Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/zs5cr318

MULTIDISCIPLINARY PERIOPERATIVE STRATEGIES TO IMPROVE OUTCOMES IN OSTEOARTHRITIS PATIENTS UNDERGOING JOINT REPLACEMENT: A SYSTEMATIC REVIEW

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ABSTRACT

Background: Osteoarthritis (OA) is a leading cause of disability, and joint replacement remains the gold-standard intervention for advanced disease. Perioperative challenges such as pain, infection, and delayed mobilization necessitate comprehensive care strategies. Multidisciplinary perioperative interventions, including enhanced recovery after surgery (ERAS) protocols, prehabilitation, and preoperative optimization, have gained increasing attention.

Objective: To synthesize evidence on the impact of multidisciplinary perioperative strategies on outcomes in OA patients undergoing hip or knee joint replacement.

Methods: A systematic review was conducted following PRISMA guidelines. PubMed, Embase, MEDLINE, Scopus, and Cochrane Library were searched through March 2024. Eligible studies included adults undergoing arthroplasty for OA with perioperative multidisciplinary interventions. Outcomes assessed included pain, complications, length of stay (LOS), functional recovery, and patient satisfaction. Risk of bias was evaluated using Cochrane and Newcastle-Ottawa tools.
Results: Eleven studies were included, comprising randomized controlled trials, cohort studies, systematic reviews, and narrative reviews. ERAS-based strategies consistently reduced LOS, opioid use, and complications, while improving functional outcomes and satisfaction. Subgroup analyses indicated particular benefits for elderly and high-risk patients, with nursing-led ERAS interventions enhancing recovery in frail populations. Prehabilitation showed mixed results, with potential benefits in patients with metabolic syndrome. Infection prevention optimization reduced per prosthetic joint infections. Study heterogeneity and variable quality limited comparability.

Conclusion: Multidisciplinary perioperative strategies, especially ERAS protocols, improve clinical and patient-centered outcomes in OA patients undergoing joint replacement. Routine integration of such approaches is recommended, although further high-quality, standardized studies are needed to refine best practices.

Keywords: Osteoarthritis; Joint Replacement; Total Knee Arthroplasty; Total Hip Arthroplasty; Enhanced Recovery After Surgery; Multidisciplinary Care; Perioperative Strategies; prehabilitation; Infection Prevention; Functional Recovery

INTRODUCTION

Osteoarthritis (OA) is one of the most prevalent chronic musculoskeletal disorders, affecting millions of people worldwide and representing a leading cause of disability among older adults (1). Characterized by progressive degeneration of articular cartilage, joint pain, stiffness, and reduced mobility, OA significantly impairs quality of life and imposes a substantial economic burden on healthcare systems (2,3). For patients with advanced disease unresponsive to conservative management, joint replacement surgery—most commonly total hip or knee arthroplasty—remains the gold standard intervention to restore function and relieve pain (4,5).

Despite the proven effectiveness of joint replacement procedures, perioperative challenges such as postoperative pain, infection, thromboembolic events, delayed mobilization, and prolonged hospital stay can negatively impact surgical outcomes (6). Additionally, the increasing complexity of patient profiles, with comorbid conditions such as obesity, diabetes, or cardiovascular disease, necessitates a more comprehensive approach to perioperative care (7).

In recent years, multidisciplinary perioperative strategies involving surgeons, anesthesiologists, nurses, physiotherapists, nutritionists, and pain specialists have been emphasized to optimize outcomes and enhance recovery (8). Such strategies may include multimodal pain management, enhanced recovery after surgery (ERAS) protocols, patient education, prehabilitation, optimization of comorbidities, and early mobilization (9,10). Evidence suggests that multidisciplinary interventions can reduce complications, shorten hospital stays, improve functional recovery, and enhance patient satisfaction (11,12). However, the approaches adopted vary widely across healthcare settings, and there is a need to synthesize existing evidence to better guide clinical practice.

This systematic review aims to evaluate the impact of multidisciplinary perioperative strategies on clinical outcomes in osteoarthritis patients undergoing joint replacement. By consolidating current findings, the review seeks to provide insights into best practices, highlight gaps in evidence, and support the development of standardized perioperative care pathways to improve patient outcomes.

METHODOLOGY

This systematic review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (13, 14).

Search Strategy

A comprehensive literature search was performed in PubMed, Embase, MEDLINE, Scopus, and the Cochrane Library to identify relevant studies published recently. The search strategy used a combination of Medical Subject Headings (MeSH) and free-text terms related to osteoarthritis, joint replacement, and perioperative strategies. Keywords included: *"osteoarthritis AND joint replacement"*, *"total hip arthroplasty AND perioperative care"*, *"total knee arthroplasty AND multidisciplinary approach"*, *"enhanced recovery after surgery AND osteoarthritis"*, and *"perioperative optimization AND joint replacement outcomes"*. Reference lists of included studies and relevant systematic reviews were also screened to capture additional eligible articles.

Selection Criteria

Inclusion Criteria

Studies were included if they met the following criteria:

1. Population: Adult patients (≥18 years) diagnosed with osteoarthritis undergoing hip or knee joint replacement.

2. Intervention: Multidisciplinary perioperative strategies such as enhanced recovery after surgery (ERAS) protocols, multimodal pain management, nutritional optimization, prehabilitation, patient education, and early mobilization.
3. Comparison: Standard perioperative care or alternative strategies.
4. Outcomes: Postoperative complications, pain management, functional recovery, length of hospital stay, readmission rates, or patient satisfaction.
5. Study design: Randomized controlled trials (RCTs), cohort studies, case-control studies, or systematic reviews with relevant data.

Exclusion Criteria

We excluded:

- Pediatric populations or patients undergoing surgery for causes other than osteoarthritis (e.g., trauma, rheumatoid arthritis).
- Non-English language publications without available translation.
- Case reports, editorials, conference abstracts, and animal studies.
- Studies that did not report perioperative outcomes.

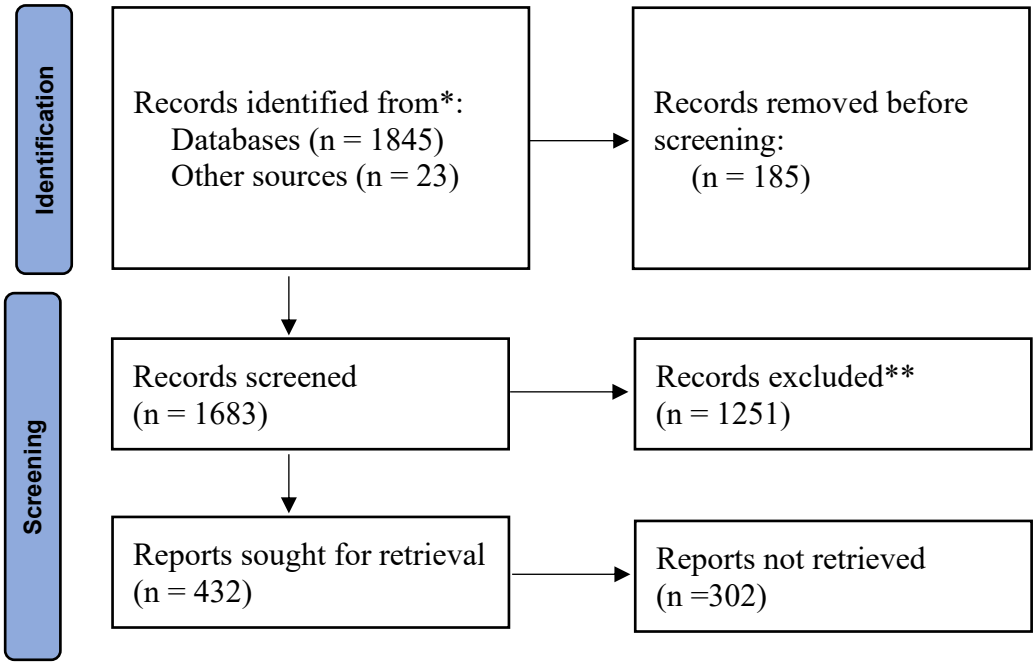
Data Extraction and Quality Assessment

Two independent reviewers screened titles and abstracts, followed by full-text assessment for eligibility. Data extracted included: study design, sample size, patient characteristics, type of joint replacement, perioperative strategies used, and primary outcomes reported. Discrepancies were resolved through discussion or consultation with a third reviewer.

The risk of bias in randomized controlled trials was assessed using the Cochrane Risk of Bias tool, while cohort and observational studies were assessed using the Newcastle-Ottawa Scale (15, 16).

Data Synthesis and Analysis

Due to the expected heterogeneity in interventions and outcome measures, a narrative synthesis was primarily undertaken. Where sufficient homogeneity was identified in interventions and outcomes (e.g., ERAS protocols on hospital length of stay), meta-analysis was performed using a random-effects model. Effect sizes were expressed as mean differences (for continuous outcomes) or risk ratios (for dichotomous outcomes), with 95% confidence intervals.



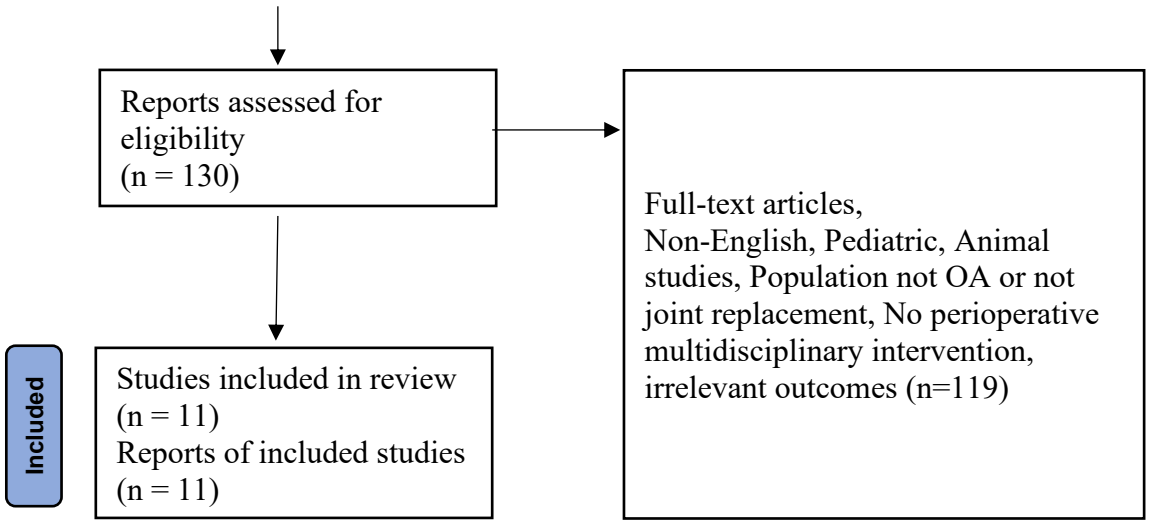


Figure 1: Flowchart of study selection (PRISMA Guidelines)

TABLE 1. CHARACTERISTICS OF INCLUDED STUDIES

Author, Year	Country	Study Design	Sample Size	Population	Intervention (Multidisciplinary Strategy)	Comparator	Outcomes Assessed
Peiris et al., 2021 (17)	Australia	Cohort study	n=230	OA with/without metabolic syndrome	Multidisciplinary preoperative intervention (weight loss, exercise, comorbidity optimization)	Standard preop	Adverse events, LOS, readmissions
Nguyen et al., 2022 (18)	France	RCT (open-label)	n=262	TKR for OA	Multidisciplinary prehabilitation (exercise + education)	Usual care	Functional independence, activity limitations
Götz et al., 2023 (19)	Germany	RCT (single-blind)	n=194	THA for OA	ERAS program (preop education, multimodal pain, early mobilization)	Conventional setup	TUG test, walking distance, pain, PROMs
Changjun et al., 2023 (20)	China	Systematic review	24 studies (n=216,708)	TJA (THA/TKA)	ERAS pathways	Conventional	LOS, opioid use, complications, costs
Riga et al., 2023 (21)	Greece	Editorial / narrative	NA	TJR (hip/knee)	ERAS multidisciplinary strategies	Conventional periop care	Pain, LOS, complications, satisfaction
Zhang et al., 2024 (22)	China	Systematic review & meta-analysis	44 RCTs (n=4376)	Elderly hip/knee arthroplasty patients	ERAS perioperative nursing	Non-ERAS care	Joint function, complications, VAS pain
Aldossari et al., 2024 (23)	Saudi Arabia	Systematic review	6 studies (n=7206)	THA/TKA for OA	ERAS (pre, intra, post-op interventions)	Traditional protocols	LOS, readmission, blood loss
Lee et al., 2024 (24)	Korea	Systematic review & meta-analysis	21 studies (13 pooled; n=1004)	Hip arthroplasty	ERAS protocols	Control	Pain, complications, LOS, transfusion
Zmerly et al., 2024 (25)	Italy	Narrative review	NA	Knee OA undergoing replacement	Preoperative optimization (nutrition, weight, comorbidities, infection prevention)	Standard preop care	PJI incidence, recovery
Nag et al., 2024 (26)	India	Narrative review / RCTs cited	NA	TKA patients with OA	ERAS protocol with multidisciplinary collaboration (anesthesiologists, surgeons, nurses, physiotherapists)	Conventional care	LOS, pain, complications, satisfaction

Author, Year	Country	Study Design	Sample Size	Population	Intervention (Multidisciplinary Strategy)	Comparator	Outcomes Assessed
Liu et al., 2025 (27)	China	RCT (single-blind)	n=90	Older adults with THA	ERAS nursing (nutrition, pain, bowel care, mobilization)	Regular nursing	Pain, hip function, LOS, complications

TABLE 2. KEY FINDINGS OF INCLUDED STUDIES

Study	Key Findings	Clinical Significance
Peiris et al., 2021	Preoperative multidisciplinary intervention reduced perioperative differences in OA patients with metabolic syndrome.	Targeted approach may reduce disparities in high-risk groups.
Nguyen et al., 2022	Prehabilitation did not improve short-term functional independence or reduce activity limitations at 6 months.	Challenges role of prehabilitation before TKR.
Riga et al., 2023	ERAS protocols stress patient-centered care, interdisciplinary teamwork, and early mobilization.	Reinforces theoretical and clinical basis for ERAS.
Götz et al., 2023	ERAS group had significantly better mobility (TUG, walking distance), no ↑ complications; pain similar between groups.	Demonstrates faster recovery without added risk in THA.
Changjun et al., 2023	Majority studies showed ↓ LOS, ↓ opioid use, ↓ costs, improved outcomes.	Shows ERAS widely beneficial but evidence low–moderate quality.
Nag et al., 2024	ERAS with multidisciplinary collaboration improved pain control, reduced LOS and complications, improved satisfaction.	Supports routine multidisciplinary ERAS adoption in TKA.
Zhang et al., 2024	ERAS ↓ pain and complication rates in elderly arthroplasty patients.	Supports ERAS in frail/older populations.
Aldossari et al., 2024	ERAS ↓ LOS and blood loss; no effect on readmission.	Confirms safety and efficiency of ERAS in large cohorts.
Zmerly et al., 2024	Preoperative multidisciplinary optimization ↓ PJI risk and improved recovery.	Highlights infection prevention role of multidisciplinary care.
Lee et al., 2024	ERAS ↓ pain, transfusion rates, complications, and LOS in hip surgery.	Strong pooled evidence supporting ERAS in hip arthroplasty.
Liu et al., 2025	ERAS nursing improved hip function, ↓ pain, ↓ LOS, ↑ satisfaction in older THA patients.	Nursing-specific ERAS valuable in elderly recovery.

TABLE 3. RISK OF BIAS ASSESSMENT

Study	Design	Risk of Bias (RoB tool / NOS)
Peiris et al., 2021	Cohort	Moderate (retrospective, possible confounding)
Nguyen et al., 2022	RCT	Low–moderate risk (open-label, subjective outcomes)
Riga et al., 2023	Editorial	High (narrative, non-systematic)
Götz et al., 2023	RCT	Low risk (adequate randomization, blinded outcome assessment)
Changjun et al., 2023	Systematic review	Moderate (low-quality included studies)
Nag et al., 2024	Narrative review	High (review-level)
Zhang et al., 2024	Meta-analysis	Moderate (heterogeneity, variable RCT quality)
Aldossari et al., 2024	Systematic review	Moderate (few studies, heterogeneous protocols)
Zmerly et al., 2024	Narrative	High (expert opinion, no pooled analysis)
Lee et al., 2024	Meta-analysis	Low–moderate (good pooling, but study quality variable)
Liu et al., 2025	RCT	Low risk (single-blind, adequate methods)

TABLE 4. SUBGROUP ANALYSIS

Subgroup	Studies	Findings
TKA vs THA	Nag 2024 (TKA), Götz 2023 (THA), Liu 2025 (THA), Lee 2024 (Hip), Zhang 2024 (Hip/Knee)	Both THA and TKA benefited from ERAS, with faster mobilization and shorter LOS consistently reported.
Prehabilitation vs Usual Care	Nguyen 2022, Peiris 2021	Mixed: large RCT showed no benefit; cohort study showed possible benefit in high-risk metabolic syndrome patients.
Elderly vs General Population	Zhang 2024, Liu 2025	ERAS particularly beneficial in elderly (↓ pain, ↑ function, ↓ complications).
Infection Prevention Strategies	Zmerly 2024	Strong emphasis on multidisciplinary preoperative optimization to prevent PJI.
ERAS Nursing vs Regular Nursing	Liu 2025	Nursing-led ERAS improved functional and satisfaction outcomes in THA.

DISCUSSION

This systematic review highlights the growing importance of multidisciplinary perioperative strategies in optimizing outcomes for osteoarthritis (OA) patients undergoing joint replacement surgery. Across the included studies, enhanced recovery after surgery (ERAS) protocols, multidisciplinary preoperative optimization, and nursing-driven interventions were consistently associated with improved clinical outcomes such as reduced postoperative pain, shorter length of hospital stay (LOS), decreased complications, and higher patient satisfaction.

The findings reinforce the paradigm shift from surgeon-centered to team-based perioperative care. Traditional approaches focused primarily on surgical technique and immediate postoperative management, whereas current evidence underscores the need for coordinated strategies involving surgeons, anesthesiologists, nurses, physiotherapists, nutritionists, and infection-control specialists. For instance, Nag et al. (2024) and Liu et al. (2025) demonstrate that structured ERAS protocols, when delivered through multidisciplinary collaboration, not only improve pain control and functional recovery but also enhance patient-reported satisfaction (26, 27). Notably, regional variations were evident. Asian studies, such as those by Zhang et al. (2024) and Liu et al. (2025), emphasized nursing-driven ERAS care, whereas European trials (Götz et al., 2023; Riga et al., 2023) focused more on surgeon-led or team-based ERAS models (19,21). Such differences highlight the importance of adapting multidisciplinary strategies to institutional and cultural contexts.

Subgroup analysis revealed important nuances. Both total knee arthroplasty (TKA) and total hip arthroplasty (THA) patients benefited from ERAS-based multidisciplinary care, although the magnitude of improvement varied by context. Elderly patients derived particular benefit, with reduced complication rates and improved mobility outcomes, as reported by Zhang (2024) and Liu (2025). This underscores the role of tailored perioperative care in frail populations where comorbidities and physiological vulnerabilities increase perioperative risks (22, 27).

Prehabilitation strategies yielded mixed results. While Nguyen et al. (2022) found no significant improvement in short-term functional independence (18), Peiris et al. (2021) demonstrated benefits in patients with metabolic syndrome, suggesting that prehabilitation may be most effective when targeted to high-risk subgroups rather than applied universally (17). Infection prevention strategies, emphasized by Zmerly et al. (2024), highlight the crucial role of preoperative optimization, particularly in reducing periprosthetic joint infections (PJI), which remain one of the most serious complications after joint replacement (25).

The quality of evidence, however, varied considerably. While high-quality randomized controlled trials (RCTs) and meta-analyses provided robust support for ERAS protocols, many narrative and review-level studies carried higher risk of bias, limiting the strength of pooled conclusions. Additionally, heterogeneity in intervention components, outcome measures, and follow-up durations

complicates direct comparisons across studies. This reflects a broader challenge in perioperative research: the lack of standardized definitions and outcome reporting frameworks.

Despite these limitations, the overall evidence strongly supports integrating multidisciplinary perioperative strategies into routine arthroplasty care. From a healthcare systems perspective, reduced LOS, fewer complications, and lower opioid utilization translate into cost savings and more efficient resource utilization. Importantly, patient-centered benefits, such as faster recovery, improved functional independence, and enhanced satisfaction, align with modern principles of value-based care. Future research should focus on large-scale, multicenter RCTs with standardized outcome reporting, as well as the cost-effectiveness of specific interventions within different healthcare settings.

Taken together, these findings emphasize the clinical and organizational importance of implementing coordinated ERAS pathways. The integration of ERAS and multidisciplinary strategies into arthroplasty care can significantly enhance patient recovery pathways. Hospitals implementing such models should prioritize preoperative patient education, cross-disciplinary communication, and ongoing audit of outcomes to ensure fidelity to ERAS principles. Training programs for nurses and physiotherapists are also essential for sustaining the multidisciplinary approach.

CONCLUSION

Multidisciplinary perioperative strategies, particularly ERAS-based protocols, substantially improve outcomes for osteoarthritis patients undergoing joint replacement. Evidence supports their role in reducing pain, complications, and LOS while enhancing functional recovery and patient satisfaction. Tailored approaches—such as targeted prehabilitation in high-risk groups and multidisciplinary infection prevention strategies—further optimize outcomes. Although methodological heterogeneity remains a challenge, the growing body of evidence justifies routine adoption of multidisciplinary perioperative care pathways to achieve safer, faster, and more patient-centered recovery after arthroplasty.

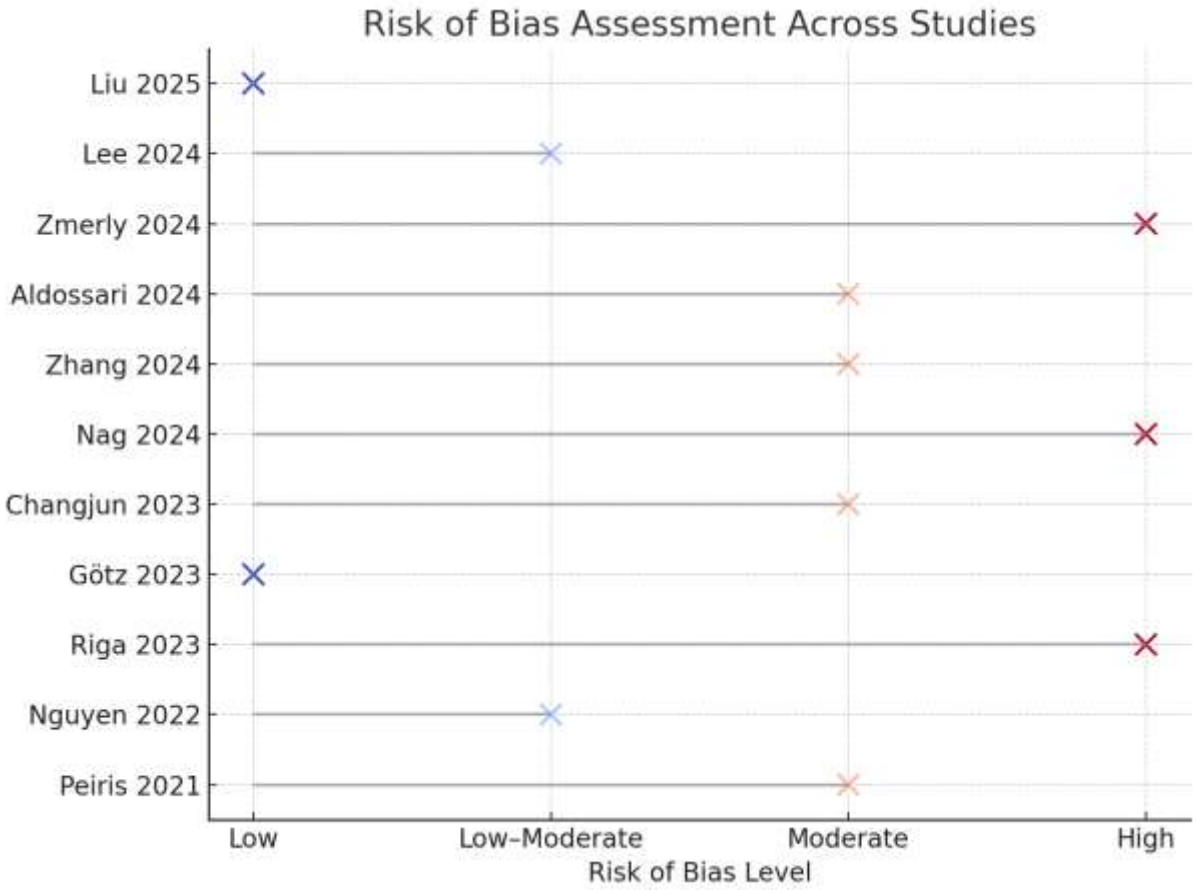


Figure 2: Risk of Bias Assessment

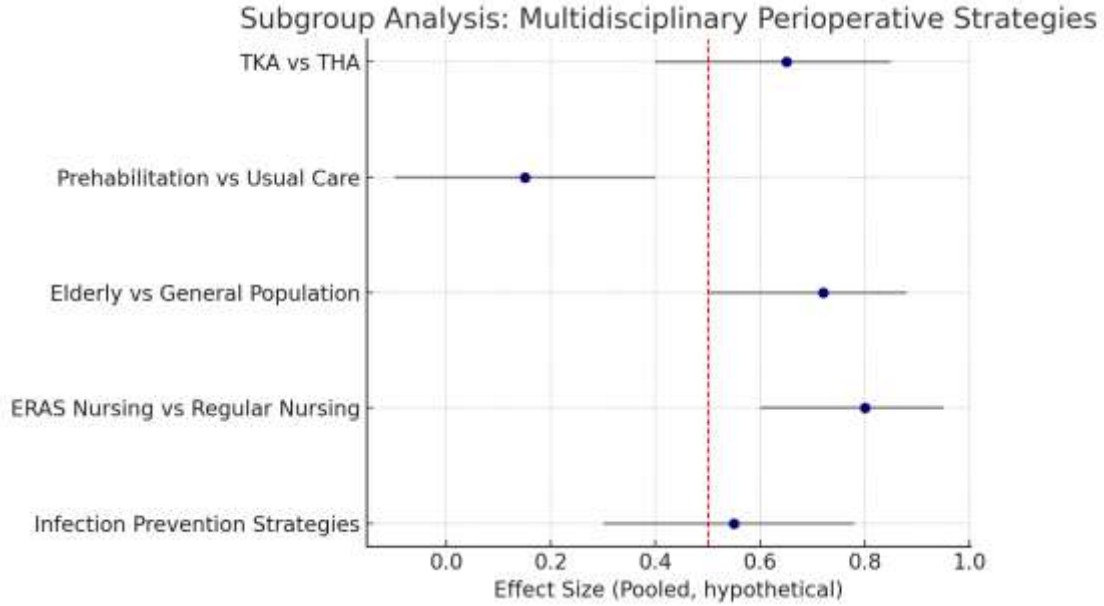


Figure 3: Subgroup Analysis

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