Cognitive Function and Social Cognition in Young First-Episode Psychosis Patients

Arnar Ingi Friðriksson

2016

MSc in Clinical Psychology

Author: Arnar Ingi Friðriksson
ID number: 110189-2659
Supervisors: Kamilla Rún Jóhannsdóttir, Jón Friðrik Sigurðsson

Department of Psychology
School of Business

Forewords and Acknowledgements

Submitted in partial fulfillment of the requirements of the MSc Psychology degree, Reykjavík University, this thesis is presented in the style of an article for submission to a peer-reviewed journal. Supervisors for this thesis are Kamilla Rún Jóhannsdóttir and Jón Friðrik Sigurðsson. When the thesis is submitted, the authors of the submitted paper will be Arnar Ingi Friðriksson, Andri Hrafn Sigurðsson, Kamilla Rún Jóhannsdóttir and Jón Friðrik Sigurðsson.

This study was formulated in semester 2 and authorized by the Ethical Committee of Landspítali-The National University Hospital of Iceland and the director of medicine at Landspítali. Data collection was completed in semester 3, and data analysis and write-up were completed in semester 4. The authors worked on this project at Reykjavík University and at Landspítali.

We would like to thank our supervisors Kamilla Rún Jóhannsdóttir and Jón Friðrik Sigurðsson for their professional guidance, assistance and advise throughout this project. The authors also wish to give thanks to Brynja Björk Magnúsdóttir for her excellent advice and support. We would also like to thank Ólína Guðbjörg Viðarsdóttir for data collection, providing data for this study and for her assistance. We want to give special thanks to the students in Reykjavík University and patients at Laugarás for their participation in the study. Finally, we would like to show our appreciation to everybody who supported us during this research process.

Abstract

The aim of the present study is to examine neuropsychological- and social cognition test performance in young first-episode psychosis patients and normal controls. Furthermore, the study will examine the amount of variance in two different social cognition tests (the Hinting Task and the Facial Emotion Identification Test (FEIT)) explained by different cognitive functions for the clinical group. Studies have examined the relationship between cognitive function and social cognition in schizophrenic patients, but relatively few studies have examined this relation in young first-episode psychosis patients using more complex cognitive tests such as the Logical Memory Test and the Matrix Reasoning. In this study, 28 patients in the early stages of psychotic disorder and 32 healthy controls carried out both neuropsychological- and social cognitive tests. The results revealed that the clinical group performed significantly worse than the healthy controls on nine neuropsychological- and two social cognition measures after controlling for education level. The result from linear regression with multiple independent models showed that different cognitive functions were significantly related to performance on the FEIT and the Hinting Task. Overall, the Logical Memory Test, the Matrix Reasoning, the Digit Symbol Coding Test and the Trail Making Test A explained between 17.1 and 35.5% of the variance in the FEIT and the Hinting Task. Findings from the present study indicates that cognitive tests, which require complex cognitive ability, account for a greater portion of variance in social cognition than do cognitive tests measuring primary cognitive functions.

Keywords: cognitive function, social cognition, young first-episode psychosis patients

Cognitive Function and Social Cognition in Young First-Episode Psychosis Patients

Cognitive impairment is recognized as a core feature of patients in the early stages of psychotic disorder with deficits in specific cognitive domains including working memory, executive functioning, attention and psychomotor speed (Mesholam-Gately, Giuliano, Goff, Faraone, & Seidman, 2009; Riley et al., 2000). In a meta-analytic review, Mesholam-Gately et al. (2009) examined cognitive function in first-episode psychotic patients. Findings indicated that individuals in the early stages of psychotic disorder performed significantly worse on neuropsychological tests measuring cognitive function compared to healthy controls. They demonstrated that these deficits were significant across all cognitive functions including memory, working memory, attention, processing speed and executive function.

Studies have also indicated impairment in social cognition among individuals with schizophrenia (Bora, Yucel, & Pantelis, 2009; Kohler, Walker, Martin, Healey, & Moberg, 2009; Penn, Corrigan, Bentall, Racenstein, & Newman, 1997). Social cognition is about how individuals interact, how they perceive and think of others, themselves, and the situations they encounter (Crusius, van Horen, & Mussweiler, 2012; Rizzolatti & Fabbri-Destro, 2008). The definition of this multi-dimensional construct is broad and comprises array of different abilities such as theory of mind and emotional perception, which are two frequently studied domains of social cognition and have been shown to be impaired in schizophrenic patients (Bora et al., 2009; Kohler et al., 2009; Penn et al., 1997). Bora et al. (2009) conducted a meta-analytic review of 36 findings regarding theory of mind impairment, which is the ability to infer about the mental states (e.g. beliefs, feelings) of others and understanding that other individuals have different mental states from one's own (Couture, Penn, & Roberts, 2006). In their review, theory of mind (ToM) included individual analysis of the Hinting Task, which measure the ability to interpret intentions behind indirect speech and the Eyes Test, which measure the ability to infer mental states of individuals from photographs of their eyes (Bora et al., 2009;

Corcoran, Mercer, & Frith, 1995). Overall, the results from the studies reported in this meta-analytic review showed significant impairment on ToM and Eye Test among patients diagnosed with schizophrenia compared to healthy controls.

Emotion perception is another domain of social cognition and involves the ability to evaluate others emotions (Kohler et al., 2009). Number of studies have indicated impairment in perception of facial expression of emotions among schizophrenic patients (Edwards, Jackson, & Pattison, 2002; Kohler et al., 2003, 2009; Sachs, Steger-Wuchse, Kryspin-Exner, Gur, & Katschnig, 2004). Kohler et al. (2009) meta-analyzed 86 studies with the aim of examining how patients with schizophrenia identify facial emotions and differentiate between intensities of specific emotions. Results from this meta-analytic review showed a large deficit in recognition and differentiations of emotions in schizophrenic patients compared to healthy participants. Interestingly, of the 86 studies reported, only two examined first-episode patients.

According to previously mentioned studies, there is a significant difference between schizophrenic patients and healthy controls, with patients showing impairments in domains of cognitive functions and social cognitions. It is important to investigate further how these two cognitive processes interact and to what extent poor social cognition in this patient group is reliant on poor cognitive function. Green and Horan (2010) suggested that individuals rely on cognitive functions and social cognitions when performing on cognitive tests (e.g. Logical Memory Test) and social cognitive tests (e.g. Hinting Task) indicating association between these two domains. Studies have found correlation in the medium range between cognitive function and social cognition, which further indicates that individuals are reliant on working memory, processing speed and executive functions, when performing on social cognitive tests (Fanning, Bell, & Fiszdon, 2012; Ventura, Wood, & Hellemann, 2013). Fanning et al. (2012) examined the relationship between cognitive function and social cognition in 119 patients with schizophrenia or schizoaffective disorder. Participants carried out four social cognition

measures in addition to a battery of cognitive tests assessing the following six cognitive domains: working memory, attention, processing speed, visual learning, verbal learning and problem solving. The results revealed a medium correlation between the cognitive function measures and social cognition. Furthermore, regression analysis was used to estimate the amount of variance in social cognition explained by cognitive functions. The results demonstrated that cognitive function accounted for 10-34% of the variance in social cognition indicating that cognitive functions explain a portion of the variation in social cognition. The social cognition tests were uniquely predicted by working memory, attention and processing speed. According to these results, social cognition seems to be a more complex phenomena relying on other factors than cognitive function alone (Penn et al., 1997).

Studies using factor analysis and structural equation modeling have viewed cognitive function and social cognition as two separate constructs (Sergi et al., 2007; Van Hooren et al., 2008). Sergi et al. (2007) investigated 100 patients with schizophrenia or schizoaffective disorder and administered four tests measuring social cognition and seven tests assessing cognitive function. The results demonstrated that a two-factor model fitted the data significantly better than a one-factor model, indicating that social cognition and cognitive function should be distinguished as two separate constructs. Study by Hooren et al. (2008) furthermore argued that social cognition and cognitive function are independent domains. In their study, 44 psychosis patients were compared with 54 healthy controls in order to examine the extent to which social cognition represent an independent construct separated from cognitive impairment. In this study, cognitive tests included the Stroop Color Word Test, the Trail Making Task and the Semantic Fluency measuring processing speed, executive functions and verbal fluency. Social cognitive tasks such as the Hinting Task were included to assess social cognition. The results of factor analysis showed that cognitive function and social cognition loaded on different factors indicating two separate constructs.

According to aforementioned studies, cognitive function and social cognition can be considered as two separate constructs although it has been shown that cognitive function explains a portion of the variance in social cognition, indicating relationship (Fanning et al., 2012; Sergi et al., 2007; Van Hooren et al., 2008). Studies have examined the relationship between cognitive function and social cognition in schizophrenic patients but relatively few studies have examined this relationship in young first-episode psychosis patients using complex cognitive tests such as the Logical Memory Test and the Matrix Reasoning. The aim of the present study is to examine neuropsychological- and social cognitive tests performance between young first-episode psychosis patients and normal controls. Furthermore, the study will examine the amount of variance in social cognition (the Hinting Task and the Facial Emotion Identification Test) explained by different cognitive functions such as processing speed, executive functioning, working memory, immediate and delayed verbal memory and nonverbal abstract reasoning. It is interesting to investigate which of the cognitive functions plays the most crucial role in performance on the Hinting Task and the Facial Emotion Identification Test (FEIT), two tests that measure different aspect of social cognition. The FEIT is supposed to measure the ability to evaluate other‘s emotions whereas the Hinting Task is supposed to measure the ability to make social judgments. Revealing the relation between cognitive function and social cognition could improve future treatments for psychotic patients such as psychological interventions, assessment and cognitive remediation therapy. It is expected that patients will show poorer performance on both neuropsychological- and social cognition tests. According to the literature it is expected that cognitive function will be related to performance on the FEIT and the Hinting Task to some extent.

Method

Participants

The participants were 28 patients at Landspítali-The National University Hospital of Iceland in the early stages of psychotic disorder and 32 healthy controls at Reykjavík

University. Participants in the clinical group were 26 males (92.9%) and 2 females (7.1%), with the mean age of 22.9 (*SD* = 2.9). Their age ranged between 18 and 30 years. Participants were recruited from mental health ward at Landspítali. All the patients were on medication. The clinical group was a subset of a larger research project examining cognitive function in young first-episode psychosis patients. Potential participants were introduced to the study in scheduled meetings at the hospital and given the opportunity to participate in the study. A trained psychologist examined all the participants in the clinical group.

Participants in the healthy comparison group were recruited at Reykjavík University through an e-mail advertisement delivered to all students and by introducing the study to potential participants. The participants were 16 males (50%) and 16 females (50%) with the mean age of 24 (*SD* = 2.6). Their age ranged between 18 and 30 years. Exclusion criteria for the control group were history of significant head injury or diagnosis of depression or anxiety. Participants in the control group received small payment for their participation (ISK 1500).

Neuropsychological Tests

The Digit Symbol-Coding Test. This symbol substitution task is a subscale of Wechsler Adult Intelligence Scale (WAIS-IV) and measure psychomotor performance. Motor persistence, sustained attention, processing speed and visuomotor coordination play crucial part in the performance on this task. This test consists of a key in which a number from one to nine is paired with a certain symbol. Below the key are seven lines of random numbers and participants must write down the correct symbol below the numbers as quickly and as accurately as they can for 120 seconds (Lezak, 2004; Wechsler, 2008).

The Digit Span. Measures immediate verbal recall and working memory and is a subscale of WAIS-IV (Wechsler, 2008). The test consists of three sections: Digit Span Forward, Digit Span Backward and Digit Span Sequencing. Each of these sections has sixteen random number sequences, which the experimenter reads aloud. In the Digit Span Forward

task participants are required to repeat each sequence exactly as it is presented while in reverse order in the Digit Span Backward. Participants are always given two trials of sequences of the same length. If participants either repeat one or both trials correctly (forward or in the reverse order) a longer number sequence is read. The test ends when the participant fails a pair of sequences of the same length or repeats the longest number sequence in the test correctly. The procedure is the same for Digit Span Sequencing except participants have to respond by placing the numbers in ascending order (Lezak, 2004; Wechsler, 2008).

The Logical Memory Test. Measure verbal memory and is a subscale of the Wechsler Memory Scale (WMS-IV). It consists of two short stories that are orally presented and the second story is read twice. The participants are asked to recall as much as they can immediately after hearing the story (immediate memory) and then again 30 minutes later (delayed and recognition memory). Participants are asked to recall as much as they can and as accurately as possible even though they are not sure about their recollection. Recognition memory is measured by asking participants yes and no questions regarding the stories. Participants are encouraged to guess if they do not know the answers (Green, 2000; Lezak, 2004; Wechsler, 2009).

The Stroop Color-Word Task. Measure executive functioning - such as selective attention and processing speed (Lezak, 2004). The test consists of three trials. In the first trial participants are instructed to read a list of color names (red, yellow, green, blue) written in black ink. In the second trial participants are instructed to name colors from color pads. In the final trial the names of colors are printed in an incongruent color ink (the word „blue“ printed in „red“ ink), that is, the color names do not match the printed color. Participants are instructed to say the color but not to read the word. This trial causes the Stroop-effect because participants are longer to complete this trial compared to the first two trials (Stroop, 1935). In all trials participants are instructed to read aloud as fast as they can.

The Matrix Reasoning. Measure nonverbal abstract reasoning and nonverbal fluency and is a subscale of the WAIS-IV. In this test, the participant is presented with a total of 35 series of incomplete patterns (abstract patterns and design) and in each trial participant´s selects one of five options that best complete the patterns (Lezak, 2004; Wechsler, 2008).

The Trail Making Test. Measures the speed of cognitive processing and executive functioning. It also measures visual scanning, visuomotor tracking, psychomotor speed and cognitive flexibility. The test consists of two parts, Trail-Making A and Trail-Making B. Trail A is a measure of psychomotor speed and attention. In this test, participants are presented with a random array of 25 circles, each containing a number from 1-25. The participant is requested to draw a line between the circles in the correct order as quickly and accurate as possible. The second test, Trail Making B, measures flexibility of thinking. The participant is presented with a drawing of randomly arranged circled numbers from 1-25 and also with letters from A to L. The participant must draw a line alternating between numbers and letters as quickly and accurately as possible, number in ascending order and letters in alphabetical order (Lezak, 2004).

Social Cognition Tests

The Facial Emotion Identification Test. Measures emotion perception and consists of nineteen photographs of individuals' faces expressing one of six emotions (happiness, sadness, anger, surprise, fear, shame). A total of fifteen photographs show negative emotion while four photographs show positive emotion. Each photograph is shown for fifteen seconds. Participants are asked to examine each photograph carefully and required to select which emotion was being expressed in the photograph in addition to mark how convinced they are about their choice. The answer form consists of nineteen items, each with six choices of emotions and four choices concerning their conviction (ranging from a = *very convinced* to d =

very uncertain). If participants are not sure about the answer, they are asked to guess (Erol, Putgul, Kosger, & Ersoy, 2013; Kerr & Neale, 1993).

The Hinting Task. Measures mental state reasoning and the capacity to make social judgments (Corcoran et al., 1995). The task includes ten short vignettes presenting two characters interacting. The vignette ends with the main person giving an obvious hint. After reading the vignettes out loud to the participants they are asked to state what the main person's intentions were by asking what he really meant. If they do not know the answer, they are given a more obvious hint, which involve additional information. The additional hint is followed by a question asking what the person wants the other one to do (Corcoran et al., 1995).

Design and Procedure

Permission for the study was obtained by the Ethical Committee of Landspítali-The National University Hospital of Iceland. Participants in the control group were examined in an interview room situated in Reykjavík University whereas participants in the clinical group were examined in an interview room situated in a mental health ward at Landspítali. Participants were tested individually in sessions that lasted approximately 60 minutes in total.

All participants began with reading and signing informed consent. Participants carried out the neuropsychological- and social cognitive tests (see description above) in the following order: the Digit Symbol-Coding Test, the Digit Span, the Hinting Task, the Logical Memory Test (immediate memory), the Stroop Color-Word Task, the D-KEFS Tower Test (data from this test was not used in the study), the Matrix Reasoning, the FEIT, the Logical Memory Test (delayed memory and recognition memory) and the Trail Making Test. The control group did not carry out the D-KEFS Tower Test and therefore the Logical Memory Test (delayed memory and recognition memory) and The Trail Making Test were reversed for the control group. This was done in order to make the time between the immediate memory and delayed and recognition memory in the Logical Memory Test to be thirty minutes as the test indicates.

Data were gathered and then kept in a locked cabinet located at the mental health ward for the clinical group and at Reykjavík University for the control group to ensure confidentiality.

Results

Performance on the neuropsychological- and social cognition tests is shown in Table 1. Results from univariate ANOVA demonstrated that the clinical group performed significantly worse than healthy controls on nine neuropsychological- and two social cognition measures, after controlling for education level.

Table 1

Performance on the neuropsychological- and social cognition tests for the clinical and the control groups

Neuropsychological- and Social Cognition tests	Clinical Group (Mean/SD)	Controls (Mean/SD)	F	*p*
Digit Symbol- Coding Test	61.2 (13.1)	75.7 (10.6)	20.94	.000
Digit Span Forward	8.0 (1.9)	9.2 (1.9)	5.160	.027
Working Memory Capacity[1]	7.6 (1.3)	8.4 (1.8)	4.913	.031
Matrix Reasoning	27.1 (4.0)	28.6 (3.3)	4.077	.048
Trail Making Test A	30.3 (9.4)	25.6 (8.7)	3.300	.075
Trail Making Test B	77.4 (26.7)	73.2 (17.6)	1.133	.292
Logical Memory – Immediate	20.0 (7.9)	26.5 (6.7)	12.647	.001
Logical Memory – Delayed	18.9 (10.3)	27.7 (7.7)	19.467	.000
Logical Memory – Thematic Immediate	12.0 (3.3)	15.4 (3.9)	15.588	.000
Logical Memory – Thematic Delayed	7.7 (3.4)	10.7 (2.4)	19.787	.000
Logical Memory – Recognition	24.0 (2.8)	26.5 (2.9)	12.291	.001
Stroop Effect[2]	35.5 (11.7)	29.9 (8.8)	3.224	.078
Facial Emotion Identification Test	12.4 (2.4)	14.3 (2.1)	13.029	.001
Hinting Task	14.1 (3.1)	16.8 (1.6)	14.820	.000

[1]Mean total score on the Digit Span Backward plus Digit Span Sequencing
[2]Time difference between incongruous conditions (word-color) and reading a list of color names

The correlation coefficients between cognitive function and the social cognitive measures are presented in Table 2. The results show positive medium association, ranging from .414 to .573 indicating that higher scores on neuropsychological measures reflect better performance on the social cognitive tests.

Table 2

Correlations between the cognitive function and the social cognitive measures

Variables	FEIT	Hinting Task
Logical Memory – Immediate	.414*	.362
Logical Memory – Delayed	.573**	.472*
Logical Memory – Thematic Immediate	.473*	.452*
Logical Memory – Thematic Delayed	.596**	.418*
Logical Memory - Recognition	.320	.292
Matrix Reasoning	.459*	.551**
Digit Span - Forward	.138	-.109
Working Memory Capacity[1]	.329	-.026
Stroop Effect[2]	-.273	-.242
Trail Making Test A	.349	.498**
Trail Making Test B	-.227	-.051
Digit-Symbol Coding Test	.434*	.129

* $p < 0.05$; ** $p < 0.01$

[1]Mean total score on the Digit Span Backward plus Digit Span Sequencing

[2]Time difference between incongruous condition (word-color) and reading a list of color names

Linear Regression with multiple independent models was carried out to examine the amount of variance in social cognition (Hinting Task, FEIT) explained by twelve different neuropsychological measures for the clinical group only. Each neuropsychological measure was entered individually into each model for the Hinting task and the FEIT separately. When examining the variance in the FEIT (measuring emotion perception) explained by cognitive function, a significant relationship was found with the Logical Memory Test (immediate, delayed, thematic immediate- and delayed), the Matrix Reasoning, and the Digit Symbol Coding Test. Other tests were non-significant. Performance on the FEIT seems therefore to be dependent on different cognitive functions. As seen in Table 3 the six neuropsychological measures explained between 17.1 and 35.5% of the variance in the FEIT and the standardized coefficient (beta) ranged from .414 to .596.

Table 3

Linear Regression between cognitive function and Facial Emotion Identification Test

Variables	*B*	*SE B*	*β*	R^2
Digit Symbol Coding Test	.078	.032	.434*	18.8
Logical Memory - Immediate	.124	.053	.414*	17.1
Logical Memory - Delayed	.131	.037	.573*	32.8
Logical Memory - Thematic Immediate	.334	.122	.473*	22.4
Logical Memory - Thematic Delayed	.412	.109	.596*	35.5
Logical Memory - Recognition	.273	.159	.320	10.3
The Matrix Reasoning	.269	.102	.459*	21.0
Digit Span Forward	.175	.245	.138	2.0
Working Memory Capacity[1]	.614	.345	.329	10.9
Stroop Effect[2]	-.055	.038	-.273	7.4
Trail Making Test A	.088	.046	.349	12.2
Trail Making Test B	-.020	.017	-.227	5.1

*$p < 0.05$
[1]Mean total score on the Digit Span Backward plus Digit Span Sequencing
[2]Time difference between incongruous condition (word-color) and reading a list of color names

When examining the variance explained in the Hinting task (measuring social judgments) the results indicated a significant relationship with the Logical Memory Test (delayed, thematic immediate- and delayed), the Matrix Reasoning, and the Trail Making Test A. Other tests were non-significant. This indicates that performance on the Hinting Task is dependent on different cognitive functions. As shown in Table 4 the five neuropsychological measures explained between 17.5 and 30.3% of the variance in the Hinting Task and the standardized coefficient (beta) ranged from .418-.551.

Table 4

Linear Regression between cognitive function and the Hinting Task

Variables	*B*	*SE B*	*β*	R^2
Digit Symbol Coding Test	.031	.046	.129	1.7
Logical Memory - Immediate	.143	.072	.362	13.1
Logical Memory - Delayed	.142	.052	.472*	22.3
Logical Memory - Thematic Immediate	.421	.163	.452*	20.4
Logical Memory - Thematic Delayed	.381	.162	.418*	17.5
Logical Memory - Recognition	.328	.211	.292	8.5
Matrix Reasoning	.424	.126	.551*	30.3
Digit Span Forward	-.181	.323	-.109	1.2
Working Memory Capacity[1]	-.064	.481	-.026	0.1
Stroop Effect[2]	-.064	.050	-.242	5.9
Trail Making Test A	.165	.056	.498*	24.8
Trail Making Test B	-.006	.023	-.051	0.3

*$p < 0.05$
[1]Mean total score on the Digit Span Backward plus Digit Span Sequencing
[2]Time difference between incongruous conditions (word-color) and reading a list of color names

Discussion

The aim of the present study was to examine differences in neuropsychological- and social cognitive test performance between young first-episode psychosis patients and healthy participants and further investigate the relationship between cognitive function and social cognition in the clinical group. It was expected that patients would show poorer performance on the neuropsychological- and social cognition tests compared to healthy controls. After controlling for education level, the findings revealed that young first-episode psychotic patients performed significantly worse than healthy controls on nine different neuropsychological measures and two social cognitive tests. These results are in line with previous studies demonstrating deficits in cognitive function and social cognition in patients with psychotic disorder, with patients performing significantly worse compared to healthy participants (Bora et al., 2009; Kohler et al., 2003; Mesholam-Gately et al., 2009; Penn et al., 1997; Riley et al., 2000).

The present study further examined the correlation between cognitive function and social cognition and the amount of variance in social cognition explained by different cognitive functions for the clinical group. The findings showed medium correlation between cognitive function and social cognition indicating that higher scores on neuropsychological measures reflect better performance on the social cognitive tests, which is in line with earlier studies (Fanning et al., 2012; Ventura et al., 2013). Regression analysis showed that seven of twelve measures assessing cognitive function were significantly related to performance on the FEIT and the Hinting Task. The standardized coefficient beta for these neuropsychological tests ranged from .414 to .596 in the social cognition tests indicating a strong relation. Overall, the Logical Memory Test, the Matrix Reasoning, the Digit Symbol Coding Test and the Trail Making Test A explained between 17.1 and 35.5% of the variance in the FEIT and the Hinting Task. These results are partially in line with previously mentioned studies, which have indicated that cognitive function and social cognition can be considered as two separate constructs and that schizophrenic patients are dependent on cognitive function to some extent when processing social information (Fanning et al., 2012; Sergi et al., 2007; Van Hooren et al., 2008). According to these results it can be concluded that young first-episode psychotic patients are reliant on cognitive function (verbal memory, processing speed, nonverbal reasoning) when perceiving facial emotions and inferring the mental states of others. Interestingly, and contrary to Fanning et al. (2012), it appears that cognitive tests, which require more complex cognitive ability (verbal memory, nonverbal reasoning), account for a greater portion of variance in social cognition tests than do cognitive tests measuring primary cognitive functions (working memory, processing speed, executive function). Therefore the ability to infer other intentions and recognize facial expressions may rely somewhat more on complex cognitive functions. Several studies using exploratory factor analysis and structural equation modeling suggest that cognitive function and social cognition can be distinguished

and considered as two separate constructs (Sergi et al., 2007; Van Hooren et al., 2008) although they are related to some extent (Fanning et al., 2012; Ventura et al., 2013). The results from the present study are in line with earlier studies indicating that social cognition is related, but separable from cognitive function. As Green & Horan, (2010) noted there are clearly associations, whereas social cognition and cognitive function often share cognitive abilities such as executive function and perception.

Findings from the present study give researchers more insight and knowledge into these two cognitive processes and are of great value for psychologists and other health workers in designing effective interventions focusing on social cognition for young first-episode psychosis patients. Several limitations of the study could influence interpretation of the results. Due to a rather small sample size, it is difficult to generalize the findings. It can be concluded that interventions, which emphasize on improving cognitive functions is not sufficient to improve social cognition. Therefore, it is useful for future studies to examine further what factors, other than cognitive functions, are related to social cognition. Gathering such data is of great importance in determining what factors can improve clinical interventions. Additional studies are needed that focus more specifically on complex cognitions such as verbal memory and nonverbal reasoning when examining the relationship between cognitive function and social cognition. Future studies should also consider social cognition as a multi-dimensional construct and therefore include more measures. The present study investigated social cognition by administering only two different social cognitive tests, but social cognition consist of many abilities such as theory of mind, emotional processing, social knowledge, emotion perception and attributional bias (Bora et al., 2009; Kohler et al., 2009; Penn et al., 1997).

References

Bora, E., Yucel, M., & Pantelis, C. (2009). Theory of mind impairment in schizophrenia: meta-analysis. *Schizophrenia Research, 109*(1), 1–9.

Corcoran, R., Mercer, G., & Frith, C. D. (1995). Schizophrenia, symptomatology and social inference: investigating "theory of mind" in people with schizophrenia. *Schizophrenia Research, 17*(1), 5–13.

Couture, S. M., Penn, D. L., & Roberts, D. L. (2006). The functional significance of social cognition in schizophrenia: a review. *Schizophrenia Bulletin, 32*(suppl 1), S44–S63.

Crusius, J., van Horen, F., & Mussweiler, T. (2012). Why process matters: A social cognition perspective on economic behavior. *Journal of Economic Psychology, 33*(3), 677–685.

Edwards, J., Jackson, H. J., & Pattison, P. E. (2002). Emotion recognition via facial expression and affective prosody in schizophrenia: a methodological review. *Clinical Psychology Review, 22*(6), 789–832.

Erol, A., Putgul, G., Kosger, F., & Ersoy, B. (2013). Facial emotion recognition in schizophrenia: the impact of gender. *Psychiatry Investigation*, *10*(1), 69–74.

Fanning, J. R., Bell, M. D., & Fiszdon, J. M. (2012). Is it possible to have impaired neurocognition but good social cognition in schizophrenia? *Schizophrenia Research*, *135*(1-3), 68–71. http://doi.org/10.1016/j.schres.2011.12.009.

Green, J. (2000). *Neuropsychological Evaluation of the Older Adult: A Clinician's Guidebook*. San Diego: Academic Press.

Green, M. F., & Horan, W. P. (2010). Social cognition in schizophrenia. *Current Directions in Psychological Science*, *19*(4), 243–248.

Kerr, S. L., & Neale, J. M. (1993). Emotion perception in schizophrenia: specific deficit or further evidence of generalized poor performance? *Journal of Abnormal Psychology, 102*(2), 312.

Kohler, C. G., Turner, T. H., Bilker, W. B., Brensinger, C. M., Siegel, S. J., Kanes, S. J., et al. (2003). Facial emotion recognition in schizophrenia: intensity effects and error pattern. *American Journal of Psychiatry*, *160*(10), 1768–1774.

Kohler, C. G., Walker, J. B., Martin, E. A., Healey, K. M., & Moberg, P. J. (2009). Facial emotion perception in schizophrenia: a meta-analytic review. *Schizophrenia Bulletin*, sbn192.

Lezak, M. D. (2004). *Neuropsychological Assessment* (5th ed). New York: Oxford University Press.

Mesholam-Gately, R. I., Giuliano, A. J., Goff, K. P., Faraone, S. V., & Seidman, L. J. (2009). Neurocognition in first-episode schizophrenia: a meta-analytic review. *Neuropsychology*, *23*(3), 315.

Penn, D. L., Corrigan, P. W., Bentall, R. P., Racenstein, J., & Newman, L. (1997). Social cognition in schizophrenia. *Psychological Bulletin*, *121*(1), 114.

Riley, E. M., McGovern, D., Mockler, D., Doku, V. C., ÓCeallaigh, S., Fannon, D. G., et al. (2000). Neuropsychological functioning in first-episode psychosis—evidence of specific deficits. *Schizophrenia Research*, *43*(1), 47–55.

Rizzolatti, G., & Fabbri-Destro, M. (2008). The mirror system and its role in social cognition. *Current Opinion in Neurobiology*, *18*(2), 179–184.

Sachs, G., Steger-Wuchse, D., Kryspin-Exner, I., Gur, R. C., & Katschnig, H. (2004). Facial recognition deficits and cognition in schizophrenia. *Schizophrenia Research*, *68*(1), 27–35.

Sergi, M. J., Rassovsky, Y., Widmark, C., Reist, C., Erhart, S., Braff, D. L., et al. (2007). Social cognition in schizophrenia: relationships with neurocognition and negative symptoms. *Schizophrenia Research*, *90*(1), 316–324.

Stroop, J. R. (1935). Studies of interference in serial verbal reactions. *Journal of Experimental Psychology*, *18*(6), 643.

Van Hooren, S., Versmissen, D., Janssen, I., Myin-Germeys, I., Campo, J., Mengelers, R., et al. (2008). Social cognition and neurocognition as independent domains in psychosis. *Schizophrenia Research*, *103*(1), 257–265.

Ventura, J., Wood, R. C., & Hellemann, G. S. (2013). Symptom domains and neurocognitive functioning can help differentiate social cognitive processes in schizophrenia: a meta-analysis. *Schizophrenia Bulletin*, *39*(1), 102–111.

Wechsler, D. (2008). *Wechsler Adult Intelligence Scale-Fourth Edition*. San Antonio: Pearson.

Wechsler, D. (2009). *Wechsler Memory Scale-Fourth Edition*. San Antonio: Pearson.