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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 influences 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 attributional 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 relevant to functioning (Carbon & Correll, 2014). Authors have argued that these represent a core aetiological feature of schizophrenia and
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 (Pisdzon & Reddy, 2012; Kurtz & Richardson, 2012; Kurtz et al., 2016) to identify any additional relevant papers. Fig. 1 shows the selectin 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 (Urine, 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 considerate 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
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 amended 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.

<table>
<thead>
<tr>
<th>Study</th>
<th>Age (years)</th>
<th>Intervention</th>
<th>Control</th>
<th>Sample</th>
<th>Gender (male)</th>
<th>Duration of illness (years)</th>
<th>Ethnicity</th>
<th>Data quality rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bechi et al. (2012)</td>
<td>SCT 37; SRT 38; NT 40</td>
<td>Video based training in AR and ToM; 12 weeks of 1 h session</td>
<td>Social rehabilitation training, CRT 2 one hour sessions per week, for 12 weeks 18 h session twice a week Active control (newspaper discussion group) 16 weeks 1 h a week</td>
<td>Outpatients. SRT 24, 0 dropout; SCT 28, 1 dropout; NT 24, 2 dropouts 30 outpatients (19 treatment no dropouts; 11 no dropouts)</td>
<td>SRT 63%; SCT 68%; NT 67%</td>
<td>SRT 15; SCT 14; NT 17</td>
<td>Not reported</td>
<td>39</td>
</tr>
<tr>
<td>Bechi et al. (2013)</td>
<td>ToMI 37.7; control 37.7</td>
<td>Theory of Mind Intervention (ToMI); 18 weeks, 1 h sessions twice a week</td>
<td>75 outpatients; ToMI 32; SCT 24; AGG 19. Dropouts not mentioned. ToMI 53%; SCT 67%; AGG 53%</td>
<td>ToMI 42%; AGG 54%</td>
<td>ToMI 10.8; AGG 15.4</td>
<td>Not reported</td>
<td>59</td>
<td></td>
</tr>
<tr>
<td>Bechi et al. (2015)</td>
<td>ToMI 40.3; SCT 38.1; control 37.2</td>
<td>ToMI 18 h sessions twice a week; SCT 1 h 12 weeks; plus CRT two 1 h sessions a week</td>
<td>Social Cognition Enhancement Training (SCET) 36 sessions, 1.5 h SCT 18 h</td>
<td>Outpatients 17 SCET (7 dropouts); 17 control; 10 dropouts</td>
<td>SCET 52%; Control 58%</td>
<td>SCET 9.3; Control 13.1</td>
<td>Not reported</td>
<td>35</td>
</tr>
<tr>
<td>Choi and Kwon (2006)</td>
<td>SCET 30.8; control 34.1</td>
<td>SCET 30.8; control 34.1</td>
<td>28 forensic inpatients (18 SCET; 10 control) no information on dropouts</td>
<td>SCIT 18.4; control 19.7</td>
<td>SCIT 67%; control 90%</td>
<td>Not reported</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>Combs et al. (2007)</td>
<td>SCIT 41.3; control 44</td>
<td>SCIT 41.3; control 44</td>
<td>18 h coping skills group</td>
<td>SCIT 18.4; control 19.7</td>
<td>SCIT 67%; control 90%</td>
<td>Not reported</td>
<td>43% white</td>
<td>57</td>
</tr>
<tr>
<td>Combs et al. (2008)</td>
<td>Total sample 38.7</td>
<td>Emotion Perception Intervention (based on attention or monetary incentive) for AR</td>
<td>FEIT only with no training</td>
<td>Intervention 45%; control 45%</td>
<td>Intervention 59.9 day hospitalised exp.; 61.6 days hospitalised</td>
<td>Not reported</td>
<td>Exp 60% white; Control 25%</td>
<td>41</td>
</tr>
<tr>
<td>Corrigan et al. (1995)</td>
<td>1 h session Vigilance alone</td>
<td>1 h session Vigilance alone</td>
<td>Inpatient and outpatient; 20 in each group</td>
<td>Intervention 45%; control 45%</td>
<td>Intervention 59.9 day hospitalised exp.; 61.6 days hospitalised</td>
<td>Exp 60% white; Control 25%</td>
<td>41</td>
<td></td>
</tr>
<tr>
<td>Eck et al. (2009)</td>
<td>CET 25.9; IST 26.0</td>
<td>Cognitive Enhancement Therapy. Two years including 45 1.5 h social cognitive therapy</td>
<td>Enriched Supportive Therapy (IST; incl individual sessions on psychoeducation, relapse prevention)</td>
<td>SCIT 10.8; control 40</td>
<td>SCIT 65%; EST 74%</td>
<td>CET 31.1; EST 3.3</td>
<td>CET 68% white; EST 70% white</td>
<td>50</td>
</tr>
<tr>
<td>Eck et al. (2015)</td>
<td>CET 39.7; TAU 34.7</td>
<td>Cognitive Enhancement Therapy. 45 sessions 1.5 h</td>
<td>Treatment as usual</td>
<td>Outpatients with substance misuse. CET 22 (posttreatment 12); TAU 9 (posttreatment 8) 23 community (IPTS 5; 2 dropouts pre intervention, 6 lost to FU); 7 control (1 before test, 2 lost to FU)</td>
<td>CET 68%; TAU 78%</td>
<td>CET 15.2; TAU 11.8</td>
<td>CET 68% white; TAU 33% white</td>
<td>65</td>
</tr>
<tr>
<td>Garcia et al. (2003)</td>
<td>IPTS 40.5; control 36.9</td>
<td>Integrated Psychological Therapy for Schizophrenia Patients (IPTS)</td>
<td>No training condition</td>
<td>IPST 82% control</td>
<td>IPST 21; control 15</td>
<td>Not reported</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>Gil Sanz et al. (2009)</td>
<td>PECS 33.3; control 41.4</td>
<td>Social Cognition Training Program (PECS)</td>
<td>Unclear but difference is that control group only received ER training, not SP</td>
<td>14 community patients (PECS 7; control 7) no information on dropouts</td>
<td>PECS 57%; control 43%</td>
<td>PECS 13.4; control 20.6</td>
<td>Not reported</td>
<td>24</td>
</tr>
<tr>
<td>Gil-Sanz et al. (2014)</td>
<td>PECS 37.1; control 43.8</td>
<td>PECS</td>
<td>Attention and memory</td>
<td>83 community patients (PECS 44; control 39) no information on dropouts</td>
<td>PECS 40%; control 66%</td>
<td>PECS 12; control 16</td>
<td>White 51</td>
<td>51</td>
</tr>
<tr>
<td>Gohar, Handi, El Ray, Horan and Green (2013)</td>
<td>38.5 years</td>
<td>Social Cognitive Skills Training. 2 sessions per week for 8 weeks.</td>
<td>Skills Training Control Group. 16 sessions</td>
<td>42 outpatients (SCST 42; control 40. No dropouts)</td>
<td>SCST 72%; control 90%</td>
<td>SCST 21.6; control 22.5</td>
<td>Not reported</td>
<td>55</td>
</tr>
<tr>
<td>Hasson-Ohayon et al. (2014)</td>
<td>TAR 31.4; TAU 33.7; HC 31.6</td>
<td>SCIT, plus social mentoring. 8 weeks, one hour sessions. 12 sessions of 45 mins Training in Affect Recognition (TAR)</td>
<td>Social mentoring; Three times per week, 1 h Treatment as usual (no additional information); Healthy controls</td>
<td>35 community patients (no drop out); 30 inpatient and outpatient (10 treatment group 4 dropouts; 10 TAU 2 dropouts; 10 HC 2 dropouts)</td>
<td>SCST 72%; control 90%</td>
<td>SCST 21.6; control 22.5</td>
<td>Not reported</td>
<td>41</td>
</tr>
<tr>
<td>Habel et al. (2010)</td>
<td>SCIT 50.7; Control 45.9</td>
<td>Social Cognitive Training; 12 h a week</td>
<td>Active control group 12 h a week; illness management and relapse prevention skills training</td>
<td>34 outpatients (SCIT 15 2 dropouts; Control 16 1 dropouts)</td>
<td>SCIT 87%; Control 100%</td>
<td>Age at first psych hospitalisation. SCT 20.2; control 18.0</td>
<td>SCT 73% non-white; Control 79% non-white</td>
<td>39</td>
</tr>
<tr>
<td>Horan et al. (2011)</td>
<td>SCST 51; NR 46.6; ST</td>
<td>Social Cognitive Skills Training; ST – standard illness management</td>
<td>85 outpatients consented</td>
<td>SCST 93.8%; NR</td>
<td>SCST 93.8%</td>
<td>SCST 93.8%</td>
<td>SCST 75% non-white</td>
<td>69</td>
</tr>
</tbody>
</table>

(continued on next page)
<table>
<thead>
<tr>
<th>Study</th>
<th>Age (years)</th>
<th>Intervention</th>
<th>Control</th>
<th>Sample</th>
<th>Gender (male)</th>
<th>Duration of illness (years)</th>
<th>Ethnicity</th>
<th>Data quality rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kayser et al. (2006)</td>
<td>45.1; Hybrid 50.4</td>
<td>24 sessions, Neurocognitive remediation; Hybrid combination.</td>
<td>training, Matched for contact time.</td>
<td>SCIT 16, 3 dropouts; NR 19, 5 dropouts; Hybrid 14 (7 dropouts)</td>
<td>89.5%, ST 78.9%; Hybrid 92.9%</td>
<td>19.7 yrs.; NR 22.7 yrs.; ST 24.1 yrs; Hybrid 23.4 yrs</td>
<td>white; NR 78.9%; ST 63.2%; Hybrid 64.3%</td>
<td>21</td>
</tr>
<tr>
<td>Mazza et al. (2010)</td>
<td>Intervention 24.4; control 24.7</td>
<td>Two days a week, 12 weeks 50 mins. Emotion and ToM Imitation Training (ETIT).</td>
<td>Problem solving group</td>
<td>33 dropouts; ETIT group; control group 16.0 dropouts</td>
<td>59%</td>
<td>Intervention 12.3; control 11.5</td>
<td>Not reported</td>
<td>48</td>
</tr>
<tr>
<td>Penn and Combs (2000)</td>
<td>39.83 (not given by group)</td>
<td>Reinforcement, facial feedback and combination targeting PAR.</td>
<td>Repeated practice condition with no feedback</td>
<td>40 community patients; FAT 29, 10 dropouts</td>
<td>58%</td>
<td>Intervention 6.3; control 6.5</td>
<td>Not reported</td>
<td>42</td>
</tr>
<tr>
<td>Roberts et al. (2014)</td>
<td>37 years</td>
<td>FAT consisted of training in affect recognition and working memory. 20 daily 1 h sessions over 4 weeks</td>
<td>CE standardised program of cognitive training, and treatment as usual</td>
<td>6%</td>
<td>Not recorded</td>
<td>Not recorded</td>
<td>Not recorded</td>
<td>59</td>
</tr>
<tr>
<td>Sachs et al. (2012)</td>
<td>TAR 27.2; TAU 31.7</td>
<td>12 sessions over 6 weeks; Training in Affect Recognition</td>
<td>12 sessions over 6 weeks</td>
<td>TAR 60%; TAU 40%</td>
<td>Age of first hospitalisation</td>
<td>Not recorded</td>
<td>Not recorded</td>
<td>38</td>
</tr>
<tr>
<td>Tas et al. (2012)</td>
<td>F-SCIT 33.3; SS 34.6</td>
<td>14 weeks; based on SCIT program</td>
<td>14 weeks; Social Stimulation (SS)</td>
<td>F-SCIT 67%; SS 67%</td>
<td>Age at first admission; SCIT 23; TAU 23</td>
<td>Sample differences</td>
<td>52</td>
<td></td>
</tr>
<tr>
<td>Taylor et al. (2015)</td>
<td>SCIT 40.7; TAU 39.2</td>
<td>16 sessions, twice a week for 45 min. Based on SCIT.</td>
<td>16 sessions over 6 weeks</td>
<td>SCIT 57.9%; SS 46.2%</td>
<td>F-SCIT 12.6; SS 11.9</td>
<td>Not reported</td>
<td>55</td>
<td></td>
</tr>
<tr>
<td>van der Gaag et al. (2002)</td>
<td>Intervention 30.4; control 31.7</td>
<td>22 sessions, training on perception, reasoning, emotion perception and social situations.</td>
<td>Treatment as experimental group, but leisure activities substituted for intervention</td>
<td>Intervention 62%; control 66%</td>
<td>Not recorded</td>
<td>Not recorded</td>
<td>48</td>
<td></td>
</tr>
<tr>
<td>Veltro et al. (2011)</td>
<td>REC 38.8; PST 37.7</td>
<td>24 sessions, 90 min Cognitive Emotional Rehabilitation (REC)</td>
<td>24 sessions, 90 min Problem solving training (PST)</td>
<td>24 outpatient</td>
<td>Not recorded</td>
<td>Not recorded</td>
<td>55</td>
<td></td>
</tr>
<tr>
<td>Wang et al. (2013)</td>
<td>SCIT 43.9; TAU 40.9</td>
<td>20 weeks based on SCIT</td>
<td>20 weeks over 6 weeks</td>
<td>SCIT 43.5%; TAU 47.1%</td>
<td>Not reported</td>
<td>Not reported</td>
<td>58</td>
<td></td>
</tr>
<tr>
<td>Wolfer et al. (2005)</td>
<td>TAR 31.5; CRT 24; control 25</td>
<td>12 sessions TAR facial affect recognition; 12 sessions CRT neurocognition</td>
<td>Treatment as usual</td>
<td>Inpatient and outpatient TAR 90%; CRT 58%; control 84%</td>
<td>Number of previous hospitalisations (TAR 8.4; CRT 6.2; TAU 3.3)</td>
<td>Not reported</td>
<td>48</td>
<td></td>
</tr>
<tr>
<td>Wolfer and Frommann (2011)</td>
<td>36.7</td>
<td>TAR facial affect recognition; 12 sessions 45–60 min</td>
<td>CRT neurocognition; 12 sessions 45–60 min</td>
<td>38 dropouts</td>
<td>68%</td>
<td>7 first episode, 13 2–4 episodes, 13 had 5 or more</td>
<td>Not reported</td>
<td>77</td>
</tr>
</tbody>
</table>

(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; PU: Follow up; ER: emotion recognition; SP: social perception; Exp: Experimental group; TAR: Training in affect recognition; 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., 2016). 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 as 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).

3.4. 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, Bengoechea-Seco, Arrieta-Rodriguez, & Perez-Fuentes, 2014, Hasson-Ohayon, Mashiah-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 (IPIAQ; 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; Veltrò et al., 2011; Wang et al., 2013; Wolver & Frommlow, 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 outcome across the four social cognition domains, or in functional functioning (Roberts et al., 2014) found significant effects 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%).

<table>
<thead>
<tr>
<th>Table 3</th>
<th>Quality ratings and findings.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Studies with significant findings</td>
</tr>
<tr>
<td></td>
<td>Mean (range)</td>
</tr>
<tr>
<td>Theory of mind</td>
<td>52 (21–77) n = 13</td>
</tr>
<tr>
<td>Affect recognition</td>
<td>52 (28–69) n = 17</td>
</tr>
<tr>
<td>Social perception</td>
<td>45 (24–77) n = 6</td>
</tr>
<tr>
<td>Attributional bias</td>
<td>64 (60–69) n = 2</td>
</tr>
<tr>
<td>Functioning</td>
<td>57 (24–69) n = 12</td>
</tr>
</tbody>
</table>

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

Table 2

Significant outcomes and functioning level.

<table>
<thead>
<tr>
<th>Functioning</th>
<th>xy^2 (p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Significant</td>
<td>Not significant</td>
</tr>
<tr>
<td>Theory of mind</td>
<td>8 2 0.22 (0.64)</td>
</tr>
<tr>
<td>Affect recognition</td>
<td>9 3 1.95 (0.16)</td>
</tr>
<tr>
<td>Attributional style</td>
<td>4 0 2.6 (0.11)</td>
</tr>
<tr>
<td>Social perception</td>
<td>5 0 5.4 (0.02)</td>
</tr>
</tbody>
</table>

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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, Woller and Fromm (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 of functional impairment, diagnosis, gender and inpatient/outpatient 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 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.

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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Contributors
NG, MC study idea; NG, ML, AP, MC systematic searches data extraction and data quality checks; NG, ML data analysis; NG, ML, AP, TW, MC manuscript drafting. All authors approved the final version of this manuscript.

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