

# Physical activity of children with cancer during the COVID-19 pandemic: what were the most relevant studies published from August 2019 to July 2021?

*Atividade física de crianças com câncer durante a covid-19: o que foi publicado de mais relevante entre agosto de 2019 e julho de 2021?*

*Actividad física em niños con cáncer durante la covid-19: ¿cuáles fueron las publicaciones más relevantes entre agosto de 2019 y julio de 2021?*

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**ABSTRACT** | This study aims to investigate up-to-date scientific information about physical activity, COVID-19, and childhood cancer. This study is an integrative review. Research was conducted in the Science Direct database, using keywords in three different combinations. In total, 50 publications classified as the most relevant of each keyword combination were selected, 26 eligible publications were reached from August 2019 to July 2021, of which nine were duplicates. When exclusion criteria were applied, 11 complete studies were selected. The level of physical activity (PA) of children diagnosed with cancer or those who survived cancer is low. Changes due to the COVID-19 pandemic include the decrease in the level of PA and the increase in the use of technological devices. The minimum PA recommendations for this population vary but some evidence supports its importance and benefits in minimizing the adverse effects arising from cancer and from the performed medical treatment. Exercise-based interventions should be chosen and carried out considering the type of cancer and the stage of treatment the child is in due to the evidence of its effectiveness.

**Keywords** | COVID-19; Physical Activity; Cancer; Children; Childhood Cancer survivor(s).

**RESUMO** | O objetivo deste trabalho é investigar, na base de dados Science Direct, informações científicas sobre atividade física, covid-19 e câncer infantojuvenil, através de uma revisão integrativa, utilizando três combinações de palavras-chave. Cinquenta publicações mais relevantes de cada combinação de palavras-chave foram selecionadas, e chegou-se a 26 artigos elegíveis no período compreendido entre agosto de 2019 e julho de 2021, dos quais nove eram textos duplicados. Aplicando-se os critérios de exclusão, foram selecionados 11 estudos completos. Constatou-se que o nível de atividade física (AF) de crianças com câncer ou sobreviventes do câncer é baixo e que entre as mudanças causadas pela pandemia de covid-19 estão a diminuição do nível de AF e o aumento do uso de dispositivos tecnológicos. As recomendações mínimas de AF para essa população variam, entretanto há evidências que sustentam sua importância e seus benefícios ao minimizar os efeitos adversos oriundos do próprio câncer e do tratamento médico realizado.

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As intervenções baseadas em exercícios, para as quais já há evidência de eficácia, devem ser escolhidas e realizadas a partir do tipo de câncer e na fase do tratamento em que a criança está.

**Descritores** | Covid-19; Atividade Física; Câncer; Crianças; Crianças Sobreviventes ao Câncer.

**RESUMEN** | Este estudio tiene como objetivo investigar, en la base de datos ScienceDirect, la información científica actualizada sobre actividad física, COVID-19 y cáncer infantil, mediante una revisión integradora, en la cual se utilizaron las palabras clave en tres combinaciones diferentes. Se seleccionaron cincuenta publicaciones clasificadas como las más relevantes de cada combinación, y se alcanzaron 26 publicaciones elegibles en el periodo entre agosto de 2019 y julio de 2021, de las cuales nueve fueron textos duplicados. Al aplicar los criterios de exclusión, se

seleccionaron 11 artículos completos. El nivel de actividad física (AF) de los niños diagnosticados de cáncer o supervivientes de cáncer es bajo, y entre los cambios provocados por la pandemia de la COVID-19 se encuentran la disminución del nivel de AF y el aumento en el uso de dispositivos tecnológicos. Las recomendaciones mínimas de AF para esta población varían entre sí, sin embargo, existe evidencia que respalda su importancia y los beneficios en la minimización de los efectos adversos derivados del propio cáncer y del tratamiento médico realizado. Las intervenciones basadas en ejercicios, para la cual ya existe evidencia de efectividad, deben elegirse y llevarse a cabo teniendo en cuenta el tipo de cáncer y la etapa de tratamiento en la que se encuentra el niño.

**Palabras clave** | COVID-19; Actividad física; Cáncer; Niños; Sobrevivientes de cáncer infantil.

## INTRODUCTION

Among all diseases that affect children, cancer is the main cause of death<sup>1</sup>. Despite this, the five-year relative survival rate for all children with cancer is approximately 80% in developed countries<sup>2-5</sup>, which brought into focus the long-term effects of treatment, with the late effects of childhood cancer (CC) representing a continuous emotional and physical burden on children and families<sup>6</sup>.

Research shows that more than two-thirds of CC survivors reported at least one late adverse effect—whether physical or psychological—incurred by previous cancer treatments<sup>7,8</sup>. These effects include obesity<sup>9</sup>, cancer-related fatigue<sup>10</sup>, musculoskeletal and pulmonary complications<sup>11,12</sup>, sleep disorders<sup>13</sup>, cardiopulmonary dysfunctions<sup>14</sup> and psychological distress<sup>15</sup>. Most children with cancer are physically inactive<sup>6,16,17</sup>, although a large body of evidence indicates that physical activity (PA) alleviates symptoms related to cancer, particularly fatigue<sup>18,19</sup>, and that physical inactivity is a public health problem, as well as one of the main risk factors that increase overall mortality<sup>20</sup>. However, more studies are needed to better understand the benefits of physical exercise in patients with cancer<sup>21</sup>, since the guidelines on minimum PA recommendations still differ from each other<sup>22,23</sup>.

In January 2020, more than 100 million individuals were diagnosed with COVID-19, with more than 2 million deaths reported worldwide<sup>24</sup>. As one of the protective measures adopted for at-risk populations,

non-urgent medical appointments of individuals with cancer were postponed and transitioned to telephone/telemedicine consultations in the early months of the pandemic<sup>25-27</sup>. In April 2020, school closures affected 1.6 billion students in 190 countries<sup>28</sup>, resulting in alarming numbers during the period of the first lockdown in 2020: children and adolescents (aged 10 to 17 years) increased their daily screen time, from about four to seven hours<sup>29</sup>. As already described in the literature, the excessive use of smartphones, tablets, computers and video games is positively related to the lack of PA<sup>30</sup>. Thus, this work aims to investigate up-to-date scientific information on physical activity, COVID-19, and childhood cancer.

Regular exercise, in conjunction with cancer treatment, requires special attention, even before the COVID-19 pandemic. In a study conducted using social media advertisements, in which participants, interviewed via video recordings, completed measures of resilience (Item 2 of the Connor-Davidson Resilience Scale, which assesses “ability to bounce back after illness or hardship”) and distress (The National Comprehensive Cancer Network Distress Thermometer), the results highlighted the complexities and dualities of living during, after, or caring for someone with cancer during the COVID-19 pandemic. The biggest challenge caused by COVID-19 was keeping the children indoors, as they wanted to go out and play with the other children<sup>40</sup>.

The severity of the cancer and the treatment affect the immune system, so each hospital needed to organize itself to meet the real needs and perform the necessary treatments according to each case during COVID-19 pandemic<sup>39</sup>. The problem that motivated our research group to conduct this investigation was the need not to lose track of the research we carried out in a hospital unit and to prepare the resumption of face-to-face research activities in 2021, understanding how studies were being carried out in other institutions and physical activity in the daily lives of patients during the pandemic.

## METHODOLOGY

This is an integrative review, which synthesizes results of previous research<sup>31</sup>. Using the PICO process (Patient/Population, Intervention, Comparison, Outcomes), the study aimed to investigate the effect of physical activity on the treatment of children and adolescents with cancer during the COVID-19 pandemic, and the most relevant studies published from August 2019 to July 2021. Data were collected in the aforementioned period in the Science Direct database, classified by relevance, peer-reviewed, in English. Those studies that investigated physical activity

related to cancer and COVID-19 were include. Those studies focused on nutritional and psychological aspects and other topics not focused on physical activity or exercise were excluded. Studies were selected based on title and abstract, using the inclusion and exclusion criteria, and then independently reviewed, and discrepancies were resolved by discussion. Five evaluators screened by titles, read the abstracts and, finally, selected the final documents for full reading. Figure 1 details the search strategy and selection of articles.

## RESULTS

Figure 1 shows the search strategy and the studies selection. A total of 65,325 scientific publications were found. Initially, the 50 most relevant publications of each combination of MeSH terms were selected by theme, and 26 publications met the inclusion criteria of each of the three combinations, of which nine were duplicates. Applying the exclusion criteria, 11 articles were selected: two qualitative studies, two systematic reviews, two prospective cross-sectional studies, two literature reviews, one quasi-experimental study, one guideline and one exploratory study. Chart 1 describes their respective details.

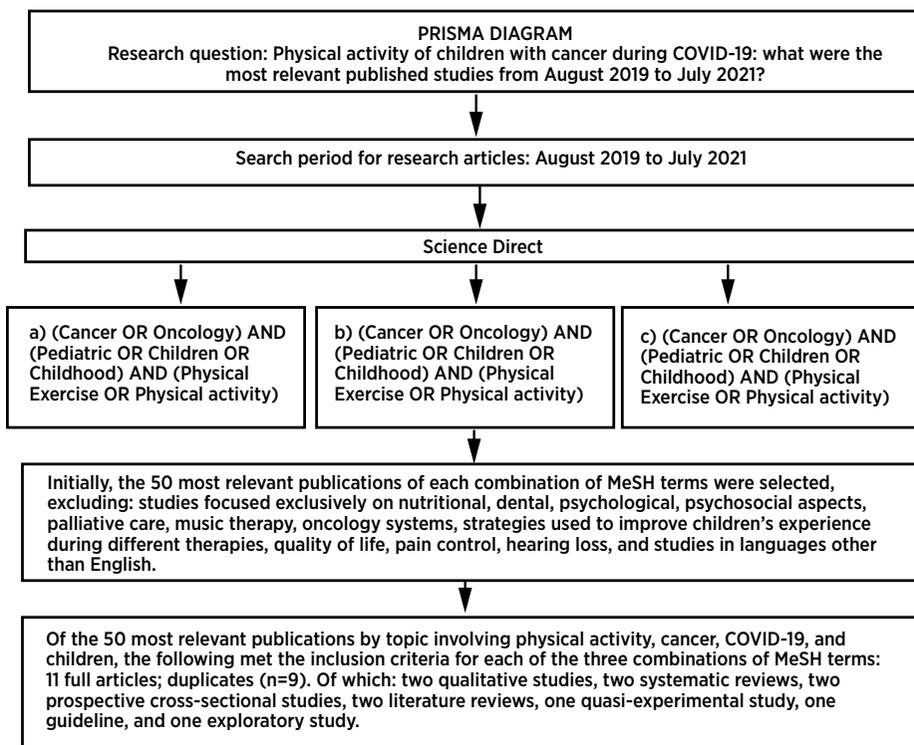


Figure 1. Flowchart of preferred reporting items for systematic reviews and meta-analyses (PRISMA).

Source: Prepared by the authors.

Chart 1. Results of the research on physical activity practice among children with cancer and COVID-19. Period: from August 2019 to July 2021.

Authors and Year	Title	Research Focus	Journal	Type	Conclusion
Cheung et al., 2021	Parental perspectives on promoting physical activity for their children surviving cancer	Physical Activity in Pediatric Oncology Patients	Patient Education and Counseling	Qualitative Research	Most caregivers do not understand the benefits of PA for children who survive cancer.
Coombs; Schilperoort; Sargent, 2020	The effect of exercise and motor interventions on physical activity and motor outcomes during and after medical intervention for children and adolescents with acute lymphoblastic leukemia	Physical Activity in Pediatric Oncology Patients	Critical Reviews in Oncology/Hematology	Systematic Review	A growing body of evidence supports the feasibility, safety, and efficacy of motor and exercise interventions for children and adolescents with Acute Lymphoid Leukemia (ALL), but specific recommendations for the practice are weak and limited.
Hayati et al., 2019	"AeRop exercise" can improve the sleep quality of Indonesian pediatric cancer patients	Physical Activity in Pediatric Oncology Patients	Enfermeria clínica	Quasi-experimental Study	AeRop exercise was associated with lower sleep problems in pediatric patients undergoing chemotherapy. This type of light exercise can be implemented as a nursing intervention to improve sleep in children with cancer.
Lam et al., 2020	Promoting physical activity among children with cancer through an integrated experiential training programme with coaching	Physical Activity in Pediatric Oncology Patients	Patient education and counseling	Qualitative Research	Maintained physical activity in patients with CC.
Murphy-Alford et al., 2018	Body composition, dietary intake and physical activity of young survivors of childhood cancer	Physical Activity in Pediatric Oncology Patients	Clinical Nutrition	Prospective Cross-Sectional Study	Parents and children undergoing cancer treatment must be educated about the quality of diet and the importance of daily physical activity to ensure that healthy habits are adopted and maintained until the disease is overcome.
Rehorst-Kleinlugtenbelt et al., 2019	Physical activity level objectively measured by accelerometry in children undergoing cancer treatment at home and in a hospital setting	Physical Activity in Pediatric Oncology Patients	Pediatric Hematology Oncology Journal	Prospective Cross-Sectional Study	It strongly recommends determining the benefits and limitations of PA in children during cancer treatment and determining differences in perceptions of PA ability in these children. PA should be encouraged among this public to minimize side effects during and after treatment.
Ho, Betz, Marchese, 2021	Exploring pulmonary function and physical function in childhood cancer	Pulmonary and Physical Function in Pediatric Oncology Patients	Critical Reviews in Oncology/Hematology	Systematic Review	Lung and physical function are related and often impaired in children during and after cancer treatment.
Spitzer, 2021	Open Schools! Weighing the Effects of Viruses and Lockdowns on Children	COVID-19	Trends in neuroscience and education	Literature Review	The pandemics of sedentary behavior and myopia that occurred affected billions of people, which are worsening due to less physical exercise and time outdoors, poor diet, weight gain, and increased screen time during lockdowns, causing future increases in cancer and other diseases.
Philipsborn et al., 2021	A pediatrician's guide to climate change-informed primary care	COVID-19	Current Problems in Pediatric and Adolescent Health Care	Clinical Practice Guideline	The American Academy of Pediatrics (AAP) recommends that children aged three to five years practice more than three hours of active play per day, and that children aged six to 17 practice 60 minutes of physical activity daily.
Tanner et al., 2020	Cancer rehabilitation in the pediatric and adolescent/young adult population	Body Disabilities, Activity Limitations and Participation Restrictions in Pediatric Oncology Patients	In Seminars in oncology nursing	Literature Review	Rehabilitation intervention holds great potential to mitigate the impact of cancer and its treatment, and may even play a role in reducing morbimortality.
Beech et al., 2021	Evaluation of parental attitudes on the use and effect of technology on physical activity levels in children aged 7 to 11	Parental Perception of Physical Activity Level and Technology Use	Social Sciences & Humanities	Exploratory Study	A substantial number of family members believe that the use of technology holds a negative impact and suggest that less access to it would increase activity levels.

Source: Prepared by the authors

## DISCUSSION

This article provides an integrative review of the most recent literature on PA, COVID-19, and CC. Generally, few studies published in the period described the relationship between the three topics, and the main themes found were: the influence and participation of parents and guardians in the promotion of PA in their children<sup>32-34</sup>, the effect of certain interventions in a specific group<sup>22,23,35</sup>, and the description of health components of children with cancer<sup>6,14,17</sup>.

In the articles found, PA is cited as essential for the healthy development of children with cancer or childhood cancer survivors (CCS), since it can minimize not only the debilitating effects of cancer, but also of the medical treatment, and help prevent a wide range of complications in their survival<sup>6,14,17,22,23,36</sup>.

However, children with cancer or survivors of cancer show low participation in PA as ratified by three of the studies included<sup>6,17,23</sup> in this work. In the study by Murphy-Alford et al.<sup>6</sup>, 57 of the 74 subjects completed the proposed daily PA, among which girls had a lower PA level when compared to boys, and whose mean PA level of the population was characteristic of a sedentary or mildly active lifestyle. The study by Rehorst-Kleinlugtenbelt<sup>17</sup> found similar results, because their sample did not meet the minimum PA recommendation, and scored below the recommended number of steps per day, which also led to the verification that PA levels were significantly lower in patients in the hospital environment compared to children evaluated in the home environment. The systematic review by Ho<sup>14</sup> also reveals that CCS are known to have low participation in PA and low levels of energy expenditure.

The articles found also addressed the importance of health education for CCS caregivers, so that the benefits of PA are addressed, as well as stimulating its practice<sup>17,33</sup>. In Lam's work<sup>34</sup>, most children described experiencing the support of a coach in the program, which indicates that the presence of a role model and company is important to motivate children with cancer to be physically active. The research carried out by Cheung<sup>33</sup> concluded that most caregivers do not understand the benefits of PA for children who survived cancer, half participants were unsure about the level of PA recommended for their children and which are appropriate or not for this population. Therefore, parents/caregivers and children should be informed about the benefits and recommendations of PA for children with cancer, so that they can encourage and stimulate their children to adhere to this practice<sup>33,17,22</sup>.

The minimum Physical Activity recommendations for CCS still vary greatly among themselves<sup>22,23</sup>. While the Children's Oncology Group recommends practicing PA for 60 min/day, five days per week, during post-treatment survival<sup>37</sup>, the clinical guideline on fatigue management recommends that PA be adapted to the specific needs of each child and adolescent<sup>22,23</sup>. When evaluating the effect of exercise in children with acute lymphoblastic leukemia during and after chemotherapy, it was confirmed that there was improvement in fatigue during acute chemotherapy; PA, range of motion, strength, bone mineral density, aerobic capacity, and fatigue during maintenance chemotherapy; functional mobility, range of motion, strength, fatigue, and aerobic capacity during post-treatment survival<sup>22</sup>. The prevalence of specific side effects appeared in only two of the 19 studies present in the systematic review by Coombs<sup>22</sup>, but none mentioned losses or adverse effects associated with motor interventions. Tanner<sup>23</sup> also points out that rehabilitation holds an excellent potential to reduce the impact of CA and its treatment, and may play a role in reducing morbidity and mortality, but further research on this relationship is needed.

Regarding the type of exercise and its effects, according to Coombs<sup>22</sup>, the interventions, for which there is already evidence of efficacy, are numerous, and should be chosen and carried out considering the stage of treatment. An example is the AeRop exercise (technique that combines aerobic exercises with progressive muscle relaxation), proposed to improve sleep quality and fatigue of children undergoing chemotherapy, in which there was a statistically significant improvement in the scores of sleep problems when compared to the control group<sup>35</sup>.

Besides all aforementioned issues, one must consider the COVID-19 pandemic and how children were affected by it. According to the study conducted by Murphy-Alford<sup>6</sup>, 64% of participants were no longer within the maximum recommendations of two hours in front of the screen every day, and during the first lockdown of 2020, children and adolescents (aged 10–17 years) increased their daily screen time spent with computer games and using social media, from four to about seven hours<sup>38</sup>, which, according to Beech<sup>32</sup>, can affect children's PA level, as 60.4% of parents surveyed think their children are more likely to choose to use technological devices than to be physically active. About the lockdown scenario, several challenges and inequalities in public transportation, as well as in access to green spaces, were exposed, and it is important to highlight that active transport, especially

when incorporated into daily routines, can be an important source of PA<sup>39</sup>.

## CONCLUSION

It is concluded that, although there is already evidence demonstrating that the practice of Physical Activity is important and beneficial for children who are cancer survivors or with cancer, their level of PA is still very low, and the minimum PA recommendations for this population vary greatly. Side effects of childhood cancer treatment result in reduced PA, decreased muscle strength, and cardiorespiratory fitness, compared to healthy peers. Physical activity for these children should be encouraged and stimulated to minimize side effects during and after treatment. Studies indicate improvements driven by exercise and motor intervention: fatigue during acute chemotherapy; physical activity, range of motion (ROM), strength, bone mineral density, aerobic capacity and fatigue during maintenance chemotherapy. Most caregivers do not understand the benefits of PA for this population, although their support and family involvement are the main facilitators for adherence to regular PA practice among pediatric CA survivors. The interventions, for which there is already evidence of efficacy, are varied, and should be chosen and carried out considering the type of CA and the stage of treatment the child is in. Finally, it is necessary to understand the changes caused by the COVID-19 pandemic, which include the decrease in PA levels and the increase in the use of technological devices, so that further research and work can be conducted in order to solve the points raised here.

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