American College of Sports Medicine

Initial Exercise Guidelines for Children and Adolescents during and beyond Cancer Treatment: ACSM Expert Consensus Statement

An Expert Consensus Statement for the American College of Sports Medicine

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Introduction

In children (≤14 yr) and adolescents (15–19 yr), cancer is highly heterogeneous and essentially differs from adult malignancies (1), with some tumors not even found in adulthood.

Most common malignancies (2):

- *acute leukemias*
- *malignant brain and other central nervous system tumors*
- *lymphomas*
- *neuroblastoma*
- *kidney tumors*
- *soft-tissue and bone tumors*
- *malignant germ cell tumors*
- *epithelial neoplasms*
- *melanomas*

Treatment of childhood cancer requires a multidisciplinary approach that integrates different modalities and requires special considerations because their organ systems are still growing and vulnerable, and thus more susceptible to treatment-related toxicities (3).

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Scientific Rationale

Given the toxicities and functional impairments associated with treatment protocols and the association of inactivity/low physiological reserve with the often-persisting sequelae found in childhood cancer survivors, there is a rationale for introducing exercise interventions earlier in life—that is, in affected children and adolescents.

It is thus conceivable that exercise intervention in children and adolescents with cancer could have the potential to attenuate, at least partly, some treatment-associated sequelae, thereby helping these individuals to enter adulthood in the best possible health and functioning conditions.

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Purpose

❖ To develop the first set of exercise guidelines for children/adolescents with cancer.

- Childhood cancer survivors are at an increased risk of disease and treatment-related long-term sequelae and premature mortality.
- Compared with siblings, survivors are more likely to report functional limitations during activities of daily living.
- There is moderate meta-analytical evidence for an impaired overall physical fitness (as assessed through a combination of different indicators such as cardiorespiratory fitness, muscle strength, and physical function) (32,50) and that inactivity is independently associated with morbidity and mortality in childhood cancer survivors.

- Given the numerous sequelae and fitness impairments associated with treatment, there is moderate evidence for positive effects of concurrent aerobic and strength exercise training on muscle strength and physical function (but not on PA levels) during active treatment.

- Given the toxicities and functional impairments associated with treatment protocols and the association of inactivity/low physiological reserve with the often-persisting sequelae found in childhood cancer survivors, there is a rationale for introducing exercise interventions earlier in life, especially when considering that youth inactivity “tracks” into adulthood.

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Methods

- A search was conducted (from January 2024 to April 2024) of randomized controlled trials, systematic reviews, and meta-analyses for childhood cancer-related health outcomes published (Box 1) using Medline/ PubMed, EMBASE, CINAHL, The Physical Therapy Evidence Database (PEDro), and Web of Science.
- The search was set for articles published before February 22, 2024, using standardized search terms for childhood cancer and exercise.
- Developed exercise recommendations for specified outcomes, where there was sufficient evidence supporting, such effect during/beyond treatment in children/adolescents.

BOX 1. List of identified common acute and long-term fitness- and health-related outcomes for review of evidence for therapeutic efficacy.

- Physical function
- Anxiety
- Body composition
- Bone health
- Cardiorespiratory fitness
- Cardiotoxicity
- Cognitive function
- Depression symptoms
- Cancer-related fatigue (asthenia)*
- Immune function
- Health-related quality of life
- Metabolism (glucose and lipid profile in blood)
- Muscle strength
- Physical activity
- Sleep
- Chemotherapy-induced peripheral neuropathy

** asthenia refers to a feeling of generalized physical weakness and/or a lack of energy and strength.*

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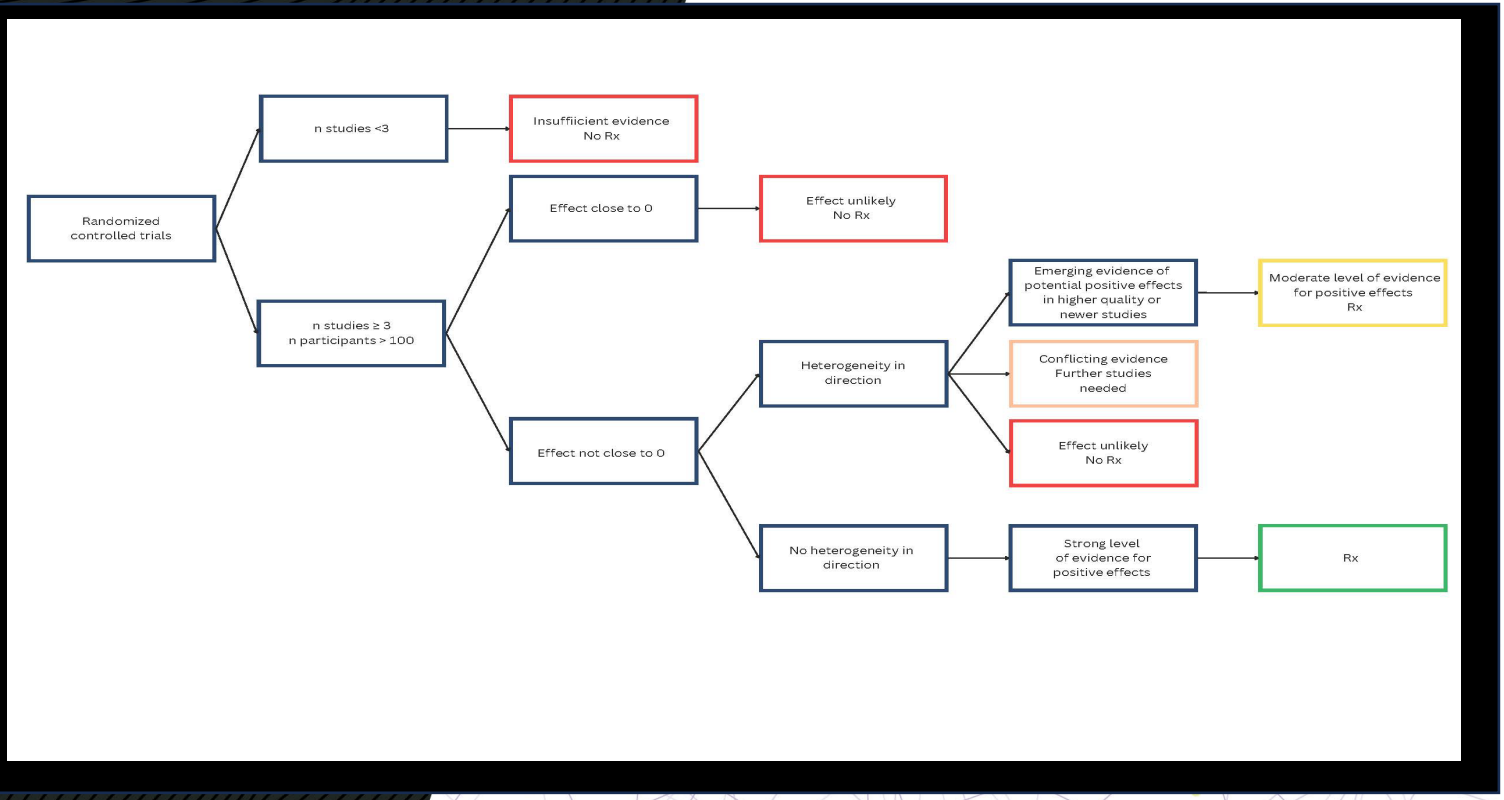
Methods Overview

FIGURE 1—Decision framework for evidence-based exercise recommendations in children and adolescents during/beyond cancer treatment (adapted version AQ9 based on Figure 1 in Campbell et al. (11).



Results

- Exercise training can generally be performed safely for children/adolescents with cancer.
- **None** of the intervention effects met the criteria for ***strong evidence*****,** underlining that pediatric exercise oncology is still an **emerging research field**.
- There is ***moderate evidence*** that concurrent (aerobic and strength) exercise training can improve two common cancer/treatment-related health outcomes, muscle strength and physical function, but not physical activity levels.
- ***Moderate evidence*** also supports that aerobic exercise improves cardiorespiratory fitness after (but not during) treatment.
- ***Evidence is insufficient*** for other important outcomes (e.g., cardiac function, bone health, and immune function), reflecting a gap in the current state of knowledge.

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Considerations

- To effectively assess exercise tolerance and design a safe, effective exercise program, exercise professionals must understand the type and stage of the patient's cancer.

- Exercise professionals need to be knowledgeable about common childhood cancer treatments, the potential side effects, and how these factors impact exercise capacity across different age groups. Based on the literature, exercise can be performed safely with no acute exercise-related adverse events (12-22).

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BOX 2. Medical clearance and precaution recommendations.

- Patients should avoid moderate-to-vigorous exercise if they have low platelet count (<10,000 per μL)[a] or hemoglobin (<5 g·dL−1),[b] temperature ≥38ºC, severe muscle pain, severe infections, cardiovascular disorders, or persistent hypoxemia (peripheral oxygen saturation levels <90%).
- Patients at a high risk of fractures (i.e., those with bone tumors or receiving high doses of corticosteroids) must avoid high-impact exercises.
- Patients with CNS tumors are at higher risk of falling and seizures, which should be considered in the exercise selection.
- If patients have undergone surgery, have platelet count between 10,000 and 20,000 per μL,a or hemoglobin between 5 and 8 $g \cdot dL^{-1}$,b exercise should be individually adjusted accordingly.
- Specific health conditions might require individual adjustments—typically, lowering the intensity or changing the focus of the exercise session.
- Real-time feedback and supervision should be provided by qualified exercise instructors to minimize risk and maximize exercise training adaptations.

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aPlatelets: very low levels result in high bleeding risk; in nonhospital settings, this may be suspected if the child shows easy bruising, frequent nosebleeds, or small red skin spots.

bHemoglobin: very low levels result in severe anemia; in nonhospital settings, this may be suspected if the child looks pale, fatigues quickly, is dizzy, or short of breath at rest.

Conclusions

The proposed recommendations should serve as an initial guide for healthcare and fitness professionals working with children/adolescents with cancer.

There is moderate evidence for positive effects of concurrent aerobic and strength exercise training on muscle strength and physical function (but not on PA levels) during active treatment.

Also, physical activity has the potential to attenuate, at least partly, some treatment-associated sequelae, thereby helping these individuals to enter adulthood in the best possible health and functioning conditions.

Exercise training can generally be performed safely for this population, who should avoid bed rest and lack of movement, starting from the inpatient phase.

Although current advances in the field are tantalizing, more research is needed to fill remaining gaps in knowledge to better serve this population and to improve clinical practice.

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