Original Article

Comparing Multiple Domains of Social Cognition in Schizophrenic Patients with vs. without Paranoid Symptoms

Zahra Saffarian [1], Behrooz Dolatshahee [1, *], Abbas Pourshahbaz [1], David Leland Roberts [2] and Najmeh Rastikerdar [3]

[1] Department of Clinical Psychology, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran
[2] Department of Psychiatry, University of Texas Health Science Center, San Antonio, United States
[3] Institute for Cognitive & Brain Science, Shahid Beheshti University, Tehran, Iran

Corresponding author: Department of Clinical Psychology, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran. Tel/Fax: +98-2122180045, Email: bdolatshahee@gmail.com

Abstract

Background: Various investigations demonstrated social cognitive impairments in schizophrenic patients. The impairments in schizophrenia patients are also associated with an increase in paranoid symptoms. However, comparing multiple domains of social cognition in subtypes of schizophrenia has received less attention.

Objectives: The current study aimed at comparing multiple domains of social cognition in schizophrenic patients and the normal population as well as schizophrenic patients with and without paranoid symptom.

Methods: In this causal-comparative study, 44 schizophrenic patients with paranoid symptoms and 18 patients without paranoid symptom admitted to three schizophrenia care centers in Shiraz, from June 1st, 2017 to July 2nd, 2017 were evaluated. The control group included 38 staff of the studied centers. The research tools were the face emotion identification task, hinting task, and ambiguous intentions hostility questionnaire (AIHQ).

Results: We used the multivariate analysis of variance to compare the functioning of the sample groups. Based on the results, schizophrenic patients with/without paranoid symptoms exhibited worse performance than normal individuals in emotion perception (P = 0.01, P = 0.01) and theory of mind (P = 0.01, P = 0.01) tasks; however, patients with and without paranoid symptoms did not differ in these tasks. With respect to AIHQ, schizophrenia patients with/without paranoid symptoms inclined to use hostile (P = 0.01, P = 0.02, respectively) and blaming (P = 0.01, P = 0.02, respectively) attributions compared with normal subjects. Moreover, patients with paranoid symptoms inclined to use more hostile and blaming attributions compared to patients without paranoid symptoms.

Conclusions: Three variables of emotion perception, theory of mind, and hostile and blaming attributions were able to distinguish schizophrenia patients from healthy individuals, while only hostile and blaming attributions were able to distinguish patients with paranoid symptoms and those without paranoid symptoms.

Keywords: Schizophrenia, Paranoia, Attributions, Theory of Mind

1. Background

In recent decades, much attention has been paid to the concept of social cognition and its assessment in schizophrenic patients (1). Social cognition is a multifaceted structure encompassing various components (2-5). The primary components of this structure include emotion perception, theory of mind, and attribution styles (6, 7). According to the investigations on social cognition in schizophrenia, social information processing is impaired in these patients compared with healthy individuals (8, 9). This impairment is reported in emotion perception (10-16) and theory of mind (14-19). Studies on the third do-

main of social cognition -attributional styles- reveal that schizophrenic patients inclined to make hostile and blaming attributions compared with healthy individuals (14, 20). In addition, much attention is paid to paranoia as the most common delusion experienced by schizophrenic patients (21). Despite the high prevalence of paranoia, not all the patients experience it. Results of studies suggest that schizophrenic patients with paranoid symptoms may process social information differently compared with schizophrenic patients without paranoid symptoms (22). In this regard, several studies which assessed emotion perception, demonstrated that patients without paranoid

symptoms had better emotion perception performance compared to patients with paranoid symptoms (23-25). However, some other studies do not support this finding (22). Regarding the theory of mind, studies report controversial results. Several studies report a relationship between impaired theory of mind and increased paranoia in schizophrenic patients (21, 26); however, other studies do not support this relationship (22). Given the attribution styles, results of studies implicate that patients with paranoia are more inclined to use hostile and blaming attributions compared with those without paranoia (22, 27).

In terms of multiple social cognition domains in schizophrenia, the pattern of multiple social cognition domains in schizophrenia with paranoid symptoms and without paranoid symptoms has remained unknown.

Studies that examined each domain of social cognition separately in schizophrenic patients with paranoid symptoms yielded inconsistent and insufficient results. Though, the concurrent examination of the multiple domains of social cognition in a study can identify the pattern of social cognitive impairments in schizophrenic patients with or without paranoid symptoms. Therefore, conducting the studies that examine the multiple domains of social cognition in schizophrenic patients with and without paranoid symptoms can determine the difference between the multiple domains of social cognition in these two groups, thereby helping design special therapeutic interventions.

It should be noted that because social cognition is a part of culture, the therapeutic interventions designed in certain cultures cannot be used for other cultures unless they are customized. This is possible when domains of multiple social cognition of patients are identified in the basic studies and then customization of therapeutic interventions is done based on these domains.

2. Objectives

This study aimed at exploring the differences between schizophrenic patients and normal individuals as well as differences in patients with and without paranoid symptoms in multiple domains of social cognition.

The study postulates that schizophrenic patients would exhibit worse performance compared with healthy individuals in emotion perception and theory of mind measures and they inclined to use hostile and blaming attributions. Moreover, patients with paranoid symptoms would exhibit worse performance compared with the ones without such symptoms in emotion perception and the theory of mind measures and they were more inclined to use hostile and blaming attributions.

3. Materials and Methods

3.1. Subjects and Procedure

The research method was causal-comparative. In the current study, the patients with a background of repeated hospitalization in care centers in Shiraz, Iran were selected. The exclusion criteria were a history of addiction, any neurological impairment due to neurological diseases such as epilepsy, as well as other psychiatric disorders, which may interfere with psychotic symptoms. The researcher decided on the time and place of the test, so the test run time for all subjects was from June 2017 to July 2nd, 2017 from 8:00 to 12:00 a.m.

All subjects were evaluated at care centers. These centers were similar in terms of atmosphere, physical conditions, and communication.

In the current study, the convenience sampling method with exclusion and inclusion criteria was employed to select 62 patients diagnosed with chronic schizophrenia, based on criteria of diagnostic and statistical manual of mental disorders, fourth edition (DSM-IV), from Al-Rahman, Mahd-e-Asayesh, and Aseman Care Centers in Shiraz. In the second step, after obtaining written consent from the patients' guardians, scale for assessment of positive symptoms and scale for assessment of negative symptoms were used to measure the severity of symptoms. Based on the persecutory delusion item, the schizophrenic patients were divided into two groups: schizophrenic patients with paranoid symptoms (n = 44) and schizophrenic patients without paranoid symptoms (n = 18) (26). The schizophrenic patients with paranoid symptoms scored $\geq$ 2 on the scale of assessment for persecutory delusion, indicating a clear presence of paranoid symptoms. The patients without paranoid symptoms scored 0 and 1 on the scale of assessment for persecutory delusion, indicating the absence or doubtful presence of paranoid symptoms. Finally, the healthy group included 38 employees of the three studied centers selected using convenience sampling method and signed a written informed consent form. Subsequently, all participants were enrolled. The current study was approved by the Ethics Committee and the Supervisory Council of the University of Social Welfare and Rehabilitation Sciences (code no. 1395-251).

3.2. Measures

To ensure that the subjects understand the questions, all the items were read face-to-face for each subject by a clinical psychologist and the response of each subject was recorded.

3.2.1. Hinting Task

The hinting task was prepared to evaluate the theory of mind [28]. In this task, 10 stories were presented with social interactions between two story characters. The characters drop a hint at the end of stories. The participants are requested to make inferences about the intention of characters. The score ranges from 0 to 20. Higher scores show that the participant can better understand other people's desires and intentions. The current study was the first study, which used the Persian version of the hinting task. To confirm formal validity due to cultural considerations, experts suggested some changes in certain task items. The study of Robert (2009) and the current study data indicated the fairly good reliability of 0.65 and 0.67, respectively via calculating the Cronbach alpha values.

3.2.2. Face Emotion Identification Task

This task included 19 facial expression images; each represents one of the six basic facial emotions. The task was designed to identify facial emotions. The participants were asked to distinguish one of the six emotions as being expressed by each face image. The higher number of correct responses indicates better performance or ability of the participants in identifying facial expressions [29]. The reliability of the questionnaire was assessed in the study of Kerr and Neale [29] and the current study sample using Cronbach alpha values (0.77 and 0.74, respectively).

3.2.3. The Ambiguous Intensions and Hostility Questionnaire (AIHQ)

This task is used to measure social cognitive biases. Subjects listen to 5 hypothetically negative events with ambiguous intention and imagine that the event has happened to them too. Then they have to answer why this scenario (hostility bias) has occurred. Next, the participants score the intention of the characters (from 1 = definitely not intentional to 5 = definitely intentional), the level of anger at this action (from 1 = definitely no to 6 = definitely yes), and the level of blaming the guilty person (from 1 = definitely no to 5 = definitely yes) on a Likert-type scale. The blame index is obtained by adding the mean scores of all three questions. Ultimately, the participants state what they would do if the situation was real (aggression bias). Two independent evaluators scored both hostility and aggression biases on a 5-point Likert-type scale [30]. Since there was no Persian version of the questionnaire, formal validity of the translated version was confirmed by professional. In the study of Combs et al. and in the current study, the intraclass correlation coefficient (ICC) for the questionnaire was 0.86. In the study of Combs et al. and in the current study, the reliability of the blame score was assessed by Cronbach alpha as 0.94 and 0.92, respectively.

3.2.4. Scale for the Assessment of Positive and Negative Symptoms

The negative symptom scale evaluates five groups of negative symptoms by 20 items, including effective flattening or blunting, alogia, avolition/apathy, anhedonia/asociality, and attention deficit. At the end of each group, a general question about the whole symptoms is asked [31]. Positive symptoms are evaluated by 30 items in four groups, including hallucinations, delusions, bizarre behavior, and positive formal thought disorder [32]. The scores of these two scales range from 0 (none) to 5 (severe). A zero score indicates that the person does not experience the symptoms and a 5 score indicates that the symptoms are severely experienced. The reliability of this scale was 0.77 using test-retest and internal consistency.

3.3. Statistical Analyses

The obtained data were analyzed using SPSS 16.0 (SPSS Inc., Chicago, IL). Descriptive statistics were used to summarize the data. Multivariate analysis of variance (MANOVA) was performed in order to investigate the differences in the domains of social cognition among the three groups (normal individuals, schizophrenic patients with paranoid symptoms, schizophrenic patients without paranoid symptoms). Moreover, univariate tests were performed for any significant omnibus effects. Tukey's test was also used where appropriate. In addition, proper analyses were performed to verify normality, linearity, and multi-collinearity of the data. The α value of 0.05 was set using two-tailed tests. Kolmogorov-Smirnov test was used for normality evaluation. The results indicated that all variables were normal (Table 1).

4. Results

The sample consisted of 62 schizophrenic patients as follows: with paranoid symptoms (12 females and 6 males), without paranoid symptoms (16 females and 28 males), and 38 healthy subjects (14 females and 24 males). The average age of schizophrenic patients was 41.75 years for those with paranoid symptoms, 42.61 years for those without paranoid symptoms, and 42.77 years for the healthy subjects. The average duration of their education was 9.35 years for those with paranoid symptoms, 8.76 years for those without paranoid symptoms, and 9.87 years for healthy subjects. Three groups were not significantly different regarding gender (χ^2=1.77, P = 0.83), age (t = 1.26, P = 0.79), and educational level (χ^2=7.92, P = 0.18). The patients with paranoid symptoms reported to have greater severity of positive symptoms compared with the ones without such symptoms. However, this difference was not significant after the removal of delusion subscale. Moreover,

Table 1. Normality Test of Research Variables

Social Cognition Groups	K - S	Sig.
AIHQ-HB		
Patients without paranoid symptoms	0.13	0.20
Patients with paranoid symptoms	0.09	0.14
Healthy group	0.14	0.08
AIHQ-AB		
Patients without paranoid symptoms	0.16	0.07
Patients with paranoid symptoms	0.12	0.12
Healthy group	0.12	0.08
AIHQ-BS		
Patients without paranoid symptoms	0.16	0.19
Patients with paranoid symptoms	0.12	0.20
Healthy group	0.13	0.10
Hinting		
Patients without paranoid symptoms	0.17	0.13
Patients with paranoid symptoms	0.10	0.20
Healthy group	0.11	0.06
FEIT		
Patients without paranoid symptoms	0.15	0.20
Patients with paranoid symptoms	0.12	0.15
Healthy group	0.11	0.06

Abbreviations: AIHQ, ambiguous intentions hostility questionnaire; FEIT, face emotion identification task.

no significant difference was found between patients with and without paranoid symptoms in the severity of negative symptoms (P = 0.91). The demographic and clinical characteristics of the groups are presented in Table 2.

The obtained results indicated a significant group effect in the multivariate analysis of variance (Wilks' λ = 0.25, $F_{10, 170}$ = 16.56, P = 0.001). Univariate analysis showed that the performance of the groups differed significantly in emotion perception task ($F_{2, 98}$ = 87.03, P = 0.001, η^2 = 0.66), hinting task ($F_{2, 98}$ = 54.88, P = 0.001, η^2 = 0.42), hostility bias ($F_{2, 98}$ = 13.19, P = 0.001, η^2 = 0.42), and blaming ($F_{2, 98}$ = 39.71, P = 0.001, η^2 = 0.35) subscales of the AIHQ. Tukey's post hoc test revealed that the performance of schizophrenic patients (with and without paranoid symptoms) was poorer in the emotion perception (P = 0.001, P = 0.001, respectively) and hinting (P = 0.001, P = 0.001, respectively) tasks than those of the healthy group (Table 3). With respect to AIHQ, schizophrenic patients with and without paranoid symptoms, compared to the healthy group, were more inclined to infer hostility in face of ambiguous social situations (P = 0.001, P = 0.02, respectively) and blame others more (P = 0.001, P = 0.02, respectively).

Furthermore, schizophrenic patients with paranoid symptoms compared with the ones without paranoid symptoms were more inclined to infer hostility in ambiguous social situations (P = 0.02) and blame others more (P = 0.01). Patients with and without paranoid symptoms were not significantly different in the hinting task and face emotion identification task.

5. Discussion

In the current study, consistent with previous findings, we initially found that two domains of emotion perception and the theory of mind were impaired in patients with schizophrenia. In other words, schizophrenic patients exhibited worse performance compared with normal individuals in emotion perception (10-13) and theory of mind tasks (17-19). In addition, they revealed a tendency toward using hostile and blaming attributions (33, 34).

However, the results of the comparison of the patients with and without paranoid symptoms with each other needs further discussion. Despite previous findings regarding the differences in emotion perception (23-25) and theory of mind (21, 26) between patients with and without paranoid symptoms, the current study observed no differences between the two groups in these domains. Nevertheless, the current study results with respect to attributional bias similar to previous reports (22, 27) indicate that patients with paranoid symptoms are more inclined to hostile and blaming attributions.

Despite previous findings indicating that patients with paranoid symptoms have greater impairment in emotion perception and theory of mind (21, 23-26), the current study did not observe such a relationship, while the current study findings were consistent with those of other studies (22). These contradictory results can be due to the reason that patients with and without paranoid symptoms were not different in emotion perception ability. However, patients with paranoid symptoms were more inclined to interpret neutral facial expressions as anger ones (35). No significant difference existed between the two groups of patients regarding theory of mind. Because studies indicate the role of thought disorder in explaining the association between poor theory of mind and paranoia (36, 37), the similarity between the two groups could be due to the lack of difference in thought disorder based on their performance on the scale for assessment of positive symptom (SAPS). These findings compared the current study with studies that reported the same results with similar diagnostic tools (such as PANSS) (22).

To interpret these findings, the two terms of social cognition capacity and social cognition bias should be defined and differentiated. Social cognitive capacity refers

Table 2. Demographic and Clinical Characteristics of the Participants[a]

Variable	Patients with Paranoid Symptoms	Patients Without Paranoid Symptoms	Healthy Group
Gender			
Male	6	16	14
Female	12	28	24
Age (y)	8.40 (41.75)	9.23 (42.61)	8.73 (42.77)
Education (y)	2.36 (9.35)	3.66 (8.76)	3.26 (9.87)
SAPS	0.90 (1.78)	0.78 (2.03)	
SANS	1.01 (1.43)	1.04 (1.40)	

Abbreviations: SANS, scale for assessment of negative symptom; SAPS, scale for assessment of positive symptom.
[a]Values are expressed as No. or mean (SD).

Table 3. Group Differences Based on Social Cognitive Measure[a]

	Patients Without Paranoid Symptoms (N = 18)	Patients with Paranoid Symptoms (N = 44)	Healthy Group (N = 38)	F	P Value	η^2
Social cognition						
AIHQ-HB	2.66 (1.05)	3.37 (0.96)	1.94 (0.72)	13.19	< 0.001	0.30
AIHQ-AB	2.17 (1.02)	2.30 (0.84)	1.89 (1.10)	14.87	0.11	0.04
AIHQ-BS	8.26 (2.11)	10.50 (2.82)	6.44 (1.85)	2.64	< 0.001	0.35
Hinting	11.23 (4.60)	10.52 (4.50)	16.50 (2.13)	19.33	< 0.001	0.42
FEIT	7.50 (3.79)	6.42 (3.30)	15 (2.05)	37.15	< 0.001	0.66

Abbreviations: AIHQ, ambiguous intentions hostility questionnaire; FEIT, face emotion identification task.
[a]Values are expressed as mean (SD).

to the individuals' ability to perform an information processing function, while social cognitive bias is defined as the individuals' tendency to process information; such that, this tendency systematically produces distorted output (38, 39). It can be stated that hinting task and FEIT in the current study measure social cognitive capacity, while AIHQ assesses social cognitive bias. Schizophrenic patients and normal people were different in both tasks that assess social cognitive capacity (emotion perception and theory of mind tasks) and social cognitive bias (AIHQ). Regarding the hinting task and FEIT, the ability of patients with schizophrenia to understand people's intentions and identify facial emotions was poor. In AIHQ task, they were inclined to interpret stimuli consistent with their delusional thoughts. In other words, social cognitive capacity are impaired in schizophrenic patients compared with normal individuals, so these patients express social cognitive bias.

The most striking clinical finding of the current study was that although no difference was observed between patients with and without paranoid symptoms in terms of capacity-based tasks (emotion perception and theory of mind tasks), the two groups were different in bias-based task (AIHQ). Regarding AIHQ, patients with paranoid symptoms were more inclined to interpret stimuli in line with paranoid thoughts (such as blaming other peo-

ple for negative events). In the other words, patients with paranoid symptoms revealed a higher social cognitive bias compared with the ones without such symptoms.

It can be said that despite the small cultural differences, multiple domains of social cognition in schizophrenic patients with and without paranoid symptoms in Iranian culture were consistent with the results of studies conducted in other countries. Thus it is likely that interventions based on the modification of the domains of multiple social cognition are useful for schizophrenic patients.

Most studies on social cognition have been conducted in the west and East Asian countries. Such studies are very few in Iranian society. Since a few clinical studies have been conducted on patients with chronic schizophrenia, studying the multiple domains of social cognition in Iranian patients with chronic schizophrenia was one of the strengths of the current study. The current study did not compare different groups with respect to social perception, social knowledge, empathy, and jumping to bias conclusions. Future studies could evaluate these variables. Because of using original images to measure facial expressions of emotion on the standardized scales in Iran and according to the reports based on the comprehensibility of original images by Iranian subjects, these images were used to measure

emotional perception. Though the language of emotion is universal, cultural affiliations cannot be ignored in the severity of emotional expression. Therefore, employing native images is recommended in future studies to measure facial expressions of emotion.

5.1. Conclusions

The findings of the current study revealed that the two domains of emotion perception and the theory of mind are impaired in schizophrenic patients compared to normal individuals. In addition, these patients demonstrate a tendency toward using hostile and blaming attributions. Therefore, interventions such as social cognition and interaction training (SCIT) that target improvement of multiple domains of social cognition can be useful to treat patients with schizophrenia. Moreover, the present results encourage the researchers to consider paranoia when studying domains of social cognition in schizophrenic patients and suggest that patients with paranoid symptoms have a tendency to use more hostile and blaming attributions compared to patients without paranoid symptoms. Therefore, these patients may benefit from specialized interventions that target the improvement of cognitive social bias.

The present study is helpful in identifying abnormalities in multiple domains of social cognition, in understanding the psychopathology of schizophrenia and its subtypes, and eventually, in designing and customizing interventions, especially for patients with paranoid symptoms. Finally, the current study motivated the authors to consider social cognition domains in other disorders that include psychotic symptoms as part of their clinical presentation (such as bipolar disorder) in future research.

Acknowledgments

Footnotes

References

1. Green MF, Horan WP. Social cognition in schizophrenia. *Curr Dir Psychol Sci*. 2010;**19**(4):243–8. doi: 10.1177/0963721410377600.
2. Green MF, Leitman DI. Social cognition in schizophrenia. *Schizophr Bull*. 2008;**34**(4):670–2. doi: 10.1093/schbul/sbn045. [PubMed: 18495642]. [PubMed Central: PMC2632454].
3. van Hooren S, Versmissen D, Janssen I, Myin-Germeys I, a Campo J, Mengelers R, et al. Social cognition and neurocognition as independent domains in psychosis. *Schizophr Res*. 2008;**103**(1-3):257–65. doi: 10.1016/j.schres.2008.02.022. [PubMed: 18434094].
4. Ochsner KN. The social-emotional processing stream: Five core constructs and their translational potential for schizophrenia and beyond. *Biol Psychiatry*. 2008;**64**(1):48–61. doi: 10.1016/j.biopsych.2008.04.024. [PubMed: 18549876]. [PubMed Central: PMC2453243].
5. Mancuso F, Horan WP, Kern RS, Green MF. Social cognition in psychosis: Multidimensional structure, clinical correlates, and relationship with functional outcome. *Schizophr Res*. 2011;**125**(2-3):143–51. doi: 10.1016/j.schres.2010.11.007. [PubMed: 21112743]. [PubMed Central: PMC3073542].
6. Penn DL, Sanna LJ, Roberts DL. Social cognition in schizophrenia: An overview. *Schizophr Bull*. 2008;**34**(3):408–11. doi: 10.1093/schbul/sbn014. [PubMed: 18375928]. [PubMed Central: PMC2632430].
7. Combs DR, Elerson K, Penn DL, Tiegreen JA, Nelson A, Ledet SN, et al. Stability and generalization of social cognition and interaction training (SCIT) for schizophrenia: Six-month follow-up results. *Schizophr Res*. 2009;**112**(1-3):196–7. doi: 10.1016/j.schres.2009.04.010. [PubMed: 19411160].
8. Fett AK, Viechtbauer W, Dominguez MD, Penn DL, van Os J, Krabbendam L. The relationship between neurocognition and social cognition with functional outcomes in schizophrenia: A meta-analysis. *Neurosci Biobehav Rev*. 2011;**35**(3):573–88. doi: 10.1016/j.neubiorev.2010.07.001. [PubMed: 20620163].
9. Green MF, Hellemann G, Horan WP, Lee J, Wynn JK. From perception to functional outcome in schizophrenia: modeling the role of ability and motivation. *Arch Gen Psychiatry*. 2012;**69**(12):1216–24. doi: 10.1001/archgenpsychiatry.2012.652. [PubMed: 23026889]. [PubMed Central: PMC3976993].
10. Edwards J, Jackson HJ, Pattison PE. Emotion recognition via facial expression and affective prosody in schizophrenia: A methodological review. *Clin Psychol Rev*. 2002;**22**(6):789–832. [PubMed: 12214327].
11. Hoekert M, Kahn RS, Pijnenborg M, Aleman A. Impaired recognition and expression of emotional prosody in schizophrenia: Review and meta-analysis. *Schizophr Res*. 2007;**96**(1-3):135–45. doi: 10.1016/j.schres.2007.07.023. [PubMed: 17766089].

12. Pinkham AE, Gur RE, Gur RC. Affect recognition deficits in schizophrenia: Neural substrates and psychopharmacological implications. *Expert Rev Neurother*. 2007;**7**(7):807–16. doi: 10.1586/14737175.7.7.807. [PubMed: 17610388].

13. Fiszdon JM, Johannesen JK. Functional significance of preserved affect recognition in schizophrenia. *Psychiatry Res*. 2010;**176**(2-3):120–5. doi: 10.1016/j.psychres.2009.08.006. [PubMed: 20202689]. [PubMed Central: PMC2844467].

14. Lahera G, Herrera S, Reinares M, Benito A, Rullas M, Gonzalez-Cases J, et al. Hostile attributions in bipolar disorder and schizophrenia contribute to poor social functioning. *Acta Psychiatr Scand*. 2015;**131**(6):472–82. doi: 10.1111/acps.12399. [PubMed: 25645449].

15. Hasson-Ohayon I, Avidan-Msika M, Mashiach-Eizenberg M, Kravetz S, Rozencwaig S, Shalev H, et al. Metacognitive and social cognition approaches to understanding the impact of schizophrenia on social quality of life. *Schizophr Res*. 2015;**161**(2-3):386–91. doi: 10.1016/j.schres.2014.11.008. [PubMed: 25499045].

16. Thaler NS, Allen DN, Sutton GP, Vertinski M, Ringdahl EN. Differential impairment of social cognition factors in bipolar disorder with and without psychotic features and schizophrenia. *J Psychiatr Res*. 2013;**47**(12):2004–10. doi: 10.1016/j.jpsychires.2013.09.010. [PubMed: 24112946].

17. Brune M. "Theory of mind" in schizophrenia: A review of the literature. *Schizophr Bull*. 2005;**31**(1):21–42. doi: 10.1093/schbul/sbi002. [PubMed: 15888423].

18. Bora E, Yucel M, Pantelis C. Theory of mind impairment in schizophrenia: Meta-analysis. *Schizophr Res*. 2009;**109**(1-3):1–9. doi: 10.1016/j.schres.2008.12.020. [PubMed: 19195844].

19. Sprong M, Schothorst P, Vos E, Hox J, van Engeland H. Theory of mind in schizophrenia: Meta-analysis. *Br J Psychiatry*. 2007;**191**:5–13. doi: 10.1192/bjp.bp.107.035899. [PubMed: 17602119].

20. Le Gall E, Iakimova G, Askenazy F. 2246 – Attribution bias in early-onset-schizophrenia: Relationship to clinical features. *European Psychiatry*. 2013;**28**:1. doi: 10.1016/s0924-9338(13)77110-4.

21. Bentall RP, Rowse G, Shryane N, Kinderman P, Howard R, Blackwood N, et al. The cognitive and affective structure of paranoid delusions: A transdiagnostic investigation of patients with schizophrenia spectrum disorders and depression. *Arch Gen Psychiatry*. 2009;**66**(3):236–47. doi: 10.1001/archgenpsychiatry.2009.1. [PubMed: 19255373].

22. Pinkham AE, Harvey PD, Penn DL. Paranoid individuals with Schizophrenia show greater social cognitive bias and worse social functioning than non-paranoid individuals with Schizophrenia. *Schizophr Res Cogn*. 2016;**3**:33–8. doi: 10.1016/j.scog.2015.11.002. [PubMed: 27990352]. [PubMed Central: PMC5156478].

23. An SK, Lee E, Kim JJ, Namkoong K, Kang JI, Jeon JH, et al. Greater impairment in negative emotion evaluation ability in patients with paranoid schizophrenia. *Yonsei Med J*. 2006;**47**(3):343–53. doi: 10.3349/ymj.2006.47.3.343. [PubMed: 16807983]. [PubMed Central: PMC2688153].

24. Russell TA, Reynaud E, Kucharska-Pietura K, Ecker C, Benson PJ, Zelaya F, et al. Neural responses to dynamic expressions of fear in schizophrenia. *Neuropsychologia*. 2007;**45**(1):107–23. doi: 10.1016/j.neuropsychologia.2006.04.026. [PubMed: 16814818].

25. Williams LM, Das P, Liddell BJ, Olivieri G, Peduto AS, David AS, et al. Fronto-limbic and autonomic disjunctions to negative emotion distinguish schizophrenia subtypes. *Psychiatry Res*. 2007;**155**(1):29–44. doi: 10.1016/j.pscychresns.2006.12.018. [PubMed: 17398080].

26. Harrington L, Langdon R, Siegert RJ, McClure J. Schizophrenia, theory of mind, and persecutory delusions. *Cogn Neuropsychiatry*. 2005;**10**(2):87–104. doi: 10.1080/13546800344000327. [PubMed: 16571454].

27. Combs DR, Penn DL, Michael CO, Basso MR, Wiedeman R, Siebenmorgan M, et al. Perceptions of hostility by persons with and without persecutory delusions. *Cogn Neuropsychiatry*. 2009;**14**(1):30–52. doi: 10.1080/13546800902732970. [PubMed: 19214841].

28. Corcoran R, Mercer G, Frith CD. Schizophrenia, symptomatology and social inference: Investigating "theory of mind" in people with schizophrenia. *Schizophr Res*. 1995;**17**(1):5–13. doi: 10.1016/0920-9964(95)00024-g. [PubMed: 8541250].

29. Kerr SL, Neale JM. Emotion perception in schizophrenia: Specific deficit or further evidence of generalized poor performance? *J Abnorm Psychol*. 1993;**102**(2):312–8. doi: 10.1037//0021-843x.102.2.312. [PubMed: 8315144].

30. Combs DR, Penn DL, Wicher M, Waldheter E. The Ambiguous Intentions Hostility Questionnaire (AIHQ): A new measure for evaluating hostile social-cognitive biases in paranoia. *Cogn Neuropsychiatry*. 2007;**12**(2):128–43. doi: 10.1080/13546800600787854. [PubMed: 17453895].

31. Andreasen NC. *The Scale for the Assesment of negative Symptoms (SAPS)*. Iowa City: University of Iowa; 1984.

32. Andreasen NC. *The scale for the assessment of positive symptoms (SAPS)*. Iowa City: University of Iowa; 1984.

33. Pinkham AE, Penn DL, Green MF, Harvey PD. Social cognition psychometric evaluation: Results of the initial psychometric study. *Schizophr Bull*. 2016;**42**(2):494–504. doi: 10.1093/schbul/sbv056. [PubMed: 25943125]. [PubMed Central: PMC4753585].

34. Buck B, Iwanski C, Healey KM, Green MF, Horan WP, Kern RS, et al. Improving measurement of attributional style in schizophrenia; A psychometric evaluation of the Ambiguous Intentions Hostility Questionnaire (AIHQ). *J Psychiatr Res*. 2017;**89**:48–54. doi: 10.1016/j.jpsychires.2017.01.004. [PubMed: 28160626].

35. Pinkham AE, Brensinger C, Kohler C, Gur RE, Gur RC. Actively paranoid patients with schizophrenia over attribute anger to neutral faces. *Schizophr Res*. 2011;**125**(2-3):174–8. doi: 10.1016/j.schres.2010.11.006. [PubMed: 21112186]. [PubMed Central: PMC3031724].

36. Freeman D. Suspicious minds: the psychology of persecutory delusions. *Clin Psychol Rev*. 2007;**27**(4):425–57. doi: 10.1016/j.cpr.2006.10.004. [PubMed: 17258852].

37. Greig TC, Bryson GJ, Bell MD. Theory of mind performance in schizophrenia: Diagnostic, symptom, and neuropsychological correlates. *J Nerv Ment Dis*. 2004;**192**(1):12–8. doi: 10.1097/01.nmd.0000105995.67947.fc. [PubMed: 17258852].

38. Roberts DL, Pinkham A. *The future of social cognition in schizophrenia: Implications for the normative literature*. New York, NY, USA: Oxford University Press; 2013.

39. Walss-Bass C, Fernandes JM, Roberts DL, Service H, Velligan D. Differential correlations between plasma oxytocin and social cognitive capacity and bias in schizophrenia. *Schizophr Res*. 2013;**147**(2-3):387–92. doi: 10.1016/j.schres.2013.04.003. [PubMed: 23628601].