



Social cognition, empathy and functional outcome in schizophrenia

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ARTICLE INFO

Article history:

Received 14 December 2009

Received in revised form 26 May 2010

Accepted 13 June 2010

Available online 6 July 2010

Keywords:

Schizophrenia

Social cognition

Emotion perception

Theory of mind

Sarcasm

Deceit

Empathy

TASIT

Social perception

Functional outcome

ABSTRACT

Social and occupational functioning difficulties are a characteristic feature of schizophrenia, and a growing body of evidence suggests that deficits in social cognition contribute significantly to these functional impairments. The present study sought to investigate whether the association between social cognition and social functioning in schizophrenia would be mediated by self-reported levels of empathy. Thirty outpatients with a diagnosis of schizophrenia or schizoaffective disorder, and twenty-five healthy controls completed a well-validated facial affect processing task (Ekman 60-faces facial task from the Facial Expressions of Emotion – Stimuli and Tests; FEEST), The Awareness of Social Inference Test (TASIT; to assess emotion perception and complex social cognitive skills such as the detection of sarcasm and deceit, from realistic social exchanges), and measures of self-reported empathy and social functioning. Participants with schizophrenia performed more poorly than controls in identifying emotional states from both FEEST and TASIT stimuli, and were impaired in their ability to comprehend counterfactual information in social exchanges, including sarcasm and lies, on the TASIT. Impairment in the comprehension of sarcasm was associated with higher empathic personal distress, and lower recreational functioning. Impairment in the identification of the emotions of others was found to be associated with lower satisfaction and lower empathic fantasy. However, empathy could not be explored as a mediator of associations between social cognition and functional outcome, due to lack of common associations with functional outcome measures. These findings have implications for the remediation of specific social cognitive deficits with respect to improving functional outcomes in schizophrenia.

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1. Introduction

Disturbances in social cognition are frequently observed in schizophrenia and contribute to poor functional outcomes, including the inability to engage in meaningful work and maintain satisfying interpersonal relationships (Couture et al., 2006). Whilst there has been recent interest in the functional impact, and targeted remediation, of basic social

cognitive impairments (such as facial emotion perception) in schizophrenia (Horan et al., 2008), the functional consequences of deficits in more complex social cognitive skills, including Theory of Mind (ToM) (Premack and Woodruff, 1978) and empathetic mentalising capacities, have been less well studied. The present study therefore set out to examine the functional impact of both facial emotion and ToM impairments in schizophrenia, and their association with the capacity to empathise as a potential mediator of the relationship between social cognition and social functioning.

Interest in the functional impact of social cognitive deficits follows a considerable body of research demonstrating

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impairments in the perception of facial affect (Edwards et al., 2002; Namiki et al., 2007) and emotional prosody (Hoekert et al., 2007; Leitman, 2005) in schizophrenia. In recent years a number of studies have shown social cognition to be a better predictor of social functioning than non-social cognition (Brune, 2005; Sergi et al., 2006). Emotion perception in particular has been linked to social competence, independent living, community involvement and interpersonal relationships (Mueser et al., 1996; Poole et al., 2000). However, examination of the functional significance of ToM deficits is less common in schizophrenia. Moreover, the impact of social perception deficits on the ability to empathise, being the ability to understand and experience the emotion of another (Hoffman, 2000) (or mentalise about others' emotional states) has not been addressed. Empathy relies on the ability to accurately perceive another's emotions, beliefs and motivations in a given situation (Decety and Meyer, 2008; Rochat and Striano, 1999), and has been demonstrated to be impaired in schizophrenia (Montag et al., 2007; Shamay-Tsoory et al., 2007). ToM deficits have also been repeatedly demonstrated in individuals with schizophrenia (Harrington et al., 2005b; Janssen et al., 2003), most commonly using false belief (deception) tasks (Frith and Corcoran, 1996; Mazza et al., 2001).

In order to examine relationships between simple and complex social perception, empathy, and functional outcome in schizophrenia, we employed The Awareness of Social Inference Test (TASIT) (McDonald et al., 2003) as an ecologically valid measure of simple (basic emotion perception) and complex (ToM skills) social cognition. TASIT utilises verbal social communication (particularly sarcasm) to indicate ToM capabilities (Channon et al., 2005; Leitman et al., 2006; McDonald, 1999), and requires the integration of cues from face, prosody, gesture, and social context to identify the emotions, beliefs and intentions of target characters in videotaped conversational interactions that closely align with real-world social encounters. Sarcasm is one example of a non-literal language device used in conversation that relies on ToM to imply that the true state of affairs is the opposite to that asserted (Brown and Levinson, 1978; Haverkate, 1990), and recent studies using the TASIT demonstrate impairments of sarcasm perception in schizophrenia (Kern et al., 2009; Leitman et al., 2006).

In this study we set out to examine the functional impact of deficits in simple and complex social cognition, with respect to vocational, interpersonal, and recreational functioning, and the ability to empathise. We specifically aimed to test the hypothesis that associations between social cognition and functional outcome would be mediated by the capacity to empathise. We therefore hypothesised (1) that schizophrenia patients would be impaired on both TASIT emotion and sarcasm perception relative to healthy controls, and (2) that deficits in emotion and sarcasm perception in schizophrenia patients would be associated with impairments in empathy and interpersonal aspects of social functioning (separately), and that empathy skills would mediate associations between social cognition and social functioning.

2. Methods

All study procedures were approved by the Human research Ethics Committees of the University of New South

Wales (HREC07104) and the South Eastern Sydney-Illawarra Area Health Service (07-171). All participants gave written informed consent prior to participation.

2.1. Participants

Twenty-five healthy controls (10 males) with a mean age of 35.7 years ($SD = 12.9$) were recruited from the general community. Thirty clinical participants (17 males) with a mean age of 46.1 years ($SD = 8.4$) were recruited from an outpatient clinic in the South Eastern Sydney and Illawarra Area Health Service, and the Australian Schizophrenia Research Bank Register (ASRB Register). Twenty-seven participants met DSM-IV (A.P.A., 1994) criteria for schizophrenia, and 3 met criteria for schizoaffective disorder. Two schizophrenia participants completed less than 70% of the test battery due to fatigue, and were therefore excluded from analyses. The twenty-eight remaining clinical outpatient participants (16 males) had a mean age of 45.9 years ($SD = 8.7$). All were taking antipsychotic medication at the time of testing: 4 participants were using conventional antipsychotics (clopixol) and 23 were taking second-generation atypicals (clozapine, olanzapine, and risperidone). Inclusion criteria were age 18–65 years, and ability to speak fluent English, with more than 10 years of formal education.

Exclusion criteria were history of head trauma, a neurological illness or central nervous system infection causing brain injury, or current alcohol or substance abuse or dependence.

2.2. Materials

2.2.1. Clinical assessment

A diagnosis of schizophrenia was confirmed by the treating clinician or via clinical assessment with the Diagnostic Interview for Psychosis (DIP) (Castle et al., 2006) on entry to the ASRB Register, and again confirmed at the time of interview using the Mini International Neuropsychiatric Interview (MINI) (Sheehan et al., 1998), based on DSM-IV diagnostic criteria (A.P.A., 1994). The MINI was also administered to healthy controls to eliminate current and past psychotic episodes, depression and anxiety. Current symptoms of schizophrenia patients were assessed using the Scale for the Assessment of Positive Symptoms (SAPS) (Andreasen, 1984) and the Scale for the Assessment of Negative Symptoms (SANS) (Andreasen, 1983). The National Adult Reading Test (NART) (Nelson and Willison, 1991) was administered to assess premorbid intelligence.

2.2.2. Social cognition measures

All subjects completed TASIT (McDonald et al., 2003) measure of emotion perception and ToM. Participants were tested on all three parts of Form A.

1. Part 1: *The Emotion Evaluation Test* is comprised of 24 short video clips in which an actor portrays one of six basic emotions (happy, sad, fear, disgust, surprise and anger).
2. Part 2: *Social Inference – Minimal* is comprised of fifteen video clips depicting sincere and sarcastic (simple sarcasm and paradoxical sarcasm) interactions between two actors, thus examining theory of mind. The dialogue is ambiguous,

requiring participants to attend to the actor's general demeanour, tone of voice, facial expression, and/or gestures. In *sincere* exchanges, the target actors mean what they say. In *simple sarcasm* exchanges, one of the target actors means the opposite of what is said, and intends for the listener to comprehend the real meaning of what is said. In *paradoxical sarcasm* exchanges, the dialogue between speakers is nonsensical unless it is understood that one speaker is being sarcastic. At the end of each clip, participants answered four questions designed to elicit interpretations of what the speaker was thinking, doing (e.g., criticising), meaning to say, and feeling.

3. Part 3: *Social Inference – Enriched*, which also examines theory of mind, is comprised of sixteen vignettes where participants are provided with extra information about the true state of affairs before or after the dialogue of interest. Participants are examined on their ability to detect deception in social encounters (i.e., lies) and sarcasm.

TASIT has an administration viewing time of approximately 35 min. Practice items were provided for all parts. The videotape was paused after each video clip to allow participants time to comprehend and answer the questions.

An additional measure of emotion perception using still faces was also administered. The 'Facial Expressions of Emotion: Stimuli and Tests' (FEEST) (Young et al., 2002) is a computerised task, where participants are required to identify six basic emotions from the Ekman and Friesen (1976) series (happiness, sadness, anger, fear, surprise, and disgust) presented in a still photographic format. Finally, the Interpersonal Reactivity Index (IRI) (Davis, 1983) was administered as a measure of self-reported empathy. The IRI is a 28 item self-report measure, comprised of four 7-item subscales: Perspective Taking, Fantasy, Empathic Concern and Personal Distress.

2.2.3. Functional outcome

The Longitudinal Interval Follow-up Evaluation – Range of Impaired Functioning Tool (LIFE-RIFT) (Leon et al., 1999) was administered to measure functional impairment. The LIFE-RIFT is a semi-structured interview which gathers information about functioning within the domains of (a) work and household functioning; (b) interpersonal relations with family and friends; (c) overall level of satisfaction; and (d) engagement in and enjoyment derived from recreational activities. Each domain is assigned a score between 1 (no impairment/very good functioning) and 5 (very poor/severe impairment). The LIFE-RIFT has demonstrated sound internal consistency, inter-rater reliability, and predictive validity (Leon et al., 1999).

2.3. Procedure

Subjects were tested individually in a dedicated testing laboratory. Administration time was approximately 3 h, with some participants tested over two sessions if vulnerable to fatigue. Participants were reimbursed for their time and travel expenses.

3. Results

3.1. Demographic and clinical variables

Table 1 displays participants' demographic and clinical characteristics. There were significant differences between schizophrenia and healthy controls on age ($F_{1,52} = 11.64$, $p < .01$), years of education ($F_{1,50} = 16.11$, $p < .01$), but not gender distribution ($\chi^2 = 1.55$, $p = .21$) or NART full-scale IQ score ($F_{1,45} = 3.50$, $p = .07$). Age and years of education were thus employed as covariates in focal analyses.

3.2. Group differences in emotion perception (FEEST and TASIT Part 1)

Group means (percent correct) are presented in Table 2 for TASIT Part 1 (Emotion Evaluation Test) and the FEEST. To examine the effects of task and valence, positive emotions (happy, surprised) were summed, and a percent correct score was calculated for TASIT Part 1 and FEEST, to enable comparison between the two tasks. Similarly, negative emotions (sad, angry, fear and disgust) were summed, and a percent correct score was calculated for each task. We used 2 (group: schizophrenia, control) \times 2 (task: TASIT Part 1, FEEST) \times 2 (valence: positive, negative) repeated measures analysis of variance (ANOVA) to examine group differences on these tasks, according to valence, controlling for age and years of education. There were significant main effects of group controlling for age ($F_{1,43} = 5.42$, $p < .05$) and years of education ($F_{1,41} = 6.93$, $p < .05$). A main effect of valence was observed when controlling for years of education ($F_{1,41} = 5.36$, $p < .05$), but not when controlling for age ($F_{1,43} = 1.97$, $p = .17$). A significant task \times valence interaction was revealed when controlling for both age ($F_{1,43} = 20.51$, $p < .001$) and years of education ($F_{1,41} = 8.74$, $p < .01$),

Table 1

Mean scores (and SDs) on demographic, clinical, and functional outcome variables.

Group	Schizophrenia	Healthy controls	F-value (significance)
Demographic			
Age, years*	45.85 (8.67)	35.68 (12.86)	11.64 ($p < .01$)
Years of education*	13.21 (2.68)	16.74 (3.55)	16.11 ($p < .01$)
IQ			
NART full-scale IQ**	104.96 (9.81)	110.00 (8.49)	3.50 ($p > .05$)
Clinical scales			
SAPS total score ^{a,b}	38.81 (26.89)		
SANS total score ^{a,b}	39.37 (21.76)		
LIFE-RIFT ^{a,b}			
Work	3.96 (1.40)		
Interpersonal	3.86 (1.41)		
Satisfaction	2.50 (.92)		
Recreation	2.54 (1.23)		
Total	12.86 (3.55)		

* Denotes significant group difference ($p < .01$).

^a Abbreviations: NART full-scale IQ = National Adult Reading Test full-scale Intelligence quotient; SAPS items = Scale for the Assessment of Positive Symptoms; SANS items = Scale for the Assessment of Negative Symptoms; LIFE-RIFT = Longitudinal Interval Follow-up Evaluation – Range of Impaired Functioning Tool.

^b Administered to participants with schizophrenia only.

Table 2

Mean scores (and SDs) on social cognitive tests (FEEST and TASIT).

Group	Schizophrenia	Healthy controls	Univariate F (sig)
FEEST (% correct)			
Positive	89.0 (14.4)	95.5 (6.3)	
Negative	63.2 (20.1)	74.8 (11.9)	
Total	70.7 (18.3)	82.2 (8.6)	2.53 ($p = .07$)
TASIT Part 1 (% correct)			
Positive	83.5 (17.9)	94.6 (7.5)	
Negative	75.3 (21.2)	90.5 (7.6)	
Total**	76.0 (18.8)	91.7 (6.5)	4.38 ($p < .01$)
TASIT Part 2			
Sincere	16.96 (3.34)	17.39 (3.12)	1.28 ($p = .29$)
Simple sarcasm**	14.41 (5.02)	19.31 (1.12)	7.34 ($p < .01$)
Paradoxical sarcasm**	14.26 (3.88)	19.22 (1.24)	10.12 ($p < .01$)
TASIT Part 3			
Lie**	25.54 (3.62)	29.55 (2.77)	8.07 ($p < .01$)
Sarcasm**	22.46 (4.95)	28.55 (1.68)	12.19 ($p < .01$)
IRI			
Perspective taking**	21.74 (5.58)	28.64 (3.08)	7.70 ($p < .01$)
Fantasy	20.74 (6.68)	20.57 (6.80)	2.01 ($p = .13$)
Empathetic concern**	23.39 (6.02)	29.57 (2.77)	5.32 ($p < .01$)
Personal distress*	19.83 (6.81)	13.36 (4.65)	3.85 ($p < .05$)

* Denotes significant group difference at $p < .05$ when controlling for age and IQ.** Denotes significant group difference at $p < .01$ when controlling for age and IQ.

indicating that participants in both groups found it more difficult to recognise negative emotions on the FEEST compared to TASIT.

Subsequent univariate analyses of covariance (ANCOVA) were conducted to examine group differences on the total scores for each emotion perception task, controlling for the effects of age and years of education: schizophrenia patients were significantly impaired on TASIT Part 1 ($F_{3,46} = 4.38$, $p < .01$), but not FEEST ($F_{3,40} = 2.53$, $p = .071$), compared to healthy participants. Post-hoc univariate analyses of covariation (ANCOVA) on *subtest* scores for TASIT (i.e., positive and negative totals scores), controlling for the effects of age and years of education, revealed that the schizophrenia group was significantly impaired in identifying negative emotions ($F_{3,46} = 4.83$, $p < .01$) but not positive emotions ($F_{3,46} = 2.21$, $p = .10$).

3.3. Group differences in theory of mind (TASIT Parts 2 and 3)

Performance on TASIT Parts 2 and 3 are summarised for each group in Table 2. A series of mixed model, repeated measures MANCOVAs were conducted separately for each TASIT section (Parts 2 and 3), to examine group differences in performance. For TASIT Part 2 – Social Inference: Minimal – we used repeated measures MANCOVA with 2 between-subjects levels (group: schizophrenia, control) and 3 within-subjects levels (task: sincere, simple sarcasm, paradoxical sarcasm), controlled for age and years of education. There was a significant main effect of group ($F_{1,44} = 14.12$, $p < .01$). A significant group \times task interaction was identified ($F_{2,88} = 3.71$, $p < .05$). We used subsequent univariate ANCOVAs for each dependent variable on the TASIT to examine group differences for each condition. There were no difference

between schizophrenia and control participants on TASIT Part 2 sincere exchanges ($F_{3,44} = 1.28$, $p = .29$). However, participants with schizophrenia were significantly impaired on the comprehension of TASIT Part 2 simple sarcasm ($F_{3,44} = 7.34$, $p < .001$), and Part 2 paradoxical sarcasm exchanges compared to healthy controls ($F_{3,44} = 10.12$, $p < .001$). For TASIT Part 3 – Social Inference: Enriched – we used repeated measures MANCOVA with 2 between-subjects levels (group: schizophrenia, control) and 2 within-subjects levels (task: lie, sarcasm). There were significant main effects of group ($F_{1,44} = 21.21$, $p < .001$), but no other significant main effects or interactions. We used subsequent ANCOVAs to examine group differences for each condition. Participants with schizophrenia had significantly more difficulty comprehending both sarcastic exchanges ($F_{3,42} = 12.19$, $p < .001$) and deceitful (lie) exchanges ($F_{3,42} = 8.07$, $p < .001$) compared to healthy controls, when controlling for age and years of education.

3.4. Group differences in empathy

Repeated measures MANOVA was used to examine group differences in facets of self-reported empathy, with 2 between-subjects levels (group: schizophrenia, control) \times 4 within-subjects levels (personal distress, perspective taking, empathetic concern and fantasy), controlling for age and years of education. There were no significant main effects, however, a significant interaction of group \times empathy emerged ($F_{3,99} = 9.56$, $p < .001$), reflecting significantly higher personal distress in schizophrenia participants, relative to controls ($F_{3,33} = 3.85$, $p < .05$), and significantly lower perspective taking ($F_{3,33} = 7.70$, $p < .001$) and empathic concern ($F_{3,33} = 5.32$, $p < .01$). There were no group differences for fantasy.

3.5. Associations between social cognitive measures and symptoms

Correlations between TASIT and current symptoms revealed that TASIT Part 1 was significantly correlated with SANS attention global rating ($r = -.46$, $p < .05$). TASIT Part 2 sincere was significantly correlated with SANS avolition/apathy global rating ($r = .40$, $p < .05$). TASIT Part 2 paradoxical sarcasm was significantly correlated with SANS alogia global rating ($r = -.53$, $p < .01$) and SANS attention global rating ($r = -.54$, $p < .01$). Correlations between empathy and current symptoms revealed that IRI empathic concern was significantly negatively correlated with SANS affective blunting global rating ($r = -.40$, $p < .05$), and positively correlated with SAPS delusions global rating ($r = .50$, $p < .05$). IRI fantasy was significantly correlated with SAPS hallucination global rating ($r = .55$, $p < .01$) and SAPS delusion global rating ($r = .62$, $p < .01$).

3.6. Medication effects on social cognition in schizophrenia

To investigate the effects of medication on social cognition measures, medication dosages were converted to Chlorpromazine equivalents (Andreasen et al., 2010) ($M = 300.92$, $SD = 153.91$). Correlations between Chlorpromazine dose and TASIT revealed significant negative associations between medication and TASIT Part 1 ($r = -.62$, $p < .001$), TASIT Part 3 sarcasm ($r = -.53$, $p < .01$), and TASIT Part 3 total ($r = -.50$,

$p < .01$), where those who were receiving higher doses of antipsychotic medication performed more poorly on TASIT. Correlations between medication dose and FEEST total score revealed a significant negative association ($r = -.58, p < .01$), where again those who were receiving higher doses of medication performed more poorly on FEEST.

3.7. Social cognition and functional outcomes

Mean scores on the LIFE-RIFT measure of social functioning are reported in Table 1 for the schizophrenia group. As an initial step toward mediation analysis, we examined relationships between social cognition and functional outcomes using a series of regression analyses within this group. Six significant associations were found. First, performance on TASIT Part 1 total was significantly associated with LIFE-RIFT satisfaction ($\beta = -.43, p < .05$), such that greater levels of emotion recognition were associated with higher overall satisfaction from activities. Second, performance on TASIT Part 1 total was significantly associated with IRI fantasy ($\beta = .44, p < .05$), such that increased accuracy of emotion recognition was associated with higher empathic fantasy. Third, performance on TASIT Part 2 simple sarcasm significantly predicted IRI personal distress ($\beta = -.47, p < .05$), such that more accurate perception of simple sarcasm was associated with lower personal distress in interpersonal situations. Fourth, performance on TASIT Part 3 sarcasm was significantly associated with LIFE-RIFT engagement in recreational activities ($\beta = -.53, p < .01$), such that more accurate perception of simple sarcasm was associated with greater engagement and enjoyment in recreational activities. Fifth, performance on TASIT Part 3 total was significantly associated with LIFE-RIFT engagement in recreational activities ($\beta = -.54, p < .01$), such that more accurate perception of sarcasm and deceit was associated with more engagement in recreational activities. Finally, performance on the FEEST was significantly associated with IRI empathic concern ($\beta = .41, p < .05$), such that more accurate perception of emotional expressions was associated with higher empathic concern. Although significant associations were demonstrated between social cognition and empathy (specifically, with emotion perception and simple sarcasm), there were no significant associations between these particular social cognition measures and functional outcomes. Therefore, we were not justified in progressing with a test of the hypothesis that associations between social cognition and functional outcome would be mediated by empathy (Baron and Kenny, 1986).

4. Discussion

This study set out to examine the functional impact of both simple and complex social cognitive impairments in schizophrenia, and associations with the capacity to empathise as a potential mediator of relationships between social cognition and social functioning. The use of TASIT replicated recent findings of impaired sarcasm perception in schizophrenia (Kern et al., 2009), and demonstrated impaired emotion perception from a combination of facial, gesture, prosodic and contextual information. These findings are consistent with previous reports of impairments in emotion perception utilising static photographs (Edwards et al., 2002),

affective vocal prosody (Bozikas et al., 2006; Hoekert et al., 2007; Leitman, 2005), and social context processing in schizophrenia (Green et al., 2007; Green et al., 2008). The finding that schizophrenia patients have more difficulty in recognising negative emotions on TASIT is consistent with previous research (Edwards et al., 2002; Namiki et al., 2007). However, the present study suggests that, relative to the more conventional measure of emotion identification utilising static photographs (Ekman stimuli from the FEEST), both control and schizophrenia participants were able to more accurately identify negative emotions on TASIT. This is consistent with previous research that suggests that additional information provided in TASIT (tone of voice, gesture and dynamic expression) might assist individuals in more accurately identifying emotional expressions (McDonald and Saunders, 2005).

Examination of specific ToM deficits using TASIT revealed that participants with schizophrenia were impaired in the understanding of sarcastic and deceitful social exchanges, even when the true state of affairs was provided within additional contextual information (Part 3). These results are consistent with previous studies showing impaired perception of sarcasm in schizophrenia (Kern et al., 2009; Leitman et al., 2006). Collectively, these findings suggest that with the use of more realistic social stimuli, schizophrenia patients may be able to effectively utilise a combination of facial, gestural, and prosodic cues to understand the intended meaning of *sincere* interpersonal exchanges. However, with increasing subtleties of vocal intonation and prosody (such as the use of sarcasm to convey attitude in conflict with the actual content of speech, or the intention to convey something other than what is being said; i.e., lies), the ToM abilities of schizophrenia patients appear to be compromised. These results thus suggest a specific, rather than general, ToM impairment in schizophrenia, in realistic social contexts, that may be limited to insincere social exchanges. Notably, social cognitive performance in schizophrenia was associated with medication dosage, with those receiving higher doses of medication more significantly impaired in the perception of emotion and sarcastic social exchanges even with additional contextual information. This is consistent with previous evidence of more significant impairment in ToM performance with increased illness chronicity, as indicated by length of illness (Harrington et al., 2005a; Langdon et al., 2002; Langdon et al., 1997).

In consideration of the functional implications of poor social cognition as measured by TASIT, the impact of social cognitive deficits on both self-reported empathy and social functioning was examined. Schizophrenia patients reported higher levels of personal distress with respect to others' emotions, and significantly lower perspective taking and empathic concern relative to healthy controls. Elevated personal distress and reduced perspective taking have been previously demonstrated in schizophrenia (Montag et al., 2007). Contrary to our findings, Montag et al. (2007) did not find evidence of lowered empathic concern in participants with schizophrenia. However, Shamay-Tsoory et al. (2007) observed a trend where participants with schizophrenia reported lower levels of empathic concern, compared to controls. These empathic facets of perspective taking, empathic concern and personal distress are related, where the failure to adopt another's perspective, but instead focusing on

the self, results in lower empathic concern and higher personal distress (Lamm et al., 2007). Elevated personal distress may motivate an individual to reduce one's own distress in an emotional situation as opposed to reducing the distress of another (Decety and Meyer, 2008). Interestingly, we found associations between the comprehension of sarcasm and lower personal distress, as well as increased engagement and enjoyment in recreational activities in schizophrenia. Also, emotion perception was associated with increased empathic fantasy and empathic concern, and higher reported overall satisfaction derived from activities. However, we did not find evidence to support empathy as a mediator between social cognition and functional outcomes.

These findings provide further evidence of direct links between social cognition and functional outcome in schizophrenia, and particularly regarding associations between ToM and community functioning. Furthermore, the performance of schizophrenia patients on TASIT, which presents test stimuli via videotaped realistic social scenarios, are suggestive of a specific, rather than general, ToM impairment that may be limited to sarcastic and insincere social exchanges. Indeed, a recent review (Couture et al., 2006) noted inconsistent findings among four previous studies of ToM and functional outcome in schizophrenia. Utilising cartoon picture stories, Brune (2005) found a significant association between ToM impairment in schizophrenia and bizarre social behaviours. In contrast, Bora et al. (2006) found that performance on the Eyes test (Baron-Cohen et al., 2001), but not a conventional measure of ToM (hinting stories), predicted social functioning, including recreational and social activities. However, the findings of the current study are in contrast to a recent study (Kern et al., 2009), where no associations between social cognition and community functioning were identified (using two global measures of social and role functioning (Cornblatt et al., 2007; McPheeters, 1984), but not recreational function). Our findings of an association between the understanding of sarcasm and greater engagement and enjoyment in recreational activities suggest that these components of ToM may be particularly relevant to the quality of interpersonal interactions that facilitate enjoyment in recreational activities. The present lack of association between social cognition and work functioning may be due to low variability (i.e., consistently poor vocational function) in schizophrenia.

The present findings in relation to both social function and empathy may thus be limited by the use of questionnaire measures. Whilst this is a common practice for the study of empathy, it is possible that assessment of empathic abilities through self-report measures does not tap empathic abilities utilised in everyday social interactions. Similarly, the range of skills relevant to social and occupational functioning that are assessed on self-report scales for functional outcome measurement may not adequately capture subtle variation among schizophrenia patients (e.g., if outcome measurement is limited to dichotomous outcomes such as whether the person is engaged in paid work, but ignores engagement in volunteer work or training). Also, it should be noted that social cognition is a set of learned abilities (Leukel, 1972), and as such, and similarly to cognition, variation in the use of pragmatic language is present in the normal population (Dress et al., 2008), and may additionally vary across cultures. As the

current study assessed the interpretation of sarcasm in fluent English speakers, we do not know whether these findings would translate across cultures. Finally, since the participants in this study were outpatients living in the community, it may not be appropriate to generalise the implications of the present findings to individuals with schizophrenia who are experiencing acute symptoms or those residing in inpatient settings.

In summary, the present findings implicate a specific deficit in ToM abilities requiring the integration of facial, vocal, postural, and contextual information to understand sarcasm and deception, operationalized here as the intention to convey information at odds with the literal interpretation of words conveyed in realistic social exchanges. These findings have implications for the targeted remediation of complex social cognitive skills in schizophrenia, with respect to facilitating improvements in interpersonal functioning and the quality of recreational interests. Improvements in interpersonal communication abilities may in turn facilitate the establishment and maintenance of meaningful social relationships, and enhance the prospects for vocational rehabilitation in schizophrenia.

Role of the funding source

This research was supported by a University of New South Wales Goldstar Award, and the Australian Research Council (Future Fellowship FT0991511), both held by MJG. The funding bodies had no role in the design of the study, collection and analysis of data, or the decision to publish.

Contributors

Author AS wrote the first draft of the manuscript. Author MJG was responsible for the design and execution of the research, contributed to the initial content of the manuscript and supervised subsequent revisions of the manuscript. Authors BL and AS contributed to data collection and analysis. Author SM assisted with study measures, and author MO assisted with recruitment for the study. All authors contributed to and have approved the final version of the manuscript.

Conflict of interest

All authors declare no conflicts of interest.

Acknowledgements

This study was supported by the Australian Schizophrenia Research Bank (ASRB), which is supported by the National Health and Medical Research Council of Australia, the Pratt Foundation, Ramsay Health Care, the Viertel Charitable Foundation and the Schizophrenia Research Institute. We would like to acknowledge the contribution of Charlotte James and Sarika Gupta who assisted with data collection and entry. We would also like to thank the volunteers who participated in this study.

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