

# A Holistic Neuropsychological Approach to Cognitive Remediation for a Community-Based Mixed Psychiatric Sample

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## Article Information

Received date: Aug 04, 2017

Accepted date: Aug 23, 2017

Published date: Aug 31, 2017

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**Keywords** Neuropsychological intervention; Neurocognitive behavioral; Cognitive rehabilitation; Real world functioning; Functional outcome

## Abstract

**Background:** Improved real world functioning is the ultimate goal of cognitive rehabilitation (which was developed for an acquired brain injury population), however, cognitive remediation for psychiatric populations focuses primarily on cognitive interventions (e.g., computerized cognitive training) and utilizes cognitive test results as outcomes. A broader range of neuropsychological interventions and outcome measures, incorporating real-world measures of functioning, is recommended for cognitive remediation program evaluation.

**Objective:** To determine the feasibility and explore the effectiveness of a holistic cognitive remediation program administered by clinical neuropsychologists for a community-based mixed psychiatric treatment-seeking sample.

**Method:** Twenty-five adults of mixed psychiatric aetiology were referred for a 10-week intervention (including four hours of weekly individual and group-based sessions). A broad array of outcomes was assessed post-intervention. Functional status, self-reported cognitive symptoms and quality of life was assessed at 11.3 months follow-up.

**Results:** Eighteen of the referred participants (72%) completed the intervention. Completers showed: a high rate of functional cognitive goal attainment; increased employment rates; improved symptoms of psychological distress and quality of life; reduced self-report of cognitive difficulties; and improved auditory attention span and verbal memory. Self-report of reduced cognitive difficulties and improved quality of life was maintained approximately one year later. The majority of participants reported very high levels of satisfaction with the program.

**Conclusions:** This intervention was acceptable to participants and associated with high satisfaction rates and gains in cognitive, psychological and functional outcomes. Findings suggest there are multiple benefits to adopting an intervention program that is holistic, individualized to the goals of the patient and facilitated by trained neuropsychologists.

## Introduction

Cognitive Remediation (CRem) has been broadly defined as interventions designed to enhance cognition (attention processing speed, memory, executive function, social cognition, or metacognition) through the use of targeted exercises and training with the general aim of durable benefits in community functioning, including school, work, social interactions and independent living [1,2]. Definitions of cognitive remediation increasingly recognize the ultimate goal of any neuropsychological intervention, which is to improve real world functioning in both the cognitive and psychosocial domains. There is tremendous variability from program to program with respect to: group or individual delivery; use of computer technology; employment of drill and practice versus strategy training and the number, duration and intensity of sessions. CRem as defined above has typically been implemented in psychiatric populations, and mostly for those with schizophrenia.

Meta-analytic reviews have demonstrated moderate Cohen's d effect sizes of CRem on cognitive functioning (0.45 - 0.51; [3,4]) and negligible to small effects on psychosocial functioning 0.05 - 0.28; [3,4]. However, when CRem is combined with other psychosocial interventions, such as psychiatric rehabilitation, the effect on psychosocial functioning is enhanced (0.45-0.59). Other adjunctive interventions that result in greater transfer to everyday functioning include job placement, social skills training and social cognitive training [6]. For example, Mc Gurk, Mueser, Feldman, Wolfe, and Pascaris [3] found that individuals with mental illness who underwent combined CRem and supported employment showed not only greater cognitive functioning at three months follow-up compared to those who received supported employment only, but were also more likely to have greater employment history and more wages, hours of work and number of jobs at three years' post intervention.

Although these findings suggest that the use of psychosocial adjuncts to CRem facilitate positive functional outcomes, only a minority of studies (27.5%) [4] employ such adjuncts and fewer than 50% measure psychosocial outcomes [4]. This may be because of an undue focus on cognitive, rather than functional “real world” outcomes [7], a lack of available relevant adjunctive clinical skills or services [8] and/or other limitations, such as the need to implement cost effective and scalable CRem interventions [9]. In recognition of the need to integrate CRem with other psychological interventions, Penadés et al. [8] developed guidelines based on what they labeled the neurocognitive behavioral approach. According to these guidelines: (i) the psychological intervention is evidence based, (ii) the main target of treatment is to ameliorate psychosocial disability, (iii) treatment must be customized for each patient and be based on patient goals, (iv) treatment targets should be agreed with the patient and should be based on their capabilities, needs, and current social environment, and (v) it encompasses emotional, functional, and psychological aspects [8].

The neurocognitive behavioral approach to CRem is similar to, if not indistinguishable from a cognitive rehabilitation developed for neurologically impaired populations, from which CRem for psychiatric populations evolved. Whilst CRem has tended to focus on improving cognition at the impairment level, cognitive rehabilitation focuses on outcomes at the activity or participation levels of the World Health Organization (WHO) International Classification of Functioning, Disability and Health (ICF) framework [10]. Thus, the neurocognitive behavioral approach may be seen as a positive regression to CRem’s roots with respect to a focus on improving real world functioning. Cognitive rehabilitation is multidimensional in scope and methodology, including a plethora of approaches and models with which to conceptualise and target functional difficulties [11]. A popular model of cognitive rehabilitation is the holistic model [12,13]. According to Wilson [11], “Holistic approaches address cognitive, social, emotional, and functional aspects of brain injury together because how we feel affects how we behave and how we think” [11].

The holistic approach necessarily includes both group and individual therapy components [11]. The inclusion of an individual therapy component is essential with respect to meeting individual patient goals. Such individual therapy components are absent from most other CRem interventions for psychiatric populations. When psychosocial adjuncts are included in CRem programs, they tend to be implemented in a group setting, which limits the extent to which specific, individualized functional goals can be targeted. This nomothetic, rather than an individualized, approach to the majority of CRem interventions has been proposed to be a significant barrier to producing relevant real world outcomes for individual CRem participants [7]. Using the neurocognitive behavioral approach, Levaux et al. [7] presented a case study of a 42 year old lady with schizophrenia who underwent a twice weekly intervention for three months whereby the intervention was tailored to her specific goals (e.g., following and retaining television or radio programs, following and retaining conversations, reading and maintaining text information, and remembering appointments, dates and activities). Cognitive and everyday functioning improved following the program and persisted at three year follow up. It is therefore likely that participants would derive additional benefit from CRem through addressing individual

specific barriers or goals. Such barriers may limit functioning directly, or may impact on functional cognition, which then limits goal attainment. For example, a person who is too anxious or passive to implement a mnemonic strategy in a real-life situation is unlikely to benefit from learning that strategy. Thus, individualized anxiety reduction or assertiveness interventions would likely enhance the functional cognitive outcomes for such an individual.

We propose that such holistic CRem necessarily requires higher training and is ideally implemented by experienced clinical neuropsychologists for the following reasons: (i) clinical neuropsychologists have particular training in understanding the relationships between cognition, emotions and behavior following known or suspected brain impairment; (ii) a clinical neuropsychological formulation necessarily encapsulates the whole person, including cognitive, emotional and behavioral factors and their interactions and (iii) clinical neuropsychologists are trained to implement a range of relevant psychological interventions, including cognitive rehabilitation, behavior management, psychoeducation, and counseling [14]. Consistent with this proposal, facilitators with higher training have been shown to achieve better outcomes for participants of CRem programs [15].

The aim of the current study was therefore to assess the feasibility and explore the effectiveness of a newly developed program utilizing a holistic neurocognitive behavioral approach facilitated by clinical neuropsychologists in an adult sample of treatment seeking mixed psychiatric patients in a community setting. As the ultimate determinant of a good outcome from such a holistic program is an enduring positive psychosocial functional change, engagement in work and study were chosen as functional outcomes. We hypothesized that participants would find the program beneficial, as reflected by self-report, and that there would be evidence of enduring functional gains over a period of approximately one year. In line with previous CRem research, we also predicted post intervention cognitive gains as assessed using objective cognitive measures.

## Methods

### Participants

Participants were community members who were recruited through referrals to a Sydney-based neuropsychological practice that offers neuropsychological intervention for those with cognitive dysfunction. Inclusion criteria included: proficiency with the English language; general computer literacy; no uncorrected visual or auditory impairments; and a psychiatric diagnosis according to the Diagnostic and Statistical Manual (DSM-IV; APA, 1994) as determined by the referring general practitioner, psychiatrist or other medical specialist. All participants were accepted into the cognitive remediation program in the calendar year of 2012, which was run on four separate occasions. A maximum of nine participants were enrolled in each program (range = four to nine). Exclusion criteria included: acute mental or medical illness; an active substance use disorder or a level of overall functioning deemed to prevent the person from actively participating in group sessions, as determined by clinical impression of the key clinician during the assessment phase. Participants were not excluded based on their comorbid diagnoses, as cognitive remediation has shown positive results in mixed psychiatric samples [16-18].

All participants provided written informed consent. Ethics approval was granted by the Macquarie University Human Research Ethics Committee.

## Measures

In order to determine program effectiveness, neuropsychological assessment and outcome measures were administered in the first two and penultimate individual sessions by each participant's primary clinician on the program (D.M. and K.W.). The final individual session comprised feedback from the final assessment. In addition, to assess the maintenance of self-reported changes, a follow-up assessment was conducted over the telephone by a psychology student who was otherwise unknown to the participants, an average of 11.3 (SD = 3.25) months after the post-intervention assessment.

## Cognitive outcome measures

Standardized cognitive measures were chosen based on previous research that has shown that the specific domains of processing speed, attention, memory and executive functioning are sensitive to the effects of cognitive remediation and rehabilitation (for reviews, see [1,19,20]). Five subtests of the Wechsler Adult Intelligence Scale – Fourth Edition (WAIS-IV [21]) were used to assess attention (Digit Span; including longest digits forwards and backwards), processing speed (Coding), abstraction (Similarities), general verbal skills (Vocabulary) and visual and constructional abilities (Block Design). Vocabulary and Block Design were included as comparators, because they are good predictors of overall intelligence and are more resilient to the effects of brain impairment than measures of processing speed and working memory [22, 23]. Being stable measures of verbal and non-verbal intelligence, respectively, improvements were not expected on those measures. The Logical Memory subtests of the Wechsler Memory Scale – Fourth Edition (WMS-IV [24]) were used to examine changes in the encoding and the spontaneous and cued retrieval of verbal information. Subtests of the WAIS and WMS are routinely used clinically and across experimental research designs as measures of general and specific cognitive abilities [25,26]. Additional measures were used to assess executive functioning (Controlled Oral Word Associate Test – COWAT [23]) and premorbid functioning (Test of Premorbid Functioning - TOPF [27]). All raw scores were transformed to standard scores (mean = 10, SD = 3) based on performances relative to age-matched healthy comparison subjects. As research has shown that these tests have practice effects when used across multiple assessment sessions in close succession [28], scores were adjusted to control for practice effects based on test-retest values reported in the test manuals, where applicable. All scores on cognitive measures were analysed such that a higher score indicated better functioning.

## Self-reported cognitive difficulties

Participants' perceived level of cognitive failure was assessed using the 25-item Cognitive Failures Questionnaire (CFQ [29]). This was administered to determine whether the program affected participants' subjective appraisal of their cognitive difficulties. Items such as "Do you read something and find that you haven't been thinking about it and must read it again?" were rated on a five-point Likert scale ranging from 1=never to 5=very often, with no reverse scoring. Scores were combined, with higher scores indicating a greater level of perceived failure. Cronbach's alpha values have been

reported at  $\alpha = 0.91$  and test-retest reliability values have been shown to be above 0.70 [30].

## Psychological symptoms

The 21-item questionnaire, the Depression, Anxiety and Stress Scale (DASS-21 [31]) consists of three subscales that assess an individual's symptoms of depression, anxiety and stress. Participants were required to rate the frequency with which each item applied to them over the previous week, with individual scores ranging from 0 = does not apply to me at all to 3 = applies to me very much, or most of the time. Total scores for each scale range from 0 to 21, with each score corresponding to a specific categorical classification ranging from 'within normal limits' to 'extremely severe'. Lovibond and Lovibond [31] established each classification cut-off value. Previous research has shown the DASS-21 to have excellent internal consistency and good temporal reliability [32].

## Quality of life

The Quality of Life Enjoyment and Satisfaction Questionnaire - Short Form (Q-LES-Q-SF) [33] is a 16-item self-report questionnaire that assesses life satisfaction across major life domains, including physical health, subjective feelings, leisure activities, social relationships, general activities, household duties, school/courses, work and satisfaction with medication. Responses are rated on a five-point Likert scale with 1 = not at all or never to 5 = frequently or all the time. Higher scores suggest greater satisfaction and enjoyment with specific life domains. Previous research has shown the Q-LES-Q-SF to be a reliable and valid measure of quality of life across various psychiatric samples [33], with internal consistency and test-retest coefficients of 0.9 and 0.93, respectively.

To supplement the quality of life data from the Q-LES-Q-SF, the four cognition related quality of life items were taken from the Medical Outcomes Study HIV Health Survey (MOS-HIV) [34] and the following two items were added: "Did you become confused and start several actions at the same time?" and "Did you react slowly to things that were said or done?"

## Study / Employment

In order to determine whether the program facilitated enhanced engagement with study and/or employment, participants were asked whether they were in the workforce and/or undertaking study prior to and at the end of the intervention as well as at follow-up. These responses were then operationalized as a dichotomous variable, with 0 corresponding to the absence of work/study and 1 to engagement with work/study.

## Functional cognitive goals

Goal Attainment Scaling (GAS), a method of quantifying tailored and specific goals [35], was used to determine whether individual participants achieved their specific functional cognitive goals by the end of the program. Goal attainment was scored on a five-point scale centered on 0, where 0 = expected outcome. Positive values (i.e., +1 and +2) indicated that the outcome was achieved at a level considered to be better or much better than expected, respectively, while negative values (i.e., -1 and -2) indicated that the outcome was less than or much less than expected, respectively. An example of a functional cognitive goal is "to attend my medical appointments 65-

75% of the time". Such goals do not necessarily map onto specific cognitive skills, and more often than not require the integration of a range of cognitive, and sometimes non-cognitive, skills. For example, attention, memory, organization, sleep hygiene, and assertiveness skills may all be required in order to meet the above goal.

### Program Satisfaction

Participants were asked to rate their satisfaction with the program by answering the following three questions:

1. Has attending our program helped you deal more effectively with your problems (e.g., at study or work or with friends)?
  - a. The range of responses was "No, it seemed to make things worse", "No, it really didn't help", "Yes, it helped somewhat", and "Yes, it helped a great deal".
2. How would you rate your experience attending the program?
  - a. The range of responses was "Poor", "Fair", "Good", and "Excellent".
3. If another person you knew said that they had problems with memory or attention and asked you where to get some help, would you recommend our program?
  - a. The range of responses was "No, definitely not", "No, I don't think so", "Yes, I think so", and "Yes, definitely".

### Intervention

The intervention involved twice-weekly sessions lasting approximately two hours each over a ten-week period (total = approximately 40 hours). The weekly individual face-to-face treatment sessions (approximately one hour) and group sessions (approximately one hour) were each followed by supervised individually tailored computer-administered cognitive training (approximately one hour). Each participant was allocated to one of two doctoral level trained clinical neuropsychologists (D.M. and K.W.) for their individual treatment component. The group sessions were facilitated by either or both of these clinicians, and occasionally by another clinical neuropsychologist (J.B.). Homework exercises were a routine aspect of the program. The intensity of the intervention was chosen based on previous findings that three sessions of remediation per fortnight (i.e. high intensity) is predictive of cognitive improvement and positive functional outcomes [15].

### Goal setting and individual face-to-face sessions

The goals of each participant were discussed in the second individual session and were used to inform the subsequent individualized content of the intervention. Participants were encouraged to develop functional cognitive goals that were specific to their limitations at an everyday functioning level. Although participants were not limited in the number of goals they could establish, they were instructed to develop a minimum of three goals for the duration of the program. Clinical skills including cognitive behavior therapy and motivational interviewing were used to facilitate motivation for goal setting [36]. Subsequent treatment sessions consisted of monitoring of goal progression and selection/development of strategies to assist with goal attainment within the structured themes that applied to each session (e.g., memory, attention, communication, assertiveness).

### Computer-based cognitive training

Cogpack [37] was used for the cognitive training component. This application consists of over 70 training exercises, from which a small number were selected for each participant on the basis of their nominated functional cognitive goals. Although the computer-based content consisted of mostly drill exercises, the supervising clinical neuropsychologist provided supplementary instruction/prompting in the use of compensatory strategies and skill acquisition as a way of enhancing learning between computerized exercises. As such, the computer exercises were viewed as opportunities to learn and develop new skills with expert instruction and guidance, rather than a means to develop skills purely through drill and practice. Strategies included: self-alerting to increase sustained attention [38]; fatigue management; mnemonics; and planning, organization and problem-solving techniques. Thus, the computer-based cognitive training was interactive and allowed the clinical neuropsychologists to build participants' self-efficacy and enhance their motivation for strategy use by way of constructive feedback and positive reinforcement. Differential praise for effort, rather than outcome, was provided to enhance a "growth" oriented mindset [39]. The computer-based content and strategies were modified based on the participants' progression. This approach was adapted from the Neuropsychological and Educational Approach to Remediation [40].

### Group sessions

The group sessions consisted of facilitated discussion, role plays and other structured exercises to promote learning about the application of cognitive and psychological strategies to the real world. Topics included cognitive compensatory strategies, communication skills, social skills, assertiveness training, Cognitive-Behavior Therapy (CBT) basics and general health management.

### Data analyses

All data are presented as means and standard deviations. Paired t-tests were used to examine changes across cognitive outcome measures and the DASS-21, with adjusted baseline values used as the comparison group, where applicable. The CFQ, Q-LES-Q-SF and MOS-HIV were individually analyzed using a one-way repeated measure analysis of variance (ANOVA), with post-hoc pair wise comparisons conducted using the Bonferroni correction. The Cochran q test was used to determine whether the dichotomous variables of study and work changed across repeated time points, with pair wise follow-up comparisons adjusted to control for multiple comparisons. All analyses were conducted using the Statistical Package for the Social Science (SPSS) Version 21 (IBM corp., Armonk, NY). Statistical significance was set at  $p < 0.05$ .

### Results

#### Participants

The data represent aggregates of the four separate cohorts of participants. Twenty-five people were referred for the intervention in response to advertisements primarily targeting health professionals, via email and hardcopy letters. Advertisements stated that the program was "designed to assist those with a mental health diagnosis who experience memory and/or other cognitive difficulties" with modules on: "attention and concentration, memory and new learning,

**Table 1:** Cognitive outcomes across the assessment time-points.

	Baseline		Adjusted <sup>^</sup>		Post		Sig
	Mean	SD	Mean	SD	Mean	SD	
<b>Wechsler Adult Intelligence Scale</b>							
Block Design	8.72	3.23	9.52	3.23	10.06	2.88	0.334
Similarities	9.17	3.19	9.67	3.19	9.72	2.97	0.918
Vocabulary	11.22	3.59	11.32	3.59	11	2.97	0.257
Digit Span	9.61	3.76	10.21	3.76	11	3.99	0.035*
Longest Forward#	6.89	1.64			7.11	1.53	0.104
Longest Backward#	4.89	1.78			5.56	1.69	0.055
Coding	7.94	2.69	8.54	2.69	9.33	2.81	0.128
<b>Wechsler Memory Scale (WMS)</b>							
Logical Memory 1	9.79	3.46	9.79	3.46	10.28	3.25	0.439
Logical Memory 2	6.89	3.6	9.19	3.6	10.61	2.93	0.011*
Recognition#	22.61	2.37			24.72	2.74	0.019*
<b>Additional Measures</b>							
Premorbid Functioning	105.65	13.66			107.35	13.81	0.191
COWAT FAS	8.39	3.2	9.19	3.2	9.78	3.44	0.456

# Raw scores used for comparison

<sup>^</sup> Adjusted for practice effects

\* p < .05

communication and social skills, organization and problem-solving, (and) dealing with stress and unhelpful thoughts". A total of 18 participants completed the entire program, from baseline to follow-up assessment, and were subsequently included in the analyses. The final sample consisted of ten males and eight females with an average age of 38.5 years (SD = 11.1). Five participants did not complete the program on the basis of either being in acute psychosis (n=2), experiencing severe processing speed impairments (<1st percentile) that precluded them from actively participating in the group sessions (n=1) or they spontaneously dropped out of their own accord (n=2). An additional two participants did not complete the required individual or group sessions and were therefore excluded from analysis. The majority of participants were referred by their General Practitioner or Psychiatrist under a mental health care plan.

**Table 2:** Self-reported cognitive, quality of life, and psychological outcomes across the assessment time points.

Outcomes	Baseline		Post		Follow up		Sig
	Mean	SD	Mean	SD	Mean	SD	
Cognitive Failures Questionnaire (CFQ)	52.17	21.40	37.83	17.99	39.06	18.50	*#
Quality of Life Enjoyment and Satisfaction Questionnaire – Short Form (Q-LES-Q-SF)	44.89	17.82	58.61	16.40	60.33	18.29	*#
Medical Outcomes Study HIV Health Survey (MOS-HIV)	18.67	7.75	26.00	5.39	27.50	7.35	*#
<b>Depression, Anxiety and Stress Scale (DASS-21)</b>							
Depression	16.56	12.44	10.33	8.74			*
Anxiety	11.22	9.73	8.78	9.10			
Stress	17.78	10.51	13.11	8.30			*

\* Post Assessment significant to baseline

# Follow up score significant to baseline

\* p < .05

The sample comprised of mixed aetiology patients including those with actual or suspected/working diagnoses of psychosis (n=8), depression (n=5) or anxiety (n=5). One participant with psychosis, one participant with depression and two participants with anxiety also had comorbid acquired brain injury. There were no significant differences in baseline outcomes across primary diagnoses or sex (p > 0.05). The last observation carried forward (LOCF) method was used to account for missing data at the post-intervention assessment. However, if both baseline and post-intervention scores were missing on a specific measure then the overall baseline average was assigned to both the missing values.

**Cognitive outcomes**

Mean values and effect sizes for scores across baseline and post-intervention assessments are shown in Table 1. Scores on the Digit Span subtest of the WAIS-IV were significantly higher at post-intervention compared to baseline performance (t (17) = -2.29, p < 0.05). Similarly, participants scored significantly higher on the WMS-IV subtests of Logical Memory 2 (t (17) = -2.86, p < 0.05) and Logical Memory Recognition (t(17) = -2.59, p < 0.05) following the intervention compared to baseline scores. All other cognitive measures were unchanged between baseline and post-intervention (p > .05).

**Self-reported cognitive difficulties**

There was a significant change in CFQ scores across baseline, post-intervention and at follow-up [F(2,34) = 6.82, p < 0.005, see Table 2]. Perceived cognitive difficulties were significantly higher at baseline compared to post-intervention (p < 0.05) and at follow-up (p < 0.05). There was no significant difference in CFQ scores between post-intervention and at follow-up (p = 1.0).

**Psychological symptoms**

Scores on the depression [t(17) = 3.063, p < 0.01] and stress [t (17) = 2.961, p < 0.01] subscales of the DASS-21 were significantly lower at post-intervention compared to baseline. There was a trend for decreased anxiety symptoms following the intervention [t(17) = 1.896, p = 0.075].

**Quality of life**

There was a significant change in Q-LES-Q-SF scores [F(2,34) =

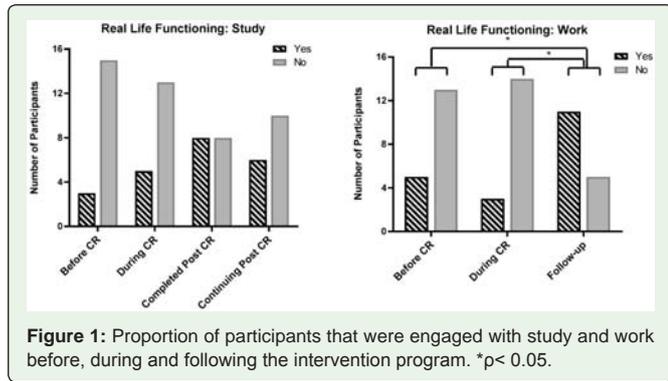


Figure 1: Proportion of participants that were engaged with study and work before, during and following the intervention program. \*p < 0.05.

12.384, p < 0.01] and MOS-HIV scores [F(2,34) = 19.088, p < 0.01] across program time-points. Responses to the Q-LES-Q-SF were significantly higher following the program (p < 0.01) and at follow-up (p < 0.01) compared to baseline, with no difference in scores between post-intervention and at follow-up (p = 1.00). Similarly, MOS-HIV scores were significantly higher at post-intervention (p < 0.01) and at follow-up (p < 0.01) compared to baseline. There was no significant difference in the MOS-HIV scores at post-intervention and at follow-up (p = 0.638).

**Study / Employment**

In order to determine whether the intervention facilitated enhanced engagement with study and/or employment, participation in these roles as a function of time throughout the program was recorded. Figure 1 shows the proportion of participants who engaged with study and work before, during and following the intervention. The proportion of participants who engaged with study did not change throughout the program [χ<sup>2</sup>(3)=3.25, p = 0.36]. However, there was a significant difference in the proportion of participants who were employed throughout the program, with 6/18 employed at baseline, 9/18 at post-intervention and 13/18 at follow-up [χ<sup>2</sup>(2)=13.27, p < 0.01]. Specifically, sixty-nine and sixty-four percent of those who were unemployed before the program (p < 0.01) and while participating in the intervention (p < 0.01), respectively, were in the workforce at follow-up.

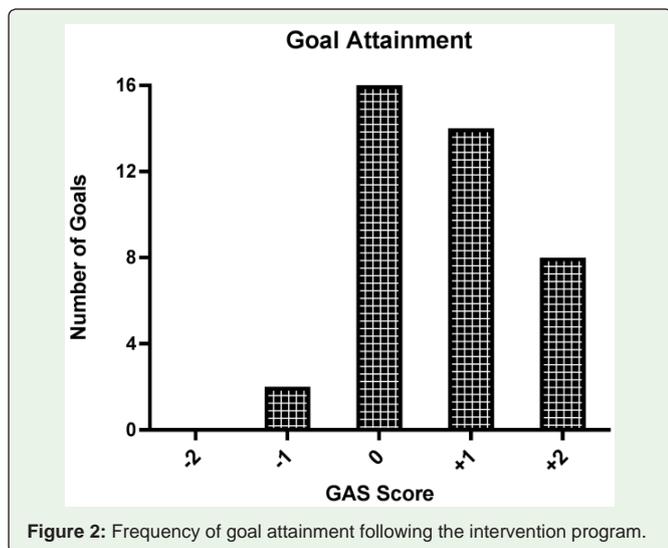


Figure 2: Frequency of goal attainment following the intervention program.

**Functional cognitive goals**

Figure 2 shows the frequency of goal attainment using GAS at post-intervention. Ninety-five percent of the functional cognitive goals created by participants were attained as expected or above, with 15% of participants having reported that their goals were attained at a level much better than expected.

**Program Satisfaction**

A total of n=13 (72%) satisfaction surveys were returned. Thirty-one percent of respondents indicated that program attendance “helped somewhat” and 69% reported that it “helped a great deal”. Thirty-eight percent of respondents indicated a “good” experience attending the program and 62% indicated an “excellent” experience. Ninety-two percent of respondents stated that they would “definitely” recommend the program for other people experiencing cognitive difficulties and 8% indicated “Yes, I think so”.

**Discussion**

The present study sought to evaluate the feasibility and explore the effectiveness of a holistic neurocognitive behavioral program implemented by clinical neuropsychologists that was targeted to individual goals and functionally-focused, in a mixed psychiatric treatment-seeking sample. In order to explore treatment effectiveness, cognitive, psychological, quality of life and ecological measures were administered at baseline, post intervention and at follow-up.

One of the referred participants (4%) was clinically deemed to be so cognitively impaired (due to extremely reduced processing speed) so as to be unlikely to benefit from the intervention (particularly group sessions) and was therefore not accepted into the program. Two of the referred participants (8%) were deemed unsuitable due to being acutely psychotic and therefore also unlikely to benefit from participation. A further two of the referred participants (8%) discontinued the program of their own accord, presumably because they did not consider the program to match their therapeutic needs or goals. Of the remaining participants, 90% attended all individual and group sessions. Seventy-two percent of completers returned satisfaction surveys with 100% of respondents indicating that the program was helpful, a positive experience and that they would recommend the program to others with cognitive difficulties. Such high satisfaction levels and the relatively high completer rate (72%) over four successive runs of the program suggest a high level of acceptability.

A number of significant outcomes were evident post-intervention, including: a very high percentage of attained functional cognitive goals; greater levels of employment; a durable improvement in quality of life; reduced self-reported cognitive difficulties and symptoms of depression and stress and improved performance on cognitive tests assessing auditory attention/working memory and delayed verbal memory. Furthermore, there were enduring functional gains over a period of approximately one year.

With regard to functional social roles, such as study and employment, there was a significant change in the proportion of participants who were employed during and following the trial, with nearly half of the participants changing their status from unemployed to employed following the program. These findings are particularly salient, as they suggest that the program may have

promoted functional gains - at least in the domain of employment - once the intervention was complete. Although 50% of participants were engaged with study following the intervention, there was no significant change in the proportion of participants who engaged with study as a function of program progression. These results are not surprising given the older age of the sample (mean = 38). That is, it is likely that study would be a more viable option for younger participants, while older individuals would be more likely to have employment goals. Interestingly, these functional gains in employment were achieved without formal systematic application of vocational rehabilitation alongside the CRem program as in previous research [41]. However, anecdotally, some participants were linked in with employment services that may have provided relevant support with respect to employment goals. Whilst the design of the study does not warrant the conclusion that the program was necessarily causally related to the employment gains, this remains a possibility, especially considering Lee et al.'s finding that neuropsychological functioning was the single best predictor of later occupational outcome in a sample of psychiatric outpatients [42]. Furthermore, a higher proportion of participants were employed approximately one year following the end of the program, suggesting a possible sleeper effect. Such effects are conceivable when practice of learned strategies leads to more effective outcomes over time [43], although there is debate about whether such effects are real or artefactual [44].

Participants reported a significant reduction in subjective cognitive difficulties, which may correspond with the actual improvements demonstrated on cognitive tests. However, an alternative interpretation is that participants benefitted from the non-specific factors associated with the intervention. Nonspecific factors (such as client expectations, self-efficacy, perceived social support, and therapist warmth and empathy) account for a large degree of the variance in psychological intervention outcome research [45]. For example, Rohling, Faust, Beverly, and Demakis [46] found that non-specific factors accounted for more than half the overall effect size in their meta-analytic review of the effectiveness of cognitive rehabilitation following acquired brain injury. Self-report questionnaires are more likely to capture non-specific factors than the more objective tests of cognitive functioning used in this study. Thus, participants may have felt more confident about their cognitive functioning by virtue of participating in the program and, in turn, reported greater gains in everyday cognition. Regardless, participants' subjective appraisal of cognitive gains speaks to the perceived acceptability and value of the intervention. Similarly, the significant decrease in symptoms of depression and stress, as well as improved self-reported quality of life may have been directly due to improved cognition or to non-specific therapeutic factors. Whilst the current study cannot differentiate between the specific and non-specific effects of this intervention, the gold standard for determining success in cognitive rehabilitation is whether or not participants improve on functional/real world measures [47,48]. The finding that 95% of functional cognitive goals were achieved, together with significantly increased employment participation following completion of the program suggests that there were concrete real world benefits arising from the intervention.

Cognitively, participants performed significantly better on tasks of verbal memory and attention following the intervention, even after controlling for practice effects. The improvement across

verbal recall and recognition tests suggests that the participants were able to appropriately store and retrieve a greater amount of verbal information when compared to baseline, with the overall post-intervention delayed recall performance being in the average range. These findings are consistent with previous research that has reported that memory improvement is the most robust and consistent outcome following CRem, particularly in individuals with schizophrenia and affective disorders [3,18].

Immediate auditory attention span is integral to other aspects of cognition (such as verbal new learning and memory), and the gains in attention may have facilitated the observed improvements in memory functioning. In line with our predictions, there were no changes in the more stable measures of cognition that are usually used to determine current or premorbid intellectual functioning (i.e., Vocabulary, Block Design and TOPF) [22,23]. However, the absence of gains on measures of processing speed and executive functioning were contrary to our expectations. As revealed in a meta-analytic study of computer-assisted cognitive remediation in schizophrenia, the effect for processing speed varied widely across studies for unclear reasons, with effect sizes ranging from -0.33 to 0.91 [49]. The absence of an effect on verbal fluency may be due to insufficient power. Tests of executive functioning are associated with a greater degree of variability than tests of other cognitive functions in normal samples, and are thus less reliable and sensitive to change than other cognitive measures [50].

A potential important factor that may have contributed to the current program's success was the fact that doctoral level clinical neuropsychologists facilitated the intervention. Previous literature has suggested that programs are most effective when facilitated by therapists with more specialized qualifications. For example, 77% of participants who made clinically significant improvements in a study by Medalia and Richardson [15] were led by doctoral-level clinicians, with effect sizes four to five times greater than those for participants led by facilitators with less formal mental health training. The mechanism underlying these effects may derive from the ability of qualified staff to be more sensitive to the subtle aspects of cognitive impairment, the outcome of which might be a more personally tailored and effective program. Alternatively or additionally, non-specific effects are likely to be greater when a client perceives that they are receiving treatment from a practitioner with more specialized qualifications [51]. Medalia and Richardson [15] also found that those trained by doctoral level clinicians had higher attendance rates. While this was not assessed in the current study, it may be that the neuropsychological qualifications of the staff contributed to not only the program's positive results, but also the relatively high attendance of participants.

Another factor that may have led to treatment success was the intensity of the program. While there is no consensus regarding the threshold associated with treatment success with respect to sessions and hours of CRem, and treatment intensity, a greater number of treatment sessions have been identified as a significant predictor of positive outcomes following CRem. Specifically, Medalia and Richardson [15] found that participants who had high intensity remediation (three sessions per fortnight) were five to six times more likely to have greater positive outcomes than those in the low intensity group. Importantly, high intensity intervention was also predictive of improvement on work outcomes and cognitive impairment, regardless of additional factors at baseline.

Whether referred to as the neurocognitive behavioral approach or holistic cognitive or neuropsychological rehabilitation, there is recognition that a broader perspective with respect to both the targets and goals of CRem interventions is beneficial. Clinical neuropsychology is well placed for the implementation of such interventions by virtue of its holistic approach encompassing cognitive, emotional, behavioral and functional aspects and their often complex interplays. The main differential between conventional CRem and the current approach is an impairment level focus of intervention and measurement in the former. Whilst CRem may result in improved cognitive test scores, this was not the sole focus of the current intervention. Although this study employed what at face value may appear to be impairment-level intervention (e.g., use of computerized cognitive training), this component was not intended as a drill and practice technique, but rather as a drill and strategy approach [52]. To the extent that the strategies related to real world cognitive difficulties, such use of computerized cognitive training can be viewed as being activity or participation level focused in the WHO ICF schema [10].

There were a number of limitations of the current study. Without an active control group, it is not possible to determine if the intervention is superior to any other intervention that offers possibly therapeutic non-specific components, such as clinician attention, a building of self-confidence and/or self-efficacy or an expectation of improvement. Whilst some degree of control was provided by comparing pre-post cognitive test gains to test manual-adjusted scores in order to statistically correct for practice effects, it cannot be assumed that the degree of practice effects are similar between our clinical sample and the normative test manual re-test samples. However, there is evidence that practice effects do not differ between normal controls and individuals with schizophrenia [53]. Another limitation was the relatively small sample size, and it is recommended that future investigation into the effectiveness of the current program use larger samples. Furthermore, the current sample was heterogeneous with respect to psychiatric diagnosis and there was comorbidity of acquired brain injury (ABI) in a minority of participants. It is possible that the inclusion of those with comorbid ABI may have enhanced outcomes, given the intervention was more akin to an established efficacious intervention in an ABI population [46,54-56]. Another sample-related limitation is that data regarding the recovery trajectory of participants during the program was not captured. That is, it could not be determined whether participants were stable symptomatically, in a phase of recovery following an acute exacerbation of mental illness or potentially in a phase of pre-episodic decline. Given there is reasonably a higher probability of participants being clinically referred following an episode of acute mental illness, some of the observed gains may have been due to spontaneous remission of temporarily disrupted cognitive and other neuropsychological processes. Another limitation is that the pre- and post- intervention assessments were not blinded, but rather conducted by the facilitators of the program. Applying the principles of holistic neuropsychological rehabilitation necessarily requires access to initial test results, in order to develop a neuropsychological formulation and design the individualized treatment elements. It is also important that the goal setting component, using GAS, be conducted by the practitioner, as there is evidence that collaborative goal setting results in greater outcomes in neuropsychological rehabilitation [48]. As such, it is recommended that future investigations involve blind

pre- and post-intervention cognitive testing, whilst still providing therapists with the pre-intervention results to guide therapy.

The results of the current intervention are encouraging and it is recommended that the program be evaluated more rigorously for efficacy, such as with randomized controlled trials. The program manual may be requested from the first author for this purpose. The major implication of the findings of the current study is that holistic CRem implemented by clinical neuropsychologists is feasible and there is preliminary evidence of efficacy, particularly with respect to functional goals. We recommend a diverse range of outcome measurement types in future program evaluations to capture potential gains at a range of levels of functioning. The approach and outcomes of this intervention in a psychiatric sample are not dissimilar to those obtained in neurologically impaired populations. It is recommended that a greater functional focus and holistic approach be implemented in future CRem studies and the current study highlights the significant benefits of this. The neurocognitive behavioral approach has served as a good model for this, and it is recommended that more clinical neuropsychologists involve themselves in CRem to assist their patients with psychiatric conditions.

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