British Journal of Clinical Psychology (2014), 53, 281–298

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A randomized, controlled trial of Social Cognition and Interaction Training (SCIT) for outpatients with schizophrenia spectrum disorders

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Objectives. In schizophrenia, the ability to adaptively infer the thoughts and feelings of others (i.e., social cognition) is strongly associated with community functioning. Researchers have designed psychosocial interventions to improve social cognition with the aim of improving downstream social functioning. Social Cognition and Interaction Training (SCIT) is one such intervention. Previous research on SCIT has been promising, but has consisted largely of smaller trials with insufficient experimental control.

Design. Randomized, controlled trial.

Methods. The current article reports on a controlled trial of 66 adults with schizophrenia randomized to receive either SCIT (n = 33), delivered in weekly group sessions, or treatment as usual (n = 33) for 6 months. Participants completed assessments of social cognition, social functioning, neurocognition and symptoms at baseline, post-treatment, and 3-month follow-up.

Results. Primary analyses suggest that SCIT may improve social functioning, negative symptoms, and possibly hostile attributional bias. *Post-hoc* analyses suggest a dose–response effect.

Conclusions. Findings are discussed in the context of continuing to refine and improve social cognitive interventions for schizophrenia.

Practitioner points

- Social cognitive intervention is a feasible and promising approach to improving social functioning among individuals with schizophrenia-spectrum disorders.
- Dose–response findings suggest that delivering social cognitive interventions with greater frequency may maximize their benefit to patients.
- Research on social cognitive interventions is still young and effects from well-controlled trials have been inconsistent.
- It is not yet clear which components of social cognitive training may be the key active ingredients.

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DOI:10.1111/bjc.12044

Most individuals with schizophrenia have impairments in social and community functioning that pharmacological interventions have shown little ability to improve (Bellack, Schooler, & Marder, 2004). Psychosocial interventions have shown promise (Kurtz & Mueser, 2008), but social dysfunction remains the greatest unmet treatment need among patients with schizophrenia (Coursey, Keller, & Ferrell, 1995; Middelboe *et al.*, 2001). A newer approach has emerged that seeks to improve social functioning by targeting the mental operations underlying social interaction, known as *social cognition* (Penn *et al.*, 2008). This approach is promising because social cognition predicts social functioning in schizophrenia (Couture, Penn, & Roberts, 2006) even more strongly than do traditional neurocognitive domains (Brekke, Hoe, Long, & Green, 2007; Fett *et al.*, 2011). Therefore, improving social cognition may lead to improved social functioning.

Extant pharmacological interventions have shown little ability to improve social cognition (Penn *et al.*, 2009; Roberts, Penn, Corrigan, *et al.*, 2010). In contrast, there is evidence that social cognition in schizophrenia can be enhanced through psychosocial intervention. Several interventions have been developed that address social cognition within a broad suite of treatment elements, including social skills training, cognitive remediation, and intensive case management (Brenner, Hodel, Roder, & Corrigan, 1992; Hogarty & Greenwald, 2006). These treatments have shown good evidence of improving social functioning (Hogarty & Greenwald, 2006; Roder, Mueller, Brenner, & Spaulding, 2010). However, it is unclear what role social cognitive intervention techniques play in their effects.

Other psychosocial interventions have been designed to target social cognitive impairments at the exclusion of other domains (e.g., Horan *et al.*, 2009; Wolwer *et al.*, 2005). One such intervention is Social Cognition and Interaction Training (SCIT; Roberts, Penn, & Combs, in press). Across a series of small trials conducted by its developers, SCIT has shown evidence of feasibility and tolerability in community settings (Roberts, Penn, Labate, Margolis, & Sterne, 2010), efficacy of improving social cognition and social functioning (Combs, Adams, *et al.*, 2007; Roberts & Penn, 2009), and some evidence that treatment gains persist over a 6-month follow-up period (Combs *et al.*, 2009). SCIT has also yielded promising findings when implemented by independent research groups in Australia, Hong Kong, mainland China, Turkey, and Spain (Bartholomeusz *et al.*, 2013; Chan *et al.*, 2010; Lahera *et al.*, 2012; Tas, Danaci, Cubukcuoglu, & Brune, 2012; Wang *et al.*, 2013). Although research on SCIT has produced promising early evidence, extant studies have been relatively small and there is no published randomized controlled trial of SCIT among outpatients with schizophrenia.

This study is a randomized, controlled trial of SCIT for outpatients diagnosed with schizophrenia spectrum disorders. We hypothesized that participants who were randomized to receive SCIT would exhibit improvements in social cognition and social functioning relative to treatment as usual (TAU) participants at post-treatment and follow-up assessments.

Method

Participants

Participants were recruited from outpatient mental health clinics who had DSM-IV diagnoses of schizophrenia or schizoaffective disorder, were aged 25–60 years, and had difficulties interacting with others based on the Interaction subscale of the Social Functioning Scale (Birchwood, Smith, Cochrane, Wetton, & Copestake, 1990). Individuals were excluded if they currently met criteria for a substance use disorder, had an IQ of

80 or below, or met criteria for mental retardation. After complete description of the study to the subjects, written informed consent was obtained. Of the 137 people who were referred and made phone contact, 66 passed baseline screening and were randomized to either SCIT or TAU. Of the 33 randomized to SCIT, 32 completed post-treatment

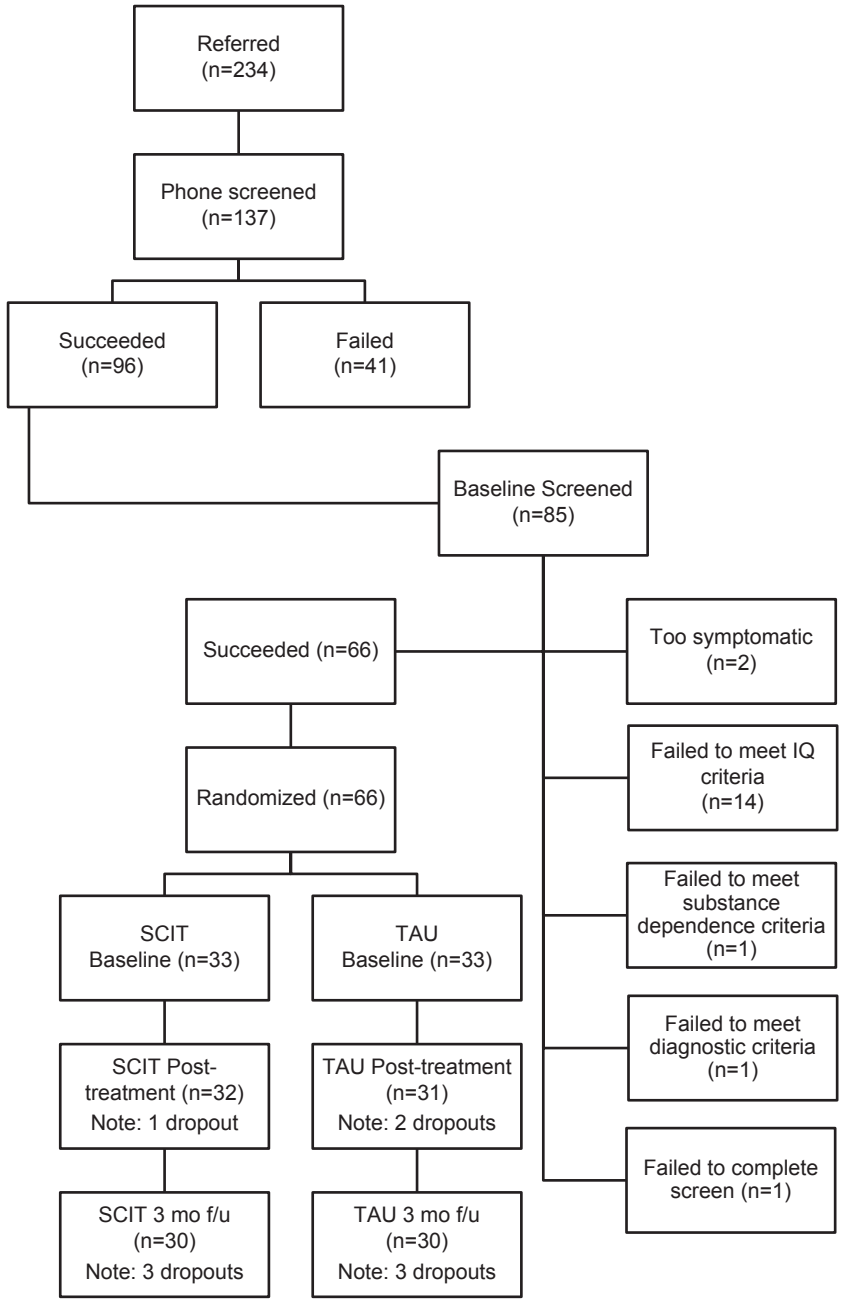

Figure 1. Consort diagram.

assessment and 30 completed 3-month follow-up assessment. For TAU, these numbers were 31 and 30, respectively (see consort diagram, Figure 1).

Treatment conditions

The TAU condition involved no study-based control or manipulation. Thus, TAU participants received varying combinations of locally available services, including pharmacotherapy, case management, and individual and group psychotherapy. SCIT group members were not prohibited from participation in other TAU services.

SCIT is a manual-based group intervention that is delivered in 20–24 weekly, hour-long sessions. The exact duration of the intervention varies based on the speed with which the group moves through the session content. Groups include two clinicians and four to eight patients. Described in detail elsewhere (Roberts *et al.*, in press), SCIT uses a combination of psychoeducation, drill-and-repeat skill practice, strategy games, heuristic rehearsal, and homework assignments to remediate deficits and decrease biases in social cognition. Each SCIT group participant was encouraged to identify a 'practice partner', a family member or acquaintance who was willing to practice SCIT skills with the participant weekly in lieu of, or in addition to, traditional homework. This approach was used because in previous clinical experience with SCIT a high proportion of participants failed to complete paper-and-pencil homework assignments. All SCIT group members identified practice partners, and partners were provided with a set of handouts and phone check-ins to guide their participation. SCIT clinicians attempted to reach practice partners by phone each week to check-in and provide guidance in their efforts to support SCIT participants' learning.

There were four study cohorts with each cohort comprising approximately 16 consecutively recruited participants, randomized to SCIT or TAU. The clinicians who co-led SCIT groups were advanced doctoral students in clinical psychology trained in SCIT. The clinicians met with DLP for weekly supervision. Therapy sessions were audiotaped and later rated by a licensed Clinical Psychologist and co-author of the SCIT manual (DRC) for fidelity to the SCIT program. A total of 73 sessions were rated for treatment fidelity by DRC using a standard scale. The average fidelity rating (of a maximum of 16) for the four SCIT cohorts was 14.7, 14.7, 14.1, and 14.8.

Measures

Symptoms, neurocognition, and IQ

Diagnostic and symptom assessments were conducted with the Structured Clinical Interview for DSM-IV – Patient version (First, Spitzer, Gibbon, & Williams, 1996). Participants completed the Positive and Negative Syndrome Scale (PANSS; Kay, Fiszbein, & Opler, 1987) and the Schizophrenia Cognition Rating Scale (SCoRS; Keefe, Poe, Walker, Kang, & Harvey, 2006), which provides a global estimate of neurocognition. The SCoRS is based on structured interview with the participant and an informant. To characterize the sample, participants were administered the Wechsler Abbreviated Scale of Intelligence – two subtest version (Wechsler, 1999).

Social cognition

Emotion perception was assessed with the Face Emotion Identification Task (FEIT; range 0–19) and the Face Emotion Discrimination Task (FEDT; Kerr & Neale, 1993; range 0–30).

On both, higher scores indicate better performance. To include a measure with more contemporary face stimuli, the final 16 TAU and 15 SCIT participants also completed the Emotion Recognition Test – 40 faces version (Kohler *et al.*, 2005).

Theory of mind (ToM) was assessed with the Hinting Task (Corcoran, Mercer, & Frith, 1995; range 0–20) and the Social Inference-Enriched subtest of The Awareness of Social Inference Task (TASIT; McDonald, Flanagan, Rollins, & Kinch, 2003; range 0–60). Higher scores on both reflect better ToM.

Attributional bias was assessed with the Ambiguous Intentions Hostility Questionnaire-Ambiguous items (AIHQ-A; Combs, Penn, Wicher, & Waldheter, 2007). Participants listen to five verbally presented, second-person vignettes describing social interactions with negative outcome. After each vignette, participants provide both free-response and Likert-type judgements about whether the other character harboured hostile intent towards the participant, how much the character is to blame for the event, and how aggressively the participant would respond. Hostility and Aggression Scales range from 5 to 25, with higher scores indicating more negative bias (i.e., towards more hostility or aggression). The Blame Scale ranges from 15 to 80, with higher scores reflecting a greater tendency to blame the other character.

Real-world behavioural manifestation of social cognitive functioning was assessed with the Observable Social Cognition, A Rating Scale (OSCARS; Healey, Roberts, Combs, & Penn, 2012). The OSCARS is a paper-and-pencil rating scale, including an informant scale, which is completed by a family member, close friend, or care provider (based on the past 7 days) and an interviewer scale reflecting the interviewer's overall impression based on the informant report and other information from the test battery. (The interviewer scale was added late to the protocol and therefore was completed for 17 TAU and 21 SCIT participants.) Eight domains are rated on 7-point Likert-type scales ranging from 1 (*no evidence of difficulty*) to 7 (*extreme evidence of difficulty*). The rated domains are emotion recognition, hostile attributional bias, jumping to conclusions, social cognitive flexibility, changing judgements in response to disconfirmatory evidence, understanding of subtlety in conversation (e.g., sarcasm), perspective-taking, and social knowledge. Scores are summed across the eight domains to yield a total score ranging from 8 to 56, with higher scores indicating greater dysfunction.

Social functioning

Social skill was assessed with the Social Skill Performance Assessment (SSPA; Patterson, Moscona, McKibbin, Davidson, & Jeste, 2001). Participants completed two 3-min role–play interactions with a trained research associate on predetermined themes. Conversations were recorded and coded by blind raters, trained to reliability (Interclass Correlation Coefficient [ICC] > .70). For each scene, the following domains were rated using 5-point Likert-type scales, with higher scores indicating better performance: Paralinguistic Skill (sum of Fluency & Clarity domains), Social Appropriateness, Conversation Skill (scored for scene 1 only), and Affect. Domain scores were summed across scenes to yield a total score ranging from 9 to 45.

The Global Social Functioning Scale (GSFS; Cornblatt *et al.*, 2007) is an interview-based assessment of peer, intimate, and family relationships. Scores range from 1 to 10, with higher scores indicating better functioning.

The Quality of Life Scale – Social (QLS-S) and Work (QLS-W) subscales (Heinrichs, Hanlon, & Carpenter, 1984) are 8- and 4-item scales, respectively, that are rated on the

basis of a semi-structured interview regarding the participant's functioning during the preceding 4 weeks. The QLS-S scale ranges from 0 to 48 and the QLS-W from 0 to 24.

Feedback on SCIT

At the end of treatment, SCIT participants were asked to complete a feedback questionnaire rating six aspects of SCIT, including the amount, ease, and understandability of the information, and the usefulness of the treatment. Each question was answered using a 3-point scale ranging from 1 (most negative; e.g., *not at all helpful*) to 3 (most positive; e.g., *very helpful*).

SCIT practice partner engagement and treatment intensity

All 33 SCIT participants identified a practice partner. At the end of each SCIT cohort, the group clinician rated the number of phone contacts between the clinician and each participant's practice partner, and rated each practice partner on four 5-point Likert-scale items (higher scores indicate greater engagement): *How helpful was the practice partner? How motivated was the practice partner? How often did the practice partner help?* and *Did the practice partner participate in all homework sessions?* This 4-item scale was highly reliable (Cronbach's alpha = .93).

Procedures

At baseline, post-SCIT treatment, and 3-month follow-up, trained research assistants who were blind to group assignment conducted assessments. For interview- and coding-based measures, raters were trained to inter-rater reliability of ICC > .70 against a gold-standard rater criterion. As a check on rater blindness, the research assistants were asked to guess participants' group assignment. Across the four cohorts, five research assistants were 66.67% accurate in identifying group membership.

To encourage study engagement, SCIT participants received a ticket for a $20 lottery for each group session attended and TAU participants received a ticket for weekly phone check-ins to confirm their contact information.

Data analysis

Statistical analyses used mixed effects linear modelling (SAS 9.1; SAS Institute Inc., Cary, NC, USA) to compare the SCIT and TAU treatment groups over time on the social cognitive, social functioning, symptom, and neurocognitive outcome variables. This approach was used in order to maximize power in the context of possible missing data, and to facilitate estimation of the optimal covariance structure. The mixed models included treatment group (TAU vs. SCIT), Time (post-treatment, 3-month follow-up), Treatment group × Time interaction, and Baseline (dependent variable) score as predictors. The Baseline score was included because it was positively correlated with outcome scores, and so its inclusion served to improve statistical power. The Treatment group × Time interaction term was included in order to test whether the magnitude of treatment group differences differed across post-treatment and follow-up periods, in which case these effects were probed using simple main effects (i.e., within time point comparisons of SCIT vs. TAU). When the Treatment group × Time interaction term was not statistically significant, the model was re-estimated dropping this term in order to

obtain a test of the overall main effect of treatment group aggregating across post-treatment and 3-month follow-up visits. Effect sizes for treatment group were computed for each time point as (adjusted M1 (SCIT) − adjusted M2 (TAU))/pooled baseline standard deviation. Effect sizes are reported below to supplement statistical tests that reached statistical significance or trends.

Results

The SCIT and TAU treatment groups did not differ significantly in any key demographic variables, IQ, or baseline symptom or neurocognitive variables (Tables 1 and 4). Sixty-one

Table 1. Demographic characteristics of sample

	SCIT		TAU	
	N = 33		*N* = 33	
Variable	*M*	*SD*	*M*	*SD*
Age (years)	40.0	12.2	39.4	10.8
Age of first hospitalization (years)	23.0	8.2	22.9	8.0
Number of hospitalizations	7.0	8.3	5.7	4.2
WASI (IQ)	97.5	16.1	100.8	15.0
Chlorpromazine equivalents*	464.0	293.6	801.1	650.4
	N	%	*N*	%
Gender				
Male	22	66.7	22	66.7
Female	11	33.3	11	33.3
Diagnosis				
Schizophrenia	15	45.5	13	39.4
Schizoaffective	18	54.5	19	57.6
Psychotic disorder NOS	0	0.0	1	3.1
Marital status				
Not married	31	93.9	32	100.0
Married	2	6.1	0	0.0
Ethnicity				
Caucasian	18	54.6	24	72.7
African-American	15	45.5	9	27.3
Hispanic/Latino origin	1	3.0	3	9.7
Highest level of education				
Did not complete high school	3	9.1	5	15.2
High school/GED	22	66.6	22	66.6
University degree or higher	8	24.2	6	18.2
Marital status				
Not married	31	93.9	33	100.0
Married	2	6.1	0	0.0
Education status				
Not in school	30	90.9	31	93.9
In school	3	9.1	2	6.1

Note. GED = general educational development; NOS = not otherwise specified; SCIT = Social Cognition and Interaction Training; TAU = treatment as usual; WASI = Wechsler Abbreviated Scale of Intelligence.
*$p < .05$.

of the 66 participants were prescribed antipsychotic medication continuously throughout this trial. Three SCIT participants and two TAU participants discontinued antipsychotic medication during the trial. TAU participants' baseline chlorpromazine equivalent antipsychotic dosage was significantly greater than SCIT participants' ($p < .05$). The variance in the TAU group's dosage was also significantly greater than the SCIT group's ($p < .001$), indicating high variability in illness severity in the TAU group. Participants' baseline PANSS symptoms were in the mild to low-moderate range and did not differ between groups, indicating that participants' symptoms were relatively well controlled. As shown in Tables 2 and 3, baseline social cognition and social functioning variables did not differ between the two treatment groups with the exception that the TAU group had significantly better Hinting Task performance at baseline.

The SCIT participants attended an average of 65% of treatment sessions (median = 71.4%). Over 95% of study participants completed post-test and over 90% completed the 3-month follow-up assessment. Sixteen (48%) of the SCIT participants had practice partners who were categorized as 'engaged in treatment' as defined by receiving average engagement ratings of 3 or higher.

Social cognition outcomes

Social cognition outcomes are summarized in Table 2. The Treatment group × Time interaction was statistically significant only for the FEDT, $F(1, 58) = 4.28$, $p < .05$. *Post-hoc* tests of simple FEDT effects were not statistically significant at either the post-treatment or follow-up time points. Effect sizes suggest a small advantage for SCIT over TAU at post-treatment ($d = .27$); however, this effect was reversed at follow-up ($d = -.33$).

For all other social cognitive variables, the model was re-estimated, dropping the interaction term to examine the main effect of treatment group aggregated across post-treatment and follow-up time points. Main effect analyses were not statistically significant for any variables. There was a trend for a significant treatment group effect, $F(1, 62) = 3.22$, $p < .08$, on the AIHQ-Hostility Scale. Follow-up analyses revealed that participants in the SCIT group had less hostile attributions at 3-month follow-up compared to those in the TAU group ($p < .05$). Consistent with these findings, effect sizes suggest a small advantage for SCIT over TAU at post-treatment ($d = .25$) and a medium-sized advantage at follow-up ($d = .48$).

Social functioning outcomes

As shown in Table 3, the GSFS did not exhibit a Treatment group × Time interaction but did show a statistically significant main effect for treatment group, $F(1, 56) = 5.65$, $p < .05$. Follow-up analyses revealed that SCIT participants received higher global functioning ratings than TAU participants at both post-treatment (trend, $p < .07$) and follow-up ($p < .05$). Accordingly, the SCIT group showed a small to medium effect size advantage over TAU at post-treatment ($d = .38$) and follow-up ($d = .43$).

On the SSPA, the Treatment group × Time interaction was statistically significant, $F(1, 53) = 4.29$, $p < .05$. At post-treatment, the SCIT group showed better social skill than TAU at a trend level of statistical significance ($p = .07$) and small effect size ($d = .31$). At follow-up, group means did not differ significantly.

Tests of the QOL scales were not statistically significant.

Table 2. Social cognition outcomes

	Full sample	SCIT		TAU		
	M (*SD*)	*M* (*SD*)	Adjusted *M*	*M* (*SD*)	Adjusted *M*	Effect size[a]
Face Emotion Identification Task						
Baseline	12.18 (2.78)	11.61 (2.88)		12.76 (2.60)		−.41
Post-treatment		12.88 (3.57)	13.18	13.65 (2.59)	13.28	−.04
Follow-up		12.6 (3.6)	13.07	13.7 (2.7)	13.46	−.14
Face Emotion Discrimination Task[b]						
Baseline	25.02 (2.21)	24.73 (2.23)		25.36 (2.18)		−.29
Post-treatment		26.12 (2.43)	26.35	25.97 (2.33)	25.76	.27
Follow-up		24.93 (4.23)	25.17	26.10 (2.55)	25.90	−.33
ER-40 (SCIT n = 15; TAU n = 16)						
Baseline	29.97 (5.57)	29.40 (6.79)		30.50 (4.29)		−.20
Post-treatment		29.81 (7.19)	30.19	31.75 (3.40)	31.32	−.20
Follow-up		30.53 (7.74)	30.93	30.27 (5.31)	29.76	.21
Hinting Task						
Baseline[c]	14.76 (2.95)	13.82 (3.32)		15.70 (2.19)		−.64
Post-treatment		14.33 (3.34)	14.91	15.10 (2.84)	14.58	.11
Follow-up		15.13 (2.57)	15.62	15.45 (3.85)	14.90	.24
The Awareness of Social Inference Task						
Baseline	47.39 (6.99)	47.39 (7.83)		47.39 (6.15)		.00
Post-treatment		48.24 (7.85)	48.19	47.97 (6.84)	48.12	.01
Follow-up		48.10 (9.44)	47.73	48.13 (8.52)	48.39	−.09
AIHQ-A Hostility Scale[d]						
Baseline	10.59 (3.03)	10.12 (3.39)		11.06 (2.59)		.31
Post-treatment		9.27 (2.53)	9.38	10.32 (3.06)	10.15	.25
Follow-up		8.73 (2.89)	8.95	10.55 (2.85)	10.41	.48
AIHQ-A Aggression Scale						
Baseline	8.98 (1.97)	8.88 (1.67)		9.09 (2.24)		.11
Post-treatment		8.58 (1.37)	8.60	8.81 (2.24)	8.83	.17
Follow-up		8.70 (1.60)	8.71	9.06 (2.00)	9.00	.15
OSCARS-Informant						
Baseline	24.10 (8.31)	22.78 (7.86)		25.50 (8.69)		.33
Post-treatment		21.40 (8.13)	22.37	23.61 (9.29)	22.96	.07
Follow-up		20.23 (7.15)	21.33	23.93 (8.99)	23.32	.24
OSCARS-Interview (SCIT n = 21; TAU n = 17)						
Baseline	25.42 (8.18)	24.19 (7.63)		26.94 (8.81)		.37
Post-treatment		22.20 (7.71)	22.01	24.32 (8.84)	23.33	.16
Follow-up		20.63 (6.82)	19.75	24.80 (8.72)	23.51	.46

Note. AIHQ-A = Ambiguous Intentions Hostility Questionnaire-Ambiguous; OSCARS = Observable Social Cognition, A Rating Scale; SCIT = Social Cognition and Interaction Training; TAU = treatment as usual; ER-40 = Emotion Recognition Test – 40 faces version.

[a]Effect sizes are computed as (adjusted M1 (SCIT) − adjusted M2 (TAU))/pooled baseline standard deviation. Baseline effect size is calculated with unadjusted means. Positive effect size values indicate results favourable for the SCIT group. [b]Treatment group × Time interaction ($p < .05$), but no group differences at post-treatment or follow-up. [c]Baseline group difference ($p < .05$). [d]Trend level main effect for treatment group ($p < .08$), and significant group difference at follow-up ($p < .05$).

Table 3. Social functioning outcomes

	Full sample	SCIT		TAU		
	M (*SD*)	*M* (*SD*)	Adjusted *M*	*M* (*SD*)	Adjusted *M*	Effect size[a]
GSFS[b]						
Baseline	5.98 (1.15)	5.91 (1.12)		6.07 (1.19)		−.06
Post-treatment		6.06 (1.16)	6.12	5.80 (1.30)	5.68	.38
Follow-up		6.48 (1.06)	6.50	6.10 (0.99)	6.00	.43
SSPA[c]						
Baseline	17.22 (3.10)	16.81 (3.46)		17.70 (2.73)		−.29
Post-treatment		17.73 (3.07)	17.98	17.14 (2.59)	17.03	.31
Follow-up		17.33 (2.69)	17.59	18.18 (2.42)	17.97	−.12
QOL Social Scale						
Baseline	24.64 (9.08)	26.21 (9.71)		23.07 (8.25)		.35
Post-treatment		27.33 (9.69)	26.38	26.55 (7.92)	27.35	−.11
Follow-up		29.43 (10.50)	28.00	26.94 (8.78)	28.28	.03
QOL Work Scale						
Baseline	14.20 (4.83)	14.49 (4.61)		13.91 (5.09)		.12
Post-treatment		13.74 (4.87)	13.57	14.45 (5.22)	14.47	−.18
Follow-up		14.43 (5.27)	14.09	13.86 (5.40)	14.08	.00

Note. GSFS = Global Social Functioning Scale; QOL = quality of life; SSPA = Social Skill Performance Assessment; SCIT = Social Cognition and Interaction Training; TAU = treatment as usual.
[a]Effect sizes are computed as (adjusted M1 (SCIT) − adjusted M2 (TAU))/pooled baseline standard deviation. Baseline effect size is calculated with unadjusted means. Positive effect size values indicate results favourable for the SCIT group. [b]Treatment group main effect ($p < .05$) and group differences at post-treatment ($p < .07$) and follow-up ($p < .05$). [c]Treatment group × Time interaction ($p < .05$) and trend level group difference at post-treatment ($p < .07$).

Symptom and neurocognitive outcomes

Symptom and neurocognitive outcomes are shown in Table 4. Neither the Treatment group × Time interaction nor the main effect of treatment group was significant for SCoRS neurocognition or for PANSS Positive or Total symptoms. The Treatment group × Time interaction was significant for the PANSS General symptom scale, $F(1, 58) = 5.08$, $p < .05$. Probing of the interaction did not reveal statistically significant group differences at either time point, although there was a trend for the TAU group to have lower General symptoms at 3-month follow-up relative to the SCIT group ($p < .10$; $d = .30$).

For the PANSS Negative symptom scale, the interaction was not significant, but there was a main effect for treatment group, $F(1, 61) = 3.92$, $p = .05$. Follow-up analyses revealed a trend toward the SCIT group having lower Negative symptoms at 3-month follow-up relative to the TAU group ($p < .06$). This trend reached a small to medium effect size ($d = .38$).

Participant feedback

Responses on the feedback questionnaire were generally positive (Table 5). Across the four items that addressed SCIT's usefulness and respect toward participants (items 3 through 6), the majority of respondents gave ratings of 3 (positive), and none gave

Table 4. Symptom and neurocognitive outcomes

	Full sample	SCIT		TAU		Effect
	M (*SD*)	*M* (*SD*)	Adjusted *M*	*M* (*SD*)	Adjusted *M*	size[a]
PANSS Positive Symptoms						
Baseline	16.50 (4.74)	17.03 (5.18)		15.97 (4.27)		−.22
Post-treatment		14.85 (4.38)	14.44	15.29 (4.22)	15.53	.23
Follow-up		14.97 (4.20)	14.72	14.81 (4.59)	15.16	−.09
PANSS Negative Symptoms[b]						
Baseline	14.85 (4.00)	15.27 (4.30)		14.42 (3.69)		−.21
Post-treatment		14.12 (4.46)	13.77	14.65 (3.79)	14.81	.26
Follow-up		13.70 (3.39)	13.55	14.77 (3.66)	15.05	.38
PANSS General Symptoms[c]						
Baseline	33.95 (7.31)	33.18 (7.27)		34.73 (7.38)		.21
Post-treatment		31.45 (6.82)	31.79	33.58 (7.64)	33.08	.18
Follow-up		31.93 (5.68)	32.55	30.97 (6.91)	30.36	−.30
PANSS Total Score						
Baseline	65.30 (12.84)	65.48 (14.20)		65.12 (11.55)		−.03
Post-treatment		60.39 (12.21)	59.92	63.52 (12.37)	63.54	.28
Follow-up		60.53 (10.10)	60.70	60.73 (11.67)	60.78	.02
Schizophrenia Cognition Rating Scale – Global						
Baseline	4.92 (2.48)	4.69 (2.33)		5.17 (2.64)		−.19
Post-treatment		4.23 (2.06)	4.36	4.45 (2.32)	4.38	−.01
Follow-up		4.20 (1.81)	4.31	4.17 (1.86)	4.10	.08

Note. PANSS = Positive and Negative Syndrome Scale; SCIT = Social Cognition and Interaction Training; TAU = treatment as usual.

[a]Effect sizes are computed as (adjusted M1 (SCIT) − adjusted M2 (TAU))/pooled baseline standard deviation. Baseline effect size is calculated with unadjusted means. Positive effect size values indicate results favourable for the SCIT group. [b]Main effect for treatment group ($p = .05$) and trend level group difference at follow-up ($p < .06$). [c]Treatment group × Time interaction ($p < .05$) and trend level group difference at follow-up ($p < .10$).

Table 5. Feedback on SCIT from participants

		Response		
	Item	'1' (% of respondents)	'2' (% of respondents)	'3' (% of respondents)
1	Right amount of information?	3.7	92.6	3.7
2	Materials easy to understand?	14.8	74.1	11.1
3	Useful to you?	0	51.9	48.1
4	Respectful to you?	0	33.3	66.7
5	Helpful for social situations?	0	44.4	55.6
6	Help you relate to others?	0	55.6	44.4

ratings of 1 (negative). The two items regarding the amount and ease of understandability of the SCIT content (items 1 and 2) received middling ratings, with the majority of respondents giving ratings of 2, and a roughly equal minority giving ratings of 1 or 3.

Post-hoc covariate analyses

Analyses were repeated separately for post-test and follow-up time points within a general linear model framework to examine the effects of variables that have previously been associated with psychosocial treatment response in schizophrenia. These included gender (Villeneuve *et al.*, 2010), maternal education (Hofer *et al.*, 2005), baseline symptomatology (Garety *et al.*, 2008), baseline cognitive functioning (the SCORS; Keefe *et al.*, 2006), and treatment intensity (Medalia & Richardson, 2005). With the exception of treatment intensity, we conducted ANCOVAs with the covariate and baseline performance on the dependent variable entered as covariates. To evaluate the effect of treatment intensity, we conducted linear regression analyses among SCIT participants with baseline performance on the dependent variable and either attendance or practice partner involvement entered as predictor variables. Due to the high number of statistical tests in these *post-hoc* analyses, we report only on covariates that exhibited significant or trend-level effects across multiple tests.

The only covariates that showed effects across multiple tests were the within-group regression effects of our three SCIT treatment intensity variables: attendance, number of phone contacts between SCIT clinicians and practice partners, and clinician rating of practice partner involvement. Attendance significantly predicted outcome for the TASIT at post-treatment ($p < .02$), QOL-Work scale at both post-treatment ($p < .03$) and follow-up ($p < .03$), the FEIT at post-treatment ($p < .01$), and predicted at a trend level the FEDT at post-treatment ($p = .10$), the AIHQ total score at post-treatment ($p = .08$), and the OSCARS-Informant version at post-treatment ($p = .09$). The number of phone contacts between practice partners and clinicians predicted outcome at a trend level on the OSCARS-Informant at post-test ($p = .10$) and the FEDT at post-test ($p = .08$). Ratings of practice partner involvement predicted outcome at a trend level on the OSCARS-Informant at follow-up ($p = .09$). In all instances, greater SCIT treatment intensity was associated with more positive outcome on the dependent variable.

Discussion

This study is the first randomized, controlled trial of SCIT among outpatients with schizophrenia-spectrum disorders in the United States. Designed as a treatment development trial, the results suggest that SCIT is feasible and well tolerated by participants. In addition, the findings indicate that SCIT may confer benefits in social functioning, negative symptoms, and possibly hostile attributional bias. Results also point to a possible dose–response effect in SCIT treatment.

The SCIT did not show an advantage over TAU in improving emotion perception or ToM, the two primary social cognitive outcome domains. The lack of effect on emotion perception is inconsistent with previous research on SCIT (Combs, Adams, *et al.*, 2007; Roberts & Penn, 2009) and other social cognitive interventions (e.g., Combs *et al.*, 2008; Horan *et al.*, 2009; Silver, Goodman, Knoll, & Isakov, 2004; Wolwer *et al.*, 2005). One explanation may be that emotion perception training in SCIT is less intense relative to targeted emotion perception interventions. Further, this training is provided at the beginning of the SCIT treatment, months before post-treatment assessments. Thus, it may be beneficial to increase emotion perception training throughout the latter half of SCIT intervention.

Results from previous efforts to improve ToM have been mixed, both with SCIT and other intervention approaches (reviewed in Fiszdon, 2013). Two previous studies that did

show SCIT-related ToM improvements on the Hinting Task were conducted among lower functioning patients (Combs, Adams, *et al.*, 2007; Roberts, Penn, Labate, *et al.*, 2010). A third study that failed to show improvement was conducted in a higher functioning sample (Roberts & Penn, 2009). Thus, SCIT may have less impact on higher functioning patients such as those in the current study: Participants had low baseline PANSS symptom ratings (average item score of 2.6 of 7) and a quarter of them scored in the normative range on the Hinting Task at baseline (i.e., 17 or higher of 20; Corcoran *et al.*, 1995; Pinkham & Penn, 2006).

Attributional bias results were somewhat more promising, as SCIT was associated with a trend-level advantage over TAU across post-treatment and follow-up time points. This finding is promising in light of the uneven success of previous efforts to impact this domain (reviewed in Fiszdon, 2013). One challenge is that hostile attributional bias exists only within a subset of individuals with schizophrenia (Bentall *et al.*, 2009; Garety & Freeman, 1999), and therefore treatment effects may not be detectable within a full schizophrenia sample.[1] Therefore, future efforts to improve this domain may do well to screen participants in order to ensure the presence of dysfunctional attributional bias prior to treatment.

Across social cognitive domains, it is possible that the lack of significant effects in the current study is due in part to the low statistical power of this treatment development trial. Effect size data provide some evidence of treatment effects that were not detectable by inferential statistics. On the Hinting Task, SCIT showed a small advantage over TAU at 3-month follow-up (d = .24). On the OSCARS, SCIT showed an advantage relative to TAU at 3-month follow-up on both the Informant (d = .24) and Interview (d = .46) versions of the measure. The provision here of these effect sizes may inform the design of larger treatment trials in the future.

The SCIT participants showed evidence of improvement on two measures of social functioning, the GSFS and the SSPA. SCIT's post-treatment advantage on the GSFS likely was influenced by a decrease in the TAU group mean; however, the advantage for SCIT at follow-up appears valid at a medium effect size. Similarly, on the SSPA, although the significance of the overall interaction test likely was influenced by the relative increase in TAU performance at the follow-up time point, nonetheless, SCIT showed a significant post-treatment benefit relative to TAU that reached an effect size of .31. Interpreting the SSPA and GSFS findings together, it is plausible that SCIT participants experienced some immediate benefit in superficial interaction abilities (SSPA), which they then internalized over time, leading to subtler, global social improvements (GSFS). The relatively small numeric values of these SCIT-related improvements bring into question their clinical significance and highlights the difficulty of achieving robust improvements in functional outcome.

SCIT's advantage over TAU in improving negative symptoms is promising in light of negative symptoms' link to functional outcome (Breier, Schreiber, Dyer, & Pickar, 1991; Milev, Ho, Arndt, & Andreasen, 2005) and their resistance to intervention (Velligan, Roberts, & Good, in press). Several previous studies using SCIT (Tas *et al.*, 2012) and other social cognitive approaches (Roncone *et al.*, 2004) have reported effects on negative symptoms. This effect may be explained by the fact that social cognition and negative symptoms are somewhat overlapping constructs (Sergi *et al.*, 2007). Social cognitive

[1] *In one current treatment development project, only 5% of schizophrenia participants scored 0.5* SD *or more above the normative mean on the AIHQ Hostility scale (Joanna Fiszdon, personal communication).*

intervention may improve emotion processing and social engagement, which may manifest as improved negative symptoms.

Overall, this study produced at least as much support for SCIT's effect on social functioning and negative symptoms as on performance-based measures of social cognition. A similar effect was observed in a recent pilot trial of SCIT among adolescents with high-functioning autism (Turner-Brown, Ratto, Dichter, Rupp, and Penn, under review). A relatively greater impact on social functioning and negative symptoms than on social cognition would be promising as the ultimate aim of SCIT is to improve functional outcome. However, it is somewhat puzzling given that SCIT targets social cognition most directly. One explanation for the relative weakness of social cognitive effects may be that, in schizophrenia, measures of social functioning and negative symptoms are more psychometrically sound than are measures of social cognition (Couture & Penn, 2012; Green *et al.*, 2008). As the validity and specificity of social cognition measurement continues to improve, it is possible that the measureable effects of social cognitive treatments will also improve.

Supplemental covariate analyses indicated that greater dosage of SCIT might lead to stronger outcomes. This finding is consistent with dose–response effects in other psychosocial interventions for schizophrenia (Medalia & Richardson, 2005). The specific finding regarding practice partner involvement is in line with recent studies that have found strong effects from delivering SCIT with both family-member (Tas *et al.*, 2012) and professional (Hasson-Ohayon, Mashiach-Eizenberg, Avidan, Roberts, & Roe, 2014) practice partners. In future research, it may be valuable to compare family-based versus professional practice partners. Family members may be stronger partners given their greater familiarity and contact with SCIT participants, but could also be poorer partners if they have impairments of their own. We did not assess social cognition or functioning in practice partners, but it should be noted that SCIT participants may benefit as much from teaching SCIT to a partner as from having the partner assist in teaching the participant.

On the SCIT feedback questionnaire, participants rated the group highly in terms of its applicability to their real world social problems and gave it moderate ratings in terms of its ease of understanding. These ratings are in line with previous feedback in terms of both praise for SCIT's usefulness and also the view that the content can be somewhat challenging for patients with cognitive and motivational deficits to grasp, remember, and use (Parker, Foley, Walker, & Dark, 2013; Penn, Roberts, Combs, & Sterne, 2007; D. L. P. Penn & D. L. R. Roberts, unpublished data). These feedback data support efforts to simplify social cognitive intervention techniques to facilitate patients' learning and engagement.

This study has several limitations. First, the study used a modest sample size and a TAU comparison group rather than an active treatment control. However, these characteristics are consistent with typical treatment development trials. Second, research assistants guessed group assignment at a 66.7% accuracy rate suggesting that blinding may have been compromised.

Overall, this study suggests that SCIT may yield modest benefits in improving social functioning, negative symptoms and possibly hostile attributional bias. Findings also suggest that SCIT may be more effective in greater dosage. Thus, one challenge for ongoing development of SCIT is to increase treatment intensity and decrease difficulty while continuing to maximize patients' sense of the content as engaging and personally relevant.

Acknowledgements

This study was supported by an NIMH R-34 grant to DLP (NIMH 1-R34-MH080010-01). The SCIT manual will be available from Oxford University Press in mid 2014. We thank Drs. Piper Meyer, Sarah Uzenoff, and Ms. Katy Harper-Romeo, M.A. for assisting in data collection, and the following mental health facilities for participating in the study: Schizophrenia Treatment and Evaluation Program (UNC), Outreach and Support Intervention Services (UNC), Triumph Corporation, Area Services and Programs, Thresholds, and Club Nova.

References

Bartholomeusz, C., Allott, K., Killackey, E., Liu, P., Wood, S., & Thompson, A. (2013). Social cognition training as an intervention for improving functional outcome in first episode psychosis: A feasibility study. *Early Intervention in Psychiatry*, *7*, 421–426. doi:10.1111/eip.12036

Bellack, A. S., Schooler, N., & Marder, S. R. (2004). Do clozapine and risperidone affect social competence and problem solving? *American Journal of Psychiatry*, *161*, 364–367.

Bentall, R. P., Rowse, G., Shryane, N., Kinderman, P., Howard, R., Blackwood, N., … Corcoran, R. (2009). The cognitive and affective structure of paranoid delusions. *Archives of General Psychiatry*, *66*, 236–247. doi:10.1001/archgenpsychiatry.2009.1

Birchwood, M., Smith, J., Cochrane, R., Wetton, S., & Copestake, S. (1990). The Social Functioning Scale: The development and validation of a new scale of social adjustment for use in family intervention programmes with schizophrenic patients. *British Journal of Psychiatry*, *157*, 853–859.

Breier, A., Schreiber, J. L., Dyer, J., & Pickar, D. (1991). National Institute of Mental Health longitudinal study of chronic schizophrenia: Prognosis and predictors of outcome. *Archives of General Psychiatry*, *48*, 239–246.

Brekke, J. S., Hoe, M., Long, J., & Green, M. F. (2007). How neurocognition and social cognition influence functional change during community-based psychosocial rehabilitation for individuals with schizophrenia. *Schizophrenia Bulletin*, *33*, 1247–1256.

Brenner, H., Hodel, V., Roder, V., & Corrigan, P. (1992). Treatment of cognitive dysfunctions and behavioral deficits in schizophrenia. *Schizophrenia Bulletin*, *19*, 21–24.

Chan, R. C. K., Gao, X.-J., Li, X.-Y., Li, H.-H., Cui, J.-F., Deng, Y.-Y., & Wang, Y. (2010). The Social Cognition and Interaction Training (SCIT): An extension to individuals with schizotypcal personality features. *Psychiatry Research*, *178*, 208–210. doi:10.1016/j.psychres.2010.03.017

Combs, D. R., Adams, S. D., Penn, D. L., Roberts, D., Tiegreen, J., & Stem, P. (2007). Social Cognition and Interaction Training (SCIT) for inpatients with schizophrenia spectrum disorders: Preliminary findings. *Schizophrenia Research*, *91*, 112–116.

Combs, D. R., Elerson, K., Penn, D. L., Tiegreen, J. A., Nelson, A., Ledet, S. N., & Basso, M. R. (2009). Stability and generalization of Social Cognition and Interaction Training (SCIT) for schizophrenia: Six-month follow-up results. *Schizophrenia Research*, *112*, 196–197. doi:10.1016/j.schres.2009.04.010

Combs, D. R., Penn, D. L., Wicher, M., & Waldheter, E. (2007). The Ambiguous Intensions Hostility Questionnaire (AIHQ): A new measure for evaluating attributional biases in paranoia. *Cognitive Neuropsychiatry*, *12*, 128–143.

Combs, D. R., Tosheva, A., Penn, D. L., Basso, M. R., Wanner, J. L., & Laib, K. (2008). Attentional-shaping as a means to improve emotion perception deficits in schizophrenia. *Schizophrenia Research*, *105*, 68–77. doi:10.1016/j.schres.2008.05.018

Corcoran, R., Mercer, G., & Frith, C. (1995). Schizophrenia, symptomatology and social inference: Investigating "theory of mind" in people with schizophrenia. *Schizophrenia Research*, *17*, 5–13.

Cornblatt, B. A., Auther, A. M., Niendam, T., Smith, C. W., Zinberg, J., Bearden, C. E., & Cannon, T. D. (2007). Preliminary findings for two new measures of social and role functioning in the prodromal phase of schizophrenia. *Schizophrenia Bulletin*, *33*, 688–702.

Coursey, R. D., Keller, A. B., & Ferrell, W. E. (1995). Individual psychotherapy and persons with serious mental illness: The clients' perspective. *Schizophrenia Bulletin*, *21*, 283–301.

Couture, S. M., & Penn, D. L. (2012). Introduction. In D. L. Roberts & D. L. Penn (Eds.), *Social cognition in schizophrenia: From evidence to treatment* (pp. 1–18). New York, NY: Oxford University Press.

Couture, S. M., Penn, D. L., & Roberts, D. L. (2006). The functional significance of social cognition in schizophrenia: A review. *Schizophrenia Bulletin*, *32*, S44–S63.

Fett, A.-K. J., Viechtbauer, W., Dominquez, M. D. G., Penn, D. L., van Os, J., & Krabbendam, L. (2011). The relationship between neurocognition and social cognition with functional outcomes in schizophrenia: A meta-analysis. *Neuroscience and Biobehavioral Reviews*, *35*, 573–588. doi:10.1016/j.neubiorev.2010.07.001

First, M. B., Spitzer, R. L., Gibbon, M., & Williams, J. (1996). *Structured Clinical Interview for DSM-IV Axis I Disorders – Patient edition (SCID-I/P, version 2.0)*. New York, NY: Biometrics Research Department, New York State Psychiatric Institute.

Fiszdon, J. M. (2013). Introduction to social cognitive treatment approaches for schizophrenia. In D. L. Roberts & D. L. Penn (Eds.), *Social cognition in schizophrenia: From evidence to treatment* (pp. 285–310). New York, NY: Oxford University Press.

Garety, P. A., Fowler, D. G., Freeman, D., Bebbington, P., Dunn, G., & Kuipers, E. (2008). Cognitive-behavioural therapy and family intervention for relapse prevention and symptom reduction in psychosis: Randomised controlled trial. *British Journal of Psychiatry*, *192*, 412–423. doi:10.1192/bjp.bp.107.043570

Garety, P. A., & Freeman, D. (1999). Cognitive approaches to delusions: A critical review of theories and evidence. *British Journal of Clinical Psychology*, *38*, 113–154.

Green, M. F., Penn, D. L., Bentall, R., Carpenter, W. T., Gaebel, W., Gur, R. C., … Heinssen, R. (2008). Social cognition in schizophrenia: An NIMH workshop on definitions, assessment, and research opportunities. *Schizophrenia Bulletin*, *34*, 1211–1220. doi:10.1093/schbul/sbm145

Hasson-Ohayon, I., Mashiach-Eizenberg, M., Avidan, M., Roberts, D. L., & Roe, D. (2014). Social Cognition and Interaction Training: Preliminary results of a RCT study in a community setting in Israel. *Psychiatric Services*, *65*, 555–558. doi:10.1176/appi.ps.201300146

Healey, K., Roberts, D., Combs, D., & Penn, D. (2012, November 17). *Observable Social Cognition: A Rating Scale: An interview-based assessment for schizophrenia*. Presented at the annual meeting of the Association for Behavioral and Cognitive Therapies, National Harbor, MD.

Heinrichs, D. W., Hanlon, T. E., & Carpenter, W. T. (1984). The Quality of Life Scale: An instrument for rating the schizophrenic deficit syndrome. *Schizophrenia Bulletin*, *10*, 388–398.

Hofer, A., Baumgartner, S., Edlinger, M., Hummer, M., Kemmler, G., Rettenbacher, M. A., … Fleischhacker, W. W. (2005). Patient outcomes in schizophrenia I: Correlates with sociodemographic variables, psychopathology, and side effects. *European Psychiatry*, *20*, 386–394.

Hogarty, G. E., & Greenwald, D. P. (2006). *Cognitive enhancement therapy: The training manual*. Retrieved from http://www.CognitiveEnhancementTherapy.com

Horan, W. P., Kern, R. S., Shokat-Fadai, K., Sergi, M. J., Wynn, J. K., & Green, M. F. (2009). Social cognitive skills training in schizophrenia: An initial efficacy study of stabilized outpatients. *Schizophrenia Research*, *107*, 47–54. doi:10.1016/j.schres.2008.09.006

Kay, S. R., Fiszbein, A., & Opler, L. A. (1987). The positive and negative syndrome scale (PANSS) for schizophrenia. *Schizophrenia Bulletin*, *13*, 261–276.

Keefe, R. S., Poe, M., Walker, T. M., Kang, J. W., & Harvey, P. D. (2006). The Schizophrenia Cognition Rating Scale: An interview-based assessment and its relationship to cognition, real-world functioning, and functional capacity. *American Journal of Psychiatry*, *163*, 426–432.

Kerr, S. L., & Neale, J. M. (1993). Emotion perception in schizophrenia: Specific deficit or further evidence of generalized poor performance? *Journal of Abnormal Psychology*, *102*, 312–318.

Kohler, C. G., Anselmo-Gallagher, G., Bikler, W., Karlawish, J., Gur, R. E., & Clark, C. M. (2005). Emotion-discrimination deficits in mild Alzheimer disease. *The American Journal of Geriatric Psychiatry*, *13*, 926–933.

Kurtz, M. M., & Mueser, K. T. (2008). A meta-analysis of controlled research on social skills training for schizophrenia. *Journal of Consulting and Clinical Psychology*, *76*, 491–504. doi:10.1037/0022-006X.76.3.491

Lahera, G., Benito, A., Montes, J. M., Fernandez-Liria, A., Olbert, C. M., & Penn, D. L. (2012). Social cognition and interaction training (SCIT) for outpatients with bipolar disorder. *Journal of Affective Disorders*, *146*, 132–136. doi:10.1016/j.jad.2012.06.032

McDonald, S., Flanagan, S., Rollins, J., & Kinch, J. (2003). TASIT: A new clinical tool for assessing social perception after traumatic brain injury. *Journal of Head Trauma Rehabilitation*, *18*, 219–238.

Medalia, A., & Richardson, R. (2005). What predicts a good response to cognitive remediation interventions? *Schizophrenia Bulletin*, *31*, 942–953.

Middelboe, T., Mackeprang, T., Hansson, L., Werdelin, G., Karlsson, H., Bjarnason, O., *et al.* (2001). The Nordic study on schizophrenic patients living in the community: Subjective needs and perceived help. *European Psychiatry*, *16*, 207–214.

Milev, P., Ho, B.-C., Arndt, S., & Andreasen, N. C. (2005). Predictive values of neurocognition and negative symptoms on functional outcome in schizophrenia: A longitudinal first-episode study with 7-year follow-up. *American Journal of Psychiatry*, *162*, 495–506.

Parker, S., Foley, S., Walker, P., & Dark, F. (2013). Improving the social cognitive deficits in schizophrenia: A community trial of Social Cognition and Interaction Training (SCIT). *Australas Psychiatry*, *21*, 346–351. doi:10.1177/1039856213486305

Patterson, T. L., Moscona, S., McKibbin, C. L., Davidson, K., & Jeste, D. V. (2001). Social skills performance assessment among older patients with schizophrenia. *Schizophrenia Research*, *48*, 351–360.

Penn, D. L., Keefe, R. S. E., Davis, S. M., Perkins, D. O., Meyer, P., Losardo, D., & Lieberman, J. A. (2009). The effects of antipsychotic medications on emotion perception in patients with chronic schizophrenia. *Schizophrenia Research*, *115*, 17–23. doi:10.1016/j.schres.2009.08.016

Penn, D. L., Roberts, D. L., Combs, D., & Sterne, A. (2007). The development of the Social Cognition and Interaction Training program for schizophrenia spectrum disorders. *Psychiatric Services*, *58*, 449–451.

Penn, D. L., Sanna, L., & Roberts, D. L. (2008). Social cognition in schizophrenia: An overview. *Schizophrenia Bulletin*, *34*, 408–411. doi:10.1093/schbul/sbn014

Pinkham, A. E., & Penn, D. L. (2006). Neurocognitive and social cognitive predictors of interpersonal skill in schizophrenia. *Psychiatry Research*, *143*, 167–178.

Roberts, D. L., & Penn, D. L. (2009). Social Cognition and Interaction Training (SCIT) for outpatients with schizophrenia: A preliminary study. *Psychiatry Research*, *166*, 141–147.

Roberts, D. L., Penn, D. L., & Combs, D. R. (in press). *Social Cognition and Interaction Training (SCIT): Treatment manual*. New York: Oxford University Press.

Roberts, D. L., Penn, D. L., Corrigan, P., Lipkovitch, I., Kinon, B., & Black, R. A. (2010). Antipsychotic medication and social cue recognition in chronic schizophrenia. *Psychiatry Research*, *178*, 46–50. doi:10.1016/j.psychres.2010.04.006

Roberts, D. L., Penn, D. L., Labate, D., Margolis, S., & Sterne, A. (2010). Transportability and feasibility of Social Cognition and Interaction Training (SCIT) in community settings. *Behavioural & Cognitive Psychotherapy*, *38*, 35–47. doi:10.1017/S1352465809990464

Roder, V., Mueller, D. R., Brenner, H. D., & Spaulding, W. D. (2010). *Integrated psychological therapy (IPT) for the treatment of neurocognition, social cognition, and social competency in schizophrenia patients*. Cambridge, MA: Hogrefe Publishing.

Roncone, R., Mazza, M., Frangou, I., De Risio, A., Ussorio, D., Tozzini, C., *et al.* (2004). Rehabilitation of theory of mind deficit in schizophrenia: A pilot study of metacognitive strategies in group treatment. *Neuropsychological Rehabilitation*, *14*, 421–435.

Sergi, M. J., Rassovsky, Y., Widmark, C., Reist, C., Erhart, S., Braff, D. L., … Green, M. F. (2007). Social cognition in schizophrenia: Relationships with neurocognition and negative symptoms. *Schizophrenia Research*, *90*, 316–324.

Silver, H., Goodman, C., Knoll, G., & Isakov, V. (2004). Brief emotion training improves recognition of facial emotions in chronic schizophrenia. A pilot study. *Psychiatry Research*, *128*, 147–154.

Tas, C., Danaci, A. E., Cubukcuoglu, Z., & Brune, M. (2012). Impact of family involvement on social cognition training in clinically stable outpatients with schizophrenia—A randomized pilot study. *Psychiatry Research*, *195*, 32–38. doi:10.1016/j.psychres.2011.07.031

Turner-Brown, L. M., Ratto, A. B., Dichter, G., Rupp, B., & Penn, D. L. (under review). *Social Cognition and Interaction Training for Autism (SCIT-A) improves social functioning and psychological well-being in adolescents with autism spectrum disorders*.

Velligan, D. I., Roberts, D. L., & Good, E. (in press). Psychosocial treatment for negative symptoms: Where we have been and where we are going. *American Journal of Psychiatric Rehabilitation*.

Villeneuve, K., Potvin, S., Lesage, A., & Nicole, L. (2010). Meta-analysis of rates of drop-out from psychosocial treatment among persons with schizophrenia spectrum disorder. *Schizophrenia Research*, *121*, 266–270.

Wang, Y., Roberts, D. L., Xu, B., Cao, R., Yan, M., & Jiang, Q. (2013). Social cognition and interaction training for patients with stable schizophrenia in Chinese community settings. *Psychiatry Research*, *210*, 751–755.

Wechsler, D. (1999). *Wechsler Abbreviated Scale of Intelligence*. New York, NY: The Psychological Corporation; Harcourt Brace & Company.

Wolwer, W., Frommann, N., Halfmann, S., Piaszek, A., Streit, M., & Gaebel, W. (2005). Remediation of impairments in facial affect recognition in schizophrenia: Efficacy and specificity of a new training program. *Schizophrenia Research*, *80*, 295–303.

Received 30 April 2013; revised version received 26 November 2013