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Tailored education enhances healthy behaviour self-efficacy in childhood cancer survivors: A randomised controlled study with a 4-month follow-up

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Abstract

This study was to evaluate the acceptability and effectiveness of a tailored education on healthy behaviour self-efficacy (HBSE) and health promotion lifestyle (HPL) for childhood cancer survivors. A two-group, randomised study with repeated measures was conducted in Taiwan. Participants were randomly assigned to receive six 45–60 min individual education and follow-up telephone counselling sessions (n = 34) or standard of care only (n = 35). Each participant was assessed with HBSE and HPL questionnaires and was evaluated at three time points (at baseline, and then 1 and 4 months after intervention). The attrition rate was 7.2%. HBSE and HPL scores increased across the three time points in the experimental group (all $p < 0.05$), except for the HBSE exercise subscale ($p = 0.85$). HBSE scores were significantly higher for the experimental group than for the control group after 4 months of intervention ($F = 5.32$, $p = 0.02$, $\eta^2 = 0.25$). No significant improvements in HBSE were observed over time in the control group. The intervention was acceptable and effective in promoting HBSE in childhood cancer survivors. Further empirical work is needed to reveal the effects of the intervention over a longer period of time and to improve patient engagement in exercise.

KEYWORDS
healthy behaviour, healthy lifestyle, intervention, paediatric cancer survivors

1 | INTRODUCTION

Advances in treatments and care have greatly improved the survival rates of paediatric cancer patients (Francisci, 2017; Robison & Hudson, 2014; Siegel, Miller, & Jemal, 2017). As a result, the number of childhood cancer survivors has greatly increased. However, completion of cancer treatment does not represent an endpoint, since childhood cancer survivors can potentially face adverse health-related consequences related to their cancer and treatments (Hsiao et al., 2018; Yi, Kim, & Tian, 2014; Yuen, Ho, & Chan, 2014). There are also challenges associated with the treatment of comorbid conditions, such as diabetes, osteoporosis, cardiovascular disease and neurocognitive problems, in these childhood patients (Dixon et al., 2018; Henderson, Friedman, & Meadows, 2010; Iyer, Balsamo, Bracken, & Kadan-Lottick, 2015; Robison & Hudson, 2014; Yi et al., 2014). Approximately 60% of childhood cancer survivors experience at least one long-term complication (Oeffinger et al., 2006; Yi et al., 2014), and 80% of these patients require medical treatment for their complication (Lackner et al., 2000). Furthermore, the risk of chronic disease for childhood cancer survivors is estimated to be 10 times

greater than their siblings' risk (Nathan et al., 2008). Therefore, long-term planning and preventive strategies are strongly recommended.

Post-treatment transition of care for cancer patients is an important milestone for establishing appropriate self-care (Syn, 2008) and optimising quality of life (Robison & Hudson, 2014). Thus, information regarding self-care and promotion of good health are considered essential components of follow-up care (Henderson et al., 2010). Cancer survivors also need to be educated regarding the health risks associated with childhood cancer and cancer therapy (Henderson et al., 2010). Such education should provide survivors with risk-directed care, while having a goal of decreasing morbidity and mortality through health promotion and early detection and treatment of cancer therapy-related complications (American Academy of Pediatrics, 2009). Importantly, childhood cancer survivors are encouraged to adopt an active role in managing their own care. However, a majority of these patients miss follow-up appointments, including patients who have endured high-risk interventions (Zheng et al., 2016). Indeed, only 20% of paediatric cancer survivors receive long-term follow-up care into adulthood, and only 35% report being aware that a history of cancer treatment can lead to future health problems (Henderson et al., 2010). These data suggest that paediatric cancer survivors may not be sufficiently educated, or encouraged, to have a direct role in their own long-term health care.

Self-efficacy is defined as the confidence or belief in one's ability to organise and execute a course of action (Bandura, 1977). In previous studies, self-efficacy has been found to be positively associated with healthcare follow-up, adaptive self-management behaviours and well-being among adolescents and young adult childhood cancer survivors (Foster et al., 2015). Provision of survivorship care plans (e.g., written treatment summaries and risk-based care plans) for young adult cancer survivors can also improve self-efficacy (Casillas et al., 2011). Thus, interventions aimed at improving patient self-efficacy in symptom management and increasing health-promoting behaviours have been topics of particular focus for young adult, and adult, cancer survivors (Foster et al., 2016; Green, Hayman, & Cooley, 2015; Kim, Kim, & Mayer, 2017; van der Hout et al., 2017; Zhang et al., 2014).

The interventions described above have contributed to the effectiveness of self-efficacy for cancer survivors. However, these interventions have previously focused on adult cancer survivors ranging in age from 29 to 80 years. Much less is known about self-efficacy in children and adolescent childhood cancer survivors. Therefore, the present study was conducted based on a self-efficacy theory (Bandura, 1977) which promotes that childhood cancer survivors need to enhance their self-efficacy in living with the ongoing aspects and risks of their cancer history, and they need to improve their health and well-being. Thus, it is important for childhood cancer patients to engage in healthy lifestyles that are comprised of health promotion behaviours and prevention of potential morbidity (Lowe et al., 2016; Warner et al., 2016). A healthy lifestyle should include regular physical activity and healthy eating behaviours to reduce the risk of delayed sequelae (Braam et al., 2013; Mendoza et al., 2017). However, studies have reported that childhood cancer survivors often have lower levels of physical activity and consume an unhealthy diet (Warner et al., 2016). Furthermore, survivors who have received very high intensity treatment regimens tend to experience higher anxiety which is accompanied by negative health-related beliefs (Kazak et al., 2010). Thus, the aim of this study was to evaluate the acceptability and efficacy of a tailored education programme aimed at enhancing healthy behaviour self-efficacy (HBSE) and health promotion lifestyle (HPL) in childhood cancer survivors. We hypothesised that: (a) an educational intervention will be acceptable for children and adolescent cancer survivors; and (b) the children and adolescent cancer survivors who receive this intervention will have improved HBSE and HPL scores compared with those who only receive standard care.

1.1 | Theoretical framework

The framework of the intervention used for this study was based on the principles of self-efficacy theory. Self-efficacy is defined as a personal judgement of "how well one can execute courses of action required to deal with prospective situations" (Bandura, 1977). Hence, people need to believe they can master and adhere to HPLs in order to devote the effort necessary to succeed (Bandura, 1977). It has been observed that cancer survivors have an increased risk of doubting their ability to manage long-term sequelae of their disease and treatments (Kazak et al., 2010). Uncertainty regarding an individual's illness and complications can interfere with their ability to adopt health-promoting behaviours and avoid behaviours associated with health risks (Lee, Gau, Hsu, & Chang, 2009). Thus, improving a patient's self-efficacy may alter that patient's perception of their previous illness and its treatment, while building self-awareness in support of health promotion and preventive care (Lev et al., 2001). Healthcare-based support may further enhance patients' sense of self-efficacy with respect to living with complications and may also improve patients' adherence to follow-up and ongoing post-cancer treatments (Meifen et al., 2014).

2 | METHODS

2.1 | Design

This randomised, controlled study included a baseline test and two additional tests that were conducted 1 and 4 months after the start of intervention (Post-test I and Post-test II respectively).

2.2 | Participants

A total of 164 potential participants treated in the paediatric haematology and oncology wards of the Southern Medical Hospital (SMH) of Taiwan between January 2014 and March 2017 were assessed. Randomisation was applied in blocks of four to ensure an even distribution between the control (without intervention) and experimental (with intervention) groups with respect to patient

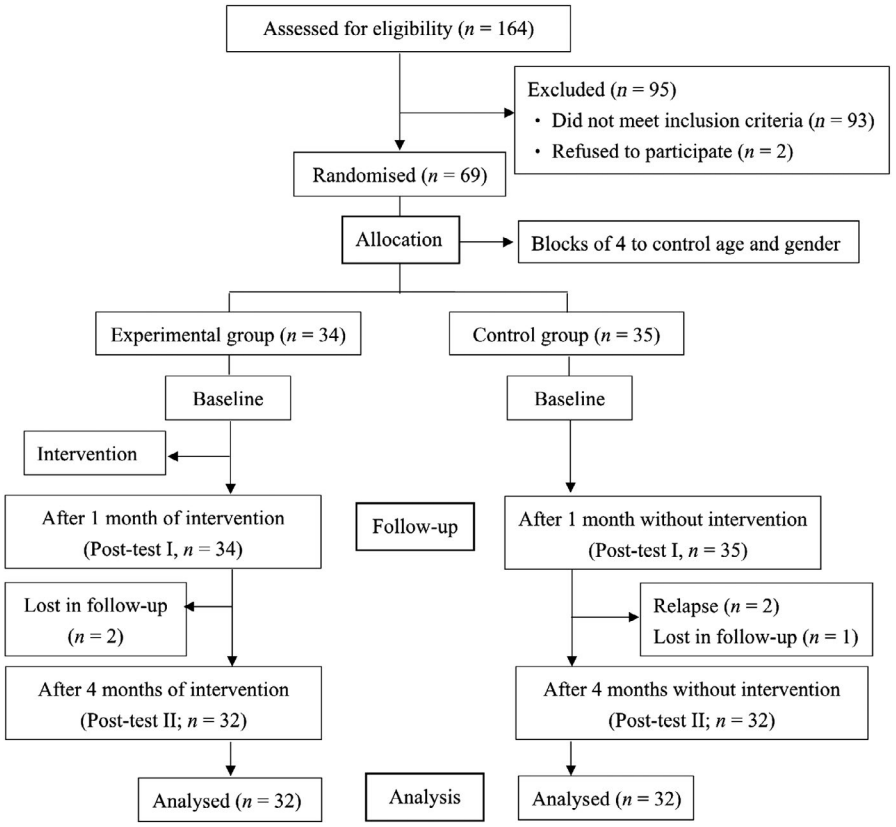

FIGURE 1 Flow chart for patient participation in this study

TABLE 1 Content of the education programme

Module	Goals	Content	No. of sessions
Building self-awareness	Keep follow-up	Potential late effects occurring after cancer treatment and illness	1
Prevent illness and promote health	Maintain health	Healthy food, exercise	1
	Physical self-care	Relapse signs and symptoms, management of side effects (e.g., fatigue, pain, fever) and related issues of concerns (e.g., Port-A, vaccine)	3
	School work	School performance and relationships	1

age, patient gender and number of participants (Figure 1). Inclusion criteria were as follows: (a) a diagnosis of paediatric cancer currently in remission; (b) enrolment within ± 2 months of completing treatment; (c) patient age between 8 and 20 years; and (d) consent to participate expressed by the patient and his or her primary caregiver. Exclusion criteria were an inability to read or communicate in Mandarin or Taiwanese or intellectual disability. Gpower software was used to determine that a sample size of 68 patients would be needed to detect an effect size of 0.2 with an α of 0.05, power of 0.08 and three measurements (Faul & Erdfeler, 2007).

2.3 | Intervention programme

An intervention programme was established according to a self-efficacy theory published by Bandura (1977). The intervention included six aspects. (a) A series of six individual patient sessions (each 45–60 min in duration) was conducted in a quiet, private setting in the pediatric haematology/oncology ward or clinics (Table 1). Each session provided 10–15 min for participants to explore their concerns and for possible solutions to be identified. The six sessions were completed within 1 week. (b) A handbook based on a previous study (Hsiao et al., 2018) was given to each participant. The handbook provided guidance and educational information regarding self-management, delayed effects and complications of cancer treatments, individual exposure-related risks and long-term follow-up. (c) Follow-up telephone counselling was provided 1 and 4 months after the intervention process was started to provide participants with an opportunity to share their experiences after engaging in healthy behaviours. (d) Bilateral communication was used to encourage participants to express their thoughts, concerns and worries regarding completion of their treatment. This communication was also intended to help

participants clarify their thoughts and encourage maintenance of healthy behaviours. The content of the intervention was intended to: (a) build self-awareness of potential health risks and maintain long-term follow-up, and (b) prevent illness and promote health through maintenance of health, physical self-care and school work. The intervention programme was conducted by a research assistant under the supervision of the first author. Meanwhile, the control group received educational intervention upon completing the 4-month post-intervention follow-up.

2.4 | Data collection

Face-to-face interventions were conducted at outpatient clinic visits and/or in the paediatric haematology and oncology wards of SMH. A handbook was used during the six individual patient sessions, and participants were encouraged to refer to the handbook for information while at home. Data were collected by a research assistant. Parents of eligible participants were approached for permission before the patients themselves were asked for their consent. Parents were permitted to be present throughout the intervention and data collection processes if requested by the participant or parent. However, parents who attended the intervention and/or data collection sessions could not interrupt the process. Following procurement of informed consent, all participants completed the HBSE and HPL questionnaires prior to participating in the intervention, thereby providing baseline scores. These two questionnaires were completed again 1 and 4 months after the intervention was started (Post-test I and Post-test II respectively). Participants and parents were unaware of their study group assignments.

2.5 | Ethical considerations

Ethical approval for this study was granted by the Institutional Review Board of SMH in Taiwan. Written informed consent was obtained from each participant and his or her parents or guardians after fully explaining the research purpose. Participants and their caregivers acknowledged that they had a right to withdraw from the study at any time. All data were de-identified.

2.6 | Measurements

Data regarding patient gender, age, education and disease status (e.g., diagnosis, time since diagnosis and remission status) were collected. Intervention efficacy was assessed based on HBSE and HPL questionnaire scores. Intervention acceptability was assessed with a patient satisfaction survey described below.

2.6.1 | HBSE questionnaire

The HBSE instrument was adapted from a health self-efficacy measure (Becker, Stuifbergen, Oh, & Hall, 1993). This instrument assesses the perceptions of children and adolescents regarding their ability to manage their own health behavioural efficacy (Huang, 2007). It is a 24-item self-report which includes four factors: healthy diet, exercise, well-being and health accountability (Huang, 2007). Respondents are asked to indicate how well they perform with respect to engaging in health-related behaviours on a scale of 1 (never) to 5 (always). Reliability and validity of the HBSE instrument were previously established (Cronbach's α range, 0.78–0.88) (Huang, 2007). In the present study, Cronbach's α for internal consistency was 0.87.

2.6.2 | HPL questionnaire

The HPL instrument is a 35-item self-report questionnaire which assesses lifestyle according to six factors: nutrition, exercise behaviours, stress adaption, interpersonal support, self-achievement and healthy behaviours. Respondents are asked to rate their frequency of performing each item on a scale of 1 (never) to 5 (always). Reliability and validity of the instrument (Cronbach's α range, 0.78–0.89), as well as psychometric testing results, were previously published (Huang, 2007). In the present study, Cronbach's α was 0.93.

2.6.3 | Participant satisfaction

Acceptability of intervention was evaluated based on a satisfaction survey that was completed by each participant. The survey consisted of five items and was developed in a previous study (Wu et al., 2014). Participants in the experimental group were asked to provide overall satisfaction ratings for the intervention programme, the programme components and the helpfulness of the programme. The items were rated on a 10-point Likert scale.

2.7 | Data analysis

Data were analysed and verified with SPSS software version 19.0 for Windows (SPSS Inc.). Per-protocol analysis included only the participants who completed both baseline and post-intervention questionnaires. Descriptive statistics are reported as mean (*M*), standard deviation (*SD*) and percentage values. Independent *t* tests and chi-squared tests were used to compare baseline patient characteristics (e.g., gender, religion, diagnosis, family structure, education and age) between the control and experimental groups. One-way repeated measures analysis of variance (ANOVA) was performed to assess simple main effects at the three time points according to group. In addition, Bonferroni-adjusted tests were performed for post hoc analyses. The Greenhouse–Geisser correction was applied when Mauchly's test of sphericity was violated. Analysis of covariance (ANCOVA) was used to elucidate differences in HBE and HPL scores between the groups across the three time points examined, with the baseline data used as covariables. *p*-values <0.05 were considered significant. To facilitate interpretations of the magnitude of detected group differences, effect sizes (η^2) were calculated (with 0.2 considered a small effect, 0.5 considered a medium effect and 0.8 considered a large effect) (Cohen, 1988).

3 | RESULTS

3.1 | Participants

A flow chart describing patient participation in this study is provided in Figure 1. Among the 71 patients who were invited to participate, two declined before starting the study. Then, following the enrolment of the remaining 69 patients, five patients withdrew from the study. The reasons for withdrawal included cancer relapse (control group, *N* = 2) and loss to follow-up (experimental group, *N* = 2; control group, *N* = 1). The resulting attrition rate was 7.2%.

The mean age of the 64 participants who completed this study was 11.89 years (*SD* = 5.9). In addition, a majority of the participants were male, living in a home with a nuclear family structure, and had completed elementary school. The most common diagnosis among the cohort was acute lymphoblastic leukaemia (43.8%). The solid tumours diagnosed included rhabdomyosarcoma, Wilm's tumour, seminoma and osteosarcoma. There were no significant differences in gender, age, religion, diagnosis, family structure, education level,

TABLE 2 Comparison of participants' characteristics between groups

Variable	Total sample *n* (%)	Intervention *n* (%)	Control *n* (%)	χ^2	*p*
Gender				0.64	0.81
Female	27 (42.2)	14 (43.8)	13 (40.6)		
Male	37 (57.8)	18 (56.2)	19 (59.4)		
Religion				7.37	0.06
None	29 (45.3)	16 (50.0)	13 (40.6)		
Tao	22 (34.4)	13 (40.6)	9 (28.1)		
Baddish	12 (18.8)	2 (6.3)	10 (31.3)		
Christian	1 (1.5)	1 (3.1)	0 (0.0)		
Diagnosis				6.06	0.30
ALL	28 (43.8)	18 (56.3)	10 (31.2)		
AML	5 (7.8)	3 (9.4)	2 (6.4)		
Lymphoma	11 (17.2)	5 (15.6)	6 (18.7)		
Brain tumour	8 (12.5)	2 (6.2)	6 (18.7)		
LCH	5 (7.8)	2 (6.2)	3 (9.4)		
Solid tumour	7 (18.7)	2 (6.2)	5 (15.6)		
Relapse					
Yes	12 (18.8)	6 (18.8)	6 (18.8)	0.01	0.07
No	52 (81.3)	26 (81.2)	26 (81.2)		
Cancer treatment					
Chemotherapy only	33 (51.6)	20 (62.5)	13 (40.6)	5.88	0.32
Chemotherapy + OP	17 (26.6)	7 (21.9)	10 (31.2)		
Chemotherapy + RT	5 (7.8)	2 (6.3)	3 (9.4)		
Chemotherapy + BMT	1 (1.6)	1 (3.1)	0 (0)		
Chemotherapy + OP + RT	6 (9.3)	2 (6.2)	4 (12.5)		
Chemotherapy + OP + RT + BMT	2 (3.1)	0 (0)	2 (6.3)		
Family structure				0.46	0.80
Nuclear	33 (51.6)	17 (53.1)	16 (50.0)		
Three generations	23 (35.9)	11 (34.4)	12 (37.5)		
Single parent	8 (12.5)	4 (12.5)	4 (12.5)		
Education level				6.33	0.36
Elementary school	35 (54.7)	17 (53.1)	18 (56.3)		
Junior high school or higher	28 (43.8)	15 (46.9)	13 (43.7)		
	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)	*t*	*p*
Age (years)	11.89 (5.9)	11.68 (5.83)	12.07 (6.06)	0.26	0.79

Abbreviation(s): ALL, acute lymphoblastic leukaemia; AML, acute myeloid leukaemia; BMT, bone marrow transplant; LCH, Langerhans cell histiocytosis; OP, operation; RT, radiation therapy.

TABLE 3 Acceptability survey completed by the intervention group (n = 32)

Question	Range[a]	Mean	*SD*
1. How would you rate your overall satisfaction with this intervention?	7–10	9.26	0.90
2. How would you rate your overall satisfaction with the content of this intervention?	7–10	9.29	0.91
3. How helpful was this program?	7–10	9.29	1.00
4. How much did you apply this program?	7–10	9.35	0.95
		Yes (%)	No (%)
5. Do you want to attend a similar program again?		31 (96.9)	1 (3.1)

Note. Abbreviation: *SD*, standard deviation.
[a]Scoring range = 1–10.

TABLE 4 Changes among baseline (Pre) tests and the two post-intervention tests for the experimental group

	Baseline (Pre)		Post-test I		Post-test II				
	M	*SD*	*M*	*SD*	*M*	*SD*	*F*	*p*	Post hoc
HBSE	77.25	13.35	81.81	15.40	87.78	12.68	8.59	0.001	II > I, II > Pre
Healthy diet	20.31	3.62	22.31	4.06	23.34	4.30	7.71	0.020	II > Pre, I > Pre
Exercise	18.41	4.25	18.59	4.31	19.91	4.08	2.74	0.085	
Well-being	19.41	3.82	20.75	5.02	22.00	3.72	4.54	0.016	II > Pre
Healthy accountability	19.13	5.36	20.16	5.33	22.53	3.66	9.16	<0.001	II > I, II > Pre
HPL	111.25	19.71	121.69	21.57	126.84	20.36	8.74	0.002	I > Pre, II > Pre
Nutrition	25.00	4.17	26.97	4.03	26.69	4.34	4.06	0.022	II > I
Exercise behaviours	17.38	4.46	19.31	5.46	19.75	4.97	4.88	0.020	II > pre
Stress adaption	18.31	4.89	20.19	4.65	21.25	4.78	5.10	0.013	II > Pre
Interpersonal support	19.75	4.66	21.81	4.42	22.84	3.80	6.93	0.004	II > Pre
Self-achievement	15.38	4.48	16.81	4.87	18.34	4.26	5.15	0.008	II > Pre
Healthy behaviours	15.44	2.77	16.59	2.96	17.97	3.40	8.27	0.001	II > Pre

Abbreviation(s): HBSE, healthy behaviour self-efficacy; HPL, health promotion lifestyle; *M*, mean; Post-test I, performed after 1 month of intervention; Post-test II, performed after 4 months of intervention; *SD*, standard deviation.

relapse or not, or cancer treatment observed between the experimental and control groups (Table 2).

3.2 | Intervention acceptability

The results of the acceptability survey conducted are reported in Table 3. An overwhelming majority of the intervention group participants reported they would be willing to attend a similar programme. They also gave the programme very high ratings with respect to the helpfulness of the intervention (M = 9.29) and the applicability of the intervention to their daily lives (M = 9.35).

3.3 | Changes over time according to group

Results from the HBSE and HPL instruments which were administered to each patient are reported in Tables 4 and 5 respectively. Both sets of scores increased significantly across the three time points in the experimental group (all $p < 0.05$), with the exception of the HBSE exercise subscale (Table 4). In contrast, the HBSE scores and the scores of its subscales did not significantly differ with time in the control group. Meanwhile, the HPL scores, including the HPL exercise behaviour and self-achievement subscores, improved significantly across the three time points in the control group (Table 5).

3.4 | Intervention efficacy at different time points

After adjusting for baseline values, significant improvements in HBSE scores were observed at the 4-month post-intervention assessments between two groups (F = 5.32, p = 0.02, η^2 = 0.025) (Table 6). In contrast, no significant treatment effects were observed between the two groups according to the HPL instrument results that were obtained at the 1 and 4 months time points after adjusting for baseline scores (all $p > 0.05$) (Table 6).

4 | DISCUSSION

Participants in the experimental group in this study provided positive feedback regarding the intervention programme. Their feedback indicated that the intervention was understandable, acceptable,

TABLE 5 Changes among baseline (Pre) tests and the two post-intervention tests for the control group

	Baseline (Pre)		Post-test I		Post-test II				
	M	*SD*	*M*	*SD*	*M*	*SD*	*F*	*p*	Post hoc
HBSE	84.13	15.09	84.88	12.90	87.06	12.82	1.64	0.20	
Healthy diet	21.00	5.14	21.94	4.77	22.06	4.30	1.21	0.29	
Exercise	19.91	5.60	20.00	4.69	21.16	4.48	1.95	0.15	
Well-being	21.41	4.78	21.19	4.06	21.47	3.99	1.42	0.87	
Healthy accountability	21.81	3.73	21.75	4.11	22.38	3.83	0.87	0.41	
HPL	119.56	22.42	121.03	20.08	126.75	18.55	4.91	0.01	II > I
Nutrition	24.34	4.91	24.44	4.33	25.59	3.84	2.87	0.64	
Exercise behaviours	17.22	6.47	19.47	5.25	21.25	4.64	12.72	<0.001	II > Pre, I > Pre
Stress adaption	20.97	4.73	20.50	4.47	21.13	4.48	0.48	0.62	
Interpersonal support	23.00	5.21	22.53	4.08	22.91	4.57	0.24	0.77	
Self-achievement	17.38	4.45	17.06	4.10	18.53	3.49	5.52	0.01	II > I
Healthy behaviours	16.66	3.33	17.03	2.73	17.34	2.96	1.28	0.26	

Abbreviation(s): HBSE, healthy behaviour self-efficacy; HPL, health promotion lifestyle; *M*, mean; Post-test I, performed after 1 month of intervention; Post-test II, performed after 4 months of intervention; *SD*, standard deviation.

satisfying and beneficial. Correspondingly, the experimental group exhibited increases in their HBSE (except in the exercise subscale) and HPL scores over time. Furthermore, significantly higher HBSE scores were achieved in the experimental group than in the control group 4 months after the start of intervention. Thus, the findings of this study support the use of educational interventions for childhood cancer survivor populations.

The World Health Organization advocates that patients should be encouraged to become actively involved in their own care. Foster and Fenlon (2011) developed a framework for health and well-being recovery for cancer survivors. Within this framework, self-efficacy is an important element. Self-efficacy is defined as the belief that one can affect their own health outcome through their behaviours and can also have a profound effect on their own motivation and actions (Bandura, 1997). Thus, interventions that address self-efficacy elements may increase participants' confidence in their abilities to initiate and maintain healthy behaviours. Consequently, the intervention employed in the present study included individualised, face-to-face communication to facilitate an active role for participating patients.

Regarding the lack of an intervention effect observed for the HBSE exercise subscale, it is possible that fatigue prevented many of the patients from engaging in exercise (Arroyave et al., 2008;

TABLE 6 Group differences at different time points (*N* = 64)

Variables	Unadjusted *M*	Adjusted *M*	95% CI	SS	*df*	MS	*F*	*p*	η^2
HBSE									
Post-test I				96.21	1	96.21	0.84	0.36	0.014
Intervention group	81.81	83.78	79.86–87.70						
Control group	84.88	82.36	78.46–86.24						
Post-test II				657.18	1	657.18	5.32	0.02	0.025
Intervention group	87.78	88.37	84.31–92.43						
Control group	87.06	85.02	80.98–89.05						
HPL									
Post-test I				630.58	1	630.58	2.80	0.09	0.044
Intervention group	121.69	124.56	119.21–129.91						
Control group	121.03	118.16	112.81–123.51						
Post-test II									
Intervention group	126.84	128.38	121.95–134.80	153.53	1	153.53	0.47	0.49	0.014
Control group	127.75	125.22	118.79–131.64						

Abbreviation(s): CI, confidence interval; *df*, degree of freedom; *M*, mean; MS, mean of square; Post-test I, performed after 1 month of intervention; Post-test II, performed after 4 months of intervention; SS, sum of square.

Chiang, Yeh, Wang, & Yang, 2009; Hockenberry-Eaton et al., 1999; Langeveld, Ubbink, & Smets, 2000). It has been reported that approximately 20% of childhood cancer survivors who experience neurocognitive sequelae are particularly vulnerable to long-term fatigue and sleep disruption (Clanton et al., 2011). The physical effects of these changes may affect how childhood cancer survivors feel about themselves and their self-efficacy in the context of exercise. The exercise subscale may also have been affected by participants who were transitioning from treatment to recovery. When paediatric patients are in hospital, approximately 50% only leave their beds for <1 hr a day (Götte, Kesting, Winter, Rosenbaum, & Boos, 2014). Moreover, it is common for cancer patients to engage in less physical exercise even before being diagnosed, and this reduced activity continues during their treatment (Götte et al., 2014). Additionally, participants are often advised by their parents and others to rest more during their illness and recovery. Thus, parents' attitudes towards physical activity, which can be supportive, inhibiting, or neutral, should be further studied (Götte et al., 2014). Ideally, physical, psychological and organisational barriers to activity should be eliminated as much as possible in order to increase patients' motivation to exercise.

The lack of a detectable intervention-associated improvement in HPL scores may have been due, in part, to the limited number of cases analysed. In the present study, a 7% withdrawal rate resulted in only 64 participants being included in the final analysis. According to Faul and Erdfeler (2007), a total of 68 patients were needed for this study to achieve statistical power (an effect size of 0.2). Secondly, the age span of our cohort was quite broad, ranging from 8 to 20 years. Moreover, this age range encompasses a time of transition from adhering to parents' expectations and gaining independence. Previously, Bandura (1977) advocated that the most influential source of self-efficacy involves individual learning through mastery of experiences. This sense of mastery can subsequently promote the development of appropriate healthy behaviours. However, in Taiwan, children and adolescents more highly conform with their parents' expectations (Zhang & Thomas, 1994) and exhibit greater respect for parental authority (Fuligin, 1998) compared with other cultures. Hence, the participants in this study may have had relatively limited independence and control over their lifestyles, and this may have affected their development of healthy behaviours. Thirdly, once cured of their primary disease, most childhood cancer survivors enjoy a period of health before late effects of their treatments develop many years later (Francisci, 2017; Hsiao et al., 2018). It is also observed that individuals tend to not recognise health issues until they are serious. It may be that small behavioural changes can be made within 30 days in preparation for longer term behaviour modifications over the next 6 months to address the health issues that develop (Syn, 2008). Thus, HPL may be influenced by an individual's cognitive process of perceived self-efficacy and self-efficacy expectations regarding actual accomplishments (Holloway & Watson, 2002). Additionally, parents may play an important role by adjusting their attitudes and perspectives regarding the abilities and achievements of their children (Wu, 2011). Thus, future intervention research should consider the involvement of parents, and their roles, during intervention processes developed for childhood cancer survivors.

4.1 | Limitations

There were limitations associated with the present study. First, the participants in this study were affected by a variety of cancer types, and only overall disease outcome was reported. Second, the extent of parental influence on the participating children's health behaviours is not described. Thus, further studies are needed to clarify the overall effects of patient and caregiver participation and to define caregiver roles and functions.

5 | CONCLUSION AND IMPLICATIONS

The results of the present study provide evidence that an intervention guided by self-efficacy principles is acceptable and effective in enhancing HBSE among childhood cancer survivors, with the exception of the exercise subscale. Moreover, the experimental group exhibited higher HBSE scores than the control group 4 months after the start of intervention, while both groups exhibited improvements in HPL scores over time. Considering that the intervention programme implemented in this study is compatible with an outpatient clinic setting, it would be of interest and value to further investigate whether improvements that are made within this programme are maintained over a longer post-intervention follow-up period. Future studies should also place greater focus on eliminating barriers to exercise.

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CONFLICT OF INTEREST

The authors have no conflicts of interest to disclose.

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