensation that distracts from pain and may interfere with pain signal transmission through a counter-irritant mechanism (Graham et al., 2022). Similarly, eugenol from clove oil has local anesthetic and anti-inflammatory properties.

The Gate Control Theory of pain, proposed by Melzack and Wall, provides another relevant framework. This theory posits that non-painful input can "close the gate" to painful input, preventing pain signals from reaching the brain (Moayedi & Davis, 2013). The pleasant, non-noxious sensory input provided by aromatherapy—the olfactory stimulus—can be viewed as a stimulus that competes with and inhibits the transmission of nociceptive signals at the spinal cord level, thereby "closing the gate" to pain.

Furthermore, the ritual of care itself—the act of a nurse taking time to offer a complementary therapy, explaining its use, and applying it with intention—can have powerful psychosocial effects. This therapeutic encounter enhances the nurse-patient relationship, fosters a sense of control and active participation in the patient's own healing process, and leverages the placebo effect positively and ethically (Kaptchuk, 2018; Kaptchuk et al., 2020). Thus, the mechanism of aromatherapy's action is best understood as a holistic, multi-modal intervention involving neurophysiological, pharmacological, and profound psychosocial components. Figure 1illustrates the mechanisms of aromatherapy in postoperative pain management.

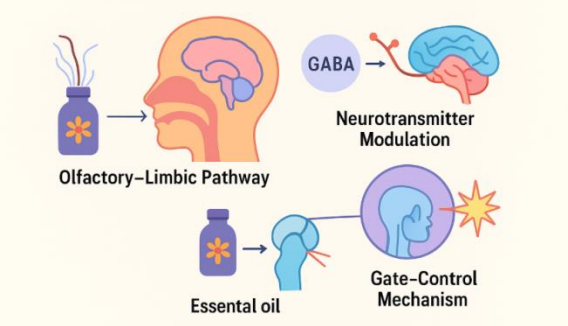

Figure 1: Mechanisms of aromatherapy in postoperative pain management.

Clinical Evidence for Aromatherapy in Postoperative Pain

A growing body of research has investigated the efficacy of aromatherapy across various surgical populations. The evidence, while promising, is characterized by heterogeneity in terms of essential oils used, methods of application, control conditions, and outcome measures. This section reviews the findings from key studies and systematic reviews published within the last decade.

Lavender oil (*Lavandula angustifolia*) is the most extensively studied essential oil in the postoperative context. A randomized controlled trial (RCT) by Hashemzadeh & Dehdilani (2022) investigated the effect of inhaled lavender oil on pain and anxiety after coronary artery bypass graft surgery. The intervention group, which received lavender aromatherapy, demonstrated statistically significant reductions in both pain intensity scores and state-anxiety scores compared to the control group that received routine care. Similarly, a study on patients undergoing laparoscopic cholecystectomy found that those who inhaled lavender oil for 30 minutes postoperatively required less morphine via patient-controlled analgesia (PCA) and reported higher satisfaction with their pain management than the control group (Saritaş et al., 2018).

Peppermint oil (*Mentha piperita*) has also shown efficacy, particularly for pain related to gastrointestinal spasms and for its invigorating effects. An RCT by Hawkins et al. (2020) examined the impact of peppermint inhalation on postoperative nausea, vomiting, and pain in patients undergoing thyroidectomy. The results indicated that the peppermint group experienced not only less severe nausea but also significantly lower abdominal pain scores. The researchers hypothesized that the antispasmodic properties of peppermint and its distracting, cooling sensation contributed to these effects. Peppermint is often used to combat postoperative drowsiness and to provide a sense of alertness, which can be beneficial for encouraging early mobilization.

Bergamot oil (*Citrus bergamia*) is another citrus oil valued for its uplifting and anxiety-reducing properties, which can indirectly alleviate pain perception. A quasi-experimental study by Mirhosseini et al. (2021) explored the effect of bergamot oil inhalation on women experiencing pain after cesarean section. The intervention group reported a greater decrease in pain scores during ambulation compared to the standard care group. The anxiolytic effect of bergamot, likely mediated through the limbic system, is thought to be a key factor in its analgesic properties.

While individual studies show positive results, systematic reviews and meta-analyses present a more nuanced picture. A meta-analysis by Guo et al. (2020) that pooled data from 15 RCTs concluded that aromatherapy significantly reduced postoperative pain scores and anxiety levels compared to control conditions. However, the authors noted a high degree of heterogeneity and a risk of bias in many included studies, often due to the difficulty of blinding participants to the distinctive scent of essential oils. Another systematic review by Huang et al. (2021) affirmed that aromatherapy is a safe and potentially effective adjuvant therapy but called for more rigorously designed trials with longer follow-up periods to assess its impact on functional recovery and opioid consumption.

The evidence, taken as a whole, strongly suggests that aromatherapy can be a beneficial adjunct for reducing the subjective experience of postoperative pain and anxiety. Its role in reducing actual opioid consumption, while suggested by some studies, requires further confirmation through larger, more robust trials.

Nursing Implementation: Assessment, Application, and Integration into Care Plans

The successful implementation of aromatherapy in postoperative care hinges on a systematic, evidence-based approach led by knowledgeable nurses. This process involves careful patient assessment, selection of appropriate essential oils and application methods, seamless integration into the nursing care plan, and thorough documentation.

Patient Assessment and Selection

Not every patient is an ideal candidate for aromatherapy, necessitating a thorough nursing assessment as the critical first step (Weaver et al., 2021). This assessment must include a comprehensive review of the patient's medical history, with specific attention to known allergies—particularly to plants, pollen, or fragrances—and a history of asthma or other respiratory conditions, as potent aromas may trigger bronchospasm. Skin sensitivities must also be evaluated if topical application is planned. For female patients, confirming obstetrical status is essential, as several essential oils are contraindicated during pregnancy. Beyond physiological factors, personal preference is paramount; nurses should inquire about the patient's scent preferences and any prior experiences with aromatherapy, as a fragrance perceived as unpleasant can be non-therapeutic and may exacerbate anxiety

(Reis & Jones, 2017). Finally, the patient's cognitive status must be assessed to ensure they are sufficiently alert and oriented to provide informed consent and safely use inhalation devices.

Application Methods

Nurses can administer aromatherapy in hospital settings using several safe and practical methods, with inhalation being the most common and safest route as it avoids dermal contact (Buckle, 2014). Direct inhalation involves placing one to two drops of essential oil on a cotton ball or gauze pad, which the patient holds four to six inches from the nose while inhaling deeply for five to ten minutes as needed. Personal, portable essential oil inhalers offer a convenient alternative. Room diffusion via an ultrasonic cool-air diffuser can create a calming environment but provides less control over individual dosing and requires consideration for roommates and staff. For topical application, which mandates dilution in a carrier oil (e.g., sweet almond, jojoba) at typical adult concentrations of 1-3% to prevent irritation or sensitization, methods include gentle massage on intact skin (e.g., temples, soles of feet) or application via a warm or cool compress to a targeted area, such as the abdomen for gas pain.

Integration and Documentation

Aromatherapy should be integrated into the patient's holistic nursing care plan rather than employed as a standalone intervention. The process begins with obtaining informed consent, wherein the nurse explains the therapy's potential benefits and risks. Clear, measurable goals for the intervention should be established and documented, such as reducing a pain score or decreasing observable anxiety behaviors. Following administration, meticulous documentation in the patient's chart is required, detailing the specific essential oil, its dilution (if topical), the method and duration of application, and the patient's immediate response (Lindquist et al., 2018). Finally, the nurse must evaluate the intervention's effectiveness by reassessing pain and anxiety levels post-application, using these outcomes to guide the future use of aromatherapy within the patient's plan of care (Table 1).

Table 1: Common Essential Oils for Postoperative Pain and Anxiety

Essential Oil	Proposed Primary Action	Common Postoperative Use	Nursing Considerations & Contraindications
Lavender *(Lavandula angustifolia)*	Calming, anxiolytic, analgesic	General pain and anxiety reduction, sleep promotion	Generally, very safe. Avoid in first trimester of pregnancy.
Bergamot *(Citrus bergamia)*	Uplifting, anxiolytic, mood-balancing	Pain related to tension and anxiety, low mood	Bergapten-free (FCF) type is recommended to avoid phototoxicity.
Peppermint *(Mentha piperita)*	Invigorating, analgesic (cooling), anti-nausea, antispasmodic	Gas pain, abdominal cramping, nausea, headache	Can be stimulating; avoid close to bedtime. Do not use on or near the face of infants/young children. Not for patients with G6PD deficiency.
Sweet Orange *(Citrus sinensis)*	Uplifting, calming, anxiolytic	Anxiety-related pain, creating a positive environment	Generally safe. Can cause phototoxicity; advise sun care if applied topically.
Roman Chamomile *(Chamaemelum nobile)*	Soothing, sedative, anti-inflammatory	Pain from inflammation, restlessness, irritability	Safe for most; rare potential for allergy in those sensitive to the Asteraceae/Compositae family.

Safety, Ethics, and Practical Considerations

The integration of aromatherapy into clinical nursing practice must be guided by a firm commitment to patient safety, ethical principles, and institutional policy. While generally safe when used appropriately, essential oils are potent substances that require respectful and knowledgeable handling.

Safety Protocols

Ensuring patient safety requires adherence to stringent protocols for the use of essential oils. First, nurses must verify the quality and purity of oils by sourcing high-quality, 100% pure, therapeutic-grade products from reputable suppliers. This is critical to avoid adulterants and synthetic fragrances, which can provoke adverse reactions (Boesl & Saarinen, 2016). For any topical application, strict adherence to safe dilution rates in an appropriate carrier oil is mandatory, as undiluted essential oils can cause skin irritation, sensitization, or chemical burns. Prior to topical use, a formal allergy and sensitivity test must be conducted; this involves applying a small amount of the diluted oil to the patient's inner forearm and observing the site for 24 hours for any adverse reaction. Finally, proper storage and handling are essential: essential oils must be kept in dark, glass bottles away from light and

heat, and stored securely out of reach of patients and visitors to prevent accidental ingestion or misuse.

Ethical and Institutional Considerations

The ethical application of aromatherapy is governed by professional and institutional guidelines. Nurses must practice strictly within their defined scope, adhering to their state's Nurse Practice Act and specific institutional policies. The integration of aromatherapy varies by facility; some have formal programs with trained nurse champions, while others require specific privileges, underscoring the need for clear institutional authorization (American Holistic Nurses Association, 2001). As with all interventions, obtaining informed consent is paramount. Patients must be clearly informed that aromatherapy is a complementary therapy, not a substitute for prescribed analgesics, and they retain the right to refuse or discontinue its use at any time. Furthermore, nurses must exercise cultural sensitivity, recognizing that scent preferences and connotations are deeply cultural and that a fragrance considered pleasant in one context may be unpleasant or offensive in another. Lastly, practitioners must consider the environmental impact of diffusion, being mindful of other patients, visitors, and staff who may have sensitivities, making private rooms the ideal setting for this method (Table 2& Figure 2).

Table 2: Nursing Protocol for Aromatherapy Administration in Postoperative Care

Step	Nursing Action	Rationale and Key Points
1. Assessment	Review patient history for allergies, asthma, and pregnancy. Assess pain/anxiety levels and the patient's scent preference.	Identifies potential contraindications and ensures patient-centered, personalized care.
2. Selection	Choose an appropriate essential oil and application method based on the patient's needs and assessment.	Matching the oil's properties (e.g., calming vs. invigorating) to the clinical goal is essential for efficacy.
3. Education & Consent	Explain the procedure, benefits, and potential risks. Obtain verbal or written consent per institutional policy.	Promotes patient autonomy and adherence to ethical principles of informed consent.
4. Preparation	Gather supplies: essential oil, carrier oil (if topical), cotton ball/inhaler/diffuser. Perform patch test if indicated.	Ensures the intervention is delivered safely and efficiently.
5. Implementation	Administer the therapy for the planned duration (e.g., 5-10 minutes of inhalation). Ensure patient comfort.	Direct care delivery. Monitor for any immediate adverse effects.
6. Evaluation	Reassess pain and anxiety levels 15-30 minutes post-intervention. Document outcomes.	Determines the effectiveness of the intervention and guides future plan of care.
7. Documentation	Document all steps in the patient's health record: assessment, intervention (oil, dose, route, duration), and evaluation.	Provides a legal record, ensures continuity of care, and contributes to the evidence base.

Figure 2: Nursing Protocol for Aromatherapy Administration in Postoperative Care

Gaps in the Literature and Avenues for Future Research

While the current body of evidence is encouraging, several significant gaps must be addressed to firmly establish aromatherapy as a standard evidence-based practice in postoperative care.

First, there is a critical need for larger, more methodologically rigorous RCTs. Future studies should prioritize adequate sample sizes, consistent and validated outcome measures (including objective biomarkers like cortisol levels or heart rate variability alongside subjective scales), and longer-term follow-up to assess impacts on functional recovery and chronic pain prevention (Gong et al., 2020). The challenge of blinding remains a significant methodological hurdle. Innovative solutions, such as using masking scents or comparing active essential oils to placebo oils with a minimal, neutral fragrance, need to be developed and validated.

Second, research into the optimal dosing and pharmacokinetics of inhaled essential oils is scarce. While topical dilutions are well-defined, the "dose" of an inhaled oil is poorly understood and varies based on the number of drops, duration of inhalation, and room ventilation. Studies are needed to establish dose-response relationships for different oils and clinical outcomes (Zhang et al., 2023).

Third, the economic impact of implementing aromatherapy has been largely unstudied. Cost-benefit analyses comparing the minimal cost of essential oils and staff training against potential

savings from reduced opioid use, shorter recovery times, and increased patient satisfaction would provide a powerful argument for hospital administrators (Munday et al., 2023).

Finally, more qualitative research is needed to fully understand the patient experience of receiving aromatherapy as part of their nursing care. Exploring themes related to perceived control, therapeutic relationship, and holistic well-being would enrich the quantitative data and provide a deeper understanding of *how* and *why* this intervention works from the patient's perspective.

Conclusion

Postoperative pain is a multifaceted challenge that demands a multifaceted solution. Holistic aromatherapy, applied within the scope of knowledgeable nursing practice, presents a safe, low-cost, and patient-centered adjunct to conventional pharmacological management. The current evidence, while requiring further strengthening, consistently indicates that essential oils like lavender, bergamot, and peppermint can effectively reduce the subjective intensity of pain and its frequent companion, anxiety, thereby potentially reducing the burden of opioid-related side effects.

The success of this modality hinges on its integration into a holistic nursing framework that includes thorough patient assessment, informed consent, skilled application, and diligent evaluation and documentation. By embracing an evidence-informed approach to aromatherapy, nurses can leverage a powerful tool to humanize the postoperative experience, empower patients in their own healing, and reaffirm their central role as providers of comprehensive, compassionate care. Future research must focus on standardizing protocols and demonstrating long-term benefits, but the existing foundation is strong enough to warrant its thoughtful and systematic inclusion in the modern postoperative pain management toolkit.

References

1. American Holistic Nurses' Association. (2001). Position on the role of nurses in the practice of complementary and alternative therapies. *Beginnings (American Holistic Nurses' Association)*, *21*(2), 1-2.
2. Benyamin, R., Trescot, A. M., Datta, S., Buenaventura, R. M., Adlaka, R., Sehgal, N., ... & Vallejo, R. (2008). Opioid complications and side effects. *Pain physician*, *11*(2S), S105.
3. Boesl, R., & Saarinen, H. (2016). Essential oil education for health care providers. *Integrative Medicine: A Clinician's Journal*, *15*(6), 38.
4. Buckle, J. (2014). Essential oils in practice. *Clinical Aromatherapy-E-Book; Churchill Livingstone: Edinburgh, UK*.
5. Chen, S. J., Chen, C. H., & Chang, H. Y. (2021). Effects of inhaling essential oil on headache-related quality of life among nurses working in emergency and critical care units. *Hu Li Za Zhi*, *68*(5), 51-64. DOI:10.6224/JN.202110_68(5).08
6. Czarnecki, M. L., Michlig, J. R., Norton, A. M., Stelter, A. J., & Hainsworth, K. R. (2022). Use of aromatherapy for pediatric surgical patients. *Pain Management Nursing*, *23*(6), 703-710. https://doi.org/10.1016/j.pmn.2022.08.003
7. Gan, T. J. (2017). Poorly controlled postoperative pain: prevalence, consequences, and prevention. *Journal of pain research*, 2287-2298. https://doi.org/10.2147/JPR.S144066
8. Gong, M., Dong, H., Tang, Y., Huang, W., & Lu, F. (2020). Effects of aromatherapy on anxiety: A meta-analysis of randomized controlled trials. *Journal of affective disorders*, *274*, 1028-1040. https://doi.org/10.1016/j.jad.2020.05.118
9. Graham, V., Flemming, K., & Booth, J. (2022). The physiological effects of menthol on thermoreception and pain perception: A systematic review. *Journal of Advanced Nursing*, *78*(5), 1245-1258.
10. Guo, P., Li, P., Zhang, X., Liu, N., Wang, J., Yang, S., ... & Zhang, W. (2020). The effectiveness of aromatherapy on preoperative anxiety in adults: A systematic review and meta-analysis of randomized controlled trials. *International Journal of Nursing Studies*, *111*, 103747. https://doi.org/10.1016/j.ijnurstu.2020.103747
11. Hashemzadeh, K., & Dehdilani, M. (2022). The effect of aromatherapy on anxiety in patients before coronary artery bypass graft surgery. *International Journal of New Chemistry*, *9*(4). Doi: 10.22034/ijnc.2022.4.13
12. Haskins, S. C., Bronshteyn, Y., Perlas, A., El-Boghdadly, K., Zimmerman, J., Silva, M., ... & Narouze, S. (2021). American Society of Regional Anesthesia and Pain Medicine expert panel recommendations on point-of-care ultrasound education and training for regional anesthesiologists and pain physicians—part I: clinical indications. *Regional Anesthesia & Pain Medicine*, *46*(12), 1031-1047. https://doi.org/10.1136/rapm-2021-102560
13. Hawkins, J., Hires, C. Y., Dunne, E. W., & Keenan, L. A. (2020). Aromatherapy reduces fatigue among women with hypothyroidism: A randomized placebo-controlled clinical trial. *Journal of Complementary and Integrative Medicine*, *17*(1). https://doi.org/10.1515/jcim-2018-0229
14. Herz, R. S. (2016). The role of odor-evoked memory in psychological and physiological health. *Brain sciences*, *6*(3), 22. https://doi.org/10.3390/brainsci6030022
15. Huang, H., Wang, Q., Guan, X., Zhang, X., Kang, J., Zhang, Y., ... & Li, X. (2021). Effect

of aromatherapy on preoperative anxiety in adult patients: A meta-analysis of randomized controlled trials. *Complementary therapies in clinical practice*, *42*, 101302. https://doi.org/10.1016/j.ctcp.2021.101302
16. Jo Kreitzer, M., Koithan, M., Sullivan, S. D., Nunez, M., & Voss, M. (2022). Integrative nursing and the ANA scope and standards of practice: expanding the reach of nursing for families and society. *Creative Nursing*, *28*(4), 228-233. https://doi.org/10.1891/CN-2022-0041
17. Kaptchuk, T. J. (2018). Open-label placebo: reflections on a research agenda. *Perspectives in biology and medicine*, *61*(3), 311-334. https://doi.org/10.1353/pbm.2018.0045
18. Kaptchuk, T. J., Hemond, C. C., & Miller, F. G. (2020). Placebos in chronic pain: evidence, theory, ethics, and use in clinical practice. *bmj*, *370*. https://doi.org/10.1136/bmj.m1668
19. Lakhan, S. E., Sheafer, H., & Tepper, D. (2016). The effectiveness of aromatherapy in reducing pain: A systematic review and meta-analysis. *Pain research and treatment*, *2016*(1), 8158693. https://doi.org/10.1155/2016/8158693
20. Laufenberg-Feldmann, R., Kappis, B., Cámara, R. J., & Ferner, M. (2018). Anxiety and its predictive value for pain and regular analgesic intake after lumbar disc surgery-a prospective observational longitudinal study. *BMC psychiatry*, *18*(1), 82. https://doi.org/10.1186/s12888-018-1652-8
21. Lindquist, R., Tracy, M. F., & Snyder, M. (Eds.). (2018). *Complementary and alternative therapies in nursing*. Springer Publishing Company.
22. Mirhosseini, S., Abbasi, A., Norouzi, N., Mobaraki, F., Basirinezhad, M. H., & Mohammadpourhodki, R. (2021). Effect of aromatherapy massage by orange essential oil on post-cesarean anxiety: a randomized clinical trial. *Journal of Complementary and Integrative Medicine*, *18*(3), 579-583. https://doi.org/10.1515/jcim-2020-0138
23. Moayedi, M., & Davis, K. D. (2013). Theories of pain: from specificity to gate control. *Journal of neurophysiology*, *109*(1), 5-12. https://doi.org/10.1152/jn.00457.2012
24. Mohammadi-Dashtaki, R., Heidari-Soureshjani, S., & Sherwin, C. M. (2023). The Effect of Inhalation Aromatherapy on Patients with Cardiovascular Disease Seeking Pain Relief: A Systematic Review and Meta-analysis. *Current Drug Therapy*, *18*(3), 262-270. https://doi.org/10.2174/1574885518666230217141950
25. Munday, J., Higgins, N., Mathew, S., Dalgleish, L., Batterbury, A. S., Burgess, L., ... & Coyer, F. (2020). Nurse-led randomized controlled trials in the perioperative setting: A scoping review. *Journal of Multidisciplinary Healthcare*, 647-660. https://doi.org/10.2147/JMDH.S255785
26. Reis, D., & Jones, T. (2017). Aromatherapy: using essential oils as a supportive therapy. *Clinical journal of oncology nursing*, *21*(1), 16-20.
27. Saritaş, S., Kavak, F., & Savaş, B. (2018). The effect of lavender oil on anxiety levels of patients before laparoscopic cholecystectomy. *Complementary Therapies in Clinical Practice*, *32*, 51-54. https://doi.org/10.1016/j.ctcp.2018.05.003
28. Tadesse, M., Ahmed, S., Regassa, T., Girma, T., Hailu, S., Mohammed, A., & Mohammed, S. (2022). Effect of preoperative anxiety on postoperative pain on patients undergoing elective surgery: Prospective cohort study. *Annals of medicine and surgery*, *73*, 103190. https://doi.org/10.1016/j.amsu.2021.103190
29. Weaver, C., Yackzan, S., Herron, R., Nettro, A., & Davies, C. (2021). Essential oil use with breast imaging a pilot study. *Journal of Holistic Nursing*, *39*(2), 108-115. https://doi.org/10.1177/0898010120939719
30. Zhang, P., Liao, X., Yuan, Q., Lyu, F., & Xie, S. (2023). Effect of aromatherapy on postoperative pain relief: A systematic review and meta-analysis of randomized controlled trials. *European Journal of Integrative Medicine*, *62*, 102289. https://doi.org/10.1016/j.eujim.2023.102289