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The efficacy of interactive group psychoeducation for children with leukaemia: A randomised controlled trial

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ABSTRACT

Objective: To evaluate an interactive group psychoeducation programme for children treated for leukaemia.
Methods: A longitudinal randomised controlled study across four UK hospitals with an immediate (N = 26) and delay control group (N = 32). The intervention covered the pathophysiology of leukaemia, its treatment, side effects and the importance of positive health behaviours. Primary outcomes were parent-reported child health related quality of life (HRQoL) and behavioural difficulties. Secondary outcomes were child-reported HRQoL, cancer-specific HRQoL, child confidence, caregiver burden, and treatment anxiety. Measures were completed pre- and immediately post-intervention, and at 13 and 26-weeks follow-up. Change over time was analysed using multilevel modelling. Acceptability questionnaires rated the intervention on benefits, recommendations, and barriers to participation.
Results: The intervention significantly improved parent-reported child HRQoL but did not have a significant effect on other outcomes. Acceptability of the intervention was high.
Conclusions: This study provides initial evidence that interactive group psychoeducation is acceptable to families and improves HRQoL in children with leukaemia. Difficulties with recruitment removed power to detect effect sizes that are plausible for psychoeducational interventions.
Practise implications: Further studies to explore the potential of psychoeducation to improve outcomes for children with leukaemia and an examination of barriers to participation within this population are warranted.
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1. Introduction

Leukaemia is the most common childhood cancer, with approximately 500 cases diagnosed in the UK annually [1]. Acute Lymphoblastic Leukaemia (ALL) makes up approximately 78% of childhood cases, 15% are Acute Myeloid Leukaemia (AML), with the remainder representing chronic cases [2]. Treatment involves chemotherapy over 2–3 years for ALL and 6 months for AML. Five-year survival rates are approximately 90% for childhood ALL and 65% for AML [3,4].

Given the strong survival rates, Health Related Quality of Life (HRQoL) is widely recognised as a key outcome target in the treatment of paediatric leukaemia [5]. The World Health Organisation [6] specified that HRQoL measures should be multi-dimensional including physical, mental, social and emotional functioning. Assessments should include measures of parent and child generic and disease-specific HRQoL [5,7].

Many aspects of leukaemia treatment could compromise HRQoL. Families face a life-threatening illness, uncertain prognosis, and long-term disruption to family and school life [8]. Children undergo approximately 20 medical procedures during treatment (e.g. lumbar punctures, bone marrow aspirations) which can cause stress and anxiety [9,10], and chemotherapy can lead to side effects (e.g. hair loss, nausea) and late effects (e.g. cardiotoxicity, joint problems) [10].

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Nomenclature

ALL	Acute Lymphoblastic Leukaemia
AML	Acute Myeloblastic Leukaemia
BCAMHS	British Child and Adolescent Mental Health Survey
ES	Effect Size
HRQoL	Health Related Quality of Life
MCID	Minimal clinically important difference
PACQLQ	Paediatric Asthma Caregiver's Quality of Life Questionnaire
PedsQL	Paediatric Quality of Life Inventory
RCT	Randomised Controlled Trial
SD	Standard Deviation
SDQ	Strengths and Difficulties Questionnaire
UK	United Kingdom

Steroid treatment causes problems with weight, cognition and behaviour which can impact peer and family relations, and HRQoL [11].

Survivors have significantly higher risks for long-term depression and impaired HRQoL compared to healthy controls, particularly when living with long-term health conditions [12,13]. One or more adverse late effects have been reported in over 70% of children treated for leukaemia [14]. Survivors are at higher risk of developing chronic health conditions and future cancers compared to the general population, making positive health-related behaviours particularly important [14,15]. However, survivors may not be equipped to engage in healthy behaviours without adequate information about their illness.

Psychoeducational interventions may mitigate the psychosocial impacts of leukaemia treatment. Being prepared for medical procedures, understanding the purpose of treatment and the ability to communicate with healthcare providers may offer children a greater sense of empowerment and control [16]. Psychoeducation may also contribute to preventing and managing late effects in survivors.

Systematic reviews of psychoeducational interventions have identified improvements in symptoms, self-efficacy and self-management for children with chronic conditions [17,18]. For children with cancer, improvements in positive thinking and communication following a group cognitive behavioural intervention have been reported [19]. Computer-delivered psychoeducational interventions have improved treatment adherence in adolescents with cancer [20] and locus of control in children with leukaemia [21]. Short interventions to familiarise children with medical procedures and reduce distress during cancer treatment, have reduced negative threat appraisal [22,23].

The study reported here evaluated a novel psychoeducational intervention for children treated for leukaemia, delivered in an interactive, social context. We hypothesised that receiving this intervention would lead to improvements in two primary outcomes: parent-reported child generic HRQoL, and emotional and behavioural difficulties. We also examined efficacy on a number of exploratory secondary outcomes (child-reported generic HRQoL, illness-specific HRQoL, child confidence, caregiver burden and treatment distress). It was hypothesised that caregiver burden would reduce in line with improvements in child quality of life, behavioural issues and treatment-related anxiety. The UK Medical Research Council recommends that acceptability should be evaluated alongside efficacy to ensure interventions could be effectively integrated into clinical provision [24]. Therefore, we also assessed intervention acceptability by recording attendance during the intervention and collecting parent and child feedback at the end of the intervention.

2. Methods

2.1. Study design

We used a longitudinal Randomised Controlled Trial (RCT) design. An immediate treatment group received the intervention in the week after receiving their first baseline questionnaire, while a delayed treatment group received the intervention 18 weeks later. The immediate group received the psycho-educational intervention for four weeks and provided data immediately post-intervention (week 5). The delay group acted as a control group before receiving the intervention at week 18, providing data at baseline and week 5; time points matched to assessments in the immediate group. At week 18 the delayed group provided pre-intervention data. They then received the intervention for four weeks, before providing post-intervention data in week 23. Both groups provided follow-up data at 13 and 26 weeks after their four-week intervention ended.

We powered our study to detect an effect size of 0.5 as meta-analyses have found medium to large effects for psychological interventions delivered to children with chronic conditions on a range of outcomes (e.g. adherence to treatment, symptoms, adjustment) [25]: mean ES = 0.71; [26]: mean ES = 0.58). Eighty percent power to detect an effect size of 0.5 using a between-group comparison with a 1-tailed hypothesis is provided by a design with 51 participants in each group. Therefore, we aimed to recruit 60 children in each group, allowing for 15% dropout.

A modified intention to treat design was used [27]. Children were analysed in their allocated treatment group, regardless of intervention attendance. However, only families providing baseline data and at least one follow-up timepoint were used to analyse change over time. The clinical protocol was registered with the International Standard Randomised Controlled Trials registry (ISRCTN: 3679062) and approved by the University of Sheffield's Psychology Ethics Committee, and the North-West Haydock National Research Ethics Service (10/H1010/45).

2.2. Participants and procedure

The eligibility criteria for participation were children aged 7–12 years, on-treatment, and survivors, treated for leukaemia in one of four participating UK hospitals (Leeds General Infirmary, Manchester Children's Hospital, Sheffield Children's Hospital, Liverpool Alder Hey). A parent or caregiver was also recruited into the study to provide parent-reported outcome data for each child. Families were informed about the study by research nurses in each hospital. From a sample of 422 children, 74 families gave consent and were recruited by research nurses (see Supplementary Fig. A.1: 78 declined, 2 excluded for comorbidities, 268 non-contactable), before they were randomised into intervention groups. Participants were randomly assigned into a delay or immediate group by the fifth author (CS), who was not involved in delivering the intervention or recruiting participants, using a random number generator. Randomisation was stratified by age (7–9 and 10–12 years) and gender. It was not possible to blind the participants or the deliverer of the intervention to group allocation due to the timing of the workshops.

Participants were assigned a unique number at randomisation which was used for data collection. Data was collected using paper questionnaires. Pre-intervention data was collected at the first intervention session. Additional questionnaires were sent and returned via mail. Data was provided by 58 families at baseline and 45 at follow-up.

2.3. Intervention

The intervention was initially developed and piloted by a clinical team at Manchester Children's Hospital (including authors DH, GM and MYS), following needs assessments from the academic literature

[e.g., 9, 10] and clinical practise. These needs were identified in the study protocol (ISRCTN: 3679062). Feedback from parents and children following piloting were used to refine intervention content and delivery. The intervention consisted of four 2 h sessions run on consecutive weeks in each hospital, following teaching plans laid out in the study protocol. Groups consisted of 2–6 children. Nine blocks of the intervention were run during the study period (June 2012–April 2016). All sessions were taught by the first author (a trained teacher) who was the research assistant on the project. Adherence to the research protocol and engagement with the learning materials was recorded using attendance records, monitoring, and assessment forms for delivery of activities and child understanding, and responses on the acceptability questionnaires.

Each session (shown in Supplementary Table B.1) included information, demonstrations, games, and activities, addressing basic anatomy, leukaemia pathophysiology, understanding treatment and its side effects and the importance of maintaining a healthy lifestyle. Supplementary Table B.2 describes the components of the intervention in relation to modifiable targets and secondary outcomes. Group sessions were interactive to engage children and to provide a supportive peer social context. As the emphasis was on education rather than therapy, children chose the extent to which they disclosed their own experiences.

2.4. Outcomes

2.4.1. Primary outcomes

Primary outcomes tested the efficacy of the intervention in relation to the main hypothesis that it would improve child quality of life and behavioural issues. Generic parent-reported child HRQoL was measured using the Paediatric Quality of Life Inventory (PedsQL) generic scale for 8–12-year-olds [28] which measures physical, emotional, social, and school functioning. For example, 'In the past 4 weeks, how much of a problem has your child had with walking down the road a little bit?' Responses used a 5-point scale (0 = never a problem to 4 = almost always a problem). Items were reverse-scored so higher scores indicate better HRQoL. Reliability and validity of the PedsQl in cancer studies has been demonstrated ($\alpha = 0.93$) [28]. A minimal clinically important difference (MCID) of 4.5 has been estimated for this scale [29] which represents the minimum amount of change required for patient benefit [30].

Child behaviour difficulties were measured using the parent-reported Strengths and Difficulties questionnaire (SDQ) for children aged 4–16 years [31], which addresses conduct, emotional difficulties, hyperactivity, and peer functioning. For example, 'Often has temper tantrums or hot tantrums'. The SDQ uses a 3-point scale (1 = not true, 2 = somewhat true, 3 = certainly true) with higher scores reflecting greater difficulties. The SDQ satisfactorily discriminates samples of young people with and without mental health problems [32] and demonstrates satisfactory internal consistency ($\alpha = 0.73$) [31].

2.4.2. Secondary outcomes

Secondary outcomes measured intervention efficacy on a number of exploratory measures. Cancer-specific parent-reported child HRQoL was measured using the cancer-specific module of the PedsQL [28]. This assesses pain and hurt, nausea, procedural anxiety, treatment anxiety, worry, cognitive problems, perceived physical appearance and communication. For example, 'In the past 4 weeks, how much of a problem has your child had with having a lot of pain?', scored as with the generic PedsQL scale. Child-reported HRQoL was measured using child versions of the generic and cancer-specific scales. These PedsQl scales have satisfactory internal consistency (parent-report cancer-specific: $\alpha = 0.87$, child-report generic $\alpha = 0.88$, cancer-specific: $\alpha = 0.72$) [28].

Caregiver burden was measured using a modified version of the Paediatric Asthma Caregiver's Quality of Life Questionnaire (PACQLQ) [33], measuring activity limitations and emotional burdens modified to be specific to caring for a child with cancer. For example, 'During the past 4 weeks how often did you feel helpless or frightened when your child had a temperature?' Responses used a 7-point scale (1 = all of the time to 7 = none of the time) and were reverse-scored with higher scores indicating greater caregiver burden. This modified scale has demonstrated satisfactory internal consistency ($\alpha = 0.87–0.92$) [34].

Parent-reported child confidence was measured using seven items modified from the Self-Efficacy Questionnaire for Children [35] for this study, which addressed leukaemia treatment. For example, 'How confident is your child that he/she can ask your doctor about matters of concern?' (shown in Appendix C). Responses used a 5-point scale (0 = not at all confident to 4 = totally confident). Satisfactory internal consistency was demonstrated in the current study ($\alpha = 0.89$).

Parent and child treatment-related anxiety were measured using 6 items developed for the study (shown in Appendix C). For example, 'thinking about coming to clinic appointments, I have felt…' with responses recorded on a 7-point scale (1 = much less anxious than usual to 7 = much more anxious than usual). Internal consistency was satisfactory in this study ($\alpha = 0.85$ to.91).

Parents and children completed acceptability questionnaires after the final intervention session (shown in Appendix C) which included open and closed questions. Closed questions rated the intervention on a range of properties (e.g. friendly, interesting, fun). Open questions recorded satisfaction with the intervention, perceived benefits, barriers to participation and recommendations for improvement. Participant attendance was also recorded for each intervention session.

2.5. Analysis

To check for baseline imbalances between study groups, baseline differences were assessed using *t*-tests and Fisher's exact tests. We checked whether our sample faced greater (parent-reported) emotional and behavioural problems than the general population by comparing our observed SDQ scores with those from the British Child and Adolescent Mental Health Survey [36] using the immediate form of the *t*-test in Stata 13 [37]. Analysis of the acceptability data used descriptive statistics for the closed questions and simple thematic coding for the open questions.

The principal hypothesis, that intervention participation would affect the outcome variables, was tested using a series of multilevel models, with repeated measurements (lower level units) nested within children (higher level units). A between-subject dichotomous variable distinguished study group (0 = delay, 1 = immediate). A within-subject dichotomous variable distinguished whether children had received the intervention at each timepoint (0 = not received, 1 = received). Time was coded as weeks since baseline.

Seven models were tested for each outcome. Model 1 was an unconditional model with no predictors which partitioned total variance into within-child (variation across time) and between-child components. Model 2 introduced time from diagnosis to baseline (measured in days) to control for stage of treatment. Model 3 added study week to measure change over time during the study. Model 4 introduced the main effect of the intervention and Model 5 introduced the main effect of study group (immediate, delay). Model 6 tested whether intervention efficacy varied between children by treating it as a random effect. Model 7 added an interaction term for study group x intervention to test whether differential intervention effects were due to variation in time of intervention delivery. Model improvement was measured using reduction in the model deviance statistic (−2Log-Likelihood [−2LL]) resulting from adding additional parameter(s). Model parameters were reported using p-values and confidence intervals. These analyses were carried out using SPSS v25 [38].

Table 1
Baseline characteristics and measures for the immediate and delay groups.

	Immediate group (N = 26) Means (SD)	Delay group (N = 32) Means (SD)	Test on group difference[a] *t*-test (df)
Age (years)	8.81 (1.79)	9.41 (1.81)	1.262 (56)
Time since diagnosis (years)	4.35 (2.63)	4.71 (3.31)	0.451 (56)
Parent reported outcomes:			
PedsQL (generic)	62.65 (19.58)	61.74 (20.04)	−0.164 (56)
PedsQL (cancer module)	73.25 (18.26)	71.17 (19.99)	−0.388 (56)
SDQ (total)	12.08 (7.88)	12.84 (6.14)	.383 (56)
Caregiver burden	4.76 (1.64)	4.16 (1.65)	−1.302 (56)
Child treatment anxiety	4.07 (1.19)	3.62 (2.01)	−0.977 (56)
Parent treatment anxiety	3.79 (1.52)	3.95 (1.56)	.371 (56)
Child self-efficacy	2.4 (1.06)	2.57 (0.79)	.647 (56)
Child reported outcomes:			
PedsQL (generic)	63.79 (17.41)	61.94 (22.29)	−0.331 (56)
PedsQL (cancer module)	78.55 (10.75)	78.14 (12.98)	−0.123 (56)
Child treatment anxiety	.71 (0.52)	.74 (0.6)	.191 (56)
	Number	Number	Fisher's exact test
Male	13	21	.288
ALL Regimen: A	15	16	
B	5	0	
C	5	14	
AML	1	2	Nc
On-treatment (number)	9	14	.592
Attrition	9	17	.145

SD: standard deviation, df: degrees of freedom, Nc: test not calculable on treatment regimen (zero value), ALL: Acute Lymphoblastic Leukaemia, Regimen A = low risk treatment, Regimen B = moderate risk treatment, Regimen C = high risk treatment, AML: Acute Myeloid Leukaemia, PedsQL: Paediatric Quality of Life Inventory, SDQ: Strengths and Difficulties Questionnaire.

[a] No *t*-tests or Fishers exact tests on differences between the study groups were statistically significant.

3. Results

Table 1 shows baseline characteristics and outcome measurements for the immediate and delay groups. There were no significant baseline differences. Numbers of children on-treatment were 9 in the immediate group (17 survivors) and 14 in the delay group (18 survivors). Our sample showed significantly higher SDQ total scores (mean = 12.45, SD = 7.02) than the BCAMHS sample [36] (mean = 8.4, SD=5.8) ($t = 4.97$, df = 10,347, $p < 0.001$).

3.1. Intervention efficacy

It was hypothesised that the intervention would lead to improvements on the primary outcome measures, parent-reported child HRQoL and behaviour difficulties. Fig. 1 plots changes in these outcomes over the study. Plots for the secondary outcomes are shown in Supplementary Fig. A.2.

3.1.1. Parent-reported child generic HRQoL

Fig. 1 shows that parent-reported generic child HRQoL scores were similar in the immediate and delay groups at baseline. Scores improved in the immediate group after receiving the intervention (week 5), with no simultaneous increase in the delay group. The immediate group's scores continued to improve 13 weeks post-intervention before falling slightly at 26 weeks post-intervention. The delay group's scores improved before and after receiving the intervention (weeks 18 and 23) and the improvement was maintained at 13 and 26-weeks post-intervention.

3.1.2. Emotional and behavioural difficulties

SDQ total difficulties decreased in the immediate group after receiving the workshops (week 5) while difficulties increased slightly in the delay group over the same period (Fig. 1). The immediate group's scores continued to decrease at 13 weeks post-intervention but increased at 26 weeks post-intervention. Difficulties in the delay group decreased before receiving the intervention (week 18), increased slightly after the intervention (week 23), decreased at 13 weeks post-intervention, and increased at 26 weeks post-intervention.

3.2. Multi-level modelling

3.2.1. Parent-reported child generic HRQoL

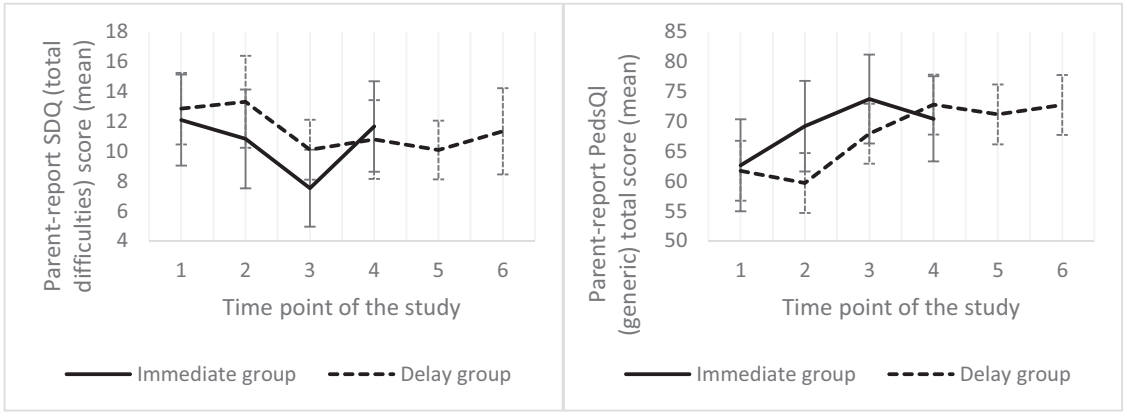
Multi-level modelling of the data (reported in Table 2), showed that time between diagnosis and baseline (Model 2) significantly improved model fit in comparison to the baseline model. This demonstrates improvements in HRQoL as time from diagnosis increased. Model 3 showed change over time during the study was a significant addition, meaning that HRQoL scores improved during the study. Adding the main effect of the intervention (Model 4) significantly improved model fit, demonstrating that HRQoL improved as a result of the intervention. Further additions to the model; adding the main effect of group (Model 5), random effect of the intervention (Model 6) and interaction term (study group × intervention) (Model 7), did not significantly improve model fit. Model 4 was the most parsimonious model (model parameter estimates are shown in Table 3). Mean parent-reported PedsQl had improved from 62.21 (SD: 19.59) at baseline to 71.25 (SD: 17.96) at 6 months.

3.2.2. Emotional and behavioural difficulties

Table 2 shows that Model 3, including change over time, was the most parsimonious model (Table 3 reports parameter estimates). Increasing study week was associated with decreasing SDQ difficulties. Time elapsed between diagnosis and baseline (Model 2) did not significantly predict SDQ scores and there was no evidence that SDQ improvements resulted from the intervention (Model 4).

3.3. Secondary outcomes

Supplementary Tables B.3 and B.4 show the modelling and parameter estimates for the secondary outcomes. Time between diagnosis and baseline significantly improved model fit in all secondary outcomes, demonstrating improvements with increasing time since diagnosis. The main effect of the intervention was not a



Time point	Immediate group	Delay group
1	Pre (Week 1)	Mc (Week 1)
2	Post (Week 5)	Mc (Week 5)
3	Follow-up 1 (Week 18)	Pre (Week 18)
4	Follow-up (Week 31)	Post (Week 23)
5		Follow-up 1 (Week 36)
6		Follow-up 2 (Week 49)

Fig. 1. Parent-reported PedsQl (generic) and SDQ (total difficulties) mean scores plotted over time for the immediate and delay groups. Key shows outcome measurement for study groups at each time point. Pre: pre-intervention, Post: post-intervention, Mc: Matched control, Follow-up 1: 13 weeks post-intervention, Follow-up 2: 26 weeks post-intervention. PedsQl: Paediatric Quality of Life Inventory. SDQ: Strengths and Difficulties Questionnaire. Error bars represent 95% confidence intervals for group means (solid line for immediate group, dashed line for delay group).

Table 2
Multilevel model-fit for the primary outcomes.

Model	Deviance (−2LL)	Change in Deviance, change in df	Residual variance	Child level intercept variance	Child level slope co-variance	Intercept slope covariance
Parent-report PedsQL (generic)						
Unconditional	1583.376		71.947	274.915		
Control model	1565.661	17.715*, 1df	71.526	197.893		
Change over time	1528.106	37.555*, 1df	55.634	199.350		
Main effect of intervention	**1522.355**	**5.751*, 1df**	**53.444**	**200.445**		
Main effect of group	1521.605	.75, 1df	53.436	197.645		
Intervention as random effect	1519.294	2.311, 2df	49.892	198.754	12.547	−20.811
Group*Int interaction	1519.205	.089, 1df	49.892	198.754	12.547	−20.811
Strengths and Difficulties Questionnaire (SDQ) (total difficulties)						
Unconditional	1243.678		13.140	34.493		
Control model	1241.670	2.01, 1df	13.135	33.175		
Change over time	**1237.586**	**4.084*, 1df**	**12.852**	**32.722**		
Main effect of intervention	1237.084	.502, 1df	12.778	32.986		
Main effect of group	1236.730	.354, 1df	12.778	32.753		
Intervention as random effect	1231.497	5.233, 2df	11.099	33.602	5.983	−6.192
Group*Int interaction	1231.449	.048, 1df	11.101	33.580	5.942	−6.112

−2LL: −2 log likelihood, df: degrees of freedom.
Bolded model is the model with the best fit to the data. * indicates a significant improvement in the model, tested using Chi-square distribution on reduction in −2LL deviance.

Table 3
Parameter estimates for the best fit models for the primary outcomes.

Parameter	Estimate	SE	Df	T	Significance (p value)	95% CI (lower bound)	95% CI (upper bound)
Outcome = Parent-report PedsQL (generic)							
Intercept	50.481	3.734	63.891	13.518	0.001*	43.020	57.941
Time since diagnosis	3.047	0.666	58.552	4.576	0.001*	1.714	4.380
Change over time	0.151	0.060	155.566	2.539	0.012*	0.034	0.269
Intervention	4.222	1.742	151.581	2.423	0.017*	0.779	7.665
Outcome = Strengths and Difficulties Questionnaire total difficulties							
Intercept	13.864	1.499	57.125	9.250	<0.001*	10.863	16.866
Time since diagnosis	−0.385	0.271	54.504	−1.419	0.162	−0.928	0.159
Change over time	−0.038	0.019	152.199	−2.031	0.044	−0.076	−0.001

SE: Standard Error, df: degrees of freedom, T: *t*-test. * indicates a significant predictor of the outcome measure.

significant predictor for any secondary outcome measure. Parsimonious models for parent-reported PedsQl (cancer) and child-reported PedsQl (generic) modelled the intervention as a random effect (Model 6), indicating that intervention efficacy varied between children. Parent-reported caregiver burden, child confidence, treatment anxiety and child-reported HrQoL (cancer) and treatment anxiety were best explained by change over time (Model 3).

3.4. Acceptability

Acceptability was high in the families who participated in the intervention. Children rated the intervention as very enjoyable (95%) and very interesting (92.5%). All parents said they would recommend the intervention to other families. Families highlighted benefits including filling in gaps in the child's knowledge, reducing child anxiety and improving the ability of children to communicate about their illness. Full attendance of the intervention for children who started the programme was 85%, with 90% attending three or more sessions. Barriers to participation included scheduling around work, school and family commitments, travel issues and child illness.

4. Discussion and conclusion

4.1. Discussion

This study evaluated a novel, small-group psychoeducational intervention for children with leukaemia. Acceptability testing showed that both children and parents found the intervention appropriate, suggesting that families would find this approach beneficial if included in healthcare provision. The acceptability assessment highlighted perceived benefits of the intervention (increasing child knowledge and communication and reducing anxiety). However, recruitment levels were substantially lower than expected, suggesting that intervention uptake might be problematic. Scheduling around work and family commitments, and travel issues, were commonly identified as barriers to participation. Similar barriers have been described in other healthcare interventions [39,40] which emphasises the importance of considering the burdens associated with intervention delivery.

Lower recruitment to the study reduced the power to detect intervention effects. Despite this, we detected an intervention effect on one of the primary outcomes (child HRQoL), suggesting that this approach is worthy of further development and evaluation. HRQoL increased by more than twice the MCID [28] during the study. This includes the significant effect of the intervention as well as other improvements over time. No effects were detected on the other primary outcome (emotional and behavioural difficulties) or the secondary outcomes.

The intervention might improve HRQoL through providing information about the disease and treatment, healthy lifestyle advice and through access to peers with shared experiences. Reducing illness uncertainty has been shown to reduce stress and anxiety [41], while improving the ability to communicate with doctors and families enables children to make choices and utilise social support [16]. Survivors may have been too young or distressed during treatment to fully assimilate illness information and will have less contact with healthcare providers once their treatment ends. Our intervention provided opportunities to address questions and misunderstandings. Lack of knowledge about health vulnerabilities is common in survivors of childhood leukaemia and survivors sometimes fail to practise health protective behaviours (e.g. healthy eating, exercise, avoiding sun exposure) despite their higher risk for long-term health conditions [41,42]. Psychoeducational interventions highlighting positive health behaviours have the potential to address these on-going health needs. Future work is needed to explore how far positive health messages are incorporated into behaviour and maintained over time and how this impacts long-term HRQoL.

Our sample showed more emotional and behavioural problems than the general population. Behavioural difficulties are a substantial burden during leukaemia treatment, particularly associated with steroid treatment [11]. SDQ was the only outcome not associated with time since diagnosis suggesting that issues remain stable. We found no evidence of improvements in behavioural difficulties associated with the intervention. In addition to psychoeducation, families might benefit from targeted interventions addressing the effects of steroids and long-term behavioural issues (e.g. parenting programmes, coping skills training, family teamwork).

Plots of scores of the HRQoL measures (child and parent-reported generic and cancer-specific QoL) showed that HRQoL improved in the immediate group after receiving the intervention, with no similar improvement in the delay group. This suggests a positive effect of the intervention. However, we also found improvements in the delay group immediately prior to beginning the workshop programme. It is possible that preparing for the intervention and completing measures might have improved family communication about leukaemia prior to the intervention, leading to improvements in HRQoL. Increased involvement with healthcare and open communication in families has been associated with improved adjustment to illness [16,43]. Likewise, HRQoL monitoring has been used in paediatric diabetes care to address problematic issues [44]. The delay group also improved in HRQoL following the intervention (parent reported generic, parent and child-reported cancer-specific HRQoL). However, improvements before the workshops may have obscured some of the effects of the intervention identified in the multilevel modelling. Improvements in HRQoL scores tended to plateau at the 3 and 6-month follow-ups for the delay and immediate groups but were also largely maintained.

The intervention included a number of different components and potentially active ingredients (see Supplementary Table B.2). The focus was on delivering psychoeducation to reduce illness uncertainty and anxiety, and to improve illness-related communication and coping. However, it is possible that the social delivery of the intervention improved HRQoL. Further evaluation of the intervention with an active control group, rather than a delay control group would be helpful in evaluating the relative contributions of these components.

A number of limitations must be considered in interpreting these findings. Our sample size was limited, removing the power to detect intervention effects that are plausible for psychoeducational interventions. This also prevented the examination of potential moderators of effect, such as treatment status and leukaemia type (ALL/AML). Some intervention components were more relevant for families receiving treatment, so effects may have been larger in this sub-group. Various methods were used to improve recruitment, including repeated attempts to contact families, involvement of family support groups and flexible arrangements for sessions. Much of the eligible sample (63.5%) were not contactable during recruitment. This reflected increased difficulties in recruiting survivors, who often had non-current contact details. Some outcome measures, such as treatment-related anxiety and cancer-specific HRQoL, may also have been more sensitive to changes in the on-treatment group.

4.2. Conclusion

We found HRQoL improvements following group psychoeducation for children treated for leukaemia which provides encouragement for the development of this interactive group approach to providing illness information, despite recruiting a smaller sample than targeted.

4.3. Practice implications

Replication of our findings in larger samples would be a useful goal for future research. Difficulties with uptake and retention are common in interventions for paediatric chronic conditions. Therefore, it is vital that future studies examine barriers to participation in intervention studies, both to improve sample sizes and to increase access to psychosocial support for this population. The acceptability assessment suggested a number of barriers to participation in our study (scheduling around work, school and family commitments, travel issues and child illness) which reflect particular difficulties in recruiting into group interventions. This might prompt an exploration of different methods for delivering group psychoeducation (e.g., remote delivery), particularly for rarer conditions such as leukaemia.

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CRediT authorship contribution statement

Marianne Day: Investigation, Formal analysis, Writing - original draft. **Sally Harris:** Writing - review & editing. **Deema Hussein:** Conceptualization, Methodology, Writing - review & editing. **Mohamad Yassin Saka:** Conceptualization, Methodology, Writing - review & editing. **Chris Stride:** Methodology, Formal analysis. **Myles Jones:** Methodology, Writing - review & editing. **Guy Makin:** Conceptualization, Methodology, Supervision. **Richard Rowe:** Conceptualization, Methodology, Writing - review & editing, Supervision.

Data availability

The data that support the findings of this study is not publically available as it contains potentially identifiable and sensitive information about participants. Data is available from the corresponding author upon request.

Conflict of interest statement

The authors report no conflicts of interest.

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Appendix A. Supplementary material

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.pec.2021.04.015.

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