



Review article

Experiences, behaviours, and perspectives of young cancer survivors on physical activity



Ewan Thomas^a, Luca Di Bartolo^{a,*}, Marina Galioto^a, Domiziana Seminara^a, Susanna Pusa^b, Rebecca Baxter^b, Sonia Ortega-Gómez^c, David Jiménez-Pavón^c, Maria Vasilopoulou^d, Apostolos Vantarakis^d, Paula Tavares^e, Maria João Campos^e, Petra Thaller^f, Joshua Thaller^f, Sofia Papakonstantinou^g, Musa Kirkar^h, Sara Vivirito^h, Francesca Gloriosoⁱ, Ennio Iannittoⁱ, Mario Lo Mauro^j, Antonino Bianco^a

^a Sport and Exercise Sciences Research Unit, Department of Psychology, Educational Science and Human Movement, University of Palermo, Palermo, Italy

^b Department of Nursing, Umeå University, Umeå, Sweden

^c MOVE-IT Research Group, Department of Physical Education, Faculty of Education Sciences, University of Cadiz, Cadiz, Spain

^d Department of Public Health, Medical School, University of Patras, Patras, Greece

^e Faculty of Sport Sciences and Physical Education, University of Coimbra, Coimbra, Portugal

^f Department of Health Consulting, Research and Science, Outdoor Against Cancer, Munich, Germany

^g Creative Thinking Development - CRE.THI.DEV, Rafina, Greece

^h CEIPES ETS, Palermo, Italy

ⁱ Lega Italiana per la Lotta contro i Tumori (LILT Palermo), Palermo, Italy

^j Medical Oncology Unit, Ospedale Buccheri-La Ferla Fatebenefratelli, Palermo, Italy

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ABSTRACT

This narrative review aimed to identify young cancer survivors' behaviours, experiences, and perspectives concerning physical activity, and identify useful strategies for promoting a healthy lifestyle. A manual search on the following databases was conducted: PubMed, Scopus, and Web of Science. The search was conducted between June 1, 2023, and April 12, 2024. Articles published from database inception up to April 12, 2024, were retrieved. Articles published in any language were considered. Perspectives including ideas, perceived barriers, and facilitators have been identified. Young cancer survivors seem to engage in physical activity as a useful coping strategy to regain normality and keep healthy after the cancer diagnosis. Although emotional and social support seems fundamental to increase participation, several other factors, including physical limitations, fatigue, sex, cancer type, and socio-economic status can influence physical activity participation. For those engaged in physical activity, the preferred activities are walking, biking, going to the gym, and exercising at home, while the least preferred are exercising at the hospital or boot camp-based exercises. Yoga is more frequently chosen by those still under treatment. Young cancer survivors appear to have unique needs different from those of adult cancer survivors. Mode of treatment delivery, increased awareness concerning the effects of

Abbreviations: YCS, Young Cancer Survivors; QoL, Quality of Life; PA, Physical Activity; CNS, Central Nervous System; PE, Physical Education; RT, Resistance Training.

* Corresponding author. Sport and Exercise Sciences Research Unit, University of Palermo, Via Giovanni Pascoli 6, 90144, Palermo, Italy.

E-mail address: luca.dibartolo01@unipa.it (L. Di Bartolo).

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physical activity, including families and friends, connecting survivors, and providing social support together with increasing motivation are key strategies for the promotion of physical activity in young cancer survivors. Fitness and healthcare professionals should consider these aspects to increase young cancer survivors' involvement in physical activities.

1. Introduction

Cancer is one of the most prevalent diseases worldwide, with a higher incidence among the elderly and adults [1]. The number of children and young adults being diagnosed with cancer is also increasing [2,3]. Medical advancements have drastically reduced the mortality rates in young cancer survivors (YCS) [4], improving the overall 5-year survival rate in the mid-70s from 58% to approximately 84% in 2017 [5,6]. However, medical treatments, such as chemotherapy, radiotherapy, immunotherapy, and/or surgery, may have deleterious effects [7]. After completing treatments, cancer survivors may experience persistent side effects that worsen their quality of life (QoL) [8]. Common adverse effects may include stress, depression, pain, fear of recurrence, immune system impairments, and cachexia, a multifactorial syndrome characterized by loss of skeletal muscle mass [9,10]. Furthermore, many YCS are at increased risk of cardiovascular disease and are also more susceptible to future chronic diseases such as diabetes, stroke, liver, and renal disease [11,12]; all of which can negatively affect both cognitive and physical functioning [10,13].

Given the elevated risk of cardiovascular and chronic diseases, it is particularly important to reduce any possible risk factors that may increase the occurrence of future diseases [14]. Among these, healthy lifestyle habits such as avoiding smoking and alcohol or drug abuse, improving diet, and avoiding sedentary habits may be promoted [15]. The project Outdoor Against Cancer Connect Us (OACCUs) is part of the European programme "EU4 Health", and aims to improve the QoL of young cancer survivors through a multidisciplinary approach. These include a balanced diet, sustainability and nature, mental and physical health, and physical activity (PA). The latter has been demonstrated to be safe in YCS and provides improvements in both physical and cognitive domains [16–18]. In particular, aerobic training at moderate intensity, combined with resistance training, has positive effects on multiple outcomes in YCS, for example in reducing anxiety, depressive symptoms and improving self-reported physical function [19].

The guidelines for PA promotion in YCS, provided by the American Cancer Society and the American Institute for Cancer Research, suggest at least 150–300 minutes of moderate activity and 30 minutes of vigorous activity 5 times per week [20].

Despite the vast literature concerning the effects of PA on YCS, there is a high proportion of YCS that are completely sedentary and engage in unhealthy behaviours [20,21].

Different reasons seem to prevent YCS from participating in PA during and after treatment. These mainly include minimal interest in exercise, pain, functional status post-cancer, the lived environment, personal and familial beliefs, and not knowing the importance of PA in relation to health [22]. However, in previous surveys investigating the interest of YCS in health-related programmes, it appears that there is a high proportion of inactive survivors who would be interested in participating in programmes that could provide information regarding the improvement of their health status, such as weight management, healthy eating and PA interventions [23].

Previous research investigating the behaviours of YCS has been carried out, yet there is a lack of information concerning personal experiences and perspectives of PA among YCS. Additionally, adding the family perspective contributes to a greater understanding of how family members and friends can influence and impact YCS lifestyle behaviours concerning PA. Therefore, this review aims to narratively identify YCS' current point of view perspectives, experiences that rationalize their behaviours, and an overview of their past relationship with PA's behaviours. This overview will help fitness and healthcare professionals to better understand the needs of YCS and increase their involvement in PA.

2. Methods

This article was conducted to narratively review studies that addressed the experiences, behaviours, and perspectives of YCS on exercise and physical activity. To retrieve eligible articles, a manual search was conducted on the following databases: PubMed, Scopus, and Web of Science. The search was conducted between June 1, 2023 and August 31, 2023, and then extended during the peer-review phase of the present study up to April 12, 2024. Articles published from database inception up to the 12th of April 2024 were included. The following search strategy was adopted to identify eligible articles: Young cancer survivor* AND ((Physical activity) OR (Exercise)) AND ((Experience* OR Knowledge OR Expertise OR Wisdom) OR (Perspective* OR Viewpoint OR Perception* OR Point of view) OR (Behavio* OR Habit*) OR (Strateg* OR Action*)). This search was extended utilising the bibliography within the recruited texts. Articles published in any language were considered. Qualitative, observational, cross-sectional studies, systematic, and scoping reviews exploring YCS perspectives, experiences, behaviours regarding PA and/or exercise were included. Studies with adult and elderly cancer survivors and/or with no information about PA and/or exercise were excluded. The findings are reported in subsections that explore the abovementioned aspects for PA among YCS.

3. Results

3.1. Perspectives

Few studies have focused on the perspectives of YCS in relation to PA. Understanding their perspectives and preferences is

informative for developing strategies to promote physical activity in this specific population. The majority of YCS indicate that they are both interested (~80–90%) and able (~90%) to participate in PA programmes [24–28] and they would have probably started a programme post-treatment (~80%) if they had the opportunity to do so [25,28]. YCS were interested in receiving information regarding PA either before, during or after treatment [24,25]. In the Bélanger et al. study [24], this interest was more present in the younger than in older cancer survivors ($P=0.002$), especially through e-mail and the Internet ($P=0.044$ and $P=0.006$, respectively). Survivors report that little information regarding PA was provided by healthcare providers [26]. However, they preferred suggestions for PA either in the form of brochures or by fitness professionals, rather than from physicians or physical therapists [25]. However, as indicated by Mooney et al. [29], 91% of YCS seek information regarding PA through the Internet. Although information retrieval is important for YCS, the information retrieved may not always be specific to their needs. For instance, a high proportion of YCS (53%) indicated that the information retrieved did not meet their needs concerning exercise programs [30] with the proportion being higher among younger survivors. The difficulty in finding information specific to their needs may lie in the philosophy of “tailored PA” or “Adapted Physical Activity (APA)”. According to this, healthcare professionals, in particular fitness professionals, when planning a training protocol, should take into account different aspects of the individual. These are not only related to their specific disease but also other variables like psychological and social ones. The PA engagement can be increased with a tailored PA program if this includes caloric expenditure, the preferred type of PA, and goal setting [31]. Additionally, YCS wanted reliable information from trustworthy sources [32]. They indicated that seeking information regarding healthy lifestyles and PA is a catalyst for a healthier lifestyle behaviour change [32]. However, they also acknowledged that they likely would not have actively sought out this information if they had not received a cancer diagnosis.

Further, YCS who are willing to start an activity indicate that they would prefer to perform the activity with either friends or family members [25,33–35] rather than alone or with other YCS [36].

Among perceived facilitators of PA participation, activity trackers were frequently identified by YCS as useful for evaluating their level of fitness. Further facilitators included gaining access to information regarding the possible activities that they may perform, support from loved ones and doctors [36,37], having good economic resources [33], and accepting personal limitations [37]. YCS reported that personalized apps that were designed for a specific type of cancer, being provided with a personalized PA plan, and setting specific exercise goals would strongly motivate them to participate in PA programmes [32,36,38]. A systematic review and meta-analysis investigated the effects of activity trackers on PA interventions during or after hospital general care in adults. The results showed small positive effects for the intervention using an activity tracker in increasing PA levels (Standardised mean difference [SMD]= 0.34; 95% CI 0.12–0.56). However, no effects were found on physical functioning. The authors highlighted that PA intervention may accelerate the rate of physical function recovery than the level of PA. In the Larsen et al. study [39], the most motivated survivors developed strategies to improve their physical function. They eventually reported that they were able to improve their physical functioning adequately and were proud to be either at the same physical level as their peers or, in some cases, even better. Further, many survivors expressed the belief that engaging in a PA program would prevent future health problems, including cancer, which represents a very strong intrinsic motivation (together with the fear of being ill again) for starting a PA [33].

In contrast, YCS recognized distinct barriers in relation to PA. These mainly included fatigue, frustration or stress from post-cancer physical limitations (which may include loss of muscle mass due to treatment, fatigue, and pain) [33–36,40,41]. These were reported by many survivors which indicated that the limitation reduced the opportunity to participate in PA, especially at school or in team sports [37]. This resulted in reduced motivation and an increased perception of disparity between survivors and their peers. Further, lack of time, boredom with exercise routines, and lack of knowledge regarding PA [27,36] prevented active participation. Many survivors harboured concerns about their ability to regain their pre-cancer physical levels, which served as a deterrent and influenced their reluctance to participate in a PA program [36].

Additional factors were perceived as either barriers or facilitators depending on how they were managed. Peers played a significant role in the lives of YCS and could act as barriers if they perceived the physical limitations of YCS as impeding their participation in PA. On the other hand, when peers actively included, invited or offered social support to survivors, they became motivators, effectively acting as facilitators for YCS [32,37]. Similarly, physical education (PE) teachers at school could also be seen as either barriers or facilitators, depending on their ability to incorporate YCS into their PE classes. Social support can also play a crucial role in the mental health of YCS. The lack of social support in PA was connected with high depression levels in 69 Italian YCS ($P<0.001$), as shown in the Gentile et al. study [42]. Another crucial factor to consider is the proximity of YCS’s residence to the location where PAs take place. Research has shown that survivors are more inclined to participate in PA if the activity site is within a half-hour distance from their homes [34,36].

3.2. Experiences

Unlike behaviour, which is generally a standardised depiction of a past event that is, therefore, observable or narratable, experiences offer a rationale for human behaviours, which include emotions, motivations, and memories [43].

PA was described as a coping strategy that could be used to overcome stress caused by the illness and to assist YCS to feel more relaxed and clear-headed [38]. However, the investigation conducted by Larsen et al. [39] explored YCS experiences with self-management in everyday life. In particular, the impact of fatigue and building self-management competencies were identified as central to PA. Survivors reported that a key theme was balancing activities and rest, but PA was often sacrificed in favour of other social activities. Further, because their physical abilities were reduced compared to the pre-cancer period, many stopped exercising either because they felt too tired or because they didn’t want to let down the expectations of their peers, especially in team sports. During this phase, it is essential for trainers and coaches to support YCS to not permanently alienate them from the practice of PA.

PA was also often used as a tool to get back in shape and to start socializing with friends again, representing a way to get back to “normality” [44]. An investigation by Vani et al. [45] aimed to explore the return to PA of YCS who were already active before their diagnosis. Four main themes emerged from the investigation. The first was related to the importance of PA. The survivors mainly compared their abilities between the pre- and post-diagnosis periods, feeling that PA was part of their pre-diagnosis identity. Since some abilities were reported to decrease post-diagnosis, YCS often felt that they had lost part of their identity. Such aspects, in conjunction with the difference between their expectations for the return to PA and the effective physical outcomes, often discouraged them from continuing PA participation. However, PA was also seen as a tool to regain control of their lives and feel “normal,” both in the mental and physical domains. The second aspect investigated was the change in appearance post-treatment. YCS described that they felt unrecognisable and very different from how they “should look”. For some YCS, the change from pre-diagnosis made them feel embarrassed to publicly engage in PA, for fear of being judged negatively. Many reported that coaches, peers, or gym attendants made negative comments regarding their change in appearance, which made them feel uncomfortable when publicly engaging in these activities. This leads the survivors to perform the PAs in parks, green spaces, or open environments with a lower probability of social engagement [45]. Conversely, PA was used as a strategy to overcome such bodily changes caused by the illness, the surgery, or the therapy.

The third aspect was supportive care for PA participation either this being emotional or financial [46].

Among the positive experiences that promoted participation in PA, certain events brought the attention of the general public to specific situations, such as for-cause events that focused on being affected by cancer. To this extent, Meyer et al. [47] observed that cause-specific cancer events promoting PA were effectively able to increase PA participation, and survivors showed also higher QoL compared to those who do not participate in these events ($P < 0.001$) representing de facto a promotor of a positive life change.

Specific factors could also influence YCS participation in PA. Survivors diagnosed with brain cancer reported a negative impact on PA (Odds Ratio= 1.83, 95% CI 1.32–2.54) [48]. Another factor associated with lower PA levels is the sex of the survivors, specifically for the female sex (Odds Ratio= 2.06, 95% CI= 1.18–3.68) [49].

3.3. Behaviours

Overall, a reduction in the level of PA was observed as a consequence of the diagnosis [23,49–51]. Murnane et al. [50] reported a significant reduction in PA levels even during treatment ($p < 0.001$). There was significant heterogeneity between how survivors met exercise recommendations, such as participation in exercise programmes (aerobic or resistance training), with reported participation rates ranging from 6% to 80% [28,49–59]. While no differences between the types of cancers appeared to be present concerning PA participation [23], differences in the choice of exercise typology may be correlated to the typology of cancer diagnosis [57]. Survivors of the central nervous system and bone cancer usually choose activities with lower intensities [57].

PA levels appear to be negatively influenced by perceived stress, anxiety [38,55,60], and also by physical limitations such as joint replacements, amputations, or paralysis [51]. In the Badr et al. study [23], YCS worried about their cancer condition significantly adhered to the guidelines for PA, than YCS who showed less cancer worry ($P = 0.02$). However, if YCS meets exercise recommendations, the reported health-related QoL benefits tend to be statistically greater ($P = 0.034$) [50]. In addition, survivors with greater physical function reported exercising more often [23,60]. Among these, greater physical function was observed in survivors performing resistance training or moderate to vigorous activities [54].

PA participation can be negatively influenced by some specific factors. Being female, older at the time of diagnosis, having a lower socioeconomic status, and being less emotionally supported were all negatively associated with lower levels of participation in the PA programme [49,51,57,61].

Among the preferred activities, YCS indicated walking, biking, a home-based PA programme, or going to the gym for strength and flexibility improvement [25,33,50,57,62]. The least preferred activities were hospital-based PA programmes and boot camp-based exercises [28]. However, walking was preferred by the least young survivors [25]. Among the activities of those still under treatment, it appears that yoga is the preferred exercise modality [28].

In the Adams et al. study [28], of 318 participants, approximately 80% preferred supervised programmes, while around 70% showed a preference for unsupervised programs. A greater proportion of respondents expressed an inclination towards engaging in individual and recreational activities over participating in team sports within competitive activities. The reason for this inclination could lie in not being judged by teammates. Further, YCS preferred activities that were planned according to age and gender rather than based on the specific type of cancer. However, female participants were more likely to identify the type of cancer as a variable that should be considered for PA participation [28]. Concerning specific exercise parameters, YCS preferred PA at least three days a week for a minimum of 30 minutes each session [28]. Table 1 reports a summary of perspectives, experiences, and behaviours of physical activity in YCS.

3.4. Additional contributing aspects

3.4.1. Adherence to physical activity

Although limited information is available regarding adherence to PA for this population, a recent study by Jung et al. [64] observed that only 48% of participants fully adhered to a one-year intervention program. The study also found that male participants and those with lower mental and physical capabilities were more likely to drop out of the program. Pugh et al. study reported significantly lower PA recommendations for YCS under treatment compared to the healthy population ($P < 0.001$), in the United Kingdom [58]. However, another study [65] reported no difference in YCS adherence rates to PA compared to their healthy counterparts.

Table 1
Summary of perspectives, experiences and behaviours of physical activity in young cancer survivors.

Perspectives	Experiences	Behaviours
<ul style="list-style-type: none"> YCS are interested in PA [24–28] YCS have a willingness to participate in PA [24–28] YCS are willing to receive information concerning PA [24, 25] Information should be delivered by Fitness Professionals [25,34] Information retrieved through the internet alone does not meet YCS needs [29,30]. Information concerning PA should come from reliable sources [29,34] YCS have a preference for engaging in PA with family and friends [26,37] YCS would like personalized PA programs according to specific cancer needs [32,36,38] YCS think that participating in PA can reduce the probability of recurrence of Cancer [33] Perceived barriers to PA are physical limitations, lack of motivation, lack of time and financial resources, and lack of knowledge concerning PA [27,35–37,40–42] Factors such as peers, PE teachers and coaches are perceived either as barriers or facilitators to PA [26, 33–37,42] 	<ul style="list-style-type: none"> PA can be used by YCS as a coping strategy [38] YCS must balance PA between activity and rest [39] Fatigue in YCS can prevent participation in PA [33] PA can be used as a tool to improve the physical condition of YCS [44] PA can be used as a tool by YCS to regain “normality [44]” PA can be used to improve YCS’s physical function and reduce fatigue [44,45,63] Emotional support by parents and friends was a key factor for PA participation [46] Participation in PA in open spaces, green environments and outdoor environments was preferred to avoid negative comments [45] For-cause events were useful tools to engage YCS in PA in everyday life [47] Age at time of diagnosis can influence PA participation [48] Cancer type can influence PA participation [28] Sex of the survivor can influence PA participation [48] 	<ul style="list-style-type: none"> Reduction in PA levels is observed post-diagnosis [50] Not many YCS meet PA recommendations [49–54,57,58] Selection of the type of PA is influenced by Cancer typology [57] PA levels are negatively influenced by stress, anxiety, and worries [38,55,60] Survivors engaging in PA have greater physical function [23,60] PA levels are lower if diagnosis occurs later [64] PA levels are lower among female survivors [49,51,57,61] PA levels are lower among subjects with lower socio-economic status [57] Walking, biking, going to the gym and exercising at home are preferred PA [25, 33,50,57,62] Exercising at the hospital or boot camp-based exercises are the least preferred PA [28] Yoga is the most preferred PA for YCS still undergoing treatment [28] Supervised programs were those most preferred by YCS [28] Exercising for at least three days per week, for at least 30 minutes, was preferred by YCS [28]

PA: Physical Activity; RT: Resistance Training; YCS: Young Cancer Survivors.

3.4.2. The influence of family and friends

Family members and friends have been identified as playing a significant role in facilitating or hindering YCS engagement in PA [37]. A study evaluating PA levels among YCS and their families found significant associations between parent participation in PA and cancer sibling participation in PA [66]; In particular, these associations were present between survivors and the mothers ($r=0.52$); however, no correlation was found between YCS and siblings. Data indicated that within families of YCS, the survivors had lower levels of participation. No differences in self-reported measures were observed between siblings; however, parents reported lower health-related QoL for YCS compared to their siblings, especially for those reported by the mother, which may indicate a certain degree of worry or concern. This phenomenon also emerged in another study [44] that described parental worry in relation to PA. Parents felt that the negative consequences of the illness or the late treatment effects could negatively impact their children. In addition, the parental perception was that YCS did not sufficiently monitor themselves during activities, which led them to be hesitant to let them engage in such activities [44]. Likewise, heightened concern about injury or infection could limit parents’ willingness to allow their children to participate in activities [67]. Furthermore, even when family or friends had an interest in a healthy lifestyle, the experience of constantly receiving excessive concerns or unsolicited advice proved to be burdensome and exasperating [33]. Facilitators associated with family included, for instance, deliberately making family time that included PA, involving YCS in the PA of parents or siblings, and adapting activities to meet the YCS’ needs. The YCS stressed the importance of engaging in unstructured family activities as highly valued for staying physically active [37]. The inclusion of families when discussing activity interventions for YCS was found to have a positive impact on promoting overall PA [67]. Some families prioritized and encouraged PA, while others did not, indicating that family attitudes and culture can act as facilitators or barriers to PA and lifestyle changes. Support from family and peers has been shown to have a positive influence on healthy lifestyles [26,32–34,37,56]. On the other hand, viewing PA as unimportant is a family-related barrier to PA [37]. The type of intervention format should therefore take YCS’ needs and obligations into consideration, inclusive of their family situation [40,68]. When parents or families undertook PAs together with YCS it strengthened feelings of companionship and support [46]. While YCS expressed a desire for parents to join them in activities, parents reported that they did not always recognize that their child had this need [46]. When undertaking PA with family, partners, or friends, YCS appreciated that their performance was not judged by the people around them [45]. Negative social influences for healthy lifestyles encompassed family and friends not having health goals that aligned with the YCS [33], when they did not accept the YCS’ limitations, or when family placed excessive demands on YCS performance and energy levels [37]. Nevertheless, socializing with friends through PA was viewed as important by YCS [26,44], even if they had active symptoms [44]. YCS relied on practical support from friends or family to conduct PA, especially when they experienced extreme tiredness [39].

Table 2
Summary of additional aspects related to physical activity in young cancer survivors.

<u>Adherence to PA</u>
<ul style="list-style-type: none"> • Limited information is available concerning adherence to PA programs [64] • PA engagement adherence rate is ~50% in YCS after one year [64]
<u>Influence of family and friends</u>
<ul style="list-style-type: none"> • Family and friends have a significant impact on encouraging or impeding YCS involvement in PA [37] • Positive relation between parental involvement in PA and YCS engagement in PA [37] • No relation between participation of siblings in PA and participation of YCS in PA [66] • No differences in health-related quality of life and PA levels between siblings and YCS [66] • Facilitating family engagement in PA included scheduling dedicated family time, involving survivors in parental or sibling activities, and adapting activities to suit the YCS' requirements [46]. • Involve families in discussions of PA interventions for YCS [67] • Parental concerns about YCS' participation in PA centred around the potential adverse health effects of PA and the perceived lack of adequate self-monitoring by YCS during PA [44] • Concerns from family and friends could be overwhelming or frustrating for YCS [33]
<u>Strategies for PA implementation</u>
<ul style="list-style-type: none"> • YCS have unique needs which differ from adult cancer survivors [34,68,69] • Web or on-line based delivery modes depend on YCS preferences [41,68] • Increased awareness and knowledge required regarding PA [36] • Connecting patients and widening social networks to improve motivation [36,67]

CNS: Central Nervous System; PA: Physical Activity; YCS: Young Cancer Survivors.

3.4.3. Strategies for physical activity implementation

To increase participation in PA, it is crucial to develop appropriate strategies. These should take into account the unique characteristics and needs that YCS exhibits [69]. A study [68] that evaluated several factors regarding tailoring PA programmes to YCS, confirmed that this population has unique needs that differ from those of adult survivors. These include the possibility for the interventions to be balanced according to their needs, convenient in terms of time, mode of delivery, and economic impact.

Approximately 50% of YCS use forums, chats, social media, or web-based communities to connect with other survivors and discuss the potential interventions and effects they have undergone. To this extent, Valle et al. [70] conducted a randomized controlled trial that delivered a PA intervention through Facebook. Despite the innovative delivery mode, PA engagement only increased when the survivors felt they were socially supported ($p=0.0006$), underscoring the importance of the surrounding social fabric. Likewise, Shabanian et al. [67], identified five main themes that could help develop appropriate strategies to increase PA engagement in YCS. These included increasing knowledge concerning how PA is defined and increasing awareness concerning the types of PA. However, the authors [67] highlight that there is still a lack of knowledge concerning which PA is appropriate for each child according to their needs. Connecting patients during and after treatment can create social engagement within hospitals, which could then be transferred to schools and after-school programs [67]. These social connections could support participation in PA given that lack of motivation has been identified as a possible contributor among YCS who do not engage in PA programs [67].

Table 2 reports a summary of these additional aspects related to physical activity in YCS.

4. Limitations and strengths

The current narrative review is not without limitations. Firstly, we did not investigate how different types of cancer can influence the participation in PA on YCS, and we did not stratify the results accordingly. We reported that PA levels are lower among subjects with lower socio-economic status, however, we did not stratify for socio-economic levels which could further represent a barrier to physical activity or if it is a specific YCS barrier. Then, PA levels seem to be lower in female survivors, but the reasons behind this phenomenon are not investigated and deserve future attention. Lastly, in this review the majority of studies arise from qualitative research, therefore the quality assessment of the included studies could not be assessed.

However, our review synthesises YCS' different points of view on PA engagement, focusing not only on cancer-specific reasons but also on the role that family, friends, social environment, and the use of the internet have on their motivation to engage in PA.

5. Conclusions

Young cancer survivors have unique needs that differ from those of adult survivors. Survivors are willing to participate in physical activity programmes, especially with family and friends. Physical activity seems to be a coping strategy that survivors adopt to regain normality post-cancer, regain physical conditioning, and engage in social activities. Nevertheless, young cancer survivors face barriers like physical limitations, lack of social support, and negative comments regarding physical abilities that can discourage them from engaging in physical activity and group programmes. To encourage young cancer survivors to engage in physical activity, fitness and healthcare professionals need to consider all aspects discussed in this review. This involves educating young cancer survivors about the benefits of physical activity, for example reducing the symptoms of therapy such as fatigue, and recommending activities tailored to their needs. Limited information is available concerning specific exercise typologies and modalities; however, studies included in this review highlighted their inclination towards activities like walking, biking, and yoga. Taking these activities into consideration to bring young cancer survivors closer to physical activity could be a starting point for improving their quality of life. All of this should be

supported by family and friends, who seem to positively influence their motivation.

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Ewan Thomas: Writing – original draft, Conceptualization. **Luca Di Bartolo:** Writing – original draft. **Marina Galieto:** Writing – review & editing. **Domiziana Seminara:** Visualization. **Susanna Pusa:** Writing – original draft. **Rebecca Baxter:** Writing – original draft. **Sonia Ortega-Gómez:** Writing – review & editing. **David Jiménez-Pavón:** Validation. **Maria Vasilopoulou:** Writing – review & editing. **Apostolos Vantarakis:** Validation. **Paula Tavares:** Writing – review & editing, Visualization. **Maria João Campos:** Writing – review & editing. **Petra Thaller:** Visualization. **Joshua Thaller:** Visualization. **Sofia Papakonstantinou:** Visualization. **Musa Kirkar:** Visualization. **Sara Vivirito:** Visualization. **Francesca Glorioso:** Visualization. **Ennio Iannitto:** Visualization. **Mario Lo Mauro:** Methodology. **Antonino Bianco:** Supervision.

Declaration of competing interest

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