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Similar and contrasting dimensions of social cognition in schizophrenia and healthy subjects

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ABSTRACT

Schizophrenia patients experience substantial impairments in social cognition (SC) and these deficits are associated with their poor functional outcome. Though SC is consistently shown to emerge as a cognitive dimension distinct from neurocognition, the dimensionality of SC is poorly understood. Moreover, comparing the components of SC between schizophrenia patients and healthy comparison subjects would provide specific insights on the construct validity of SC. We conducted principal component analyses of eight SC test scores (representing four domains of SC, namely, theory of mind, emotion processing, social perception and attributional bias) independently in 170 remitted schizophrenia patients and 111 matched healthy comparison subjects. We also conducted regression analyses to evaluate the relative contribution of individual SC components to other symptom dimensions, which are important clinical determinants of functional outcome (i.e., neurocognition, negative symptoms, motivational deficits and insight) in schizophrenia. A three-factor solution representing socio-emotional processing, social–inferential ability and external attribution components emerged in the patient group that accounted for 64.43% of the variance. In contrast, a two-factor solution representing socio-emotional processing and social–inferential ability was derived in the healthy comparison group that explained 56.5% of the variance. In the patient group, the social–inferential component predicted negative symptoms and motivational deficits. Our results suggest the presence of a multidimensional SC construct. The dimensionality of SC observed across the two groups, though not identical, displayed important parallels. Individual components also demonstrated distinct patterns of association with other symptom dimensions, thus supporting their external validity.

1. Introduction

Social cognition (SC) is defined as mental operations underlying social interactions (Brothers, 1990). It represents the interface between emotional and cognitive processing, with an inter-subjective quality, requiring reflective (meta-cognitive) and social-inferential abilities. Schizophrenia patients demonstrate significant deficits across multiple dimensions of SC (Savla et al., 2013). Their clinical and heuristic significance lies in their associations with psychopathology (Corcoran et al., 1995; Ventura et al., 2013), functional outcome (Fett et al., 2011; Schmidt et al., 2012) and their role as a potential composite-endophenotype marker to explore the neurobiology of schizophrenia (Meijer et al., 2012; Mehta et al., 2013b). The distinctiveness of SC from general cognitive processes (neurocognition) has been consistently demonstrated in factor analytical and brain lesion studies in both schizophrenia patients and healthy comparison subjects (Mehta et al., in press). Nevertheless, modest correlations between neurocognitive and SC abilities have also been observed (Ventura et al., 2013). This indicates a possibility of there being distinct, yet overlapping neural processes underlying SC and neurocognition.

While distinctiveness of neurocognition and SC has been consistent, such consistency has not been observed regarding the factor structure of SC per se in schizophrenia. These inconsistencies are reflected in the *number* of observed factors — unitary (Addington and Piskulic, 2011), binary (Williams et al., 2008; Lin et al., 2012;

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Mehta and Thirthalli, 2013) and multi-factorial (Mancuso et al., 2011). In addition, the *dimensionality* of the observed factors was also disparate — cognition about self versus others (Lysaker et al., 2013a), lower-level versus higher-level cognitive processes (Mancuso et al., 2011) and cognitive versus affective processes (Mehta and Thirthalli, 2013). These disparities possibly arise due to differences in dimensions and comprehensiveness of SC assessments, types of tests used, heterogeneity in the sample studied (e.g., different stages of illness – symptomatic versus remitted, and samples from different cultures – western versus non-western).

Furthermore, very few studies have researched as to how SC dimensions in schizophrenia differ from those in healthy individuals. This has the potential to yield better insights into the specifics of construct validity of SC, and the potential neural underpinnings of SC in schizophrenia. This knowledge may aid in developing novel treatment strategies for SC deficits.

Factor analytical studies have been used to determine how individual cognitive processes cluster together, thus reducing a larger set of cognitive abilities to smaller subgroups (Kerlinger, 1979). When SC was assessed using the Mayer–Salovey–Caruso Emotional Intelligence Test (MSCEIT), it was found that an alternative two-factor model representing emotional knowledge and regulation provided the best solution in the schizophrenia sample, in contrast to a four-factor model (emotion perception, facilitation, understanding and management) in normative samples (Eack et al., 2009). This study however had limitations: the sample size of patients was small ($n = 64$), psychiatric disorders were not ruled out in the normative sample and the two groups were not matched for age, gender or education. Moreover, the authors also reflected upon the modest scope of MSCEIT in assessing the broad range of SC paradigms, highlighting the need for broader social cognition assessment strategies (Eack et al., 2010). In another investigation, two out of the three social cognitive factors in a normative sample (Rowe et al., 2007) were partially replicated in first episode schizophrenia patients (Williams et al., 2008). This investigation also had similar limitations in the form of small sample of schizophrenia patients and lack of matching between the two groups.

While understanding the dimensional construct of SC is important, it is equally crucial to establish the clinical significance of the derived SC construct(s). This can be ascertained to some extent by examining how the extracted components relate to other clinically important symptom dimensions. This method of establishing the generalizability of the components to different processes, provides support for the external validity of the components (Anderson and Bushman, 1997).

In the present study, we aimed to explore the dimensionality of SC in schizophrenia patients in remission, and compare it with that of healthy comparison subjects using comprehensive SC assessments. We also aimed to study the clinical significance of the extracted construct(s) by examining their relationship with important and related symptom dimensions like neurocognition, negative symptoms, motivational deficits and insight. These variables were chosen as they were deemed important based on past observations of their consistent ability to predict functional outcome in schizophrenia (Gard et al., 2009; Saravanan et al., 2010; Fett et al., 2011; Lin et al., 2013).

2. Methods

2.1. Subjects

Data for this analysis was taken from two studies that examined (a) the clinical significance of SC in the absence of florid positive symptoms (Mehta et al., 2013b), and (b) neurobiology of SC in schizophrenia (Mehta et al., 2013a). Data for schizophrenia patients was obtained from the former; data for healthy subjects was obtained from both the former and the latter studies. These studies were conducted at the National Institute of Mental Health & Neurosciences, Bangalore and were reviewed and approved by the institute's ethics committee. All participants provided a written informed consent. A total of 170 schizophrenia patients diagnosed independently by two qualified psychiatrists according to the DSM IV criteria, and confirmed using the Mini-International Neuropsychiatric Interview (M.I.N.I.) (Sheehan et al., 1998) were compared to 111 healthy comparison subjects. Patients fulfilled the operational criteria for remission (scoring ≤ 3 on the Positive and Negative Syndrome Scale rated for the previous 6 months) in psychotic (P1 — delusions, P3 — hallucinatory behavior and G9 — unusual thought content) and disorganization (P2 — conceptual disorganization and G5 — mannerisms/posturing) dimensions (Andreasen et al., 2005). Patients fulfilling these remission criteria were chosen to obtain a homogeneous group of patients in whom the clinical significance of SC could be better studied. Patients with substance dependence in the last six months (except nicotine), and those with co-morbid neurological or medical disorder or clinically diagnosable or self-reported visual or auditory impairment were excluded. The Hindi Mental Status Examination (Ganguli et al., 1995) was used as a cognitive screening instrument to draw inference about the patients' potential ability to participate in the more complex social and neurocognitive tasks. All patients performed adequately on the HMSE; their scores ranged from 26 to 31, with a mean (SD) score of 29.3 (0.84). All patients were on stabilized doses of antipsychotics four months prior to evaluation. 150 (88.2%) patients were on atypical antipsychotics, nine (5.3%) were on typical antipsychotics and the rest (6.5%) were on a combination of atypical and typical antipsychotic medications. The mean chlorpromazine equivalent dose was 398.76 ± 218.83 mg/day (Andreasen et al., 2010).

Healthy comparison subjects were recruited through 'word-of-mouth' from consenting volunteers. They did not have family history of any psychotic disorder in first and second-degree relatives as assessed by clinical interview. They were screened to rule out Axis-1 psychiatric disorder using the Mini-International Neuropsychiatric Interview-Screening (Sheehan et al., 1998).

2.2. Assessments

Subjects from both groups underwent SC assessments. In addition, patients were assessed for their symptom status, neurocognitive performance, motivational deficits and insight.

2.2.1. Social cognition

Consistent with expert committee recommendations (Green et al., 2005, 2008), we selected 4 out of the 5 recommended SC domains, namely, Theory of Mind (ToM), emotion processing, social perception, and attributional bias. Social knowledge was not assessed, as there are no reliable tools to assess it in the Indian context. ToM, social perception and attributional bias were assessed using the Social Cognition Rating Tools in Indian Setting (SOCRATIS) (Mehta et al., 2011b). Emotion processing was assessed using the Tool for Recognition of Emotions in Neuropsychiatric Disorders (TRENDS) (Behere et al., 2008). Cultural factors are known to influence social cognition (Mehta et al., 2011a). SOCRATIS and TRENDS have undergone *cultural adaptation* (e.g., use of native names, attire, and actors) and *translational procedures* (e.g., using conceptual, rather than literal, translations in two Indian languages) to modify the tasks to the Indian cultural setting, without disturbing the actual SC constructs that they were meant to test. The content validity, in terms of fidelity to the original construct and cultural appropriateness of these tasks has been found to be satisfactory. When tested on bilinguals, there was good concurrence of their performance in the original and the modified tasks (concurrent validity). These