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Preliminary effectiveness and feasibility of an integrated hope techniques and narrative-based card game intervention for pediatric cancer patients in China: a randomized controlled trial

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Abstract

Background Spiritual well-being is the fourth dimension of well-being for pediatric cancer patients. A high level of spiritual well-being can protect them from psychological symptoms. Few interventions, however, have been focused on the spiritual dimension among pediatric patients with cancer. This study aimed to examine the feasibility and preliminary effectiveness of an integrated hope techniques and narrative-based card game (HT-NCG) intervention for pediatric cancer patients on spiritual and psychological well-being and quality of life (QoL).

Methods A total of 60 Chinese pediatric cancer patients aged 12–17 years were recruited from the pediatric oncology ward of Hunan Children's Hospital, China. Among them, 30 participants were randomized to the experimental group and received four sessions of the HT-NCG intervention. Another 30 participants were allocated to the control group and received a placebo intervention. Spiritual well-being, hope, anxiety, depressive symptoms, and QoL were assessed at baseline (T0), post-intervention (T1), and at 1-month (T2) and 3-month (T3) follow-up. Assessors were blinded to the group allocation. The feasibility outcomes and results from generalized estimating equations were reported.

Results The feasibility of the HT-NCG intervention was demonstrated by a high recruitment rate (80%), high attendance rates in both groups, and a low attrition rate (20.0%) at 3 months. No adverse events were reported. At the 3-month follow-up, patients in the intervention group showed significantly greater improvement in spiritual well-being (T3 $B = 5.99$; 95% CI, 0.27, 11.75; $p = 0.042$) and a greater reduction in depressive symptoms (T3 $B = -6.41$; 95% CI, −12.75, −0.07; $p = 0.047$) compared with the control group.

Conclusions This study supports that the HT-NCG is a feasible intervention among pediatric patients with cancer. This intervention can effectively improve spiritual well-being and decrease depressive symptoms in this patient population with a sustainable effect to three-month follow-up. The HT-NCG may help address the spiritual needs and improve spiritual well-being of pediatric cancer patients. This short, engaging, and relaxing card game intervention is concise and structured and can be easily disseminated, making it highly applicable in clinical settings.

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Trial registration This study was registered in the ClinicalTrials.gov (Registration number NCT05639062).
Keywords Pediatric oncology, Spiritual well-being, Psychological symptoms, Narrative intervention, RCT

Background

Cancer is a leading cause of death among children worldwide, with China having the highest number of pediatric cancer cases, over 40,000 annually [1–3]. Beyond physical suffering, pediatric cancer patients commonly experienced various spiritual concerns, including struggling to understand their illness, feeling disconnected, and questioning their belief [4, 5]. Addressing the spiritual concerns of pediatric cancer patients is important, as it directly impacts their spiritual well-being [6], which is defined as a state in which an individual finds meaning and fulfillment in daily lives [7]. Postulated by a path analysis model, spiritual well-being is associated with anxiety and depressive symptoms in pediatric cancer patients, playing a vital role in their quality of life (QOL) [8, 9].

A growing number of spiritual interventions, such as spiritual therapy, creative therapy, and narrative approach, have been tested in pediatric cancer patients [10, 11]. However, a recent review of 12 studies indicated insufficient evidence of these interventions in enhancing spiritual, psychological outcomes, or QoL [12]. Possible reasons for this result include small sample sizes, lacking theoretical foundations underpinning the interventions, and intervention content not tailored to the specific spiritual needs of pediatric cancer patients [12]. This underscores the need for more rigorously designed interventions tailored to this vulnerable population [12].

Meaning-making, a core component influencing spiritual well-being, is the process of interpreting personal experiences, particularly those that are stressful, such as experiencing cancer [13]. While this process can lead to positive outcomes such as personal growth, negative outcomes like self-blame are more commonly observed in pediatric cancer patients and affect their spiritual well-being [14].

A narrative approach can potentially facilitate the meaning-making process and improve spiritual well-being in pediatric cancer patients [15]. As a spiritual intervention, it uses a question framework to help patients express emotions and discover overlooked positive life stories, shifting focus from negative experiences to strengths and resources [10, 12, 15]. This process helps reconstruct patients' life meaning and their connections with themselves and others, which are key elements of spiritual well-being [10, 15]. Several reviews have shown that narrative interventions can improve spiritual and psychological outcomes and QoL among adult cancer patients [15, 16]. Nonetheless, evidence of their effectiveness in pediatric cancer patients is limited; a systematic review only identified three relevant studies, none showing significant improvement in spiritual well-being or QoL [17–19]. This could be due to the interventions not fully addressing the complex spiritual needs of pediatric patients, suggesting a need for further refinement [12].

Hope, defined as a positive cognitive state, is an important factor influencing the meaning-making process [13, 20]. Patients with higher levels of hope are more likely to view their challenges as transformation opportunities, interpret experiences positively, and apply these transformative insights to their future [4, 21]. A phenomenological study found that pediatric cancer patients regarded hope as a key strength for overcoming pain and suffering [4]. Additionally, a path analysis showed that hope and spiritual well-being reinforce each other, both reducing anxiety and depressive symptoms [8]. These findings suggest that incorporating elements of hope into narrative interventions can potentially enhance their effects on spiritual and psychological outcomes [8]. This study, therefore, developed a hope-integrated narrative intervention for pediatric cancer patients. While the narrative component of such intervention could enhance spiritual well-being by constructing a more powerful new narrative [15], the future-oriented hope technique could sustain hope and translate their new narrative insights into their future daily life [21]. By expressing negative emotions and building spiritual well-being and hope, patients could experience a reduction in psychological symptoms [8]. Consequently, these spiritual and psychological improvements would contribute to an enhanced overall QoL [22].

Playing games is an applicable format with which to deliver narrative intervention for pediatric cancer patients because play naturally facilitates children's self-expression [23]. However, existing game interventions for pediatric cancer patients are limited to either resource-intensive electronic formats [24, 25] or group-based board games that compromise privacy for sensitive discussions [26]. A conversation-based card game offers a solution by using cards with customizable questions or prompts to facilitate dialogue [27, 28]. It effectively engages patients in discussing emotionally sensitive topics, such as advanced care planning [29], and is inexpensive and easy to disseminate [27, 28], making it a practical tool for delivering narrative intervention.

The current randomized controlled trial (RCT) aimed to examine the feasibility and preliminary effectiveness

of an integrated hope techniques and narrative-based card game (HT-NCG) intervention for pediatric cancer patients. The theoretical framework of this intervention was illustrated in Additional file 1 [4, 8, 30–32]. The hypotheses of this study were as follows: (1) The HT-NCG intervention would be feasible as indicated by satisfactory recruitment, attendance, retention, and low attrition rates; (2) The HT-NCG intervention would demonstrate greater effectiveness compared to the placebo intervention in improving spiritual well-being, hope, and QoL, while reducing anxiety and depressive symptoms among pediatric cancer patients.

Methods

Study design

This study was conducted using a prospective, two-arm RCT. The trial was conducted from January 2023 to February 2024 in the pediatric oncology ward of Hunan Children's Hospital, one of the largest children's hospitals in southern China. The pediatric oncology ward in this hospital has approximately 110 beds and accommodates around 600 newly diagnosed inpatients annually. The hospital is a widely recognized cancer hospital in the province and attracts many pediatric patients for cancer treatment, thereby enhancing the representativeness of the recruited sample. This study adhered to the CONSORT guidelines and was registered in ClinicalTrials.gov under the registration number NCT05639062.

Participants

Pediatric cancer patients who met the inclusion criteria were invited to participate in this study. The inclusion criteria were as follows: (1) aged between 12 and 17 years old, (2) diagnosed with any type of cancer, and currently undergoing active treatment with an aim to reduce or eliminate cancer, (3) aware of their cancer diagnosis, which was confirmed in consultation with the patient's parents and health professionals, and (4) able to communicate in Chinese language. The exclusion criteria were as follows: (1) patients with identified cognitive and/or behavioral problems that affected their verbal communication; (2) patients with advanced cancer, including those with non-responsive leukemia, stage IV solid tumors, or a physician-estimated poor prognosis of less than 60% chance for survival [33, 34]. These patients were excluded because pediatric patients with advanced cancer might have different spiritual needs compared with those at non-advanced stage; and (3) age younger than 12 years because these patients might not possess the cognitive maturity to comprehensively articulate their thoughts and might not be capable to derive personalized meaning from their life events [35, 36].

Sample size calculation

To examine the preliminary effectiveness and feasibility of the intervention, at least 25 participants per group were required [37]. Taking into account an anticipated attrition rate of 20% [38], we calculated the sample size as $25 \times (1 + 20\%) = 30$ for each group. The total sample size for this study was set at 60 participants. To determine the capacity of this study to detect the observed effect of the intervention on spiritual well-being at 3-month follow-up, a post hoc power analysis was performed using G*Power software (Version 3.1.9.7). The post hoc power was calculated based on a sample size of 44, an alpha level of 5%, and the effect size of the intervention on spiritual well-being at 3-month follow-up.

Intervention group

Intervention development

Guided by the theoretical framework as in Additional file 1 [4, 8, 30–32], our intervention facilitates the steps of externalization, deconstruction, and re-authoring through guiding questions, which were developed based on previous narrative interventions for both children and adult patients with cancer, as well as our qualitative results on spirituality of pediatric cancer patients [4, 15, 17–19, 39]. We identified that pediatric cancer patients often discuss their feelings and concerns related to school, home, hospital, and themselves [4]. The narrative components of this intervention were therefore structured around these four themes to facilitate patient expression. To incorporate the hope technique into the narrative intervention, we adapted guiding questions related to three hope techniques—goal setting, pathway thinking, and positive self-talk—from the hope manual developed by our research team [40, 41], which has proven effective in improving hope levels in adult cancer patients [41]. These guiding questions were reviewed and refined through discussion with our expert panel, which included three professors specializing in pediatric oncology care, two head nurses from pediatric oncology wards, two pediatric oncologists, one clinical psychologist, and one social worker experienced in implementing narrative interventions for children. The finalized guiding questions were pilot-tested in six pediatric cancer patients, and no difficulty or concern was noted.

Intervention design and delivery format

The HT-NCG intervention was delivered individually to protect participant privacy, with sessions conducted either at the bedside (curtains drawn) or in private rooms according to patients' preference. While family members were excluded from sessions to encourage open expression of personal concerns, participants could choose to share session insights with family after the sessions. The

HT-NCG intervention consisted of four one-to-one sessions titled "My Adventure in the Hospital," "My School," "My Family," and "Myself,". Each session lasted 40 to 50 min and was facilitated by the interventionalist who is a registered nurse over four consecutive weeks. The intervention dosage was comparable to other narrative interventions [19, 42].

To begin, the interventionalist established rapport with each participant during the first session by asking warm-up questions. The interventionalist then guided participants through four parts in each session—externalization, unique outcomes, re-authoring, and hope—using a deck of cards with corresponding guiding questions. Participants responded to these questions in their own words or with the support of scratch cards and blank cards, facilitated by the interventionalist. Scratch cards featured common feelings experienced by pediatric cancer patients [4, 43], and when participants were unsure how to answer, they scratched a card with a coin to reveal potential responses. Blank cards allowed participants to write or draw their responses and ideas. During the externalization stage, the interventionalist helped participants express their experiences and concerns using the guiding question cards in sequence. In the unique outcomes stage, participants selected one concern to explore more deeply, using guiding questions focused on times when the concern did not exist, highlighting supports and strengths and recognizing positive impacts of the illness. In the re-authoring stage, participants were guided to reflect on similar events, identify common themes, and consider the meaning of their new narrative in relation to personal values. To integrate these re-authored narratives into their present and future, the interventionalist employed three hope techniques of goal setting, pathway thinking, and positive encouraging language. Participants would be asked to set achievable goals that resonated with strengths or values identified during re-authoring, intended for immediate pursuit or within the following week. Pathway thinking and positive encouraging language were integral to goal attainment, facilitated by the interventionalist. At the beginning of subsequent sessions, the interventionalist led discussions on participants' progress, including self-reported goal completion rates, reasons for success or challenges, and how positive thoughts could aid future goal achievements. In the concluding session, the interventionalist invited participants to write a letter to their future selves, reflecting on personal growth and aspirations, with the intention of opening the letter three months later. Additional file 2 provides the session protocol, including examples of guiding questions and corresponding prompts on scratch cards.

Control group

To minimize the difference in attention between the experimental and control groups, participants in the control group were invited to join a placebo intervention comprising four sessions of poker games. The delivery time, format, and venue were the same as those of the HT-NCG intervention. Participants in both the intervention and control groups received standard medical care.

Data collection

Ethical approval was obtained from the Institutional Review Board of Hong Kong Polytechnic University (reference, HSEARS20221106001) and that of Hunan Children's Hospital (reference, KS 2023–62). During the study period, patients who underwent treatment and fulfilled the eligibility criteria were referred to the research team by their primary physicians or nurses. We also displayed posters on the wards to recruit participants. The first research assistant explained the purpose and details of the study to potential participants. Parents who were willing to allow their children to participate in the study were asked to give their written consent. Additionally, patients were invited to sign a child assent form with their names. The first research assistant distributed a set of questionnaires to participants to collect baseline data (T0). Then, participants were assigned to their respective groups according to the group assignment in sequentially numbered opaque sealed envelopes. The assistant asked participants to complete the questionnaires face-to-face immediately after the intervention (T1) and via telephone interviews at 1 month (T2) and 3 months (T3) post-intervention. The mean time for participants to complete the set of questionnaires was 19.56 (standard deviation [SD], 2.34) min. Consistent with the CONSORT Harms Statement, adverse events were defined as the totality of possible adverse consequences arising from the intervention [44]. In the context of this trial, adverse events primarily referred to psychological harms experienced by participants [45], as the intervention did not involve invasive procedures and the risk of physical harm was minimal. Adverse events were assessed after each session and at subsequent follow-up points by having a research assistant invite participants to report any negative experiences using the open-ended question, "Did any part of the intervention make you feel worse?" [45]. Additionally, both patients and caregivers were informed that they could voluntarily disclose any adverse experiences at any time throughout the intervention period.

Randomization and blinding

An independent statistician, who was not involved in any intervention implementation or data collection, used the

online tool Research Randomizer (https://www.randomizer.org/) to create a randomized schedule. Participants were randomly assigned to either the intervention group or the attention control group at a 1:1 ratio. This was conducted using block randomization with varying block sizes of 4, 6, or 8 to prevent predictability of group assignment while maintaining balanced group sizes. After collecting the baseline data from the participants, the first research assistant opened each sequentially numbered, sealed, opaque envelope, which contained a card indicating the group allocation. Owing to the differences between our intervention and the routine care, it was not possible to blind the interventionalists and participants. However, the second research assistant, who was the outcome assessor, was kept unaware of the group allocation.

Contamination

Since the intervention was delivered using a card game with guiding questions, participants in the control group were unlikely to be exposed to the intervention's therapeutic components. Hence, the possibility of contamination is low. To further minimize this possibility, procedural measures such as separate scheduling for intervention and control groups to prevent participant overlap, explicit instructions to participants prohibiting discussion of session content during the intervention period, and the use of distinct materials (therapeutic cards versus poker decks) were adopted.

Outcome measures

The primary outcomes were the feasibility measures, including recruitment rate, attendance rate, retention rate, attrition rate, and reasons for discontinuing the intervention. The secondary outcomes were the spiritual well-being, hope, anxiety, depressive symptoms, and QoL of pediatric cancer patients at three months after completion of the intervention. These outcomes were chosen based on the path analysis model, which included spiritual well-being, hope, and psychological outcomes [8]. Three months (T3) was selected to capture the sustained effects of the HT-NCG intervention [15].

Instruments

The Chinese version of the adapted Functional Assessment of Chronic Illness Therapy Spiritual Well-being (FACIT-Sp) Scale for childhood cancer patients: This scale for assessing spiritual well-being was developed for adult cancer patients by Peterman et al. [46] and then translated and adapted specifically for Chinese pediatric cancer patients aged 8–17 years by Liu et al. [47]. The Chinese version of the FACIT-Sp scale comprises 15 items, further divided into four domains: meaning, peace, faith, and connections with others [47]. Each item is rated on a 5-point scale, from 0 to 4. The total score ranges from 0 to 60, with higher scores indicating a higher level of spiritual well-being. Reliability was confirmed with a Cronbach's alpha of 0.815 and a test–retest reliability coefficient of 0.79. Content validity index ranged from 0.8 to 1.0, with a scale index of 0.84. Convergent validity was supported by correlations with CES-DC and PedsQL scores. Factor analysis revealed a four-factor structure that demonstrated strong model fit, confirming its structural validity [47].

- The Chinese version of the Herth Hope Index (HHI) for children with cancer: This scale was used to assess levels of hope among participants. The HHI was developed by Herth et al. [48] and translated into Chinese and validated with Chinese pediatric cancer patients aged 8–17 years [49]. This 11-item scale, rated on a 4-point scale (total score 11–44), demonstrated good reliability, with internal consistency ($\alpha = 0.78$) and test–retest reliability (ICC = 0.82) [49]. It showed strong content validity, with item validity ranging from 0.8 to 1.0 and a scale index of 0.9 [49]. Factor analyses confirmed a stable three-factor structure, supporting its structural validity. Convergent validity was evidenced by correlations with measures of depressive symptoms and QoL [49].
- The Chinese version of the short form of the State Anxiety Scale for Children (CSAS-C): Participants' anxiety levels were assessed using the CSAS-C [50]. The original CSAS was developed by Spielberger et al. [51], and it was modified into a short form Chinese version by Li in 2007 [50]. This shorter Chinese version consists of 10 items, and its psychometric properties have been empirically validated [50, 52]. Each item on the CSAS-C is rated on a 3-point scale, yielding a total score range of 10 to 30, with higher scores indicating increased anxiety levels [50]. The short form of the CSAS-C demonstrated a high correlation with the full form ($r = 0.92$), exhibited acceptable internal consistency ($r = 0.83$), and showed good convergent validity in distinguishing children's state anxiety under stressful versus relaxed conditions [50]. Additionally, confirmatory factor analysis confirmed the construct validity of the CSAS-C short form [52]. This scale has been well used in pediatric patients aged 8–16 years [53].
- The Chinese version of the Center for Epidemiological Studies Depression Scale for Children (CES-DC): Depressive symptoms of participants were assessed

using the Chinese version CES-DC. This scale was designed to measure depressive symptoms in children aged 6–17 [54]. Participants rate their experiences over the previous 7 days using 20 items, each evaluated on a 4-point Likert scale ranging from 0 (not at all) to 3 (a lot), resulting in total scores from 0 to 60 [54]. Higher scores indicate more severe depressive symptoms. The psychometric properties of the Chinese version were examined by Li, Chung, and Ho [55], who found the scale to have good internal consistency ($\alpha = 0.82$) and appropriate convergent validity ($r = 0.63$) and discriminant validity ($r = -0.52$).

- The Chinese version of Pediatric Quality of Life Inventory 3.0 Cancer Module (PedsQL 3.0 Cancer Module): The participants' QoL was assessed by the Chinese version of PedsQL 3.0 Cancer Module. The PedsQL 3.0 Cancer Module was developed to measure the QoL of pediatric cancer patients aged 2–18 [56]. This instrument comprises 27 items categorized into eight subscales, named pain and hurt, nausea, procedural anxiety, treatment anxiety, worry, cognitive problems, perceived physical appearance, and communication [56]. The PedsQL scores range from 0 to100, with higher scores representing better health-related QoL [56]. A study by Ji et al. empirically examined the psychometric properties of the Chinese version, finding it to be reliable, with a Cronbach's alpha of 0.87 and a test–retest reliability of 0.84. Factor analysis confirmed adequate factorial validity [57].

Intervention integrity

To ensure the integrity of the intervention, the research team implemented multiple strategies. First, we developed detailed protocols for the intervention and placebo control in the experimental and control groups, respectively. The interventionalist was instructed to adhere closely to these protocols. Second, only one interventionalist delivered the entire intervention, ensuring that the intervention received by each participant was consistent. Third, 10% of the intervention in the experimental group was randomly selected for audio recording, allowing the research team to review levels of adherence to the protocol. Furthermore, the team conducted regular assessment of how the intervention and placebo control were administered in both groups. To ensure data quality, telephone interviews followed standardized scripts and were conducted by blinded assessors not involved in intervention delivery. Random fidelity checks confirmed consistent administration.

Data analysis

Data were analyzed using IBM SPSS version 26.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summarize the baseline characteristics of participants as well as feasibility outcomes. The $\chi 2$ test and independent t-test were used to compare the differences between the experimental and control group regarding continuous and categorical variables, respectively. A generalized estimating equations (GEE) model was used to assess the differences in repeated measures outcomes at various time points (T0, T1, T2, and T3) between the intervention and control groups, which indicated the preliminary intervention effectiveness. We conducted an intention-to-treat analysis, whereby participants were analyzed according to their initial group assignment. Missing data were handled using multiple imputation. Parameter estimations were calculated using the quasi-likelihood estimation method integrated within the GEE procedure of IBM SPSS. Effectiveness outcomes were analyzed independently without multiplicity adjustment of p values and interpreted separately per current recommendations for complex interventions [58, 59]. The effect size was calculated to measure the clinical significance of the outcomes and was interpreted using Cohen's d, as follows: small = 0.2, moderate = 0.5, and large = 0.8 [60].

Results

The mean age of the participants was 14.17 years (standard deviation [SD], 1.92). Most participants were boys (55.0%). No statistically significant differences were found between the experimental and control groups with respect to demographic characteristics (Table 1), or the outcome variables at baseline (Table 2).

Feasibility of the intervention

Figure 1 presents the CONSORT flow diagram. Of 106 pediatric cancer patients who were approached regarding the study, 75 were eligible. Sixty of the eligible patients agreed to participate in the study, resulting in a recruitment rate of 80.0% (60/75). These participants were randomly allocated into the experimental and control groups (30 participants each) to receive corresponding interventions. In the experimental group, 86.7% (26/30) of the participants completed all four sessions of the intervention. In the control group, 93.3% (28/30) of the participants completed all four sessions of the placebo. The retention rate at 3-month follow-up was 73.3% (44/60). The attrition rates were 13.3% (4/30), 20.0% (6/30), and 20.0% (9/30) at T1, T2, and T3 for the experimental group, and 6.7% (2/30), 16.7% (5/30), and 23.3% (7/30) for the control group. The overall attrition rate was 26.7% (16/60). The median number of days between sessions in

Table 1 Demographic and clinical characteristics of participants at baseline ($N = 60$)

Socio-demographic variables	Total ($n = 60$)	Experimental group ($n = 30$)	Control group ($n = 30$)	*t*	*p*
	n (%)	*n* (%)	*n* (%)		
Age (years), mean (SD)	14.17 (1.92)	14.20 (2.01)	14.13 (1.87)	0.13[a]	0.90
Sex					
Male	33 (55)	17 (56.7)	16 (53.3)	0.07[b]	0.80
Female	27 (45)	13 (43.3)	14(46.7)		
Parents' educational attainment					
Lower secondary school or below	39 (65)	19 (63.3)	20 (66.7)	0.07[b]	0.79
Upper secondary school or above	21 (35)	11 (36.7)	10 (33.3)		
Household size					
1–3	12 (20.0)	7 (23.3)	5 (20.0)	0.71[b]	0.70
4–5	27 (45.0)	12 (40.0)	27 (45.0)		
>5	21 (35.0)	11 (36.7)	21 (35.0)		
Diagnosis					
Leukaemia	22 (36.7)	11 (36.7)	11 (36.7)	0.15[b]	0.99
Lymphoma	17 (28.3)	8 (26.7)	9 (30.0)		
CNS	10 (16.7)	5 (16.7)	5 (16.7)		
Non-CNS solid tumor	11 (18.3)	6 (20.0)	5 (16.7)		
Time since treatment					
<6 months	30 (50.0)	16 (53.3)	14 (46.7)	0.42[b]	0.81
6–12 months	16 (26.7)	8 (26.7)	8 (26.7)		
>12 months	14 (23.3)	6 (20.0)	8 (26.7)		
Treatment received					
Surgery	13 (21.7)	5 (16.7)	8 (26.7)	1.78[b]	0.41
Chemotherapy	29 (48.3)	17 (56.7)	12 (40.0)		
Mix-method	18 (30.0)	8 (26.7)	10 (33.3)		
Family religion					
With religion	9 (15.0)	5 (16.7)	4 (13.3)	0.13[c]	0.72
Non-religion	51 (85.0)	25 (83.3)	26 (86.7)		
Average duration of each session	46.77 (1.80)	46.54 (1.73)	46.99(1.86)	−0.92	0.36[a]
The number of days between sessions	7.48 (0.66)	7.49 (0.74)	7.48 (0.59)	0.09	0.93[a]

[a] Independent samples *t*-test; [b]chi-square test; [c]Fisher's exact test. Abbreviations: *SD*, standard deviation; *CNS*, central nervous system

the experimental group was 7.49 (SD 0.74). The median time of each session is 46.54 (SD 1.73) min. No adverse events were reported.

Effectiveness outcomes of the HT-NCG intervention

Spiritual well-being

The HT-NCG had a significant group-by-time interaction effect on spiritual well-being (Table 3). The improvement of spiritual well-being was significantly greater in the intervention group than that in the control group at T1 (T1 $B = 8.48$; 95% CI, 2.33; 14.63; $p = 0.007$), T2 ($B = 6.15$; 95% CI, 0.43; 11.88; $p = 0.035$), and T3 ($B = 5.99$; 95% CI, 0.27; 11.75; $p = 0.042$). In terms of the subscale, the mean score of the meaning domain showed a significant increase in the intervention group compared with that in the control group at all timepoints (T1 $B = 4.05$; 95% CI, 2.21, 5.88; $p < 0.001$; T2 $B = 2.80$; 95% CI, 0.91, 4.69; $p = 0.004$; T3 $B = 2.95$; 95% CI, 0.93, 4.97; $p = 0.004$). For the peace domain, the intervention group showed a significant improvement at T1 ($B = 2.12$; 95% CI, 0.43 to 3.80; $p = 0.013$) and T2 ($B = 1.60$; 95% CI, 0.05 to 3.15; $p = 0.043$) compared with the control group. However, this improvement was not sustained at T3 (p = 0.093). Although the improvement of the intervention group for the connection domain was not significant compared with that in the control group at T1 ($p = 0.114$), it reached statistical significance at T2 ($B = 1.32$; 95% CI, 0.18, 2.47; $p = 0.023$) and T3 ($B = 1.75$; 95% CI, 0.50, 3.00; $p = 0.006$). At these timepoints, the effect on spiritual well-being was large ($d = 0.80$–0.94), and the effects on the meaning ($d = 0.78$–1.05) and connection ($d = 0.52$–1.21) subscales were moderate to large. The effect of HT-NCG on the faith domain was not significant at all time points (Table 3).

Table 2 Mean scores of the outcome variables for experimental and control groups across study time points ($N = 60$)

Outcomes	Times	Experimental group ($n = 30$)	Control group ($n = 30$)	Effect size (T0–T1 T0–T2 T0–T3)	Comparison of groups at T0	
		M (SD)	*M (SD)*	*Cohen's d*	*t*	*p*
Spiritual well-being	T0	33.63 (13.43)	31.47 (10.60)		0.69	0.49
	T1	40.69 (12.65)	32.21 (10.67)	0.80		
	T2	36.83 (10.95)	30.68 (9.89)	0.97		
	T3	34.78 (9.94)	28.78 (10.24)	0.94		
Spiritual well-being—meaning	T0	9.87 (4.30)	8.50 (3.49)		1.35	0.18
	T1	12.15 (3.73)	8.11 (3.24)	1.05		
	T2	11.04 (3.59)	8.24 (3.28)	0.89		
	T3	10.86 (3.26)	7.91 (3.81)	0.78		
Spiritual well-being—peace	T0	8.97 (3.63)	7.77 (3.08)		1.38	0.17
	T1	10.19 (3.60)	8.07 (2.73)	0.44		
	T2	9.04 (3.04)	7.44 (2.58)	0.45		
	T3	8.18 (2.61)	6.91 (2.57)	0.17		
Spiritual well-being—faith	T0	8.00 (4.09)	7.97 (3.62)		0.03	0.97
	T1	9.85 (4.21)	8.11(3.50)	0.54		
	T2	8.42 (3.73)	7.56 (3.37)	0.67		
	T3	7.50 (3.38)	7.04 (2.87)	0.52		
Spiritual well-being—connection	T0	6.80 (3.04)	7.23 (3.06)		-0.55	0.58
	T1	8.50 (3.08)	7.93 (3.41)	0.52		
	T2	8.33 (2.51)	7.44 (3.15)	1.04		
	T3	8.23 (2.64)	6.91 (3.09)	1.21		
Hope	T0	29.17 (7.36)	27.77 (8.85)		0.67	0.51
	T1	35.42 (7.75)	27.86 (9.13)	1.12		
	T2	33.21 (7.80)	27.28 (8.97)	0.86		
	T3	32.00 (6.59)	28 (8.94)	0.56		
Anxiety	T0	20.20 (5.37)	18.77 (5.06)		1.06	0.29
	T1	14.92 (3.67)	17.96 (4.48)	1.72		
	T2	19.04 (3.79)	18.08 (5.32)	0.56		
	T3	19.68 (4.57)	19.24 (5.74)	0.69		
Depressive symptoms	T0	26.40 (14.68)	27.10 (8.12)		−0.23	0.82
	T1	19.23 (12.94)	26.48 (8.49)	1.08		
	T2	19.63 (12.88)	26.71 (8.38)	1.14		
	T3	21.09 (13.67)	27.50 (7.34)	1.20		
QoL	T0	60.33 (19.61)	61.79 (10.83)		−0.36	0.73
	T1	64.35 (17.36)	61.44 (8.55)	0.24		
	T2	62.99 (14.23)	60.02 (6.13)	0.04		
	T3	63.17 (12.23)	60.83 (5.86)	0.16		
QoL-Communication	T0	60.33 (19.61)	61.79 (10.83)		−1.15	0.26
	T1	73.39 (28.38)	59.13 (15.76)	1.08		
	T2	70.34 (22.39)	55.83 (23.24)	1.20		
	T3	75.83 (19.94)	52.95 (23.21)	1.42		

T0 baseline, *T1* post-intervention, *T2* 1 month after intervention, *T3* 3 months after intervention, *QoL* quality of life

Hope

At both T1 and T2, participants in the intervention group reported significantly higher levels of hope compared with those in the control group (Group * Time, T1 $B = 7.57$; 95% CI, 3.14, 11.99; $p = 0.001$; T2 $B = 5.93$; 95% CI, 1.32, 10.53; $p = 0.012$), with large effect sizes ($d = 0.86–1.12$). However, this difference in hope scores between the two groups was not statistically significant at T3 ($p = 0.080$) (Table 3).

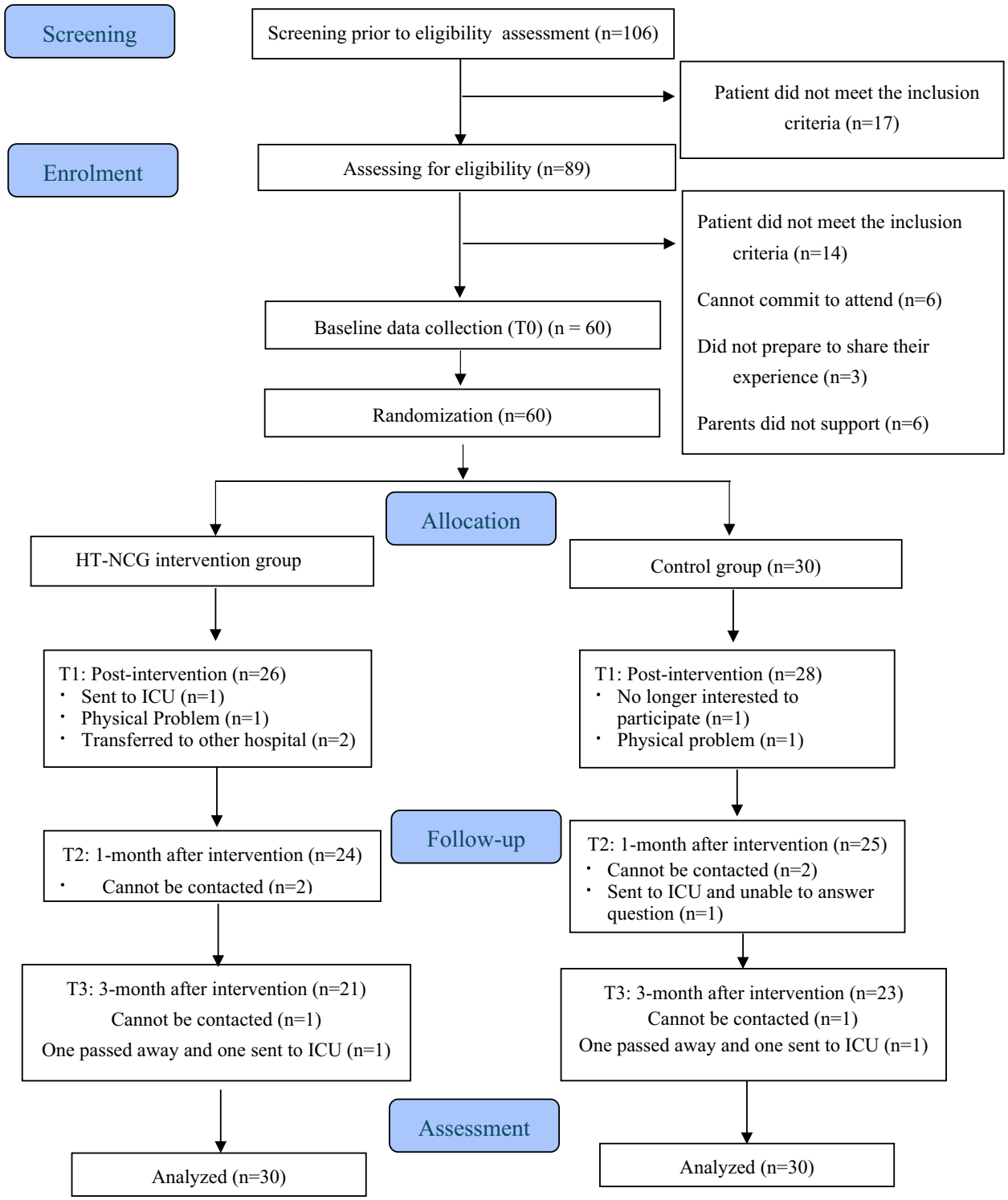

Fig. 1 Consort diagram

Table 3 Generalized estimating equation models for the comparison of outcomes across time between the two groups

Outcomes	Regression coefficients													
	Group		T1		T2		T3		Group * T1		Group * T2		Group * T3	
	B(95% CI)	*p*	*B*(95% CI)	*p*	*B*(95% CI)	*p*	*B*(95% CI)	*p*	*B*(95% CI)	*p*	*B*(95% CI)	*p*	*B*(95% CI)	*p*
Spiritual well-being	2.17 (−3.86, 8.19)	0.480	0.75 (−1.53, 3.03)	0.520	−0.79 (−0.29, 1.21)	0.440	−2.69 (−4.94, −0.43)	**0.02**	8.48 (2.33, 14.63)	**0.007**	6.15 (0.43, 11.88)	**0.035**	5.99 (0.27, 11.75)	**0.042**
Spiritual well-being—Meaning	1.37 (−0.58, 3.32)	0.169	−0.39 (−1.14, 0.36)	0.675	−0.26 (−1.07, 0.55)	0.771	−.587 (−1.68, 0.51)	0.29	4.05 (2.21, 5.88)	**<0.001**	2.80 (0.91, 4.69)	**0.004**	2.95 (0.93, 4.97)	**0.004**
Spiritual well-being—peace	1.20 (−0.48, 2.88)	0.160	0.31 (−0.45, 1.05)	0.426	−0.33 (−0.98, 0.33)	0.330	−0.85 (−1.66, −0.04)	**0.039**	2.12 (0.43, 3.80)	**0.013**	1.60 (0.05, 3.15)	**0.043**	1.27 (−0.21, 2.75)	0.093
Spiritual well-being—Faith	0.03 (−1.89, 1.96)	0.970	0.14 (−0.61, 0.89)	0.712	−0.41 (−1.17, 0.36)	0.300	−0.92 (−1.78, −0.06)	**0.035**	1.74 (−0.30, 3.77)	.094	0.86 (−1.09, 2.81)	0.389	0.46 (−1.34, 2.25)	0.618
Spiritual well-being—connection	−0.43 (−1.95, 1.09)	0.576	0.70 (0.01, 1.38)	**0.047**	0.21 (−0.41, 0.82)	0.510	−0.32 (−1.00, 0.36)	0.358	1.01 (−0.24, 2.25)	0.114	1.32 (0.18, 2.47)	**0.023**	1.75 (0.50, 3.00)	**0.006**
Hope	1.40 (−2.65, 5.45)	0.498	0.09 (−1.45, 1.63)	0.908	−0.49 (−2.16, 0.19)	0.570	0.233 (−1.41, 1.87)	0.78	7.57 (3.14, 11.99)	**0.001**	5.93 (1.32, 10.53)	**0.012**	4.00 (−0.47, 8.47)	0.080
Anxiety	1.43 (−1.16, 4.03)	0.279	−0.62 (−1.75, 0.51)	0.28	−0.68 (−1.83, 0.47)	0.24	0.28 (−1.16, 1.72)	0.71	−2.23 (−4.44, −0.01)	**0.049**	0.29 (−2.20, 2.78)	0.819	−0.23 (−3.13, 2.67)	0.878
Depressive symptoms	−0.70 (−6.60, 5.20)	0.816	−0.62 (−2.39, 1.15)	0.494	−0.39 (−2.25, 1.46)	0.679	0.400 (−1.53, 2.33)	0.684	−7.25 (−13.05, −1.45)	**0.014**	−7.08 (−13.10, −1.07)	**0.021**	−6.41 (−12.75, −0.07)	**0.047**
Qol	−1.45 (−9.34, 6.43)	0.718	−0.35 (−3.02, 2.33)	0.799	−1.76 (−4.44, 0.91)	0.197	−0.95 (−4.42, 2.51)	0.590	2.91 (−4.36, 10.18)	0.432	2.97 (−3.10, 9.04)	0.337	2.34 (−3.20, 7.88)	0.407
Qol-Communication	−7.50 (−20.12, 5.12)	0.244	−5.03 (−9.67, −0.40)	0.033	−8.34 (−15.38, −1.29)	0.020	−11.21 (−20.71, −1.71)	0.021	14.26 (2.08, 26.45)	**0.022**	14.52 (1.88, 27.15)	**0.024**	22.88 (10.39, 35.37)	**<0.001**

Anxiety

Only at T1, the intervention group showed a significantly greater reduction in anxiety scores than that in the control group (Group * Time, $B = -2.23$; 95% CI, −4.44, −0.01; $p = 0.049$), with a large effect size ($d = 1.72$); no significant decrease was noted at T2 and T3 (Table 3).

Depressive symptoms

A significant reduction in the mean score of depressive symptoms was observed in the intervention group relative to the control group at all time points (Group * Time, T1 −7.25; 95% CI, −13.05, −1.45; $p = 0.014$; T2 $B = -7.08$; 95% CI, −13.10, −1.07; $p = 0.021$; T3 $B = -6.41$; 95% CI, −12.75, −0.07; $p = 0.047$). The effect on depressive symptoms at these time points was large ($d = 1.08$–1.20) (Table 3).

QoL

A greater improvement in the mean score of QoL was shown at all time points in the intervention group compared with the control group; however, statistical significance was not reached. Nevertheless, there was a significant improvement in the communication subscale for the intervention group compared with the control group at all timepoints (Group * Time, T1 $B = 14.26$; 95% CI, 2.08, 26.45; $p = 0.022$; T2 $B = 14.52$; 95% CI, 1.88, 27.15; $p = 0.024$; T3 $B = 22.88$; 95% CI, 10.39, 35.37; $p < 0.001$), with large effect sizes ($d = 1.08$–1.42) (Table 3).

Post hoc power analysis

The post hoc power analysis showed a power of 99.99% for detecting the effect of the intervention on spiritual well-being at 3-month follow-up, with an effect size of 0.94.

Discussion

Spiritual well-being is a crucial indicator of overall well-being but has not been well explored in pediatric oncology patients [12]. This study is the first RCT to address this under-researched area in a Chinese cultural context. Most importantly, the intervention is original because it integrated hope techniques into a narrative intervention to enhance the effectiveness and was delivered using an innovative card game format to match the developmental characteristics of children.

The findings showed that the HT-NCG intervention is feasible for pediatric cancer patients, as evidenced by its high completion rate (86.7%) and low attrition rate (20.0%) at 3 months. The completion rate was higher than that of other spiritual interventions for pediatric cancer patients [18, 61], likely due to our consideration of patients' preference and convenience. Given the frequent hospitalizations and discharges as well as changes in their medical conditions, we did not set a fixed schedule for the intervention. Instead, we allowed some flexibility for participants to decide the best timing for the intervention. The result showed that the mean time interval between each session was 7.49 days (SD 0.74); hence, delivering this intervention weekly can be considered in future large-scale RCTs. This proposed time interval between sessions is also comparable to that of other narrative intervention [42]. The attrition rate at three months in this study was notably lower than 55.6% reported in another spiritual intervention for pediatric cancer patients [62]. This low attrition rate could be owing to our regular contact with patients' families to maintain engagement.

The effect on spiritual well-being

The mean spiritual well-being scores at baseline were 33.63 (SD = 13.43) for the experimental group and 31.47 (SD = 10.60) for the control group, indicating moderate levels of spiritual well-being among participants, which is comparable to the mean score of 34.47 (SD = 12.98) from a previous path analysis among Chinese pediatric cancer patients [8], suggesting consistency in spiritual well-being levels within similar populations. Consistent with the result of previous narrative interventions for adult patients with cancer [16], this study showed that the HT-NCG intervention effectively improved the spiritual well-being of pediatric cancer patients, with large effect sizes lasting up to three months. Among the four subscales, only the meaning domain showed consistent significant improvement across all three assessment time points, suggesting enhanced positive meaning-making process for these patients. For the peace domain, a significant effect was found post-intervention and at one month, but not at 3 months. A previous study revealed that peace of mind in pediatric cancer patients can be greatly affected by their psychological factors, as well as their involvement in receiving medical information [63]. Whereas the HT-NCG intervention could help pediatric cancer patients process negative emotions and resolve internal conflicts, the continued challenges and sufferings owing to their illness and its treatment might interrupt their peace of mind [63], leading to the non-significant finding at three months. The connection domain in the intervention group showed a different trend compared to the control group; it did not show a significant increase immediately post-intervention but reached significance at one and three months. This significant improvement could be owing to the patients' increased sensitivity to love and support surrounding them during the intervention as well as participants' ongoing perception of these feelings after the intervention [64]. The HT-NCG intervention did not significantly impact the

faith domain at any time point, likely because only 15% of participants were from religious families. This suggests that spiritual interventions like HT-NCG may work better in a stronger religious context to effectively influence faith-related outcomes. Future research could explore tailored approaches to accommodate varying levels of religious engagement when using HT-NCG in religion-dominated populations, thereby better supporting faith development.

The effect on hope

Although participants in the intervention group reported significant improvements in hope levels post-intervention and at one-month follow-up, with large effect sizes, no significant improvement was observed at the three-month follow-up. This lack of sustained effect may be due to the absence of a booster intervention, which has been suggested as beneficial in other cognitive-behavioral interventions [65]. In this study, participants set short-term goals during each session, ranging from immediate tasks like writing letters to longer-term objectives like overcoming fear of injections. The focus was on cultivating a hopeful mindset and enhancing problem-solving skills, not just on completing goals [31]. For those who did not achieve their goals, we facilitated reflection on their experiences, encouraging them to evaluate both positive and negative thoughts instead of forcing them to complete, which aligned with the core objectives of the hope techniques [31]. Nonetheless, failure to achieve goals might undermine the participants' perceptions about their own potential, impacting their hope levels in the long run [31]. These results suggest that future studies should include a booster intervention to reassess goal accomplishment and provide additional support, potentially sustaining hope levels over time.

Moreover, the non-significant improvement in hope at three months contradicted the previous results of path analysis indicating a mutually reinforcing relationship between spiritual well-being and hope [8], and considering our current findings that showed a significant improvement in spiritual well-being simultaneously. This discrepancy might be attributed to the cross-sectional nature of the variables' correlations in the path analysis model, which does not capture changes over time [8]. Our results suggest that the relationship between spiritual well-being and hope might change over time, particularly after an intervention. Longitudinal studies are needed to further explore the dynamic relationship between spiritual well-being and hope so as to offer deeper insights for intervention strategies.

The effect on anxiety and depressive symptoms

The study provides preliminary evidence that the HT-NCG intervention sustainably alleviates depressive symptoms in pediatric cancer patients at a three-month follow-up, with large effect sizes, likely due to the intervention's narrative component, which allows patients to express and externalize their concerns [43]. This process helps reduce the internalization of negative emotions [30], which can exacerbate depressive symptoms. Additionally, the enhancement of spiritual well-being and hope, both protective factors against depression [8], could contribute to this alleviation. In contrast, the intervention did not significantly reduce anxiety levels at 3-month follow-up, likely due to anxiety's unique sensitivity to external stressors in pediatric cancer patients—such as invasive treatments and unpredictable medical fluctuations [66]—which may have overshadowed HT-NCG's effects without booster sessions. This suggests that while narrative-based interventions can effectively address enduring emotional states like depressive symptoms, context-dependent symptoms like anxiety may need ongoing reinforcement or adjunctive strategies, such as cognitive skills [66, 67]. These findings highlight the need for tailored approaches, including booster sessions for anxiety and personalized monitoring of medical status, to optimize intervention timing and components.

The effect on QoL

While the intervention group demonstrated consistent improvements in overall QoL scores across all time points compared to controls, these differences did not reach statistical significance. This pattern suggests two possible interpretations: First, the study may have been underpowered to detect a modest treatment effect, especially given the complex, multidimensional nature of QoL assessment [56]. The HT-NCG intervention focused on emotional and spiritual well-being, which effectively improved depressive symptoms and hope, but did not address critical physical determinants of QoL such as pain, nausea, and fatigue [56]. Since physical distress is a primary concern for pediatric cancer patients [56], this omission likely limited the intervention's ability to enhance overall QoL perceptions. Previous evidence suggests that narrative interventions can aid in coping with physical symptoms like pain and are well-received by cancer patients without causing harm [68]. Future interventions could incorporate strategies to translate emotional and spiritual gains into physical relief [68], thereby holistically improving the QoL of participants. Second, the intervention's benefits appear to have benefited

certain domains rather than the whole QoL. This interpretation is supported by the robust, statistically significant improvements observed in the communication subscale at all assessments, with effect sizes increasing from moderate to large over time, likely because participants were freer to express themselves after multiple expressions during the intervention.

Post hoc *power analysis*

Despite the inherent limitations of the relatively small sample sizes, the strong power observed in our post-hoc analysis is encouraging. It suggests that the intervention demonstrated a substantial impact on spiritual well-being, one that was detectable even within the constraints of the smaller sample sizes. The high power reduces the likelihood of Type II error, meaning that the positive effect of the intervention on spiritual well-being is unlikely to be owing to chance. This serves as a promising indication that the present intervention might have a meaningful and robust effect, warranting further investigation in larger-scale studies to confirm these preliminary findings and explore the potential for broader application in similar populations.

Limitation

This RCT had several limitations. First, the generalizability of the current study was limited by its small sample and its conduct at a single research center. Given the intervention's good feasibility and acceptability, as well as its preliminary effectiveness on spiritual and psychological outcomes, a full-scale RCT will be conducted in the future. Second, patients with a low score of spiritual well-being were not screened at baseline, which could have increased the chance of observing differences between the two study groups. This decision was made for a specific reason. Previous research has indicated that narrative interventions benefit cancer patients, irrespective of their baseline outcome levels [69]. Setting a minimum threshold for spiritual well-being as a criterion for study inclusion would have excluded most patients and caused difficulty with recruitment [69]. Similarly, the use of an active control group, in which participants played a poker game, rather than a passive control (e.g., waitlist) may contribute to underestimated effect sizes. However, this design was intentional to control for non-specific factors such as group participation and attention from facilitators. Future studies could further disentangle these effects by including both active and passive control groups. Third, while our exclusion criteria controlled for major psychiatric confounders, we did not systematically track non-psychiatric medications (e.g., steroids, opioids) that might modulate mood states [70]. Future trials should consider documenting medication regimens to enable post-hoc analysis of potential interactions and strategically timing interventions relative to medication cycles. Fourth, while uncorrected p-values may increase Type I error risk for individual outcomes, our focus on effect sizes and consistent patterns across related measures (e.g., spiritual well-being and depressive symptoms both improving) supports the intervention's potential effectiveness. Future confirmatory large-scale trials can be implemented to exclude the possibility of false positives. Lastly, the HT-NCG intervention was developed based on the Chinese culture context. Because culture is an important factor affecting patients' spiritual well-being [12], the generalizability of the study findings to different cultures or countries might be affected. Cultural adaption is necessary for its implementation of the HT-NCG across various cultural contexts.

Implication to research

This study addresses a gap in the literature by focusing on spiritual well-being among pediatric cancer patients, demonstrating the clinical significance of the HT-NCG intervention. With large effect sizes for spiritual well-being and depressive symptoms at the three-month follow-up, the findings indicate that HT-NCG not only provides immediate benefits but also sustains effects over time. The substantial improvements suggest that HT-NCG can effectively address spiritual needs and enhance spiritual well-being in pediatric cancer patients. The intervention, a short, engaging, and relaxing card game, is structured and easily incorporated into the daily activities of pediatric patients, for whom play is a natural part of life [23]. Its low cost and ease of dissemination make it highly applicable in clinical settings. The safe and relaxing nature of HT-NCG provides a supportive space for children to express and externalize their concerns, with engaging elements like card drawing and scratching aligning with children's natural inclination to play. HT-NCG has the potential to be used throughout the disease trajectory, helping pediatric cancer patients express their concerns and find meaning and hope during challenging times. Its concise and structured format allows for adaptation using technology to overcome geographic limitations, ensuring that spiritual needs can be met even after hospital discharge. This makes HT-NCG a promising option for clinical sites aiming to support the holistic well-being of pediatric cancer patients.

Conclusions

This study supports the HT-NCG as a feasible intervention among pediatric patients with cancer. The results showed that this intervention is potentially effective in improving spiritual well-being, decreasing depressive symptoms, and promoting communication within this population. To strengthen the effect, a booster intervention is recommended. After the modification, a large-scale RCT is warranted to confirm the effectiveness of the HT-NCG in Chinese pediatric oncology patients.

Abbreviations

CES-DC	Center for Epidemiological Studies Depression Scale for Children
CSAS-C	Chinese version of the short form of the State Anxiety Scale for Children
FACIT-Sp	Functional Assessment of Chronic Illness Therapy Spiritual Well-being
HHI	Herth Hope Index
HT-NCG	Hope techniques and narrative-based card game
PedsQL 3.0 Cancer Module	Pediatric Quality of Life Inventory 3.0 Cancer Module
QoL	Quality of life
RCT	Randomized controlled trial

Supplementary Information

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Additional file 1. CONSORT.

Additional file 2. Theoretical framework.

Additional file 3. Protocols.

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Authors' contributions

Q.L.: Conceptualization, methodology, data collection, and draft preparation, revision. K.Y.H.: Conceptualization, methodology, draft preparation, revision and supervision. K.K.W.L.: Review and editing. F.W.K.Y: Methodology, supervision and revision. W.L.: Methodology and supervision. F.C.: Methodology. H. W.: Revision. K.C.: Methodology. M.T.: Data analysis. F.N.Y: Data analysis. P.X.: Methodology, data collection. T.N.L: Methodology, data collection. H.X.W.: Data collection. J.Y.: Methodology and revision. All authors read and approved the final manuscript.

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Data availability

The authors confirms that data supporting the conclusions of this study are included in the article. The dataset used and analyzed during the current study are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate

Ethical approval was obtained from the Institutional Review Board of Hong Kong Polytechnic University (reference, HSEARS20221106001) and that of Hunan Children's Hospital (reference, KS 2023–62). Parents who were willing to allow their children to participate in the study were asked to give their written consent. Additionally, patients were invited to sign a child assent form with their names.

Consent for publication

All authors have approved the final version. Participating patients provided consent to data being used in publications. Confidentiality is guaranteed.

Competing interests

The authors declare no competing interests.

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