**A Feasibility Study of Group Cognitive Rehabilitation for Cancer Survivors:
Enhancing Cognitive Function and Quality of Life**

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Abstract

Objective: This research aimed to address the gap in evidence-based treatment available for cancer survivors who are experiencing cognitive dysfunction through piloting a novel treatment intervention. The overall research question was whether a group cognitive rehabilitation intervention would be feasible for improving cognitive function and quality of life for people who have completed cancer treatment.

Methods: Three groups of adults were recruited: an intervention group of 23 cancer survivors who completed a 4-week group cognitive rehabilitation treatment, a comparison group of 9 cancer survivors, and a community sample of 23 adults who had never experienced cancer. Measures of objective and subjective cognitive function, quality of life, psychosocial distress and illness perceptions were used. The research design was non-randomised.

Results: The results indicated that the intervention was effective in improving overall cognitive function, visuospatial/constructional performance, immediate memory, and delayed memory beyond practice effects alone. It was helpful in reducing participants' perceptions of cognitive impairment and psychosocial distress, as well as promoting social functioning and understanding of cognition. The improvements were maintained at three months after the intervention. Participants reported a high level of satisfaction with the treatment.

Conclusions: The results provided evidence for the feasibility of a brief group-based cognitive rehabilitation intervention to treat cognitive problems experienced by cancer survivors.

Keywords: cancer; oncology; survivorship; cognitive dysfunction; cognitive-behavioural treatment

A Feasibility Study of Group Cognitive Rehabilitation for Cancer Survivors: Enhancing Cognitive Function and Quality of Life

A cancer survivorship issue that is gaining in recognition is cognitive impairment [1]. Cognitive dysfunction has been associated with not only central nervous system (CNS) tumours and their treatments, but also with many other types of cancer and treatment [1-4]. Treatments as diverse as chemotherapy, radiotherapy, hormonal treatments, bioimmunotherapy, and adjunctive medications, as well as the cancer itself before treatment, have been associated with cognitive changes [4-7].

Conceptual reviews have modelled the complex mix of factors associated with cognitive dysfunction, including demographic, tumour, treatment, and psychosocial variables [6,8]. Additional complexity arises from a distinction between objective and subjective findings. A recent review of cognitive effects of chemotherapy reported objective impairments in 15-50% of patients [3]. Self-report incidence rates as high as 71% at six months post-chemotherapy have been found [9]. Frequently, there is no correlation between objective and subjective cognition [6,10]. However, while this discrepancy is widely acknowledged, there remains a need for evidence-based interventions to address this survivorship issue [1,5]. Cognitive rehabilitation has the potential to address both subjective and objective cognitive difficulties [11].

Very few published studies have examined whether cognitive rehabilitation can affect cognitive dysfunction following adult-onset non-CNS tumours [12-15]. Brief individual cognitive rehabilitation for breast cancer survivors, comprising four face-to-face sessions plus phone calls and a workbook, showed improved self-reported cognition, quality of life, and objective cognition in 29 participants [12]. A randomised study of the same intervention showed improved spiritual quality of life and verbal memory compared to waitlist controls [13]. Computerised rehabilitation has also shown promise [14], as has group cognitive rehabilitation among cancer survivor participants in a general cognitive rehabilitation program for older adults [15].

In addition to cognitive difficulties, issues such as quality of life and mental health are significant concerns for many cancer survivors [3]. A key model of individual differences in these adjustment domains is the Self-Regulatory model of illness perceptions [16]. Only recently applied to cancer survivorship, the Self-Regulatory Model describes how individuals mentally represent illness and how these representations may influence treatment outcomes [16]. Previous illness perceptions research has suggested that cancer patients and survivors

who show low illness coherence (limited understanding of their condition), low treatment control and who view their cancer as being chronic, uncontrollable, having high consequences and serious symptoms also show poorer outcomes in physical and mental health, especially when subjective outcomes are considered [17,18]. From this research, it can be predicted that illness perceptions would associate with subjective cognition but this has not been tested in relation to cancer.

The present study addressed the gap in evidence-based treatment for cancer survivors who experience cognitive dysfunction through developing and evaluating a new brief intervention incorporating cognitive rehabilitation principles. This intervention was novel in using group rather than individual treatment, and included cancer survivors who represented a mix of cancer diagnoses and treatments, rather than focussing on a single tumour or treatment history. Further to this, the study aimed to offer additional insight into the complex relationships between objective and subjective cognitive dysfunction, quality of life and mental health, as well as explore the role of illness perceptions in cognitive dysfunction for the first time.

Methods

Participants

Intervention participants were 23 cancer survivors aged 34-84 years ($M=58.2$, $SD=11.8$). A cancer comparison group comprised 9 survivors (age $M=58.3$, $SD=8.6$) who were waitlisted but declined to attend the intervention ($n=3$), or volunteered after the final group began ($n=6$). Referral rates were not sufficient to allow randomised group allocation. A community comparison group comprised 23 adults with no history of cancer (age $M=58.5$, $SD=11.1$). Demographic and medical characteristics are summarised in Table 1.

Insert Table 1 about here

All participants were aged at least 18 years and fluent in English. Additional criteria for cancer survivors were previous diagnosis of adult-onset cancer and completion of major treatments such as surgery, chemotherapy, and radiotherapy at least six months prior. One intervention participant was four months post- treatment but was included on ethical and compassionate grounds. Exclusion criteria were childhood cancer history, known primary or secondary CNS tumour, and history of intracranial radiotherapy or intrathecal chemotherapy.

After ethical approval, participants were recruited through flyers at university and community locations, as well as cancer support organisations and a public hospital (cancer survivors) and personal contacts of the research team (community comparison). Community

participants were recruited for a parallel psychometric study with 72 participants aged 20-79 years [19]; 23 individuals who matched intervention participants for age, gender and education were selected to form the community comparison group for the present study.

Measures

Objective Cognitive Function. The *Repeatable Battery for Assessment of Neuropsychological Status* (RBANS) has demonstrated high internal reliability, test-retest stability, and divergent and convergent validity [20]. The second objective measure, the *Trail Making Test* (TMT), assesses complex visual attention and psychomotor speed with sensitivity and validity [21] and has high test-retest reliability [22]. Both measures have demonstrated sensitivity to cognitive rehabilitation [12,23].

Subjective Cognitive Function. The authors of the 38-item *Multiple Ability Self-Report Questionnaire* (MASQ) found excellent internal reliability, test-retest reliability, and criterion, concurrent and discriminant validity [24]. The MASQ was sensitive to cognitive rehabilitation in cancer survivors [12]. The 37-item *Functional Assessment of Cancer Therapy – Cognitive Scale* (FACT-Cog v3) was used as a subjective cognition measure developed for cancer survivors [25]; the similar FACT-Cog v2 has demonstrated reliability and validity [26].

Adjustment and Illness Perceptions. The 30-item *European Organisation for Research and Treatment of Cancer Core Quality of Life Questionnaire* (EORTC-QLQ-C30v3; [27]) measures multiple adjustment domains. Its functioning and global quality of life scale show high internal consistency (Cronbach's $\alpha > .82$, except cognitive functioning $\alpha = .55$ [28]). The 10-item *Kessler Psychological Distress Scale* (K10) measures psychosocial distress, with excellent internal consistency, sensitivity and specificity [29]. The 9-item *Brief Illness Perception Questionnaire* (BIPQ) has shown good test-retest reliability as well as concurrent and discriminant validity [30].

Participant Satisfaction. Three 5-point items were used: satisfaction with treatment (1=*strongly dissatisfied* to 5=*strongly satisfied*); extent of change in cognitive problems (1=*got a lot worse* to 5=*improved a lot*); and likelihood of recommending the program if a friend had similar problems (1=*very unlikely* to 5=*very likely*). An overall program rating between 1=*very poor* to 10=*excellent* was also requested. Demographic and participant satisfaction items are available from the corresponding author.

Intervention

The intervention developed for this study was based on self-regulatory cognitive rehabilitation [11,31] and cognitive behavioural principles [32,33] and was manualised [34,35]. The authors co-facilitated the weekly 2-hour group sessions and between-session homework. Each session first focussed on psychoeducation, followed by a thematic group discussion and a 10-15 minute refreshment break. The second half of each session emphasised developing and applying skills.

Session One (Aging, health, cancer and cognitive function) involved psychoeducation on cognition, and training in goal setting, problem solving and relaxation. Sessions Two (Memory) and Three (Attention) involved education and skills training regarding memory and attention respectively, including compensatory and enhancement strategies [11]. Session Four (Fatigue, emotions and cognition) involved psychoeducation and cognitive-behavioural strategies related to emotional adjustment, fatigue, sleep, and self-care. Four groups of 4-8 participants completed the intervention at no charge.

Procedure

Participants completed assessments at baseline (T1), post-treatment (T2, 6 weeks after T1) and follow-up (T3, 3 months after T2, for intervention participants). Between T1 and T2, intervention participants completed the group program, and comparison participants completed no intervention. Assessors were trained and supervised by the second author (a registered clinical health psychologist). The nine assessors were psychology graduates in postgraduate or advanced undergraduate studies and were not involved in delivering the intervention. On eight occasions, the first author completed assessments as other assessors were not available.

Statistical Analyses

Group(3) x Time(2) ANOVAs were computed. When statistical assumptions for ANOVA were not met, the non-parametric Kruskal-Wallis and Wilcoxon Signed-Rank tests were used. Simple effects tests used familywise Bonferroni corrections for multiple planned comparisons. Effect sizes for interactions (d) were computed using the pooled pre-test standard deviation for the two groups being compared [36]. Positive interaction effects represent intervention-group improvements that exceeded comparison-group improvements. Clinical significance of changes was calculated using Jacobson and Truax's Reliable Change Index formulae and community group values for pre-test standard deviation and test-retest reliability [37]. For the K10, a further indicator of clinical significance was whether participants moved into the non-distressed range [29,37]. Maintenance effects were assessed

by comparing T1 and T3. The pattern of results was the same for both completer and intention-to-treat analyses, where the latter analyses estimated missing data as remaining unchanged from the previous assessment. Inferential statistics below used completer analyses.

Results

All intervention participants completed treatment. Missed sessions were compensated for by participants working through the manual and receiving briefings from facilitators: Ten participants missed one session (47.8%) and 2 missed two sessions (8.7%). T2 assessment data were missing for 2 participants (illness: one intervention participant; family bereavement: one cancer comparison). Three intervention participants had missing T3 data (illness: two participants; moved away: one participant).

Objective Cognitive Function

Means and standard deviations for objective and subjective cognitive measures are shown in Table 2. No RBANS measure showed a main effect for group. All RBANS measures except immediate memory had a main effect of time, indicating improved performance at retest. For RBANS total, there was a significant Group x Time interaction, $F(2,50)=19.26, p<.001$. The interaction occurred because the intervention group significantly improved in overall cognitive function, $p<.001$ but comparison groups did not (see Figure 1 and Table 2). Similarly, statistically significant Group x Time interactions were found for the RBANS subscales of immediate memory, visuospatial/constructional, and delayed memory. See Table 2 for effect sizes of intervention group changes corrected for comparison group changes [36]. For RBANS total, eight intervention participants met reliable change criteria (36.4% [25]). One cancer comparison participant showed reliable improvement (12.5%). No community comparison participant improved reliably.

Insert Table 2 about here

Insert Figure 1 about here

For the TMT, a main effect of Time indicated faster Trails A performance at T2 than T1, $Z(52)=-2.76, p=.006$. A similar trend was seen for improved Trails B performance at T2 but this did not reach two-tailed significance, $Z(52)=-1.675, p=.094$. There was no Group effect for Trails A or B.

Subjective Cognitive Function

For the MASQ, there were no main effects and no interaction. Unexpectedly, community participants reported improved subjective function at retest. For the FACT-Cog, interaction effects were not significant, although the power to detect these interactions was low. There was a main effect of group on all four FACT-Cog subscales, with cancer comparison participants reporting better cognitive performance than intervention participants, $p=.007-.042$. There was also a main effect of time indicating improvement in perceived cognitive impairment at re-test, $F(1,16)=10.29$, $p=.005$. On the FACT-Cog perceived cognitive impairments score, three intervention participants (30.0%) and one cancer comparison participant (12.5%) met reliable change criteria.

Quality of Life, Emotional Distress and Illness Perceptions

Table 3 shows relevant descriptive statistics. There were no main effects of time for EORTC-QLQ-C30 quality of life measures. However, significant group effects occurred for role, emotional, and cognitive function at T1 ($\chi^2(2)=7.63-11.57$, $p=.003-.022$) and T2 ($\chi^2(2)=6.42-14.62$, $p=.001-.040$), due to lower quality of life reported by intervention than community participants. There was also a group effect for social function at T1 ($\chi^2(2)=10.70$, $p=.005$), but not T2 ($\chi^2(2)=0.62$, $p=.735$.) The intervention group significantly improved in social functioning by T2, $Z(20)=2.56$, $p=.010$.

Insert Table 3 about here

For psychosocial distress (K10), there was no interaction and no main effect of time. There was a significant group effect at T1 ($\chi^2(2)=15.01$, $p=.001$) and T2 ($\chi^2(2)=10.27$, $p=.006$), due to greater distress among intervention participants than comparison participants. However, among intervention participants who were clinically distressed at pre-treatment, psychosocial distress significantly reduced at post-treatment, $Z(6)=-2.03$, $p=.043$. As a significant K10 time effect was only noted for participants whose scores started in the clinical range, only those participants from each group were considered for reliable change. Three intervention participants (42.9%) and one community comparison participant (33.3%) demonstrated reliable change.

For illness perceptions (BIPQ), no interactions were found. A main effect of time was noted for illness coherence, $F(1,49)=6.73$, $p=.012$. Simple effects tests showed that intervention participants improved significantly in illness coherence after treatment, $p=.003$, whereas comparison participants did not, $p=.274-.517$. When clinical significance was

considered for illness coherence, one participant in each group met reliable change criteria (intervention 4.5%, cancer comparison 12.5%, community 4.3%).

Maintenance at Followup

As shown in Tables 2 and 3, almost all significant gains by intervention participants at T2 were maintained at T3. Maintenance was demonstrated for RBANS total (T2 within-group effect size $d=1.37$; T3 $d=1.42$), Immediate Memory (T2=0.55;T3=0.74), Visuospatial/Constructional (T2=1.44, T3=1.69), and Delayed Memory (T2=1.50;T3=1.81). Subjective cognition demonstrated maintenance effects for FACT-Cog perceived cognitive impairment (T2=0.45;T3=0.50) and perceived cognitive abilities (T2=0.55;T3=0.57). Other self-report measures demonstrated maintenance of improved social function (T2=0.42;T3=0.31), psychosocial distress for participants who started in the clinical range (T2=1.55;T3=1.37), and illness coherence (T2=0.63;T3=0.83).

No maintenance of T2 gains in RBANS Language and Attention/Concentration was found; these variables also contrasted with other RBANS measures in that they did not show Group x Time interactions. One variable, Trails A, improved significantly at T3, $Z(19)=-3.47$, $p=.001$, but not T2 (T2=0.09;T3=0.28).

Participant Satisfaction

At post-treatment, all 21 intervention participants who provided feedback reported being *satisfied* or *very satisfied*. Cognitive difficulties were rated *improved a lot* by 2/21 participants, *improved a little* by 17, and *no change* by 2. Twenty participants indicated that they would be *likely* or *very likely* to recommend the group to a friend, with one neutral response. When asked to rate the group overall, 15/21 participants rated the program as *excellent* and 6 as *good*. Similar feedback was received at follow-up: 5/18 participants now thought their cognitive difficulties had *improved a lot*, 8 *improved a little*, 4 *no change*, and one reported that their cognitive difficulties had *got a little worse*.

Discussion

The main aim was to determine the feasibility of brief group cognitive rehabilitation for cancer survivors. The intervention was associated with improved objective and subjective cognition, psychosocial distress, social functioning, and perceived understanding of cognition that exceeded changes in comparison groups. Gains were maintained at three month follow-up. The intervention was acceptable and feasible to run. This represents a positive step forward in addressing the need for interventions for cancer survivors with cognitive difficulties [38].

Intervention participants' gains in overall cognitive performance, visuospatial/constructional performance, immediate memory, and delayed memory showed within-group effect sizes that compared favourably to previous cognitive rehabilitation studies [12,23]. After accounting for comparison group changes, intervention participants' objective improvements exceeded recent recommendations that an effect size of $d=0.41$ be considered as a "recommended minimum practical effect", 1.15 a "moderate" and 2.70 a "strong" effect in social sciences [39]. The three groups did not differ in baseline objective cognition, except that visuospatial/constructional performance was significantly higher among community comparison than cancer survivor participants.

At baseline, intervention participants reported significantly worse FACT-Cog3 subjective cognition than cancer comparison participants and were more likely to report adapting their behaviour due to perceived cognitive changes, such as delaying return to work. This is consistent with previous research which has noted that individuals who decline participation in cancer support groups are often in a less distressed state [40]. Intervention participants improved significantly on two FACT-Cog3 subscales and no longer differed from cancer comparison participants on Perceived Cognitive Ability after the intervention. Thus, the FACT-Cog3 appeared to be more sensitive to both baseline subjective cognition and intervention gains than the MASQ. Given that the FACT-Cog3 was developed specifically for cancer survivors, it would seem to be a promising measure for further psycho-oncology research.

Intervention gains in other self-report measures were also consistent with distress reducing towards the baseline levels of the comparison groups. This pattern was seen for social functioning and for psychosocial distress among participants with clinical distress at pre-treatment. These effect sizes were comparable with previous research [12,41]. Improved social functioning may suggest a specific social benefit from group treatment. Perceived illness coherence demonstrated this same pattern compared to the cancer comparison group. Illness perceptions were actually significantly more dysfunctional for community participants (who were instructed to imagine what cognitive difficulties would be like for someone with these problems) than the cancer survivor groups (who were asked about "your cognitive difficulties").

A strength regarding generalisability came from the mix of genders, ages, cancer types and cancer treatments. A focus on breast cancer has limited much previous research regarding generalisation to other cancer types [3]. In the present study, reliable improvement on the main outcome measure (RBANS total) was seen for intervention participants with

breast, colorectal, prostate, and testicular cancer. Examination of subgroups showed no trends for intervention response to associate with the type of tumour or treatment. Recruitment of participants from a range of sources suggested that the research had applicability to a number of organisations relevant to cancer survivors. Finally, an advantage was found in the high acceptability and low attrition rate of the intervention group (4.3% post-intervention), compared to the 20% attrition rate that has been reported as typical for cancer survivor group interventions [42].

However, a number of limitations are noted. Sample sizes were relatively small, which limits statistical power to detect differences between groups, including the post-hoc analysis regarding which tumour types showed effects [43]. It is known that comparison of uneven group sizes is not methodologically ideal [43]. To address the issues of both small and uneven group numbers, interpretation of results incorporated effect sizes which are independent of group size [43], and comparisons of percentage of reliable change between groups [37].

Another limitation was non-random allocation to intervention and cancer comparison groups. A randomised controlled trial would provide a stronger test of efficacy now that feasibility has been established [3]. The finding that participants started and finished in a normal range for some measures, such as MASQ subjective cognition, was not considered typical for cancer survivors [3,12] and suggests that baseline impairment would be an important inclusion criterion in future intervention studies. Ideally, all assessors would be blinded to group allocation, whereas 6% of assessments were conducted by one of the intervention facilitators. Finally, it was noted that the scope of the present study does not address the complete range of potential factors associated with cognitive impairment for cancer survivors [6,8].

In conclusion, this research supported the practicality and acceptability of a brief group cognitive rehabilitation intervention for cancer survivors [34,35]. These results suggest that further research regarding brief group interventions for this population is warranted [1,12,38]. In addition, future research which incorporates illness perceptions would be beneficial as this remains an emerging area of research for cancer survivors [17,18].

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Table 1
Participant Characteristics

Variable	Intervention (n=23)	Cancer Comparison (n=9)	Community Comparison (n=23)
	<u>M (SD) Range</u>	<u>M (SD) Range</u>	<u>M (SD) Range</u>
Age (years)	58.2 (11.8) 34-84	58.3 (8.6) 47-74	58.5 (11.1) 34-78
Education (years)	15.4 (3.2) 10-20	13.6 (3.4) 10-19	15.7 (3.9) 9-25
	<u>Median (SD) Range</u>	<u>Median (SD) Range</u>	<u>Median (SD) Range</u>
Months since cancer diagnosis	54.0 (44.8) 19-166	60.0 (41.7) 19-162	-
Months since finished cancer treatment	36.0 (32.8) 4-123	48.0 (44.6) 11-159	-
	<u>%</u>	<u>%</u>	<u>%</u>
Living with partner	73.9	77.8	78.3
Female	56.5	77.8	56.5
Born in Australia	78.9	77.8	65.2
Neurological history	4.3	0.0	0.0
Cancer type			
Breast	47.8	55.6	-
Prostate	17.4	0.0	-
Colorectal	17.4	33.3	-
Neck	4.3	0.0	-
Testicular	4.3	0.0	-
Ovarian	0.0	11.1	-
Mixed	8.7	0.0	-
Treatment			
Chemotherapy	73.9	44.4	-
Radiotherapy	60.9	55.6	-
Surgery	82.6	100.0	-
Other	52.2	55.6	-
Cognitive difficulties			
After cancer treatment	82.6	88.9	-
Current difficulties	65.2	66.7	-
Required adaptations ^b	78.3	33.3 ^a	-

^aSignificantly lower in cancer comparison than intervention group.

^bExamples: change work duties; delay return to work for cognitive reasons

Table 2

Interaction Effects, Means (and Standard Deviations) for Cognitive Measures

Measure	Interaction		Time 1			Time 2			Time 3
	d_{I-Can}/d_{I-Com} (p)		Intervention	Cancer	Community	Intervention	Cancer	Community	Intervention
			Comparison			Comparison			
			($n=22$)	($n=8$)	($n=23$)	($n=22$)	($n=8$)	($n=23$)	($n=20$)
Neuropsych. Battery (RBANS)									
Total	1.00/1.19	(.000)	95.1 (9.9)	94.6 (8.2)	101.3 (13.2)	108.7 (11.0)***	98.4 (11.5)	100.7 (13.6)	109.5 (13.7)***
Immediate memory	0.48/0.73	(.015)	100.5 (13.6)	98.3 (11.1)	105.3 (17.0)	108.0 (11.4)**	99.4 (11.9)	101.4 (19.6)	111.1 (14.5)***
Visuospatial/constructional	1.17/0.91	(.000)	83.4 (10.3)	85.5 (8.7)	95.5 (20.0)	98.2 (14.8)***	88.4 (16.3)	95.5 (20.5)	101.1 (14.5)***
Language	0.05/0.71	(.099)	101.3 (9.7)	96.5 (8.1)	99.6 (7.0)	108.8 (8.5)***	103.5 (8.8)	101.0 (8.4)*	105.0 (12.6)
Attention/concentration	0.09/0.30	(.443)	102.1 (15.2)	108.3 (20.7)	104.5 (16.4)	108.3 (15.4)*	112.9 (14.0)	105.8 (15.7)	106.7 (17.7)
Delayed memory	1.57/1.22	(.000)	95.6 (8.2)	95.3 (10.1)	100.6 (13.1)	107.9 (9.9)***	93.5 (12.2)	99.3 (11.9)	110.8 (8.8)***
Trail Making Test									
Trails A ^a	-0.52/0.18		39.9 (15.4)	46.5 (21.3)	36.0 (14.4)	38.5 (22.5)	35.9 (10.2)	31.8 (15.3)*	35.6 (27.4)**
Trails B ^a	0.22/0.11		76.8 (27.5)	70.8 (23.3)	71.7 (43.3)	73.4 (35.0)	73.3 (25.2)	64.1 (33.7)*	73.3 (35.5)
Self Report (MASQ)									
Total	0.04/-0.29	(.157)	88.5 (18.1)	83.9 (13.3)	83.1 (16.7)	88.5 (14.3)	84.6 (11.6)	77.9 (15.5)*	87.7 (16.2)
Self Report (FACT-Cog) ^b									
Perceived Cog. Impairments	0.15/-	(.538)	38.7 (17.7)	62.6 (16.2)	-	46.7 (17.0)*	68.0 (12.0)	-	47.6 (16.8)*
Comments From Others ^a	0.16/-		12.5 (3.0)	15.5 (1.1)	-	13.4 (3.4)	16.0 (0.0)	-	13.0 (3.4)
Perceived Cognitive Ability	0.38/-	(.211)	16.8 (5.8)	25.4 (8.5)	-	20.0 (5.9)*	25.8 (8.5)	-	20.1 (8.9)*
Impact on Quality of Life	-0.24/-	(.289)	9.6 (5.0)	13.4 (3.4)	-	9.6 (5.1)	14.5 (2.3)	-	11.2 (4.9)

* $p < .05$ ** $p < .01$ *** $p < .001$ for within-group comparison to T1

^aNon-parametric tests.

^bOnly 10 intervention participants completed FACT-Cog due to late addition of this measure.

Note. Higher scores indicate better performance for RBANS and FACT-Cog. Lower scores indicate better performance for Trail Making and MASQ. Under Interaction, d_{I-Can} =Effect size for Intervention improvement between T1 and T2 corrected for Cancer comparison improvement; d_{I-Com} =Intervention improvement corrected for Community comparison improvement; p =probability value for Group(3) x Time(2) interactions (not applicable for variables requiring non-parametric tests).

Table 3
Interaction Effects, Means (and Standard Deviations) for Psychosocial Measures

Measure	Interaction	Time 1			Time 2			Time 3
	d _{I-Can} /d _{I-Com} (<i>p</i>)	Intervention	Cancer	Community	Intervention	Cancer	Community	Intervention
		Comparison			Comparison			
		(<i>n</i> =22)	(<i>n</i> =8)	(<i>n</i> =23)	(<i>n</i> =22)	(<i>n</i> =8)	(<i>n</i> =23)	(<i>n</i> =20)
Quality of Life (QLQ-C30)								
Physical ^a	0.19/0.09	87.0 (15.0)	90.8 (9.4)	91.3 (18.9)	89.5 (12.6)	90.8 (11.8)	92.2 (13.1)	92.0 (13.1)
Role ^a	-0.05/-0.05	80.2 (26.7)	83.3 (19.9)	91.3 (24.6)	81.0 (21.9)	85.4 (18.8)	93.5 (17.2)	77.5 (29.8)
Emotional ^a	-0.04/-0.13	67.9 (20.6)	86.5 (10.9)	83.0 (22.0)	65.1 (19.1)	84.4 (19.6)	83.0 (19.4)	71.7 (19.8)
Cognitive ^a	0.15/-0.07	67.5 (21.4)	81.3 (16.5)	86.2 (17.2)	70.6 (15.7)	81.3 (18.8)	90.6 (13.1)	70.0 (23.3)
Social ^a	0.48/0.57	69.8 (31.9)	85.4 (18.8)	89.1 (29.1)	83.3 (21.1)**	85.4 (20.8)	84.8 (26.5)	78.3 (26.5)*
Global quality of life ^a	-0.40/0.02	68.7 (13.2)	76.0 (12.1)	72.5 (18.4)	68.7 (13.4)	81.3 (11.6)	72.1 (18.6)	70.8 (20.1)
Distress (K10)								
All participants ^a	0.26/0.32	19.4 (7.9)	13.5 (3.2)	13.2 (4.5)	17.5 (5.5)	13.3 (3.1)	13.4 (4.9)	17.3 (6.3)
Clinical range at T1 ^a (≥20)	-/0.85	29.4 (4.7)	-	23.3 (1.5)	22.1 (5.7)*	-	19.0 (6.2)	23.0 (7.4)*
Illness Perceptions (BIPQ)								
Consequences	0.24/-0.17 (.377)	4.0 (3.0)	1.6 (1.2)	8.0 (1.5)	3.8 (3.0)	2.0 (1.6)	7.4 (2.5)	3.6 (3.0)
Timeline ^a	0.22/0.36	6.1 (3.5)	5.1 (4.2)	7.9 (1.7)	5.1 (3.4)	5.0 (4.1)	7.9 (1.8)	5.4 (3.4)
Personal control	0.24/0.23 (.814)	4.9 (2.9)	7.1 (1.6)	4.7 (2.2)	5.8 (2.4)	7.4 (2.0)	5.0 (2.3)	6.6 (2.2)
Treatment control ^a	0.40/0.04	6.1 (2.8)	5.4 (3.0)	7.4 (2.3)	6.4 (2.9)	4.5 (3.0)	7.6 (1.8)	6.8 (2.7)
Illness identity	-0.10/0.20 (.494)	3.9 (3.0)	2.5 (2.4)	6.4 (1.9)	3.8 (2.7)	2.1 (1.6)	6.8 (1.9)	3.5 (2.4)
Concern ^a	0.22/0.28	5.6 (3.7)	2.9 (3.0)	8.8 (1.7)	4.9 (3.3)	3.0 (2.9)	8.9 (1.3)	4.5 (3.3)
Illness coherence	0.26/0.49 (.209)	4.8 (3.0)	5.9 (2.9)	6.6 (3.0)	6.7 (2.7)**	7.0 (2.6)	7.0 (2.6)	7.4 (2.5)**
Emotional representations	-0.13/0.15 (.592)	4.8 (3.4)	2.3 (2.1)	8.0 (1.8)	4.9 (3.2)	2.0 (2.6)	8.5 (1.3)	4.2 (3.3)

* $p < .05$ ** $p < .01$ for within-group comparison to T1

^aNon-parametric tests.

Note. Higher scores indicate better quality of life for QLQ-C30 and more functional illness perceptions for personal control, treatment control and illness coherence. Lower scores indicate less psychosocial distress on K10 and more functional illness perceptions for consequences, timeline, illness identity, concern, and emotional representations. Under Interaction, d_{I-Can} =Effect size for Intervention improvement between T1 and T2 corrected for Cancer comparison improvement; d_{I-Com} =Intervention improvement corrected for Community comparison improvement; p =probability value for Group(3) x Time(2) interactions (not applicable for variables requiring non-parametric tests).

Figure 1. Change in RBANS total score over time for each group.