Theory of mind deficits in symptom remittent schizophrenia: a state or a trait?

Mohamed Elsayed Eltaweel[a] and Yaakob Ibrahim[b]

[a]Department of Psychiatry, Faculty of Medicine, Cairo University, Kasr Al Ainy, Egypt and [b]Department of Clinical Psychology, Psychologist Kuwait Mental Health Center, Kuwait

Correspondence to Mohamed Elsayed Eltaweel, MD, Department of Psychiatry, Faculty of Medicine, Cairo University, Kasr Al Ainy 11562, Egypt
Tel: +20 105 181 837;
e-mail: taweel24@hotmail.com

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Background
Several research studies have reported impairments in theory of mind (ToM) abilities in patients with schizophrenia. In addition, there is some evidence that family relatives of schizophrenic patients also demonstrate deteriorating ToM and task performance suggesting a genetic vulnerability for the disorder. This study aimed to compare ToM impairments among symptom remittent patients with first-episode schizophrenia, their unaffected biological full siblings, and controls and also determine whether there is any association between clinical profile of schizophrenic patients and components of ToM abilities.

Patients and methods
The study included 50 male patients with symptom remittent first-episode schizophrenia, 50 biological unaffected full siblings, and 50 healthy individuals. The Awareness of Social Inference Test (TASIT) consists of a series of videotaped vignettes that are designed to measure social perception abilities and assess the detection of sarcasm, an important component of ToM.

Results
Compared with controls, patients with symptom remittent first-episode schizophrenia and their biological unaffected full siblings performed poorer on TASIT components ($P=0.001$), with siblings having intermediate performance between patients and controls. We found a significant correlation between severity of negative symptom score, duration of hospitalization at index episode, and poor TASIT performance in the schizophrenic patient group ($P<0.02$).

Conclusion
Our findings support the notion that poor TOM abilities may be a trait rather than a state phenomenon of remittent first-episode schizophrenic patients. This suggests that effective interventions, such as social cognition and interaction training, may be beneficial in such patients.

Keywords:
biological siblings, schizophrenia, social perception, the awareness of social inference, theory of mind

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Introduction

Schizophrenia is the most debilitating and costly of all adult mental disorders [1]. Cardinal in schizophrenia psychopathology is communicatory disturbance [2]. This disturbance is multifaceted and can take the form of language disorganization as well as difficulty in decoding affect based upon either visual (i.e. facial) or auditory input. Some researchers have sought to tie these deficits to impairment in theory of mind (ToM), or the ability to infer one's own or another' internal mental state based upon behavioral interaction [3]. Others see ToM deficits as reflecting more general impairment of core executive functioning ability and negative symptoms [4], although such deficits typically remain significant even when controlling for such factors [5]. The literature on social cognition in schizophrenia has grown rapidly in the past decade. Schizophrenia patients exhibit impairments in both low-level and high-level social cognitive processes [6–10], and their impaired social cognition is consistently related to functional outcome [11,12]. ToM is an important domain of social cognition and has the strongest association with community functioning, compared with other cognitive functions [12]. Current research in social cognitive processing and schizophrenia has begun to link ToM ability to social dysfunction and global outcome in the illness. Some researchers found that ToM defects were a predictor of social behavioral abnormalities using the social behavioral scale [13,14]. Recent research suggests that ToM abilities are more strongly associated with social functioning than with any other aspect of social cognition or neurocognition [12]. ToM refers to the ability of an individual to attribute mental states, such as beliefs and intentions, to another individual. ToM abilities are consistently found to be impaired in schizophrenic patients [15].

A more recent debate has focused on whether these symptoms are more state-related or trait related. To date,

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there have been conflicting findings. There is some evidence that suggests that ToM deficits are present early in the course of the illness and may be maintained throughout the course of the illness [16].

Given that ToM has been associated with critical aspects of social functioning [12,17], it is important to understand the underpinnings of ToM deficits in schizophrenia and identify associated vulnerabilities in nonpsychotic relatives. Emerging evidence indicates that performance on social cognitive tasks is indeed amenable to psychosocial intervention techniques [18], and more targeted treatments can lead to improvements in functional outcome [19].

Hypothesis

We hypothesized the following: the clinically remittent first-episode schizophrenic patients will show greater deficits compared with controls; unaffected biological full siblings of participating patients will share some of these deficits but not all; and subtle differences will be revealed between unaffected siblings and matched controls. Furthermore, we hypothesized that greater ToM impairment would predict worse social and global functioning and greater symptomatology in schizophrenic patients.

Aim

The present study aims were as follows: (a) to investigate whether ToM impairments exist in clinically remittent patients with first-episode schizophrenia; (b) to clarify whether ToM impairment is a state or trait marker, by studying unaffected biological full siblings of schizophrenic patients; and (c) to examine the relationship between ToM and symptom psychopathology in schizophrenic patients.

Patients and methods

Design

This work adopted a family-based control design study during the period between January 2007 and December 2008.

Setting

This study was conducted at Kuwait Mental Health Center, Kuwait, after being approved by the local scientific and ethical committee. Written informed consent was obtained from all patients and/or their caregivers. The study included three groups. The first group comprised 50 clinically remittent first-episode schizophrenic male patients diagnosed according to *Diagnostic and statistical manual of mental disorders*, 4th ed., text revision (DSM-IV-TR) [20]. Every participant's assessment took place within a month after fulfillment of symptom remission following first-episode schizophrenia. We classified this group as 'remitted' according the standardized remission criteria for schizophrenia by the Remission in Schizophrenia Working Group [21]. The second group comprised 50 unaffected biological full siblings of the enrolled patients. The control group comprised 50 healthy individuals.

Participants

A total of 150 individuals participated: 50 first-episode schizophrenic patients fulfilling symptom remission criteria, 50 adult nonpsychotic biological full siblings of participating patients, and 50 healthy controls who were biologically unrelated to the participating patients. The same exclusion criteria were applied for the patients and the siblings, except that none of the controls had any lifetime or family history of psychiatric disorder. Inclusion criteria for all participants included the following: (a) male sex, (b) age 21–30, and (c) minimum IQ of 70. Further criteria for inclusion of biological full siblings were as follows: no lifetime diagnosis of a psychotic disorder or bipolar disorder, or history of antipsychotic medication use. Further criteria for inclusion of healthy controls were as follows: no personal or family history of a psychotic disorder or bipolar disorder, or personal use of an antipsychotic medication. The exclusion criteria were as follows: (a) comorbid DSM-IV Axis I Disorder; (b) lifetime history of any DSM-IV-TR disorders; (c) mental retardation; (d) severe hearing or visual impairment; (e) history of head injury or neurological disorders; (f) history of receiving electroconvulsive therapy in the past 6 months; and (g) lifetime history of alcohol and substance abuse.

Diagnosis and assessment

All participants were subjected to the following:

(1) The Structured Clinical Interview for DSM-IV Axis I Disorders [22].
(2) The structured interview for schizotypy, with supplemental questions, to measure Axis II cluster A disorders in relatives and controls [23.] Diagnoses were assigned according to DSM-IV-TR criteria [20]. No relatives or controls met criteria for a cluster A disorder.
(3) Clinical symptom assessment:
We assessed clinical symptoms using the Positive and Negative Syndrome Scale (PANSS) [24] for schizophrenic patients to assess the severity of psychopathology symptoms of schizophrenia [24]. The PANSS is a 30-item, clinician-rated measure of common symptoms of schizophrenia. Each item was rated on a 1–7 scale with higher numbers representing more severe symptoms. The range for the PANSS total score was from 30 to 210. The range for the PANSS subscale was from 8 to 56.
(4) We defined remission according to PANSS operational criteria [24] set up by the Remission in Schizophrenia Working Group [21]. The symptomatic criterion includes eight core PANSS items (delusion, unusual thought content, hallucinatory behavior, conceptual disorganization, mannerism/posturing, blunted affect, social withdrawal, and lack of spontaneity) with a score less than or equal to 3. The duration criterion is symptomatic remission

maintenance over 6 consecutive months. Definition of remission is clearly important for a proper interpretation of the findings as residual positive, and persistent negative symptoms are commonly observed in recent onset and in stable individuals affected by schizophrenia. The criteria published by Andreasen for clinical remission are based on eight selected items from PANSS, thus excluding all items that significantly contribute toward overall clinical picture and quality of life, such as depressive and other symptoms.

(5) The Wechsler Abbreviated Scale of Intelligence [25] and the vocabulary and matrix reasoning subtests of the Wechsler Abbreviated Scale of Intelligence were used to estimate the IQ of all participants.

(6) Assessments of ToM: The Awareness of Social Inference Test (TASIT) (parts II, Social Inference Minimal and part III, Social Inference Enriched) [26] was used to assess participants' ToM abilities. TASIT is an audiovisual tool designed for the clinical assessment of social perception with alternate forms for retesting. Part I assesses emotion recognition, parts II and III assess the ability to interpret conversational remarks meant literally (i.e. sincere remarks and lies) or nonliterally (i.e. sarcasm) as well as the ability to make judgments about the thoughts, intentions, and feelings of speakers. Part II (Social Inference Minimal) is made up of 15 vignettes, each lasting 20–60 s, with five sincere and 10 sarcastic exchanges and associated comprehension questions. Part III of the TASIT consists of 16 videoed scenes, each lasting 15–60 s, depicting lies or sarcasm (eight of each presented in a fixed random order).

For each scene, participants answer four types of forced-choice (yes/no) questions: (a) what one character in the scene is doing to the other; (b) what the character is trying to say to the other person; (c) what the character is thinking; and (d) what the character is feeling. The test provides an overall total score (maximum = 64).

Statistical analysis

The collected data were organized and statistically analyzed using SPPS, version 19, statistical computer package (North Castle, New York, USA). The mean and SD was used for presentations of quantitative data. The difference as regards ToM abilities were analyzed using multivariate analysis of variance (ANOVA). The Student *t*-test was used for comparison between two means. The χ^2-test was used for comparison between studied groups. Repeated-measures ANOVAs were used to analyze the effect of condition and group on task performance. Multiple regression analyses were conducted to test the model that symptom severity (i.e. PANSS negative subscale scores), duration of illness, and time to achieve symptom remission in the schizophrenia group predict poor TASIT performance. The 5% level of significance was adopted for interpretations of tests of significance.

Results

Sociodemographic characteristics

The study included three groups: the schizophrenic group with a mean ± SD age of 22.4 ± 5.7 years, the unaffected biological full siblings of schizophrenic patients group with a mean ± SD age of 23.1 ± 6.3 years, and the control group with a mean ± SD age of 22.8 ± 5.7. All groups were matched as regards various sociodemographic variables such as age, marital status, employment status, and education level ($P > 0.05$) (Table 1).

The result of clinical profile for patients with schizophrenia is presented in Table 2. The mean ± SD age of onset was 21.1 ± 6.2. Duration of duration of untreated psychosis (DUP) was 18.2 ± 7.9. Time to reach symptom remission was 9.3 ± 4.6. The score of PANSS positive symptom was 24.9 ± 11.51, and that of PANSS negative symptom was 21.6 ± 10.9.

All 50 schizophrenic patients were on antipsychotic medication: 30 (60%) patients were on monotherapy, and 20 (40%) patients on polytherapy. The score of antipsychotic switches was 2.1 ± 0.9.

Performance on TASIT part II subscales (Social Inference Minimal) in the three study groups is summarized in Table 3, and effect sizes are listed for the differences between groups.

Using composite scores for each TASIT part II subscales, repeated-measures ANOVA revealed a significant main effect of group ($F = 39,76$, *d.f.* $= 2,124$, $P < 0.001$), with schizophrenic patients performing worst compared with controls ($P < 0.001$) and siblings ($P < 0.01$). Controls performed best, and siblings showed intermediate performance significantly different from that of healthy individuals ($P < 0.01$).

In addition, evaluation of the interference of the three subscales, sincere, simple sarcasm, and paradoxical sarcasm, with the three groups (schizophrenic, sibling, and control) using repeated-measures ANOVA demonstrated a main effect of subscale (sincere, $P < 0.001$; simple sarcasm, $P < 0.004$; and paradoxical sarcasm, $P < 0.04$).

Furthermore, there was an interaction between TASIT part II subscales and group ($F = 2,293$, *d.f.* $= 2$, $P < 0.03$). To follow-up on this significant interaction, repeated-measures ANOVAs were conducted to specifically compare performance among the three groups on the sincere, simple sarcasm, and paradoxical sarcasm subscales.

Evaluation of interaction of the three subscales, sincere, simple sarcasm, and paradoxical sarcasm, with the schizophrenic and control groups using repeated-measures ANOVA demonstrated no main effect of condition ($F = 1,4$, *d.f.* $= 2,139$, $P < 0.41$). However, a significant main effect of group was found ($F = 8,777$, *d.f.* $= 2$, $P < 0.001$), with schizophrenic patients scoring lower overall compared with controls. Moreover, there was a significant condition with group interaction ($F = 24,82$, *d.f.* $= 2,128$, $P < 0.001$). One-way ANOVA

Table 1 Demographic characteristics of participants

Variables	Symptom remittent schizophrenia ($n=50$)	Unaffected biological full siblings ($n=50$)	Healthy individuals ($n=50$)	F/χ^2	P-value
Age (years) (mean ± SD)	22.4 ± 5.7	23.1 ± 6.3	22.8 ± 5.7	0.43	0.89
Education (years) (mean ± SD)	9.3 ± 4.1	10.1 ± 5.4	10.3 ± 6.7	0.03	0.18
Marital status [*N* (%)]					
Single	28 (56)	30 (60)	29 (58)	0.163	0.997
Married	22 (44)	20 (40)	21 (42)		
Employment [*N* (%)]					
Having paid employment	30 (60)	31 (62)	32 (64)	1.143	0.873

Table 2 Clinical characteristics of the schizophrenic patients (*N*=50)

Clinical characteristics	*n* (%)/mean ± SD
Age at onset of psychosis (years)	21.1 ± 6.2
Duration of untreated psychosis (weeks)	18.2 ± 7.9
Time to achieve symptom remission (months)	9.3 ± 4.6
PANSS score	
PANSS positive subscale score	24.9 ± 11.5
PANSS negative subscale score	21.6 ± 10.9
Antipsychotic pharmacotherapy	
Antipsychotic monotherapy	30 (60)
Antipsychotic polytherapy	20 (40)
Antipsychotic switches	2.1 ± 0.9
Other psychotropic medications	
Anticholinergics	22 (44)
Antidepressants	18 (36)
Anxiolytics	16 (32)
Mood stabilizers	11 (22)

PANSS, Positive and Negative Syndrome Scale.

follow-up tests demonstrated that schizophrenic patients scored significantly lower on all TASIT part II scales compared with controls: sincere ($F=12,73$, $d.f.=2,128$, $P<0.001$), simple sarcasm ($F=8,89$, $d.f.=2,122$, $P<0.001$), and paradoxical sarcasm ($F=9,12$, $d.f.=2,1222$, $P<0.003$).

Evaluation of interaction of the three subscales, sincere, simple sarcasm, and paradoxical sarcasm, with the schizophrenic and sibling groups using repeated-measures ANOVA demonstrated no main effect of condition ($F=0,29$, $d.f.=1,102$, $P>0.17$). However, a significant main effect of group was found ($F=21,17$, $d.f.=2,135$, $P<0.004$), with schizophrenic patients scoring significantly lower overall compared with siblings. Importantly, there was a statisically significant difference by group interaction ($F=18,74$, $d.f.=2,135$, $P<0.01$). Importantly, there was a statisically significant difference by group interaction ($F=13,16$, $d.f.=2,139$, $P<0.001$). One-way ANOVA follow-up tests demonstrated that schizophrenic patients scored significantly lower compared with siblings on all TASIT part II subscales compared with siblings: sincere ($F=5,19$, $d.f.=1,102$, $P<0.01$), simple sarcasm ($F=25,3$, $d.f.=1,102$, $P<0.02$), and paradoxical sarcasm ($F=13,16$, $d.f.=2,139$, $P<0.002$) compared with siblings.

Evaluation of the interaction of the three subscales, sincere, simple sarcasm, and paradoxical sarcasm, with the sibling and control groups using repeated-measures ANOVA demonstrated a significant main effect of condition ($F=9,293$, $d.f.=2$, $P<0.005$), with siblings scoring significantly lower compared with controls on all TASIT part II subscales: sincere ($F=8,777$, $d.f.=2$, $P<0.01$), simple sarcasm ($F=10,573$, $d.f.=2,118$, $P<0.001$), and paradoxical sarcasm ($F=6,620$, $d.f.=2$, 123, $P<0.03$). No main effect of group was found ($F=5,598$, $d.f.=2,123$, $P>0.72$). Similarly, there was no significant condition by group interaction ($F=0,29$, $d.f.=1,113$, $P>0.39$).

Performance on TASIT part III tasks (Social Inference Enriched) in the three study groups is summarized in Table 4, and effect sizes are listed for the differences between groups. Using composite scores for each TASIT part III subscales, repeated-measures ANOVA revealed a significant main effect of group and interaction. A significant main effect of group was found ($F=12,73$, $d.f.=2$, 139, $P<0.001$), with schizophrenic patients performing worst compared with controls ($P<0.001$) and siblings ($P<0.01$). Controls performed best, and siblings showed intermediate performance significantly different from that of healthy individuals ($P<0.01$).

Given the main effect of group, follow-up testing was conducted to evaluate which groups differed for which conditions. Looking more specifically at the group differences, follow-up one-way ANOVAs demonstrated that schizophrenic patients scored significantly lower on lie comprehension compared with both controls ($F=12,73$, $d.f.=2,128$, $P<0.001$) and siblings ($F=9,12$, $d.f.=2,122$, $P<0.02$). In addition, schizophrenic patients scored significantly lower compared with both controls ($F=26,43$, $d.f.=2,123$, $P<0.004$) and siblings ($F=3,67$, $d.f.=5,514$, $P<0.006$) on enriched sarcasm comprehension.

One-way ANOVA follow-up tests demonstrated that siblings scored significantly lower on lie subscale ($F=4,15$, $d.f.=5,280$, $P<0.03$) but not on enriched sarcasm subscale ($F=0,32$, $d.f.=1,133$, $P>0.18$) compared with controls.

Relationship among social cognition, and symptoms in patient group

Spearman's correlation analysis was used to identify the relationship between social cognition TASIT parts II and III tasks (Social Inference Minimal and Social Inference Enriched), and some clinical characteristics in the patient group (Table 5). TASIT part II (Social Inference Minimal) was significantly correlated with time to achieve symptom remission ($r=0.301$, $P<0.05$), PANSS negative symptoms ($r=0.410$, $P<0.001$), polytherapy ($r=-0.545$, $P<0.001$), and first-degree family history of severe mental disorders ($r=-0.340$, $P<0.001$).

Table 3 Performances of first-episode schizophrenic patients, first-degree siblings, and healthy controls in The Awareness of Social Inference Test part II (Social Inference Minimum) subscales

Subscales	Group A	Group B	Group C	A vs. C	A vs. B	B vs. C
Sincere	13.2 (3.1)	15.4 (4.3)	18.3 (2.5)	0.001	0.01	0.01
Paradoxical sarcasm	15.6 (3.8)	18.6 (3.7)	19.4 (4.1)	0.003	0.002	0.03
Total	42.9 (9.5)	50.7 (14.2)	56.3 (9.2)	0.001	0.001	0.005

A, first-episode schizophrenia patients; B, first-degree siblings; C, healthy controls.

Table 4 Performances of first-episode schizophrenic patients, first-degree siblings, and healthy controls in The Awareness of Social Inference Test part III (Social Inference Enriched) tasks

Tasks	Group A	Group B	Group C	A vs. C	A vs. B	B vs. C
Lies	21.3 (3.8)	25.6 (5.3)	29.3 (3.8)	0.001	0.02	0.03
Sarcasm	23.8 (4.1)	29.8 (4.7)	30.3 (4.5)	0.004	0.006	0.18
Total	45.1 (7.9)	54.4 (10.0)	59.6 (8.4)	0.001	0.01	0.01

A, first-episode schizophrenia patients; B, first-degree siblings; C, healthy controls.

TASIT part III task (Social Inference Enriched) was significantly correlated with DUP ($r = -0.288$, $P < 0.05$), time to achieve symptom remission ($r = -0.300$, $P < 0.05$), PANSS negative symptoms ($r = -0.402$, $P < 0.001$), polytherapy ($r = -0.621$, $P < 0.001$), and first-degree family history of severe mental disorder ($r = 340$, $P < 0.001$). Meanwhile, there was no association between medication dose and other variables.

Discussion

This study investigated ToM abilities in clinically remittent first-episode schizophrenic patients, nonpsychotic biological full siblings, and healthy controls to investigate whether ToM impairments represent a trait or state phenomenon and are associated with the genetic liability for the disorder. Our results suggest that both patients and their siblings are impaired in ToM tasks as compared with healthy controls, and the ToM impairment is more severe in the patient group compared with the sibling group. Consistent with our hypotheses, schizophrenic patients demonstrated impairments in ToM tasks. Taken together, our results support the previous literature suggesting that schizophrenic patients have impairments in ToM reasoning compared with controls [15,27,28]. Earlier studies reported that schizophrenic patients have deficits in understanding the pragmatics of language, including sarcasm and comprehension [12,29,30]. Our results are consistent with previous studies conducted on first-episode psychosis patients, which clearly demonstrated the existence of ToM disorders in this population [31,32]. Our results suggest that ToM impairments in schizophrenia persist even after the remission of acute psychosis. These results suggest that there is a trait related to ToM impairment in schizophrenia, because ToM ability deficits are not influenced by symptoms as our sample was in remission. According to the meta-analyses of Bora *et al.* [15], only few studies reported data from remitted patients, and, with regard to ToM tasks, patients revealed significant impairments when compared with healthy controls. The finding that patients in remission are also impaired favors the notion that metalizing impairment represents a possible trait marker of schizophrenia [33,34].

This result contradicts the theoretical positions of Frith [3] and Sarfati *et al.* [35], who suggested that ToM deficit in schizophrenia is a state-related impairment. It is noteworthy that unaffected siblings are also impaired in ToM performance, albeit to a lesser extent compared with patients with first-episode schizophrenia, providing further support for disease-specific effects. Our findings are consistent with previous family studies in this area. Moreover, the attenuated ToM deficits in unaffected siblings could be interpreted as reflecting their genetic liability to develop schizophrenia. This suggests that ToM deficit may be a trait marker or cognitive endophenotype of schizophrenia [36–38].

Similar to our findings some studies have found genetic liability effects, with relatives demonstrating impairments in false belief reasoning [36] and difficulty interpreting cartoon jokes that tap into metalizing abilities [39]. In contrast to our findings, studies assessing the ability to identify mental states through images of eyes [40], second-order false belief reasoning [41,42], and comprehension of hinting statements have found no differences in relatives compared with controls [43]. Overall, differences in findings between our study and previous studies may be due to differences in task choices, as the majority of previous research in this area has utilized paper-and-pencil or image-based tasks that are not generally representative of real-world social encounters [44,45].

Finally, it is possible that the null findings were due to ceiling effects with the ToM task.

Among patients with first-episode schizophrenia we obtained a correlation between TASIT part II asks scores (poor performance profile) and time to achieve symptom remission, antipsychotics polytherapy, and first-degree family history of severe mental disorders. However, we obtained an inverse correlation for TASIT part II tasks profile; the lower the score achieved in total score of TASIT part II tasks, the higher the negative symptomatology in schizophrenic patients. Furthermore, we obtained a correlation between TASIT part III tasks profile (poor performance) and DUP, time to achieve symptom remission, antipsychotics polytherapy, and first-degree family history of severe mental disorder.

Moreover, we found an inverse correlation for TASIT PART III Tasks profile; the lower the score achieved in total score of TASIT part III tasks, the higher the negative

Table 5 Relationship between theory of mind abilities with duration of untreated psychosis, time to achieve symptom remission, symptoms, antipsychotics polytherapy, and first-degree family history of severe mental illness in schizophrenia patients

TASIT tasks	DUP	Time to achieve symptom remission	PANSS negative subscale score	Antipsychotics polytherapy	First-degree family history of severe mental disorder
Part II	−0.039	0.301*	0.410**	−0.545**	−0.340**
Part III	−0.288*	−0.300*	−0.402**	−0.621**	−0.340**

DUP, duration of untreated psychosis; PANSS, Positive and Negative Syndrome Scale; TASIT, The Awareness of Social Inference Test.
*$P<0.05$.
**$P<0.01$.

symptomatology in schizophrenic patients. This finding supports other reports of previous studies [22,46,47].

These studies found that negative symptom had a negative relationship with performance of social cognition. This is in contrast to results from other recent studies [22,48]. The explanation for that contradiction may be derived from different sources. The most obvious one is that there is in fact no such direct relation between negative symptoms and social cognitive difficulties. This would be in line with the claim that negative symptoms and social cognition are indeed separate domains [49]. There is emerging evidence that negative symptoms appear to play an indirect role, mediating the relationship between neurocognition and social cognition with functional outcomes [50,51]. Further explorations of this mediating role of negative symptoms have revealed that motivational deficits appear to be particularly important in explaining the relationship between both neurocognitive and social cognitive dysfunction and functional outcomes in schizophrenia [52]. A recent study addressed the relative contribution of two key constructs – social cognitive deficits and negative symptoms – and how intertwined they could be in daily life functioning of patients with schizophrenia [53]. The key issue is that deficits in social cognition not only worsen positive symptoms, but also contribute to and drive negative symptoms. The current finding of ToM impairments in schizophrenic patients compared with both controls and their unaffected siblings, coupled with the impairment in siblings compared with controls, indicates that impaired ToM tasks are a trait characteristic of schizophrenia rather than just state characteristic.

Limitation

This study has several limitations. First, only one measure of ToM was used. It would have been useful to evaluate the relationship between ToM reasoning and other forms of social cognition and nonsocial cognition.

Second, our cross-sectional study is unable to demonstrate how impaired ToM tasks evolve with different phases of the disease. Third, because all patients in this study were on antipsychotic drugs, antipsychotic medications might have affected their ToM performance. A third limitation concerns medication. All schizophrenic patients who participated in the study were on medication, and several studies have concluded that ToM performance is influenced by what type of antipsychotic medication the patients have taken [54].

Future study should compare the ToM performance of medicated and medication-naive patients with schizophrenia. Fourth, our controls were not assessed for subclinical psychopathology. Finally, our family study design cannot control for the confounding effects of shared environment between patients and their siblings, such as attachment style, which has been found to account for some of the differences in ToM performance.

Despite the limitations, this study has a number of strengths, including the use of a more valid task to assess ToM abilities in an attempt to mimic day-to-day social interactions. This study also used age-matched and sex-matched comparison groups to more accurately assess for ToM impairments.

Notwithstanding these, our findings have theoretical and clinical implications. From a theoretical perspective, the attenuated ToM impairments found in siblings of patients with schizophrenia suggest a ‘gradient effect’ in terms of a gradual reduction in genetic vulnerability from patients with schizophrenia to their first-degree relatives. From a clinical perspective, it may be useful to examine whether siblings of schizophrenic patients also exhibit deficits in ToM tasks. Moreover, as ToM impairment appears to be a primary deficit in first-episode schizophrenia, effective interventions, such as social cognition and interaction training [55], may be able to benefit patients with schizophrenia.

Conclusion

Patients with first-episode schizophrenia in clinical remission and their nonpsychotic biological full siblings perform worse compared with controls in ToM tasks, with siblings having intermediate performance between patients and controls. The ToM impairments are apparently not attributable to other neurocognitive deficits. Our findings suggest that ToM deficit may be a trait marker for schizophrenia.

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Conflicts of interest

There are no conflicts of interest.

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