

## Abstract

*Background:* There is growing concern about declining levels of physical activity in childhood cancer survivors. This study aimed to examine the effectiveness of an integrated adventure-based training and health education program in promoting changes in exercise behavior and enhancing the physical activity levels, self-efficacy, and quality of life of Hong Kong Chinese childhood cancer survivors.

*Methods:* A randomized controlled trial, two-group pretest and repeated post-test, between-subjects design was conducted to 71 childhood cancer survivors (9-16-year olds). Participants in the experimental group joined a four-day integrated adventure-based training and health education program. Control group participants received the same amount of time and attention as the experimental group, but not in such a way as to have any specific effect on the outcome measures. Participants' exercise behavior changes, levels of physical activity, self-efficacy and quality of life were assessed at the time of recruitment, 3, 6, and 9 months after starting the intervention.

*Results:* Participants in the experimental group reported statistically significant difference in physical activity stages of change ( $p < 0.001$ ), higher levels of physical activity ( $p < 0.001$ ) and self-efficacy ( $p = 0.04$ ) than those in the control group. Besides, there were statistically significant mean differences ( $p < 0.001$ ) in physical activity levels ( $-2.6$ ), self-efficacy ( $-2.0$ ) and quality of life ( $-4.3$ ) of participants in the experimental group from baseline to 9 months after starting the intervention.

*Conclusions:* The integrated adventure-based training and health education program was found to be effective in promoting regular physical activity among childhood cancer survivors.

Keywords: adventure-based training; childhood cancer; Chinese; pediatric oncology; physical activity; self-efficacy

## Introduction

Advances in cancer treatment and cancer treatment efficacy have significantly improved the prognosis of childhood cancer [1]. Nevertheless, research indicates that increased survival rates are accompanied by an increase in associated chronic health problems [2], such as second malignancies, growth and endocrine dysfunction, and serious organ toxicities, consequently affect survivors' psychological well-being and quality of life [3,4].

Over the past two decades, there has been an increase in the promotion of regular physical activity among childhood cancer survivors [5,6] based on the evidence from numerous studies that have shown that regular physical activity enhances the physical and psychological well-being of childhood cancer survivors [5-7]. Specifically, engaging in regular moderate-intensity physical activity may help to ameliorate adverse treatment-related effects such as fatigue and decreased muscle strength and endurance, and thus it may eventually improve cancer survivors' quality of life [6-8]. Nevertheless, there is growing concern about declining levels of physical activity in childhood cancer survivors [9,10]. Moreover, the frequency of both moderate and vigorous physical activity remained substantially reduced after treatment had been completed [11].

Many survivors report that fatigue and reduced physical strength and endurance after remission prevents them from engaging in regular physical activity [7,9]. In addition, to avoid cancer- or treatment-related fatigue, children are often advised by their parents or even some

healthcare professionals to take more rest and to reduce their physical activity. Nevertheless, such a recommendation can accelerate fatigue because physical inactivity induces muscle catabolism and atrophy, which in turn may lead to a further decrease in functional capacity [9,12]. It is vital, therefore, for healthcare professionals to correct misconceptions about physical activity among childhood cancer survivors and, most importantly, to advocate the principle of regular physical activity for these children with the aim of enhancing their physical and psychological well-being and promoting their quality of life. However, a large body of evidence has shown that education alone is insufficient or unlikely to change behavior [13,14], thus healthcare professionals must explore strategies that are effective in helping to change the physical activity habits of childhood cancer survivors.

There has been an increase in the use of adventure-based training to promote the psychological well-being of primary schoolchildren [15], and to help youth substance abusers [16] and adolescents suffering from chronic illness [17] to change their feelings, patterns of thought, and behavior through the experience of such training. Nevertheless, there is an imperative need for rigorous empirical scrutiny of the effectiveness of adventure-based training. It is also important to integrate this training with health education in promoting the adoption and maintenance of regular physical activity among childhood cancer survivors. The aim of this study was to examine the effectiveness of an integrated adventure-based training and health education program in promoting changes in exercise behavior and enhancing the

physical activity levels, self-efficacy, and quality of life of Hong Kong Chinese childhood cancer survivors.

### **Theoretical Framework**

The intervention study reported here was guided by Kolb's experiential learning theory [18].

However, to have a more thorough understanding of how childhood cancer survivors change their physical activity behavior, the concepts of self-efficacy and transtheoretical model of behavior change was also integrated into the framework of this study.

Adventure-based training rests on the theory of experiential learning, and involves a four-step model of concrete experience, reflective observation, abstract conceptualization, and active experimentation. At the adventure-based training camp, participants would have a 'concrete experience' by having some physical activities. Trainers would observe and note down the important moments for further discussion and could recap the experiences that participants had had in the activity (reflective observation). While recapping the experience, trainers could assist the participants to sum up their experience and help them to discuss what they could do to make the experience better (abstract conceptualisation). With consolidation, the trainer would then encourage participants to think of similar situations that they might face in their daily lives, and how they could apply the lessons learnt in this experience into others (active experimentation).

Using physical activity as a tool, adventure-based training allowed participants to experience the “cannot” and learnt how to achieve the “can”, such adventure experience can enhance participants’ self-efficacy [16, 19]. According to social cognitive theory, self-efficacy is an important personal determinant of human behavior and has been defined as the belief in one’s capability to engage in behavior to solve difficult tasks [20,21]. This belief influences decisions about whether a certain form of behavior will be adopted and maintained and is therefore important in the promotion of physical activity [22].

Based on the transtheoretical model of behavior change [23], Marcus *et al.* [24] identified five exercise patterns: (1) the individual does not participate in physical exercise and does not intend to start exercising in the next 6 months (pre-contemplation); (2) the individual does not participate in physical exercise but is thinking about starting to exercise in the next 6 months (contemplation); (3) the individual currently participates in exercise, but not regularly (preparation); (4) the individual currently exercises regularly, but has only begun doing so within the last 6 months (action); and (5) the individual currently exercises regularly and has done so for longer than 6 months (maintenance). Self-efficacy has been shown to be closely linked to stages of change in physical activity [24], with individuals in the pre-contemplation stage has the lowest self-efficacy scores and those in the maintenance stage has the highest scores [25]. It was anticipated that through adventure-based training,

participants' self-efficacy could be enhanced and consequently, facilitated them step by step to get involved in different levels of physical activities.

## Methods

### Design

A randomized controlled trial (RCT), two-group pretest and repeated post-test, between-subjects design was conducted. To eliminate the experimenter bias effect a single-blind technique was used whereby the person collecting the data was ignorant of the intervention allocation of the study participants. We prepared a box with two sealed opaque envelopes labeled "Group A" and "Group B". A parent of each child was asked to draw an envelope from the box to indicate the group assignment. The envelope was then put back into the box to be drawn by the next parent.

### Participants

Recruitment of participants was carried out through the Sunshine Parents Club, which is a non-profit voluntary organization providing education and psychological support to parents of Hong Kong Chinese childhood cancer survivors. The inclusion criteria were (a) Hong Kong Chinese childhood cancer survivors who had completed treatment at least six months previously, (b) aged between 9 and 16 years, (c) able to speak Cantonese and read Chinese, and (d) had not engaged in regular physical activity for the past 6 months. Regular exercise is referred here as 60 minutes or more per day of aerobic activity with most of the activity of

moderate or vigorous intensity and with vigorous-intensity physical activity on at least 3 days

[26]. We excluded childhood cancer survivors with evidence of recurrent or second malignancies, and those with physical impairment or cognitive and learning problems identified from their medical records. The sample size was based on the availability and voluntary participation of eligible children.

### Intervention

#### Placebo control group

Control group participants received medical follow-up according to the schedules of their respective oncology units. They also received the same amount of time and attention as the experimental group, but not in such a way as to have any specific effect on the outcome measures. The children were invited to attend four days of leisure activities over a six-month period, for example at 2 weeks, 2 months, 4 months and 6 months after the day of recruitment.

Leisure activities were organized by a community center, which included cartoon film shows, handicraft workshops, chess games, health talks on the prevention of influenza and eating a healthy diet, and a day visit to a museum and theme park.

#### Experimental group

In addition to receiving medical follow-up, participants joined a four-day integrated adventure-based training and health education program with activities such as educational talks, a workshop to develop a feasible individual action plan for regular physical activity,

and adventure-based training activities. Previous research has shown that having an individual action plan is important as it increases the possibility that the person will turn his or her intentions into action [27]. The content of the educational talks was tailored to participants who did not engage in regular physical activity. **The detailed content of the program, including the educational talks and examples of adventure-based activities, are shown in Tables 1 and 2, respectively.**

To ensure that the intervention dosage – in terms of the amount, frequency, duration, and breadth – would adequately assess outcomes such as physical activity levels, self-efficacy, stages of change, and quality of life, the following measures were taken. An advisory committee was set up to develop an appropriate integrated program for Hong Kong Chinese childhood cancer survivors. The committee included the researcher, an assistant professor at a local university with considerable experience of conducting psychological interventions among children, a pediatric oncologist, an oncology nurse specialist with rich experience in taking care of children with cancer, two professional adventure-based trainers, and an assistant professor of Sports and Recreation Management with extensive experience and professional knowledge in conducting adventure-based training for children. In addition, the content of the adventure-based training program was sent to a professional adventure-based training center for content validation. **The program was implemented in small groups with a maximum of 12 participants per group and in a day camp training center on four days over a**



six-month period. The intervention schedule was the same as the placebo control group.

Health education talks and workshops took place between the adventure-based training activities in the day camp center and were conducted by healthcare professionals working in a local university. The adventure-based training activities were led by two qualified adventure-based training instructors with extensive experience and professional knowledge of conducting such training for children. At least two healthcare professionals joined the adventure-based training to monitor the physical condition of the participants and their fitness to join the adventure-based training activities.

Measures

**The Chinese University of Hong Kong: Physical Activity Rating for Children and Youth (CUHK-PARCY)**

The physical activity levels of participants were assessed using the CUHK-PARCY, which is a 1-item activity rating scale modified from the Jackson Activity Coding [28] and the Godin-Shephard Activity Questionnaire Modified for Adolescents [29]. The CUHK-PARCY adopts an 11-point scoring system (0-10) to grade levels of physical activity ranging from no exercise at all (0) to vigorous exercise on most days (10) and taking into consideration the frequency, duration, and intensity of the activity concerned. Accordingly, scores of 0 to 2, 3 to 6, and 7 to 10 are interpreted as low, moderate, and high physical activity levels. The CUHK-PARCY has been used with Hong Kong Chinese children [30,31] and its

psychometric properties have been tested. The results showed that the content validity index was 90% and test-retest reliability coefficient at a 2-week interval was 0.86[31].

#### **Physical Activity Stages of Change Questionnaire (PASCQ)**

Participants' current stages of exercising were evaluated using the PASCQ, which identified different exercise patterns to the five stages: pre-contemplation, contemplation, preparation, action, and maintenance. The PASCQ is a 4-item questionnaire on which participants answer "yes" or "no" to questions about their physical activity practices [32]. Each participant is then classified into one of the five different stages by means of a scoring algorithm. The PASCQ has been used with Hong Kong Chinese children [31] and its psychometric properties have been tested. The results showed that the content validity index was 92% and test-retest reliability coefficient at a 2-week interval was 0.83[31].

#### **Physical Activity Self-Efficacy (PA-SE)**

The PA-SE was used to measure the children's self-confidence in their ability to participate in various age-appropriate physical activities [33]. The PA-SE comprises five items in which children are asked if they are "not sure," "a little sure," or "very sure" that they can do such things as "keep up a steady pace without stopping for 15-20 min." Higher scores indicate higher self-efficacy. This scale has been validated and used in Chinese children [34], with internal consistency found to have alpha coefficients ranging from 0.67 to 0.69.

#### **Pediatric Quality of Life Inventory (PedsQL)**

The PedsQL was used to measure the participants' quality of life. The instrument comprises 23 items grouped into four subscales: physical functioning (8 items), emotional functioning (5 items), social functioning (5 items), and school functioning (5 items). Participants were asked to rate how often they had experienced problems over the past month on a scale from 0 to 4. Higher scores indicate better quality of life. **The psychometric properties of the Chinese version of the PedsQL have been empirically tested [35], with internal consistency found to have an alpha coefficient of .86 and test-retest reliability ranging from  $r = 0.62$  to  $r = 0.8$ .**

#### Data Collection Procedures

Approval for the study was obtained from the hospital ethics committees. To identify potential participants, a leaflet containing details of the study and a demographic information sheet were mailed to all parents of childhood cancer survivors attending the Sunshine Parents Club. Children and their parents who were interested in the research were asked to return the demographic sheet using the enclosed envelope to convey their willingness to participate in the study. A briefing session was then conducted in the out-patient clinic for those children who were eligible. Written consent was obtained from the parents after they were told the purposes of the study, although they were of course given the option of allowing or refusing their child's involvement. The children were also invited to sign their names on a special children's assent form and told that their participation was voluntary.

After obtaining participants' demographic data, they were asked to complete the Chinese versions of the PA-SE, CUHK-PARCY, PASCQ, and PedsQL (baseline: T1). Participants were then randomly assigned to the experimental and control groups. All of the participants received a telephone call inviting them to join the interventions according to their group assignment at an appointed time. Data collection was conducted again at 3 months (T2), 6 months (T3), and 9 months (T4) after starting the intervention. All of the participants were informed that there would be home visits for data collection.

#### Statistical analysis

The Statistical Package for Social Sciences (SPSS) software, version 19.0 for Windows was used to analyze the quantitative data. Intention-to-treat analysis was used and missing data were substituted using the last-observation-carried-forward procedure. The comparability of the experimental and control groups was assessed using inferential statistics (independent  $t$ -test and  $\chi^2$ ). Descriptive statistics were used to calculate the mean scores and standard deviations of the scales. Mixed between-within-subjects ANOVA was used to determine whether the integrated program was effective in increasing childhood cancer survivors' levels of physical activity and self-efficacy and enhancing their quality of life. Pairwise comparisons were conducted to examine how physical activity, self-efficacy, and quality of life changes from T1 to T2, T1 to T3, and T1 to T4. In addition, the Friedman Test was used

to determine any differences between the exercise behavior of participants in the experimental and control groups.

## **Results**

A leaflet containing details of the study and a demographic information sheet were mailed to 178 members of the Sunshine Parents Club and 141 members returned the demographic information sheet. Of the 141 respondents, 82 children met the inclusion criteria. However, 11 of the parents either showed no interest in joining the study or were unavailable for the upcoming interventions. The remaining 71 children were randomly assigned to the experimental and control groups, with 34 children in the experimental group and 37 in the control group. A Consolidation Standards of Reporting Trials (CONSORT) flowchart is shown in Figure 1. Table 3 compares the demographic and baseline characteristics between those who completed and dropped out of the study and between the experimental and control groups. There were no statistically significant differences in any of the demographic and baseline data between those who completed the study and those who dropped out. The results also indicated that the experimental and control groups were similar with respect to the children's age, sex, diagnosis, treatment received, time since treatment was completed, baseline physical activity levels, stages of change, self-efficacy, and quality of life, suggesting a high level of comparability of variance between the two groups.

Attendance rates for the intervention sessions were high for both groups: 85.3% of participants in the experimental group attended all interventions (four sessions), with three participants (8.8%) absent from one session, one (2.9%) from two sessions, and one (2.9%) from three sessions; 78.4% of participants in the attention placebo control group attended all interventions (four sessions), with four participants (10.8%) absent from one session, three (8.1%) from two sessions, and one (2.7%) from three sessions; all of the participants joined the visit to the museum and theme park.

The results of the mixed between-within-subjects ANOVA on the scores for physical activity levels, physical activity self-efficacy, and quality of life across the four periods are shown in Table 4. The results indicated that there were statistically significant main effects for time, suggesting a change in the levels of physical activity, self-efficacy, and quality of life in children in both groups across the four time periods. There were statistically significant interaction effects between time and intervention, indicating that the changes in the levels of physical activity, self-efficacy, and quality of life in children at different time points were dissimilar between the experimental and control groups. The result of between-subjects effects showed that there was a statistically significant main effect for intervention on physical activity and self-efficacy, indicating that children in the experimental group reported higher mean scores for physical activity levels and self-efficacy than the control group. Nevertheless, there was no statistically significant main effect for intervention on children's

quality of life, indicating that there was no difference in quality of life of children between the two groups. Using the commonly used guidelines proposed by Cohen [36], the effect sizes for the integrated program on the levels of physical activity, self-efficacy, and quality of life were large, moderate, and small, respectively. The mean scores for physical activity, self-efficacy and quality of life across the four periods for both groups are presented in Table 5. Pairwise comparisons showed that there were statistically significant changes in the levels of physical activity and self-efficacy from T1 to T2, T1 to T3, and T1 to T4 in the experimental group. Moreover, there was a statistically significant change in quality of life from T1 to T4 in the experimental group. Although the result showed that there was a statistically significant change in self-efficacy from T1 to T4 in the control group, the actual mean difference was very small (0.3).

The results of the Friedman Test on physical activity stages of change for the experimental and control groups are shown in Table 6. There was a statistically significant difference in the physical activity stages of change of participants in the experimental group, but not in the control group across the four time periods.

## Discussion

We examined the effectiveness of the integrated adventure-based training and health education program in promoting the adoption and maintenance of regular physical activity among childhood cancer survivors. The results showed that childhood cancer survivors

participated in the integrated program reported significantly higher levels of physical activity and self-efficacy than those in the control group. Moreover, there was an increase in the number of survivors in the experimental group progressing from the pre-contemplation stage to the contemplation stage, and from the preparation stage to the action stage at a later date. Our findings add further empirical evidence to the literature that adventure-based training can enhance individuals' self-efficacy [16,19], which is crucial in promoting the adoption and maintenance of regular physical activity [22].

Based on the evidence from previous studies that education alone is insufficient or unlikely to change behavior [13,14], this study integrated health education and adventure-based training to promote regular physical activity for childhood cancer survivors. Such approach did not only promote survivors' awareness of the importance of regular physical activity for their well-being and correct their misconceptions about physical activity, but also enhance their self-efficacy in engaging physical activity, and consequently foster stage transition.

The finding is at odds with previous studies [6-8], where it was reported that engaging in regular physical activity could improve survivors' quality of life. Nevertheless, this study indicated that the quality of life of survivors in both groups was more or less the same across the different periods, regardless of the type of intervention. Unlike the intervention effects on physical activity levels and self-efficacy, only a small intervention effect size was found for



quality of life. A possible reason for this non-significant finding is that the relationship between intervention and quality of life might have been affected by the limited sample size. The observed statistical power for the quality of life variable was only 0.26, indicating a high chance (74%) of Type II error. Another possible reason is that quality of life might be less responsive or require a longer time to respond to the intervention than the adoption and maintenance of regular physical activity. **This is evidenced by the fact that only a statistically significant change was observed in quality of life of survivors in the experimental group from T1 to T4.**

To enhance the study's feasibility and minimize attrition, the interventions for both groups took place on weekends over a 6-month period. Over 80% of the experimental group attended all of the intervention sessions, with only one participant absent from more than two sessions. Most of the childhood cancer survivors participated actively in the adventure games. Implementation of the integrated adventure-based training and health education program appeared to be feasible and acceptable for childhood cancer survivors.

#### Limitations

This study had some limitations. First, all of the participants were recruited from the Sunshine Parents Club. Although this is one of the largest voluntary organizations for childhood cancer survivors in Hong Kong, the sample selection might limit the generalizability of the results. **Additionally, this study did not incorporate power analysis to**

calculate the sample size. With a sample of 71, the study might have been underpowered and the findings can only be regarded as 'preliminary'. Though it is understandable that the population size for pediatric oncology patients in Hong Kong is small, future studies may consider using larger samples, in particular to examine the relationship between such intervention and survivors' quality of life. Second, due to the limits of available resources, including funding support, data collection was carried out only up to 9 months after starting the intervention. As a result, the long-term effects of the intervention are uncertain; in particular, it is unclear whether participants sustained their levels of physical activity over time. Third, this study did not measure possible physiological changes in the participants, although previous research has indicated that engaging in regular physical activity may help to ameliorate adverse treatment-related effects such as fatigue and decreased muscle strength and endurance. Therefore, it is recommended that future longitudinal studies be conducted to monitor the level of physical activity and physical activity behavior of childhood cancer survivors, and to detect any physiological changes that occur over an extended period of time. Fourth, this study is limited by using 'opaque' envelopes for randomization. It is recommended that future studies may consider using more sophisticated methods, such as to generate a list of computer-based random number for randomization.

Implications for practice

This study demonstrates the feasibility and appropriateness of implementing the integrated adventure-based training and health education program in the Hong Kong Chinese context, and the content, nature, and duration of the program appeared to be acceptable to the children and parents concerned. Most importantly, healthcare professionals should go beyond their normal roles by building partnerships with schools and communities to promote the adoption and maintenance of regular physical activity among childhood cancer survivors using a multi-disciplinary approach.

#### Conclusion

This study addressed a gap in the literature by developing and evaluating the effectiveness of an integrated adventure-based training and health education program for promoting the adoption and maintenance of regular physical activity among childhood cancer survivors. The program was found to be effective, feasible to implement, and acceptable to the childhood cancer survivors.

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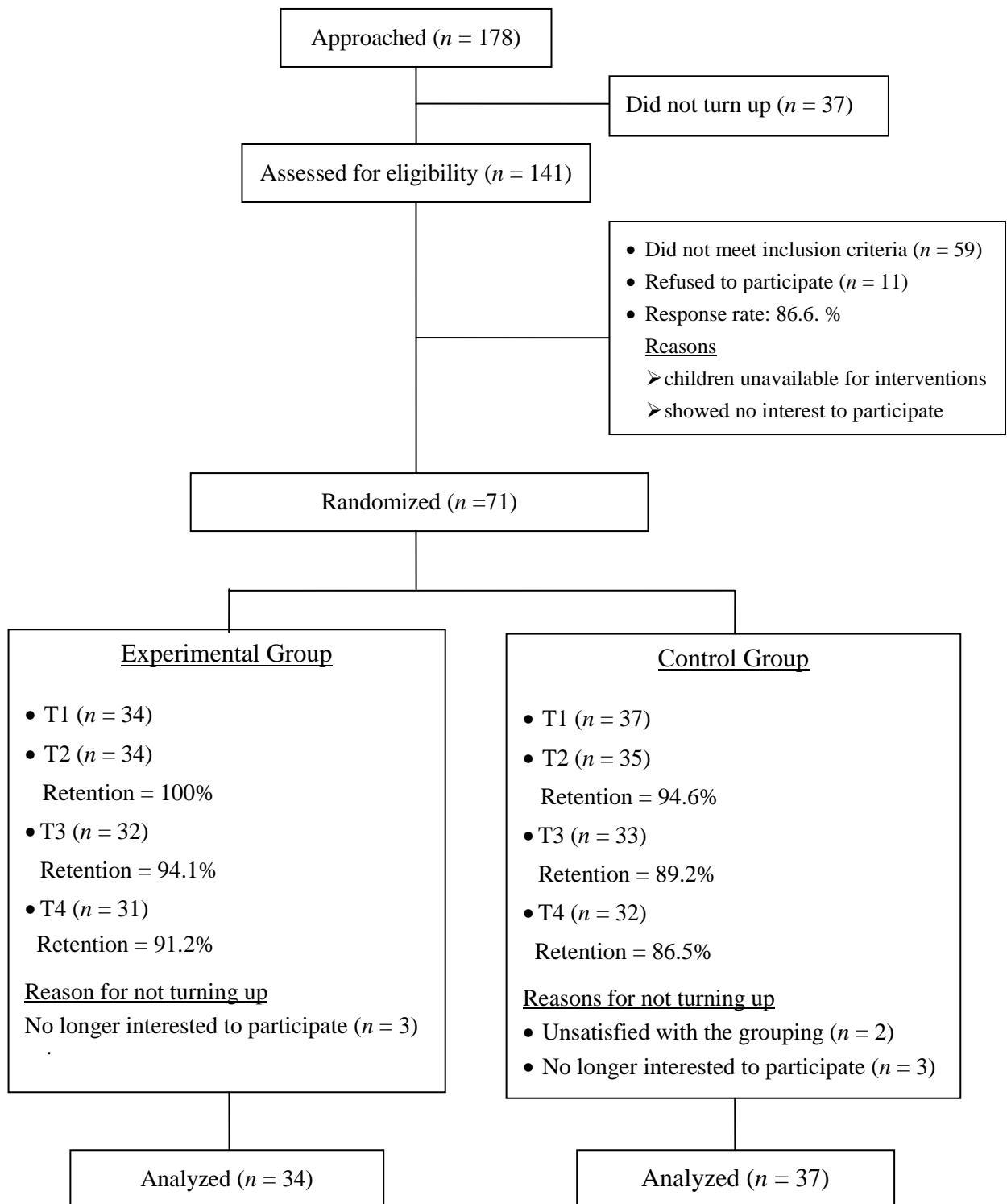
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Figure 1. The consolidated standards of reporting trial (CONSORT) flowchart to track participants through randomized controlled trial.



Note: Data was collected at four points: at the time of recruitment (T1), three months after starting the intervention (T2), six months after starting the intervention (T3) and nine months after starting the intervention (T4)

Table 1. Content of the Educational Talks

Date	Content of the Educational Talks
Day 1	<ul style="list-style-type: none"> <li>• The importance of regular physical activity</li> <li>• The pros and cons of physical activity</li> </ul>
Day 2	<ul style="list-style-type: none"> <li>• Methods to overcome possible barriers to physical activity</li> <li>• Introduce types of light, moderate, and vigorous activities</li> </ul>
Day 3	<ul style="list-style-type: none"> <li>• Discuss the recommended levels of physical activity</li> <li>• Introduce various types of indoor and outdoor physical activities</li> </ul>
Day 4	<p>Strategies to sustain regular physical activity</p> <p><u>* Workshop</u></p> <p>Work out a feasible individual action plan for regular physical activity (Supervised by health care professionals and an assistant professor of Sports and Recreation Management)</p>

Remark: Each educational talk lasted around 40 minutes and the workshop on day 4 lasted around 90 minutes.

Table 2. Examples of Adventure-Based Training Activities

Activity 1	Big Foot
Objective	<ol style="list-style-type: none"> <li>1. To provide an opportunity for participants to participate in physical activity</li> <li>2. To help participants understand their physical strength</li> <li>3. To motivate participants to engage in physical activity requiring a moderate level of physical exertion</li> </ol>
Game Rules	<p>The given route must be completed with all of the team members and achieve their best time record.</p> <ul style="list-style-type: none"> <li>• At least three people on the “Big Foot” at a time</li> <li>• Everyone in the team must drive the “Big Foot” at least once</li> <li>• No touching of the ground allowed</li> <li>• Any violation of the rules results in a time penalty of 5 seconds</li> </ul>
Activity 2	Wall Climbing
Objective	<ol style="list-style-type: none"> <li>1. To help participants understand their physical strength</li> <li>2. To build up their physical self-efficacy by assisting the participants to overcome the challenge of wall climbing</li> </ol>
Game Rules	<p>Each group has to climb up the wall and touch each of the numbers placed there in a random sequence. The climber is blind-folded and the rest of the team supports and protects the climber.</p> <ul style="list-style-type: none"> <li>• The rest of the team needs to supervise the climber and offer protection</li> <li>• Climbers’ limbs should be on the rock at all times, with only one limb moving at a time</li> </ul>
Activity 3	Mini Olympics
Objective	<ol style="list-style-type: none"> <li>1. To help participants understand the fun element and the attraction of participating in physical activities</li> <li>2. To arouse participants’ interest in and commitment to ongoing participation in physical activities</li> </ol>
Game Rules	<p>Participants perform in three different races to try and win the maximum number of points.</p> <ul style="list-style-type: none"> <li>• Transport a huge ball using only the feet without the ball touching the ground (relay)</li> <li>• Caterpillar Relay</li> <li>• Rope Skipping</li> </ul>
Activity 4	Two-legged Run
Objective	<ol style="list-style-type: none"> <li>1. To build up participants’ physical activity self-efficacy through overcoming the challenge of a two-legged run</li> <li>2. To help participants understand their physical strength</li> </ol>
Game Rules	<p>Participants need to pair up and perform a two-legged run. The group must arrive at the other end at the same time to win.</p> <ul style="list-style-type: none"> <li>• Participants need to pair up</li> <li>• They need to use a rope to tie their legs together</li> <li>• Run to the destination to achieve their best record</li> </ul>

\*A debriefing session was conducted at the end of each activity to consolidate the participants’ experiences, feelings, and learning. The trainers facilitated participants in sharing and gave them suitable recognition.

Table 3. Demographic and baseline characteristics between those who completed and dropped out during the study and between the experimental and control groups

	<i>n</i> (%)		$\chi^2$	<i>p</i>	<i>n</i> (%)		$\chi^2$	<i>p</i>
	Completed ( <i>n</i> = 63)	Dropped out ( <i>n</i> = 8)			Experimental ( <i>n</i> = 34)	Control ( <i>n</i> = 37)		
Gender								
Male	33 (52.4)	4 (50.0)	0.02	0.89 <sup>ns</sup>	19 (55.9)	18 (48.6)	0.14	0.71 <sup>ns</sup>
Female	30 (47.6)	4 (50.0)			15 (44.1)	19 (51.4)		
Diagnosis								
Leukaemia	31 (49.2)	4 (50.0)	1.50	0.83 <sup>ns</sup>	15 (44.1)	20 (54.1)	2.54	0.64 <sup>ns</sup>
Lymphoma	17 (27.0)	1 (12.5)			8 (23.5)	10 (27.0)		
Brain tumour	3 (4.8)	1 (12.5)			3 (8.8)	1 (2.7)		
Bone tumour	7 (11.1)	1 (12.5)			4 (11.8)	4 (10.8)		
Neuroblastoma	5 (7.9)	1 (12.5)			4 (11.8)	2 (5.4)		
Treatment received								
Surgery	5 (7.9)	1 (12.5)	1.42	0.70 <sup>ns</sup>	4 (11.8)	2 (5.4)	1.48	0.69 <sup>ns</sup>
Chemotherapy	44 (69.8)	5 (62.5)			22 (64.7)	27 (73.0)		
Radiotherapy	2 (3.2)	1 (12.5)			2 (5.9)	1 (2.7)		
Mixed method	12 (19.1)	1 (12.5)			6 (17.6)	7 (18.9)		
Time since treatment was completed								
6 - 12 months	16 (25.4)	3 (37.5)	2.17	0.82 <sup>ns</sup>	11 (32.4)	8 (21.6)	3.49	0.63 <sup>ns</sup>
13 - 24 months	15 (23.8)	1 (12.5)			9 (26.5)	7 (18.9)		
25 - 36 months	12 (19.0)	1 (12.5)			6 (17.6)	7 (18.9)		
37 - 48 months	9 (14.3)	2 (25.0)			3 (8.8)	8 (21.6)		
49 - 60 months	8 (12.7)	1 (12.5)			4 (11.8)	5 (13.6)		
> 60 months	3 (4.8)	0 (0.0)			1 (2.9)	2 (5.4)		
Physical activity stages of change								
pre-contemplation	15 (23.8)	3 (37.5)	1.14	0.57 <sup>ns</sup>	11 (32.4)	7 (18.9)	2.16	0.34 <sup>ns</sup>
contemplation	36 (57.1)	3 (37.5)			18 (52.9)	21 (56.8)		
preparation	12 (19.1)	2 (25.0)			5 (14.7)	9 (24.3)		
	<i>M</i> ( <i>SD</i> )		<i>t</i>	<i>p</i>	<i>M</i> ( <i>SD</i> )		<i>t</i>	<i>p</i>
Age	12.7 (2.1)	12.4 (2.7)	0.42	0.68 <sup>ns</sup>	12.5 (2.2)	12.8 (2.1)	-0.55	0.59 <sup>ns</sup>
Physical activity levels	2.7 (0.7)	2.9 (0.8)	-0.60	0.55 <sup>ns</sup>	2.7 (0.7)	2.8 (0.7)	-0.30	0.77 <sup>ns</sup>
Physical Activity Self-Efficacy	8.6 (1.2)	8.6 (1.4)	0.02	0.98 <sup>ns</sup>	8.6 (1.2)	8.7 (1.3)	-0.10	0.92 <sup>ns</sup>
Quality of Life	65.6 (6.2)	65.4 (4.9)	0.09	0.93 <sup>ns</sup>	64.8 (7.0)	66.2 (4.9)	-0.95	0.35 <sup>ns</sup>

Notes: <sup>ns</sup> = Not significant at  $p > 0.05$

Table 4. The results of mixed between-within subjects ANOVA on physical activity levels, physical activity self-efficacy and quality of life scores in children across four time periods ( $N = 71$ )

	Physical activity levels				Physical activity self-efficacy				Quality of life			
	<i>F</i> -value	<i>p</i> -value	Eta Squared	Power	<i>F</i> -value	<i>p</i> -value	Eta Squared	Power	<i>F</i> -value	<i>p</i> -value	Eta Squared	Power
Time effect	69.33	0.00*	0.76	1.00	33.34	0.00*	0.6	1.00	10.93	0.00*	0.33	0.99
Interaction effect	40.52	0.00*	0.64	1.00	13.37	0.00*	0.6	1.00	9.81	0.00*	0.31	0.99
Intervention effect	23.52	0.00*	0.25	0.99	4.23	0.04*	0.06	0.53	0.81	0.24	0.01	0.26

\* Significant at  $p < 0.005$ .

Effect size (eta squared) conventions: small effect = 0.01; moderate effect = 0.06; large effect = 0.14

Table 5. Pairwise comparisons of mean scores for physical activity levels, self-efficacy and quality of life between T1 and T2, T1 and T3, and T1 and T4 for the experimental ( $n = 34$ ) and control groups ( $n = 37$ )

	Mean (S.D.)				Pairwise Comparisons					
					T1 Vs T2		T1 Vs T3		T1 Vs T4	
	T1	T2	T3	T4	Mean Difference	<i>p</i> -value	Mean Difference	<i>p</i> -value	Mean Difference	<i>p</i> -value
Physical activity levels										
Experimental	2.7 (0.7)	3.1 (0.5)	3.9 (1.0)	5.3 (1.2)	-0.4	<.001*	-1.2	<.001*	-2.6	<.001*
Control	2.8 (0.7)	2.9 (0.6)	2.9 (0.8)	3.0 (0.8)	-0.1	0.69	-0.1	0.10	-0.2	0.04*
Self-efficacy										
Experimental	8.6 (1.2)	9.0 (1.3)	9.7 (1.1)	10.6 (1.2)	-0.4	<.001*	-1.1	<.001*	-2.0	<.001*
Control	8.7 (1.3)	8.9 (1.1)	8.9 (1.2)	9.0 (1.3)	-0.2	0.06	-0.2	0.06	-0.3	0.03*
Quality of life										
Experimental	64.8 (7.0)	65.5 (6.5)	66.8 (5.7)	69.1 (4.7)	-0.7	0.06	-2.0	0.06	-4.3	<.001*
Control	66.2 (4.9)	66.3 (5.1)	65.9 (4.9)	66.3 (5.4)	-0.1	0.99	0.3	0.99	-0.1	0.99

SD; standard deviation; T1 = at the time of recruitment; T2: at 3 months after starting the intervention; T3: at 6 months after starting the intervention; T4: at 9 months after starting the intervention.

Table 6. Results of the Friedman Test on physical activity stages of change of participants between the experimental and control groups (N = 71)

Stages of Change	<i>n (%)</i>											
	Experimental ( <i>n</i> = 34)						Control ( <i>n</i> = 37)					
	T1	T2	T3	T4	$\chi^2$	<i>p</i>	T1	T2	T3	T4	$\chi^2$	<i>p</i>
Pre-contemplation	11 (32.4)	0 (0.0)	0 (0.0)	0 (0.0)	65.9	0.00	7 (18.9)	6 (16.2)	5 (13.5)	5 (13.5)	6.0	0.11
Contemplation	18 (52.9)	24 (70.6)	17 (50.0)	6 (17.6)			21 (56.8)	22 (59.5)	23 (62.2)	23 (62.2)		
Preparation	5 (14.7)	10 (29.4)	16 (47.1)	22 (64.7)			9 (24.3)	9 (24.3)	9 (24.3)	8 (21.6)		
Action	0 (0.0)	0 (0.0)	1 (2.9)	5 (14.7)			0 (0.0)	0 (0.0)	0 (0.0)	1 (2.7)		
Maintenance	0 (0.0)	0 (0.0)	0 (0.0)	1 (2.9)			0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)		