






## RESEARCH ARTICLE

# Perceived barriers and facilitators to physical activity in childhood cancer survivors and their parents: A large-scale interview study from the International PACCS Study

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## Abstract

**Background:** Physical activity (PA) may reduce risks of late effects in childhood cancer survivors, yet many have low activity levels. Using the WHO's International Classification of Functioning, Disability, and Health for Children and Youths (ICF-CY) as a conceptual framework, we aimed to identify perceived barriers and facilitators to PA in young survivors and their parents.

**Design/methods:** We conducted individual, semi-structured interviews with 63 survivors, aged 9–18 years,  $\geq 1$ -year off treatment, and 68 parents, recruited from three pediatric oncology departments in Norway and Denmark. Interviews were analyzed inductively using thematic analysis to identify barriers and facilitators to PA, which were mapped onto the ICF-CY model components; body function/structures, activities, participation, and environmental and personal factors.

**Results:** Two-thirds of the survivors described how treatment-related impairments of bodily functions (e.g., fatigue, physical weakness, reduced lung capacity) caused physical limitations, reducing opportunities to participate in PA, especially team sports and school physical education. This resulted in a perceived ability gap between survivors and peers, reducing motivation for PA. These PA barriers were moderated by

**Abbreviations:** ICF-CY, International Classification of Functioning, Disability, and Health for Children and Youths; PA, physical activity; PACCS, The Physical Activity and fitness in Childhood Cancer Survivors.

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environmental factors that facilitated or further hindered PA participation (family, peer, and school support). Similarly, personal factors also facilitated (acceptance, motivation, goal setting) or hindered (anxiety, low motivation, and lack of trust) PA participation.

**Conclusion:** Treatment-related long-term or late effects represented significant barriers to PA as their functional consequences reduced survivors' capacities and capabilities to be active. Environmental and personal factors acting as facilitators or further barriers to PA were identified. Applying the ICF-CY framework in clinical practice could help to enable PA participation.

#### KEYWORDS

barriers and facilitators, childhood cancer survivor, ICF model, late effects, physical activity

## 1 | INTRODUCTION

The 5-year survival rate after childhood cancer exceeds 80% in most developed countries, resulting in a growing population of survivors with high risks of treatment-related long-term morbidity and premature mortality.<sup>1-5</sup> By the age of 50 years, 98% of childhood cancer survivors experience multiple chronic health conditions (late effects), including cardiorespiratory disorders, metabolic syndrome, neurocognitive impairments, fatigue, early frailty, and secondary cancers.<sup>3,6-9</sup> Reduced cardiorespiratory fitness alone is associated with an almost four-fold increase in the hazard of early death among survivors compared with the general population.<sup>10</sup> Thus, late effects after cancer treatment can significantly affect the survivors' and their families' quality of life, and healthcare and societal costs.<sup>11-13</sup>

Participating in physical activity (PA) in childhood is essential for attaining developmental milestones, improving physical fitness, and forming long-lasting beneficial lifestyle behaviors.<sup>14-16</sup> PA is especially important for young cancer survivors, as PA can reduce their risk of late effects such as metabolic syndrome, cardiovascular disease, and premature death.<sup>17-21</sup> Regardless, most survivors are less active than siblings and age-matched healthy controls.<sup>22-24</sup> A recent study found that only 25% of childhood cancer survivors meet PA recommended guidelines (60 minutes a day).<sup>25</sup> In adult childhood cancer survivors, sedentary behavior is attributed to a range of interlinked physical and psychosocial factors, including: (a) adverse consequences of anti-cancer therapies on physical fitness and function<sup>26-28</sup>; (b) worries and safety concerns regarding PA<sup>29,30</sup>; and (c) lack of knowledge regarding appropriate PAs for survivors.<sup>31,32</sup> A recent systematic review of childhood cancer survivors identified barriers and facilitators to PA such as parental and social support, access to facilities, time and financial constraints, and perceived competence or concerns regarding appearance.<sup>33</sup> However, confidence in the findings is low due to low methodological quality of the studies. Although young survivors were dependent on their families to facilitate and model PA, we lack studies of both young survivors and their families perceived barriers and facilitators to PA.<sup>33</sup> To systematically explore parents and survivors' perspectives, the WHO's Classification system for Function, Disability, and Health for Children and Youths (ICF-CY) represents a useful framework, illustrating the interrelationships between body functions

and structures impairments (e.g., late effects), activity limitations, and participation restrictions, given personal factors of the survivor's and his or her environment (social, cultural, structural factors).<sup>34</sup>

The aim of this study was to identify survivors and their parents' perceived barriers to, and facilitators of, PA using the ICF-CY model as a guiding framework.

## 2 | MATERIALS AND METHODS

### 2.1 | Design

The present study is the part of a larger, international study: the Physical Activity and fitness in Childhood Cancer Survivors (PACCS) aiming to generate empirical evidence on PA (substudy 1), physical fitness (substudy 2), and facilitators and barriers to PA (substudy 3), to inform the development of evidence-based PA interventions for young survivors (substudy 4). This is a qualitative study with semistructured, individual interviews with survivors and their parents enrolled in the PACCS study.<sup>35</sup>

### 2.2 | Sample and recruitment

The sample consisted of 63 survivors and 68 parents recruited at the largest pediatric oncology departments in Norway (Oslo and Bergen) and Denmark (Copenhagen). We used a purposive sampling strategy,<sup>36</sup> to maximize variation in age, cancer diagnoses, treatment protocols, times since treatment completion, area-of-residence (urban to rural), and PA levels (determined in substudy 1). In Norway, study nurses called the parents of eligible survivors. In Denmark, an invitation was sent by mail prior to the survivors' outpatient appointment. Inclusion criteria were:  $\leq 18$  years of age at study,  $\geq 1$  year since cancer treatment completion, and in remission. Parents of survivors consenting to participate were then invited to participate in the study. The recruitment and data collection took place from January 2018 to July 2020. Of 76 survivors invited to participate in the interview study, 12 declined (not wanting to re-experience their cancer [ $n = 8$ ], provided no reason [ $n = 4$ ]), and one no-show for the interview, resulting in a total sample of 63 survivors (response rate of 83%).

## 2.3 | Data collection

A semistructured interview guide was developed by three of the authors (Anneli Viktoria Mellblom, Elna Hamilton Larsen, Hanne Cathrine Lie) and user representatives, guided by the study aim, existing literature, and the ICF-CY framework, focusing on experiences with PA. The interviews were conducted at the hospital departments, in the participants' homes, or by telephone due to COVID-19 restrictions ( $n = 6$ ). Interviews lasted for an average of 27 minutes (range: 8–105 minutes) and were conducted by six females and one male researcher, all experienced with pediatric oncology research (Anneli Viktoria Mellblom, Elna Hamilton Larsen, Hanne Cathrine Lie, Sunniva Helland, Maria Brinkkjær, Natasha Nybro Petersen, Benjamin Graungaard). Interviewers and participants did not know each other, with the exception of four interviews. Survivors and parents were interviewed separately unless the survivor asked to have the parent present ( $n = 2$ ). All interviews were audiorecorded and transcribed verbatim. Diagnosis and treatment information were collected from medical records. Recruitment stopped when information power was reached, meaning no additional themes arose in subsequent interviews.<sup>37</sup>

## 2.4 | Data analyses

All interviews were analyzed according to principles of systematic text condensation,<sup>38</sup> applying a hybrid inductive-deductive approach.<sup>39</sup> First, transcripts were quality assured using the audio recordings. The coding process included multiple back and forth analyses of the data performed by Anneli Viktoria Mellblom, Elna Hamilton Larsen, Hanne Cathrine Lie, and Lene Thorsen, resulting in a final codebook based on  $n = 42$  interviews. MB, Natasha Nybro Petersen, Martin Kaj Fridh, and Hanne Bækgaard Larsen then applied the codebook to the remaining interviews. No further adjustments to the codebook were required. From the codes, overarching themes were generated. These themes were then mapped onto the components of the ICF model to provide structure and enhance the interpretability of the findings. We used NVivo software (Version 12, 2018) for data management.<sup>40</sup> The study adhered to the Consolidated Criteria for Reporting Qualitative Research (COREQ) checklist.<sup>41</sup>

## 2.5 | Ethics

The regional committee for ethics South-Eastern Norway (2016/953), the Data Protection Officer at Oslo University Hospital (2016-7216), and the Regional Ethics Committee for the Capital Region, Denmark (H-19032270) approved the study. The survivors and the parents received written and oral study information and provided written consent. Children under the age of 16 years provided oral assent, while adolescents >16 years provided written consent. All procedures were conducted in accordance with the Helsinki II Declaration.<sup>42</sup>

## 3 | RESULTS

### 3.1 | Participants

Sample characteristics are provided in Table 1. In brief, 39 (62%) survivors were male, average age at interview was 14 years, with leukemia being the most common diagnosis (43%). Of the parents, 46 (65%) were mothers (Table 1).

The results reflect the main ICF-CY components. The first main theme, "Barriers to PA," contains the three subthemes: (a) Body functioning and structures impairments, (b) Activity limitations, and (c) Participation restrictions. The second main theme, "Moderators of PA," contains the two subthemes: (i) Environmental factors, and (ii) Personal factors (see Figure 1 for an overview).

### 3.2 | Barriers to physical activity

#### 3.2.1 | Body functioning and structures impairments

About one-third of the survivors ( $n = 23$ ) reported no health-related impairments as barriers to PA. They described themselves just as fit as their peers. Among the remaining two-thirds of survivors, the most common health impairments perceived as barriers to PA were tiredness and fatigue ( $n = 32$ ), reduced physical fitness and function ( $n = 19$ ), reduced lung capacity ( $n = 9$ ), organ impairment ( $n = 12$ ), headaches, and neuropathic pain ( $n = 12$ ) (Table 2, Q1–Q4). Almost half of central nervous system (CNS) tumor survivors described that decreased motor skills negatively influence balance and coordination ( $n = 7$ ). Weight gain was also mentioned as a barrier to PA by a few survivors ( $n = 3$ ) (Table 2, Q5).

Similarly, the parents reported tiredness and fatigue ( $n = 34$ ), impaired physical fitness ( $n = 20$ ), and pain ( $n = 16$ ) as the most frequent barriers for the survivors' participation in PA (Table 2, Q6–Q8). Many parents also described how survivors were physically weak ( $n = 24$ ) due to reduced muscle mass and strength caused by the cancer treatment and long periods of immobility (Table 2, Q9). Most of these perceived barriers were attributed to consequences of cancer and/or its treatment by both the survivors and their parents.

#### 3.2.2 | Activity limitations

The impairments described above were perceived as limiting the survivors' physical capacity and capabilities to perform a range of activities in everyday life; for example, being with peers, attending school, and participate in various PAs (Table 2, Q10–Q12). Additionally, the impairments were related to feelings of being physically weaker and less capable than their peers, acting as a further barrier to PA. Although some impairments had improved with time, the parents noted that the survivors did not quite "catch-up" with peers. As such, this physical

**TABLE 1** Participants and their parents' characteristics (*N* = 63)

	Norway <i>n</i> (%)	Denmark <i>n</i> (%)	Total sample <i>N</i> (%)
Female	8 (36)	16 (39)	24 (38)
Male	14 (64)	25 (61)	39 (62)
Age and habitation	Mean (SD)		
Mean age at interview	14 (2.7)	13.9 (2.6)	14 (2.7)
	<i>n</i> (%)		
10–14 years at interview	11 (50)	25 (61)	36 (57)
15–18 years at interview	11 (50)	16 (39)	27 (43)
Rural living	9 (41)	1 (2)	10 (16)
Urban living	13 (59)	40 (98)	53 (84)
	Median (range)		
Median age at diagnosis	8 (0.5–15)	7 (1–17)	7.5 (0.5–17)
Median years after treatment	4 (1–12)	3.5 (1–13.5)	3.8 (1–13.5)
Diagnosis	<i>n</i> (%)		
Leukemia	8 (36)	19 (46)	27 (43)
Central nervous system tumor	3 (14)	13 (32)	16 (26)
Non-Hodgkin lymphoma	5 (23)	3 (7)	8 (13)
Extracranial solid tumors	3 (14)	4 (10)	7 (11)
Hodgkin lymphoma	3 (14)	2 (5)	5 (8)
Treatment	<i>n</i> (%)		
Chemotherapy	22 (100)	37 (90)	59 (93.7)
Surgery	6 (27)	15 (37)	21 (33)
Radiation	6 (27)	10 (24)	16 (25)
Bone marrow transplant	4 (18)	3 (7)	7 (11)
Parents interviewed	<i>N</i> (%)		
Mothers	13 (59)	33 (72)	46 (65)
Fathers	9 (41)	16 (28)	25 (35)
Married/in a relationship	19 (86.4)	35 (85.4)	54 (76.0)
Working full-time	16 (72.7)	37 (90.2)	53 (74.6)
Working part-time	4 (18.2)	4 (9.8)	8 (11.2)

capacity and capability gap was perceived as a significant barrier to participate in PA.

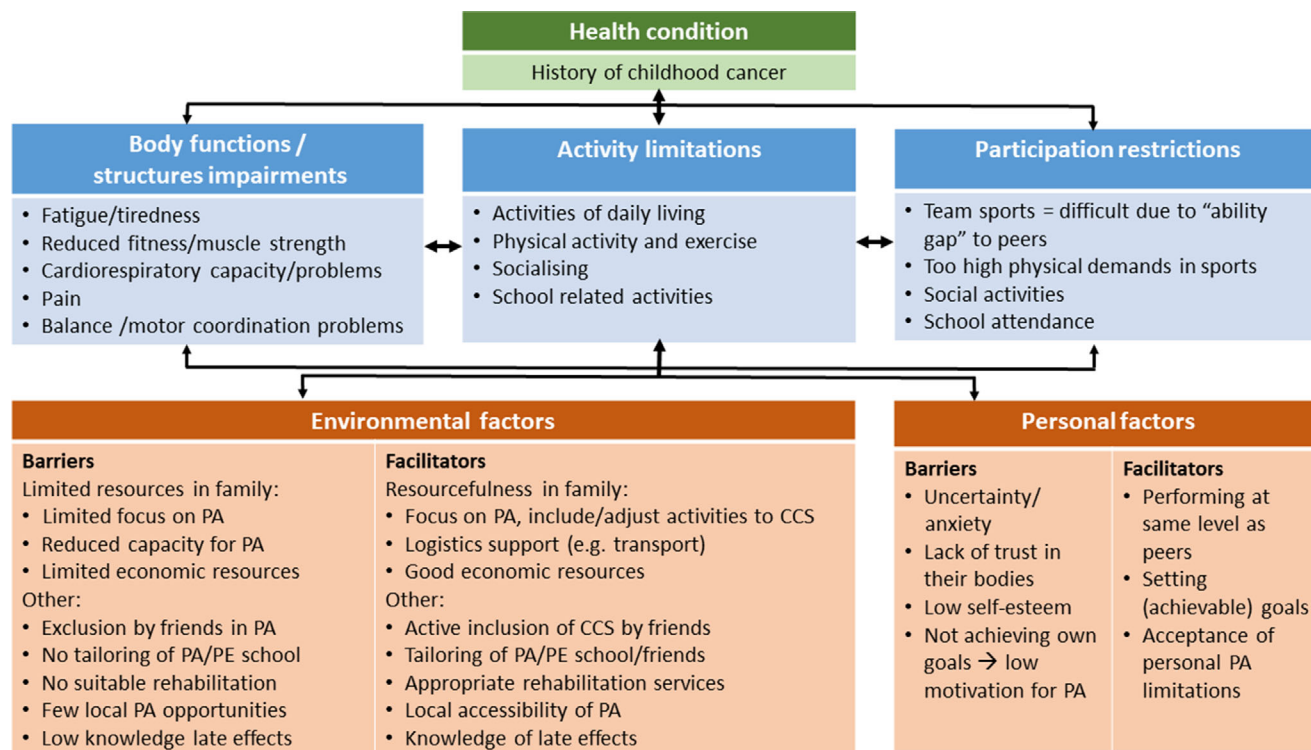
### 3.2.3 | Participation restrictions

Most survivors reported that their impairments and activity limitations restricted their opportunities to participate in PA and other activities across a range of contexts (Table 3, Q1). The physical capacity and capability gap mentioned above was described as a significant barrier to participation in team sports (e.g., soccer, handball), where others depend on their performance (Table 3, Q2 and Q3) or in physically demanding sports (Table 3, Q4). When survivors perceived the demands as too challenging, they typically labeled that sport as “boring” (Table 3, Q5 and Q6). When asked to elaborate, they explained that their reduced capacity and/or

capability to perform at the level of their peers made it “boring,” decreasing their motivation to participate. Several survivors had also experienced being excluded from unorganized after-school activities due to this gap, reducing opportunities for participation (Table 3, Q7).

The most common activities survivors and their parents reported enjoying were informal and outdoors, such as bicycling, hiking, and skiing with peers and/or family. Several families frequently participated in outdoor activities. The positive experiences associated with being outdoors were seen as an important facilitator of PA (Table 3, Q8 and Q9).

In sum, late effects were experienced as significant barriers to participation in PA for the majority of the survivors and their parents, through perceived physical capacity and capability gaps to their peers, which restricted PA participation, especially in competitive or team-based PA.



**FIGURE 1** International Classification of Functioning, Disability, and Health for Children and Youths (ICF-CY) model applied to identify barriers and facilitators to physical activity among young childhood cancer survivors. Note: ICF-CY model conceptualizes a person's level of functioning (blue boxes) as a dynamic interaction between her or his health conditions (green box), environmental factors, and personal factors (orange boxes).

### 3.3 | Moderating factors of PA participation

#### 3.3.1 | Environmental factors

Of environmental factors, family members, peers, coaches, school personnel, and local resources were described to act as moderators, that is further barriers or facilitators, of survivors' participation in PA. Typical family-related barriers discussed by survivors and their parents were parents' lack of time, siblings' need for parental attention, and regarding PA as unimportant. After years of treatments, uncertainties, and numerous admissions, some parents described that coming back to "normal life" had been challenging. They were tired and emotionally exhausted from the cancer experience, influencing their ability to assist the survivors in PA (Table 4, Q1).

Family-related facilitators were intentionally prioritizing family time that includes PA, the inclusion of survivors in parents' or siblings' PA, parents as motivators, adjusting activities to meet the survivors' needs, and having economic resources to ease access to PA (e.g., buying an electric bike, Table 4, Q2–Q4). The survivors emphasized participation in unorganized family activities and free play (younger survivors) as a highly valued and important way of being physically active (Table 4, Q5–Q7). Many parents discussed the need for their practical and logistical support to facilitate the survivors' participation in PA, including providing transportation and ensuring that they were well rested, fed, and hydrated before PA.

Peers were also seen to play a significant role in hindering or supporting the survivors' PA participation. Peers were seen as barriers to PA when they did not accept the survivors' limitations, when they had too high expectations of their performance and energy levels, or stopped inviting the survivor to participate in activities (Table 4, Q8). In contrast, when invited in and included by their peers, the social aspects of PA were described by nearly all as a significant motivating factor and as such a facilitator for PA participation. Many survivors prioritized specific activities to be with their peers. To be included often required that their peers understood and accepted the survivors' PA limitations and adjusted their expectations to the survivors' performance level (Table 4, Q9).

School was highly valued and prioritized by many survivors, representing a sense of normality and an important opportunity for participating in PA with peers. The parents described several successful school measures to facilitate the survivors' activity, including strategies to conserve their energy throughout the day (Table 4, Q10). Here, the physical education (PE) teachers were essential "gate keepers," as their expectations and attitudes toward the survivors and their limitations affected the survivors' ability to participate in PE and thus, their motivation for PA (Table 4, Q11 and Q12).

Local availability and accessibility of PA were also important; for example, short travel distance to facilities made the survivors independent of transportation. Most survivors reported having many different organized PA opportunities to choose from (Table 4, Q13), and several

**TABLE 2** Body functions and structure impairments and activity limitations: Illustrative quotes

Quotations in text	Illustrative quote
Q1	Female, 17 years (P12) <sup>a</sup> : "I am drained in the weekdays because of school and tired in the weekends because I have had a long week."
Q2	Male, 16 years: "I have nausea every day and I am constantly tired."
Q3	Male, 11 years (P18): "It is very frustrating. I don't like being this weak. I can't throw as hard or as far or run as fast, as my friends. My body used all its strength to fight the cancer."
Q4	Male, 11 years (P15): "I am totally ordinary except that I have very bad pain in my legs. I use all my energy on school so when I come home I limp and have a lot of pain."
Q5	Female, 17 years (P2): "I am afraid that my peers will just see me as a big girl that is not able to accomplish anything - the weight issue is a sore spot for me."
Q6	Father to female, 18 years (P12): "Yes, so if you think about her physical activity, it is still quite low and have been for a long time. She is struggling a lot with fatigue."
Q7	Mother to male, 11 years (P15): "He feels pain in his legs from running indoors on floor. Pain in the joints. Pain in knees and more or less always pain in ankles."
Q8	Mother to male, 17 years (P31): "He still has the late effects and he got a lot of them. He got brittle bones, a weak stomach, shakes, and cramps in his fingers, pains, and nausea. [...] He has trouble concentrating and he gets tired very easily."
Q9	Father to male, 11 years (P4): "He is very affected by the fact that he had that disease and has been put very back. His is weak in terms of endurance and muscles. And his coordination has been bad."
Q10	Male 18 years (P38): "When I exercise and work out, my legs get tired quickly and it is a different tiredness than before [I was sick]. They have a special tiredness in them that they did not have before."
Q11	Female, 13 years (P49): "If I do a lot [of activities], my foot begins to hurt. A throbbing pain really."
Q12	Male 17 years (P39): "I cannot run like a normal person. It is something with my fitness. I can run but it has to be run-walk, run-walk like you run for 2 minutes and then you walk. It does not hurt in the beginning, but if I keep running then the pain starts. That is when I start walking."

<sup>a</sup>P = participant number.

**TABLE 3** Participation restrictions: Illustrative quotes

Quotations in text	Illustrative quote
Q1	Female, 18 years (P12) <sup>a</sup> : "It's hard to go to the gym, when you are so drained, to motivate yourself when you are as tired and exhausted, as I am. Then it is easier to just sleep, listen to music or watch TV, and save the energy."
Q2	Male, 17 years (P17): "I tried to start on the football team again after the treatment, but I was not in good enough physical shape. The others had gone to the football training as usual, so I was physically pretty far behind, so then I just quit."
Q3	Father to male, 17 years (P17): "The football ended because he was so much smaller and weaker than his peers, and because of this they were not that interested in his participation - at the end, he did not feel welcome."
Q4	Female 13 years (P7): "I really wanted to start with gymnastics, but I was not strong enough. You had to hang by a pole and pull your legs up, to be allowed to participate. So I began kickboxing instead."
Q5	Mother to male, 15 years (P11): "The swim training was prearranged around certain skills you had to accomplish before they moved you to the next level. When my son after a while experienced no progression he felt that swimming became a bit boring."
Q6	Male, 11 years (P6): "Football is boring because I do not see the ball well. I think football is fun, but I can't see the ball so then it becomes boring because I can't catch it."
Q7	Male, 11 years (P4): "They don't think of me, they have so many other friends."
Q8	Male, 11 years (P18): "I prefer to go hiking with my family. I like when everybody is together."
Q9	Female aged 15 (P57): "I do not participate in any activities, but I like to be together with my friends and be out in the nature."

<sup>a</sup>P = participant number.

**TABLE 4** Environmental factors: Illustrative quotes

Quotations in text	Illustrative quote
<b>Family</b>	
Q1	Father to male, 11 years (P4) <sup>a</sup> : "When he comes from school, he is tired and only wants to relax and watch TV, so then you are dependent on a refreshed parent to include him in some kind of activity."
Q2	Father to male, 15 years (P11): "When he's with peers he often manages to keep up to their speed, but that's because we have made sure that he is well-rested in advance."
Q3	Male 13 years (P50): "I do not have the same fitness as everybody else. My fitness can be a challenge sometimes. But mostly it is because I do not want to [be physical active]. Sometimes I can be tired as well. I try to think of the positive things and my parents often force me [to be physical active]."
Q4	Mother to male, 15 years (P11): "We decided that we could not both work full time, our son needed a parent facilitating at home."
Q5	Male 11 years (P4): "Try to be outdoors as much as possible, be with your friends and have fun." His advice to parents was clear: "Let children have fun, do as they like and be free!"
Q6	Mother to female, 12 years (P5): "The most important thing is to be outdoors. Then they do what they can manage, or what they want. If they want to walk, they walk, if they want to run they run, and they play if they want to play. We are "outdoor people," because then she is at her best."
Q7	Father to male, 11 years (P6): "The trampoline and the daily competitions with his active brother helped him getting faster back his balance and his motor skills."
<b>Peers</b>	
Q8	Female, 17 years (P2): "They forgot about me, thought I was not able to participate. But it's much better to be asked and then decline than be excluded every time."
Q9	Male, aged 13 years (P25): "I like to get my pulse up. And it is very nice that I play with the boys. I like to play soccer because of my friends include me and win tournaments."
<b>School</b>	
Q10	Mother to male, 11 years (P15): "His teacher called me before the ski-day and said it would be smart if he (the son) took a car. Because the teacher figured that he would use up all his energy on skiing, rather than having fun. The point is for him to have fun."
Q11	Mother to female, 11 years (P62): "Quietly, her PE teacher made a calm program for her, where he took some girls with him so they could help her. It was a group where the focus was on helping her to what they could."
Q12	Female, 18 years (P12): "Because, I become very tired and dizzy very fast, so I cannot do a somersault and stuff. I just cannot do it. And then I feel as if I cannot participate in gym, and that it will affect my grade. That is difficult for me."
<b>Municipally</b>	
Q13	Male, 16 years (P27): "If I could choose myself I would do BMX, strength training, bicycle."
Q14	Female 17 years (P19): "My football coach was very nice [when I got back from treatment]. He said: We put you on the field first, and you play as long as you are able to and then we switch."
Q15	Female, 18 years (P1): "I did not feel that it [training at the community center] was my kind of thing, it was very general training... it seemed like they did not think that I with the things that I had, would be able to train myself back into shape. So then I stopped with the physiotherapy, I am not quite sure why, but I think that it wasn't quite me." Her father elaborated: "It was not very easy to motivate her, as it were just old people there. Very little motivation for an adolescent to enter such a place ... so yes, it worked well against the intention, to say the least."

<sup>a</sup>P = participant number.

of the older survivors said they preferred individual, noncompetitive PA (e.g., swimming or going to the gym). Like peers, coaches played an important role as facilitators to PA through adjusting their expectations and actively enabling the survivors to participate in various PAs (Table 4, Q14).

Related to follow-up care, both survivors and parents explained that few healthcare professionals had raised the topic of how to re-engage in PA after treatment completion. Such lack of information was a barrier to PA participation. They missed information and guidance on rebuilding strength, stamina, and physical capac-

ity. Especially those experiencing fatigue reported a lack of interest and acceptance by healthcare professionals, making them feel that they had to find out how to balance restitution and activity. In several of the cases where survivors had been referred to local physiotherapy for rehabilitation, survivors and families described frustration concerning the available local services; for example, being placed in group physiotherapy sessions with older people (Table 4, Q15).

Environmental factors, such as family, peers, and other professionals around the survivors and the local offers of PA, were seen as important

**TABLE 5** Personal factors: Illustrative quotes

Quotations in text	Illustrative quote
Q1	Mother to male, aged 13 years (P26) <sup>a</sup> : "I think he is very sensitive about how his body is and how it reacts [when being physical active]. Even the smallest things that he does not like he reacts on. He is very insecure about his body and especially sore muscles are difficult for him. He gets nervous and afraid."
Q2	Father to male, 11 years (P4): "The first year after treatment was hard; he was concerned for his body. Did not like to be physical touched, worried that things could break. The whole boy looked anxious and fragile."
Q3	Father to female 10 years (P8): "She has to re-experience that it is not dangerous to be breathless, it works out okay, but she doesn't trust her body in the same way as before. I think she is a bit more careful, but I do not know if she is able to express it as clearly."
Q4	Father to male 11 years: (P6): "He [the son] wants to be like everybody else and pushes his limits, it's important as parents to allow this because then he will accomplish more than if we make restrictions. He has crashed sometimes and learned the hard way."
Q5	Male 11 years (P15): "If it is a competition, I run as far as I need, because I love to win. I am always tired, but my endurance is getting better. I push forward, all the time."
Q6	Female 17 years (P1): "I must do it [the activity] more as a hobby now than a competition. When I found out this, it was perfect."

<sup>a</sup>P = participant number.

moderators of the impact of the survivors' impairments and further limited or enabled PA participation.

### 3.3.2 | Personal factors

Motivation to participate in PA was described to be affected by various personal factors. For example, a few survivors expressed feeling worried, cautious, or insecure when participating in play and PA due to not trusting their bodies capacities or not knowing their limitations (Table 5, Q1). Consequently, these survivors reported feeling insecure and having low self-esteem, which were seen as a barrier to PA participation (Table 5, Q2 and Q3). Some survivors felt frustrated and unmotivated when their posttreatment exercise did not yield expected effects (Table 5, Q4). In contrast, personal factors that motivated PA participation were performing at level with peers or setting themselves new physical performance goals (Table 5, Q5). A strategy used by several survivors to handle the physical setback was to redefine their goals to better fit their PA limitations (Table 5, Q6).

## 4 | DISCUSSION

This multicenter, explorative interview study investigated childhood cancer survivors and their parents' perspectives on barriers and facilitators concerning PA, using the World Health Organization's ICF-CY model as a conceptual framework and its components.<sup>34</sup> The survivors' and their parent's experiences concerning PA mapped well on to the ICF-CY framework, thereby making it a useful conceptual and practical tool for the analysis.

Late effects of childhood cancer treatment include impaired cardiorespiratory fitness, muscle weakness, and fatigue,<sup>43-45</sup> often with critical consequences on the individual's general health.<sup>10,46</sup> In this study, the survivors and their parents considered such impairments to

their bodily functions as major barrier to participate in PA. The experience of fatigue was seen as the main barrier for PA in the present study, which is in line with previous research.<sup>47,48</sup> The survivors and their parents reported that the feeling of being physically weak and tired resulted in refraining from PA, especially in competitive settings, as they could not compete on equal terms with their peers. Similar finding of capability gap as a barrier to PA is also reported in a recent review<sup>33</sup> where they perceived the cancer to have adversely affected the survivors overall ability to be physically active. In the present study, the survivors often felt excluded from organized team sports and physical education in school. Refraining from team sports and physical education represented a dilemma for the survivors as the social aspects of PA were seen as the pri-

mary motivation for being physically active.

In line with Bandura et al.'s theory of self-efficacy,<sup>49</sup> previous studies have shown that having significant relationships (e.g., peers, physical education teachers, parents) promoting participation in PA is associated with efficacious beliefs of one's own ability to overcome potential barriers (e.g., feeling physically weak and tired).<sup>50-52</sup> Moreover, support from peers is associated with increased PA levels.<sup>48</sup> Social support is also found to increase PA levels among adult cancer survivors.<sup>53-55</sup> This suggests that significant others need knowledge about and an appreciation of the long-term consequences of treatment to avoid demeaning evaluations of the survivors' physical capabilities. Therefore, it is essential to create a motivating environment for the survivors.<sup>56</sup> Recent studies showed that increasing peers' understanding of treatment-related challenges is possible.<sup>57,58</sup> These studies reported that peers who had obtained knowledge of treatment-related challenges supported the survivors to be more physically active during and following treatment.<sup>57,58</sup>

In this study, the survivors explained that they could not participate in some activities (e.g., social aspects of PA, including team sports and physical education). Accordingly, the survivors need targeted rehabilitation to regain their possibility to participate in these



central activities. Yet, the survivors and their parents were concerned about the available municipality rehabilitation offers—not targeting the survivors' needs. This concern is supported in a recent study where they concluded that interdisciplinary rehabilitation care for childhood cancer survivors is essential, but lacking.<sup>59</sup> Combined, these results highlight the needs for improved means of communication and information sharing between specialist healthcare services and local services to improve local knowledge of the survivors' support needs.

Most parents in this study held a positive attitude toward PA and facilitated actively their child's participation in PA. This is important because parents play an important role in influencing the PA behaviors of their children, through role modeling and parental support.<sup>60,61</sup> Nonetheless, some parents de-emphasized the importance of PA because of their child's feeling of fatigue, worrying that the survivor would be too tired, or that the fatigue symptoms would worsen following PA. Similar worries as barriers to PA have been reported previously.<sup>62</sup>

This parental concern of PA aggravating fatigue symptoms may be problematic as PA has been shown to reduce fatigue.<sup>63,64</sup> Therefore, educating the parents and the survivors on the value of PA regarding fatigue is important along with helping the parents to incorporate short-activity bouts tailored to the survivors' energy level, thereby, reducing fatigue-related symptoms while building stamina.<sup>47</sup> Personal factors in the survivor could further facilitate (acceptance, motivation, goal setting) or hinder (anxiety, low motivation, lack of trust) PA participation. Self-motivation has been reported important to facilitate PA in previous studies.<sup>65,66</sup> Survivors with higher confidence in their abilities were found to be more physically active,<sup>48</sup> and this finding is confirmed in the present study.

In this study, we strived to include a varied sample of both survivors and parents, in terms of gender, ages, and of diagnoses to obtain different perspectives on PA post treatment. This strengthens the study's reliability. Moreover, including both survivors' and parents' perspectives offered insight into facilitators and barriers to PA post treatment seen from different angles. To enhance the credibility, we used a stringent coding process and had a robust qualitative data size. We cannot exclude the possibility of social-desirability bias on the participants' accounts of participating in PA.<sup>67</sup> The importance of PA is widely accepted in the Nordic countries. Accordingly, the survivors and their parents may have expressed their desire to promote PA in their everyday life, because this attitude may be viewed as favorable by the interviewer, potentially affecting the trustworthiness of the study.

Clinicians are well-positioned to empower and engage young survivors in PA as they typically follow the survivors over time. Collectively, knowledge about barriers and facilitators to PA could support them in motivating and sharing information about PA with patients and parents, as well as identify suitable rehabilitation options for childhood cancer survivors when needed. The ICF-CY framework can be used as a guiding framework to identify barriers and facilitators to PA at the level of the individual. Our findings may be useful to guide future qualitative and quantitative studies of PA in cancer survivorship and support intervention development.<sup>68</sup>

## 5 | CONCLUSION

Survivors experience several barriers for participation in PA, where the main barriers are feeling physically weak and fatigued, thereby reducing the possibilities for participation in PA on equal terms with their peers. The main facilitators to participate in PA were participating in a social context with family and friends and improving one's physical capabilities. The ICF-CY model offers a conceptual framework for understanding the complexity of PA in survivors. An appreciation of this complexity would be useful when addressing PA in the hospital setting, when providing interventions, and when guiding survivors and their parents in everyday life and rehabilitation post cancer treatment.

## AUTHOR CONTRIBUTIONS

Conception and design: Hanne Cathrine Lie, Ellen Ruud, Martin Kaj Fridh, Elna Hamilton Larsen, Anneli Viktoria Mellblom, and Hanne Bækgaard Larsen. Financial support: Hanne Cathrine Lie, Ellen Ruud, and Hanne Bækgaard Larsen. Administrative support: Hanne Cathrine Lie and Ellen Ruud. Provision of study materials or patients: Hanne Cathrine Lie, Ellen Ruud, Hanne Bækgaard Larsen, and Martin Kaj Fridh. Collection and assembly of data: Hanne Cathrine Lie, Natasha Nybro Petersen, Elna Hamilton Larsen, and Anneli Viktoria Mellblom. Data analysis and interpretation: Hanne Cathrine Lie, Martin Kaj Fridh, Elna Hamilton Larsen, Anneli Viktoria Mellblom, Marie Hamilton Larsen, and Lene Thorsen. Manuscript writing, final approval of manuscript, and accountable for all aspects of the work: All authors.

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## CONFLICT OF INTEREST

The authors have no conflict of interest, financial or otherwise, to disclose.

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## REFERENCES

1. Ward E, Desantis C, Robbins A, Kohler B, Jemal A. Childhood and adolescent cancer statistics. *CA Cancer J Clin*. 2014;64(2):83-103. <https://doi.org/10.3322/caac.21219>

2. Oeffinger K, Mertens A, Sklar C, et al. Chronic health conditions in adult survivors of childhood cancer. *N Engl J Med*. 2006;355:1572-1582.
3. Hudson MM, Ness KK, Gurney JG, et al. Clinical ascertainment of health outcomes among adults treated for childhood cancer. *JAMA*. 2013;309(22):2371-2381. <https://doi.org/10.1001/jama.2013.6296>
4. Fidler MM, Reulen RC, Winter DL, et al. Long term cause specific mortality among 34 489 five year survivors of childhood cancer in Great Britain: population based cohort study. *BMJ*. 2016;354:i4351. <https://doi.org/10.1136/bmj.i4351>
5. Yeh JM, Ward ZJ, Chaudhry A, et al. Life expectancy of adult survivors of childhood cancer over 3 decades. *JAMA Oncol*. 2020;6(3):350-357. <https://doi.org/10.1001/jamaoncol.2019.5582>
6. de Fine Licht S, Rugbjerg K, Gudmundsdóttir T, et al. Long-term inpatient disease burden in the Adult Life after Childhood Cancer in Scandinavia (ALiCCS) study: a cohort study of 21,297 childhood cancer survivors. *PLoS Med*. 2017;14(5):e1002296.
7. Phillips SM, Padgett LS, Leisenring WM, et al. Survivors of childhood cancer in the United States: prevalence and burden of morbidity. *Cancer Epidemiol Biomarkers Prev*. 2015;24(4):653-663. <https://doi.org/10.1158/1055-9965.EPI-14-1418>
8. Mittal N, Kent P. Long-term survivors of childhood cancer: the late effects of therapy. In: *Pediatric Cancer Survivors*. IntechOpen; 2017.
9. Hayek S, Gibson TM, Leisenring WM, et al. Prevalence and predictors of frailty in childhood cancer survivors and siblings: a report from the Childhood Cancer Survivor Study. *J Clin Oncol*. 2020;38(3):232-247. <https://doi.org/10.1200/JCO.19.01226>
10. Ness KK, Plana JC, Joshi VM, et al. Exercise intolerance, mortality, and organ system impairment in adult survivors of childhood cancer. *J Clin Oncol*. 2020;38(1):29-42. <https://doi.org/10.1200/JCO.19.01661>
11. Frederiksen LE, Mader L, Feychting M, et al. Surviving childhood cancer: a systematic review of studies on risk and determinants of adverse socioeconomic outcomes. *Int J Cancer*. 2019;144(8):1796-1823. <https://doi.org/10.1002/ijc.31789>
12. Yeh JM, Hanmer J, Ward ZJ, et al. Chronic conditions and utility-based health-related quality of life in adult childhood cancer survivors. *J Natl Cancer Inst*. 2016;108(9):djw046. <https://doi.org/10.1093/jnci/djw046>
13. Mader L, Michel G, Roser K. Unemployment following childhood cancer - a systematic review and meta-analysis. *Dtsch Arztebl Int*. 2017;114(47):805-812. <https://doi.org/10.3238/arztebl.2017.0805>
14. Biddle SJH, Ciaccioni S, Thomas G, Vergeer I. Physical activity and mental health in children and adolescents: an updated review of reviews and an analysis of causality. *Psychol Sport Exerc*. 2019;42:146-155. <https://doi.org/10.1016/j.psychsport.2018.08.011>
15. Poitras VJ, Gray CE, Borghese MM, et al. Systematic review of the relationships between objectively measured physical activity and health indicators in school-aged children and youth. *Appl Physiol Nutr Metab*. 2016;41(6):S197-S239. <https://doi.org/10.1139/apnm-2015-0663>
16. Sawyer SM, Afifi RA, Bearinger LH, et al. Adolescence: a foundation for future health. *Lancet*. 2012;379(9826):1630-1640. [https://doi.org/10.1016/s0140-6736\(12\)60072-5](https://doi.org/10.1016/s0140-6736(12)60072-5)
17. Smith WA, Li C, Nottage KA, et al. Lifestyle and metabolic syndrome in adult survivors of childhood cancer: a report from the St. Jude Lifetime Cohort Study. *Cancer*. 2014;120(17):2742-2750. <https://doi.org/10.1002/cncr.28670>
18. Friedenreich CM, Neilson HK, Farris MS, Courneya KS. Physical activity and cancer outcomes: a precision medicine approach. *Clin Cancer Res*. 2016;22(19):4766-4775. <https://doi.org/10.1158/1078-0432.CCR-16-0067>
19. Slater ME, Ross JA, Kelly AS, et al. Physical activity and cardiovascular risk factors in childhood cancer survivors. *Pediatr Blood Cancer*. 2015;62(2):305-310. <https://doi.org/10.1002/psc.25276>
20. Hayek S, Brinkman TM, Plana JC, et al. Association of exercise intolerance with emotional distress, attainment of social roles, and health-related quality of life among adult survivors of childhood cancer. *JAMA Oncol*. 2020;6(8):1194-1202. <https://doi.org/10.1001/jamaoncol.2020.2054>
21. Wogksch MD, Goodenough CG, Finch ER, Partin RE, Ness KK. Physical activity and fitness in childhood cancer survivors: a scoping review. *Aging Cancer*. 2021;2(4):112-128. <https://doi.org/10.1002/aac2.12042>
22. Antwi GO, Jayawardene W, Lohrmann DK, Mueller EL. Physical activity and fitness among pediatric cancer survivors: a meta-analysis of observational studies. *Support Care Cancer*. 2019;27(9):3183-3194. <https://doi.org/10.1007/s00520-019-04788-z>
23. Zhang FF, Saltzman E, Must A, Parsons SK. Do childhood cancer survivors meet the diet and physical activity guidelines? A review of guidelines and literature. *Int J Child Health Nutr*. 2012;1(1):44-58. <https://doi.org/10.6000/1929-4247.2012.01.01.06>
24. Ness KK, Leisenring WM, Sujuan H, et al. Predictors of inactive lifestyle among adult survivors of childhood cancer: a report from the Childhood Cancer Survivor Study. *Cancer*. 2009;115(9):1984-1994. <https://doi.org/10.1002/cncr.24209>
25. Mizrahi D, Fardell JE, Wakefield CE, et al. How physically active do Australian and New Zealander childhood cancer survivors perceive themselves? A report from the ANZCHOG survivorship study. *Complement Ther Med*. 2019;44:196-203
26. Scheede-Bergdahl C, Jageo RT. After the chemotherapy: potential mechanisms for chemotherapy-induced delayed skeletal muscle dysfunction in survivors of acute lymphoblastic leukaemia in childhood. *Front Pharmacol*. 2013;4:49. <https://doi.org/10.3389/fphar.2013.00049>
27. Rueegg CS, Gianinazzi ME, Michel G, et al. Do childhood cancer survivors with physical performance limitations reach healthy activity levels? *Pediatr Blood Cancer*. 2013;60(10):1714-1720. <https://doi.org/10.1002/pbc.24595>
28. Nielsen MKF, Larsen HB, Schmiegelow K, Christensen JF. Muscle dysfunction in childhood cancer: biological mechanisms and implications for long-term survivorship. review. *Eur Med J*. 2016;4:78-85
29. Ross WL, Le A, Zheng DJ, et al. Physical activity barriers, preferences, and beliefs in childhood cancer patients. *Support Care Cancer*. 2018;26(7):2177-2184. <https://doi.org/10.1007/s00520-017-4041-9>
30. Arroyave WD, Clipp EC, Miller PE, et al. Childhood cancer survivors' perceived barriers to improving exercise and dietary behaviors. *Oncol Nurs Forum*. 2008;35(1):121-130
31. Robertson AR, Johnson DA. Rehabilitation and development after childhood cancer: can the need for physical exercise be met? *Pediatr Rehabil*. 2002;5(4):235-240. <https://doi.org/10.1080/1363849031000094072>
32. Yelton L, Forbis S. Influences and barriers on physical activity in pediatric oncology patients. *Front Pediatr*. 2016;4:131-131. <https://doi.org/10.3389/fped.2016.00131>
33. Brown MC, Podmore M, Araújo-Soares V, Skinner R, Sharp L. Childhood cancer survivors' perceptions of the barriers and facilitators to physical activity: a systematic review and thematic synthesis of qualitative evidence using the Theoretical Domains Framework. *Health Psychol Rev*. 2022;1-24. <https://doi.org/10.1080/17437199.2022.2032795>
34. World Health Organization. *International Classification of Functioning, Disability, and Health: Children & Youth Version: ICF-CY*. World Health Organization; 2007.
35. Lie H, Anderssen S, Rueegg C, et al. The Physical Activity and fitness in Childhood Cancer Survivors (PACCS) Study: protocol for an international, mixed-methods study. *JMIR Res Protoc*. 2021;11:e35838. <https://doi.org/10.2196/35838>
36. Patton MQ, Patton MQ. *Sampling, Qualitative (Purposive)*. John Wiley & Sons; 2007.

37. Malterud K, Siersma VD, Guassora AD. Sample size in qualitative interview studies: guided by information power. *Qual Health Res.* 2016;26(13):1753-1760. <https://doi.org/10.1177/1049732315617444>
38. Kirsti M. Systematic text condensation: a strategy for qualitative analysis. *Scand. J Public Health.* 2012;40(8):795-805. <https://doi.org/10.1177/1403494812465030>
39. Fereday J, Muir-Cochrane E. Demonstrating rigor using thematic analysis: a hybrid approach of inductive and deductive coding and theme development. *Int J Qual Methods.* 2006;5(1):80-92
40. Jackson K, Bazeley P. *Qualitative Data Analysis with NVivo.* Sage Publication Ltd; 2019.
41. Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *Int J Qual Health Care.* 2007;19(6):349-357. <https://doi.org/10.1093/intqhc/mzm042>
42. World Medical Association Declaration of Helsinki: ethical principles for medical research involving human subjects. *JAMA.* 2013;310(20):2191-2194. <https://doi.org/10.1001/jama.2013.281053>
43. Sontgerath R, Eckert K. Impairments of lower extremity muscle strength and balance in childhood cancer patients and survivors: a systematic review. *Pediatr Hematol Oncol.* 2015;32(8):585-612. <https://doi.org/10.3109/08880018.2015.1079756>
44. Berkman AM, Lakoski SG. A review of cardiorespiratory fitness in adolescent and young adult survivors of childhood cancer: factors that affect its decline and opportunities for intervention. *J Adolesc Young Adult Oncol.* 2016;5(1):8-15. <https://doi.org/10.1089/jayao.2015.0031>
45. Fridh MK, Simonsen C, Schmidt-Andersen P, et al. Cardiorespiratory fitness and physical performance after childhood hematopoietic stem cell transplantation: a systematic review and meta-analysis. *Bone Marrow Transplant.* 2021;56(9):2063-2078. <https://doi.org/10.1038/s41409-021-01370-2>
46. Wilson CL, Howell CR, Partin RE, et al. Influence of fitness on health status among survivors of acute lymphoblastic leukemia. *Pediatr Blood Cancer.* 2018;65(11):e27286. <https://doi.org/10.1002/xbc.27286>
47. Mizrahi D, Wakefield CE, Simar D, et al. Barriers and enablers to physical activity and aerobic fitness deficits among childhood cancer survivors. *Pediatr Blood Cancer.* 2020;67(7):e28339. <https://doi.org/10.1002/xbc.28339>
48. Adamovich T, Watson R, Murdoch S, et al. Barriers and facilitators to physical activity participation for child, adolescent, and young adult cancer survivors: a systematic review. *J Cancer Surviv.* 2022. <https://doi.org/10.1007/s11764-022-01217-9>
49. Bandura A, Freeman WH, Lightsey R. *Self-efficacy: The Exercise of Control.* Springer; 1999.
50. Springer AE, Kelder SH, Hoelscher DM. Social support, physical activity and sedentary behavior among 6th-grade girls: a cross-sectional study. *Int J Behav Nutr Phys Act.* 2006;3:8. <https://doi.org/10.1186/1479-5868-3-8>
51. Cox AE, Ullrich-French S. The motivational relevance of peer and teacher relationship profiles in physical education. *Psychol Sport Exerc.* 2010;11(5):337-344. <https://doi.org/10.1016/j.psychsport.2010.04.001>
52. Fitzgerald A, Fitzgerald N, Aherne C. Do peers matter? A review of peer and/or friends' influence on physical activity among American adolescents. *J Adolesc.* 2012;35(4):941-958. <https://doi.org/10.1016/j.adolescence.2012.01.002>
53. Barber FD. Social support and physical activity engagement by cancer survivors. *Clin J Oncol Nurs.* 2012;16(3):E84-E98
54. McDonough MH, Beselt LJ, Daun JT, et al. The role of social support in physical activity for cancer survivors: a systematic review. *Psychooncology.* 2019;28(10):1945-1958. <https://doi.org/10.1002/pon.5171>
55. Fong AJ, Scarapicchia TMF, McDonough MH, Wrosch C, Sabiston CM. Changes in social support predict emotional well-being in breast cancer survivors. *Psychooncology.* 2017;26(5):664-671. <https://doi.org/10.1002/pon.4064>
56. Ryan RM, Deci EL. Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *Am Psychol.* 2000;55(1):68-78. <https://doi.org/10.1037/0003-066x.55.1.68>
57. Thorsteinnsson T, Schmiegelow K, Thing LF, et al. Classmates motivate childhood cancer patients to participate in physical activity during treatment: a qualitative study. *Eur J Cancer Care (Engl).* 2019;28:e13121. <https://doi.org/10.1111/ecc.13121>
58. Ingersgaard MV, Fridh MK, Thorsteinnsson T, Adamsen L, Schmiegelow K, Baekgaard Larsen H. A qualitative study of adolescent cancer survivors perspectives on social support from healthy peers - a RESPECT study. *J Adv Nurs.* 2021;77(4):1911-1920. <https://doi.org/10.1111/jan.14732>
59. Houdeshell MJ, Thomas KM, King AA, L'Hotta AJ. Limitations of current rehabilitation practices in pediatric oncology: implications for improving comprehensive clinical care. *Arch Phys Med Rehabil.* 2021;102(12):2353-2361. <https://doi.org/10.1016/j.apmr.2021.05.021>
60. Yao CA, Rhodes RE. Parental correlates in child and adolescent physical activity: a meta-analysis. *Int J Behav Nutr Phys Act.* 2015;12:10. <https://doi.org/10.1186/s12966-015-0163-y>
61. Zecevic CA, Tremblay L, Lovsin T, Michel L. Parental influence on young children's physical activity. *Int J Pediatr.* 2010;2010:468526. <https://doi.org/10.1155/2010/468526>
62. Cheung AT, Li WHC, Ho LLK, Chan GCF, Chung JOK. Parental perspectives on promoting physical activity for their children surviving cancer: a qualitative study. *Patient Educ Couns.* 2021;104(7):1719-1725. <https://doi.org/10.1016/j.pec.2020.11.009>
63. Cramp F, Byron-Daniel J. Exercise for the management of cancer-related fatigue in adults. *Cochrane Database Syst Rev.* 2012;2021:CD006145. <https://doi.org/10.1002/14651858.CD006145.pub3>
64. Van Dijk-Lokkart EM, Steur LMH, Braam KI, et al. Longitudinal development of cancer-related fatigue and physical activity in childhood cancer patients. *Pediatr Blood Cancer.* 2019;66(12):e27949. <https://doi.org/10.1002/xbc.27949>
65. Finnegan L, Wilkie D, Wilbur J, Campbell R, Zong S. Correlates of physical activity stages of change in young adult survivors of childhood cancers. *Oncol Nurs Forum.* 2007;34(5):E60-E69.
66. Dugan KF, Hidde MC, Chard CA, Graham DJ, Withycombe JS, Leach HJ. Exploring social ecological determinants of physical activity among adult survivors of childhood cancer. *J Adolesc Young Adult Oncol.* 2021;10(3):316-325. <https://doi.org/10.1089/jayao.2019.0169>
67. Adams SA, Matthews CE, Ebbeling CB, et al. The effect of social desirability and social approval on self-reports of physical activity. *Am J Epidemiol.* 2005;161(4):389-398. <https://doi.org/10.1093/aje/kwi054>
68. Lie HC, Anderssen S, Rueegg CS, et al. The Physical Activity and Fitness in Childhood Cancer Survivors (PACCS) study: protocol for an international mixed methods study. *JMIR Res Protoc.* 2022;11(3):e35838. <https://doi.org/10.2196/35838>

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