



Review

Social cognition interventions for people with schizophrenia: a systematic review focussing on methodological quality and intervention modality



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HIGHLIGHTS

- This is the first systematic review to compare modular and global intervention for social cognition.
- Both modular and global social cognition interventions are effective in improving theory of mind and affect recognition.
- There is insufficient evidence for benefit to social perception, attributional bias and functional outcomes.
- The evidence quality is limited by measure heterogeneity, modest study methodology and short follow-up periods.

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ABSTRACT

Background: People with a diagnosis of schizophrenia have significant social and functional difficulties. Social cognition was found to influence these outcomes and in recent years interventions targeting this domain were developed. This paper reviews the existing literature on social cognition interventions for people with a diagnosis of schizophrenia focussing on: i) comparing focussed (i.e. targeting only one social cognitive domain) and global interventions and ii) studies methodological quality.

Method: Systematic search was conducted on PubMed and PsycInfo. Studies were included if they were randomised control trials, participants had a diagnosis of schizophrenia or schizoaffective disorder, and the intervention targeted at least one out of four social cognition domains (i.e. theory of mind, affect recognition, social perception and attribution bias). All papers were assessed for methodological quality. Information on the intervention, control condition, study methodology and the main findings from each study were extracted and critically summarised.

Results: Data from 32 studies fulfilled the inclusion criteria, considering a total of 1440 participants. Taking part in social cognition interventions produced significant improvements in theory of mind and affect recognition compared to both passive and active control conditions. Results were less clear for social perception and attributional bias. Focussed and global interventions had similar results on outcomes. Overall study methodological quality was modest. There was very limited evidence showing that social cognitive intervention result in functional outcome improvement.

Conclusions: The evidence considered suggests that social cognition interventions may be a valuable approach for people with a diagnosis of schizophrenia. However, evidence quality is limited by measure heterogeneity, modest study methodology and short follow-up periods. The findings point to a number of recommendations for future research, including measurement standardisation, appropriately powered studies and investigation of the impact of social cognition improvements on functioning problems.

1. Introduction

One of the main unresolved challenges in the treatment of schizophrenia is addressing functional problems. Whilst antipsychotic medications are considered effective in managing positive symptoms, these

treatments have only a modest impact on functioning difficulties (Swartz et al., 2007). Cognitive impairments in schizophrenia have been consistently identified as a treatment target because of their relevance to functioning (Carbon & Correll, 2014). Authors have argued that these represent a core aetiological feature of schizophrenia and

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may be as important as positive symptoms in predicting recovery (e.g. Kahn & Keefe, 2013). With current pharmacological interventions having a little effect on cognitive impairments, there is a clear need to develop effective treatments to tackle cognition (Cella, Reeder, & Wykes, 2015a; Murray et al., 2016; Reichenberg et al., 2014). Social cognition explains more functional outcome variance than basic cognition and has therefore been increasingly considered as an important treatment target promoting functional change in people with a diagnosis of schizophrenia (Fett et al., 2011; Green, Olivier, Crawley, Penn, & Silverstein, 2005).

Several studies have found marked deficits in social cognition in people with a diagnosis of schizophrenia when compared to healthy controls (e.g. Savla, Vella, Armstrong, Penn, & Twamley, 2013). Research also showed that problems in social cognition are directly associated with impaired functioning (Couture, Penn, & Roberts, 2006; Fett et al., 2011). This notion led to the development of interventions targeting social cognition problems. A meta-analysis of training programmes reported moderate to large effect sizes for interventions on specific social cognitive domains: affect recognition and theory of mind (Kurtz & Richardson, 2012). Smaller effects were found for social perception and attribution bias. This review also suggests, from a restricted and heterogeneous pool of studies, that social cognition interventions have a moderate effect on functional outcomes. A second review recently confirmed these results (Kurtz, Gagen, Rocha, Machado, & Penn, 2016). However the studies included in these reviews considered only broad-based social cognition interventions (i.e. those targeting more than one social cognition domain). These two reviews also did not systematically assess the included studies for methodological quality. Studies with modest methodological quality may not detect reliable effect sizes. Studies with low power are less reliable in their estimate of the intervention true effect and may increase the chance of false positives (Button et al., 2013). It is therefore important for systematic reviews to consider how studies methodological quality relates to outcomes.

Despite social cognition interventions having the same overarching aim, there is substantial variability in format, implementation methods and therapy modalities. Some target multiple social cognition domains, (e.g. Social Cognitive Interaction Training, Combs et al., 2007, Penn, Roberts, Combs, & Sterne, 2007), while others selectively target only one domain (e.g. Targeted Theory of Mind program, Bechi et al., 2013). Some interventions are administered in a group format while many targeted interventions are delivered individually (e.g. Combs et al., 2007; Corrigan, Hirschbeck, & Wolfe, 1995). A number of interventions are administered by computer software (e.g. Sachs et al., 2012), while others are led by therapists (e.g. Taylor et al., 2015). In addition, programme length varies substantially, with some requiring as little as one session (e.g. Corrigan et al., 1995) while others last for over two years (e.g. Eack et al., 2009). The diversity in intervention modalities and delivery methods provides options for clinicians. However, at present there is limited understanding about which programmes should be selected. The study by Kurtz et al. (2016) excluded targeted interventions whilst previous reviews included these (Horan, Kern, Green, & Penn, 2008). One of the strengths of this review is the inclusion of both targeted and broad-based interventions, allowing investigation of how training in specific social cognition domains may influence others.

With many differences being specific of global or targeted programs it seems that comparing these two intervention clusters may highlight effective elements. Previous reviews in this area have not used systematic methods to evaluate study quality. It is likely that studies with poorer methodology may have over inflated results, or are subject to type II error due to insufficient power to reliably detect an effect size. Further, this review investigated both targeted and broad-based interventions. It is plausible that beneficial effects from one area (such as theory of mind) may transfer to other areas of social cognition or may exert a positively impact functioning. In addition, focussed interventions are easier to administer as they are often delivered in a one to one

format so can be used in settings where groups are not viable, for example with patients with social anxiety. Focussed interventions can also be included as part of a stepped-care approach and therefore may be relevant to low-intensity services. The consideration of focussed intervention studies will inform clinical practice where short-term and cost-effective interventions are highly valued.

This paper systematically reviews the current status of social cognition interventions, with particular reference to the issues that will be instrumental in evaluating their efficacy: methodological quality and intervention type. This review will also report on the effects of social cognition interventions on functioning outcomes to characterise the extent to which social cognitive change may impact people's everyday life functioning. Investigating these areas will provide a timely reflection on the status of social cognition intervention research and help direct future research towards areas where evidence is lacking or needs consolidation.

2. Methods

This systematic review was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher, Liberati, Tetzlaff, Altman, & Group, 2009) (see Appendix B for the PRISMA checklist).

2.1. Data sources and search terms

Systematic searches were conducted up to May 2016 using PsycInfo and PubMed databases. The following search terms were used as keywords: (“Social cogn*” OR “Training” OR “Rehabilitation” OR “Remediation”) AND (“Schizo*” OR “Psychotic” OR “Psychosis”). Only studies including human participants and those written in English were included. We also inspected the reference list of the included papers and relevant reviews (Fiszdon & Reddy, 2012; Kurtz & Richardson, 2012; Kurtz et al., 2016) to identify any additional relevant papers. Fig. 1 shows the selection process.

2.2. Study inclusion criteria

The inclusion criteria were: (a) randomised controlled trials including a social cognition intervention and a comparison group (e.g. treatment as usual or active control group); (b) participants were aged 18 to 65 years with a diagnosis of schizophrenia or schizoaffective disorder, according to the Diagnostic and Statistical Manual of Mental Disorder (Mendelson, 1995), Research Diagnostic Criteria (Spitzer, Endicott, & Robins, 1978) or International Classification of Diseases (Uribe, 1996); (c) the intervention targeted one or more social cognition domains. These are defined as theory of mind, affect recognition, attributional style and social perception. (d) If combined with other interventions targeting different outcomes (e.g. cognition), the social cognition intervention accounted for > 50% of the therapy time.

2.3. Procedures and data extraction

Initially, titles and abstracts were screened to identify eligible studies by two authors independently (NG and ML). Full text articles were obtained for all the studies considered eligible on the bases on the abstract screening and further reviewed for eligibility. Any disagreements were resolved with discussion with a third author (MC). From each included paper we extracted: participant number and demographic characteristics, details of the intervention (e.g. group/individual, duration), nature of the control group, social cognition outcomes and functioning outcomes. The results were grouped by four social cognition domains: affect recognition; theory of mind; social perception, attribution bias and also functional outcome. We considered studies describing treatment effect only when the interaction term was reported (i.e. group [treatment vs control] x time [pre and

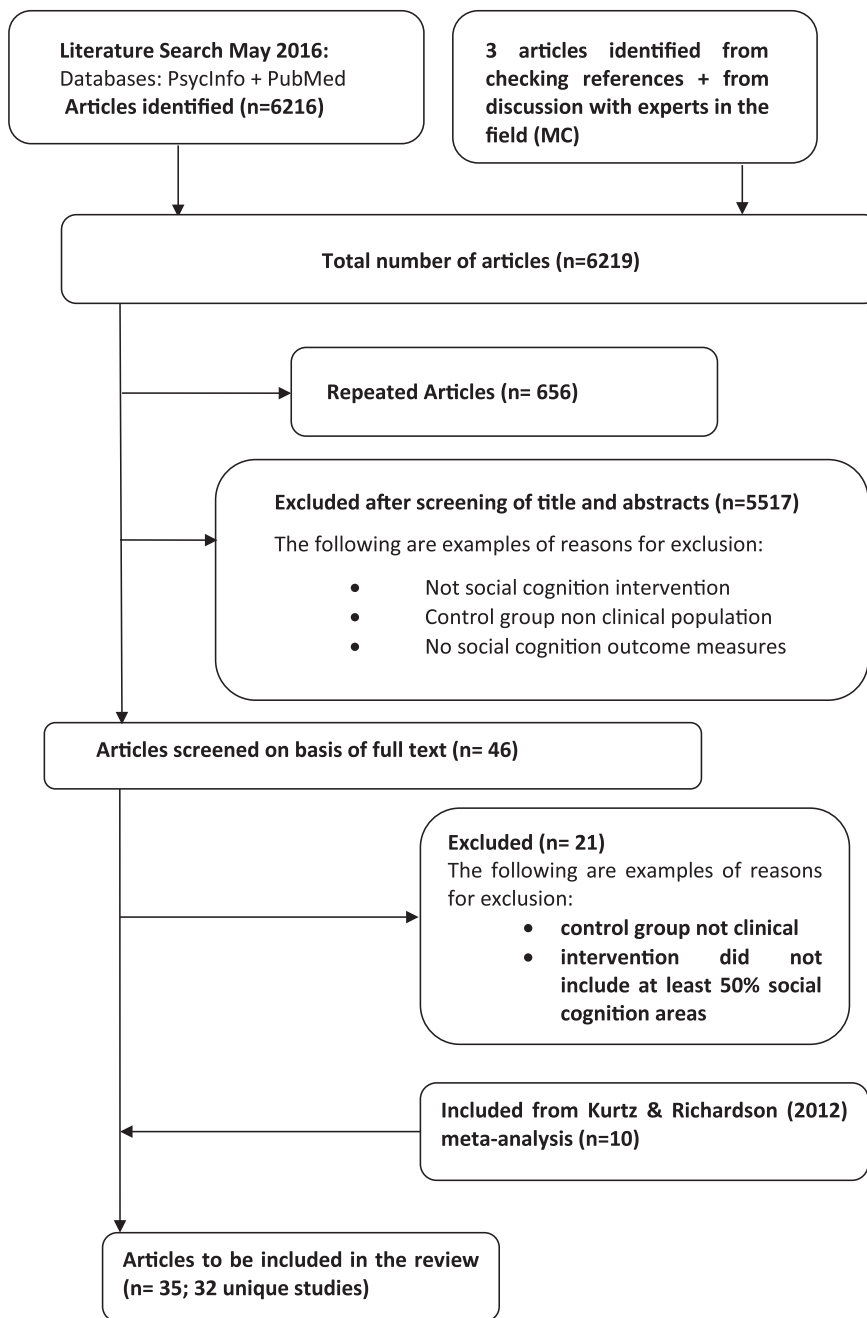


Fig. 1. Systematic search Consort diagram.

post intervention]). In cases where the interaction effect was not reported (e.g. only main effects for group or time), these results were described as *indicative* of efficacy.

2.4. Study quality

Study quality was assessed using the Clinical Trials Assessment Measure (CTAM) (Wykes, Steel, Everitt, & Tarrier, 2008). This is a 15-item measure of trial methodology specifically developed for psychological treatment studies. CTAM assesses methodological features related to: sample characteristics; treatment allocation; comparison condition; outcome assessments; treatment description and adherence and analysis. The maximum score is 100. The studies were independently rated by three authors (NG, ML, and MC) and discrepancies were discussed until consensus was reached. All corresponding authors of the included studies were contacted and asked to check the accuracy of the ratings. Twenty-five authors replied to this request and confirmed or

amend their study's CTAM score. The CTAM has been used to assess trial quality in systematic studies of psychological interventions for people with a diagnosis of schizophrenia and proved fit for purpose (Cella, Preti, Edwards, Dow, & Wykes, 2016b).

3. Results

3.1. Studies included in the review

Thirty-five papers reporting data from 32 unique studies were included. These studies considered total number of 1440 participants. Twelve studies were from the US, 18 from Europe and the remaining five from Australia, China, Egypt, Israel and Korea. Study characteristics are detailed in Table 1. The majority of participants were men (66%), with an average age of 36. Nineteen studies included outpatients, seven inpatients and a further six recruited mixed samples. Seventeen studies reported participants' illness duration, which ranged

Table 1
Description of the included studies.

Study	Age (years)	Intervention	Control	Sample	Gender (male)	Duration of illness (years)	Ethnicity	Data quality rating
Bechi et al. (2012)	SCT 37; SRT 38; NT 40	Video based training in AR and ToMI; 12 weeks of 1 h session	Social rehabilitation training, CRT 2 one hour sessions per week, for 12 weeks	Outpatients. SRT 24; 0 dropout; SCT 28, 1 dropout; NT 24, 2 dropouts	SRT 63%; SCT 68%; NT 67%	SRT 15; SCT 14; NT 17	Not reported	39
Bechi et al. (2013)	ToMI 37.7; control 37.7	Theory of Mind Intervention (ToMI); 18 weeks, 1 h sessions twice a week	18 1 h session twice a week Active control (newspaper discussion group)	30 outpatients (19 treatment no dropouts; 11 no dropouts)	ToMI 42%; ACG 54%	ToMI 10.8; ACG 15.4	Not reported	59
Bechi et al. (2015)	ToMI 40.3; SCT 38.1; control 37.2	ToMI 18 1 h sessions twice a week; SCT 1 h 12 weeks; plus CRT two 1 h sessions a week	16 weeks 1 h a week	75 outpatients; ToMI 32; SCT 24; ACG 19. Dropouts not mentioned.	ToMI 53%; SCT 67%; ACG 53%	ToMI 16.3; SCT 13.9; ACG 14.94	Not recorded	52
Choi and Kwon (2006)	SCET 30.8; control 34.1	Social Cognition Enhancement Training (SCET) 36 sessions, 1.5 h	Standard psychiatric rehabilitation training (coping skills, medication adherence)	Outpatients 17 SCET (7 dropouts); 17 control; 10 dropouts)	SCET 52%; Control 58%	SCET 9.3; Control 13.1	Not reported	35
Combs et al. (2007)	SCIT 41.3; control 44	SCIT; 18 h	18 h coping skills group	28 forensic inpatients (18 SCIT; 10 control) no information on dropouts	SCIT 67%; control 90%	SCIT 18.4; control 19.7	SCIT 61% white; control 50% white	60
Combs et al. (2008)	Total sample 38.7	Emotion Perception Intervention (based on attention or monetary incentive) for AR	FEIT only with no training	60 inpatients (20 in each group, no mention of dropouts)	65%	Not reported	43% white	57
Corrigan et al. (1995)	Intervention 35.9; control 34.7	1 h session Vigilance plus memory training for social perception (self-instruction, salient cues, repeated practice)	1 h session Vigilance alone	Inpatient and outpatient; 20 in each group	Intervention 45%; control 45%	59.9 day hospitalised exp.; 61.6 days hospitalised control	Exp 60% white; Control 25% white	41
Eack et al. (2009)	CET 25.9; EST 26.0	Cognitive Enhancement Therapy. Two years including 45 1.5 h social cognitive therapy	Enriched Supportive Therapy (EST; incl individual sessions on psychoeducation, relapse prevention)	58 inpatient and outpatient; CET 31, EST 27 (9 dropouts at 1 year, 12 at 2 years)	CET 65%; EST 74%	CET 3.1; EST 3.3	CET 68% white; EST 70% white	50
Eack et al. (2015)	CET 39.7; TAU 34.7	Cognitive Enhancement Therapy. 45 sessions 1.5 h	Treatment as usual	Outpatients with substance misuse. CET 22 (posttreatment 12); TAU 9 (posttreatment 8)	CET 68%; TAU 78%	CET 15.2; TAU 11.8	CET 68% white; TAU 33% white	65
García et al. (2003)	IPTS 40.5; control 36.9	Integrated Psychological Therapy for Schizophrenia Patients (IPTS)	No training condition	23 community (IPTS 5; 2 dropouts pre intervention, 6 lost to FU); 7 control (1 before test, 2 lost to FU)	IPTS 82% control 55%	IPTS 21; control 15	Not recorded	24
Gil Sanz et al. (2009)	PECS 33.3; control 41.4	Social Cognition Training Program (PECS)	Unclear but difference is that control group only received ER training, not SP	14 community patients (PECS 7; control 7) no information on dropouts	PECS 57%; control 43%	PECS 13.4; control 20.6	Not recorded	24
Gil-Sanz et al. (2014)	PECS 37.1; control 43.8	PECS	Attention and memory	83 community patients (PECS 44; control 39) no information on dropouts	PECS 40%; control 66%	PECS 12; control 16	White	51
Gohar, Hamdi, El Ray, Horan and Green (2013)	SCST 32.9; control 30.8	Social Cognitive Skills Training. 2 sessions per week for 8 weeks.	Skills Training Control Group. 16 sessions	42 outpatients (SCST 42; control 40. No dropouts)	SCST 72%; control 90%	SCST 21.6; control 22.5	Not reported	55
Hasson-Ohayon et al. (2014)	38.5 years	SCIT, plus social mentoring. 8 weeks, one hour sessions.	Social mentoring. Three times per week, 1 h	55 community patients (no drop outs)	69%	Not reported	Not reported	41
Habel et al. (2010)	TAR 31.4; TAU 33.7; HC 31.6	12 sessions of 45 mins Training in Affect Recognition (TAR)	Treatment as usual (no additional information); Healthy controls	30 inpatient and outpatient (10 treatment group 4 dropouts; 10 TAU 2 dropouts; 10 HC 2 dropouts)	100%	Not reported	Not reported	27
Horan et al. (2009)	SCT 50.7; Control 45.9	Social Cognitive Training: 12 1 h once a week	Active control group 12 1 h once a week; illness management and relapse prevention skills training	34 outpatients (SCT 15 2 dropouts; Control 16 1 dropout)	SCT 87%; Control 100%	Age at first psych hospitalisation. SCT 20.2; control 18.0	SCT 73% non-white; Control 79% non-white	39
Horan et al. (2011)	SCST 51; NR 46.6; ST	Social Cognitive Skills Training;	ST – standard illness management	85 outpatients consented	SCST 93.8%; NR	age of onset. SCST	SCST 75% non white	69 (continued on next page)

Table 1 (continued)

Study	Age (years)	Intervention	Control	Sample	Gender (male)	Duration of illness (years)	Ethnicity	Data quality rating
	45.1; Hybrid 50.4	24 sessions, Neurocognitive remediation; Hybrid combination.	training. Matched for contact time.	(SCST 16, 3 dropouts; NR 19, 5 dropouts; Hybrid 14 (7 dropouts)	89.5%; ST 78.9%; Hybrid 92.9%	19.7 yrs.; NR 22.7 yrs.; ST 24.1 yrs.; Hybrid 23.4 yrs	white; NR 78.9%; ST 63.2%; Hybrid 64.3%	
Kayser et al. (2006)	Intervention 32.4; control 38.2	2 one hour training sessions, Video clips showing social interactions, with training in theory of mind	Treatment as usual	14 (13 outpatients, 1 being discharged) (8 exp.; 6 control) dropouts not reported	Intervention 60%; control 84%	Intervention 12.3; control 11.5	Not reported	21
Mazza et al. (2010)	Intervention 24.4; control 24.7	Two days a week, 12 weeks 50 mins. Emotion and ToM Imitation Training (EITT). Reinforcement, facial feedback and combination targeting FAR.	Problem solving group	33 outpatients; EITT group 17; control group 16. 0 dropouts	59%	Intervention 6.3; control 6.5	Not reported	48
Penn and Combs (2000)	39.83 (not given by group)	Reinforcement, facial feedback and combination targeting FAR.	Repeated practice condition with no feedback	40 community patients (10; 12; 9; 9 group split) dropout info not reported	58%	17.1	55% White	42
Popova et al. (2014)	37 years	FAT consisted of training in affect recognition and working memory. 20 daily 1 h sessions over 4 weeks	CE standardised program of cognitive training, and treatment as usual	Inpatients; FAT 29, 10 dropouts; TAU 24, 5 dropouts; CE 27, 8 dropouts	66%	Not recorded	Not recorded	59
Roberts et al. (2014)	SCIT 40; TAU 39.4	20–24 Weekly hour long sessions of SCIT	TAU	66 outpatients (SCIT 33, 2 drop outs; TAU 33, 1 dropout)	SCIT 67% TAU; 67%	age at first hospitalisation SCIT 23; TAU 23	SCIT 55% white; TAU 73%	63
Roncone et al. (2004)	Intervention 33.9; control 33.5	Metacognitive Intervention Programme; 22 h of training to change social cognitive structure	Medication and supportive psychotherapy “where needed”	20 inpatients (10 exp.; 10 control) dropouts not mentioned	Intervention 60%; control 70%	Intervention 16.9; control 11.1	Not reported	58
Russell et al. (2008)	Intervention 40; control 44	METT	Repeated exposure	40 outpatients (26 in exp. groups, 13 in control 1 dropout in ctrl)	Intervention 65%; 71% control	Age at onset Intervention 21.6; control 23.6	Not recorded	28
Sachs et al. (2012)	TAR 27.2; TAU 31.7	12 sessions over 6 weeks; Training in Affect Recognition	12 sessions over 6 weeks Treatment as usual	40 inpatients and outpatients (TAR 20, 0 dropouts; control 18, 2 dropouts)	TAR 60%; TAU 40%	Age of first episode. TAR 24.3; TAU 24.3	Not reported	38
Tas et al. (2012)	F-SCIT 33.3, SS 34.6	14 weeks; based on SCIT program	14 weeks; Social Stimulation (SS)	49 outpatients (F-SCIT 19, 3 dropouts; SS 26, 1 dropout)	F-SCIT 57.9%; SS 46.2%	F-SCIT 12.6; SS 11.9	Not reported	52
Taylor et al. (2015)	SCIT 40.7; TAU 39.2	16 sessions, twice a week for 45 min. Based on SCIT.	TAU	45 forensic inpatients (SCIT 21, 5 dropouts; TAU 15, 4 dropouts)	100% (single sex ward)	Age at first admission SCIT 25.2; TAU 22.3	Afro-Caribbean SCIT 81%; TAU 73%	55
van der Gaag et al. (2002)	Intervention 30.4; control 31.7	22 sessions, training on perception; reasoning, emotion perception and social situations.	Treatment same as experimental group, but leisure activities substituted for intervention	42 inpatients (21 per group, 3 dropouts)	Intervention 62%; control 66%	Not recorded	Not recorded	48
Veltro et al. (2011)	REC 38.8; PST 37.7	24 sessions, 90 min Cognitive Emotional Rehabilitation (REC)	24 sessions, 90 min Problem solving training (PST)	24 outpatient	Not reported	REC 14.2; PST 11.9	Not reported	55
Wang et al. (2013)	SCIT 43.9; TAU 40.9	20 weeks based on SCIT	Treatment as usual	43 outpatients (SCIT 22, 0 dropouts; Control 21, 4 dropouts)	SCIT 54.5%; TAU 47.1%	Not reported	Not reported	58
Wolwer et al. (2005)	TAR 31.5; CRT 24; control 25	12 sessions TAR facial affect recognition; 12 sessions CRT neurocognition	TAU	Inpatient and outpatient TAR 28; CRT 24; 25 TAU (24 dropouts)	TAR 90%; CRT 58%; control 84%	Number of previous hospitalisations (TAR 4.8; CR T 6.2; TAU 3.3)	Not reported	48
Wolwer and Frommann (2011)	36.7	TAR facial affect recognition; 12 sessions 45–60 min	CRT neurocognition; 12 sessions 45–60 min	38 inpatients (TAR 20, 5 dropouts; CRT 18, 3 drops outs)	68%	7 first episode, 13 2–4 episodes, 13 had 5 or more	Not reported	77

(SCT Social cognitive training; SRT Standard rehabilitation treatment; NT Control group; CRT Cognitive remediation therapy; ToM Theory of Mind; ACG Active control group; SCIT Social cognitive interaction training; CET Cognitive enhancement training; FU Follow up; ER emotion recognition; SP social perception; Exp experimental group; TAR Training in affect recognition; SCST Social cognitive skills training; FAR Facial affect recognition; CE Cognitive exercises; METT Micro-expression training tool; F-SCIT Family involvement in social cognition training; SS Social stimulation; REC Cognitive emotional rehabilitation; PST Problem solving training.)

from 3 to 19 years with a mean duration of 13.4 years. The average study sample size was 45 participants (range 14–85).

3.2. Interventions description

Of the 32 studies included, 14 used an intervention targeting only one domain of social cognition, either emotion recognition or ToM, while the remaining 18 evaluated interventions that covered more than one domain of social cognition. The most common intervention targeting more than one domain of social cognition was the Social Cognitive and Interaction Training (SCIT) (Penn et al., 2007). This intervention targets four social cognition domains: theory of mind, affect recognition, attributional style and social perception. Other interventions targeting multiple social cognitive domains were loosely based on the SCIT template (Roberts, Penn, & Combs, 2016).

The majority of the interventions were delivered in a group format ($N = 24$), with the remaining programmes being delivered individually. Group size varied from 2 to 10 participants, while the number of facilitators was between one and five. One study also involved family members who attended four psychoeducation sessions to support therapy delivery (Tas, Danaci, Cubukcuoglu, & Brune, 2012). Most studies used a primary intervention that was therapist-led, especially when the intervention was in a group format. There were higher numbers of dropouts in studies which used comprehensive in comparison to focussed interventions (see Table 1).

3.3. Methodological quality

The mean CTAM score for the studies considered was 46.4 (SD 13.6; range 24–77). Out of the 25 papers whose authors replied to the request for information, 18 agreed with the score assigned and 7 provided further information. In these 7 cases the scores were increased. Procedures were described with enough detail in only 26% of the studies. For two studies, randomisation did not follow a 1:1 procedure so that more participants were allocated to the treatment condition compared to control (Popova et al., 2014; Veltro et al., 2011). One study used a block randomisation procedure and randomised by ward (Taylor et al., 2015). Assessor blinding to treatment allocation was present in only 22% of studies. While all studies used validated measures as primary outcomes, independent raters were only used in 28% of the studies to administer these measures. The average sample size for the social cognition group was 20.7 (9.2), while in the control condition it was 19.9 (8.5). Of the studies considered 38% had treatment as usual as the control condition, 56% had an active control condition (e.g. cognitive remediation) and 6% had both (see Table 1 for full details). The majority of studies (88%) were underpowered to reliably detect the effect size reported. Seventy-five percent of studies reported a dropout rate which ranged from 0 to 24 participants with a mean of six. Of the studies which reported this figure, nine had a dropout rate of > 15%. Most studies (94%) provided a good description of the intervention and/or reference to protocols and manuals.

3.4. Social cognition intervention outcomes

Twenty-four social cognitive outcome measures were used. These were grouped in four domains: Theory of Mind, Affect Recognition, Attributional Style, and Social Perception Knowledge (see Appendix C).

3.5. Theory of mind

Eighteen studies included theory of mind (ToM) as an outcome and 13 found significant effects (Bechi et al., 2012, Bechi et al., 2013, Bechi et al., 2015, Combs et al., 2007, Gil-Sanz, Fernandez-Modamio, Bengochea-Seco, Arrieta-Rodriguez, & Perez-Fuentes, 2014, Hasson-Ohayon, Mashiach-Eizenberg, Avidan, Roberts, & Roe, 2014, Kayser, Sarfati, Besche, & Hardy-Bayle, 2006, Mazza et al., 2010, Roncone

et al., 2004, Tas et al., 2012, Taylor et al., 2015, Veltro et al., 2011, Wang et al., 2013, Wolwer & Frommann, 2011). Five studies failed to find any improvements following the intervention (Eack et al., 2015; Horan et al., 2009; Horan et al., 2011; Roberts et al., 2014; Taylor et al., 2015). All studies using a focussed intervention reported a significant effect. Of those using a broad-based intervention, seven found positive effects and five did not. One further study found generalizable effects from a targeted affect recognition intervention to ToM, but this intervention has a significant focus on ToM abilities.

3.6. Affect recognition

Twenty-six studies included data assessing the effect of social cognition interventions on Affect Recognition (AR). These studies used 15 different AR outcome measures, most ($N = 13$) consisted of facial affect recognition but two studies used speech measures where participants were required to identify emotion from a recorded speech. Positive effects were found for the majority of studies ($n = 15$) (Combs et al., 2007, Combs et al., 2008, Eack et al., 2015, Gohar, Hamdi, El Ray, Horan, & Green, 2013, Horan et al., 2009, Horan et al., 2011, Mazza et al., 2010, Penn & Combs, 2000, Popova et al., 2014, Roberts et al., 2014, Sachs et al., 2012, Tas et al., 2012, Taylor et al., 2015, Veltro et al., 2011, Wang et al., 2013). Other studies assessed the effect of the intervention using non-parametric analyses, did not control for baseline scores or did not report the interaction effect. Overall, these studies found an improvement on AR following intervention (Gil-Sanz et al., 2014; Habel et al., 2010; Roncone et al., 2004; Russell, Green, Simpson, & Coltheart, 2008; van der Gaag, Kern, van den Bosch, & Liberman, 2002; Wolwer et al., 2005), however this was not the case for one (Gil Sanz et al., 2009). No significant improvements were reported by four studies (Bechi et al., 2012; Choi & Kwon, 2006; Gil Sanz et al., 2009; Hasson-Ohayon et al., 2014; Roberts et al., 2014). All studies using a focussed intervention reported a positive effect. Of those with a broad-based intervention, 13 found a significant effect and five no effect.

3.7. Attribution style

Eight studies examined the effect of social cognition interventions on Attributional Style. These used three different attributional style measures (see Appendix C). Six found no significant effect of the intervention (Hasson-Ohayon et al., 2014; Horan et al., 2009; Roberts et al., 2014; Tas et al., 2012; Wang et al., 2013). Two studies, Horan et al. (2009) and Tas et al. (2012), found no significant main effects in two attribution measures: Ambiguous Intentions Hostility Questionnaire (AIHQ; Combs et al., 2007) and the Internal Personal and Situational Attribution Questionnaire (IPSAQ; Kinderman & Bentall, 1996), respectively. Roberts et al. (2014) found no interaction effect using the AIHQ, which was supported by Taylor et al. (2015). Combs et al. (2007) and Horan et al. (2011) did find a significant effect on the aggression subscale of the AIHQ. However, Horan et al. (2011) found improvements on the AIHQ Blame subscale. The interventions for attributional style in both of these studies were based on SCIT. All studies which included attributional style as an outcome used a broad-based intervention.

3.8. Social perception knowledge

Nine studies examined the effect of social cognition interventions on Social Perception Knowledge. These studies used nine different social perception measures (see Appendix C), and there was little consistency in the findings. Positive findings were reported by four studies (Choi & Kwon, 2006; Combs et al., 2007; Tas et al., 2012; Wolwer & Frommann, 2011) while two reported no effect (Horan et al., 2009; Horan et al., 2011). Three studies used non-parametric statistics and two of these found significant improvements (Garcia, Fuentes,

Ruiz, Gallach, & Roder, 2003; Gil Sanz et al., 2009) while one (Corrigan et al., 1995) did not. Of studies using a focussed intervention, one found not significant effects and one reported no effect. Of the seven using a broad-based intervention, two found no effects and the other five a significant effect.

3.9. Global social cognition

Two studies used measures of global social cognition. Eack et al. (2009) used a composite measure (see Appendix C) and showed that participants improved significantly on this measure following the intervention, and these effects were maintained at 2-year follow-up. Roberts et al. (2014) used an informant and interviewer rated scaled and found no differences following the intervention between the treatment and the control group.

3.10. Functional outcomes

Nineteen studies reported functional outcomes using 15 different measures (see Appendix A). Ten reported a significant effect of the intervention on functioning levels (Combs et al., 2007; Eack et al., 2015; Hasson-Ohayon et al., 2014; Mazza et al., 2010; Roberts et al., 2014; Roncone et al., 2004; Tas et al., 2012; Veltro et al., 2011; Wang et al., 2013; Wolwer & Frommann, 2011). Hasson-Ohayon et al. (2014) found improvements in social engagement but not in interpersonal communication. Roberts et al. (2014) found significant effects for social performance but not on a measure of quality of life.

The remainder used non-parametric statistics or reported only main effects from the analysis. Eack, Greenwald, Hogarty, and Keshavan (2010) using a composite measure of functional outcomes, found a significant main effect for the treatment group at one and two year follow-up. Gil-Sanz et al. (2009) also found improvement in measures of personal care and daily activities. Garcia et al. (2003) found significant improvements in one out of ten functional assessment scores considered.

To examine further the potential mechanisms by which social cognition improvement may affect functioning we carried out an explorative analysis to highlight the co-occurrence of significant findings using likelihood chi-square analyses (see Table 2). This indicated that only studies reporting a significant improvement in social perception reported a significantly higher chance of functional improvements.

3.11. Methodological quality and outcome

Table 3 shows the average CTAM rating following adjustment for studies in each of the five outcomes included in this review (theory of mind, affect recognition, social perception, attributional style, and functioning). There was no clear relationship between quality rating and outcome across the four social cognition domains, or in functional outcome. For example, studies which reported a significant effect for theory of mind had scores ranging from 21 to 77, compared to those

Table 2
Significant outcomes and functioning level.

		Functioning		L χ^2 (p)
		Significant	Not significant	
Theory of mind	Significant	8	2	0.22 (0.64)
	Not significant	2	1	
Affect recognition	Significant	9	3	1.95 (0.16)
	Not significant	4	0	
Attributional style	Significant	1	1	2.6 (0.11)
	Not significant	4	0	
Social perception	Significant	5	0	5.4 (0.02)
	Not significant	0	1	

Table 3
Quality ratings and findings.

	Studies with significant findings Mean (range)	Studies with null findings Mean (range)
Theory of mind	52 (21–77) n = 13	58 (39–69) n = 5
Affect recognition	52 (28–69) n = 17	40 (27–63) n = 6
Social perception	45 (24–77) n = 6	50 (39–59) n = 3
Attributional bias	64.5 (60–69) n = 2	61 (39–63) n = 6
Functioning	57 (24–69) n = 12	64 (38–77) n = 6

reporting no effect which had CTAM scores ranging from 39 to 69. In order to further examine the potential relationship between methodological quality and outcome, studies were split in to high and low quality based on the median of 48 (see Fig. 2). In studies with higher quality ratings, there appears to be a higher percentage finding significant results for theory of mind, affect recognition and social perception compared to those with not significant results. There was no clear pattern between outcome measures used and study quality rating. For theory of mind, there are a higher count of studies with high quality (72%) compared to low quality (28%).

4. Discussion

This review examined the effectiveness of social cognition interventions on social cognition domains and functional outcomes. Overall, our findings support, in line with previous research, the efficacy of social cognition interventions (Kurtz & Richardson, 2012; Kurtz et al., 2016).

The results suggest that both targeted and broad-based interventions are effective, particularly for theory of mind and affect recognition, but they do not seem to provide significant benefits for attributional style. Social perception improved in the majority of studies. However, the two studies that did not find a benefit were from the same research group (Horan et al., 2009; Horan et al., 2011) and used a similar intervention (i.e. SCST). A previous review found some evidence of positive effects for attributional bias, but only in 4 out of the 9 studies included (Kurtz et al., 2016). It is possible that specific psychotic symptoms may account for this inconsistent finding. For example, individuals with higher levels of paranoia have been shown to be more impaired on a measure of attributional bias compared to those with low paranoia (Pinkham, Harvey, & Penn, 2016) but no differences were found for theory of mind or affect perception. Further, a recent paper investigating the factorial structure of social cognition found that attributional style was separate from other social cognition domains (Buck, Healey, Gagen, Roberts, & Penn, 2016).

The studies that reported a positive effect on functional outcomes used a variety of interventions. These included both broad-based and focussed studies. The majority of studies which found an improvement in functioning also reported a change in theory of mind; with the exception of one (Roberts et al., 2014). This supports previous research suggesting that improvement in theory of mind may benefit more directly functional outcomes (Pollice et al., 2002). This could be because theory of mind skills may be more directly relevant to everyday social interactions and influences communication, social reasoning and pragmatism (Brune & Brune-Cohrs, 2006). Social perception improvements were associated with gains in functioning. However, of the 32 studies included in this review, only nine included measures of social perception. Previous reviews of social cognition and functional outcome supported this relationship, finding a moderate effect for social perception and community functioning (Fett et al., 2011). Social perception requires the ability to decode social interactions and also to understand them in context (Penn, Ritchie, Francis, Combs, & Martin, 2002). This contextual information may also be associated with theory of mind, explaining why both theory of mind and social perception were found associated to functional outcome improvements. We

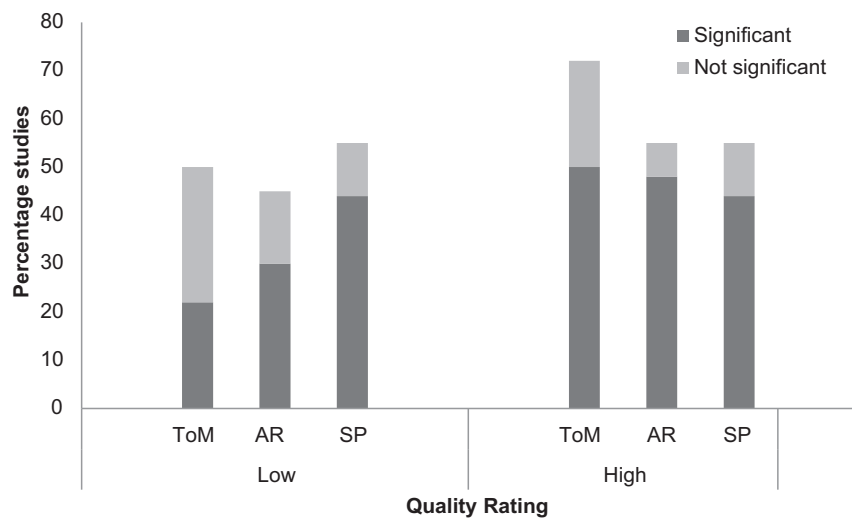


Fig. 2. Study quality ratings and social cognition outcomes.

investigated the specific contribution on functional outcome of only those studies which found a significant improvement in a social cognition outcome following intervention (to avoid the identification of false positives).

4.1. Limitations of included studies

The studies considered have several limitations. These can be grouped in main areas:

- (i) *Measure heterogeneity* across all social cognitive domains limited the possibility to draw conclusions on therapy efficacy. Measures may be assessing slightly different constructs or have limited psychometric validation. The Social Cognition Outcome Evaluation group has assessed relevant measures and made recommendations for future social cognition research (Pinkham et al., 2014). Studies which have not used these measures may increase the likelihood of finding a spurious effect. Indeed some studies included in this review used measures that were idiosyncratic and did not undergo rigorous validation (e.g. Kayser et al., 2006). It is also worth noting that none of the studies included in this review used measures of social perception recommended by the SCOPE panel (Pinkham et al., 2014). Additionally, many of the measures have not been tested on repeated assessment and their sensitivity to repeated usage is unknown. As found by the VALERO study, measurement of functioning may not capture entirely intervention effects (Harvey et al., 2011).
- (ii) *Durability of outcomes*: Social cognition interventions are time intensive for both therapists and service users and therefore costly. To be viable these interventions need to show that they can achieve durable improvements. However, most studies only reported outcomes at the end of the intervention period with no follow-up. Two studies only published follow-up findings of their original findings with a longer term outcome period suggesting a degree of improvement retention (Combs et al., 2009; Eack et al., 2010).
- (iii) *Methodological quality*: This review assessed the studies methodological quality in depth. The results showed that in 91% of the studies included the risk of bias was moderate to high (i.e. CTAM score < 65, as in Wykes, Huddy, Cellard, McGurk, & Czobor, 2011). The field of social cognition interventions is relatively young and it is to be expected that evaluation studies begin with pilot interventions. The surge of more approaches and the developing interest in this field, fuelled by promising results, means that to establish this approach, larger and appropriately powered trials should be conducted. The results of this review also showed that

studies tend to use multiple outcomes often with a number of subscales. This is a further limitation, as studies tended to report positive findings but rarely controlled for multiple testing. A further methodological limitation relates to analysis. Many studies despite having a control group, estimated the effect of the therapy only by assessing change in the social cognition group. This is a source of bias because it does not account for changes in the control group over time and, when conducting randomised controlled studies, more reliable outcomes can be found by comparing groups rather than looking at single effects. Finally, assessor independence and blinding was relatively low. To put this in context, other reviews using the same bias rating measure reported greater data quality ratings, with means of 57.4 and 61.2 (Wykes et al., 2008; Wykes et al., 2011) for other psychological interventions in people with a diagnosis of schizophrenia, compared to the mean in this review of 47. Wykes et al. (2008) found large differences in effect sizes between studies with low and high methodology (high being defined as > 65) and suggested that caution should be used when drawing conclusions from these studies.

4.2. Social cognitive interventions: what's next?

Limited research in this area has investigated service users' satisfaction with the intervention outcomes and participants' personal goal achievement (e.g. Crawford et al., 2011). Having outcomes aligned with service users' priorities should be an important area of future development. The high rates of dropouts in some studies suggest that some interventions may need refinement to become more acceptable (e.g. Choi & Kwon, 2006; Popova et al., 2014; Wolwer & Frommann, 2011; Wolwer et al., 2005).

Whilst social cognition is related to community functioning (Cella, Edwards, & Wykes, 2016a; Fett et al., 2011; Pijnenborg et al., 2009) it does not necessarily follow that improving social cognition will automatically translate in improved function. Transfer mechanisms and opportunities to use therapy skills in everyday life are likely to play an important part. Research in this field could explore mechanisms which are starting to gather support as relevant transfer mechanisms, such as metacognition (Cella, Reeder, & Wykes, 2015b; Koren, Seidman, Goldsmith, & Harvey, 2006).

As noted in the study limitations section above many of the studies included did not use recommended measures of social cognition. This is an area where future studies should improve. Future studies should measure include more routinely measures assessing each of the four main social cognition domains. Further, many studies had a CRT component either before or alongside the social cognition intervention. It would be beneficial to further explore this relationship, as a previous

study has suggested that CRT combined with social cognition can be an efficacious approach (Lindenmayer et al., 2013).

At present, there is limited evidence on what therapeutic mechanism may impact a specific domain. We also have limited information on how domain specific improvement may transfer to other domains. For example, Wolwer and Frommann (2011) found that a targeted intervention on affect recognition produced a positive effect on social perception. It will be a target for future studies which focus on one domain of social cognition should include additional domain outcomes measures to further explore the transfer of effects across domains. Both theory of mind and social perception appear to be important for functioning outcomes. However, there is no indication yet of the amount and type of training necessary to achieve significant functional gains. Further investigation of the effects of focussed interventions could be useful to low-intensity services for people with a diagnosis of schizophrenia.

Studies highlighting the role of possible moderating factors, would be also important to develop the next generation of social cognition programmes. This includes areas such as illness chronicity, initial levels of functional impairment, diagnosis, gender and inpatient/outpatient status. Cognition, in particular, is one such factor that is likely to have a role in moderating the ability of patients to respond to social cognitive training. One area of interest is negative symptoms, as there is evidence that this specific symptom domain is important in understanding the relationship between cognition and functioning (Lin et al., 2013).

Finally, future studies should strive to improve methodological rigour and statistical analyses. It would be also important to conduct appropriately powered studies so that the efficacy of an intervention can be estimated more precisely.

4.3. Conclusions

In conclusion, the evidence summarised suggests that social cognition interventions can improve affect recognition, theory of mind and social perception. However, there continues to be unclear evidence for attributional style and there is no clear relationship between improvement on social cognition measures and functional outcomes. To move the field forward we need to conduct appropriately powered and robustly designed studies and explore the mechanisms responsible for transferring social cognitive gains to everyday functioning benefits. There is also a need to further investigate transfer effects between focussed interventions and other social cognition domains.

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References

- Bechi, M., Bosia, M., Spangaro, M., Buonocore, M., Cocchi, F., Pigoni, A., ... Cavallaro, R. (2015). Combined social cognitive and neurocognitive rehabilitation strategies in schizophrenia: Neuropsychological and psychopathological influences on theory of mind improvement. *Psychological Medicine*, *45*, 3147–3157.
- Bechi, M., Riccaboni, R., Ali, S., Fresi, F., Buonocore, M., Bosia, M., ... Cavallaro, R. (2012). Theory of mind and emotion processing training for patients with schizophrenia: Preliminary findings. *Psychiatry Research*, *198*, 371–377.
- Bechi, M., Spangaro, M., Bosia, M., Zanoletti, A., Fresi, F., Buonocore, M., ... Cavallaro, R. (2013). Theory of mind intervention for outpatients with schizophrenia. *Neuropsychological Rehabilitation*, *23*, 383–400.
- Brune, M., & Brune-Cohrs, U. (2006). Theory of mind - evolution, ontogeny, brain mechanisms and psychopathology. *Neuroscience and Biobehavioral Reviews*, *30*, 437–455.
- Buck, B. E., Healey, K. M., Gagen, E. C., Roberts, D. L., & Penn, D. L. (2016). Social cognition in schizophrenia: Factor structure, clinical and functional correlates. *Journal of Mental Health*, *25*, 330–337.
- Button, K. S., Ioannidis, J. P., Mokrysz, C., Nosek, B. A., Flint, J., Robinson, E. S., & Munafo, M. R. (2013). Power failure: Why small sample size undermines the reliability of neuroscience. *Nature Reviews Neuroscience*, *14*, 365–376.
- Carbon, M., & Correll, C. U. (2014). Thinking and acting beyond the positive: The role of the cognitive and negative symptoms in schizophrenia. *CNS Spectrums*, *19*(Suppl. 1), 38–52 (quiz 35–7, 53).
- Cella, M., Edwards, C., & Wykes, T. (2016a). A question of time: A study of time use in people with schizophrenia. *Schizophrenia Research*, *176*, 480–484.
- Cella, M., Preti, A., Edwards, C., Dow, T., & Wykes, T. (2016b). Cognitive remediation for negative symptoms of schizophrenia: A network meta-analysis. *Clinical Psychology Review*, *52*, 43–51.
- Cella, M., Reeder, C., & Wykes, T. (2015a). Cognitive remediation in schizophrenia — Now it is really getting personal. *Current Opinion in Behavioral Sciences*, *4*, 147–151.
- Cella, M., Reeder, C., & Wykes, T. (2015b). Lessons learnt? The importance of meta-cognition and its implications for cognitive remediation in schizophrenia. *Frontiers in Psychology*, *6*, 1259.
- Choi, K. H., & Kwon, J. H. (2006). Social cognition enhancement training for schizophrenia: A preliminary randomized controlled trial. *Community Mental Health Journal*, *42*, 177–187.
- 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.
- 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.
- Corrigan, P. W., Hirschbeck, J. N., & Wolfe, M. (1995). Memory and vigilance training to improve social perception in schizophrenia. *Schizophrenia Research*, *17*, 257–265.
- Couture, S. M., Penn, D. L., & Roberts, D. L. (2006). The functional significance of social cognition in schizophrenia: A review. *Schizophrenia Bulletin*, *32*(Suppl. 1), S44–S63.
- Crawford, M. J., Robotham, D., Thanan, L., Patterson, S., Weaver, T., Barber, R., ... Rose, D. (2011). Selecting outcome measures in mental health: The views of service users. *Journal of Mental Health*, *20*, 336–346.
- Eack, S. M., Greenwald, D. P., Hogarty, S. S., Cooley, S. J., DiBarry, A. L., Montrose, D. M., & Keshavan, M. S. (2009). Cognitive enhancement therapy for early-course schizophrenia: Effects of a two-year randomized controlled trial. *Psychiatric Services*, *60*, 1468–1476.
- Eack, S. M., Greenwald, D. P., Hogarty, S. S., & Keshavan, M. S. (2010). One-year durability of the effects of cognitive enhancement therapy on functional outcome in early schizophrenia. *Schizophrenia Research*, *120*, 210–216.
- Eack, S. M., Hogarty, S. S., Greenwald, D. P., Litschge, M. Y., McKnight, S. A., Bangalore, S. S., ... Cornelius, J. R. (2015). Cognitive enhancement therapy in substance misusing schizophrenia: Results of an 18-month feasibility trial. *Schizophrenia Research*, *161*, 478–483.
- Fett, A. K., Viechtbauer, W., Dominguez, M. D., 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.
- Fiszdon, J. M., & Reddy, L. F. (2012). Review of social cognitive treatments for psychosis. *Clinical Psychology Review*, *32*, 724–740.
- van der Gaag, M., Kern, R. S., van den Bosch, R. J., & Liberman, R. P. (2002). A controlled trial of cognitive remediation in schizophrenia. *Schizophrenia Bulletin*, *28*, 167–176.
- García, S., Fuentes, I., Ruiz, J. C., Gallach, E., & Roder, V. (2003). Application of the IPT in a Spanish sample: Evaluation of the social perception subprogramme. *International Journal of Psychology and Psychological Therapy*, *3*, 299–310.
- Gil Sanz, D., Diego Lorenzo, M., Bengochea Seco, R., Arrieta Rodríguez, M., Lastra Martínez, I., Sánchez Calleja, R., & Alvarez, Soltero A. (2009 May). Efficacy of a social cognition training program for schizophrenic patients: A pilot study. *The Spanish Journal of Psychology*, *12*(1), 184–191 PubMed PMID: 19476231.
- Gil-Sanz, D., Fernandez-Modamio, M., Bengochea-Seco, R., Arrieta-Rodríguez, M., & Perez-Fuentes, G. (2014). Efficacy of the social cognition training program in a sample of schizophrenic outpatients. *Clinical Schizophrenia & Related Psychoses*, *1*–27.
- Gohar, S. M., Hamdi, E., El Ray, L. A., Horan, W. P., & Green, M. F. (2013 Aug). Adapting and evaluating a social cognitive remediation program for schizophrenia in Arabic. *Schizophrenia Research*, *148*(1–3), 12–17. <http://dx.doi.org/10.1016/j.schres.2013>.

- 05.008 Epub 2013 Jun 4. PubMed PMID: 23756297.
- Green, M. F., Olivier, B., Crawley, J. N., Penn, D. L., & Silverstein, S. (2005). Social cognition in schizophrenia: Recommendations from the measurement and treatment research to improve cognition in schizophrenia new approaches conference. *Schizophrenia Bulletin*, *31*, 882–887.
- Habel, U., Koch, K., Kellermann, T., Reske, M., Frommann, N., Wolwer, W., ... Schneider, F. (2010). Training of affect recognition in schizophrenia: Neurobiological correlates. *Social Neuroscience*, *5*, 92–104.
- Harvey, P. D., Raykov, T., Twamley, E. W., Vella, L., Heaton, R. K., & Patterson, T. L. (2011). Validating the measurement of real-world functional outcomes: Phase I results of the VALERO study. *The American Journal of Psychiatry*, *168*, 1195–1201.
- Hasson-Ohayon, I., Mashiach-Eizenberg, M., Avidan, M., Roberts, D. L., & Roe, D. (2014). Social cognition and interaction training: Preliminary results of an RCT in a community setting in Israel. *Psychiatric Services*, *65*, 555–558.
- 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.
- Horan, W. P., Kern, R. S., Tripp, C., Helleman, G., Wynn, J. K., Bell, M., ... Green, M. F. (2011). Efficacy and specificity of social cognitive skills training for outpatients with psychotic disorders. *Journal of Psychiatric Research*, *45*, 1113–1122.
- Horan, W. P., Kern, S. R., Green, M. F., & Penn, D. (2008). Social cognition training for individuals with schizophrenia: Emerging evidence. *American Journal of Psychiatric Rehabilitation*, *11*, 205–252.
- Kahn, R. S., & Keefe, R. S. (2013). Schizophrenia is a cognitive illness: Time for a change in focus. *JAMA Psychiatry*, *70*, 1107–1112.
- Kayser, N., Sarfati, Y., Besche, C., & Hardy-Bayle, M. C. (2006). Elaboration of a rehabilitation method based on a pathogenetic hypothesis of “theory of mind” impairment in schizophrenia. *Neuropsychological Rehabilitation*, *16*, 83–95.
- Kinderman, P., & Bentall, R. P. (1996). A new measure of causal locus: The internal, personal and situational attributions questionnaire. *Personality and Individual Differences*, *20*, 261–264.
- Koren, D., Seidman, L. J., Goldsmith, M., & Harvey, P. D. (2006). Real-world cognitive- and metacognitive-dysfunction in schizophrenia: A new approach for measuring (and remediating) more “right stuff”. *Schizophrenia Bulletin*, *32*, 310–326.
- Kurtz, M. M., Gagen, E., Rocha, N. B., Machado, S., & Penn, D. L. (2016). Comprehensive treatments for social cognitive deficits in schizophrenia: A critical review and effect-size analysis of controlled studies. *Clinical Psychology Review*, *43*, 80–89.
- Kurtz, M. M., & Richardson, C. L. (2012). Social cognitive training for schizophrenia: A meta-analytic investigation of controlled research. *Schizophrenia Bulletin*, *38*, 1092–1104.
- Lin, C. H., Huang, C. L., Chang, Y. C., Chen, P. W., Lin, C. Y., Tsai, G. E., & Lane, H. Y. (2013). Clinical symptoms, mainly negative symptoms, mediate the influence of neurocognition and social cognition on functional outcome of schizophrenia. *Schizophrenia Research*, *146*, 231–237.
- Lindenmayer, J. P., McGurk, S. R., Khan, A., Kaushik, S., Thanju, A., Hoffman, L., ... Herrmann, E. (2013). Improving social cognition in schizophrenia: A pilot intervention combining computerized social cognition training with cognitive remediation. *Schizophrenia Bulletin*, *39*, 507–517.
- Mazza, M., Lucci, G., Pacitti, F., Pino, M. C., Mariano, M., Casacchia, M., & Roncone, R. (2010). Could schizophrenic subjects improve their social cognition abilities only with observation and imitation of social situations? *Neuropsychological Rehabilitation*, *20*, 675–703.
- Mendelson, G. (1995). Diagnostic and statistical manual of mental-disorders, 4th edition (Dsm-iv). *Australian and New Zealand Journal of Psychiatry*, *29*, 529–535.
- Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & Group, P. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *BMJ*, *339*, b2535.
- Murray, R. M., Quattrone, D., Natesan, S., van Os, J., Nordentoft, M., Howes, O., ... Taylor, D. (2016). Should psychiatrists be more cautious about the long-term prophylactic use of antipsychotics? *The British Journal of Psychiatry*, *209*, 361–365.
- Penn, D. L., & Combs, D. (2000). Modification of affect perception deficits in schizophrenia. *Schizophrenia Research*, *46*, 217–229.
- Penn, D. L., Ritchie, M., Francis, J., Combs, D., & Martin, J. (2002). Social perception in schizophrenia: The role of context. *Psychiatry Research*, *109*, 149–159.
- Penn, D. L., Roberts, D. L., Combs, D., & Sterne, A. (2007). Best practices: The development of the Social Cognition and Interaction Training program for schizophrenia spectrum disorders. *Psychiatric Services*, *58*, 449–451.
- Pijnenborg, G. H., Withaar, F. K., Evans, J. J., van den Bosch, R. J., Timmerman, M. E., & Brouwer, W. H. (2009). The predictive value of measures of social cognition for community functioning in schizophrenia: Implications for neuropsychological assessment. *Journal of the International Neuropsychological Society*, *15*, 239–247.
- Pinkham, A. E., Harvey, P. D., & Penn, D. L. (2016). Paranoid individuals with schizophrenia show greater social cognitive bias and worse social functioning than non-paranoid individuals with schizophrenia. *Schizophrenia Research Cognitive*, *3*, 33–38.
- Pinkham, A. E., Penn, D. L., Green, M. F., Buck, B., Healey, K., & Harvey, P. D. (2014). The social cognition psychometric evaluation study: Results of the expert survey and RAND panel. *Schizophrenia Bulletin*, *40*, 813–823.
- Pollice, R., Roncone, R., Falloon, I. R. H., Mazza, M., De Risio, A., Necozone, S., ... Casacchia, M. (2002). Is theory of mind in schizophrenia more strongly associated with clinical and social functioning than with neurocognitive deficits? *Psychopathology*, *35*, 280–288.
- Popova, P., Popov, T. G., Wienbruch, C., Carolus, A. M., Miller, G. A., & Rockstroh, B. S. (2014). Changing facial affect recognition in schizophrenia: Effects of training on brain dynamics. *Neuroimage Clinics*, *6*, 156–165.
- Reichenberg, A., Feo, C., Prestia, D., Bowie, C. R., Patterson, T. L., & Harvey, P. D. (2014). The course and correlates of everyday functioning in schizophrenia. *Schizophrenia Research Cognitive*, *1*, e47–e52.
- Roberts, D. L., Combs, D. R., Willoughby, M., Mintz, J., Gibson, C., Rupp, B., & Penn, D. L. (2014). A randomized, controlled trial of Social Cognition and Interaction Training (SCIT) for outpatients with schizophrenia spectrum disorders. *The British Journal of Clinical Psychology*, *53*, 281–298.
- Roberts, D. L., Penn, D. L., & Combs, D. R. (2016). *Social cognition and interaction training (SCIT): Group psychotherapy for schizophrenia and other psychotic disorders clinician guide*. Oxford; New York: Oxford University Press.
- Roncone, R., Mazza, M., Frangou, I., De Risio, A., Ussorio, D., Tozzini, C., & Casacchia, M. (2004). Rehabilitation of theory of mind deficit in schizophrenia: A pilot study of metacognitive strategies in group treatment. *Neuropsychological Rehabilitation*, *14*, 421–435.
- Russell, T. A., Green, M. J., Simpson, I., & Coltheart, M. (2008). Remediation of facial emotion perception in schizophrenia: Concomitant changes in visual attention. *Schizophrenia Research*, *103*, 248–256.
- Sachs, G., Winklbaur, B., Jagsch, R., Lasser, I., Kryspin-Exner, I., Frommann, N., & Wolwer, W. (2012). Training of affect recognition (TAR) in schizophrenia—impact on functional outcome. *Schizophrenia Research*, *138*, 262–267.
- Savla, G. N., Vella, L., Armstrong, C. C., Penn, D. L., & Twamley, E. W. (2013). Deficits in domains of social cognition in schizophrenia: A meta-analysis of the empirical evidence. *Schizophrenia Bulletin*, *39*, 979–992.
- Spitzer, R. L., Endicott, J., & Robins, E. (1978). Research diagnostic criteria - rationale and reliability. *Archives of General Psychiatry*, *35*, 773–782.
- Swartz, M. S., Perkins, D. O., Stroup, T. S., Davis, S. M., Capuano, G., Rosenheck, R. A., ... Investigators, C. (2007). Effects of antipsychotic medications on psychosocial functioning in patients with chronic schizophrenia: Findings from the NIMH CATIE study. *The American Journal of Psychiatry*, *164*, 428–436.
- 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.
- Taylor, R., Cella, M., Csipke, E., Heriot-Maitland, C., Gibbs, C., & Wykes, T. (2015). Tackling social cognition in schizophrenia: A randomized feasibility trial. *Behavioural and Cognitive Psychotherapy*, *1*–12.
- Uribe, M. O. (1996). International classification of diseases, World Health Organization, tenth version ICD-10. *Salud Mental*, *19*, 11–18.
- Veltro, F., Mazza, M., Vendittelli, N., Alberti, M., Casacchia, M., & Roncone, R. (2011). A comparison of the effectiveness of problem solving training and of cognitive-emotional rehabilitation on neurocognition, social cognition and social functioning in people with schizophrenia. *Clinical Practice and Epidemiology in Mental Health*, *7*, 123–132.
- 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.
- Wolwer, W., & Frommann, N. (2011). Social-cognitive remediation in schizophrenia: Generalization of effects of the Training of Affect Recognition (TAR). *Schizophrenia Bulletin*, *37*(Suppl. 2), S63–S70.
- 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.
- Wykes, T., Huddy, V., Cellard, C., McGurk, S. R., & Czobor, P. (2011). A meta-analysis of cognitive remediation for schizophrenia: Methodology and effect sizes. *American Journal of Psychiatry*, *168*, 472–485.
- Wykes, T., Steel, C., Everitt, B., & Tarrier, N. (2008). Cognitive behavior therapy for schizophrenia: Effect sizes, clinical models, and methodological rigor. *Schizophrenia Bulletin*, *34*, 523–537.