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Efficacy and specificity of Social Cognitive Skills Training for outpatients with psychotic disorders

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Abstract

Psychosocial interventions that target social cognition show promise for enhancing the functional outcomes of people with psychotic disorders. This randomized controlled trial evaluated the efficacy and treatment-outcome specificity of a 24-session Social Cognitive Skills Training (SCST) that targets emotional processing, social perception, attributional bias, and mentalizing (or Theory of Mind). Sixty-eight stable outpatients with primary psychotic disorders were randomly assigned to one of four time- and group format-matched treatment conditions: (1) SCST, (2) computerized neurocognitive remediation, (3) standard illness management skills training, or (4) a Hybrid treatment that combined elements of SCST and neurocognitive remediation. The SCST group demonstrated greater improvements over time than comparison groups in the social cognitive domain of emotional processing, including improvement on measures of facial affect perception and emotion management. There were no differential benefits among treatment conditions on neurocognitive or clinical symptom changes over time. Results indicate that a targeted social cognitive intervention led to improvements in social cognition among outpatients with psychosis. Findings provide guidance for continued efforts to maximize the benefits of social cognitive interventions.

Keywords

Schizophrenia; Psychosocial treatment; Social cognition; Skills training

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Contributions Drs. Green, Horan, Kern, Bell, and Marder designed the study and wrote the protocol. Drs. Horan and Hellemann undertook the statistical analysis. Dr. Wynn and Ms. Tripp assisted with data acquisition and processing. Dr. Horan wrote the first draft of the manuscript. All authors contributed to and have approved the final manuscript.

Conflict of interest None.

1. Introduction

Recovery-oriented treatments for schizophrenia and related psychotic disorders reflect a fundamental shift from a narrow focus on symptom reduction to the broader goal of functional recovery (Kern et al., 2009a). The development of such treatments involves identifying key determinants of poor functioning and testing interventions designed to ameliorate them. Considerable evidence indicates that cognitive factors, including neurocognition (defined here as non-social aspects of cognition such as speed of processing, memory, attention) and social cognition are important determinants of functional outcome (Horan et al., in press; Mandal et al., 1998; Pinkham et al., 2003). Neurocognition has well-documented relations to functioning (Green et al., 2000, 2004) that have led to major efforts to enhance neurocognition through training interventions (Bell et al., 2008; Dickinson et al., 2010; Fisher et al., 2009; McGurk et al., 2007) and pharmacological interventions (Marder and Fenton, 2004). More recently, social cognition has emerged as a high-priority for research and treatment development partly because it appears to have a unique role in the cognitive processes that lead to poor functional outcomes.

Individuals with schizophrenia show substantial social cognitive impairments in emotion processing (e.g., affect perception and regulation), social perception, attributional style, and mentalizing or “Theory of Mind” (Green and Horan, 2010). Mounting evidence indicates that these impairments account for incremental variance in outcome, above and beyond neurocognition, and that they mediate the relation between neurocognition and outcome (Bell et al., 2009; Couture et al., 2006; Horan et al., in press). This mediating role suggests social cognition is more proximal to functional outcome than is neurocognition and, for that reason, could be an even better target for interventions that generalize to improvements in functioning. Several studies of treatment programs that specifically target social cognition impairments provide evidence for their efficacy in inpatient samples (Horan et al., 2008). For example, pioneering work by Frommann et al. (2003), Wölwer et al. (2005) and Penn et al. (2007) established the feasibility and efficacy of interventions targeting one or more of the social cognitive domains noted above.

More recent studies extended these treatments to community dwelling outpatients (Roberts and Penn, 2009; Roberts et al., 2010). In an initial randomized controlled trial our group examined the efficacy of a structured 12-session Social Cognitive Skills Training (SCST) intervention as compared to 12 sessions of standard illness management skills training in outpatients with psychotic disorders (Horan et al., 2009). The intervention combined successful elements from two existing programs mentioned above (Frommann et al., 2003; Penn et al., 2007) with a variety of novel training exercises and materials to target emotion identification, social perception, attributional bias, and mentalizing. The SCST group demonstrated a significant improvement in facial affect perception that was independent of symptoms and not present in the control group, supporting the feasibility and efficacy of targeted interventions in outpatients. The groups did not significantly differ on neurocognitive changes.

These findings from our initial study are generally consistent with a study by Wölwer et al. (2005) in which hospitalized inpatients who received their Training in Affect Recognition

(TAR), a 12-session intervention administered to pairs of participants that targets facial affect perception, or neurocognitive remediation. In that study, the TAR group demonstrated significant improvements in facial affect recognition, whereas patients receiving computerized neurocognitive remediation did not demonstrate improvements in social cognition. The authors suggested that specialized training is required to improve social cognition, as neurocognitive remediation alone did not lead to such improvements. However, the TAR group also showed greater improvements in verbal working memory than the neurocognitive remediation group, a finding that is not fully consistent with specific treatment-outcome linkages. Further research is needed to determine whether psychosocial treatments for social cognition versus neurocognition demonstrate outcome-specific effects on social cognition versus neurocognition. It also remains to be determined whether a “hybrid” approach (i.e., combining social cognitive plus neurocognitive training exercises) would lead to greater improvements in each domain compared to focused treatments for each domain alone.

We report here the results of a randomized, controlled trial of an expanded version of our SCST intervention for outpatients with psychotic disorders. We expanded the number of sessions from 12 to 24 to provide more extensive coverage of each of the four targeted social cognitive domains with an intention to demonstrate more pronounced and generalizable effects than those reported in our original feasibility study. Patients were randomized to one of four 24-session treatment conditions: (a) SCST, (b) Neurocognitive remediation (NR) using a novel computerized software package, (c) Standard illness management skills training (ST), (d) Hybrid treatment, which combined elements of SCST and NR. The primary goal was to assess the efficacy and specificity of SCST and NR by evaluating: (a) whether both interventions showed greater improvements on social cognitive and neurocognitive measures than ST, and (b) whether the SCST intervention led to greater improvements on social cognitive measures than NR, whereas NR led to greater improvements on neurocognitive measures than SCST. The study also had two secondary goals to evaluate (a) whether a Hybrid group receiving a combination of social cognitive and neurocognitive training sessions demonstrated better outcomes than the SCST or NR alone, and (b) whether any benefits in the four treatment conditions generalized to improvement on measures of functional capacity.

2. Methods

2.1. Design

Participants received a baseline assessment and were then randomized to one of the four treatment conditions: SCST, NR, a hybrid combining aspects of both, or ST. Details of each intervention are described below. Each consisted of 24 1-h sessions over a 12-week period (two sessions per week). Training for all conditions took place in groups of six to eight participants with two co-facilitators. The facilitators included a licensed clinical psychologist (WPH) and two bachelor's-level clinicians. All groups were held at the same research clinic on the West Los Angeles campus of the VA Greater Los Angeles Healthcare System (VAGLAHS). Assessments of social cognition and neurocognition were conducted at baseline, midpoint (6 weeks), and endpoint (12 weeks). Symptoms and functional

capacity were assessed at baseline and endpoint. Written informed consent was obtained from all study participants based on a complete description of the study. Participants received financial compensation after each session and testing occasion (\$12/h).

2.2. Subjects

Participants were recruited from outpatient clinics at the VAGLAHS and local community mental health facilities. Veteran/non-veteran status was not a stratification factor for randomization into treatment conditions. All patients met DSM-IV criteria for schizophrenia, schizoaffective disorder, delusional disorder, or psychosis NOS (not secondary to substance use disorder) as determined by medical records and consultation with treating psychiatrists. Subjects were clinically stable (no psychiatric hospitalizations in the past 2 months, same antipsychotic medication for past 6 weeks, no medication changes anticipated for the next 3 months). Exclusion criteria were evidence of current or past neurological disorder (e.g., epilepsy), mental retardation, or substance use disorder within the past month. Medication types and dosages were not controlled in the study but were left to the discretion of subjects' treating physicians.

Subjects were recruited in groups of six to eight and these groups were assigned to one of the four treatment conditions using a randomized permuted block design. This ensures roughly equivalent numbers of subjects per condition while keeping the assignment unpredictable to the recruiter. Eighty-five subjects consented, completed baseline testing, and were randomized. Sixty-eight of the randomized subjects (48 schizophrenia, 13 schizoaffective, 7 psychosis NOS) completed at least one of the follow-up assessments and were included in the data analyses for the SCST (16/19 included), NR (19/24), ST (19/21), or Hybrid (14/21) groups.¹ Sixty-eight completed midpoint assessments and 66 completed endpoint assessments.

2.3. Interventions

2.3.1. Social Cognitive Skills Training (SCST)—The training approach incorporated several skill-building strategies that are widely used in psychiatric rehabilitation including: 1) breaking down complex social cognitive processes into their component skills, 2) initially teaching/training skills at the most fundamental level and gradually increasing complexity of skill acquisition, and 3) repetition and practice so that the skills would become more routinized through repeated experiences. All sessions were accompanied by PowerPoint slide presentations and were structured to begin with a brief review of previously covered material, didactic presentation of new material, and group-based practice and training exercises. The sequence of sessions was designed to gradually increase in complexity and real-world relevance. The second half of training integrated several activities and accompanying training videos from the Social Cognition & Interaction Training program (SCIT; Penn et al., 2005, 2007), including exercises on suspicious feelings, jumping to

¹For the 17 excluded cases, the number of sessions attended and reasons for discontinuation were as follows: (a) SCST: one excluded subject attended zero sessions (scheduling conflict), two attended six (jail admission, moved out of area); (b) NR: three attended zero sessions (clinical instability, changed mind, no reason given), one attended one (discomfort in group setting), one attended two (no reason given); (c) ST: one attended two sessions (death in family), one attended eight (psychiatric admission); (d) Hybrid: four attended zero sessions (two changed mind, one scheduling conflict, one clinical instability), one attended four (scheduling conflict), one attended five (no reason given), one attended 10 sessions (no reason given).

conclusions, making sense of bad events, and distinguishing facts versus guesses. The ultimate goal of SCST is to enable participants to become better “social detectives.”

Training proceeded through the following four increasingly complex modules: (a) *Emotional processing*: didactic presentations focused on defining six basic emotions (happy, sad, angry, disgusted, afraid, surprised), identifying them on the face and in the voice, and reviewing non-social situations that typically lead people to experience them. Training incorporated detailed analysis of still photos of faces, audio clips, dynamic films of faces, and facial and vocal mimicry exercises. (b) *Social perception*: presentations covered non-verbal social cues and social contexts that typically lead people to experience different emotions (e.g., social norms, posture, eye contact, hand gestures, status differences between interaction partners, emotional intensity, sounds that convey understanding). Training materials included still photos, vignettes describing social situations, clips from English-language movies and television programs, and clips from foreign-language films. (c) *Attributional bias*: this module drew heavily on the relevant curriculum and training materials from the SCIT program (Penn et al., 2007) and involved conceptualizing suspiciousness as an emotion, distinguishing between useful suspiciousness versus harmful suspiciousness, distinguishing among facts, guesses, and feelings, and avoiding “jumping to conclusions” by checking out the evidence for one’s beliefs. Materials included written social vignettes and videos, and participants were increasingly encouraged to describe and process relevant personal experiences. (d) *Mentalizing*: the final phase focused on integrating the various emotional and social cues covered to understand and adaptively respond to others’ beliefs and intentions. Social detective exercises focused on putting together the “5-W’s” of social situations (who, what, when, where, and why) to evaluate whether the cues “add up” or whether mismatches among the clues point toward non-literal language use (sarcasm, humor) or deception (social lies, blatant lies). Training included analysis of complex videos, discussion of relevant material from participants’ lives, and role-play exercises to practice obtaining additional information in socially ambiguous situations.

2.3.2. Neurocognitive remediation (NR)—We used a prototype version of the computerized Aristotle training exercises developed by Posit Science (www.positscience.com), which includes exercises focused on sustained attention, speed of processing, and response inhibition. The decision to use the Aristotle program was made in discussions with scientists at Posit Science because of concerns that their auditory-based Brain Fitness program would not be well-suited to our outcome measure, the MATRICS Consensus Cognitive Battery (MCCB). The Brain Fitness program is heavily perceptual and has relatively little emphasis on higher-level processes. In contrast, the MCCB has a large number of visual, vigilance, and speed of processing measures that seemed more consistent with the Aristotle program. Participants sequentially completed three broad classes of increasingly complex, self-paced exercises: (a) *Sample-Match* (within modality): participants were presented with a target and were then presented with continuous streams of stimuli that included targets or foils within a specified modality (either auditory or visual) – subjects had to respond quickly to targets and avoid responding to foils; (b) *Pair-Match* (across modality): participants were presented with a continuous synchronized stream of

auditory and visual stimuli, and had to respond quickly when the stimuli matched in a specified manner and avoid responding otherwise; (c) Triad-Figures: an elaborated variant of the Sample-Match exercise using a stimulus set similar to card-sorting assessments in which a stimulus has attributes including color, shape, texture, and number of items – the target is defined as a specific conjunction or dysjunction of stimulus features, allowing for the creation of easy targets (e.g., “green” stimuli), moderately complex targets (“red solid squares”), or difficult targets (“two circles that are not green”). Within each session, task parameters were continuously adjusted by an adaptive algorithm based on the subject’s previous responses to yield an optimal training level of 85% correct response rate.

2.3.3. Hybrid intervention—This intervention was a combination of 12 sessions of SCST and 12 sessions of NR. The SCST sessions addressed all four content domains covered in the full intervention, but provided less in-depth coverage and practice for each area. The cognitive remediation sessions began at the same level as the full intervention and participants worked through the same sequence of exercises at their own pace. One of each type of session was administered each week; the order of sessions within each week was determined randomly because we did not want the subjects to be able to predict which intervention they would receive on any particular day in case there were large differences in tolerability of the interventions.

The Aristotle computerized training exercises used in the CR and Hybrid groups included two positive control configurations to track changes in performance over the course of training (i.e., tasks with specific parameters that were not used for training but administered periodically). These control conditions provided indexes of (a) reaction time for correct trials and (b) the minimum stimulus presentation time required to maintain an 85% correct response rate.

2.3.4. Standard illness management skills training (ST)—As an active control condition, we used a modified version of the UCLA Social and Independent Living Skills Program (Lieberman et al., 1993; Wallace et al., 1992). Training exercises were selected from the Symptom Self-Management, Recreations for Leisure, and Workplace Fundamentals modules. The format for training each skill involves a didactic introduction, videotape demonstrations, resource problem solving, and outcome problem solving. The purpose of this treatment condition for the current study was to provide a time- and format-matched active control condition that was engaging and useful for patients, but would not likely influence the central variables under study. We therefore excluded role-play exercises and exercises that directly target social skill building due to concerns that the nature of these exercises could influence social cognitive test performance. Patients in this condition completed a 34-item pre- and post-intervention knowledge quiz.

2.4. Measures

Assessments of social cognition, neurocognition, and functional outcome were conducted by testers who were blind to treatment condition.

2.4.1. Social cognition assessment—Five measures were used: (a) A *Facial Emotion Identification Test* includes eight digitized photos of facial expressions for each of 6 different emotions in the training program plus neutral expressions (total of 56 images) from the Ekman picture set (Ekman, 2004). The six emotions were the same ones covered in the training program, but the photos were not used in training. Subjects viewed each face and then selected the label they thought was correct from a list of emotions (possible score range = 0–56). (b) The *Managing Emotions* subtest of the Mayer–Salovey–Caruso Emotional Intelligence Test (Mayer et al., 2002, 2003) comprises two subscales that examined the regulation of emotions in oneself and in one’s relationships with others. These subscales include vignettes of various situations, along with ways to cope with the emotions depicted in these vignettes. Subjects were required to indicate the effectiveness of each solution, ranging from one (very ineffective) to five (very effective). Scores were derived using the MSCEIT General Consensus scoring method (presented as T-scores). (c) The *Half-Profile of Non-verbal Sensitivity* (PONS) assesses social perception (Ambady et al., 1995; Rosenthal et al., 1979). The 110 scenes in this videotape-based measure last 2 s each and contain facial expressions, voice intonations, and/or bodily gestures of a Caucasian female. After watching each scene, participants selected which of two labels (e.g., saying a prayer; talking to a lost child) better describes a situation that would generate the social cue(s) (possible score range = 0–110). (d) The *Ambiguous Intentions Hostility Questionnaire* (AIHQ) assessed attributional style. Subjects read a series of vignettes describing social situations and answered questions about the intentions of the characters and how subjects themselves would respond to the situation. Following (Combs et al., 2007a), we examined scores for ambiguous situations only. The AIHQ contains Hostility and Aggression bias scores, which were independently scored by two blinded raters (intraclass correlation coefficient’s [ICC] for both bias scores were >.85), along with a composite “Blame” score (average of Intentionality, Anger, and Blame item ratings) (possible score ranges = 1–5). (e) *The Awareness of Social Inference Test* (TASIT) – Part 3 is a videotape measure of Theory of Mind that contains 16 scenes with two or three actors appearing in each one. After presentation of each scene, subjects responded to questions about the characters’ communicative intentions, whether they want the literal or non-literal meaning of their message to be believed, their beliefs and knowledge about the situation, and their emotional state. The responses were summed to create a composite score (possible score range = 0–64). Higher scores on the social cognitive tasks indicate better performance with the exception of AIHQ. The AIHQ produces bias scores in which higher and lower scores indicate higher or lower levels of bias, respectively, toward attributing hostile intentions and blaming others in ambiguous social situations.

2.4.2. Neurocognitive assessment—The MATRICS Consensus Cognitive Battery (MCCB) (Nuechterlein and Green, 2006) was used to assess general cognitive performance (Kern et al., 2008; Nuechterlein et al., 2008). It includes tests of seven domains of neurocognition: speed of processing, attention/vigilance, working memory, verbal learning, visual learning, reasoning and problem solving, and social cognition. Because the goal of the study was to look at specialized measures of social cognition and neurocognition separately, we excluded the social cognition domain (i.e., the Managing Emotions subtest described

above) from the composite score, which was based on the average of *T*-scores from the six remaining domains.

2.4.3. Functional capacity—Two measures of functional capacity were administered at pre- and post-intervention. The UCSD Performance-based Skills Assessment (UPSA, Patterson et al., 2001) involves role-play tests with props that are administered as simulations of events in the areas of general organization, finance, social/communications, transportation, and household chores. An overall summary score was used. The Maryland Assessment of Social Competence (MASC; Bellack et al., 1994), a measure of subjects' ability to solve common problems in an interpersonal context, consists of four 3-min role-play scenarios. One scene involves initiating a conversation with a casual acquaintance, two involve negotiation and compromise, and one involves standing up for one's rights. The interactions were videotaped and subsequently scored by two specially trained raters. Both raters received training from the developers of this task or individuals they had certified, and achieved ICC's exceeding .85 for all the MASC variables on a set of 10 videos that were not from the current study. For this study, each video was rated by one of the two raters who were blind to treatment group and assessment point; each rater scored approximately half of the videos. The Overall Effectiveness rating (a composite measure of the ability to maintain focus and achieve the goal of the scenario) was used.

2.4.4. Symptom assessment—Psychiatric symptoms were assessed pre- and post-intervention using the 24-item *Brief Psychiatric Rating Scale* (BPRS; Kopelowicz et al., 2008; Ventura et al., 1993) and the *Scale for the Assessment of Negative Symptoms* (SANS; Andreasen, 1984). All interviewers were trained to a minimum ICC of .80 by the Treatment Unit of the Veterans Integrated Service Network 22, MIRECC and participated in an on-going quality assurance program throughout the project.

2.4.5. Tolerability ratings—At the completion of the interventions, participants provided ratings of their perceptions of how much they enjoyed the treatment, how enthusiastic and knowledgeable they found the trainers, and how effective the training was in helping them deal with daily life. Ratings were provided on Likert scales ranging from 1 (not at all) to 10 (very much).

2.5. Data analysis

Preliminary ANOVA's examined (a) the comparability of included versus excluded subjects, (b) the comparability of the treatment groups on demographics and attendance levels, as well as baseline levels on the social cognitive tasks, neurocognitive tasks, symptoms, and functional capacity, (c) within-group changes on the positive control conditions in the Aristotle program for the NR and Hybrid group, and (d) within-group changes on the knowledge quiz for the ST group.

For the primary analyses, group differences in social cognition, neurocognition, symptoms, and functional capacity over time (0, 6, 12 weeks) were examined using a general linear mixed model (GLMM). This analytic approach has the advantage of directly accounting for the longitudinal structure of these data by (a) evaluating any between-group differences that

may exist independent of changes over time, (b) evaluating average change over time and group differences in the rate of change over time separately, and (c) controlling for variation caused by the subject effects by including them as a random factor in the model (Singer and Willet, 2003). Additionally, it provides a powerful approach to dealing with missing data as it allows unbiased parameter estimates even when including cases with incomplete data as long as the data are missing completely at random (MCAR; Little and Rubin, 1987; Verbeke and Molenberghs, 2000). *F*-tests evaluated (a) Group effects (i.e., differences between the groups independent of time), (b) Time effects (i.e., overall slope indicating change across 0, 6, and 12 weeks in the sample as a whole), and (c) Group $\times$ Time interaction effects (i.e., between-group differences in slopes across 0, 6, and 12 weeks). Significant Group $\times$ Time interaction effects were followed up with pair-wise comparisons of slopes between each group using *z*-tests (based on the maximum likelihood parameter estimates of the slopes and their standard errors). Graphs of outcome variables depict the estimated linear slopes from the models fitted using the GLMM. All statistical tests are 2-tailed, using a significance level of $p < .05$.

3. Results

3.1. Preliminary analyses

We first examined the comparability of included ($n = 68$) versus excluded ($n = 17$) subjects. There were no significant differences in the proportions of excluded cases across treatment conditions ($X^2 [3, N = 85] = 3.99, p > .05$). There were also no significant differences between included versus excluded subjects on demographic characteristics or any baseline social cognitive, neurocognitive, symptom, or functional outcome measure (all $p > .20$).

Regarding the comparability of the treatment groups, as shown in Table 1, there were no significant group differences on any demographic characteristic. The patients were generally chronically ill with mild to moderate levels of symptoms. There were no significant group differences in attendance levels, with patients attending an average of about 19/24 sessions. Regarding outcome and symptom levels, there were no significant group differences at baseline on any social cognitive, neurocognitive, symptom or functional outcome measure (all $p > .20$).

Finally, within-group changes on control measures were examined. Across the CR and Hybrid groups, significant improvements (declines) from early to late training stages were seen for both reaction time ($t[32] = 3.15, p < .01$) and stimulus presentation time ($t[32] = 2.34, p < .05$), indicating that participants' performance improved over the course of training. For the ST group, scores on the skills knowledge quiz significantly improved from pre- ($M = 25.8, SD = 5.1$) to post-treatment ($M = 29.5, SD = 2.5$) ($t[18] = 2.30, p = .03$) suggesting that participants were engaged and learning.

3.2. Social cognition

Descriptive data and results are presented in Table 2. At baseline, mean scores for emotion perception, managing emotions, PONS, and TASIT were in the impaired range (Kee et al., 2009; Kern et al., 2009b; Sergi and Green, 2002). However, baseline mean scores on the

AIHQ variables were comparable to previously reports for healthy subjects (Combs et al., 2009, 2007b).

There were significant differences in the trajectories in the predicted direction for three of the social cognitive measures. In the domain of emotional processing, the significant Group $\times$ Time interactions on both measures showed relative benefits for SCST. As displayed in Fig. 1a, for facial affect perception, SCST demonstrated significantly greater improvement over time than NR ($Z = 2.57, p = .01$) and ST ($Z = 1.96, p = .05$), which did not significantly differ from each other. Changes in the Hybrid group fell in the middle, but did not significantly differ from any group. For emotion management (see Fig. 1b), SCST demonstrated significantly greater improvement over time than NR ($Z = 3.01, p < .01$) and the Hybrid group ($Z = 2.34, p = .02$), and a non-significant trend for greater improvement than ST ($Z = 1.89, p = .06$). There were no other significant between-group differences.

For attributional bias, there was a significant Group $\times$ Time interaction on the Blame score. As shown in Fig. 2, the Hybrid group demonstrated significantly greater changes over time (i.e., decrease of Blame scores) than the other three groups (all $Z > 2.10, p < .05$), which did not significantly differ from each other. There was also a trend-level interaction for the Aggression scores, reflecting a non-significant tendency for the Hybrid group to improve more than the others.

For the remaining social cognitive variables, there were no significant or trend-level interaction effects. There were significant Time effects for all of the social cognitive measures (except for AIHQ Aggression), reflecting general improvement on these tests across all subjects.

3.3. Neurocognition

As shown in Table 2, there was a significant Time effect for total scores on the MCCB, reflecting a general improvement across all subjects. However, there was no significant interaction effect, indicating no differential improvement on the MCCB across treatment conditions.

3.4. Symptoms

Descriptive data and results for the BPRS are presented in Table 3. There were no significant effects for Group, Time, or Group $\times$ Time for symptom levels. There were also no significant or trend-level effects for SANS total or subscale scores (data not presented).

3.5. Functional capacity

As shown in Table 3, there was a trend-level interaction effect for the MASC. This trend, depicted graphically in Fig. 3, reflected a tendency toward improvement in the SCST and NR groups compared to stable or slightly declining scores in the Hybrid and ST groups. There were no significant effects for scores on the UPSA.

3.6. Tolerability ratings

In general, the patients liked their treatments, but the Hybrid group ($M = 8.5$; $SD = 1.2$) liked their treatment significantly less than the others (SCST [$M = 9.6$, $SD = .9$], NR [$M = 9.6$, $SD = 0.8$], ST [$M = 9.5$, $SD = .7$], $F [3,63] = 4.39$, $p < .01$). There were no other significant between-group differences, with generally high ratings provided for group leader enthusiasm (range = 9.4–9.8) and knowledge (range = 9.6–9.8), as well as relevance of treatment for dealing with people (range = 8.1–8.9) and managing symptoms (range = 7.6–8.4).

4. Discussion

The 24-session SCST intervention showed treatment benefits for the social cognitive domain of emotion processing. There was also evidence of specific treatment-outcome effects for SCST, as groups receiving NR or ST did not show relative improvements in social cognition. There were no differential treatment effects across treatment conditions for neurocognition or clinical symptoms. These findings suggest that specialized social cognitive interventions uniquely contribute to the enhancement of social cognition in outpatients with psychotic disorders. Results also point toward remaining challenges for treatment development research in this area.

4.1. Efficacy of SCST

SCST was well-tolerated as indicated by the comparable attendance levels across treatment conditions and subjective reports of enjoyment and perceived relevance. The differential increases on emotional processing tasks for SCST reflect improvement in one of the four social cognitive domains that are targeted in this intervention. The improvement in facial affect perception replicates findings from our previous study and several other targeted treatment studies (Horan et al., 2008, 2009; Roberts & Penn, 2009); this is clearly the most consistently replicated benefit of targeted social cognitive interventions.

Although the facial affect perception scores across treatment conditions were not significantly different at baseline, there was some indication that the SCST group had lower mean scores than other groups. This creates a potential problem in that lower baseline scores can create phantom effects if there is (a) regression to the mean and/or (b) a ceiling effect on the outcome variable. However, neither of these possible confounding factors appears to account for the current findings. First, if the treatment effect were solely a consequence of regression to the mean, we would expect all groups to reach highly comparable levels at the endpoint. However, there was some dispersion among the group means; we would have been more concerned about this possibility if the relatively ranking of the 4 groups did not change, but they did. Second, there does not appear to be a ceiling effect. The SCST group had a mean of 46 (the highest of all groups) out of a possible 56 at the endpoint, or 82% correct, suggesting additional room for improvement. Additionally, the most powerful analyses (presented in Fig. 1) that make the most use of the data (e.g., account for missing data) support the conclusions and show the SCST group ending up in a different place than the other groups. Another point in favor of an actual treatment effect is that this pattern of

results is repeated across multiple tests in the emotion processing domain, as seen in the findings for the Managing Emotions subtest of the MSCEIT.

The results of the current study indicate generalization of SCST benefits to the Managing Emotions subtest, which has not previously been reported in targeted treatment studies. This test measures the regulation of emotions in oneself and in one's relationships with others. Although the early stages of SCST spend considerable time defining emotions, discussing their impact on perceptions of social interactions, and identifying emotions on the face and in the voice, it does not address specific emotion regulation strategies (e.g., cognitive reappraisal, suppression). There was some indication from the means reported in Table 2 that improvement on Managing Emotions was more pronounced in the second half of treatment. The latter stage of treatment is largely aimed at consolidating lower-level emotion perception skills and applying higher-level, integrative skills to personally relevant social situations. Speculatively, patients may have become more emotionally aware during the latter phase of SCST as they learned to more adaptively cope with their own and others' emotions. Since poorer performance on this and other emotion regulation measures have shown relations to worse functioning in schizophrenia in prior studies (Henry et al., 2008; Kee et al., 2009), efforts to directly target emotion regulation skills in future treatment development work might help promote functional recovery.

To explore possible interactive effects of SCST and NR, this study included a Hybrid group that received 12 sessions of each type of intervention. This combination did not show clear relative benefits and was rated as being less enjoyable than the other conditions. One curious finding was that the Hybrid group demonstrated an improvement in the attributional bias domain on AIHQ Blame scores. This finding is difficult to interpret because the mean Blame scores across treatment conditions at baseline were similar to those found in healthy college student samples (Combs et al., 2009, 2007b), suggesting a floor effect. The Hybrid group's significant decline from this baseline level indicates that these patients reported becoming even less prone to attribute blame in ambiguous situations than healthy subjects. This questionable result may reflect characteristics of the AIHQ; as noted by Roberts and Penn (2009), this is a face valid test that may be susceptible to self-enhancement bias (though it is unclear why this bias would affect the Hybrid group in particular). Aside from this single finding, we saw no clear synergistic advantage of combining elements of social cognitive and neurocognitive treatment. Given that both NR and SCST were administered in half the amounts used in the other conditions, we do not know what would have happened if subjects received a combined full dose of both treatments. Results may also have differed if the types of sessions were administered successively in blocks (e.g., all NR sessions first) rather than inter-mixed.

4.2. Specificity of SCST

The results reflect specific treatment-outcomes for SCST in emotion processing, as NR or ST alone was insufficient to improve social cognitive test performance. Furthermore, the absence of differential treatment benefits for neurocognition or symptoms suggest that the benefits of SCST were not directly associated with changes in these domains. These results extend findings from the Wölwer et al. (2005) study of the 12-session TAR program for

pairs of hospitalized inpatients to suggest that gains in social cognition are not necessarily dependent on improvements in neurocognition. Hence, neurocognition does not appear from these data to be a prerequisite “building block” for improvements in social cognition (e.g., Bell et al., 2001; Hogarty et al., 2006). Instead, intervention at the level of social cognition may be useful as a stand-alone treatment approach. Since social cognition appears to be more proximal, and perhaps more strongly related, to outcome than is neurocognition (Fett et al., 2011; Horan et al., in press), efforts to directly address social cognitive impairments appear to be worth pursuing.

In the current study, computerized neurocognitive remediation focused on categorization and cognitive flexibility with increasing demands for processing speed and response inhibition. The positive control measure for Aristotle indicated that subjects made significant gains on the trained tasks over time and participants reported generally high ratings of level of engagement, enjoyment, and relevance to daily life. Nevertheless, the MCCB results suggest little generalization of this cognitive improvement from the NR condition to standard cognitive performance measures. It should be noted that Aristotle was a newly developed program, though it is similar in content and structure to other computerized training program that emphasize vigilance, response inhibition, and speed of processing. In addition, it should be emphasized that this study was not intended to be a full evaluation of the Aristotle program because the number of sessions was reduced to match the duration of SCST and was considerably shorter than some computerized neurocognitive training programs, including others from Posit Science (e.g., Bell et al., 2008; Dickinson et al., 2010; McGurk et al., 2007). We selected the Aristotle program instead of more established auditory perception training programs (e.g., Fisher et al., 2009) because the MCCB does not have many auditory tasks and we decided to emphasize training in visual and cognitive processes. Adaptive computerized neurocognitive remediation is clearly feasible and tolerable, and differential benefits may be achieved with larger dosages.

4.3. Remaining challenges and conclusions

While this study supports the value of specialized social cognitive interventions, the findings also highlight three challenges for treatment development in this area. First, SCST showed benefits for only one of the four targeted social cognitive domains, a finding that is consistent with our earlier study (Horan et al., 2009) and a recent study of SCIT (Roberts et al., 2009). Training in emotion perception is amenable to highly structured skills training approaches and facial affect perception is the first area covered by both SCST and SCIT, providing the greatest opportunity for consolidation of benefits in this domain. Other aspects of social cognition are considerably more challenging treatment targets. While a number of interesting approaches to training in the more complex domains of social perception, attributional bias, and theory of mind have shown efficacy in inpatient samples, (e.g., Kayser et al., 2006; Moritz and Woodward, 2007; Penn et al., 2007), extending these benefits to community dwelling outpatients may require alternative approaches and/or larger treatment dosages.

Second, we did not find clear benefits for functional capacity, though non-significant trends for improvement on the MASC were seen for the SCST and NR treatments. This is

inconsistent with a recent trial of SCIT (Roberts & Penn, 2009), which reported significant improvement in a subset of nine patients who completed an abbreviated version of the MASC compared to treatment as usual. The absence of a significant effect for the UPSA may reflect the fact that this instrument does not involve functional capacity for social cognition. The ultimate value of social cognitive interventions depends on their ability to help patients achieve gains in real-world functioning and alternative approaches may be required to see this type of generalization. As a follow-up to the current study, we are refining our treatment package and augmenting it with “in vivo” sessions in which social cognitive training exercises will be carried out in real-world community sessions.

A third challenge concerns the suitability of available social cognitive measures for use as outcome measures in clinical trials. Many commonly used measures in social cognition research have psychometric properties that are unknown, or inadequate, such as floor and ceiling effects (Green et al., 2008; Roberts et al., 2009). In addition, properties such as test–retest reliability and sensitivity to change, which are regarded as critical for end-points in clinical trials of cognition enhancing treatments (Kern et al., 2004), have received limited attention. Efforts to improve social cognitive instrumentation are an important direction for future research.

In summary, the current study supports the efficacy and specificity of targeted social cognitive interventions for outpatients with psychosis. Limitations include the small sample sizes comprised predominantly of males receiving psychiatric services at Veteran’s Administration facilities and the absence of standardized diagnostic interviews, which may limit generalizability. In addition, participants received compensation, which could have affected attendance levels, and therapist adherence to the treatment protocol and the durability of training effects were not assessed. Despite these limitations and the treatment development challenges that remain, the current findings point toward the potential benefits of social cognitive training for people with psychotic disorders.

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Fig. 1.

Estimated linear slopes for the emotion processing measures by treatment condition. Slopes are based on maximum likelihood parameter estimates using the General Linear Mixed Model (GLMM).

Fig. 2.

Estimated linear slopes for AIHQ blame scores by treatment condition. Slopes are based on maximum likelihood parameter estimates using the General Linear Mixed Model (GLMM).

Fig. 3.

Estimated linear slopes for MASC effectiveness scores by treatment condition. Slopes are based on maximum likelihood parameter estimates using the General Linear Mixed Model (GLMM).

Table 1

Demographic and attendance data.

	SCST	NR	ST	Hybrid	Statistic
Age (years)	51.0 (7.1)	46.6 (7.4)	45.1 (11.2)	50.4 (10.1)	$F[3,64] = 1.65$
Education (years)	12.9 (1.5)	13.3 (2.5)	12.7 (2.0)	12.6 (1.4)	$F[3,64] = .33$
Age onset (years)	19.7 (2.8)	22.7 (6.5)	24.1 (9.8)	23.4 (13.3)	$F[3,64] = .67$
Sex					
Male	15	17	15	13	$\chi^2[3,68] = 2.36$
Female	1	2	4	1	
Ethnicity					
White	4	4	7	5	$\chi^2[12,68] = 17.80$
Hispanic	0	1	5	3	
Asian	0	2	0	0	
Black	12	11	7	6	
Other	0	1	0	0	
Sessions attended	19.6 (3.9)	19.3 (3.9)	20.1 (2.7)	20.1(2.7)	$F[3,64] = .21$

Notes: Standard deviations appear in parentheses. SCST = Social Cognitive Skills Training. NR = Neurocognitive remediation. ST = Standard Illness management skills training.

Table 2

Social cognition and neurocognition by treatment condition.

	Baseline						Midpoint						Endpoint						F-tests											
	SCST		NR		ST		Hybrid		SCST		NR		ST		Hybrid		SCST		NR		ST		Hybrid		Group		Time		Group × time	
	Mean (SD)		Mean (SD)		Mean (SD)		Mean (SD)		Mean (SD)		Mean (SD)		Mean (SD)		Mean (SD)		Mean (SD)		Mean (SD)		Mean (SD)		Mean (SD)		F value [df]		F value [df]		F value [df]	
Social cognition																														
Affect perception	37.1 (6.1)	40.6 (8.4)	43.4 (3.7)	38.6 (8.3)	44.7 (7.0)	41.4 (7.8)	44.2 (5.3)	43.3 (5.8)	45.5 (8.2)	41.1 (12.1)	45.1 (5.0)	43.8 (6.7)	2.03 [3,143]	29.82 ^{****} [1,124]	6.28 ^{****} [3,124]															
Managing emotions	37.7 (10.5)	38.1 (9.8)	40.2 (10.5)	40.9 (11.2)	39.6(11.4)	38.8 (10.6)	39.8 (10.7)	37.4 (13.6)	45.6 (12.2)	39.2 (11.1)	40.0 (12.0)	39.5 (14.1)	1.87 [3,101]	4.62 [*] [1,124]	5.00 ^{****} [3,124]															
PONS	74.1 (7.2)	76.1 (5.9)	81.5 (7.6)	79.8 (8.3)	77.0 (5.5)	76.5 (8.1)	81.5 (6.9)	79.8 (6.4)	75.9(7.1)	75.8 (8.9)	80.8 (6.2)	80.1 (7.7)	.59 [3,178]	5.23 [*] [1,130]	1.14 [3,130]															
AIHQ: Hostility	1.7 (5)	1.8 (5)	1.8 (5)	1.8 (7)	1.7 (5)	1.9 (7)	1.8 (4)	1.7 (4)	1.5 (6)	1.7 (6)	1.7 (6)	1.5 (4)	.22 [3,191]	5.13 [*] [1,130]	.42 [1,130]															
AIHQ: Aggression	1.8 (5)	1.6 (5)	1.9 (5)	1.8 (4)	1.8 (5)	1.6 (5)	1.8 (6)	1.6 (5)	1.9 (4)	1.8 (5)	2.0 (5)	1.5 (6)	.84 [3,192]	.02 [1,129]	2.26 ⁺ [3,129]															
AIHQ: Blame	2.8 (1.1)	2.8 (9)	3.1 (1.0)	2.8 (1.0)	2.9 (1.1)	2.8 (1.2)	3.0 (8)	2.4 (7)	2.9 (9)	2.7 (1.1)	3.0 (9)	2.0 (8)	.38 [3,153]	4.14 [*] [1,129]	4.06 ^{**} [3,129]															
TASIT	43.9 (6.5)	46.5 (6.7)	46.5 (7.7)	45.6 (9.9)	45.2 (5.8)	45.9 (6.4)	47.1 (7.1)	45.9 (9.5)	45.3 (5.0)	48.2 (5.9)	49.3 (7.0)	45.6 (8.7)	.13 [3,129]	6.02 [*] [1,129]	.80 [3,129]															
Neurocognition																														
MCCB Composite	33.9 (7.1)	39.1 (9.1)	38.2 (5.5)	37.4 (8.9)	37.5 (7.9)	40.1 (10.2)	40.3 (5.2)	39.9 (9.9)	39.2 (7.0)	41.6 (9.4)	40.8 (3.7)	40.3 (10.3)	1.64 [3,101]	41.70 ^{****} [1,125]	1.5 [3,125]															

Notes: All means are based on raw scores except for the Managing Emotions test and the Modified MCCB Composite, which are based on T-scores. Standard deviations appear in parentheses. Degrees of freedom are rounded to the nearest whole number. SCST = Social Cognitive Skills Training. NR = Neurocognitive remediation. ST = Standard Illness management skills training. PONS = Profile of Non-Verbal Sensitivity. AIHQ = Ambiguous Intentions Hostility Questionnaire. TASIT = The Awareness of Social Inference Test. MCCB = MATRICS Consensus Cognitive Battery (not including social cognition subtest).

* $p < .05$;
** $p < .01$;
*** $p < .005$;
**** $p < .001$;
+ $p < .10$.

Symptoms and functional capacity by treatment condition.

	Baseline				Endpoint				F-tests							
	SCST		NR		ST		Hybrid		SCST		NR		ST		Hybrid	
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Symptoms																
Positive	1.6 (.6)	2.1 (.9)	2.1 (.9)	2.1 (.9)	2.0 (.5)	1.5 (.3)	1.9 (.8)	2.1 (1.0)	1.7 (.7)	0.76 [3,108]	1.47 [1,70]	0.51 [3,70]				
Depression/Anxiety	1.8 (.8)	2.0(1.0)	2.1 (.7)	2.1 (.7)	1.9 (.5)	1.9 (.6)	1.7 (.6)	2.4 (1.0)	1.9 (.9)	1.03 [3,97]	0.13 [1,68]	1.40 [3,68]				
Negative	1.9 (.8)	1.9 (.8)	2.3 (1.1)	2.3 (1.1)	2.1 (1.0)	1.9 (1.1)	1.9 (1.1)	1.9 (.7)	2.2 (.7)	0.37 [3,103]	0.02 [1,69]	0.13 [3,69]				
Agitation	1.2 (.2)	1.2 (.5)	1.3 (.5)	1.3 (.5)	1.3 (.4)	1.1 (.2)	1.3 (.5)	1.2 (.3)	1.1 (.2)	1.17 [3,91]	0.66 [1,74]	1.50 [3,74]				
Total	37.21 (9.25)	41.22 (11.47)	45.76 (9.58)	45.76 (9.58)	43.62 (6.95)	37.87 (4.00)	40.42 (9.00)	46.29 (13.39)	38.69 (7.89)	1.27 [3,103]	0.82 [1,70]	0.74 [3,70]				
Functional capacity																
MASC: effectiveness	3.11 (.91)	3.32 (.78)	3.43 (.65)	3.43 (.65)	3.30 (.82)	3.43 (.78)	3.57 (.74)	3.19 (.86)	3.35 (1.11)	1.55 [3,122]	0.69 [1,61]	2.60 ⁺ [3,61]				
UPSA	70.81 (12.35)	74.26 (10.51)	76.63 (7.97)	76.63 (7.97)	73.87 (10.97)	72.46 (11.20)	76.39 (9.73)	77.83 (10.46)	75.89 (14.23)	1.38 [3,127]	2.11 [1,64]	.32 [3,64]				

Notes: All means are based on raw scores. Standard deviations appear in parentheses. Degrees of freedom are rounded to the nearest whole number. SCST = Social Cognitive Skills Training, NR = Neurocognitive remediation, ST = Standard Illness management skills training, MASC = Maryland Assessment of Social Competence, UPISA = UCSD Performance-based Skills Assessment.

 $^+p < .10.$