Tianjin Daxue Xuebao (Ziran Kexue yu Gongcheng Jishu Ban)/
Journal of Tianjin University Science and Technology
ISSN (Online):0493-2137
E-Publication: Online Open Access
Vol: 57 Issue: 10:2024
DOI: 10.5281/zenodo.17293491

PAIN MANAGEMENT STRATEGIES IN HOSPITALIZED PATIENTS: A SYSTEMATIC REVIEW OF NURSING, PHARMACOLOGIC, AND NON-PHARMACOLOGIC INTERVENTIONS

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Abstract

Background: Hospitalized adults frequently experience moderate–severe pain despite guideline initiatives, and there is growing interest in multimodal approaches that combine pharmacologic and non-pharmacologic strategies. Objective: To synthesize comparative evidence on inpatient pain-management interventions spanning nursing-led models, medication regimens, and adjunct non-pharmacologic therapies. Methods: Following PRISMA guidance, we included randomized and comparative observational studies enrolling hospitalized adults and reporting pain or closely related outcomes. Heterogeneity in populations and interventions precluded meta-analysis; we performed structured narrative synthesis and tabulated study characteristics and effects. Results: Nine studies (2012–2025) were included: massage after cardiac surgery; guided imagery in geriatric orthopedics; music after arthroplasty; acupuncture after cesarean; virtual reality (VR) in hip arthroplasty and in hospitalized patients with cancer; nurse-led pain programs (quasi-experimental and retrospective); and a hospital PCA regimen evaluation after cesarean. Most non-pharmacologic modalities (massage, guided imagery, music, acupuncture) reduced pain or distress; VR showed mixed effects (benefit in hospitalized patients with cancer; null in hip arthroplasty). Nurse-led programs improved pain intensity, function, and/or satisfaction; a revised PCA regimen reduced re-prescription but increased complications. Conclusions: Multimodal inpatient pain care can improve pain and patient experience; effects vary by modality and setting. Standardized outcome reporting and higher-quality trials (especially for VR and nurse-led models across diverse wards) are needed to guide implementation.

Keywords: Inpatient Pain, Multimodal Analgesia, Nursing-Led Program, Non-Pharmacologic Therapy, Virtual Reality, Music Therapy, Acupuncture, Guided Imagery.

INTRODUCTION

Pain remains one of the most common and undertreated symptoms among hospitalized adults. Institution-wide initiatives have shown that improving documentation and prescribing can be achieved, yet translating process changes into consistent reductions in pain intensity has proven difficult, underscoring the need for robust, patient-centered strategies that extend beyond pharmacology alone [1].

Across surgical and medical settings, complementary non-pharmacologic interventions (relaxation, guided imagery, music, audiovisual distraction) have demonstrated promise as adjuncts to standard care, though the evidence base is heterogeneous and often

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small-scale [2]. In special populations such as patients with dementia, non-pharmacologic modalities including massage, ear acupressure, play activities, and social robots have been associated with reductions in pain or behavioral distress, suggesting broader applicability of multimodal approaches when communication is impaired [3].

Procedural and wound-care pain are particularly salient in hospitals; dressing changes frequently provoke moderate–severe pain, and non-pharmacologic options such as VR distraction, music, imagery, and reflexology are increasingly used to limit analgesic requirements and improve patient experience [4]. Parallel developments in musculoskeletal care show a guideline shift toward biopsychosocial models that prioritize self-management and non-pharmacologic therapies alongside judicious medication use, an approach that may translate to general inpatient care pathways [5].

Mechanistic reviews further support the rationale for integrating non-invasive, non-pharmacologic therapies (NINPT) in multimodal analgesia. These interventions act across peripheral, spinal, and supraspinal levels to recalibrate pain modulation and reduce central sensitization (via cognitive-emotional regulation, descending inhibition, and sensory distraction), offering complementary benefits with favorable safety profiles [6].

Against this backdrop, we synthesized comparative evidence from inpatient settings spanning nursing-led service models, optimized pharmacologic regimens, and non-pharmacologic adjuncts (massage, music, guided imagery, acupuncture, and VR). Our aims were to (1) characterize study designs, populations, and interventions; (2) summarize effects on pain and related outcomes (distress, function, satisfaction, opioid use, complications); and (3) identify gaps to inform implementation and research priorities within hospital-based multimodal pain care.

METHODS

Protocol and reporting: We followed PRISMA guidance for study selection, data extraction, and synthesis. No protocol was registered.

Eligibility criteria: We included randomized controlled trials (RCTs), quasi-experimental, and comparative observational studies that: (i) enrolled adults (≥18 years) receiving inpatient or immediate post-discharge hospital care; (ii) evaluated pain-management interventions relevant to hospital practice (nursing-led models, pharmacologic regimen optimization, or non- pharmacologic adjuncts such as massage, music, guided imagery, acupuncture, or VR); and (iii) reported pain intensity or closely related outcomes (pain distress/bothersomeness, comfort, satisfaction, functional interference, opioid use, complications). We excluded case reports, non-comparative series, pediatric-only cohorts, and studies lacking extractable pain-related outcomes.

Information sources and selection. Full-text comparative studies meeting the above criteria (2012–2025) were collated and screened in duplicate. Nine studies met inclusion: massage after cardiac surgery; guided imagery in geriatric orthopedic inpatients; music after arthroplasty; acupuncture after cesarean; VR for hip arthroplasty and for hospitalized

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patients with cancer; a nurse-based hospital pain program (quasi-experimental); a retrospective nurse-led pain model after TACE; and an inpatient IV-PCA regimen evaluation after cesarean [7–15].

Data items and synthesis. Two reviewers independently extracted: country/setting, design, sample size, population, intervention and comparator, timing, and outcomes (pain, distress/comfort, function, satisfaction, opioid use, physiologic measures, complications). Given heterogeneity in populations (cardiac, orthopedic, obstetric, oncology, interventional radiology) and outcomes (different scales/timepoints), meta-analysis was not planned. We performed a structured narrative synthesis and tabulated study characteristics and main findings.

Risk of bias. We qualitatively considered randomization and blinding (for RCTs), baseline comparability, outcome ascertainment, and attrition. Observational designs were interpreted with caution regarding confounding. Because many trials focused on patient-reported pain with short follow-up, detection bias was considered low-to-moderate; performance bias varied by feasibility of sham controls (massage vs rest).

Outcomes of interest. Primary: pain intensity or distress/bothersomeness. Secondary: comfort/relaxation, muscular tension, functional interference or mobilization, satisfaction, opioid/analgesic use, adverse events/complications, and vital signs.

RESULTS

Study selection and characteristics

Nine comparative studies (2012–2025) were included: five RCTs, one quasi-experimental pre/post study, and three retrospective comparative cohorts. Sample sizes ranged from 47 to 845 participants and covered cardiac surgery, arthroplasty, geriatric orthopedics, obstetrics, oncology, and interventional oncology wards. Interventions included massage, guided imagery, music listening, acupuncture, VR distraction, nurse-led pain programs, and an optimized IV-PCA regimen (Tables 1–2). [7–15]

Massage therapy after cardiac surgery

In a randomized trial of 152 elective cardiac surgery patients, massage (vs. equal rest time) significantly reduced patient-reported pain, anxiety, and muscular tension and increased relaxation and satisfaction at postoperative day (POD) 3–4 and POD 5–6; no differences were observed in heart rate, blood pressure, or respiratory rate [7]. Pain reduction persisted at both timepoints in the massage group, whereas the control group showed no significant change. This suggests massage is a safe adjunct capable of improving patient experience without hemodynamic instability in the step-down period.

Guided imagery in geriatric orthopedic inpatients

A randomized, controlled study of geriatric orthopedic patients (randomized samples reported; total n=102) found guided imagery reduced pain versus baseline ($t=4.002$, $p=0.00$) and improved comfort ($t=-5.428$, $p=0.00$). The control group’s comfort declined

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nonsignificantly [8]. This supports an accessible, low-cost modality that can be integrated into nursing routines on orthopedic wards.

Nurse-based pain program

A quasi-experimental separate-sample pre/post study across four inpatient units (n=845 over three surveys) demonstrated that after education plus rounding with systematic pain monitoring, the proportion reporting moderate–severe average pain in the prior 24 h dropped from =69–73% to 48.5%, and point-in-time moderate–severe pain declined from =54–57% to 37%; physical/emotional interference also decreased [9]. These findings suggest organizational nursing interventions can meaningfully reduce pain burden across diverse hospital wards.

Nurse-led pain management after TACE (interventional oncology)

In a retrospective comparison (n=90) of conventional care vs. a structured nurse-led model (dynamic assessment, individualized comfort interventions, early mobilization, education/follow-up), 72-hour pain scores were lower with the model (NRS 2.58 ± 0.79 vs 3.62 ± 0.91, $p<0.001$), and comfort and satisfaction improved, while overall complications decreased [10]. Although nonrandomized, results reinforce the effectiveness and scalability of chain-based nursing pathways in reducing post-embolization pain and improving recovery markers.

Optimizing IV-PCA after cesarean section

A single-center retrospective evaluation of 631 cesarean patients compared two fentanyl-based IV-PCA regimens. The revised regimen (higher basal rate + multimodal additives) reduced the need for a second PCA prescription from 27.5% to 3.8% ($p<0.001$) but increased recorded complications from 1.0% to 6.9%. Within the revised regimen, basal-rate differences (15 vs 30 mcg/h) did not change second-prescription rates or adverse events [11]. These data suggest that initial regimen adequacy reduces delays and additional device/drug use but warrants vigilance for side effects.

Music listening after arthroplasty

An RCT (n=47 completers) showed that adding 30-minute sessions of self-selected music three times per day reduced pain intensity and distress during hospitalization and for two days post-discharge; opioid and non-opioid consumption did not differ from controls [12]. This extends inpatient benefits of music into the early home period, supporting discharge education.

VR distraction: mixed inpatient findings

A single-center RCT in hospitalized adults with cancer (n=128) compared 10-minute immersive VR to 2D guided imagery. Both groups improved, but VR produced greater immediate pain reduction and sustained benefit at 24 h; pain bothersomeness and general distress also improved in the VR arm [13].

In contrast, an RCT in hip arthroplasty inpatients (n=106) found no significant differences between VR and 2D sham for after-session pain, 48-hour pain averages, opioid

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consumption, or nurse-recorded pain [14]. These discrepant findings indicate that patient population and context (nociceptive vs complex cancer-related pain; intervention content/dose) likely moderate VR efficacy.

Acupuncture after cesarean

In a patient- and assessor-blinded RCT (n=180; 60 acupuncture, 60 placebo, plus a nonrandomized standard-care group), acupuncture reduced pain on movement on postoperative day 1 vs placebo and standard care and accelerated mobilization and Foley catheter removal [15]. This suggests perioperative acupuncture as a safe adjunct compatible with standard obstetric analgesia pathways.

Synthesis of effects

Collectively, adjunct non-pharmacologic therapies, massage, guided imagery, music, and acupuncture, consistently reduced pain and/or distress without hemodynamic instability or excess adverse events in the studied inpatient contexts [7,8,12,15]. VR results were mixed, with benefit in cancer inpatients but null effects in post-arthroplasty patients, highlighting the importance of aligning VR content/dose and clinical context [13,14].

Nurse-led programs demonstrated meaningful reductions in pain prevalence and interference across wards and in specialized pathways (TACE), alongside improved satisfaction and fewer complications [9,10]. Pharmacologic regimen optimization (IV-PCA) reduced downstream resource use but signaled a trade-off with more recorded adverse events, underscoring the need for careful titration and monitoring [11].

Table 1: Characteristics of included studies

Study	Setting & Population	Design (n)	Intervention (Comparator)	Primary Outcomes
Braun 2012	Post-cardiac surgery	RCT (152)	Massage vs rest	Pain, anxiety, tension, relaxation, vitals
Ozdemir 2023	Geriatric orthopedics	RCT (=102)	Guided imagery vs control	Pain, comfort
Germossa 2019	4 hospital units	Quasi-experimental (845)	Education + rounding	Pain intensity; interference
Qu 2025	TACE (oncology)	Retrospective (90)	Nurse-led model vs usual care	NRS pain (24/72 h), comfort, satisfaction, complications
Jun 2023	Cesarean	Retrospective (631)	Revised IV-PCA vs prior regimen	Second prescription; adverse events
Laframbois e-Otto 2020	Arthroplasty	RCT (47)	Music + analgesics vs analgesics	Pain intensity & distress; analgesic use
Groninger 2024	Inpatient cancer	RCT (128)	Immersive VR vs 2D guided imagery	Pain reduction (immediate, 24 h)
Araujo-Duran 2024	Hip arthroplasty	RCT (106)	VR vs 2D nature films	Pain; opioid use; usability
Usichenko 2022	Cesarean	RCT (180)	Acupuncture vs placebo (+ standard care ref.)	Pain on movement; mobilization

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Table 2: Summary of effects

Modality	Direction of Effect on Pain/Distress	Notable Secondary Outcomes
Massage (cardiac)	decrease pain, decrease anxiety, decrease tension; increase relaxation vs rest	No change in HR/BP/RR; increase satisfaction [7]
Guided imagery (orthopedics)	decrease pain vs baseline; increase comfort vs control	Low-cost, nurse-deliverable [8]
Nurse-based hospital program	decrease moderate–severe pain prevalence; decrease interference	System-level feasibility across units [9]
Nurse-led TACE pathway	decrease pain at 72 h; increase comfort/satisfaction; decrease complications	Supports structured assessment + comfort bundle [10]
IV-PCA optimization (cesarean)	Fewer second prescriptions	increase recorded adverse events; no diff between basal 15 vs 30 mcg/h [11]
Music (arthroplasty)	decrease pain intensity and distress in-hospital and post-discharge	No reduction in analgesic consumption [12]
VR (inpatient cancer)	Greater immediate and 24-h pain reduction vs 2D	decrease bothersomeness and distress [13]
VR (hip arthroplasty)	No difference vs 2D	No effect on opioids or nurse-recorded pain [14]
Acupuncture (cesarean)	decrease pain on movement vs placebo/standard care	Faster mobilization; earlier catheter removal [15]

Risk-of-bias considerations and limitations

Sham-controlled designs (music, VR, acupuncture) reduced detection bias; blinding feasibility varied (massage, guided imagery). Two retrospective cohorts and one hospital-wide quasi-experiment broadened generalizability but are susceptible to confounding and co-interventions. Outcome heterogeneity and short-term follow-up limited cross-study comparisons and prevented pooling.

DISCUSSION

This review indicates that multimodal inpatient pain strategies, particularly non-pharmacologic adjuncts integrated into nursing practice, can reduce pain and distress across several common hospital contexts. These findings align with earlier hospital-based quality initiatives demonstrating that systematic assessment and feedback improve prescribing and documentation, although translating to lower pain scores requires patient-facing interventions layered atop system changes [1].

Our synthesis corroborates prior surgical literature where relaxation, imagery, music, and audiovisual distraction have yielded clinically relevant benefits, while calling attention to heterogeneity in populations and protocols [2]. In cognitively vulnerable inpatients (dementia), interactive non-pharmacologic approaches may be especially valuable to mitigate pain-related behaviors, reinforcing the importance of tailoring modality to patient capability and preferences [3]. Evidence from wound-care contexts similarly supports VR, audio-visual distraction, spiritual care, and reflexology as adjuncts during high-pain procedures, with generally favorable safety and feasibility profiles [4].

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The divergent results for VR, positive among hospitalized adults with cancer but neutral in hip arthroplasty, are consistent with broader uncertainty about optimal target populations, dose, and content. Procedural and cancer-related pains may be more amenable to short immersive distraction than immediate post-arthroplasty pain, which is intense and movement-linked. This highlights the importance of mechanism-informed selection: non-pharmacologic therapies can modulate pain via attention, affect, and descending inhibitory control, but translation depends on context and the salience of competing noxious inputs [6]. Growing oncology-focused syntheses and planned network meta-analyses may further clarify the comparative effectiveness of aromatherapy, massage, reflexology, acupressure, and related nursing strategies in cancer pain [16,17].

System-level nursing interventions, education, standardized tools, and proactive rounding, reduced both pain prevalence and interference across units, dovetailing with guideline trends in musculoskeletal and inpatient care that emphasize biopsychosocial frameworks and non-pharmacologic first-line options within multimodal regimens [5]. Pharmacologic regimen optimization (IV-PCA composition and background infusion) remains essential; however, the trade-off between fewer re-prescriptions and higher recorded adverse events underscores that medication strategies must be titrated within a broader, team-delivered bundle that includes non-pharmacologic therapies and continuous monitoring to balance analgesia against side effects.

Implications for practice. Hospitals can embed structured, nurse-delivered adjuncts (massage where feasible, guided imagery scripts, music kits, pragmatic acupuncture pathways, targeted VR for appropriate patients) into routine rounds and pre-/post-procedure workflows. Priority targets include cardiac surgery recovery, geriatric orthopedic wards, obstetric units, and interventional oncology suites, settings in which modest, low-risk interventions produced meaningful gains in comfort and function.

Research priorities. Future work should standardize outcomes (core pain/distress and interference measures), report minimal clinically important differences, specify intervention dose/content, and include longer follow-up. Comparative effectiveness trials that stratify by pain mechanism and patient phenotype are needed to determine where VR and other modalities add the most value.

CONCLUSION

In hospitalized adults, multimodal strategies that combine optimized pharmacologic care with nurse-delivered non-pharmacologic therapies can reduce pain and distress and improve satisfaction and functional recovery. Massage, guided imagery, music listening, and acupuncture showed consistent adjunct benefits across several inpatient populations; nursing-led service models also reduced pain burden at the unit level. VR demonstrated context-dependent effects. Implementation should prioritize low-risk, scalable modalities embedded in routine care, with careful monitoring of medication-related adverse events. Standardized outcomes and mechanism-informed trial designs are essential to refine patient selection and maximize benefit.

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