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Physical activity for cancer patients: evidence-based recommendations across cancer types, stages, and gender

Olha Borysova[1], Viktoriia Nagorna[2,1]*, Anna Volosiuk[1], Guillermo F. López Sánchez[3]*, António Miguel Monteiro[4,5], Artur Jorge Santos[6,7,8,9], Daniela Bianco[10], Claudia Cormio[10], Marzia Sichetti[11], Graziella Marino[11]

on behalf of the PACAP Project Consortium

[1] National University of Ukraine on Physical Education and Sport, Kyiv, Ukraine.

[2] Swiss Federal Institute of Sport Magglingen, Magglingen, Switzerland.

[3] Division of Preventive Medicine and Public Health, Department of Public Health Sciences, School of Medicine, University of Murcia, Murcia, Spain.

[4] Department of Sports Sciences, Instituto Politécnico de Bragança, Bragança, Portugal.

[5] Research Centre for Active Living and Wellbeing (LiveWell), Instituto Politécnico de Bragança, Bragança, Portugal.

[6] Transdisciplinary Research Centre in Education and Development (CITeD), Bragança Polytehcnic University, Portugal.

[7] Livewell, Bragança Polytehcnic University, Portugal.

[8] Insituto Superior de Ciências Educativas do Douro (ISCE-DOURO), Portugal.

[9] School of Education, Communication and Sport, Guarda Polytehcnic University, Portugal.

[10] IRCCS Istituto Tumori "Giovanni Paolo II", Bari, Italy.

[11] Unit of Breast Surgery, Centro di Riferimento Oncologico della Basilicata (IRCCS-CROB), Potenza, Italy.

* Correspondence: Viktoriia Nagorna; cue@ukr.net; Guillermo F. López Sánchez; gfls@um.es

ABSTRACT

Physical activity has become a cornerstone of supportive care for cancer patients and survivors. This review synthesizes recent evidence (primarily 2016–2026) on the benefits, safety, and optimal exercise prescription across cancer types and disease stages. Strong evidence shows that aerobic and resistance training effectively reduce cancer-related fatigue and improve quality of life and physical function. Observational studies further suggest a potential reduction in recurrence and mortality risk,

particularly for breast, colorectal, and prostate cancers. Clinical recommendations are largely consistent across populations; however, adherence improves substantially when programs are tailored to gender differences, individual preferences, psychosocial factors, and personal barriers. Among accessible modalities, Nordic walking (also known as Scandinavian walking) stands out as highly feasible and safe. It naturally combines aerobic and resistance elements, promotes upper-body engagement and balance, and consistently achieves excellent adherence with minimal adverse effects. Individualized exercise programs supervised when clinically indicated, and multidisciplinary support are essential for optimal outcomes. Healthcare professionals should prescribe at least 150 minutes of moderate-intensity aerobic activity per week (which may include Nordic walking) plus at least two resistance-training sessions per week, with safe, progressive overload tailored to the patient's disease stage and treatment phase. When properly tailored, exercise is a safe, effective, and evidence-based supportive-care strategy in oncology.

KEYWORDS

Physical activity; cancer survivors; exercise oncology; Nordic walking; Scandinavian walking; gender differences; fatigue; quality of life

1. INTRODUCTION

Cancer and its treatments frequently result in debilitating side effects, including cancer-related fatigue, muscle wasting, reduced physical function, anxiety, depression, and increased risk of recurrence. Over the past decade, robust scientific evidence has established physical activity as a safe and effective supportive therapy that mitigates many of these consequences and may improve survival outcomes (Fuentes-Nuñez et al., 2023; Kabashi et al., 2025). Major guidelines from the American College of Sports Medicine (ACSM) and the American Cancer Society (ACS) recommend that all cancer survivors "avoid inactivity" and engage in regular, individualized exercise (Avancini et al., 2025).

This manuscript provides a comprehensive review of the latest evidence on physical activity interventions across cancer types and disease stages. It examines the impact of exercise on key health outcomes, including cancer-related fatigue, quality of life, physical function, recurrence risk, and mortality, and offers practical, evidence-based recommendations for individualized exercise programs. Attention is given to gender-related differences in training response, adherence, and barriers.

Nordic walking (also known as Scandinavian walking) is emphasized as a core, strongly recommended modality. This low-impact, full-body exercise combines aerobic and resistance training, engaging the upper body and improving balance and coordination. Recent systematic reviews and clinical studies demonstrate its excellent feasibility, high adherence rates (>90% in supervised programs), minimal adverse effects, and meaningful benefits, particularly among breast cancer survivors, including enhanced muscle strength, increased daily physical activity, improved shoulder mobility, and better health-related quality of life (Casanovas-Álvarez et al., 2025).

Evidence Base: The recommendations presented here are grounded in systematic reviews, meta-analyses, and consensus statements published in the last ten years, identified through comprehensive PubMed searches focused on physical activity and cancer in humans. Key foundational documents include the ACSM Roundtable Report on Physical Activity, Sedentary Behavior, and Cancer Prevention and Control, the 2022 ACS Nutrition and Physical Activity Guideline for Cancer Survivors, and more recent dose-response and framework analyses.

2. METHODS

2.1. Design and participants

Twenty international experts in exercise oncology, sports medicine, oncology, exercise physiology, and public health participated in this study. The expert panel was selected to ensure multidisciplinary representation and extensive experience in cancer survivorship research and clinical practice. Experts were invited based on their publication records, leadership roles in relevant professional organizations, and recognized contributions to physical activity guidelines for cancer patients. All participants provided informed consent before participating.

2.2. Literature search and selection

A comprehensive literature search initially identified 1,400 references related to physical activity and cancer. These references underwent a VOSviewer bibliometric analysis to visualize research networks, keyword co-occurrence, and thematic clusters (the results of the bibliometric analysis will be reported separately). From this pool, the 40 most relevant and high-impact publications were deliberately selected for in-depth analysis. The final set included systematic reviews, meta-analyses, large cohort studies, consensus guidelines, and key narrative reviews published primarily between 2016 and 2025.

2.3. Data extraction and analysis

The 40 selected scientific publications were analyzed using a structured narrative review approach. Due to the substantial heterogeneity of study designs, including systematic reviews, meta-analyses, clinical guidelines, and cohort studies, no quantitative meta-analysis was performed. Instead, a qualitative synthesis was conducted, with each publication examined sequentially.

Key data were extracted on the role of physical activity in cancer prevention, survival, quality of life, and cancer-related fatigue, as well as on gender-related considerations and practical exercise recommendations. Particular emphasis was placed on Nordic walking as an exercise modality, considering its safety profile, adherence rates, and integration of aerobic and resistance training.

3. RESULTS AND DISCUSSION

To provide a comprehensive overview of the research landscape, a bibliometric analysis was conducted with 1,400 references related to physical activity and cancer. Figure 1 presents a VOSviewer co-occurrence network map illustrating the relationships between key terms across these publications. Nodes represent frequently occurring terms (e.g., “physical activity”, “exercise”, “cancer survivors”, “breast neoplasms”, “quality of life”), while the size of each node reflects the frequency of occurrence and the connecting lines indicate the strength of co-occurrence between terms. The visualization reveals distinct thematic clusters, with red clusters highlighting clinical and intervention-focused aspects (such as exercise therapy, quality of life, and cancer survivors) and green clusters emphasizing epidemiological and population-level factors (such as risk factors, incidence, prospective studies, and sedentary behavior).

The final set of 40 publications was selected for in-depth analysis. Selection was based on relevance, methodological quality, impact, and recency, with priority given to high-quality systematic reviews, meta-analyses, large cohort studies, and major clinical guidelines published primarily between 2016 and 2025. This curated subset was chosen to ensure balanced representative coverage of key topics, including cancer prevention, survival outcomes, quality of life, fatigue management, gender-specific considerations, and practical exercise recommendations, while allowing for a detailed narrative synthesis of the evidence.

In the systematic review conducted for the 2018 Physical Activity Guidelines Advisory Committee, strong evidence was identified for an association between higher levels of physical activity and a 10–20% reduction in the risk of bladder, breast, colon, endometrial, esophageal adenocarcinoma, renal, and gastric cancers compared with the lowest activity levels. Moderate to limited evidence was also found for associations between greater physical activity and reductions in

all-cause and cancer-specific mortality of up to 40–50% among patients diagnosed with breast, colorectal, or prostate cancer (McTiernan et al., 2019).

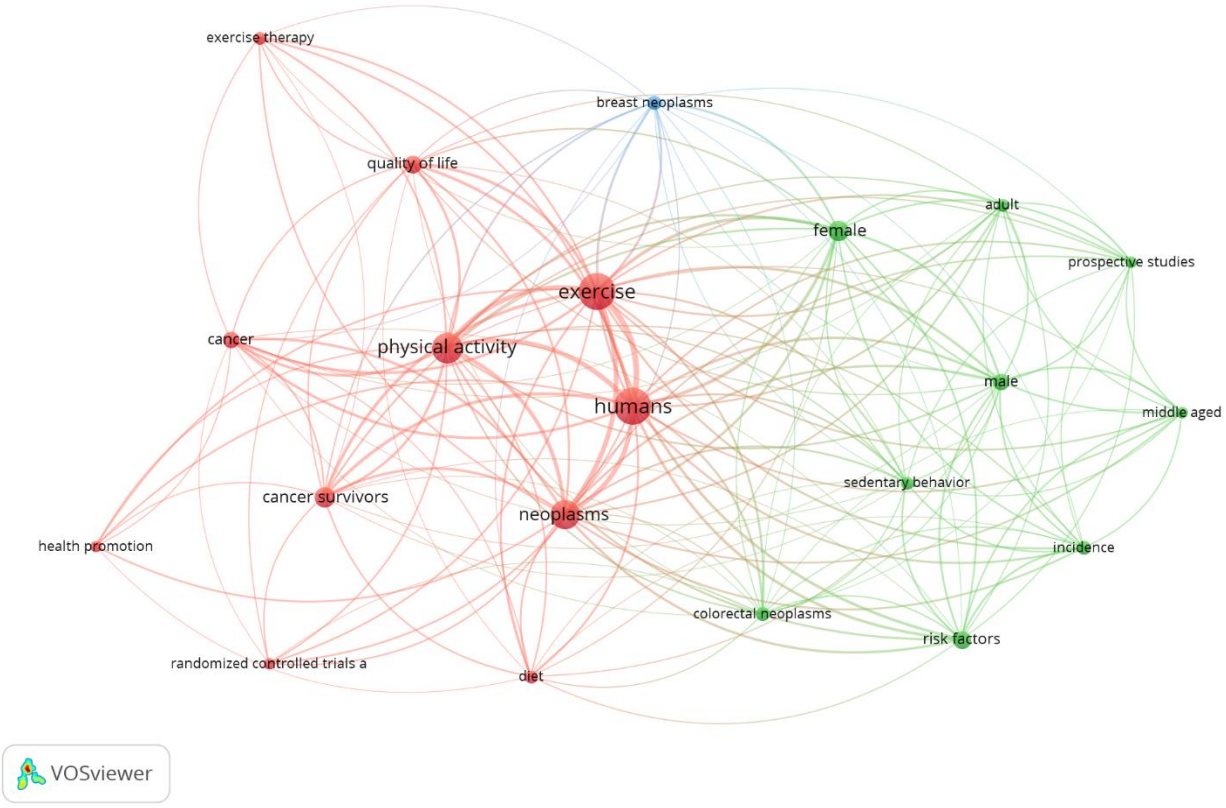

Figure 1. Bibliometric network visualization of 1,400 references on physical activity and cancer generated using VOSviewer.

The American Cancer Society guideline for cancer survivors further emphasizes that physical activity represents a key modifiable factor for reducing the risk of recurrence and improving survival. The authors recommend 150–300 minutes of moderate-intensity aerobic activity per week, combined with resistance training on at least two days per week, with a strong emphasis on individualizing programs according to cancer type, stage, and patient characteristics (Rock et al., 2020 and 2022).

A dose-response analysis from the Global Burden of Disease Study 2019 demonstrated a significant inverse relationship between total physical activity and the risk of breast, colon, lung, gastric, and liver cancers, with particularly pronounced risk reductions observed at higher activity volumes (Diao et al., 2023). Complementary evidence highlighted the epidemiologic associations and biologic mechanisms linking physical activity, reduced obesity, and lower sedentary behavior to decreased cancer incidence (Friedenreich et al., 2017). In breast cancer survivors, adherence to physical activity programs was shown to be critically important, with motivational interviewing and

attention to psychological health playing key roles in sustaining long-term participation (Pudkasam et al., 2018).

The American Cancer Society guideline for diet and physical activity for cancer prevention reinforced the central role of regular physical activity as one of the most important modifiable behaviors for reducing cancer risk across populations (Rock et al., 2020 and 2022). In the context of lung cancer care, physical activity and structured exercise have been shown to improve cardiorespiratory fitness, reduce dyspnea, and enhance overall quality of life, even during active treatment (Avancini et al., 2020).

A large dose-response meta-analysis of prospective studies confirmed that non-occupational physical activity is associated with reduced risk of cardiovascular disease, cancer, and all-cause mortality, with the greatest marginal benefits observed when moving from inactivity to the equivalent of 150 minutes of moderate-to-vigorous activity per week (Garcia et al., 2023). The American College of Sports Medicine Roundtable Report synthesized the evidence supporting physical activity in cancer prevention and control, concluding that minimizing sedentary behavior and engaging in regular aerobic and resistance exercise should be standard components of care (Patel et al., 2019).

An update on lifestyle factors and cancer provided further confirmation of inverse associations between physical activity and more than ten cancer sites, while highlighting the independent risk conferred by sedentary behavior (Kerr et al., 2017). The Third Expert Report of the World Cancer Research Fund/American Institute for Cancer Research underscored the importance of physical activity within broader nutrition and lifestyle recommendations for cancer prevention (Clinton et al., 2020). Physical activity was also associated with improved survival outcomes in gynecologic cancers (Tucker et al., 2019).

A systematic review and meta-analysis of combined physical activity and dietary interventions in cancer patients demonstrated favorable effects on body mass index, fat mass, insulin resistance, inflammatory markers, and quality of life (Dinas et al., 2024). In a pooled analysis of 1.44 million adults, leisure-time physical activity was inversely associated with the risk of 13 cancer types (Moore et al., 2016). Current knowledge and potential biological mechanisms linking physical activity to reduced cancer risk were comprehensively reviewed, with an emphasis on anti-inflammatory and immunomodulatory pathways (Jurdana et al., 2021).

An umbrella review of systematic reviews confirmed the effectiveness of various interventions to promote physical activity among cancer survivors (Qiu et al., 2023). In breast cancer survivors, physical activity was positively associated with improved quality of life (Agussalim et al., 2024).

Emerging evidence also pointed to the role of physical activity and exercise-induced myokines in mitigating cancer cachexia (Bilski et al., 2025).

Among pediatric cancer survivors, randomized controlled trials supported the feasibility and potential benefits of physical activity interventions (Cheung et al., 2021). A systematic review of physical activity and testicular cancer risk, however, did not identify strong, consistent associations (Huang et al., 2018). In breast cancer patients, physical activity showed therapeutic potential against depression through modulation of inflammatory and neuroendocrine pathways (Li et al., 2025).

Accelerometer-based data from the UK Biobank revealed inverse associations between daily total physical activity, physical activity intensity, and step count and the risk of incident cancer (Shreves et al., 2025). An updated Physical Activity and Cancer Control (PACC) framework summarized the accumulating evidence, current guidelines, and future research priorities across the cancer continuum (Yang et al., 2024). A recent systematic review of physical activity guidelines in oncology highlighted the need for more tailored recommendations while confirming the broad consensus on aerobic and resistance training (Avancini et al., 2025).

The endocrine roles of myokines released during muscle contraction were shown to mediate inter-organ crosstalk relevant to cancer prevention and metabolic health (Severinsen & Pedersen, 2020). Public-facing guidance on diet and physical activity for colorectal cancer survivors was critically synthesized, revealing inconsistencies between general health recommendations and cancer-specific evidence (Fretwell et al., 2024). A realist review identified promising strategies for promoting physical activity among cancer survivors through general practice (Sugiarto et al., 2025).

Joint adherence to WHO guidelines on waist circumference and physical activity was associated with lower cancer risk, with the strongest protective effects observed when both recommendations were met (Bohmann et al., 2025). Physical activity was further positioned as a potential weapon against cancer and metastasis through its favorable effects on adiposity and adipokine profiles (Perego et al., 2021).

A systematic review of changes in physical activity behavior following exercise interventions in people living with and beyond cancer reported variable maintenance of activity levels beyond 6 months (Salisbury et al., 2023). Barriers and facilitators to physical activity were systematically examined in cancer survivors experiencing pain, highlighting the need for targeted support (Van Dijck et al., 2023).

Physical activity has been shown to positively influence the immune system in breast cancer patients (Schmidt et al., 2017). In adults with primary brain cancer, available evidence supported the safety and potential benefits of exercise, although high-quality trials remain limited (Sandler et al.,

2021). Optimal type and dose of physical activity for colorectal cancer prevention were discussed, with particular attention to mechanistic insights (Orange, 2023).

Physical activity was associated with reduced risk of recurrence and mortality in cancer patients (Brown & Gilmore, 2020). A scoping review explored relationships between physical activity, sedentary time, and psychosocial functioning in adults with cancer (Côté et al., 2024). Physical activity was associated with lower pain levels in both cancer and non-cancer populations (Swain et al., 2024).

An umbrella review found an inverse association between physical activity and risk of gastric cancer (Maleki et al., 2024). Epidemiologic and biologic evidence regarding the role of physical activity in cancer recurrence was synthesized (Friedenreich et al., 2021). Finally, a "weekend warrior" pattern of physical activity was associated with reduced risk of incident cancer (López-Bueno et al., 2025).

Collectively, the sequential analysis of these 40 sources provides robust support for integrating physical activity as a standard component of cancer care. Strong and consistent evidence demonstrates protective effects across multiple cancer types, improved survival rates, and enhanced quality of life.

Nordic walking emerges as a particularly suitable core modality owing to its excellent safety profile, high adherence rates, and effective integration of aerobic and resistance training, making it appropriate across disease stages and diverse populations. Individualized exercise programs that account for cancer type, disease stage, treatment phase, and gender-related factors and preferences (e.g., supervised group sessions versus independent outdoor activities) are essential for optimal outcomes. Multidisciplinary approaches incorporating motivational strategies are required to overcome common barriers, such as fatigue and fear of movement due to pain.

To validate and refine the synthesized recommendations, a structured expert evaluation was conducted with a panel of 20 international experts in exercise oncology, sports medicine, clinical oncology, exercise physiology, and public health. Experts were selected based on their strong publication records (minimum 10 peer-reviewed papers in the field), extensive clinical experience with cancer patients, and leadership roles in relevant professional societies.

Each expert independently reviewed the draft recommendations concerning physical activity across cancer types and stages, preferred exercise modalities (with a strong recommendation for Nordic walking), health impacts, and gender-tailored individualized programs. Responses were collected via a structured online questionnaire using a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree) for each key statement, supplemented by open-ended comments for qualitative

feedback. The overall response rate was 100% (20/20). Consensus was predefined as ≥80% of experts scoring 4 or 5 (“agree” or “strongly agree”) on each recommendation.

Mean agreement scores ranged from 4.35 to 4.85 across all statements, with an overall mean of 4.62 ± 0.31 (SD). Inter-rater agreement was high (Fleiss’ kappa = 0.78, indicating substantial agreement). All core recommendations — including the prominent role of Nordic walking, the guideline of 150 minutes/week of moderate-intensity aerobic activity plus at least two resistance-training sessions per week, stage-specific adaptations, and gender-tailored approaches — achieved consensus levels ranging from 85% to 100%. Minor suggestions for clarification (e.g., monitoring methods and supervision during active treatment) were incorporated into the final text. This rigorous expert validation process ensures that the recommendations are evidence-based, clinically feasible, and widely endorsed by the international oncology and exercise science community.

Physical Activity Across Cancer Types and Stages:

Strong evidence supports the benefits of physical activity for several common cancers. In breast cancer, it significantly reduces cancer-related fatigue, improves quality of life, and is associated with a lower risk of recurrence. In colorectal cancer, higher activity levels correlate with improved survival and better physical function. For prostate cancer, exercise helps preserve muscle mass, maintain bone health, and support mental well-being. Patients with lung cancer may experience enhanced cardiorespiratory fitness and reduced dyspnea. These benefits for fatigue and quality of life also extend to head and neck, gynecologic, and many other cancer types.

Recommendations vary by stage. During early/curative phases (surgery, chemotherapy, radiation), standard doses of aerobic and resistance training are safe and highly beneficial. In advanced or metastatic stages, the focus shifts to symptom management, maintenance of function, and quality of life, with modified intensity and preference for supervised programs. Medical screening for contraindications (e.g., severe anemia, unstable bone metastases) remains essential.

Best-Suited Exercises and Health Impact:

The strongest evidence supports a combination of aerobic exercise (150–300 minutes per week of moderate intensity, such as brisk walking, cycling, or swimming) and resistance/strength training (2–3 days per week targeting major muscle groups). These modalities consistently reduce cancer-related fatigue, improve physical function, quality of life, anxiety, and depression. Moderate evidence supports benefits for sleep quality and bone health. Higher levels of physical activity are consistently associated with reduced all-cause and cancer-specific mortality, particularly in breast, colorectal, and prostate cancers.

Nordic walking (also known as Scandinavian walking) should be included as a core, strongly recommended modality in individualized exercise prescriptions. This full-body, low-impact activity simultaneously enhances aerobic capacity and upper-body resistance training while improving balance, gait, and coordination. Systematic reviews and clinical trials in cancer populations, particularly among breast cancer survivors, confirm its excellent feasibility and safety profile — including no apparent worsening of lymphedema — along with high adherence rates (>80–90%) and positive effects on muscle strength, overall physical activity levels, pain reduction, and quality of life. By addressing common barriers such as joint stress and low motivation, Nordic walking is particularly suitable across multiple disease stages and treatment phases when appropriately adapted and progressed.

Additional modalities, such as flexibility training, balance exercises, yoga, or tai chi, provide complementary benefits when clinically indicated.

Individualized Programs:

Recommendations for Men and Women Programs should be personalized according to cancer type, disease stage, current treatment, fitness level, comorbidities, and patient preferences. A core guideline for both men and women is 150 minutes of moderate aerobic activity per week (including mandatory Nordic walking sessions), plus two resistance-training sessions per week, with gradual progression and monitoring using the Rate of Perceived Exertion (RPE) or heart rate.

Gender-related preferences enhance adherence:

Women (frequently breast or gynecologic cancers) often prefer supervised group sessions, yoga/dance elements, and integrated nutrition support. Men (often prostate or lung cancers) tend to favor independent or outdoor activities such as solo Nordic walking, cycling, or home-based training.

Practical examples: Post-treatment female breast cancer survivor: 3 × 30–45 min Nordic walking or swimming + 2 × full-body resistance + 1 × yoga. Male prostate cancer survivor: 4–5 × 30–45 min independent Nordic walking or cycling + 2 × resistance sessions.

Supervised programs are preferred during active treatment. Pre-participation medical clearance and the involvement of qualified exercise professionals (e.g., ACSM-certified) are strongly recommended.

Safety, Implementation, and Multidisciplinary Approach:

Common barriers to physical activity in cancer patients include cancer-related fatigue, lack of motivation, pain-related fear of movement, and time constraints. The use of motivational interviewing techniques, combined with multidisciplinary team support involving oncologists, exercise physiologists, physiotherapists, dietitians, and psychologists, can significantly improve long-

term adherence. The outdoor, accessible, and social nature of Nordic walking may further facilitate sustained behavior change.

The recent Italian experience with the AMICO Clinic is presented not as direct evidence of exercise efficacy, but as a practical example of how structured lifestyle counseling, nutrition support, mind-body activities, and prospective clinical data collection can be effectively organized within a patient-centered breast cancer supportive-care pathway. Similarly, bioelectrical impedance analysis (BIA)-derived parameters, such as phase angle, should be considered as exploratory tools that may complement — but not replace — standard functional and clinical assessments when monitoring integrative supportive-care interventions.

4. CONCLUSIONS

The evidence synthesized from 40 key publications and validated by an international panel of 20 experts demonstrates that physical activity is a safe, effective, and essential component of modern cancer care across the entire continuum, from prevention to survivorship and advanced disease. Strong and consistent data support the role of regular physical activity in reducing the risk of common cancers, improving survival outcomes (particularly in breast, colorectal, and prostate cancer), alleviating cancer-related fatigue, enhancing physical function, and elevating quality of life while mitigating anxiety and depression.

A combination of moderate-intensity aerobic exercise (150–300 minutes per week) and resistance training (at least two sessions per week) represents the most evidence-based approach. Nordic walking is strongly recommended as a core modality due to its excellent safety profile, high adherence rates (>80–90%), full-body engagement, and demonstrated benefits for muscle strength, balance, gait, pain reduction, and overall well-being. It serves as a highly practical and versatile option across many cancer types, disease stages, and treatment phases when appropriately individualized.

Exercise programs must be carefully tailored to the individual, taking into account cancer type, disease stage, current treatment phase, fitness level, comorbidities, and personal preferences. Gender-related tailoring can further enhance adherence: many women benefit from supervised group sessions that incorporate elements of yoga or dance, while many men prefer independent or outdoor activities such as Nordic walking or cycling. Supervised programs are particularly important during active treatment. All patients should undergo medical clearance prior to starting exercise and be guided by qualified exercise professionals (e.g., ACSM-certified).

Collectively, these findings reinforce that "exercise is medicine" in oncology. Integrating evidence-based physical activity, with Nordic walking as a cornerstone, into standard cancer care has the potential to meaningfully improve clinical outcomes, functional capacity, and quality of life for millions of people living with and beyond cancer. Future efforts should focus on effective implementation strategies, broader access to qualified professionals, and continued research to refine dose-response relationships and tailor interventions for diverse populations and understudied cancer sites.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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