Schizophrenia Bulletin vol. 32 no. S1 pp. S44–S63, 2006
doi:10.1093/schbul/sbl029
Advance Access publication on August 17, 2006

The Functional Significance of Social Cognition in Schizophrenia: A Review

Shannon M. Couture, David L. Penn[1], and David L. Roberts

Department of Psychology, University of North Carolina at Chapel Hill, CB #3270, Davie Hall, Chapel Hill, NC 27599-3270

Deficits in a wide array of functional outcome areas (eg, social functioning, social skills, independent living skills, etc) are marked in schizophrenia. Consequently, much recent research has attempted to identify factors that may contribute to functional outcome; social cognition is one such domain. The purpose of this article is to review research examining the relationship between social cognition and functional outcome. Comprehensive searches of PsycINFO and MEDLINE/PUBMED were conducted to identify relevant published manuscripts to include in the current review. It is concluded that the relationship between social cognition and functional outcome depends on the specific domains of each construct examined; however, it can generally be concluded that there are clear and consistent relationships between aspects of functional outcome and social cognition. These findings are discussed in light of treatment implications for schizophrenia.

Key words: social functioning/emotion perception/social perception/theory of mind

Deficits in social functioning, including communicating with others, maintaining employment, and functioning in the community, are observed in many disorders but are a defining feature of schizophrenia.[1] Indeed, social functioning deficits are evident premorbidly in those who later develop schizophrenia[2,3] and are often present in first-degree relatives of individuals with schizophrenia.[4] Impaired social functioning also impacts the quality of life[5] and predicts outcome in schizophrenia, including relapse, poor illness course, and unemployment.[6–8] Thus, social dysfunction is a hallmark characteristic of schizophrenia that has important implications for the development, course, and outcome of this illness.

One of the challenges to research in this area is inconsistent definitions of social functioning. This term has been used to apply to self- or other report of interpersonal behaviors, behavior in community settings (eg, skill ratings while shopping), skills of independent living (eg, self-care skills, grooming, financial skills, etc), ratings of social skill in laboratory settings (eg, role-play tests), and ratings of social problem-solving skills. Accordingly, some researchers have taken to describing this conglomeration of domains as "functional outcome," a broader term used to encapsulate all these diverse areas.[9,10] This review also uses this term, recognizing that it includes strictly social behaviors as well as behaviors that are less purely social, such as engaging in activities in the community and caring for oneself.

Given the critical role of functional outcome in schizophrenia, there has been growing interest in factors that may underlie it. If the nature of these factors can be delineated, interventions may be devised to ameliorate them, which, in turn, may have a concomitant impact on long-term outcome. Neurocognition is one such factor. Whereas most previous research supports a significant relationship between at least one aspect of neurocognition and functional outcome, the amount of variance accounted for is typically rather modest.[5,9,11] In fact, although Green et al[11] reported that 20% to 60% of the variance in functional outcome could be explained by composite measures of neurocognition, the variance accounted for in most of the studies was only in the 20% to 40% range; studies reporting variance estimates of greater than 40% were the exception, rather than the rule. Thus, anywhere from 60% to 80% of the variance in functional outcome is unaccounted for by traditional neurocognitive measures, spurring researchers to continue searching for other contributing factors.[11]

More recently, social cognition has been identified as a likely contributor to functional outcome. Brothers[12(p28)] defined social cognition as the "mental operations underlying social interactions, which include the human ability and capacity to perceive the intentions and dispositions of others." Similarly, Adolphs[13(p231)] identified social cognition as "the ability to construct representations of the relation between oneself and others and to use those representations flexibly to guide social behavior." Thus, the theory implies a close association between social cognition and functional outcome because the ability to quickly process social stimuli is essential for social interactions, and problems in this area can impact peer,

[1]To whom correspondence should be addressed; tel: 919-843-7514, fax: 919-962-2537, e-mail: dpenn@email.unc.edu.

romantic, and family relationships as well as work/school behavior. In addition, social cognition may impact the functional outcome of independent living skills because accurately assessing social cues from the environment (such as someone responding to body odor by increasing bodily distance or making a facial expression of disgust), and having the social opportunities necessary to learn skills such as home and financial care, may be a necessary prerequisite for making improvements in daily living skills.

There is general consensus that neurocognition and social cognition are related, but different constructs.[5] For example, research examining the neural underpinnings of neurocognitive and social cognitive abilities[14–19] suggest semi-independent systems for processing nonsocial and social stimuli. In addition, there appears to be only a modest association between neurocognition and social cognition.[20–26] Thus, social cognition may contribute to functional outcome in a way that is not redundant with neurocognition.

The purpose of this article is to review the extant research on the relationship between social cognition and functional outcome, with an eye toward implications for social cognition as a potential treatment target for schizophrenia. Before a meaningful description of the reviewed studies can occur, definitions of the relevant constructs and a conceptual model are needed.

Definitions

Social cognition is a broad construct encompassing many abilities. The ones identified and studied most frequently in the schizophrenia literature are emotion perception (EP), social perception (SP), theory of mind (ToM), and attributional style (AS).[27] EP (also called emotion recognition, affect recognition, or affect perception) is the ability to infer emotional information (ie, what a person is feeling) from facial expressions, vocal inflections (ie, prosody), or some combination of these (ie, video clips). SP refers to a person's ability to ascertain social cues from behavior provided in a social context, which includes, but is not limited to, emotion cues.[27] SP is also closely tied to social knowledge, which refers to a person's comprehension of social rules and conventions (eg, as stored in social schemas); thus, these 2 abilities will be grouped together. ToM involves both the ability to understand that others have mental states different from one's own and the capability to make correct inferences about the content of those mental states (eg, others' intentions or beliefs). ToM is typically operationalized as participants' ability to understand false beliefs (first- or second-order ToM) or the ability to understand verbal hints. AS refers to an individual's characteristic tendencies in explaining the causes of events in their lives. Research indicates that individuals with persecutory delusions and/or paranoia tend to blame others, rather than situations, for negative outcomes, an AS known as a personalizing bias.[28]

The personalizing bias can be understood within a social information–processing framework. Specifically, it has been demonstrated that when forming impressions of others, nonclinical controls automatically make dispositional judgments and only subsequently "correct" for situational factors.[29] For example, if you meet someone and they are not friendly, you might infer that they are a rude person. However, if you subsequently learn that the person had just received bad news (eg, someone in their family had died), you would correct that impression in light of the contextual information. Thus, individuals with persecutory delusions do not engage in the second stage of modifying initial impressions. This may be due to a number of factors, including the possibility that individuals with persecutory beliefs have a strong need "for closure" (ie, a desire to get a specific answer on a topic or issue, rather than dealing with ambiguity),[30,31] impaired cognitive flexibility, which prevents individuals with delusions from entertaining other causal hypotheses,[32,33] and problems with ToM, which has shown an association with personalizing biases in both nonclinical and clinical samples.[34–36]

A Conceptual Model of Social Cognition and Functional Outcome

Figure 1 presents our conceptual model of social cognition, as well as its proposed link with functional outcome. The model includes an example of a particular social situation (the reaction of a client with schizophrenia to a coworker who has rushed past him without saying hello) in order to explicate how this model would operate. First, the client may misperceive the emotional expression on the coworker's face to be anger, rather than upset or stressed, and attend to the social cues of rushing past, without observing additional information present in the situation. These misperceptions may then result in the client making a faulty conclusion that the coworker is angry. Subsequently, the next phase of processing involves the client's generation of an explanation of why the coworker is angry. Biases in AS, such as a personalizing bias, led the client to conclude that the coworker is "angry at me," a bias that is not corrected because the client has difficulty putting himself in the coworker's position (ie, deficits in ToM). In other words, the client is unable to grasp the "emotional and social context" of the coworker's behavior. This results in the client feeling angry and resentful toward the coworker, which causes him to act in an unfriendly manner toward the coworker in the future (ie, inappropriate social behavior), who in turn avoids the client. This culminates in an increase in the client's general discomfort at work, thus affecting life satisfaction, and creating a vicious cycle whereby the client will anticipate negative

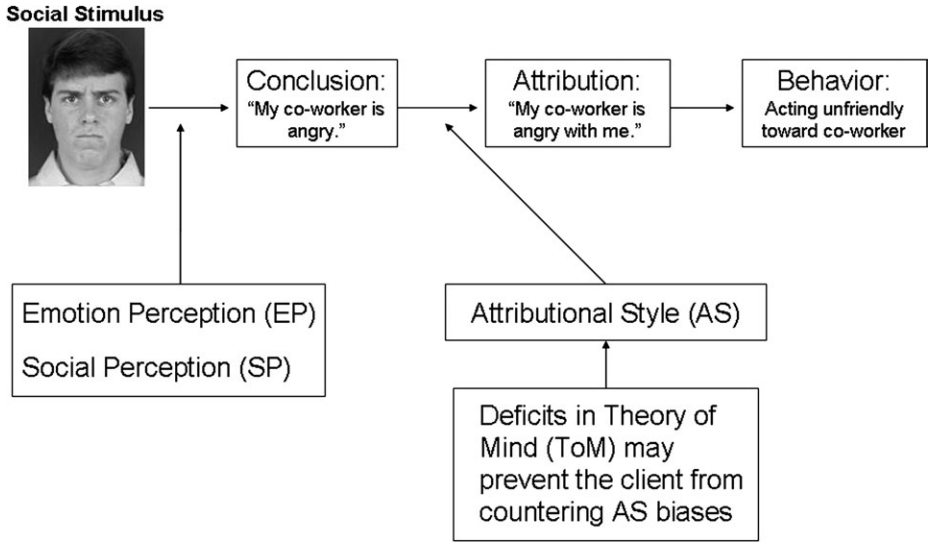

Fig. 1. Conceptual Framework for Understanding the Interplay Between Social Cognition and Social Functioning.

interactions in the future but does not seek information that may contradict these expectations.[37] Thus, his relationships at work will become strained, via difficulties in initiating interactions with others (ie, problems in social skill), via problems in reacting to problems at work (ie, problems in social problem solving), or due to being unable to carry out his work activities (ie, as a result of being distracted by his anger toward coworkers). Therefore, according to this model, impairments (or biases) in social cognition can impact a variety of indices of functional outcome.

Search Strategy

A comprehensive search of the PsycINFO and MEDLINE/PUBMED databases was conducted. Within the domain of social cognition, the following search terms were used: (1) SP, (2) emotion/affect perception, (3) emotion/affect recognition, (4) attributions/AS, (5) ToM, (6) mentalizing/mentalising, (7) social cognition, (8) prosody, (9) social knowledge, (10) mind reading, (11) social cue, and (12) social judgment. Within the domain of functional outcome, the following terms were used: (1) functional outcome, (2) independent living skills/skills of daily living, (3) community/social functioning, (4) work/occupational/vocational functioning, (5) social skill, (6) quality of life, (7) community/social behavior, (8) life satisfaction, (9) social adjustment/dysfunction, and (10) employment. Search terms for schizophrenia included the following: (1) psychosis, (2) schizophrenia, and (3) schizoaffective disorder.

The results from these searches were evaluated for relevance; that is, only studies including at least one statistical technique (ie, correlation, regression, structural equation modeling, *t* tests, etc) for evaluating the relationship between an aspect of social cognition and functional outcome were included in this review. The majority of studies included assessment at only one time point, although 2 studies[38,39] included assessment of abilities 1 year after baseline as well.

Domains Comprising the Review

For purpose of clarity, we describe below the most commonly used measures within each domain of social cognition and functional outcome that are the focus of this review. Following this, we summarize the findings on the relationship between social cognition and functional outcome in the text, and in tables 1–4, we provide information on each study's measures, results, and effect sizes. Effect sizes were obtained via examination of all provided correlation coefficients in the reviewed studies. In instances when a correlation coefficient was not available, the percentage of variance accounted for or a *t* statistic was converted to a correlation. Ranges for effect sizes are as follows: ≤.1 (minimal to small), .1–.3 (small to > moderate), .3–.5 (moderate to large), .5 and above (large), which is in concert with commonly used conventions in the field.[40] In addition, power estimates for each study were calculated for a moderate effect size (r = .3) to determine if the reviewed studies were underpowered (ie, power less than .80).

Due to the fact that social cognition is a multifaceted construct, we have grouped studies in terms of the most common social cognitive domains in the field[27,41] (ie, SP, EP, ToM, and AS). Four measures of SP were common across studies: the Social Cue Recognition Test (SCRT, included in 3 of the 12 SP studies),[42,43] the Schema

Table 1. Social Perception (SP) and Functional Outcome (FO) in Schizophrenia (S)

Study	Participants	SC Measures	FO Measures	Major Findings
Appelo et al[59]	39 S inpatients MA = 30 Male: 71.8% Yrs Ed: 10 Yrs Ill: 7 Clor eq: ?	Picture Arrangement from WAIS-R	Social behavior in milieu: Staff ratings on general behavior subscale from rehabilitation evaluation SSIT	• SP predicted 34% of the variance in social behavior in milieu ($P < .0001$) • SP did not predict social skills (did not include statistics) • Effect size for social behavior is large ($r = .58$); unable to detect for social skill • Power for effect size of $r = .3$ is 0.451
Addington et al[65]	50 FE inpatients MA = 25 Male: 60% Yrs Ed: 66% completed 12th grade Yrs ill: <3 mo treatment Clor eq: 307/380 (1st/2nd assess) 53 S outpatients MA = 35 Male: 71.6% Yrs Ed: 71% completed 12th grade Yrs Ill:? > 3 y Clor eq: 715/665 (1st/2nd assess)	SCRT, SFRT	Community functioning: QLS Social problem solving: AIPSS	• In both groups, scores on SCRT and SFRT associated with QLS at baseline and 1 y later ($r = .25$ to $.39$, $P < .01$) and with AIPSS at both time points ($r = .33$ to $.51$, $P < .011$) • SP composite predicted 7.8% ($P < .05$) and 15.2% ($P < .0001$) of the variance in QLS at baseline and 1 y, respectively • SP composite predicted 19.4% ($P < .0001$) and 24% ($P < .0001$) of the variance in AIPSS at baseline and 1 y • In a series of regressions using composite SP and composite cognition, found evidence to support SP as a mediator for QLS, and particularly for AIPSS • Most effect sizes appear to be small to moderate (not all correlations were provided) • Power for effect size of $r = .3$ is 0.869
Corrigan and Toomey[66]	26 S or SA inpatients MA = 34 Male: 6.9% Yrs Ed: 12.2 Yrs Ill: ~14.3 Clor eq: 1218	SCRT	Social problem solving: AIPSS	• SCRT correlated with sending skills at Bonferroni level ($r = .73$, $P < .001$) • After partialling out effects of verbal memory and learning, the effects remained but were slightly reduced • Effect sizes were all large • Power for effect size of $r = .3$ is 0.309
Kim et al[63]	14 S outpatients MA = 38 Male: 64% Yrs Ed: 12 Yrs Ill: 14.5 Clor eq: 290	Biological motion task	Community function: Zigler Social Competence Scale	• Biological motion perception was associated with community functioning scores in full sample ($r = .71$, $P < .0001$) • This is equivalent to a large effect • Power for effect size of $r = .3$ is 0.170

Table 1. Continued

Study	Participants	SC Measures	FO Measures	Major Findings
Penn et al[60]	35 S or SA residents of acute care MA = 35 Male: 82.8% Yrs Ed: 11.3 Yrs Ill: ? Clor eq: 738	SCST-R, GPT, SMT	Social behavior in milieu—NOSIE: staff ratings for social competence, social interest, neatness	• Social competence associated with SCST-R scales (r = .34, −.35, .42, P's < .05) but not SMT or GPT • Social Interest associated with SCST-R scales (r = −.38, −.43, −.47, −.50, P's < .05) but not SMT or GPT • Neatness associated with SMT (r = .37, P < .05) and SCST-R (r = .47, P < .05) but not GPT • Many correlations were not provided; those given are all moderate to large range effects • Power for effect size of r = .3 is 0.409
Revheim and Medalia[64]	87 S or SA inpatients 75 S or SA outpatients MA = 37 Male: 62.3% Yrs Ed: 11.1 Yrs Ill: ~14 Clor eq: ?	WAIS-R Comprehension	Community status (inpatient or outpatient)	• Significant difference in SP based on community status (t = −2.50, P < .01), and it was a significant predictor in logistic regression (r = .12) • This is equivalent to a small to moderate range effect (r = .19) • Power for effect size of r = .3 is 0.973
Sergi et al[10]	75 S Outpatients MA = 47 Male: 92% Yrs Ed: 13.0 Yrs Ill: 21.2 Clor eq: ?	Half-PONS	Community functioning: RFS independent living, social functioning, and work functioning subscales (used as latent variable)	• SP significantly correlated with work functioning (r = .36, P < .01) and independent living (r = .33, P < .05) but not social functioning (r = .11) • SEM revealed SP was predicted by early visual processing (β = .57, P < .05) and SP predicted RFS (β = .44, P < .05); the significant indirect effect of early visual processing on RFS but nonsignificant direct effect suggests mediation • Early visual processing and SP together accounted for 18% of the variance in RFS • 33.3% of the effect sizes were small to moderate range, and 66.7% were moderate to large range • Power for effect size of r = .3 is 0.742
Toomey et al[67]	29 S inpatients MA = 34 Male: 68.9% Yrs Ed: 12.5 Yrs Ill: 14.3 Clor eq: 1090.7	PONS	Social problem solving: AIPSS	• Controlling for WRAT-R, correlations between AIPSS and PONS was significant the role play (content r = .52, P < .01, performance r = .50, P < .01, overall r = .51, P < .01) • All of the effect sizes were large • Power for effect size of r = .3 is 0.343

Table 1. Continued

Study	Participants	SC Measures	FO Measures	Major Findings
Vauth et al[61]	133 S inpatients MA = 28 Male: 64.7% Yrs Ed: ? Yrs Ill: 6.6 Clor eq: ?	SFRT, SCST-R	Social behavior on milieu: Social Skills and Personal Presentation subscales from WPP	• SFRT correlated with social skills ($r = .28$, $P < .01$) and personal presentation ($r = .31$, $P < .001$) • SCST-R correlated with social skills ($r = .23$, $P < .01$) and personal presentation ($r = .28$, $P < .01$) • SEM analyses revealed 25% of the variance in WPP was accounted for by SP and neurocognition latent variables; SP alone accounted for 10% of the variance • 75% of the effect sizes were small to moderate range, and 25% were moderate to large range • Power for effect size of $r = .3$ is 0.940

Note: SC = Social Cognition; SA = Schizoaffective; FE = First Episode; MA = Mean Age; Yrs Ed = Years of Education; Yrs Ill = Number of Years Ill; Clor eq = Chlorpromazine equivalent (mg/d); AIPSS = Assessment of Interpersonal Problem Solving Skills[57]; GPT = Gilbert-Pelham Task[107]; QLS = Quality of Life Scale[56]; NOSIE = Nurse's Observation Scale for Inpatient Evaluation[53]; PONS = Profile of Nonverbal Sensitivity[45]; Rehabilitation Evaluation[108]; RFS = Role Functioning Scale[55]; SEM = Structural Equation Modeling; SCRT = Social Cue Recognition Test[42,43]; SCST-R = Schema Component Sequencing Task-Revised[44]; SSIT = Simulated Social Interaction Test[109]; SMT = Situation Matching Task (T. Ferman, unpublished data, 1993); SFRT = Situational Features Recognition Test[42,43]; WAIS-R = Wechsler Adult Intelligence Scales-Revised[110]; WPP = Work Personality Profile[111]; Zigler Social Competence Scale.[112]

Component Sequencing Task-Revised (SCST-R, 4 of 12 studies),[44] the Profile of Nonverbal Sensitivity (PONS, 2 of 12 studies),[45] and the Situational Features Recognition Test (SFRT, 2 of 12 studies).[42,43] Two of these measures require judgments about short videotaped vignettes (eg, SCRT and PONS) and are clearly SP in nature, whereas the SCST-R and SFRT assess social knowledge. Additional, less commonly used measures of SP are presented in tables 1 and 4.

Within the domain of EP, the most consistently used measure was the Facial Emotion Identification Task (FEIT, tables 2 and 4; 6 of 10 studies).[46] In the FEIT, participants choose from among 6 emotion words (happy, angry, afraid, sad, surprised, and ashamed) to describe the facial expression depicted in black-and-white photographs. Other studies used similar measures, including the Pictures of Facial Affect (3 of 10 studies)[47] and the Facial Emotion Discrimination Test (3 of 10 studies).[46] In addition, EP was also measured via other modalities, such as measures of vocal affect perception (2 of 10 studies, Vocal Emotion Identification Test),[46] and video tasks including both vocal and facial affect cues (Bell-Lysaker Emotion Recognition Test),[48] and the Videotape Affect Perception Test,[49] included in 3 of 10 studies).

The only consistently utilized ToM measure was the Hinting Task (tables 3 and 4; 2 of 4 studies),[50] which requires participants to listen to a story presented verbally and ascertain what one character intends when she/he provides a verbal hint to another character. Other studies used some form of ToM "story" (either verbally, with cartoons, or both), which required participants to ascertain characters' false beliefs. Finally, AS was typically assessed with a questionnaire that described various situations (eg, your friend forgot to pick you up from work), following which, participants are asked to devise an explanation for why this event occurred. These explanations are often coded by the participant him/herself (eg, whether the outcome was due to themselves or others) or by research assistants (eg, for how much the responses involves an internal or external attribution and/or a hostile response).[51,52]

As functional outcome is also a multifaceted construct that has been measured in diverse ways, we have divided most measures of functional outcome into 4 main areas as follows: social behavior in the milieu, community functioning, social skills, and social problem solving. Social behavior in the milieu is comprised of staff-rated assessments of the participants' behavior in a variety of treatment settings. Examples of measures included in this

Table 2. Emotion Perception (EP) and Functional Outcome (FO) in Schizophrenia (S)

Study	Participants	SC Measures	FO Measures	Major Findings
Brekke et al[38]	139 S or SA outpatients MA = 38 Male: 69% Yrs Ed: 11.9 Yrs Ill: 13.9 Clor eq: ?	FEIT, VEIT, and Videotape Affect Perception Test; created a composite of these 3 measures	Community functioning—RFS: total score, work, social functioning, and independent living subscales; combined in composite for global functioning	• Global functioning was significantly related to EP at baseline ($r = .35$, $P < .01$) and 12 mo ($r = .30$, $P < .01$). Results held in path model and neurocognition had a significant indirect effect through EP on global functioning at baseline and 12 mo • Work functioning was significantly related to EP at baseline ($r = .22$, $P < .01$) and 12 mo ($r = .27$, $P < .01$). Results held in path analysis and EP was a mediator between neurocognition and work functioning at baseline and 12 mo • Social functioning was significantly related to EP at baseline ($r = .25$, $P < .01$) and 12 mo ($r = .18$, $P < .05$). Results held in path model and EP mediated the relationship between neurocognition and social functioning • Independent living was significantly related to EP at baseline ($r = .31$, $P < .01$) and 12 mo ($r = .26$, $P < .01$). Results held in path model and EP was again a mediator • 62.5% of effects were small to moderate range, and 37.5% were moderate to large range • Power for effect size of $r = .3$ is 0.949
Cohen et al[70]	28 S Inpatients MA = 33 Male: 85.7% Yrs Ed: 11.9 Yrs Ill: 12.9 Clor eq: ?	FEIT	Social skills: role-play test Social behavior in milieu: 5 social behavior questions from SAS-II	• SAS-II correlated with FEIT ($r = .38$, $P < .05$), but role play was not correlated with FEIT ($r = .24$) • In regression with cognitive composite, FEIT accounted for nonsignificant proportions of the variance: 1% in role-play test (cognition 24%, $P < .01$) and 8% in SAS-II (cognition 13%, NS) • There was a small to moderate range effect for social skills and a moderate to large range effect for social behavior in the milieu • Power for effect size of $r = .3$ is 0.332

Table 2. Continued

Study	Participants	SC Measures	FO Measures	Major Findings
Hooker and Park[71]	20 S inpatients MA = 39 Male: 75% Yrs Ed: 12.7 Yrs Ill: 18.8 Clor eq: 1043	Biehl Facial Affect Recognition, Nowicki and Duke Vocal Affect Recognition	Social behavior in milieu: SDI with 8 subscales Note—only 14 participants completed this measure	• No significant relationship between SDI total and EP measures in omnibus test • Facial EP significantly correlated with communication/social dysfunction ($r = -.59$, $P < .05$), occupation dysfunction ($r = -.56$, $P < .05$), and with Public self (social behavior) at trend level ($r = -.46$, $P < .10$) but not independent living, family or other relationships, or community/recreational functioning • Vocal EP correlated with occupation dysfunction ($r = -.58$, $P < .05$) but not communication/social functioning ($r = -.1$), public self ($r = -.1$), independent living, family or other relationships, or community/recreation functioning • Significant effects are moderate to large; nonsignificant correlations were not provided • Power for effect size $r = .3$ is 0.240
Kee et al[39]	81 S or SA outpatients MA = 38 Male: 77.8% Yrs Ed: 12.1 Yrs Ill: 13.6 Clor eq: ?	Measured at baseline and 12 mo: FEIT, VEIT, and Videotape Affect Perception Test; created a composite of these 3 measures	Measured at baseline and 12 mo—SCOS: Social Contacts and Useful Employment RFS: work productivity, independent living, relationships with family and spouse, relationships with friends Community function—Split measures into 2 factors: work functioning/ independent living and social functioning/ family relationships	• At baseline, EP composite correlated with work functioning/independent living ($r = .36$, $P < .01$) but not social functioning/ family relationships ($r = .009$) • At 12 mo (concurrent), EP related to work functioning/independent living ($r = .29$, $P < .05$) but not social functioning/ family relationships ($r = .05$) • Baseline EP correlated with work functioning/ independent living at 12 mo ($r = .41$, $P < .001$) but not social functioning/ family relationships ($r = .04$) • 50% of effect sizes were minimal to small range, 16.7% were small to moderate range, and 33.3% were moderate to large range • Power for effect size of $r = .3$ is 0.776

Table 2. Continued

Study	Participants	SC Measures	FO Measures	Major Findings
Mueser et al[72]	28 S or SA inpatients MA = 45 Male: 47% Yrs Ed: 11 Yrs Ill: ~23 Clor eq: 650	FEIT, FEDT	Social skill: ratings of social skill from conversation probes Social behavior in milieu—SBS: social mixing, inappropriate behavior, altered activity level, personal appearance subscales	• For social skills, FEIT related to nonverbal paralinguistic skills (eg, meshing, fluency, etc; $r = .37$, $P < .05$) but not verbal content ($r = -.04$) or overall social skill ($r = .30$). The FEDT was not related to any of these skills (nonverbal $r = .20$, verbal content $r = .06$, overall $r = .14$) • For SBS, FEIT related to social mixing ($r = -.45$, $P < .01$) and personal appearance ($r = -.61$, $P < .001$) but not inappropriate behavior ($r = -.02$) or altered activity ($r = -.11$) • For SBS, FEDT related to social mixing ($r = -.35$, $P < .05$), activity level ($r = -.34$, $P < .05$), and personal appearance ($r = -.38$, $P < .05$) but not inappropriate behavior ($r = -.16$) • For social skills, 33.3% of effect sizes were minimal to small range, 33.3% were small to moderate range, and 33.3% were moderate to large range • For social behavior in the milieu, 12.5% of effect sizes were minimal to small range, 25% were small to moderate range, 50% were moderate to large range, and 12.5% were large • Power for effect size of $r = .3$ is 0.332
Poole et al[74]	40 S or SA outpatients MA = 41 Male: 77.5% Yrs Ed: 13 Yrs Ill: ? Clor eq: 300	Composite of Ekman and Friesen's Pictures of Facial Affect and Vocal Affect Recognition from Florida Affect Battery	Community function—QLS: interpersonal relations, vocation, community participation subscales and total score	• EP correlated with QLS total ($r = .36$, $P < .05$), interpersonal relations ($r = .35$, $P < .05$), and community participation ($r = .39$, $P < .01$) but not vocation ($r = .03$) • After partialling out cognition, EP correlated with household relations ($r = .35$, $P < .05$) and social activity ($r = .34$, $P < .05$) on the QLS • 25% of the effects were minimal to small range, and 75% were moderate to large range • Power for effect size of $r = .3$ is 0.461

Note: SC = Social Cognition; NC = Neurocognition; SA = Schizoaffective; MA = Mean Age; NS = Not Significant; Yrs Ed = Years of Education; Yrs Ill = Number of Years Ill; Clor eq = Chlorpromazine equivalent (mg/d); Biehl Facial Affect Recognition[113]; FEIT = Facial Emotion Identification Task[46]; FEDT = Facial Emotion Discrimination Task[46]; Nowicki and Duke Vocal Affect Recognition[114]; QLS = Quality of Life Scale[56]; Pictures of Facial Affect[47]; RFS = Role Functioning Scale[55]; SAS-II = Social Adjustment Scale-II[115]; SBS = Social Behavior Scale[54]; SCOS = Strauss and Carpenter Outcome Scale[116]; SDI = Social Dysfunction Index[117]; VEIT = Vocal Emotion Identification Task[46]; Videotape Affect Perception Task.[49]

Table 3. Theory of Mind (ToM) or Attributional Style (AS) and Functional Outcome (FO) in Schizophrenia (S)

Study	Participants	SC Measures	FO Measures	Major Findings
Pollice et al[76]	44 S or SA outpatients MA = 33 Male: 77.3% Yrs Ed: 11.6 Yrs Ill: 10.6 Clor eq: 289	First-order ToM from Sally and Anne and Cigarettes tasks; second-order ToM from Ice Cream Van and Burglar tasks; also combined measures for global ToM score	Community function—Disability Assessment Schedule: Self-care, social contact, work activity, global rating of community functioning made by interviewer	• Global community functioning correlated with combined ToM ($r = .43$, $P < .01$) and second-order ToM ($r = .30$, $P < .05$) but not first-order ToM ($r = .276$); effects remained or were strengthened after partialling out IQ; second-order ToM explained 15% of the variance in global community functioning in stepwise regression • Poor self-care and combined ToM significantly correlated after partialling out IQ ($r = -.367$, $P < .05$) but not before ($r = -.002$); not related to second-order ($r = -.216$) or first-order ToM ($r = -.017$) • ToM not related to poor social contact (first order, $r = -.078$; second order, $r = -.148$; combined, $r = -.201$) • ToM not associated with work ability (first order, $r = -.026$; second order, $r = -.085$; combined, $r = -.020$) • 41.7% of effects were minimal to large range, 33.3% were small to moderate range, and 25% were moderate to large range • Power for effect size of $r = .3$ is 0.501
Schenkel et al[77]	42 S or SA inpatients MA = 41 Male: 60% Yrs Ed: 12.1 Yrs Ill: ? Clor eq: ?	Hinting Task	Premorbid social functioning coded from charts	• Group differences on ToM between poor and good premorbid social functioning groups ($t(40) = 3.86$, $P < .0001$) • This is equivalent to a large effect size ($r = .52$) • Power for effect size of $r = .3$ is 0.481

Table 3. Continued

Study	Participants	SC Measures	FO Measures	Major Findings
Lysaker et al[51]	40 S or SA outpatients MA = 46 Male: 97.5% Yrs Ed: 12.5 Yrs Ill: ~21.4 Clor eq: ?	ASQ	Community function—QLS: interpersonal function, community participation	• Making a greater number of stable attributions predicted 8% of the variance in interpersonal function, 16% in community participation • When cognitive variables were covaried, the relationships with the ASQ were the same except for community participation (NS) • Effect sizes were small to moderate range and moderate to large range, respectively • Power for effect size of $r = .3$ is 0.461
Waldheter et al[52]	29 S or SA inpatients MA = 33 Male: 86% Yrs Ed: 10.6 Yrs Ill: ? Clor eq: 698–895	AIAQ IPSAQ	Social behavior in milieu: Modified Overt Aggression Scale	• Frequency of violence correlated with AIAQ hostility bias in accidental situations ($r = .407$, $P < .05$) but not in intentional ($r = -.010$) or ambiguous ($r = .053$) situations • Severity of violence was not significantly correlated with any AIAQ hostility bias (accidental $r = .368$, intentional $r = .129$, ambiguous $r = .106$) • The IPSAQ personalizing bias was correlated with severity ($r = .325$, $P < .05$) but not history ($r = .269$) of violence • AIAQ hostility bias for ambiguous situations and the IPSAQ personalizing bias together predicted 4% of the variance in severity of violence • 25% of effect sizes were minimal to small range, 37.5% were small to moderate range, and 37.5% were moderate to large range • Power for effect size of $r = .3$ is 0.343

Note: SC = Social Cognition; NC = Neurocognition; SA = Schizoaffective; MA = Mean Age; NS = Not Significant; Yrs Ed = Years of Education; Yrs Ill = Number of Years Ill; Clor eq = Chlorpromazine equivalent (mg/d); AIAQ = Ambiguous Intentions Attributions Questionnaire (Combs et al, in preparation); ASQ = Attributional Style Questionnaire[118]; Burglar Task[119]; Cigarettes Task[120]; Disability Assessment Schedule (WHO)[121]; Hinting Task[50]; Ice Cream Van Task[122]; IPSAQ = Internal, Personal, and Situational Attributions Questionnaire[123]; Modified Overt Aggression Scale[124]; Sally and Anne Task[125]; QLS = Quality of Life Scale.[56]

Table 4. Multiple Measures of Social Cognition (SC) and Functional Outcome (FO)

Study	Participants	SC Measures	FO Measures	Major Findings
Brune[73]	23 S inpatients or day clinic attendees MA = 38 Male: 78.2% Yrs Ed: ? Yrs Ill: 12.3 Clor eq: ?	EP: 36 photos from Ekman and Friesen Pictures of Facial Affect ToM: 6 Cartoon picture stories (sequencing and time scores derived), ToM questionnaire; also combined these two for ToM total score	Social behavior on milieu—SBS: total, BSM (mild to severe behavior problems), BSS (severe behavior problems only)	• BSM correlated with ToM questionnaire ($r = -.421$, $P < .05$) but not ToM sequencing ($r = -.261$), ToM time ($r = -.073$), ToM total ($r = -.366$) • BSS correlated with ToM total ($r = -.444$, $P < .05$) and ToM questionnaire ($r = -.524$, $P < .05$) but not ToM sequencing ($r = -.308$) or ToM time ($r = -.165$); BSS no longer correlated with ToM total when IQ controlled for ($r = -.27$, $P = .22$) • No correlation between EP and BSM ($r = -.086$), BSS ($r = -.082$) or SBS total ($r = -.005$) • No correlations between ToM and SBS total (sequencing, $r = -.188$; time, $r = .081$; questionnaire, $r = -.264$; total, $r = -.245$) • ToM questionnaire added 15% of the variance in BSS after duration of illness and IQ • For EP, all effect sizes were minimal to small range • For ToM, 16.7% of effect sizes were minimal to small range, 41.7% were small to moderate range, 33.3% were moderate to large range, and 8.3% were large • Power for effect size of $r = .3$ is 0.275
Ihnen et al[69]	26 S outpatients MA = 33 Male: 57.6% Yrs Ed: 12.1 Yrs Ill: ? Clor eq: 698	EP: FEIT, FEDT SP: SCRT	Social skills: Conversation probe role play rated for: Overall social skill, clarity, fluency, affect, gaze, involvement, and asks questions	• FEIT correlated with overall social skills ($r = .44$, $P < .05$), speech clarity ($r = .50$, $P < .01$), and involvement ($r = .34$, $P < .05$) but not fluency ($r = .08$), affect ($r = .32$), gaze ($r = -.29$) or asks questions ($r = .09$) • FEDT not correlated with any skills (overall $r = .17$, speech clarity $r = .29$, fluency $r = .12$, affect $r = .07$, involvement $r = .18$, ask questions $r = .08$) except gaze ($r = -.39$, $P < .05$) • SCRT not related to any skills (overall $r = .14$, fluency $r = .27$, affect $r = .09$, gaze $r = -.17$, involvement $r = .23$, asks questions $r = -.04$), except clarity ($r = .38$, $P < .05$) • After multiple test correction, only clarity and FEIT were significantly correlated

Table 4. Continued

Study	Participants	SC Measures	FO Measures	Major Findings
				• Backward multiple regression found FEIT was a significant predictor of overall social skill (β = .37), greater speech clarity (25% of the variance); FEDT was a significant predictor of gaze (β = −.41) • For EP, 28.5% of effect sizes were minimal to small range, 35.7% were small to moderate range, 28.5% were moderate to large range, and 7.2% were large • For SP, 28.5% of effect sizes were minimal to small range, 57.1% were small to moderate range, and 14.3% were moderate to large range • Power for effect size of $r = .3$ is 0.309
Penn et al[62]	27 S or SA inpatients MA = 34 Male: 66.7% Yrs Ed: ? Yrs Ill: ? Clor eq: 923	EP: Pictures of Facial Affect SP: Sequencing task	Social behavior on milieu—NOSIE: staff ratings for social interest, neatness, social competence	• EP associated with neatness at Bonferroni level ($r = .54$, $P < .01$), but social competence ($r = .37$, $P < .05$) and social interest ($r = .34$, $P < .05$) did not meet correction criteria • SP not related to social competence ($r = -.31$ and .12), social interest ($r = -.19$ and .07) or neatness ($r = -.26$ and .24) • For EP, 66.7% of effect sizes are moderate to large range, 33.3% are large • For SP, 16.7% of effect sizes are minimal to small range, 66.7% are small to moderate range, and 16.7% are moderate to large range • Power for effect size of $r = .3$ is 0.321
Pinkham and Penn[68]	49 S or SA outpatients MA = 33 Male: 57% Yrs Ed: 14.3 Yrs Ill: 10.4 Clor eq: 352.65	EP: FEIT, FEDT, BLERT SP: SCST (time, accuracy) ToM: Hinting Task, ToM vignettes	Social skills—conversation probe role play using overall rating of social skill	• Of the EP measures, BLERT ($r = .38$, $P < .01$) and FEIT ($r = .32$, $P < .05$) were significantly related to social skill but the FEDT was not ($r = .224$) • Of the SP measures, both time ($r = -.497$, $P < .01$) and accuracy ($r = .406$, $P < .01$) on the SCST were significantly correlated with social skill • Of the ToM measures, both Hinting ($r = .387$, $P < .05$) and ToM vignettes ($r = .456$, $P < .05$) were significantly associated with social skill • Addition of all social cognition measures predicting social skill (except FEDT) to a regression containing cognition added 26% variance

Table 4. Continued

Study	Participants	SC Measures	FO Measures	Major Findings
				• In regression, only significant predictor was SCST time, which accounted for 7% of the variance in social skill • For EP, 66.7% effect sizes were moderate to large range, and 33.3% were small to moderate range • For SP and ToM, all effect sizes were moderate to large range • Power for effect size of $r = .3$ was 0.548

Note: NC = Neurocognition; S = Schizophrenia; SA = Schizoaffective; MA = Mean Age; ToM = Theory of Mind; Yrs Ed = Years of Education; Yrs Ill = Number of Years Ill; Clor eq = Clorpromazine equivalent dose (mg/d); BLERT = Bell-Lysaker Emotion Recognition Test (D. Bell, P. Lysasker, G. Bryson, unpublished data) FEIT = Facial Emotion Identification Task[46]; FEDT = Facial Emotion Discrimination Task[46]; Hinting Task and ToM vignettes[50]; NOSIE = Nurse's Observation Scale for Inpatient Evaluation[53]; Pictures of Facial Affect[47]; SBS = Social Behavior Scale[54]; SCRT = Social Cue Recognition Test[42,43]; SCST-R = Schema Component Sequencing Task-Revised.[44]

domain are the Nurse's Observation Scale for Inpatient Evaluation[53] and the Social Behavior Scale.[54] Community functioning encompasses a wide variety of behaviors and activities related to independent living skills, such as social or work functioning. Examples of measures used to assess this construct are the Role Functioning Scale[55] and the Quality of Life Scale,[56] with most measures being rated by the interviewer. The area of social skill was conceptualized as those studies that used role-play tasks in which specific interactional skills were rated (eg, eye contact, voice volume, meshing, etc). Finally, social problem solving was defined as the ability of participants to generate solutions to everyday social problems. The most commonly used measure in this area is the Assessment of Interpersonal Problem Solving Skills,[57] although one study used the problem solving subscale of the Independent Living Scales.[58] It should be noted that when measures were identified by the authors as assessing "social skill" or "social problem solving," they were only included in the review if direct observation of social skill or social problem solving behavior occurred, so as to differentiate it from more cognitively based skills. In the following section, we summarize the relationship between each social cognitive domain and the 4 indices of functional outcome.

The Relationship of Social Cognition to Functional Outcome

SP

There is general support for a significant association between SP and social behavior on the milieu (tables 1 and 4). Specifically, 3 studies reported significant relationships between SP and social behavior in treatment settings,[59–61] although 1 did not.[62] The null findings for Penn et al[62] may have been due to the fact that the measure of SP, a social sequencing task (similar to the SCST and Picture Arrangement task), was developed for this study and did not have well-established psychometric properties. SP has also shown a consistent relationship with community functioning[10,62,63] across a variety of tasks and indices of functioning and predicted community status (ie, inpatient or outpatient).[64] Likewise, a robust relationship has been found between SP and social problem solving,[65–67] although these findings were mostly observed within inpatient samples. In contrast, the link between SP and social skill has not been firmly established because one study supports an association,[68] whereas two do not.[59,69] Although the only notable difference between these studies is the higher educational level of participants in Pinkham et al[68] study that found positive results, it is unclear if this is contributing to the discrepant findings.

The studies reviewed above generally used correlational analyses to examine the relationship between SP and functional outcome. A number of recent studies have extended this line of research to investigate whether SP mediates the relationship between neurocognition and functional outcome. Specifically, Sergi et al[10] and Vauth et al[61] used path analysis and Structural Equation Modeling, respectively, to show that SP does serve as a mediator between neurocognition and outcome, findings that have been replicated in a recent study that used multiple regression.[65]

In summary, SP has generally demonstrated significant relationships with most measures functional outcome, as evidenced by 10 of the 12 studies finding evidence for significant associations (see tables 1 and 4), although the

specific link with social skill remains equivocal. Effect sizes for these studies range the gamut, from null findings to large effects. Thus, SP may be more relevant for some social behaviors more than others.

EP

There appears to be a relationship between EP and social behavior in the milieu (tables 2 and 4),[44,70–72] although there are exceptions.[62] The study which did not support a relationship is methodologically similar to the others; thus, the reason for this discrepancy is unclear. However, it is important to note that most studies found evidence for moderate to large effect sizes for the relationship between EP and social behavior in the milieu, with the exception of Brune.[73]

Consistent with the foregoing, the majority of studies show a significant association between EP and social skill,[68,69,72] although there are exceptions.[70] Again, the reason for these discrepant findings are unclear, although Cohen et al[70] study had a substantially larger percentage of males than the other studies. EP also has a fairly consistent relationship with community functioning because 2 studies clearly support an association[38,74] and a third found 3 of 6 correlations of EP and community functioning to be statistically significant.[39] No study has yet examined the relationship between EP and social problem solving. Finally, there is preliminary evidence that EP may mediate the relationship between neurocognition and functional outcome.[38]

In summary, EP is consistently associated with community functioning, and there is good support for a relationship with social behavior in the milieu and social skill as well. Finally, the relationship of EP to social problem solving is unknown.

ToM

To date, few studies have examined the relationship between ToM and functional outcome.[75] Brune[73] examined the relationship between ToM and social behavior in the milieu and found that 3 of the 11 correlations between these domains were statistically significant. However, it should also be noted that of the nonsignificant correlations, only 2 would be interpreted as a null effect (ie, $r < .1$). Pinkham and Penn[68] found that performance on the Hinting task was associated with overall social skill among outpatients with schizophrenia. In the only study examining the relationship between ToM and community functioning, 5 of the 11 correlations conducted between a combined index of ToM or second-order ToM and community functioning were significant; none were significant if only first-order ToM performance was examined.[76] Additionally, ToM was related to premorbid social functioning as coded (poor or good) from chart records.[77] Finally, no study to date has examined the relationship between ToM and social problem solving.

Thus, given the relative paucity of studies in this area, it is difficult to draw firm conclusions about the relationship between ToM and any one domain of functional outcome. However, there is some preliminary evidence that ToM is related to social skill, community functioning, and social behavior in the milieu, although these results clearly require replication. It should be noted that all these studies found at least some significant results (including Brune[73]), but few of them presented reliability estimates on their ToM measures. This is a critical methodological issue, given the low reliability reported for ToM vignettes (.31) of Pinkham and Penn[68], which is a commonly used measure in this area.

AS

Only 2 studies have examined AS and functional outcome. Lysaker and colleagues[51] found that the number of stable attributions made was related to community functioning. Waldheter et al[52] found that having a "hostile attributional bias" predicted a small, yet significant amount of variance in aggression on an inpatient unit (ie, social behavior in the milieu), even after accounting for previous violence history. Clearly, however, more research is required before confident conclusions can be drawn about the relationship of AS to functional outcome.

Conclusions and Future Directions

The purpose of this review was to examine the relationship between social cognition (SP, EP, ToM, and AS) and functional outcome (social behavior in the milieu, community functioning, social skill, and social problem solving). Based on this review, we have drawn the following conclusions: First, there is a fairly consistent relationship between SP and various domains of functional outcome, particularly social problem solving, social behavior in the milieu, and community functioning. There is promising, but still inconsistent, evidence for a relationship between SP and social skill. Finally, there is growing evidence that SP may serve as a mediator between neurocognition and functional outcome. Second, EP appears to have a fairly consistent, yet modest, relationship with community functioning, social skill, and social behavior in the milieu, while no study has examined its relationship with social problem solving. Finally, one study suggests that EP may mediate the relationship between neurocognition and functional outcome.

Third, the domains of ToM and AS have received far less attention in terms of their functional significance. Current work is suggestive of a significant association between ToM and social skills and possibly with community functioning and social behavior in the milieu, but clearly more research is needed to draw firm conclusions. Only 2 studies have examined the relationship between

attributions and functional outcome. This is likely due to the fact that AS has typically been studied in the context of persecutory delusions, rather than functional outcome. However, findings suggest that attributions might be related to functional outcome, particularly those in which the behaviors match the content of the attributional biases (eg, hostile attributional biases and aggressive behavior).[52] These conclusions, however, should be met with caution due to the early and still developing nature of the literature. As more data become available on the relationship between social cognition and functional outcome, and some of the methodological problems plaguing this area are addressed in future studies, the findings from the current review may or may not change.

This review raises a number of issues that need to be considered in future research. At the conceptual level, a critical question is which aspects of functional outcome are expected to change to relate to specific domains of social cognition. In the extant literature, many studies focus on the notion that there should be a relationship between social cognition and functional outcome, but these relationships are generically defined, and do not specify which domain of social cognition should relate to which domain of functional outcome. In essence, the field needs to move from exploratory-based studies to hypothesis-based ones. For example, one might expect social cognition to be more strongly related to laboratory-based direct assessments of particular skills, rather than to community functioning. In fact, performance-based assessments might provide the most theoretically relevant link to neurocognition and social cognition in that they assess whether individuals are capable of performing certain behaviors in specific situations.[78] Of course, these skills are influenced by factors such as the motivation of the individual, but arguably, they provide a closer approximation of an individual's competence in particular areas than other measures of functional outcome. Broader-based domains of functional outcome (eg, recreational and work functioning) are not always strongly related to performance-based assessments,[70,79,80] and in addition, they may be influenced by factors outside the individual's control, such as level of social support, financial means, personal resources (eg, having an automobile), etc.[38]

A related conceptual issue is how social cognition relates to functional outcome. The majority of studies in this review examined social cognition and functional outcome at a single time point, thus assuming that they covary with one another, but with little consideration for causal relationships. In addition, as noted above, 2 longitudinal studies found evidence that EP was predictive of functional outcome at a later time point.[38,39] These findings provide preliminary support for a causal relationship between social cognition and functional outcome, but clearly more long-term studies are needed.

The review also raises a number of critical methodological issues. First, it is essential for future studies to use well-defined measures of functional outcome and multiple measures of social cognition to help elucidate the relationships between these constructs. Currently, it is difficult to examine specific relationships or employ meta-analytic techniques, given the different measures utilized across studies. Of course, the National Institute of Mental Healths' Measurement and Treatment Research to Improve Cognition in Schizophrenia program (MATRICS)[81,82] is an important step in this direction because well-defined measures of neurocognition have been chosen to comprise this battery (and a number of social functioning tasks are included under secondary outcomes). However, only a single social cognitive measure is included in the MATRICs battery (the Mayer-Salovey-Caruso Emotional Intelligence Test),[83] and it does not address the range of social cognitive abilities impaired in schizophrenia. Second, it is important for future studies to clearly operationally define the constructs of interest as well as to utilize measures with sound psychometric properties. For example, we noted that basic psychometric information for ToM measures, such as reliability and validity, are often not presented and, when they are, their coefficients are not satisfactory,[68] a problem that also has been observed for measures of EP.[72]

Third, sample characteristics, such as years of education achieved, duration of illness, and medication dosages, were inconsistently reported. Relatedly, over half of the reviewed studies had samples with over 70% of the participants being male. Given that schizophrenia occurs fairly often in females and that females with schizophrenia may have different illness trajectories and perhaps better social functioning, treatment response, and neuropsychological abilities than males,[84–86] it is critical for future work to attempt to recruit women with schizophrenia more heavily.

Fourth, over half of the research in this area included only inpatients. Although improving functioning in treatment settings (ie, social behavior in the milieu) is a valuable treatment goal, increasing current understanding of outpatient community functioning may be more pressing, given the move toward community-based care and that the largest subgroup of individuals with schizophrenia are outpatients.[87] And finally, most studies were underpowered. Specifically, 65% of studies had power estimates of .50 or less for detecting a moderate effect size, whereas only 17% of studies had adequate power of .80. Thus, extant research in this area may be underestimating significant findings due to the majority of the studies suffering from low statistical power.

Despite these limitations, it is clear that significant relationships exist between the domains of social cognition and functional outcome. Given the preliminary evidence that social cognition does have functional significance in schizophrenia, there has been growing interest

in devising interventions aimed at improving functional outcomes via remediation of social cognitive deficits. The rationale for this endeavor is further strengthened by the fact that prominent current interventions, such as symptom-focused cognitive behavior therapy (CBT), show limited generalizability to improvements in social functioning.[88–90]

The social cognitive interventions that have been developed to date can be classified as either ''targeted'' or ''broad based.'' Targeted interventions focus on a specific social cognitive domain (eg, EP), whereas broad-based interventions combine a variety of psychosocial approaches, including cognitive remediation, social skills training, and social cognitive skill building. Several targeted interventions have been shown to improve EP in schizophrenia.[91–96] Similarly, broad-based interventions have been found to improve some of the cognitive and social cognitive skills that they have targeted.[97–102] These findings are promising but also highlight several key issues that remain unaddressed. First, can we expect the narrow focus of targeted interventions to yield improvements across social cognitive domains or to generalize to social functioning? Second, if targeted interventions are too narrow, are broad-based interventions too burdensome? That is, is it necessary to stack social cognitive training atop intensive cognitive remediation and social skills training or might social cognitive training alone be sufficient to improve social functioning?

In an effort to address these issues, our research group has recently developed a social cognitive intervention that targets the 3 major domains that are impaired in schizophrenia: EP, ToM, and AS. Social Cognition and Interaction Training (SCIT) is an empirically derived, multimodal, 24-week group intervention for individuals with schizophrenia. Preliminary results from SCIT are promising. In our first (uncontrolled) pilot study, we showed that SCIT was associated with improvements in ToM, AS, and symptoms and that social cognitive and symptom improvement was independent of one another.[103] In a second pilot study, an initial group of participants who received SCIT showed improvement in all 3 social cognitive domains (EP, ToM, and attributions) as well as social functioning (as measured by the Social Functioning Scale[104] and aggression on the ward (as measured by incident reports) and showed a reduced need for closure and better tolerance for ambiguity (D. R. Combs, S. D. Adams, D. L. Penn, D. L. Roberts, J. Tiegreen, P. Stem, unpublished data, 2006) (as measured by the Need for Closure Scale).[105] All effect sizes were in the medium to large range. Although promising, these preliminary, open-trial results require replication in a controlled study before confident conclusions can be drawn.

At the current juncture, it is unclear how successful these social cognitive interventions will be; similar attempts in the cognitive remediation literature have been met with only modest success in improving neurocognitive abilities[106] or in impacting functional outcome.[107] However, it is hoped that over time, these interventions will play a prominent role—alongside medication management, CBT, social skills training, and cognitive remedation—in addressing the perennial riddle of improving functional outcome in schizophrenia.

Acknowledgments

This literature review was supported in part by a grant from Johnson and Johnson to D.L.P. We thank Amy Pinkham for creating the figure.

References

1. Bellack AS, Morrison RL, Wixted JT, Mueser KT. An analysis of social competence in schizophrenia. *Br J Psychiatry*. 1990;156:809–818.
2. Davidson M, Reichenberg A, Rabinowitz J, Weiser M, Kaplan Z. Behavioral and intellectual markers for schizophrenia in apparently healthy male adolescents. *Am J Psychiatry*. 1999;156:1328–1335.
3. Dworkin RH, Cornblatt BA, Friedmann R, et al. Childhood precursors of affective vs. social deficits in adolescents at risk for schizophrenia. *Schizophr Bull.* 1993;19:563–577.
4. Hans SL, Auerbach JG, Asarnow JR, Styr B, Marcus J. Social adjustment of adolescents at risk for schizophrenia: the Jerusalem infant development study. *J Am Acad Child Adolesc Psychiatry*. 2000;39:1406–1414.
5. Penn DL, Corrigan PW, Bentall RP, Racenstein JM, Newman L. Social cognition in schizophrenia. *Psychol Bull.* 1997;121:114–132.
6. Perlick D, Stastny P, Mattis S, Teresi J. Contribution of family, cognitive, and clinical dimensions to long-term outcome in schizophrenia. *Schizophr Res.* 1992;6:257–265.
7. Sullivan G, Marder SR, Liberman RP, Donahoe CP, Mintz J. Social skills and relapse history in outpatient schizophrenics. *Psychiatry*. 1990;60:340–345.
8. Tien AY, Eaton WW. Psychopathologic precursors and sociodemographic risk factors for the schizophrenia syndrome. *Arch Gen Psychiatry*. 1992;49:37–46.
9. Green MF. What are the functional consequences of neurocognitive deficits in schizophrenia? *Am J Psychiatry*. 1996; 153:321–330.
10. Sergi MJ, Rassovsky Y, Nuechterlein KH, Green MF. Social perception as a mediator of the influence of early visual processing on functional status in schizophrenia. *Schizophr Res.* 2006;163:448–454.
11. Green MF, Kern RS, Braff DL, Mintz J. Neurocognitive deficits and functional outcome in schizophrenia: are we measuring the ''right stuff''? *Schizophr Bull.* 2000;26:119–136.
12. Brothers L. The social brain: a project for integrating primate behavior and neurophysiology in a new domain. *Concepts Neurosci.* 1990;1:27–61.
13. Adolphs R. The neurobiology of social cognition. *Curr Opin Neurobiol.* 2001;11:231–239.
14. Adolphs R. Investigating the cognitive neuroscience of social behavior. *Neuropsychologia*. 2003;41:119–126.

15. Blakemore SJ, Frith CD. How does the brain deal with the social world? *Neuroreport: For Rapid Commun Neurosci Res*. 2004;15:119–128.
16. Bozikas VP, Kosmidis MH, Anezoulaki D, Giannakou M, Karavatos A. Relationship of affect recognition with psychopathology and cognitive performance in schizophrenia. *J Int Neuropsychol Soc.* 2004;10:549–558.
17. Lee KH, Farrow TFD, Spence SA, Woodruff PWR. Social cognition, brain networks, and schizophrenia. *Psychol Med.* 2004;34:391–400.
18. Phillips ML, Drevets WC, Rauch SL, Lane RD. Neurobiology of emotion perception I: the neural basis of normal emotion perception. *Biol Psychiatry*. 2003;54:504–514.
19. Pinkham AE, Penn DL, Perkins DO, Lieberman J. Implications for the neural basis of social cognition for the study of schizophrenia. *Am J Psychiatry*. 2003;160:815–824.
20. Bryson G, Bell MD, Lysaker PH. Affect recognition in schizophrenia: a function of global impairment or a specific cognitive deficit. *Psychiatry Res.* 1997;71:105–113.
21. Kee KS, Kern RS, Green MF. Perception of emotion and neurocognitive functioning in schizophrenia: what's the link? *Psychiatry Res.* 1998;81:57–65.
22. Kohler C, Bilker WB, Hagendoorn M, Gur RE, Gur RC. Emotion recognition deficit in schizophrenia: association with symptomatology and cognition. *Biol Psychiatry*. 2000;48:127–136.
23. Penn DL, van der Does A, Spaulding WD, Garbin C, Linszen D, Dingemans P. Information processing and social cognitive problem solving in schizophrenia: assessment of interrelationships and changes over time. *J Nerv Ment Dis.* 1993;181:13–20.
24. Sachs G, Steger-Wuchse D, Krypsin-Exner I, Gur RC, Katschnig H. Facial recognition deficits and cognition in schizophrenia. *Schizophr Res.* 2004;68:27–35.
25. Schneider F, Gur RC, Gur RE, Shtasel DL. Emotional processing in schizophrenia: neurobehavioral probes in relation to psychopathology. *Schizophr Res.* 1995;17:67–75.
26. Silver H, Shlomo N. Perception of facial emotions in chronic schizophrenia does not correlate with negative symptoms but correlates with cognitive and motor dysfunction. *Schizophr Res.* 2001;52:265–273.
27. Green MF, Olivier B, Crawley JN, Penn DL, Silverstein S. Social cognition in schizophrenia: recommendations from the MATRICS new approaches conference. *Schizophr Bull.* 2005;31:882–887.
28. Bentall RP, Corcoran R, Howard R, Blackwood N, Kinderman P. Persecutory delusions: a review and theoretical interpretation. *Clin Psychol Rev.* 2001;21:1143–1192.
29. Gilbert DT, Pelham BW, Krull DS. On cognitive busyness: when person perceivers meet persons perceived. *J Pers Soc Psychol.* 1988;54:733–740.
30. Bentall RP, Swarbrick R. The best laid schemas of paranoid patients: autonomy, sociotropy, and need for closure. *Psychol Psychother Theory Res Pract.* 2003;76:163–171.
31. Colbert SM, Peters ER. Need for closure and jumping to conclusions in delusion-prone individuals. *J Nerv Ment Dis.* 2002;170:27–31.
32. Freeman D, Garety PA, Fowler D, Kuipers E, Bebbington PE, Dunn G. Why do people fail to choose more realistic explanations for their experiences? An empirical investigation. *J Consult Clin Psychol.* 2004;72:671–680.
33. Garety PA, Freeman D, Jolley S, et al. Reasoning, emotions, and delusional conviction in psychosis. *J Abnorm Psychol.* 2005;114:373–384.
34. Kinderman P, Dunbar R, Bentall RP. Theory of mind deficits and causal attributions. *Br J Psychol.* 1998;89:191–204.
35. Randall F, Corcoran R, Day JC, Bentall RP. Attention, theory of mind, and causal attributions in people with persecutory delusions. A preliminary investigation. *Cog Neuropsy*. 2003;8:287–294.
36. Taylor JL, Kinderman P. An analogue study of attributional complexity, theory of mind deficits and paranoia. *Br J Psychol.* 2002;93:137–140.
37. Woodward TS, Moritz S, Cuttler C, Whitman JC. Contribution of a cognitive bias against disconfirmatory evidence to delusions in schizophrenia. *J Clin Exp Neuropsychol.* 2006;28:605–617.
38. Brekke JS, Kay DD, Kee KS, Green MF. Biosocial pathways to functional outcome in schizophrenia. *Schizophr Res.* 2005;80:213–225.
39. Kee KS, Green MF, Mintz J, Brekke JS. Is emotion processing a predictor of functional outcome in schizophrenia? *Schizophr Bull.* 2003;29:487–497.
40. Lipsey MW, Wilson DB. *Practical Meta-Analysis.* Thousand Oaks, Calif: Sage; 2001.
41. Penn DL, Addington J, Pinkham A. Social cognitive impairments. In: Lieberman JA, Stroup TS, Perkins DO, eds. *American Psychiatric Association Textbook of Schizophrenia.* Arlington, Va: American Psychiatric Publishing Press Inc; 2006:261–274.
42. Corrigan PW, Buican B, Toomey R. Construct validity of two tests of social cognition in schizophrenia. *Psychiatry Res.* 1996;63:77–82.
43. Corrigan PW, Garman A, Nelson D. Situational feature recognition in schizophrenic outpatients. *Psychiatry Res.* 1996;62:251–257.
44. Corrigan PW, Addis IB. The effects of cognitive complexity on a social sequencing task in schizophrenia. *Schizophr Res.* 1995;16:137–144.
45. Rosenthal R, Hall JA, DiMatteo MR, Rogers PL, Archer D. *Sensitivity to Nonverbal Communication: The PONS Test.* Baltimore, Md: Johns Hopkins University Press; 1979.
46. Kerr SL, Neale JM. Emotion perception in schizophrenia: specific deficit or further evidence of generalized poor performance? *J Abnorm Psychol.* 1993;102:312–318.
47. Ekman P, Friesen WV. *Pictures of Facial Affect.* Palo Alto, Calif: Consulting Psychologists Press; 1976.
48. Bell D, Lysasker P, Bryson G. Positive and negative affect recognition in schizophrenia: a comparison with substance abuse and normal controls. *Psychiatry Res.* 1997;73:73–82.
49. Bellack AS, Blanchard JJ, Mueser KT. Cue availability and affect perception in schizophrenia. *Schizophr Bull.* 1996;22:535–544.
50. Corcoran R. Theory of mind and schizophrenia. In: Corrigan PW, Penn DL, eds. *Social Cognition and Schizophrenia.* Washington, DC: American Psychological Association; 2003:149–174.
51. Lysaker PH, Lancaster RS, Nees MA, Davis LW. Attributional style and symptoms as predictors of social function in schizophrenia. *J Rehabil Res Dev.* 2004;41:225–232.
52. Waldheter EJ, Jones NT, Johnson ER, Penn DL. Utility of social cognition and insight in the prediction of inpatient violence among individuals with a severe mental illness. *J Nerv Ment Dis.* 2005;193:609–618.

53. Honigfeld R, Gillis R, Klett JC. NOSIE-30: a treatment sensitive ward behaviour scale. *Psychol Rep.* 1996;191: 180–182.
54. Wykes T, Sturt E. The measurement of social behaviour in psychiatric patients: an assessment of the reliability and validity of the SBS schedule. *Br J Psychiatry*. 1986;148:1–11.
55. Goodman SH, Sewell DR, Cooley EL, Leavitt N. Assessing levels of adaptive functioning: the role functioning scale. *Community Ment Health J*. 1993;29:119–131.
56. Heinrichs DW, Hanlon T, Carpenter WT. The quality of life scale: an instrument for rating the schizophrenic deficit syndrome. *Schizophr Bull.* 1984;10:388–398.
57. Donahoe CP, Carter MJ, Bloem WD, Hirsch GL, Laasi N, Wallace CJ. Assessment of interpersonal problem-solving skills. *Psychiatry*. 1990;53:329–339.
58. Loeb PA. *ILS: Independent Living Scales Manual.* San Antonio, Tex: The Psychological, Harcourt Brace Jovanovich; 1996.
59. Appelo MT, Woonings FM, VanNieuwenhuizen CJ, Emmelkamp PMG, Sloof CJ, Louwerens JW. Specific skills and social competence in schizophrenia. *Acta Psychiatr Scand.* 1992;85:419–422.
60. Penn DL, Ritchie M, Francis J, Combs D, Martin J. Social perception in schizophrenia: the role of context. *Psychiatry Res.* 2002;109:149–159.
61. Vauth R, Rusch N, Wirtz M, Corrigan PW. Does social cognition influence the relation between neurocognitive deficits and vocational functioning in schizophrenia? *Psychiatry Res.* 2004;128:155–165.
62. Penn DL, Spaulding W, Reed D, Sullivan M. The relationship of social cognition to ward behavior in chronic schizophrenia. *Schizophr Res.* 1996;20:327–335.
63. Kim J, Doop ML, Blake R, Park S. Impaired visual recognition of biological motion in schizophrenia. *Schizophr Res.* 2005;77:299–307.
64. Revheim N, Medalia A. Verbal memory, problem-solving skills and community status in schizophrenia. *Schizophr Res.* 2004;68:149–158.
65. Addington J, Saeedi H, Addington D. Facial affect recognition: a mediator between cognitive and social functioning in psychosis? *Schizophr Res.* 2006;85:143–150.
66. Corrigan PW, Toomey R. Interpersonal problem solving and information processing in schizophrenia. *Schizophr Bull.* 1995;21:395–403.
67. Toomey R, Wallace CJ, Corrigan PW, Schuldberg D, Green MF. Social processing correlates of nonverbal social perception in schizophrenia. *Psychiatry*. 1997;60:292–300.
68. Pinkham AE, Penn DL. Neurocognitive and social cognitive predictors of interpersonal skill in schizophrenia. *Psychiatry Res.* In press.
69. Ihnen GH, Penn DL, Corrigan PW, Martin J. Social perception and social skill in schizophrenia. *Psychiatry Res.* 1998;80:275–286.
70. Cohen AS, Forbes CB, Mann MC, Blanchard JJ. Specific cognitive deficits and differential domains of social functioning impairment in schizophrenia. *Schizophr Res.* 2006; 81:227–238.
71. Hooker C, Park S. Emotion processing and its relationship to social functioning in schizophrenia patients. *Psychiatry Res.* 2002;112:41–50.
72. Mueser KT, Doonan R, Penn DL, et al. Emotion recognition and social competence in chronic schizophrenia. *J Abnorm Psychol.* 1996;105:271–275.
73. Brune M. Emotion recognition, 'theory of mind,' and social behavior in schizophrenia. *Psychiatry Res.* 2005;133: 135–147.
74. Poole JH, Tobias FC, Vinogradov S. The functional relevance of affect recognition errors in schizophrenia. *J Int Neuropsychol Soc.* 2000;6:649–658.
75. Brune M. "Theory of mind" in schizophrenia: a review of the literature. *Schizophr Bull.* 2005;31:21–42.
76. Pollice R, Roncone R, Falloon IRH, et al. Is theory of mind in schizophrenia more strongly associated with clinical and social functioning than with neurocognitive deficits? *Psychopathology*. 2002;35:280–288.
77. Schenkel L, Spaulding W, Silverstein SM. Poor premorbid social functioning and theory of mind deficit in schizophrenia: evidence of reduced context processing? *J Psychiatr Res.* 2005;39:499–508.
78. McKibbin CL, Brekke JS, Sires D, Jeste DV, Patterson TL. Direct assessment of functional abilities: relevance to persons with schizophrenia. *Schizophr Res.* 2004;72:53–67.
79. Dickerson FB, Parente F, Ringel N. The relationship among three measures of social functioning in outpatients with schizophrenia. *J Clin Psychol.* 2000;56:1509–1519.
80. Penn DL, Mueser KT, Doonan R, Nishith P. Relations between social skills and ward behavior in chronic schizophrenia. *Schizophr Res.* 1995;15:225–232.
81. Green MF, Nuechterlein KH. The MATRICS initiative: developing a consensus cognitive battery for clinical trials. *Schizophr Res.* 2004;72:1–3.
82. Marder SR, Fenton W. Measurement and treatment research to improve cognition in schizophrenia: NIMH MATRICS initiative to support the development of agents for improving cognition in schizophrenia. *Schizophr Res.* 2004;72:5–9.
83. Mayer JD, Salovey P, Caruso DR. *Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT) User's Manual.* Toronto, Ontario: MHS Publishers; 2002.
84. American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders.* 4th ed. text revision. Washington, DC: Author; 2000.
85. Angermeyer MC, Goldstein JM, Kuehn L. Gender differences in schizophrenia: rehospitalization and community survival. *Psychol Med.* 1989;19:365–382.
86. Goldstein JM, Seidman LJ, Goodman JM, et al. Are there sex differences in neuropsychological functions among patients with schizophrenia? *Am J Psychiatry*. 1998;155: 1358–1364.
87. Brier A. The management of treatment-resistant schizophrenia. *Curr Opin Psychiatry*. 1995;81:41–44.
88. Cather C, Penn DL, Otto MW, Yovel I, Mueser T, Goff D. A pilot study of functional cognitive behavior therapy (fCBT) for chronic schizophrenia. *Schizophr Res.* 2005; 74:201–209.
89. Garety P, Fowler D, Kuipers E, et al. London-East Anglia randomised controlled trial of cognitive-behavioural therapy for psychosis. II: predictors of outcome. *Br J Psychiatry*. 1997;171:420–426.
90. Gumley A, O'Grady M, McNay L, Reilly J, Power K, Norrie J. Early intervention for relapse in schizophrenia: results of a 12-month randomized controlled trial of cognitive behavioral therapy. *Psychol Med.* 2003;33:419–431.
91. Choi KH, Kwon JH. Social cognition enhancement training for schizophrenia: a preliminary randomized controlled trial. *Community Ment Health J*. 2006;42:177–187.

92. Frommann N, Streit M, Wolwer W. Remediation of facial affect recognition in patients with schizophrenia: a new training program. *Psychiatry Res.* 2003;117:281–284.
93. Penn DL, Combs D. Modification of affect perception deficits in schizophrenia. *Schizophr Res.* 2000;46:217–229.
94. Russell TA, Chu E, Phillips ML. A pilot study to investigate the effectiveness of emotion recognition remediation in schizophrenia using the micro-expression training tool. *Br J Clin Psychol*. In press.
95. Silver H, Goodman C, Knoll G, Isakov V. Brief emotion training improves recognition of facial emotions in chronic schizophrenia: a pilot study. *Psychiatry Res.* 2004;128: 147–154.
96. Wolwer W, Frommann N, Halfmann S, Piaszek A, Streti M, Gaebel W. Remediation of impairments in facial affect recognition in schizophrenia: efficacy and specificity of a new training program. *Schizophr Res.* 2005;80:295–303.
97. Brenner HD, Hodel B, Roder V, Corrigan PW. Treatment of cognitive dysfunctions and behavioral deficits in schizophrenia. *Schizophr Bull.* 1992;18:21–26.
98. Hodel B, Brenner HD, Merlo M, Teuber JF. Emotional management therapy in early psychosis. *Br J Psychiatry*. 1998;172:128–133.
99. Hogarty GE, Flesher S, Urlich R, et al. Cognitive enhancement therapy in schizophrenia: effects of a 2-year randomized trial on cognition and behavior. *Arch Gen Psychiatry*. 2004;61:866–876.
100. Roncone R, Mazza M, Frangou I, et al. Rehabilitation of theory of mind deficit in schizophrenia: a pilot study of metacognitive strategies. *Neuropsychol Rehabil.* 2004;14: 421–435.
101. Spaulding WD, Reed D, Sullivan M, Richardson C. Weiler M. Effects of cognitive treatment in psychiatric rehabiltation. *Schizophr Bull.* 1999;25:657–676.
102. Van der Gaag M, Kern RS, van den Bosch RJ, Liberman RP. A controlled trial of cogntive remediation in schizophrenia. *Schizophr Bull.* 2002;28:167–176.
103. Penn DL, Roberts DL, Munt E, Silverstein E, Sheitman B. A pilot study of Social Cognition and Interaction Training (SCIT) for schizophrenia. *Schizophr Res.* 2006;80:357–359.
104. Birchwood M, Smith J, Cochrane R, Wetton S, Copestake S. The Social Functioning Scale: the development and validation of a new scale of social adjustment for use in family intervention programmes with schizophrenic patients. *Br J Psychiatry*. 1990;157:853–859.
105. Webster DM, Kruglanski AW. Individual differences in need for cognitive closure. *J Pers Soc Psychol.* 1994; 67:1049–1062.
106. Krabbendam L, Alleman A. Cognitive rehabilitation in schizophrenia: a quantitative analysis of controlled studies. *Psychopharmacology*. 2003;169:376–382.
107. Kurtz MM, Moberg PJ, Gur RC, Gur RE. Approaches to cognitive remediation of neuropsychological deficits in schizophrenia: a review and meta-analysis. *Neuropsychol Rev.* 2001;11:197–210.
108. Baker R, Hall JN. REHAB: a new assessment instrument for chronic psychiatric patients. *Schizophr Bull.* 1988;14:97–110.
109. Curran JP. A procedure for the assessment of social skills: the simulated social interaction test. In: Curran JP, Monti PM, eds. *Social Skills Training: A Practical Handbook for Assessment and Treatment.* New York, NY: Guilford Press; 1982.
110. Wechsler D. *WAIS-R Manual: Wechsler Adult Intelligence Scale-Revised.* San Antonio, Tex: The Psychological, Harcourt Brace Jovanovich; 1981.
111. Bolton B, Roessler R. The work personality profile: factor scales, reliability, validity, and norms. *Vocat Eval Work Adjustment Bull.* 1986;19:143–149.
112. Zigler E, Levine J. Premorbid competence in schizophrenia: what is being measured? *J Consult Clin Psychol.* 1981;49: 96–105.
113. Biehl M, Matsumoto D, Ekman P, Hearn V. Matsumoto and Ekman's Japanese and Caucasian Facial Expression and Emotion (JACFEE): reliability data and cross national differences. *J Nonverbal Behav.* 1997;21:3–21.
114. Nowicki S, Duke MP. Individual differences in the nonverbal communication of affect: the diagnostic analysis of nonverbal accuracy scale. *J Nonverbal Behav.* 1994;19:9–35.
115. Schooler NH, Weissman G. *Resource Materials for Community Mental Health Program Evaluators.* Rockville, Md: National Institute of Mental Health; 1979.
116. Strauss JS, Carpenter WT. The predictor of outcome in schizophrenia: I. Characteristics of outcome. *Arch Gen Psychiatry*. 1972;27:739–746.
117. Munroe-Blum H, Collins E, McCleary L, Nutall S. The social dysfunction index for patients with schizophrenia and related disorders. *Schizophr Res.* 1996;20:211–219.
118. Peterson C, Semmel A, von Baeyer C, Abramson LY, Metalsky GI, Seligman MEP. The attributional style questionnaire. *Cognit Ther Res.* 1982;6:287–300.
119. Frith CD, Corcoran R. Exploring 'theory of mind' in people with schizophrenia. *Psychol Med.* 1996;26:521–530.
120. Happe F. An advanced test of theory of mind: understanding of story characters' thoughts and feelings by able autistics, mentally handicapped and normal children and adults. *J Autism Dev Disord.* 1994;24:129–154.
121. World Health Organisation. *WHO Psychiatric Disability Assessment Schedule (WHO/DAS) With a Guide to its Use.* Geneva, Switzerland: Author; 1988.
122. Baron-Cohen S. The autistic child's theory of mind: a case of specific developmental delay. *J Child Psychol Psychiatry.* 1989;30:285–297.
123. Kinderman P, Bentall RP. A new measure of causal locus: the internal, personal and situational attributions questionnaire. *Pers Individ Dif.* 1996;20:261–264.
124. Kay SR, Wolkenfeld F, Murrill LM. Profiles of aggression among psychiatric patients: I. Nature and prevalence. *J Nerv Ment Dis.* 1988;176:539–546.
125. Baron-Cohen S, Leslie A, Firth U. Do the autistic children have a 'Theory of Mind'? *Cognition*. 1985;21:521–530.