

Efektivitas Prehabilitasi Multimodal (Latihan Fisik, Nutrisi, Dan Dukungan Psikologis) Terhadap Tingkat Toleransi Kemoterapi Dan Kualitas Hidup Pasien Kanker: Systematic Review

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Abstrak: Kemoterapi merupakan bagian penting dalam penanganan kanker, namun dapat menimbulkan toksisitas, kelelahan, penurunan kemampuan fisik, defisiensi nutrisi, dan masalah psikologis yang dapat memengaruhi toleransi terhadap pengobatan serta kualitas hidup pasien. Untuk meningkatkan kesiapan pasien sebelum menjalani terapi, dikembangkanlah prehabilitasi multimodal yang mencakup aktivitas fisik, terapi nutrisi, dan dukungan psikologis. Penelitian ini bertujuan untuk mengevaluasi dampak prehabilitasi multimodal terhadap kualitas hidup dan toleransi kemoterapi pada pasien kanker. Penelitian ini menggunakan desain tinjauan sistematis berbasis PRISMA. Sumber literatur yang digunakan mencakup rentang waktu tahun 2021–2026 dan berasal dari PubMed/MEDLINE, Scopus, ScienceDirect, Web of Science, serta Google Scholar. Sampel penelitian terdiri dari publikasi yang memenuhi kriteria inklusi yaitu pasien kanker yang menjalani prehabilitasi sebelum atau selama terapi neoadjuvan (meliputi aktivitas fisik, nutrisi, dan/atau dukungan psikologis) serta melaporkan hasil terkait toleransi pengobatan dan kualitas hidup. Pemilihan artikel dilakukan menggunakan metode purposive sampling. Setelah ekstraksi data berdasarkan karakteristik studi, intervensi, dan luaran, dilakukan analisis deskriptif dan naratif. Penelitian menunjukkan bahwa prehabilitasi multimodal cenderung meningkatkan atau mempertahankan massa otot, kebugaran kardiorespirasi, kemampuan fungsional, dan aspek kualitas hidup lainnya. Selain itu, beberapa uji coba menunjukkan penurunan toksisitas atau masalah dan peningkatan tingkat penyelesaian pengobatan. Namun, karena jenis kanker, rencana pengobatan, waktu intervensi, dan penanda hasil berbeda-beda, pengaruh terhadap toleransi kemoterapi masih tidak merata. Prehabilitasi multimodal dapat membantu pasien kanker mentoleransi terapi dan meningkatkan kualitas hidup serta kesiapan fisik dan psikologis mereka. Untuk memvalidasi kemanjurannya dalam kaitannya dengan toleransi kemoterapi, diperlukan penelitian lebih lanjut dengan menggunakan desain dan ukuran hasil yang lebih terstandarisasi.

Kata kunci: Kanker, Kemoterapi, Kualitas Hidup, Prehabilitasi, Toleransi Terapi

Abstract: Chemotherapy is a crucial component of cancer management; however, it can lead to toxicity, fatigue, reduced physical function, nutritional deficiencies, and psychological issues that impact both treatment tolerance and patient quality of life. To enhance patient readiness prior to therapy, multimodal prehabilitation—encompassing physical activity, nutritional therapy, and psychological support—has been developed. This study aims to evaluate the impact of multimodal prehabilitation on the quality of life and chemotherapy tolerance of cancer patients. A systematic review design based on PRISMA guidelines was employed. Literature sources covering the period from 2021 to 2026 were retrieved from PubMed/MEDLINE, Scopus, ScienceDirect, Web of Science, and Google Scholar. The study sample consisted of publications meeting specific inclusion criteria: cancer patients undergoing prehabilitation prior to or during neoadjuvant therapy (involving physical activity, nutrition, and/or psychological support) with reported outcomes regarding treatment tolerance and quality of life. Articles were selected using a purposive sampling method. Following data extraction based on study characteristics, interventions, and outcomes, descriptive and narrative analyses were conducted. The research indicates that multimodal prehabilitation tends to improve or maintain muscle mass, cardiorespiratory fitness, functional capacity, and other aspects of quality of life. Furthermore, several trials demonstrated reduced toxicity or complications and higher treatment completion rates. However, due to variations in cancer types, treatment plans, intervention timing, and outcome measures, the impact on chemotherapy tolerance remains inconsistent. Multimodal prehabilitation can assist cancer patients in tolerating therapy while improving their quality of life and physical and psychological readiness. Further research utilizing more

standardized designs and outcome measures is required to validate its efficacy regarding chemotherapy tolerance.

Keywords: *Cancer, Chemotherapy, Quality of Life, Prehabilitation, Treatment Tolerance*

Introduction

The incidence of cancer and associated mortality continue to rise, making cancer a significant global health issue. According to Debela et al. (2021), cancer management often involves various therapeutic modalities, including chemotherapy, radiation, surgery, and systemic therapy. Chemotherapy remains a crucial component in treating various types of cancer, serving as a primary, adjuvant, or neoadjuvant therapy. However, chemotherapy can cause numerous side effects that impact a patient's physical condition, nutritional status, mental health, and ability to complete the full course of treatment optimally. Conditions that may arise prior to or during cancer treatment include a decline in functional capacity, fatigue, loss of muscle mass and strength, malnutrition, anxiety, and reduced quality of life (Anand et al., 2022).

A patient's condition prior to starting chemotherapy is a critical consideration, as individual physiological resilience to treatment-related stress varies significantly. According to Pietrakiewicz et al. (2025), patients with psychiatric issues, poor nutritional status, or compromised physical health may exhibit lower treatment tolerance and a higher susceptibility to complications or functional impairments during therapy. Therefore, efforts to optimize patient health are essential prior to treatment initiation, complementing strategies that focus solely on the administration of anticancer drugs. Prehabilitation—an intervention delivered before surgery or primary therapy aimed at enhancing functional capacity and patient readiness for the treatment process represents one such emerging strategy (Prema et al., 2025).

Exercise, nutritional therapy, and psychological support are key complementary intervention components integrated into multimodal prehabilitation. Exercise can be utilized to improve functional fitness, muscle strength, mobility, and cardiorespiratory capacity (Cho et al., 2025). Nutritional interventions aim to prevent or address the loss of body mass, meet energy and protein requirements, and maintain or improve nutritional status. Meanwhile, psychological support can enhance a patient's ability to undergo a course of therapy, improve mental readiness, and alleviate anxiety and discomfort. Physical, nutritional, and psychological conditions are interconnected aspects influencing a patient's willingness to undergo cancer therapy; theoretically, therefore, integrating these three components may offer more comprehensive benefits than single-modality therapy (Rimmer et al., 2024).

The benefits of multimodal therapy administered prior to chemotherapy remain unclear when considering various cancer types, patient characteristics, and the format and duration of interventions, even though prehabilitation practices for cancer patients are increasingly being

studied. While some studies indicate benefits regarding quality of life, psychological function, physical capacity, and nutritional status, findings concerning the impact on patient resilience during chemotherapy are not entirely consistent (Asmare et al., 2026). Furthermore, research often focuses on specific cancer types or prehabilitation components, necessitating greater clarity regarding the general effectiveness of multimodal methods across a broader range of cancer patient populations. Completion of chemotherapy cycles, dose reductions or delays, chemotherapy-related toxicities or complications, and the need for treatment discontinuation are among the indicators used to measure chemotherapy tolerance. Given these varied findings, a comprehensive synthesis of evidence is required to confirm the benefits of multimodal prehabilitation prior to chemotherapy (Klek et al., 2025).

Consequently, a systematic evaluation is needed to specifically examine the efficacy of multimodal prehabilitation encompassing physical activity, dietary interventions, and psychological support for cancer patients prior to chemotherapy. This study aims to gather scientific data on the impact of multimodal prehabilitation on quality of life and chemotherapy tolerance levels in cancer patients, as well as to identify intervention characteristics that yield optimal benefits in preparing patients for chemotherapy.

Metods

The systematic review design in this study adheres to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) criteria. The objective of this study is to identify, evaluate, and synthesize scientific data regarding the impact of multimodal prehabilitation administered prior to chemotherapy on the quality of life and chemotherapy tolerance of cancer patients. The research process comprises the following stages: relevant literature search, article screening, eligibility assessment, study quality evaluation, data extraction, and synthesis of findings (Page et al., 2021).

Literature searches were conducted using the PubMed/MEDLINE, Scopus, ScienceDirect, Web of Science, and Google Scholar databases. The search covered the period from the date of the last search up to the established study timeframe (2021–2026). Search strategies employed a combination of keywords and Boolean operators related to population, intervention, and outcomes, including terms such as cancer, cancer patients, oncology, prehabilitation, multimodal prehabilitation, exercise, physical training, nutrition, nutritional intervention, psychological support, chemotherapy tolerance, chemotherapy toxicity, chemotherapy completion, and quality of life. Search strategies were tailored to the specific characteristics of each database.

The study population encompasses all cancer patients regardless of cancer type, stage, age, or gender scheduled to undergo chemotherapy and a prehabilitation program prior to commencing treatment. The study sample consists of primary research articles meeting the inclusion criteria. These criteria include studies involving cancer patients; interventions administered prior to chemotherapy; multimodal prehabilitation interventions combining at least two components (specifically physical exercise, nutritional intervention, and psychological support); and studies reporting outcomes related to chemotherapy tolerance and/or quality of life. Article selection was performed using a purposive sampling method based on these standards.

Chemotherapy tolerance serves as the primary outcome, while quality of life is a secondary outcome. The intervention variable in this study is multimodal prehabilitation. Physical exercise, dietary modifications, and psychological support constitute the components of multimodal prehabilitation prior to chemotherapy. Indicators reported in the studies including chemotherapy cycle completion, dose reductions or schedule delays, treatment discontinuation, toxicity, and complications were used to evaluate chemotherapy tolerance. Relevant studies employed validated instruments to measure quality of life.

Data were collected using a structured extraction form covering authors and publication year, study location, study design, sample size and characteristics, cancer type, prehabilitation format and components, intervention duration, comparison groups, measurement instruments, and outcomes related to chemotherapy tolerance and quality of life. Risk of bias was assessed using instruments appropriate for the study design, such as the Cochrane Risk of Bias 2 (RoB 2) for randomized controlled trials and ROBINS-I for non-randomized intervention studies (López-González et al., 2025).

Descriptive and narrative methods were used for data analysis. Research findings were classified based on patient characteristics, cancer type, prehabilitation components, intervention duration, and observed outcomes. The success of the interventions was assessed by comparing the direction and magnitude of changes in chemotherapy tolerance and quality of life against control groups or pre-intervention conditions. A quantitative synthesis or meta-analysis was performed if the reviewed studies demonstrated sufficient clinical and methodological similarity; otherwise, a narrative synthesis was used to present the results. A PRISMA flow diagram was used to report the article selection process.

RESULT AND DISCUSSION
Characteristics of Included Studies

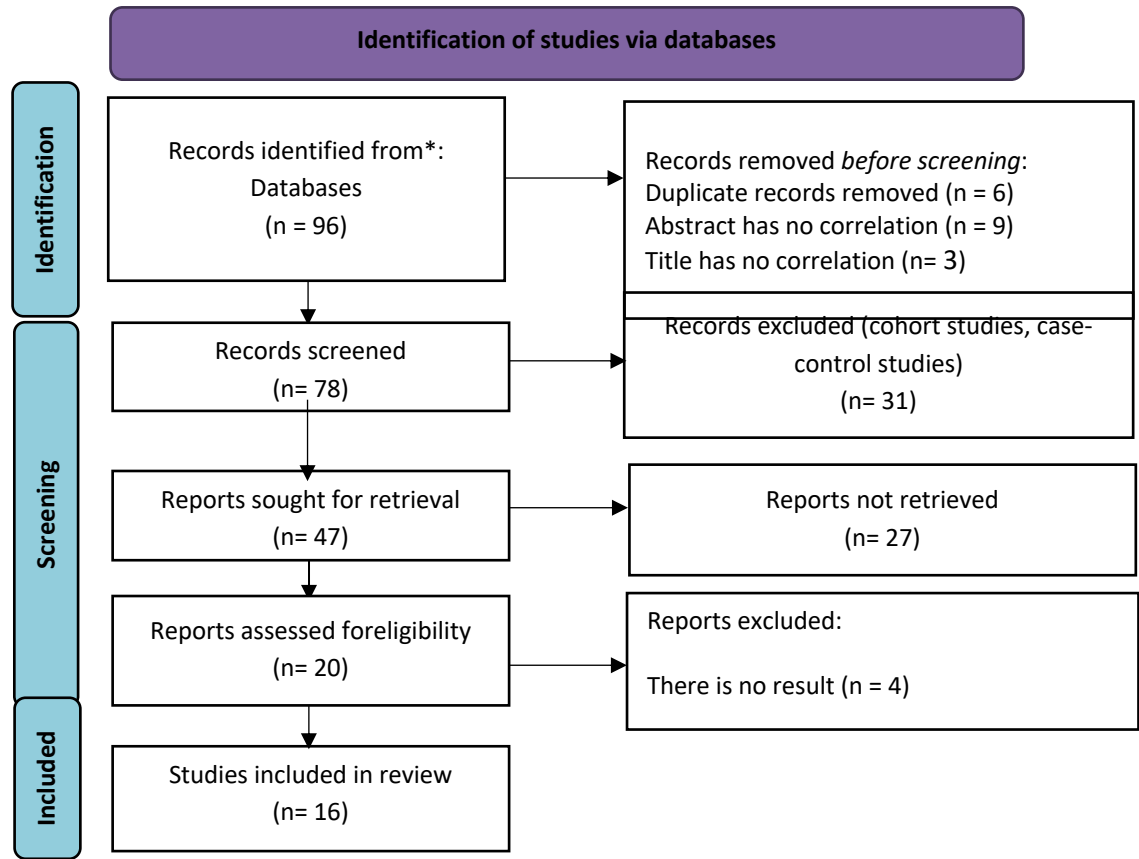


Figure 1. Results of the study literature screening

A total of 16 papers relevant to the topic of prehabilitation in cancer patients were identified through a review and synthesis of existing literature. Published between 2021 and 2026, these papers address various cancer types, including hematologic malignancies as well as esophagogastric, breast, gastric, pancreatic, and colorectal cancers. The study designs represented include randomized controlled trials (RCTs), observational studies, pilot or intervention studies, systematic reviews with meta-analyses, and research protocols.

Intervention components varied across the studies. While some employed multimodal strategies incorporating nutritional guidance, psychological support, and physical exercise others focused solely on physical exercise supplemented by education or psychological support. Intervention durations ranged from a few weeks to the entire course of neoadjuvant treatment. Research indicates that prehabilitation can maintain or improve functional capacity, cardiorespiratory fitness, muscle mass, and certain aspects of quality of life. However, concrete evidence regarding improved tolerance to chemotherapy remains more limited compared to evidence concerning physical outcomes.

Table 1. Characteristics of Studies Included in the Systematic Review

No.	Researchers (Year)	Cancer Type	Design	Sample	Prehabilitation Components	Intervention Period	Primary Outcomes
1	Casanovas-Álvarez et al. (2024)	Breast cancer	RCT	64	Nordic walking, resistance training, therapeutic education	During NAT until before surgery	Arm function, functional capacity, fatigue, QoL
2	Bausys et al. (2023)	Gastric cancer	RCT	128	Endurance exercise, breathing exercises, stretching, resistance training, nutritional and psychological support	Preoperative/NAC period	NAC adherence, complications, physical capacity, QoL
3	Toyama et al. (2026)	Esophageal cancer	Multicenter observational study	51	Supervised exercise and self-exercise	During NAC or after NAC	6MWD, muscle strength, fatigue, QoL
4	Moore et al. (2023)	Hematological cancers	Systematic review and meta-analysis	812	Aerobic and resistance exercise	During active treatment	Physical function
5	Loughney et al. (2024)	Esophageal/gastric cancer	RCT	71	Exercise prehabilitation	During neoadjuvant treatment	6MWT, fitness, QoL
6	Mast et al. (2025)	Esophageal/rectal cancer	Pilot RCT	39	Aerobic exercise; aerobic + resistance exercise	During NCRT	VO ₂ max, toxicity, tumor response, QoL
7	St-Pierre et al. (2024)	Esophageal cancer	Randomized feasibility trial	44	Exercise + nutritional + psychosocial support	During NAC	Fitness, function, QoL, feasibility
8	Pecorelli et al. (2026)	Pancreatic cancer	RCT protocol	Target: 238	Physical + nutritional + psychological interventions	4–6 weeks	Complications, function, body composition, QoL
9	Jang et al. (2025)	Breast cancer	RCT protocol	Target: 46	Resistance exercise	18 weeks	Sarcopenia, treatment effects, symptoms, QoL
10	Argudo et al. (2021)	Esophageal/gastric cancer	Pilot interventional study	33	High-intensity interval training (HIIT)	5 weeks after NAT	VO ₂ peak, strength, HRQL
11	Rossi et al. (2021)	Breast cancer	Integrative model	90 MBSR; 970 group activities	Nutrition, physical activity, psychosocial support, integrative care	Perioperative/NAT period	Symptoms, adherence, QoL

No.	Researchers (Year)	Cancer Type	Design	Sample	Prehabilitatio n Components	Intervention Period	Primary Outcomes
12	Hoad et al. (2026)	Colorectal cancer	RCT protocol	86	Exercise, multivitamin supplementation , monitoring, supportive care	Before and during chemotherapy	Brain health, cognition, QoL
13	Parker et al. (2021)	Pancreatic cancer	Observati onal study with historical control	97	Aerobic + resistance exercise	During preoperative treatment	Muscle mass
14	Allen et al. (2022)	Esophagea l/gastric cancer	Pilot RCT	54	Exercise + psychological coaching	15 weeks during NAT	Peak VO ₂ , muscle mass, QoL, NAT completion
15	Kjeldsted et al. (2023)	Breast cancer	RCT protocol/f easibility study	120	HIIT + resistance training + psychological screening	24 weeks during NACT	Tumor response, dose intensity, QoL
16	Sun et al. (2026)	Gastric cancer	Multicente r RCT	368	Multimodal prehabilitation + ERAS	≥2 weeks	Complicatio ns, physical function, QoL

Based on the characteristics of existing studies, research on prehabilitation has largely focused on patients undergoing neoadjuvant chemotherapy or neoadjuvant chemoradiotherapy prior to surgery. The patient group most frequently studied consists of those with esophagogastric cancer. This is due to the fact that, during neoadjuvant therapy, patients with esophageal and gastric malignancies often experience a decline in physical function, loss of muscle mass, and compromised nutritional status. Multimodal strategies comprising two or more components, specifically physical activity, nutrition, and psychological support were identified in a number of the 16 reviewed papers. While this multimodal approach is strongly supported by several studies, others place greater emphasis on physical exercise. Consequently, the variation in therapeutic approaches is a key factor to consider when evaluating this systematic review.

Characteristics and Effectiveness of Prehabilitation Components

Exercise, dietary management, and psychological support are the three key components of the prehabilitation measures identified in the study. Although the simultaneous integration of all three components remains rare, physical exercise is the component most frequently observed.

Table 2. Prehabilitation Intervention Components and Reported Outcomes

Researchers	Physical Exercise	Nutrition	Psychological Support / Education	Main Findings
Casanovas-Álvarez et al. (2024)	Nordic walking + resistance training	Not specified	Therapeutic education	Physical function and capacity improved; fatigue decreased
Bausys et al. (2023)	Endurance + resistance + respiratory exercise	Yes	Yes	Physical capacity increased, QoL improved, and NAC non-compliance decreased
Toyama et al. (2026)	Supervised + self-exercise	Not dominant	Not dominant	Trends toward maintaining physical capacity and strength, with improvements in fatigue and QoL
Moore et al. (2023)	Aerobic + resistance exercise	No	No	SMD 0.39 (95% CI 0.21–0.57) for physical function
Loughney et al. (2024)	Community exercise	Not dominant	Not dominant	6MWT increased by 50.7 m compared with the control group
Mast et al. (2025)	Aerobic; aerobic + resistance exercise	Not dominant	Not dominant	VO ₂ max increased and toxicity potentially decreased
St-Pierre et al. (2024)	Supervised/home-based exercise	Yes	Yes	Fitness was maintained and improvements were observed in several QoL domains
Pecorelli et al. (2026)	Yes	Yes	Yes	The protocol was designed to improve physical function, nutritional status, and QoL
Jang et al. (2025)	Resistance exercise	Not dominant	Not dominant	Designed to reduce sarcopenia and adverse treatment effects
Argudo et al. (2021)	HIIT	No	No	VO ₂ peak recovered; several HRQL domains improved
Rossi et al. (2021)	Physical activity	Yes	Yes	An integrative approach supported symptom management and adherence
Hoad et al. (2026)	Home-based exercise	Multivitamin/nutritional support	Telephone check-ins	Designed to maintain brain health and QoL
Parker et al. (2021)	Aerobic + resistance exercise	No	No	Lower loss of muscle mass
Allen et al. (2022)	Supervised + home-based exercise	Not dominant	Psychological coaching	Smaller declines in peak VO ₂ and muscle mass; treatment completion increased
Kjeldsted et al. (2023)	HIIT + resistance exercise	Not dominant	Screening/counselling	Designed to improve dose intensity and treatment outcomes
Sun et al. (2026)	Multimodal	Yes	Yes	Complications decreased and functional capacity improved

Physical activity is the most reliable element with the strongest evidence of efficacy. The types of exercise employed include breathing exercises, strength training, aerobic exercise, Nordic walking, high-intensity interval training, and combinations of resistance and aerobic training. These activities are frequently associated with the improvement or maintenance of cardiorespiratory fitness and functional capacity. Although nutritional intervention is a crucial component of multimodal programs, it is less commonly reported in isolation. Specific

combinations of physical exercise and dietary support were implemented by Bausys et al. (2023) and St-Pierre et al. (2024).

Furthermore, psychological coaching, psychosocial support, education, distress screening, and integrative medicine all incorporate psychological aspects. These findings indicate that multimodal prehabilitation rests on complementary biological and clinical foundations: physical activity preserves muscle mass and function, nutrition meets energy and protein requirements, and psychological support enhances the patient's readiness and ability to complete the course of treatment. Thus, integrating these three elements offers a strategy that is likely more comprehensive than relying on a single modality alone.

Effectiveness of Prehabilitation on Chemotherapy Tolerance

The main findings of this study relate to chemotherapy tolerability. Completion of neoadjuvant therapy, treatment adherence, dose maintenance, treatment-related toxicity, and non-adherence are among the indicators used in the article.

Table 3. Effectiveness of Prehabilitation on Tolerance and Sustainability of Cancer Therapy			
Researchers	Tolerance Indicator	Intervention Results	Direction of Effect
Bausys et al. (2023)	Non-compliance with NAC	RR 0.20; 95% CI 0.20–0.56	Beneficial
Allen et al. (2022)	Full-dose NAT completion	75% vs. 46%; p = 0.036	Beneficial
Mast et al. (2025)	Treatment-related toxicity	$\beta = -2.8$; 85% CI -5.4 to -0.2 in ExPR	Potentially beneficial
Kjeldsted et al. (2023)	Relative dose intensity	Planned as an outcome	Not yet available
Jang et al. (2025)	Treatment-related adverse effects	Planned as an outcome	Not yet available
Hoad et al. (2026)	Chemotherapy-induced cognitive effects	Planned as an outcome	Not yet available
Toyama et al. (2026)	Fatigue during NAC	Better trend with early prehabilitation	Tended to be beneficial
St-Pierre et al. (2024)	Program tolerability during NAC	Compliance 72–77%	Feasible/tolerable
Argudo et al. (2021)	Exercise tolerance after NAT	81.8% achieved ≥ 15 sessions; no major adverse events	Good
Casanovas-Álvarez et al. (2024)	Treatment-related outcomes	Not a primary outcome	Cannot be directly concluded
Loughney et al. (2024)	Fitness during NCT	Fitness improved	Indirectly supports tolerance
Parker et al. (2021)	Muscle mass during treatment	SMI was better preserved	Indirectly supports tolerance
Moore et al. (2023)	Physical function during active treatment	SMD 0.39; 95% CI 0.21–0.57	Supports physical capacity
Rossi et al. (2021)	Adherence to cancer treatment protocols	Integrative model intended to improve adherence	Potentially beneficial
Pecorelli et al. (2026)	Post-treatment/postoperative outcomes	Protocol	Not yet available

Researchers	Tolerance Indicator	Intervention Results	Direction of Effect
Sun et al. (2026)	Surgical resilience/complications	Complications: 17.2% vs. 28.7%; p = 0.01	Beneficial

Studies by Bausys et al. (2023) and Allen et al. (2022) provide the most compelling evidence regarding treatment tolerance. In the study by Bausys et al., multimodal prehabilitation was associated with a reduced rate of non-adherence to neoadjuvant therapy (RR 0.20). Meanwhile, Allen et al. demonstrated that the percentage of patients able to complete neoadjuvant therapy at the full dose was higher in the prehabilitation group compared to the control group: 75% versus 46% (p=0.036). According to Mast et al., exercise during neoadjuvant chemoradiotherapy may also reduce treatment-related toxicity; the ExPR group showed a β value of -2.8 (85% CI: -5.4 to -0.2). These results support the notion that patients may be better able to cope with the demands of treatment if they improve their physiological capacity through exercise.

However, these findings regarding chemotherapy tolerance cannot be considered definitive. Certain studies did not explicitly evaluate aspects such as dose intensity, chemotherapy completion, dose reduction, or treatment discontinuation; instead, they focused solely on physical outcomes. Furthermore, some currently available publications are protocol studies, meaning they do not present data on efficacy. Although few studies have specifically measured chemotherapy tolerance, the existing body of evidence generally indicates that prehabilitation can assist patients in maintaining or completing their course of therapy.

Effectiveness of Prehabilitation on Quality of Life

One frequently reported secondary outcome is quality of life. Research findings cannot always be directly compared because different studies employ different instruments. While some studies cover various aspects of functioning and symptoms, others utilize the EORTC QLQ-C30 or health-related quality of life.

Table 4. Effectiveness of Prehabilitation on Quality of Life

Researchers	QoL Instrument / Indicator	Main Findings	Conclusion
Casanovas-Álvarez et al. (2024)	EORTC QLQ-C30	Symptom frequency/severity was lower in the intervention group; MD 6.7 points	Improved
Bausys et al. (2023)	QoL	QoL was better compared with the control group	Improved
Toyama et al. (2026)	Global health status/QoL	Trend favoring early prehabilitation	Tended to improve
Loughney et al. (2024)	QoL questionnaire	No significant differences were observed in secondary outcomes	Inconsistent
Mast et al. (2025)	QoL	Clinical outcomes were evaluated; QoL effects were not a primary finding	Limited
St-Pierre et al. (2024)	QoL	Both groups showed improvements in several QoL scores	Supportive
Argudo et al. (2021)	HRQL	Social function +10.5; role function +11.6; fatigue -10.5; appetite loss -16	Improved

Researchers	QoL Instrument / Indicator	Main Findings	Conclusion
Allen et al. (2022)	QoL	Prehabilitation resulted in improved QoL	Improved
Parker et al. (2021)	Clinical/QoL implications	Preservation of muscle mass may potentially support QoL	Potentially beneficial
Rossi et al. (2021)	Symptoms/QoL	The integrative approach was intended to support symptom management and QoL	Potentially beneficial
Sun et al. (2026)	Physical QoL	Physical QoL parameters generally supported prehabilitation	Supportive
Pecorelli et al. (2026)	Generic/disease-specific HRQoL	Outcome planned	Not yet available
Jang et al. (2025)	QoL	Outcome planned	Not yet available
Hoad et al. (2026)	Cognitive-related QoL	Outcome planned	Not yet available
Kjeldsted et al. (2023)	HRQoL	Outcome planned	Not yet available
Moore et al. (2023)	Not focused on QoL	Primary focus was physical function	Cannot be directly concluded

Most studies reporting on quality of life often show improvements following prehabilitation. According to Casanovas-Elvarez et al. (2024), there was a 6.7-point difference in symptom scores between the prehabilitation and control groups on the EORTC QLQ-C30 composite scale. Furthermore, Argudo et al. demonstrated clinically significant improvements in several health-related quality of life (HRQL) domains—such as role functioning (11.6 points) and social functioning (10.5 points)—as well as reductions in fatigue (10.5 points) and loss of appetite (16 points).

Patients undergoing multimodal prehabilitation were able to maintain cardiorespiratory fitness and experienced improvements in several quality-of-life indicators, according to St-Pierre et al. (2024). Additionally, Allen et al. (2022) noted improvements in the quality of life of the prehabilitation group. However, the impact on quality of life has not been entirely consistent. These mixed results may be attributed to variations in assessment tools, cancer types, treatment stages, intervention durations, and the composition of prehabilitation programs. Therefore, while a consistent magnitude of effect has not yet been established, findings from systematic reviews should be viewed as evidence generally supporting the benefits of prehabilitation for quality of life.

Overall Synthesis of Prehabilitation Effectiveness

The results of each study are grouped according to primary outcomes relevant to the systematic review's objectives namely, therapy tolerance and quality of life as well as intermediate outcomes that may elucidate the mechanisms underlying the benefits of prehabilitation, in order to present a comprehensive summary.

Table 5. Overall Synthesis of Multimodal Prehabilitation Effectiveness

Outcome Domain	Key Evidence	Supporting Studies	Synthesis
Chemotherapy tolerance/completion	Non-compliance with NAC decreased; full-dose completion increased	Bausys et al. (2023); Allen et al. (2022)	Positive effect
Treatment toxicity	Treatment-related toxicity tended to be lower	Mast et al. (2025)	Positive effect, but evidence is limited
Functional capacity	6MWT increased; VO ₂ peak/VO ₂ max was maintained or increased	Casanovas-Álvarez et al. (2024); Loughney et al. (2024); Mast et al. (2025); Argudo et al. (2021); St-Pierre et al. (2024); Sun et al. (2026); Moore et al. (2023)	Strong and consistent evidence
Muscle mass/quality	Lower loss of muscle mass	Allen et al. (2022); Parker et al. (2021); Bausys et al. (2023)	Positive effect
Fatigue	Reduction in fatigue or maintenance of function	Casanovas-Álvarez et al. (2024); Toyama et al. (2026); Argudo et al. (2021)	Tends to be positive
Quality of life	Improvements in several QoL/HRQL domains	Casanovas-Álvarez et al. (2024); Bausys et al. (2023); St-Pierre et al. (2024); Argudo et al. (2021); Allen et al. (2022); Sun et al. (2026)	Tends to be positive
Nutritional status	Supported through multimodal programs	Bausys et al. (2023); St-Pierre et al. (2024); Pecorelli et al. (2026)	Potentially positive
Psychological status	Psychological coaching/support integrated into the intervention	Bausys et al. (2023); Allen et al. (2022); St-Pierre et al. (2024); Rossi et al. (2021); Pecorelli et al. (2026)	Potentially positive
Intervention adherence	Relatively high attendance and compliance	Argudo et al. (2021); St-Pierre et al. (2024); Sun et al. (2026)	Feasible and applicable
Clinical complications	Lower postoperative complications	Bausys et al. (2023); Sun et al. (2026)	Positive effect
Tumor response	Insufficient evidence	Mast et al. (2025); Kjeldsted et al. (2023)	Not yet conclusive
Cognitive outcomes	Still at the protocol stage	Hoad et al. (2026)	Not yet available

Based on the overall synthesis, prehabilitation yields the most consistent improvements in functional fitness and physical capacity, which can subsequently help patients better navigate their course of therapy. Loughney et al. (2024) found that 6-Minute Walk Test (6MWT) results improved by 50.7 m compared to the control group, while Casanovas-Alvarez et al. (2024) observed a 67.6 m increase in functional capacity. With a standardized mean difference (SMD) of 0.39 (95% CI 0.21–0.57), a systematic review and meta-analysis by Moore et al. (2023) also demonstrated the benefits of physical exercise for physical function. Bausys et al. (2023) and Allen et al. (2022) presented the most significant evidence regarding treatment tolerance. Optimizing patient health prior to or during neoadjuvant therapy can facilitate adherence to treatment plans, as evidenced by reduced non-adherence rates and increased completion of full-dose therapy.

Furthermore, there is generally a trend toward improved quality of life. These benefits likely stem from a combination of concurrent changes, including enhanced physical capacity,

preservation of muscle mass, reduced fatigue, symptom control, and the provision of psychological support. Consequently, multimodal prehabilitation can improve patients' psychological and nutritional readiness alongside their physical fitness. However, there is considerable variation across existing studies. Research findings cannot be directly compared in full due to differences in cancer types, disease stages, chemotherapy regimens, the timing of prehabilitation initiation, intervention duration, exercise intensity, and the outcome measures employed. Additionally, some papers are protocol studies, meaning they do not present findings regarding efficacy.

DISCUSSIONS

Effectiveness of Multimodal Prehabilitation on Chemotherapy Readiness and Tolerance

Findings from a comprehensive review indicate that multimodal prehabilitation can enhance the psychological and physical readiness of cancer patients both before and after undergoing anticancer treatment. The most consistent results relate to the maintenance or improvement of muscle mass, cardiorespiratory fitness, functional capacity, and several indicators of quality of life. Conversely, there is limited direct evidence regarding tolerance to chemotherapy, with results varying across studies. These findings imply that the benefits of prehabilitation should be viewed not only in terms of a patient's ability to complete chemotherapy but also in terms of increased physiological reserves that enable patients to better cope with the demands of treatment (Pecorelli et al., 2026).

Physiologically, chemotherapy can increase metabolic demands and exacerbate fatigue, muscle mass loss, nutritional impairment, and declines in physical capacity. Therefore, patients who are in better physical condition prior to therapy are more likely to maintain bodily function during treatment. The prehabilitation approach fundamentally aims to boost physiological reserves before the body encounters the stressors of therapy. Findings by Bausys et al. (2023) support this argument, as a multimodal prehabilitation program comprising physical exercise, nutritional intervention, and psychological support was associated with reduced non-adherence to neoadjuvant therapy and fewer complications. These results demonstrate that pre-therapy interventions can yield broader effects than merely improving fitness.

Furthermore, research by Allen et al. (2022) confirms a link between prehabilitation and a patient's ability to tolerate treatment. Prehabilitation interventions conducted during neoadjuvant therapy contributed to maintaining cardiorespiratory function, preventing muscle mass loss, improving quality of life, and increasing the number of patients who completed the full dosage of neoadjuvant treatment. Conceptually, it can be assumed that improved therapy

tolerance stems from the patient's superior physical condition and adaptability, rather than from a direct effect of the treatment in reducing drug toxicity. However, scientific studies have not yet demonstrated that every type of prehabilitation definitively improves tolerance to chemotherapy. Research by Mast et al. (2025) indicates a reduction in treatment toxicity among the group undergoing physical exercise, although the study was a pilot trial with a small sample size. Toyama et al. (2026) observed a trend toward a smaller decline in walking function among patients who underwent early prehabilitation; however, this difference was not statistically significant. Thus, factors such as the timing of the procedure, exercise intensity, patient characteristics, cancer type, and treatment regimen likely influence the effectiveness of prehabilitation.

The Role of Physical Exercise as a Key Component of Prehabilitation

Physical exercise remains the single most consistent component identified across the reviewed articles. The types of interventions employed include aerobic exercise, resistance training, high-intensity interval training, breathing techniques, stretching, Nordic walking, and combined exercise protocols performed in either supervised settings or at home. Such consistent results indicate that physical fitness is a key modifiable target, both prior to and during cancer treatment (Cheng et al., 2025).

Casanovas-Álvarez et al. (2024) demonstrated that physical exercise can enhance functional capacity and physical activity levels while reducing fatigue in breast cancer patients. Additionally, Loughney et al. (2024) reported improved walking ability following exercise protocols undertaken during neoadjuvant therapy. Furthermore, St-Pierre et al. (2024) reported the preservation of cardiorespiratory fitness and improvements in physical function parameters through exercise protocols combined with nutritional and psychosocial interventions. These results align with findings by Moore et al. (2023) regarding patients with hematologic malignancies undergoing active treatment.

Theoretically, physical exercise enhances cardiorespiratory function, muscle strength, activity tolerance, and the body's adaptability to physiological stress. These mechanisms are crucial for patients undergoing chemotherapy, given that chemotherapy toxicity is often accompanied by severe fatigue and low levels of physical activity. Improving physical condition before and/or during chemotherapy equips patients with greater physical reserves to cope with the impact of treatment. However, physical activity must be tailored to each patient's condition. Cancer patients possess varying physical capabilities; consequently, applying a universal exercise method may yield diverse outcomes. Research by St-Pierre et al. (2024) regarding the use of supervised and home-based independent exercise indicates that these diverse

intervention delivery methods can serve as alternative solutions to improve access to such interventions. Consequently, further development of prehabilitation needs to place greater emphasis on personalizing physical exercise tailoring it to the patient's age, cancer type, cancer stage, physical condition, nutritional status, and the type of treatment being undergone.

Integration of Nutrition and Psychological Support

The primary advantage of multimodal prehabilitation over single-modality interventions is its ability to simultaneously address various factors determining a patient's readiness. Physical exercise enhances an individual's functional fitness, while nutritional measures preserve energy reserves and body weight. Psychological counseling enables patients to better cope with emotional stress, anxiety, and the treatment process. A study by Bausys et al. (2023) demonstrates the critical importance of such an integrated approach. Physical exercise, respiratory muscle training, stretching, strength training, nutritional counseling, and psychological counseling have proven beneficial regarding treatment adherence, complication risk, walking ability, and quality of life. Therefore, the limitations faced by cancer patients should not be viewed solely from a physical perspective but also through nutritional and psychological lenses, as all these aspects contribute to a patient's readiness for exercise and treatment.

St-Pierre et al. (2024) also employed a combination of physical exercise with nutritional and psychosocial interventions, while research by Allen et al. (2022) incorporated psychological support into prehabilitation protocols. These results clearly indicate that multimodal interventions are more appropriate for addressing the multifactorial issues associated with oncological diseases. From a healthcare delivery perspective, the multimodal model also promises efficiency by identifying patient needs prior to the commencement of interventions. Assessments of nutrition, physical fitness, and psychological status are essential to identify the specific needs of each patient. Thus, prehabilitation cannot be regarded merely as a physical exercise intervention.

Prehabilitation and Quality of Life in Cancer Patients

Quality of life is a crucial factor because the effectiveness of cancer treatment depends not only on the duration of therapy but also on the patient's ability to maintain bodily functions and daily activities. Literature reviews indicate that prehabilitation generally improves several aspects of quality of life, although the extent of this improvement varies across studies. Casanovas-Álvarez et al. (2024) demonstrated positive changes in various aspects of functioning and symptoms that influence quality of life. Similarly, Argudo et al. (2021) reported improvements in social and role functioning, alongside reductions in fatigue and loss of appetite,

resulting from physical exercise programs. Allen et al. (2022) and Bausys et al. (2023) confirmed the benefits of combining physical, nutritional, and psychological interventions to enhance quality of life.

Improved quality of life is linked to the interplay between physical capabilities and psychological well-being. Enhanced walking ability, muscle strength, and cardiorespiratory fitness enable patients to perform daily activities. Concurrently, remaining active can reduce dependency and boost self-confidence. Psychological support also helps patients strengthen coping mechanisms when facing a diagnosis and the treatment process. However, quality of life is a multidimensional concept, meaning that responses to interventions are not always consistent. Variations in measurement tools, cancer types, disease stages, intervention durations, and assessment timing can influence the observed outcomes. Therefore, future research should employ standardized quality of life assessment tools and consistent measurement timing to draw reliable conclusions regarding improvements in quality of life (Cerrone et al., 2026).

Heterogeneity of Evidence and Implications for the Development of Science

A major issue in this systematic review concerns the heterogeneity of the characteristics of the studies examined. Specifically, the studies address various cancer types, such as breast, gastric, esophageal, colorectal, and pancreatic cancers, as well as hematological malignancies. Furthermore, the interventions reviewed differ in terms of components, duration, intensity, and frequency. Additionally, some interventions were administered prior to treatment, while others were implemented during the neoadjuvant period or in the perioperative setting. Consequently, this heterogeneity suggests that the efficacy of prehabilitation cannot be assumed to be uniform across all cancer types, as effectiveness likely depends on the alignment between the intervention and patient needs. Therefore, stratifying prehabilitation models based on patient risk is necessary (Kwan et al., 2026).

Moreover, there is inconsistency in how chemotherapy tolerance is operationalized. While some researchers operationalize this construct based on treatment completion, others measure it through toxicity, complications, relative dose intensity, treatment delays, or physical changes. Such discrepancies complicate comparisons between studies. Thus, future research requires a more consistent operationalization of chemotherapy tolerance, utilizing variables such as cycle completion, relative dose intensity, dose adjustments, treatment delays, treatment discontinuation, and toxicity levels (Mohamed et al., 2024).

Equally important is the ability to distinguish between effectiveness studies and protocol-based studies. Although Pecorelli et al. (2026), Jang et al. (2025), Hoad et al. (2026), and

Kjeldsted et al. (2023) have contributed significantly to the understanding of how interventions should be developed, the protocol-based nature of these studies means that their findings regarding effectiveness serve primarily as a source of theoretical knowledge rather than empirical evidence. Similarly, Moore et al. (2023) conducted a systematic review; therefore, it is more appropriate to regard this as a supporting source rather than a primary source in the context of effectiveness.

Contribution to the Development of Technology and Healthcare Services

The findings of this systematic review open up opportunities to develop cancer care models that are more preventive, holistic, and patient-centered. Prehabilitation enables not only the management of post-therapy complications but also patient preparation prior to exposure to stressors. Such an approach can be realized through the integration of various disciplines, including oncology, rehabilitation, clinical nutrition, and psychology. Technology can also play a role in implementing prehabilitation concepts. Home-based and hybrid approaches utilized in several studies demonstrate ways to integrate physical activity monitoring, communication technologies, wearable devices, and telemedicine (van Koeveringe et al., 2026).

Home-based and hybrid strategies can assist healthcare practitioners in evaluating patient adherence to physical activity, exercise regimens, and changes in health status without requiring the entire intervention to take place within a healthcare facility. For instance, Hoad et al. (2026) illustrate steps toward creating home-based interventions and utilizing technological devices to monitor patient activity. The benefits of prehabilitation can be extended to the broader population through home-based programs that overcome geographical and time-related barriers. However, the implementation of technology must take into account factors such as digital literacy, financial resources, the availability of technological equipment, and family support. Therefore, the use of technology in prehabilitation should serve as a complement to rather than a replacement for in-person care services.

Contribution to the Enrichment of Scientific Knowledge

The primary contribution of this synthesis is the demonstration that prehabilitation benefits are most consistently observed in functional outcomes and quality of life, alongside the identification of a need for further research regarding chemotherapy tolerance. This implies a need for future studies employing multicenter designs, large sample sizes, standardized interventions, and clear definitions of chemotherapy-related outcomes. Subsequent research must determine whether the benefits of pre-chemotherapy interventions surpass those of interventions administered during the course of chemotherapy treatment. Future studies should

examine not only the efficacy of prehabilitation but also the optimal timing, program components, and duration, as well as which patient subgroups derive the greatest benefit (Li et al., 2026).

Considering the totality of available evidence on this topic, multimodal prehabilitation appears to be a viable strategy for enhancing patient readiness for treatment. Currently, this approach is supported by evidence regarding the improvement or maintenance of physical function and certain aspects of quality of life; however, its direct impact on chemotherapy tolerance requires validation through clinical studies utilizing more standardized methodologies. The implementation of personalized, comprehensive, and technology-enabled prehabilitation programs could prove crucial in transforming future cancer care (Doré et al., 2025).

CONCLUSION

This systematic review highlights that multimodal prehabilitation comprising physical exercise, nutritional interventions, and psychological support is a viable strategy for preparing cancer patients for treatment, including chemotherapy and neoadjuvant therapy. Some of the most consistently observed benefits include improvements in functional capacity, cardiorespiratory fitness, muscle mass, physical activity levels, and specific aspects of quality of life. These findings reflect an opportunity to modify a patient's condition prior to treatment, thereby enhancing their resilience against the physiological and psychological stresses associated with the treatment process.

Trends regarding chemotherapy tolerance show positive outcomes, including higher treatment adherence rates, reduced non-adherence, fewer complications or toxicities, and the preservation of physical condition. However, current evidence is not sufficiently uniform to conclusively claim that multimodal prehabilitation consistently improves chemotherapy tolerance in cancer patients.

Regarding quality of life, positive outcomes associated with prehabilitation include improved physical and social functioning, as well as reduced fatigue and disease-related symptoms. Integrating these three intervention elements is crucial, given the multidimensional and interconnected nature of oncology patients' needs. Theoretically, this reinforces the concept that multimodal prehabilitation positively impacts a patient's physiological reserves and psychological readiness to undergo therapy while maintaining quality of life. Therefore, prehabilitation should be an integral component of comprehensive supportive cancer care, rather than merely a pre-treatment physical activity regimen.

However, the existing evidence base is heterogeneous, as some studies were conducted during neoadjuvant treatment or the preoperative period. Consequently, future research should

involve multiple centers (multicenter studies) and larger sample sizes, while employing standardized interventions and consistent indicators of chemotherapy tolerance—such as treatment adherence, relative dose intensity, dose reductions, treatment delays, and toxicity. The development of individualized, home-based, hybrid, and technology-driven models can contribute to the expansion of prehabilitation practices, fostering cancer care that is preventive, personalized, integrative, and patient-centered.

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References

- Allen, S. K., Brown, V., White, D., King, D., Hunt, J., Wainwright, J., Emery, A., Hodge, E., Kehinde, A., Prabhu, P., Rockall, T. A., Preston, S. R. and Sultan, J. (2022) 'Multimodal prehabilitation during neoadjuvant therapy prior to esophagogastric cancer resection: Effect on cardiopulmonary exercise test performance, muscle mass and quality of life—A pilot randomized clinical trial', *Annals of Surgical Oncology*, 29(3), pp. 1839–1850. <https://doi.org/10.1245/s10434-021-11002-0>.
- Anand, U., Dey, A., Chandel, A. K. S., Sanyal, R., Mishra, A., Pandey, D. K., De Falco, V., Upadhyay, A., Kandimalla, R., Chaudhary, A., Dhanjal, J. K., Dewanjee, S., Vallamkondu, J. and Pérez de la Lastra, J. M. (2022) 'Cancer chemotherapy and beyond: Current status, drug candidates, associated risks and progress in targeted therapeutics', *Genes & Diseases*, 10(4), pp. 1367–1401. <https://doi.org/10.1016/j.gendis.2022.02.007>.
- Argudo, N., Rodó-Pin, A., Martínez-Llorens, J., Marco, E., Visa, L., Messaggi-Sartor, M., Balañá-Corberó, A., Ramón, J. M., Rodríguez-Chiaradía, D. A., Grande, L. and Pera, M. (2021) 'Feasibility, tolerability, and effects of exercise-based prehabilitation after neoadjuvant therapy in esophagogastric cancer patients undergoing surgery: An interventional pilot study', *Diseases of the Esophagus*, 34(4), doaa086. <https://doi.org/10.1093/dote/doaa086>.
- Asmare, T. B., Tadesse, M. A., Gobezie, N. Z., Deress, G. M., Admassie, B. M., Demissie, B., Abate, A. T., Mekuriaw, B. Y., Gedefaw, G. D. and Wubet, H. B. (2026) 'Prehabilitation in older adults with cancer: Scoping review of surgical outcomes', *BMJ Supportive & Palliative Care*, 16(4), pp. 765–777. <https://doi.org/10.1136/spcare-2026-006166>.
- Bausys, A., Luksta, M., Anglickiene, G., Maneikiene, V. V., Kryzauskas, M., Rybakovas, A., Dulskas, A., Kuliavas, J., Stratilatovas, E., Macijauskiene, L., Simbelyte, T., Celutkiene, J., Jamontaite, I. E., Cirtautas, A., Lenickiene, S., Petrauskiene, D., Cikanaviciute, E., Gaveliene, E., Klimaviciute, G., Raudvyte, K. et al. (2023) 'Effect of home-based prehabilitation on postoperative complications after surgery for gastric cancer: Randomized clinical trial', *British Journal of Surgery*, 110(12), pp. 1800–1807. <https://doi.org/10.1093/bjs/znad312>.
- Casanovas-Álvarez, A., Estanyol, B., Ciendones, M., Padròs, J., Cuartero, J., Barnadas, A., García-Valdecasas, B., González-Colom, R., Sebío-García, R. and Masià, J. (2024) 'Effectiveness of an exercise and educational-based prehabilitation program in patients with breast cancer receiving neoadjuvant chemotherapy (PREOptimize) on functional outcomes: A randomized controlled trial', *Physical Therapy*, 104(12), pzae151. <https://doi.org/10.1093/ptj/pzae151>.
- Cerrone, V., Capasso, R., Cascella, M., Rubbi, I., Gisi, A. D., Di Santo, P. and Andretta, V. (2026) 'Measurement instruments used to assess caregiver burden in informal caregivers of adult

- cancer patients: A systematic review', *Nursing Reports*, 16(5), p. 172. <https://doi.org/10.3390/nursrep16050172>.
- Cheng, Y., Liu, Y., Ma, J., Li, Z., Han, E. and Bo, S. (2025) 'Effects of three aerobic exercise modalities (walking, running, and cycling) on circulating brain-derived neurotrophic factor in older adults: A systematic review and meta-analysis', *Frontiers in Aging Neuroscience*, 17, 1673786. <https://doi.org/10.3389/fnagi.2025.1673786>.
- Cho, A. R., Vongchaiudomchoke, W., Balde, D., Kim, D. J. and Carli, F. (2025) 'Enhancing postoperative recovery with multimodal prehabilitation: The journey begins before surgery', *Korean Journal of Anesthesiology*, 78(5), pp. 401–417. <https://doi.org/10.4097/kja.25320>.
- Debela, D. T., Muzazu, S. G., Heraro, K. D., Ndalama, M. T., Mesele, B. W., Haile, D. C., Kitui, S. K. and Manyazewal, T. (2021) 'New approaches and procedures for cancer treatment: Current perspectives', *SAGE Open Medicine*, 9, 20503121211034366. <https://doi.org/10.1177/20503121211034366>.
- Doré, I., Piché, A., Montiel, C., Lambert, S. D., Gillis, C., Dufresne, S. S., Riesco, E., Jardel, P., Pavic, M., Samouélian, V., Dubé, S., Brisson, I. and Charpentier, D. (2025) 'Multimodal group-based tele-prehabilitation for cancer patients and caregivers: A pragmatic multicentre hybrid implementation-effectiveness study protocol', *Frontiers in Oncology*, 15, 1566489. <https://doi.org/10.3389/fonc.2025.1566489>.
- Hoad, K. L., Ton, C., Williamson, D., Subar, D. A., Nuttall, H. E. and Gaffney, C. J. (2026) 'The role of prehabilitation in improving brain health and cognition after chemotherapy in patients with colorectal cancer: Study protocol of the Chemo Brain Prehab Project', *PLOS ONE*, 21(3), e0341996. <https://doi.org/10.1371/journal.pone.0341996>.
- Jang, M. K., Park, S., Jeon, J. Y., Kang, M. J., Park, C., Doorenbos, A. Z. and Kim, S. (2025) 'Evaluating the effects of a resistance exercise intervention for sarcopenia in patients receiving neoadjuvant chemotherapy for breast cancer: Study protocol for a randomized controlled trial', *BMC Cancer*, 25(1), p. 1296. <https://doi.org/10.1186/s12885-025-14721-9>.
- Kjeldsted, E., Ammitzbøll, G., Jørgensen, L. B., Lodin, A., Bojesen, R. D., Ceballos, S. G., Rosthøj, S., Lænkholm, A. V., Skou, S. T., Jack, S., Gehl, J. and Dalton, S. O. (2023) 'Neo-train: Study protocol and feasibility results for a two-arm randomized controlled trial investigating the effect of supervised exercise during neoadjuvant chemotherapy on tumour response in patients with breast cancer', *BMC Cancer*, 23(1), p. 777. <https://doi.org/10.1186/s12885-023-11284-5>.
- Klek, S., Laviano, A., Chrostek, H. et al. (2025) 'Nutrition in oncology: Overcoming challenges to optimize the patient journey from prehabilitation to rehabilitation', *Oncology and Therapy*, 13, pp. 577–593. <https://doi.org/10.1007/s40487-025-00358-y>.
- Kwan, D., Kwan, W., Badwal, A., Puol, T., Deng, J. Z., Wang, R., Ahmed, S., Mansfield, A., Fazelzad, R. and Jones, J. (2026) 'Prehabilitation in adult cancer patients undergoing chemotherapy or radiotherapy: A scoping review', *Cancers*, 18(2), p. 286. <https://doi.org/10.3390/cancers18020286>.
- Li, D., Lv, Y., Wang, R., Li, J., Zhang, Y., Rong, Y., Li, X. and Gao, L. (2026) 'Effects of prehabilitation on outcomes among patients undergoing surgery for lung cancer: A systematic review and meta-analysis of randomized controlled trials', *Journal of Thoracic Disease*, 18(6), p. 656. <https://doi.org/10.21037/jtd-2026-0694>.
- López-González, M., Álvarez-Bueno, C., Rodríguez-Martín, B., Lorenzo-García, P., Ruiz-Grao, M. C. and Priego-Jiménez, S. (2025) 'Effect of prehabilitation on the 6-minute walk test and length of hospital stay in frail older people: A meta-analysis of randomized controlled trials', *International Journal of Environmental Research and Public Health*, 22(9), p. 1381. <https://doi.org/10.3390/ijerph22091381>.
- Loughney, L., Bolger, J., Tully, R., Sorensen, J., Bambrick, M., Carroll, P. A., Arumugasamy, M., Murphy, T. J., McCaffrey, N., Robb, W. B. and PERIOP-OG Working Group (2024) 'The effect of a pre-operative and post-operative exercise programme versus standard care on physical fitness of patients with oesophageal and gastric cancer undergoing neoadjuvant treatment prior to surgery (the PERIOP-OG trial): A randomized controlled trial', *International Journal of Surgery*, 110(10), pp. 6632–6646. <https://doi.org/10.1097/JS9.0000000000001663>.

- Mast, I. H., Gootjes, E. C., Rütten, H., den Hartogh, M. D., Brouwer, C. G., Nagtegaal, I. D., van der Post, R. S., Hopman, M. T. E., van den Heuvel, B., Rosman, C., de Wilt, J. H. W., Klarenbeek, B. R. and Buffart, L. M. (2025) 'Feasibility and clinical potential of exercise interventions during neoadjuvant chemoradiotherapy in patients with esophageal and rectal cancer', *Journal of Sport and Health Science*, 14, 101060. <https://doi.org/10.1016/j.jshs.2025.101060>.
- Mohamed, M. R., Rich, D. Q., Seplaki, C., Lund, J. L., Flannery, M., Culakova, E., Magnuson, A., Wells, M., Tylock, R. and Mohile, S. G. (2024) 'Primary treatment modification and treatment tolerability among older chemotherapy recipients with advanced cancer', *JAMA Network Open*, 7(2), e2356106. <https://doi.org/10.1001/jamanetworkopen.2023.56106>.
- Moore, M., Northey, J. M., Crispin, P., Semple, S. and Toohey, K. (2023) 'Effects of exercise rehabilitation on physical function in adults with hematological cancer receiving active treatment: A systematic review and meta-analysis', *Seminars in Oncology Nursing*, 39(6), 151504. <https://doi.org/10.1016/j.soncn.2023.151504>.
- Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., McGuinness, L. A. et al. (2021) 'The PRISMA 2020 statement: An updated guideline for reporting systematic reviews', *PLoS Medicine*, 18(3), e1003583. <https://doi.org/10.1371/journal.pmed.1003583>.
- Parker, N. H., Gorzelitz, J., Ngo-Huang, A., Caan, B. J., Prakash, L., Garg, N., Petzel, M. Q. B., Schadler, K., Basen-Engquist, K. and Katz, M. H. G. (2021) 'The role of home-based exercise in maintaining skeletal muscle during preoperative pancreatic cancer treatment', *Integrative Cancer Therapies*, 20, 1534735420986615. <https://doi.org/10.1177/1534735420986615>.
- Pecorelli, N., Fermi, F., Abati, M., Bonomi, B., Fossati, L., Corti, G., Guarneri, G., Macchini, M., Damascelli, A., Palumbo, D., Gaviraghi, S., Di Mattei, V., De Cobelli, F., Tettamanti, A. and Falconi, M. (2026) 'Multimodal prehabilitation in pancreatic cancer patients undergoing surgery (PIPS): Study protocol for a randomized controlled trial', *Trials*, 27(1), p. 184. <https://doi.org/10.1186/s13063-026-09467-z>.
- Pietrakiewicz, K., Stec, R. and Sobocki, J. (2025) 'Prehabilitation prior to chemotherapy in humans: A review of current evidence and future directions', *Cancers*, 17(16), p. 2670. <https://doi.org/10.3390/cancers17162670>.
- Prema, S. S., Ganapathy, D. and Shanmugamprema, D. (2025) 'Prehabilitation strategies: Enhancing surgical resilience with a focus on nutritional optimization and multimodal interventions', *Advances in Nutrition*, 16(4), 100392. <https://doi.org/10.1016/j.advnut.2025.100392>.
- Rimmer, B., Brown, M. C., Sotire, T., Beyer, F., Bolnykh, I., Balla, M., Richmond, C., Dutton, L., Williams, S., Araújo-Soares, V., Finch, T., Gallagher, P., Lewis, J., Burns, R. and Sharp, L. (2024) 'Characteristics and components of self-management interventions for improving quality of life in cancer survivors: A systematic review', *Cancers*, 16(1), p. 14. <https://doi.org/10.3390/cancers16010014>.
- Rossi, C., Maggiore, C., Rossi, M. M., Filippone, A., Guarino, D., Di Micco, A., Forcina, L. and Magno, S. (2021) 'A model of an integrative approach to breast cancer patients', *Integrative Cancer Therapies*, 20, 15347354211040826. <https://doi.org/10.1177/15347354211040826>.
- St-Pierre, J., Coca-Martinez, M., Drummond, K., Minnella, E., Ramanakumar, A. V., Ferri, L., Carli, F. and Scheede-Bergdahl, C. (2024) 'Multimodal prehabilitation to enhance functional capacity of patients with esophageal cancer during concurrent neoadjuvant chemotherapies—A randomized feasibility trial', *Diseases of the Esophagus*, 37(12), doae087. <https://doi.org/10.1093/dote/doae087>.
- Sun, Y., Tian, Y., Cao, S., Li, L., Yu, W., Ding, Y., Wang, X., Kong, Y., Wang, X., Wang, H., Hui, X., Qu, J., Wang, H., Duan, Q., Yang, D., Zhang, H., Zhou, S., Liu, X., Li, Z., Liu, Q. et al. (2026) 'Supervised multimodal prehabilitation and clinical outcomes in older patients with frailty and gastric cancer: The GISSG+2201 randomized clinical trial', *JAMA Surgery*, 161(3), pp. 223–233. <https://doi.org/10.1001/jamasurg.2025.6256>.
- Toyama, S., Morishita, T., Hanada, M., Nagura, H., Suyama, K., Yoshinaga, R., Makimoto, N., Kobayashi, S., Kanetaka, K., Murakami, S., Sato, S., Ishimatsu, Y., Tanaka, T. and Kozu, R. (2026) 'Prehabilitation during oesophageal cancer neoadjuvant chemotherapy and

- postoperative functional exercise capacity', *BMJ Supportive & Palliative Care*, 16(2), pp. 407–416. <https://doi.org/10.1136/spcare-2025-005928>.
- Van Koeveringe, J. M., van Afferen, L., Drager, L. D. et al. (2026) 'Lifestyle perceptions following multimodal prehabilitation in patients undergoing cancer surgery: A qualitative study', *Supportive Care in Cancer*, 34, p. 45. <https://doi.org/10.1007/s00520-026-10661-7>.