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Integrative cognitive remediation for early psychosis: Results from a randomized controlled trial

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ABSTRACT

Early application of cognitive remediation may help prevent the development of long-term functional impairments that characterize psychotic disorders. Interventions that encompass both neurocognitive and social-cognitive training may work synergistically to bridge the gap between cognitive gains and functional outcomes in early psychosis. We integrated three cognitive remediation approaches: Neuropsychological Educational Approach to Remediation (NEAR), Compensatory Cognitive Training (CCT), and Social Cognition and Interaction Training (SCIT), and evaluated the effects on cognition, clinical symptoms, self-assessed and informant-assessed social functioning in early psychosis. A total of 49 patients diagnosed with primary psychotic disorder seeking service at an early-intervention service in Iceland were randomized to either a waiting-list control group (n = 24) or a 12-week group-based integrative cognitive remediation (n = 25). Neurocognition, social cognition, community functioning and clinical symptoms were assessed at baseline and post-treatment. The intervention group showed significant improvements in verbal memory, cognitive flexibility, working memory, ToM and a significant reduction in hostile attributions, compared to those receiving standard treatment alone, but there were no differences between groups on measures of social functioning or clinical symptoms. The intervention was well tolerated and received high treatment satisfaction ratings. Findings indicate that integrated cognitive remediation has potential to improve neurocognition and social cognition in early psychosis.

1. Introduction

Cognitive deficits are a core feature in psychotic disorders and have been found to explain anywhere from 20 to 60% of the variance in functional outcomes (Bilder et al., 2006; Fett et al., 2011; Green et al., 2000). One of the great challenges of treatment has been to develop effective treatment options for the functional impairments that characterize psychotic disorders. One prominent treatment is cognitive remediation, which effectively improves neurocognition, and when delivered within a comprehensive psychiatric rehabilitation program, functional outcomes in schizophrenia (McGurk et al., 2007; Wykes et al., 2011).

Cognitive remediation can be divided into three major intervention categories: Strategy-based/compensatory approaches, restorative approaches and social cognitive approaches. Regardless of training approach, cognitive remediation was defined by the Cognitive Remediation Expert Group in 2012 as “an intervention targeting cognitive deficit (attention, memory, executive function, social cognition or meta cognition) using scientific principles of learning with the ultimate goal of improving functional outcomes” (Cognitive Remediation Expert Working Group, 2012). Although the ultimate goal of cognitive remediation is to improve functional outcomes, generalization to everyday life remains a concern (Addington et al., 2005). In recent years, there has been growing interest in combining cognitive remediation and social-cognitive training. Social cognition, defined as the mental processes underlying people´s capacity to perceive, process and comprehend social information (Green et al., 2008), appears to have a stronger relationship to functional outcomes than does neurocognition

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(Allen et al., 2007; Fett et al., 2011) and mediate the relationship between the two constructs (Couture et al., 2006; Ludwig, 2017; Pinkham and Penn, 2006; Schmidt et al., 2011). Addressing social cognitive impairments may therefore increase the ability of patients to engage in and benefit from cognitive remediation as well as enhance the generalization of any cognitive gains acquired through the intervention to real-world functioning (Horan et al., 2016)

The existing interventions that combine cognitive remediation and social-cognitive training are effective in improving neurocognition and social cognition as well as psychosocial functioning in schizophrenia (Bell et al., 2001; Hogarty et al., 2004; Roder et al., 2011). However, most published trials on combined interventions include middle-aged chronically ill individuals with a confirmed diagnosis of schizophrenia, and although promising, the results in early psychosis remain preliminary (Boriello et al., 2015; Eack et al., 2009). Individuals early in the course of their psychotic disorder show, relatively stable, functionally relevant impairments in multiple domains of neurocognition and social cognition, but are also generally characterized by fluctuations in clinical presentation (Barder et al., 2013; Horan et al., 2011b; Mesholam-Gately et al., 2009; Williams et al., 2008). There is some evidence that early application of cognitive remediation may enhance the potential benefits on functional, social and cognitive outcomes (Bowie et al., 2014) and it has even been suggested that to achieve optimal functional response in these populations, it may be necessary to target both neurocognitive and social-cognitive deficits (Eack et al., 2011).

This study aimed to pilot-test a 12-week, group-based Integrative Cognitive Remediation (ICR) program that included three previously validated treatments: Social Cognition and Interaction Training (SCIT(Roberts et al., 2016); Neuropsychological Educational Approach to Remediation (NEAR(Medalia and Freilich, 2008), and Compensatory Cognitive Training (CCT(Mendella et al., 2015; Twamley et al., 2017, 2012) in a sample of patients early in the course of their psychotic illness. Integrating these three cognitive remediation approaches instead of using existing comprehensive interventions had several advantages.

First, we delivered three intervention approaches within 12-weeks, which is shorter than other combined neurocognitive and social-cognitive interventions and possibly more cost-effective and less of a burden to patients. In addition it gives room for more frequent treatment entry points, allowing earlier treatment in the course of first episode psychosis. Second, SCIT targets the full range of social-cognitive domains impaired in early psychosis and is flexible in its methods and activities to accommodate the full range of symptoms and characteristics of psychotic disorders. In addition, SCIT uses booster sessions in the form of “practice partners” to help with generalization. A practice partner can be an acquaintance or a close relative, which may be of value for younger patients who still live at home with their families. Third, the CCT approach targets cognitive domains (prospective memory, attention, learning/memory, and executive functioning) that have been found to be impaired in first-episode samples (Mesholam-Gately et al., 2009) and therefore it may be particularly valuable to include this approach. In addition, the goal of the CCT approach is to help patients learn and develop cognitive strategies to form long-term habits that are meaningful in the real world and patients early in the course or their illness may have greater brain plasticity and be especially receptive to developing new cognitive habits (Berger et al., 2007). Fourth, the intervention leaves room for personalized computer training tailored to baseline cognitive profiles, which has the potential to further enhance cognitive gains (Medalia and Saperstein, 2017). Most of the combined interventions use restorative methods (i.e., computer training) with a standard computer package where all participants work on the same exercises.

To our knowledge, there are no published studies that have integrated these three treatments. The current study will provide new information about the feasibility and effects of this brief, group-based intervention. It was hypothesized that, compared to a wait-list control group receiving treatment as usual, the ICR group would demonstrate improvements in neurocognition, social cognition, and social functioning at post-treatment.

2. Methods

2.1. Participants

Participants were recruited from an early intervention service for psychosis at Landspitali- The National University Hospital in Reykjavik, Iceland. Inclusion criteria were: duration of psychotic illness of five years or less; aged between 18–30 years; presence of cognitive performance greater than or equal to 0.5 standard deviations below norms on any of the neurocognitive or the social-cognitive measurements at baseline; Icelandic as first language; no evidence of intellectual disability (i.e. IQ < 70), or organic brain disorder.

The study was conducted from January 2016 to June 2017. Baseline assessments were performed on seventy-two patients up to eight months prior to the intervention, as part of a previous study by the current authors (Vidarsdottir et al., review). Forty nine participants that met the inclusion criteria were enrolled and randomized (see Fig. 1). Fifteen participants dropped out at different points in the study. Participants who attended less than one third of the sessions were considered as dropouts but included in the final intent-to-treat analysis. The study was approved by Landspitali, National University Hospital Ethics Committee (20/2015, ref.16; LSH 42–15) and written informed consent was obtained from all participants.

2.2. Design

The study had a randomized wait-list control design which allowed all individuals to be treated eventually. It allowed for a comparison between ICR and treatment as usual (TAU) as well as measurement of change in performance before and after treatment. It also allowed for double-baseline assessment in a subset of participants ($n = 12$), which allowed for an informal check of the test-retest reliability of the social-cognitive measures in this sample. Following baseline assessment, participants were randomized by an independent research assistant in blocks of four and five into ICR group ($n = 25$) or wait-list control group ($n = 24$). Cognitive assessments were completed by trained psychologists who were blind to treatment assignment. After treatment, each participant was re-administered the outcome measures and, if in the ICR group, asked to complete a feedback questionnaire.

2.3. Measures

2.3.1. Neurocognition

Participants were administered a comprehensive neuropsychological test battery including measures previously used in Icelandic populations (Guðmundsson, 2015; Stefansson et al., 2014). Processing speed was assessed using the Digit Symbol Coding subtest from the Wechsler Adult Intelligence Scale, 4th edition (WAIS-IV; (Wechsler, 2008) and Trails A (Reitan, 1958). Verbal memory was assessed using the Wechsler Memory Scale, 3rd edition (WMS-III) Logical Memory immediate recall total score (LMI), delayed recall total score (LMII), immediate theme total score (LMI theme) and delayed theme total score (LMII theme(Wechsler, 1997). Logical reasoning was assessed using the Wechsler Abbreviated Scale of Intelligence ($WASI^{is}$) Matrix Reasoning total score, Icelandic standardization (Guðmundsson, 2015; Wechsler, 1999). Attention and working memory were assessed using the WAIS-IV Digit Span forward and Digit Span working memory span (Digit Span backwards + Digit Span in a row)/2; (Wechsler, 2008). Planning was assessed using the Delis-Kaplan Executive Function System (D-KEFS) Tower subtest (Delis, 2001). Inhibition was assessed using the Stroop Color-Word Interference score

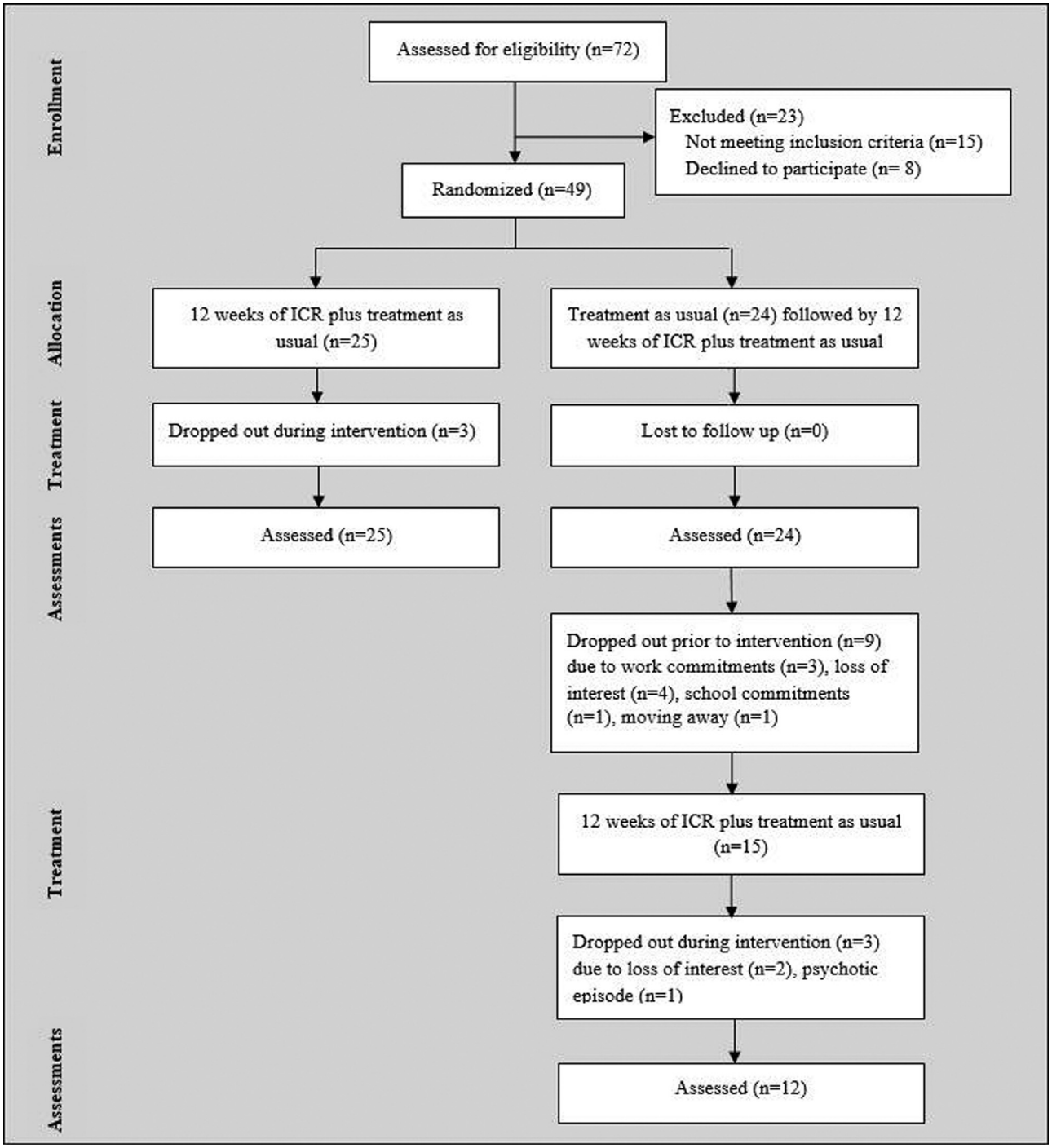

Fig. 1. Consort diagram.

(Golden, 1978; Stroop, 1935). Cognitive flexibility was assessed using Trails B (Reitan, 1958).

2.3.2. Social cognition and cognitive insight

Social cognition was assessed with three widely used social-cognitive measures that are sensitive to social-cognitive training effects. ToM was assessed using the Hinting task (range 0–20) (Corcoran et al., 1995). Attributional bias was assessed using the Ambiguous Intentions Hostility Questionnaire-Ambiguous items (AIHQ-A; Combs et al., 2007b). The scale yields scores for hostility bias, aggression bias and a blame score. The hostility and aggression scales range from 5 to 25 and the blame scale ranges from 15 to 80. Emotion recognition was assessed using the Facial Emotion Identification Task (range 0–19) (FEIT; (Kerr, 1993). A metacognitive measure of confidence was added to the standard administration of the FEIT by asking participants to indicate how confident they were that their answer was correct using Likert-type anchors ranging from *100% sure* (4) to *guessed* (1). We then calculated average confidence ratings for trials where participants correctly identified an emotion with higher score indicating more confidence in correct answers, and confidence ratings for trials where participants incorrectly identified an emotion with higher score indicating more confidence in incorrect answers. The Beck Cognitive Insight Scale (Beck et al., 2004) was used to assess cognitive insight (range −18–27).

The test-retest reliability of the social-cognitive measures for those participants with a double baseline (n = 12) were as following: Hinting task (r = 0.720, p = 0.000), FEIT (r = 0.525, p = 0.000), confidence in

FEIT correct answers ($r = 0.488$, $p = 0.001$), confidence in FEIT incorrect answers ($r = 0.507$, $p = 0.000$), AIHQ hostility bias ($r = 0.416$, $p = 0.008$), AIHQ blame score ($r = 0.583$, $p = 0.000$), and AIHQ aggression bias ($r = 0.191$, $p = 0.271$).

2.3.3. Social functioning

Social functioning was assessed with three self-report measures and two informant-report measures. The informant-based measures completed by family members, partners, or high-contact clinicians and included the Life Skills Profile-39 (range 38–156) (LSP-39; (Rosen et al., 1989) and the informant-report version of the Behavior Rating Inventory of Executive Function-Adult Version (range 72–225) (BRIEF-A; (Roth et al., 2005). Self-assessed social functioning included the self-report version of the Behavior Rating Inventory of Executive Function-Adult Version (range 72–225) (BRIEF-A; (Roth et al., 2005), the Quality of Life Scale (range 16–112) (QOLS; (Flanagan, 1978) and the Occupational Self Assessment (range 21–84) (OSA; (Baron et al., 2006).

2.3.4. Clinical symptoms

Symptomatology was assessed with the Positive and Negative Syndrome Scale (PANSS; (Stanley et al., 1987) and the Depression Anxiety Stress Scale 21-item (DASS-21; Lovibond and Lovibond, 1995). PANSS raters were experienced clinicians who knew the participants well. They routinely use the measure and had received training in its use prior to the study.

2.3.5. Participant feedback

The feedback questionnaire included ratings of treatment intensity (length of the intervention and length of each session) and usefulness of specific treatment components (SCIT, CCT and NEAR).

2.4. Treatment conditions

Both groups received TAU during the study which differed across participants based on their individual treatment plan. All participants received case-management and supportive counseling at least one times per week in addition to one or more of the following treatment components: medication management, socialization at the early intervention service (lunch, board games, all girl groups) occupational therapy, education about psychosis, individual or group-based exercise, and/or family support. Some participants were enrolled in school or had part-time employment but no participants received other organized cognitively oriented therapies.

ICR was conducted twice per week over a 12-week period, with each session lasting up to 120 min and consisted of 10–12 participants and four therapists. The lead author (OGV) was the leading therapist, trained and supervised by the second and third co-authors (DR and EWT, respectively). Other co-therapists included an occupational therapist, a clinical psychologist, and a staff member from the early intervention center.

Each session started with SCIT, a manual based group psychotherapy targeting several domains of social cognition including emotion recognition, ToM and attributions as well as metacognitive overconfidence and interaction skills to improve social functioning. A break was provided after SCIT, followed by a combined session of CCT, a strategy-based compensatory approach designed to target prospective memory, attention, learning/memory, and executive functioning, and NEAR, which utilizes commercially available educational software in a manner that is intrinsically motivating and rewarding. It used computer based exercises and games from BrainHQ (Posit Science, Inc., San Francisco, CA), Lumosity (www.lumosity.com) and Games for the Brain (www.gamesforthebrain.com). The CCT manual was edited by EWT and OGV to fit this study. For a summary of session content, treatment strategies, and modifications applied, see Table 1. To enhance motivation, each participant received their cognitive profile from the baseline measures and had an interview with one of the therapists about which cognitive domains they viewed as most important to improve and why. To support generalization to everyday life, all group members were assigned a practice partner who was a staff member at the early intervention service. All sessions were audiotaped and rated by an independent rater for fidelity to the SCIT and CCT programs separately. No material was edited out of the SCIT program and the fidelity to the manual was 86.6%. The main domains targeted by the CCT program were targeted in the intervention and most of the strategies were introduced. However the time spent on practicing each strategy was shorter than in the original CCT manual and a new fidelity scale was developed by the authors for this study. Fidelity to the modified CCT treatment manual was 83.3%.

2.5. Data analysis

Raw scores were used for all measures. Measures of distribution were calculated and inspected to assess normality and potential outliers. Skewed data were handled using Log transformations. Chi-square and *t*-tests were used to compare individuals who received the intervention to those who were in the wait-list control group on demographic, clinical, and cognitive variables. Chi-square and *t*-tests were also used to compare individuals who dropped out of the study to those who completed the study.

Analysis of covariance (ANCOVA) was used to test change over time between the two conditions post-treatment while controlling for pre-treatment levels. Paired sample *t* tests were used to compare baseline with post-training assessments for all subjects who received the intervention ($n = 37$). The number of improvers on the cognitive measures was calculated using the Standard Deviation Index (Duff, 2012). The 68% confidence interval was used to determine reliable change (improvement >1 SD).

3. Results

3.1. Baseline analysis

Demographic and clinical characteristics are shown in Table 2. Comparisons revealed significant differences on years of education between the ICR group and the TAU group at baseline. Education correlated with Matrix ($r = 0.381$, $p = 0.007$), Digit Span backward ($r = 0.392$, $p = 0.006$), LMI ($r = 0.288$, $p = 0.045$), LMII ($r = 0.302$, $p = 0.035$), and the AIHQ blame scale ($r = 0.304$, $p = 0.044$) and was therefore entered as a covariate with the baseline performance in the ANCOVA for those variables only.

No other significant differences were found on other demographic, clinical, or cognitive variables. No significant differences were found between those who dropped out of the study ($n = 12$) and those who were included in the intent-to-treat analysis on any demographic, clinical or cognitive variables ($n = 37$).

3.2. Between-group comparisons

For the ANCOVA, the data met assumptions of equality of error variances and homogeneity of regression. There were significant between-group effects on the LMI theme, LMII theme, Digit Span working memory span, Trails B, Hinting task and the AIHQ hostility bias (see Table 3). All other group differences in outcomes at post-treatment were non-significant. However, medium effect sizes in favor of ICR were noted on the BRIEF-A self-report. The post-treatment completion rate for the cognitive measures was 100% (49 out of 49) and 95% (47 out of 49) for the self-report measures. The post-treatment completion rate for the PANSS was 69% (34 out of 49) and 75% (37 out of 49) for the informant-based social functioning measures. For outcome variables that were correlated with education, there were no group differences whether or not we controlled for education.

Table 1
Session content, treatment strategies and modifications.

	SCIT	CCT	NEAR
Session content	Review of the agenda for the session, check-ins, and activities specific to the session topic	Introduction of a strategy, discussion on how participants could use the strategy in everyday life	Strategy practice iPad training
Treatment strategy	*Sessions 1–6* *Phase I – Emotions* Introduce ICR and establish group alliance. Address emotion perception, emotion self-awareness and overconfidence by defining emotions as a group, emotion mimicry training, and understanding paranoia *Sessions 7–15* *Phase II-Figuring out situations* Address theory of mind, social perception, attributional bias and overconfidence by learning to think up other guesses, separating social facts from guesses, and gathering more evidence about a situation *Sessions 16–24* *Phase III – Checking it out* Integrate skills learned in the group to real life events and focus on generalization to day-to-day life	*Sessions 1–6* *Prospective memory* Goal setting, calendar use and weekly planning *Session 7–12* *Conversational and task vigilance* Goals revisited, "self-talk" to stay focused during tasks *Sessions 13–18* *Verbal learning and memory* Goals revisited, reducing information, making information meaningful, writing things down and name-learning skills *Sessions 19–24* *Executive functioning/ cognitive flexibility* Goals revisited, brainstorming and 6-step problem solving method	*Sessions 1–24* *Individualized iPad training using commercial programs* Training programs tailored to each participants baseline cognitive profile CCT strategy practice on iPads Participants select exercises that are fun and easy to build confidence Therapists use verbal encouragement and reinforcement Therapists guided the training using questions to enhance metacognition and information processing
Modifications	Discussion about homework eliminated No homework assigned other than meeting with the practice partner Practice partner exercises reduced to include CCT strategy training as well	Manual reduced to twelve 15–20 min sessions using iPad training for practice instead of paper-pencil No discussion about homework	Strategies from the CCT manual were practiced on iPads when appropriate

Note. SCIT: Social Cognition and Interaction Training; CCT: Compensatory Cognitive Training; NEAR: Neuropsychological Educational Approach to Remediation.

3.3. Within-group comparisons

Among all ICR recipients, the neurocognitive variables that significantly improved from baseline to post ICR treatment included all the verbal memory measures (LMI, LMI theme, LMII, and LMII theme), Stroop Interference, Tower, and Matrix (see Table 4). Significant changes were also observed in performance on the Hinting Task and the AIHQ hostility bias. The only social functioning measure that significantly improved was the BRIEF-A self-report. Significant change was seen on the PANSS negative symptom scale with negative symptoms reducing. Thirty-three of the 37 participants improved on at least one of the neurocognitive measures and 29 improved on at least one of the social-cognitive measures. No one improved on all outcome measures.The post-treatment completion rate for the cognitive measures was 92% (34 out of 37) and 97% (36 out of 37) for the self-report measures. The post-treatment completion rate for the PANSS was 84% (31 out of 37) and 76% (28 out of 37) for the informant-based social functioning measures.

3.4. Feasibility

Group attendance levels were good (77.6%; range 33.3–100%). Satisfaction ratings revealed that participants found the SCIT component most useful (44.2%) followed by the iPad training (37.8%) and CCT strategies (18.0%). Most rated the length of ICR (12 weeks) being appropriate (79.1%) and the length of each session (two hours) also being appropriate (93.5%). The practice partner exercises were completed 63.3% of the time and took on average 17.4 min (SD 2.2).

3.5. Post-hoc analysis

We conducted linear regression analysis among ICR participants to evaluate the effects of attendance and the number of completed practice partner exercises on post-treatment outcomes. Attendance significantly predicted outcome for the following measures at post-treatment: LMII theme ($p = 0.038$), Digit Span working memory span ($p = 0.046$), Trails A ($p = 0.043$), and predicted at trend-level outcome for LMI theme ($p = 0.063$), and LMII ($p = 0.087$). The number of practice

Table 2
Demographic and clinical characteristics for study participants.

Characteristics		*Whole samplen = 49*		*ICRn = 25*		*TAUn = 24*			
	n	Mean (SD)/%	*n*	Mean (SD)/%	*n*	Mean (SD)/%	t/x^2	*df*	*p*
Age (years)	49	24.2 (3.2)	25	23.6 (3.4)	24	24.8 (2.9)	−1.31	47	0.196
Education (years)	49	11.3 (1.6)	25	10.7 (1.2)	24	11.9 (1.7)	−3.00	42	0.006*
Gender,% male	43	86.0%	23	92.0%	20	83.3%	0.86	1	0.417
Diagnosis									
Schizophrenia	34	68.0%	16	64.0%	18	75.0%	0.70	1	0.404
Psychosis NOS	14	28.0%	8	32.0%	6	25.0%	0.29	1	0.588
Bipolar with psychotic features	1	2.0%	1	4.0%	0	0.0%	0.98	1	1.000
Age of onset (years)	49	22.3 (3.1)	25	21.6 (3.4)	24	23.0 (2.6)	−1.62	47	0.112
Duration of illness (months)	49	28.7 (22.0)	25	30.4 (26.5)	24	26.8 (16.4)	0.57	47	0.571
Number of hospitalizations	49	2.73 (1.9)	25	3.0 (2.2)	24	2.5 (1.6)	0.85	47	0.397
Atypical antipsychotics	44	89.8%	22	88.0%	22	91.7%	0.18	1	1.000
Typical antipsychotics	5	10.2%	4	16.0%	1	4.2%	1.87	1	0.349
No antipsychotics	3	6.0%	1	4.0%	2	8.3%	0.40	1	0.609

Note. ICR: integrated cognitive remediation; TAU: Treatment as Usual: Psychosis NOS: Psychosis not otherwise specified.
* Significant difference between groups.

Table 3
Analysis of covariance results comparing conditions at post-treatment and controlling for baseline scores.

Measures	Baseline Mean (SD) TAU	Post-treatment Mean (SD) TAU	Baseline Mean (SD) ICR	Post-treatment Mean (SD) ICR	*F*	*p*	N^2 *effect size*
Neurocognition							
Symbol Coding	65.5 (14.8)	64.5 (11.5)	59.2 (14.4)	62.6 (13.6)	0.22	0.644	0.01
Trails A[a]	29.8 (8.7)	30.9 (11.3)	28.6 (10.9)	27.9 (12.0)	0.82	0.371	0.02
Digit Span forward	8.3 (1.9)	8.3 (1.5)	8.1 (1.8)	8.5 (1.7)	0.18	0.678	0.01
Digit Span WM	8.0 (1.4)	7.6 (1.3)	7.7 (1.5)	8.2 (1.4)	6.63	**0.014**	0.13
LMI	31.2 (8.7)	33.3 (10.3)	29.8 (10.5)	35.1 (12.4)	1.09	0.301	0.03
LMI theme	12.3 (2.7)	12.2 (3.3)	11.7 (3.2)	14.4 (4.6)	6.10	**0.018**	0.13
LMII	20.0 (8.2)	20.2 (8.4)	16.6 (9.4)	22.1 (9.5)	3.93	0.054	0.09
LMII theme	8.4 (2.7)	8.4 (3.0)	7.4 (3.4)	9.4 (3.1)	4.81	**0.034**	0.11
Matrix Reasoning	27.2 (4.5)	28.6 (3.8)	26.8 (4.8)	28.0 (5.2)	0.29	0.593	0.01
Stroop Interference[a]	29.2 (11.7)	29.6 (9.2)	30.4 (9.3)	27.0 (7.5)	1.87	0.179	0.04
Tower	16.7 (3.5)	18.3 (4.1)	16.1 (2.6)	17.1 (4.4)	0.15	0.697	0.01
Trails B[a]	77.6 (28.7)	86.9 (32.1)	73.1 (20.4)	70.6 (14.2)	9.53	**0.004**	0.19
Social cognition							
Hinting Task	14.8 (2.9)	15.8 (3.0)	14.0 (2.7)	16.5 (2.6)	4.76	**0.035**	0.10
AIHQ Hostility[a]	10.3 (3.0)	8.4 (2.7)	9.2 (2.8)	6.2 (1.9)	6.21	**0.025**	0.13
AIHQ Blame[a]	34.0 (9.5)	33.1 (9.7)	34.4 (10.9)	29.8 (10.1)	0.49	0.488	0.01
AIHQ Aggression[a]	8.6 (1.8)	7.9 (1.3)	7.9 (1.8)	7.7 (1.9)	0.00	0.997	0.01
FEIT	12.9 (2.2)	13.1 (2.7)	12.7 (2.7)	13.6 (2.4)	0.57	0.456	0.01
FEIT confidence in correct answers	1.8 (0.4)	1.8 (0.4)	1.8 (0.4)	2.0 (0.5)	2.59	0.115	0.05
FEIT confidence in incorrect answers[a]	1.2 (0.8)	1.1 (0.8)	1.2 (0.7)	1.0 (0.6)	0.14	0.714	0.01
BCIS total	8.8 (6.8)	8.8 (65)	8.5 (6.5)	7.7 (5.9)	0.245	0.624	0.01
Social functioning							
LSP-39	124.7 (13.8)	128.6 (8.6)	127.5 (15.1)	127.6 (14.5)	0.19	0.670	0.01
BRIEF-A informant-report[a]	127.8 (32.2)	130.3 (30.3)	130.4 (27.2)	129.9 (23.1)	0.13	0.718	0.01
BRIEF-A self-report[a]	127.0 (22.8)	128.2 (22.2)	124.9 (25.1)	119.0 (23.3)	2.73	0.110	0.06
OSA	49.2 (8.9)	47.6 (9.4)	52.06 (12.0)	49.8 (7.8)	0.41	0.526	0.01
QOLS	73.0 (13.3)	69.1 (10.2)	77.1 (14.4)	70.1 (13.6)	0.26	0.616	0.01
Clinical symptoms[a]							
PANSS positive	11.9 (4.0)	11.1 (3.8)	13.7 (5.2)	12.9 (4.9)	1.30	0.264	0.04
PANSS negative	15.6 (4.9)	13.0 (3.7)	15.6 (6.2)	14.2 (5.0)	0.89	0.354	0.03
DASS-21 depression	6.3 (5.2)	9.7 (5.9)	7.7 (6.8)	7.4 (5.4)	2.25	0.141	0.05
DASS-21 anxiety	4.2 (4.2)	6.3 (5.0)	4.8 (4.2)	4.3 (4.3)	1.37	0.249	0.03
DASS-21 stress	5.7 (4.7)	7.2 (5.5)	5.7 (4.9)	6.7 (5.1)	0.05	0.829	0.01

Note. TAU; Treatment as Usual; ICR: integrated cognitive remediation; Digit Span WM: Digit Span working memory span; LMI and LMII: Logical Memory part I and II; AIHQ: Ambiguous Intentions Hostility Questionnaire; FEIT: Facial Emotion Identification Task; BCIS: Becks Cognitive Insight Scale; LSP-39: Life Skills Profile; BRIEF-A: Behavior Rating Inventory of Executive Function – Adult version; OSA: Occupational Self Assessment; QOLS: Quality of Life Scale; PANSS: Positive and Negative Syndrome Scale; DASS-21: Depression, Anxiety and Stress Scale.
Bolded significant values indicate those significant at $p < 0.05$.
[a] Higher scores reflect greater pathology.

partner meetings predicted at trend-level outcome for LMI theme ($p = 0.096$). In all instances, greater ICR treatment intensity was associated with more positive outcome on the dependent variable.

4. Discussion

This study examined the effectiveness of ICR on neurocognition, social cognition, social functioning, and clinical symptoms compared with TAU, in patients engaged with the services of an early intervention service for psychosis in Iceland. ICR, compared to TAU, was associated with small to medium effect size improvements on both neurocognitive and social-cognitive measures, including immediate and delayed verbal memory (LMI theme and LMII theme), cognitive flexibility (Trails B), working memory (Digit Span working memory span), ToM (Hinting Task), and hostile attributions (AIHQ hostility bias). Other comparable integrated therapy approaches have yielded similar results (Eack et al., 2009; Roder et al., 2011).

The effects on immediate and delayed verbal memory add to the extensive findings from similar studies in early schizophrenia (Revell et al., 2015). The relative contribution of each subprogram to outcomes is uncertain. The CCT approach specifically targets verbal memory and executive functioning but previous research on CCT in early psychosis did not find specific effects on executive functions or verbal memory post-treatment (Mendella et al., 2015). The significant effects found in this study may indicate that we were more efficient in teaching specific CCT training content related to verbal memory and executive functions, or that other components of the intervention may contribute to these gains. Cognitive remediation using NEAR has demonstrated significant effects on cognitive flexibility and verbal memory (Hodge et al., 2010) and previous research on SCIT has also reported improvements in cognitive flexibility (Combs et al., 2007a). In addition to the between-group effects, The ICR group obtained significant within-group effects on inhibition, planning and logic reasoning. Since this is an initial study with limited power to detect between-group differences, it may be useful to interpret within-group effects to evaluate whether ICR should be evaluated in a large-scale study. In contrast to numerous studies on cognitive remediation in schizophrenia (Mendella et al., 2015; Wykes et al., 2011) we did not observe improvements in processing speed (Digit Symbol Coding) which may reflect that the baseline performance was within 0.5 standard deviations of the usual reference age group, leaving little room for improvement (Twamley et al., 2011; Wechsler, 2008). However, these results are in line with a previous study on the effects of a combined neurocognitive and social-cognitive intervention in early course schizophrenia (Eack et al., 2009) and highlight the importance of investigating the potential benefits of these interventions in early psychosis samples.

The improvement in ToM is in line with previous findings on the social-cognitive gains from social-cognitive interventions (Kurtz et al., 2016). These results are promising since ToM has been identified as the social-cognitive domain with the strongest associations to community outcomes and interpersonal skills (Fett et al., 2011). A significant effect

Table 4
Pre- to post-treatment change in ICR intent-to-treat sample (n = 37).

Measures	Baseline Mean (SD)	Post-treatment Mean (SD)	Paired t-test	Cohen´s D_{av}	Number and percentage of improvers based on SDI
Neurocognition					
Digit Symbol Coding	61.4 (15.4)	64.4 (12.7)	−1.48, p = 0.149	0.06	4/34, 12%
Trails A[a]	28.9 (10.3)	28.0 (11.8)	0.68, p = 0.500	0.01	8/33, 24%
Digit Span Forward	8.1 (1.8)	8.3 (1.6)	−1.53, p = 0.135	0.07	11/35, 31%
Digit Span WM	7.6 (1.4)	8.0 (1.4)	−2.56, p = 0.015	0.17	8/34, 24%
LMI	29.5 (10.6)	35.5 (12.3)	−3.62, p = 0.001	0.29	12/33, 36%
LMI theme	11.7 (3.2)	14.2 (4.5)	−3.70, p = 0.001	0.37	15/33, 45%
LMII	17.5 (9.5)	23.8 (10.0)	−5.07, p = 0.001	0.45	9/32, 28%
LMII theme	7.6 (3.3)	9.7 (2.9)	−4.20, p = 0.001	0.36	9/32, 28%
Matrix Reasoning	26.6 (4.9)	28.1 (5.0)	−2.33, p = 0.026	0.14	4/34, 12%
Stroop Interference[a]	30.6 (10.9)	25.6 (9.1)	2.98, p = 0.005	0.21	12/34, 35%
Tower	16.6 (2.8)	17.9 (3.9)	−2.08, p = 0.047	0.13	10/30, 30%
Trails B[a]	72.3 (18.6)	69.4 (16.5)	1.11, p = 0.274	0.04	3/31, 10%
Social cognition					
Hinting Task	14.3 (2.8)	16.3 (2.8)	−5.92, p = 0.001	0.54	15/31, 48%
AIHQ Hostility[a]	9.7 (2.9)	7.0 (2.3)	5.74, p = 0.001	0.52	13/31, 42%
AIHQ Blame[a]	30.6 (9.9)	30.7 (9.9)	−0.07, p = 0.947	0.00	3/32, 9%
AIHQ Aggression[a]	8.0 (1.8)	8.1 (1.9)	−0.08, p = 0.938	0.00	7/30, 23%
FEIT	12.9 (2.6)	13.6 (2.4)	−1.85, p = 0.073	0.09	7/34, 21%
FEIT confidence in correct answers	1.8 (0.4)	1.9 (0.3)	−1.45, p = 0.158	0.06	6/32, 19%
FEIT confidence in incorrect answers[a]	1.1 (0.7)	1.0 (0.6)	0.67, p = 0.508	0.01	6/33,18%
BCIS total	8.0 (6.5)	7.7 (5.6)	−0.28, p = 0.779	0.06	1/30, 3%
Social functioning					
LSP-39	124.0 (15.0)	127.8 (12.7)	−1.62, p = 0.118	0.10	6/25, 24%
BRIEF-A informant-report[a]	130.4 (30.8)	127.1 (25.5)	0.69, p = 0.497	0.02	2/26, 8%
BRIEF-A self-report[a]	127.6 (22.9)	120.3 (22.7)	2.07, p = 0.047	0.12	6/32, 19%
OSA competence	49.58 (11.4)	51.5 (9.8)	−1.05, p = 0.303	0.05	4/24, 17%
QOLS	76.9 (13.9)	73.3 (12.8)	1.88, p = 0.071	0.11	0/31, 0%
Clinical symptoms[a]					
PANSS positive	12.2 (4.7)	12.6 (4.5)	−0.39, p = 0.700	0.00	6/26, 23%
PANSS negative	16.2 (5.6)	14.0 (4.6)	2.47, p = 0.020	0.18	6/26, 23%
DASS-21 depression	6.6 (6.0)	6.6 (5.0)	0.00, p = 1.00	0.00	6/31, 19%
DASS-21 anxiety	4.3 (4.0)	4.3 (4.3)	−0.05, p = 0.964	0.00	6/31, 19%
DASS-21 stress	5.0 (4.1)	6.0 (4.7)	−1.55, p = 0.133	0.07	2/31, 6%

Note. SDI: Standard Deviation Index; Digit Span WM: Digit Span working memory span; LMI and LMII: Logical Memory part I and II; AIHQ: Ambiguous Intentions Hostility Questionnaire; FEIT: Facial Emotion Identification Task; BCIS: Becks Cognitive Insight Scale; LSP-39: Life Skills Profile; BRIEF-A: Behavior Rating Inventory of Executive Function – Adult version; OSA: Occupational Self Assessment; QOLS: Quality of Life Scale; PANSS: Positive and Negative Syndrome Scale; DASS-21: Depression, Anxiety and Stress Scale.

[a] Higher scores reflect greater pathology.

was not found for emotion recognition, which contradicts some previous studies on social-cognitive interventions (Bartholomeusz et al., 2013; Grant et al., 2017; Horan et al., 2011a). Results on SCIT´s effect on emotion recognition have been inconsistent, with some studies reporting significant effects (Combs et al., 2007a; Roberts and Penn, 2009) but others not (Roberts et al., 2014). One explanation may be that emotion recognition training was only a small part of the intervention and only addressed in the first month of treatment, when two months remained until the post-treatment assessments were done. As suggested by (Roberts et al., 2014) it may be beneficial to increase emotion recognition training throughout the latter half of the intervention. The improvements in hostile attributional style should be interpreted with caution, due to the low test-retest reliability of the measures. However, these findings add valuable information to the previous inconsistent results of the small number of studies conducted on the effects of social-cognitive interventions on attributional style (Grant et al., 2017). Given the correlation between attributional style and executive functioning (Mehta et al., 2014), and SCIT´s previous success in remediating both domains, improvements in cognitive flexibility may enhance improvements in attributional style, and vice versa.

We did not find ICR associated improvements in informant-assessed social functioning or clinical symptoms which was also reported in a recent short-term trial on CCT for first-episode subjects (Mendella et al., 2015). Generally, smaller effect sizes have been found for functioning in early psychosis samples than chronic schizophrenia (Revell et al., 2015). It may be that observable changes in functioning are not detected at post-treatment, but rather at longer follow-up and a 12-month follow-up study is currently underway. Although we did find a small within-group effect on self-assessed problems related to exectutive functioning in every-day life, the results may reflect the need for more appropriate measures of social functioning in early psychosis focusing on social relationships and self-esteem. It is plausible that some of the measures of social functioning used in this study did not capture impairments in functioning in this sample, since baseline functioning was relatively high. In addition, the post-treatment completion rate for the informant-based social functioning measures (BRIEF-A informant-report and LSP-39) and the clinician-rated measure of symptomatology (PANSS) was relatively low, and the results may in part reflect reduced power. However, we did find a small within-group effect on negative symptoms for participants who completed the ICR but it may be that a more symptom-focused intervention is needed to improve psychiatric symptoms severity (Eack et al., 2009).

Regarding the feasibility, ICR was well received by participants, with good attendance and little drop-out. Most found the intervention to be useful and tolerable, in line with previous research on SCIT (Parker et al., 2013; Roberts et al., 2010). A greater dosage of ICR might lead to stronger outcomes, consistent with dose-response effects observed in other psychosocial interventions for schizophrenia (Medalia and Richardson, 2005; Roberts et al., 2014). When asked which treatment approach they found most beneficial the participants varied in their answers, suggesting it may be highly valuable to offer participants personalized approaches to meet the rehabilitation needs of each individual.

This study had several methodological limitations. First, the sample

size is modest, which may have reduced power to detect smaller treatment effects. Second, the average time between the baseline assessments and start of treatment was 3.7 months (SD 3.6). During this time, patients received treatment at the early intervention service and therefore the effects may be due to other factors than the ICR. However none of the participants received any other group psychotherapy or cognitive training, and cognitive test findings have been reported to be highly stable over many years in first-episode and schizophrenia patients (Haatveit, 2015; Horan et al., 2011a; Kurtz et al., 2005). Third, PANSS raters were not blind to group assignment. Fourth, we did not correct for multiple comparisons due to our small sample size, and it is possible that some of our results reflect Type I error. The results should therefore be regarded as preliminary until replicated. Fifth, test-retest reliability for some of the social-cognitive measures was low. However, limitations in social-cognitive assessment are a well-known methodological issue and recently, the Hinting Task has been identified as the only social-cognitive measure recommended for use in clinical research in early psychosis (Ludwig et al., 2017).

We conclude that ICR is a time-effective and feasible program for early psychosis patients. It appears to yield clinical benefits, particularly in the areas of verbal memory, cognitive flexibility, working memory, ToM, and hostile attributional biases. More training of the acquired skills in everyday life may be necessary for the effects to generalize to social functioning and a follow-up study is needed to determine the durability of the effects. Future research should clarify the relative contribution of each subprogram to its impact on outcomes and replication of the study in a larger sample is needed.

Conflict of interest

None.

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