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Investigating the Mediating Role of Facial Emotion Recognition in the Relationship between Cognitive Functioning and Social Performance in Patients with Schizophrenia

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By considering the importance of social performance in schizophrenia disorder, understanding the underlying factors of this defect is of great importance. On the one hand, as several studies have shown, facial emotion recognition is associated with social performance but on the other hand it is related to cognitive functioning. Facial emotion recognition may have a significant role in the relationship between cognitive functioning and social performance, so that this component can provide a more useful position for treatment interventions. The study was implemented on 51 patients who were selected by available sampling with schizophrenia disorder (18 men, 33 women). Cognitive functions including short-term verbal memory, understanding interpersonal non-verbal positions and sustain attention, were measured by verbal paired associates subtest of Wechsler Memory Scale Revised (WMS-R), picture arrangement subtest of Wechsler Adult Intelligence Scale (WAIS) and Continuous performance test (CPT), respectively. Social performance was also evaluated by personal and social performance scale (PSP). Facial emotion recognition was examined by the images of facial emotions according to Ekman and Friesen (1976). Results showed that facial emotion recognition plays a mediating role in the relationship between cognitive functioning and social performance. Generally, these findings lead us towards the position that treatments targeting social cognition in general and emotion recognition in particular must be noted.

Keywords: neurocognition, schizophrenia, social cognition, social performance.

Deficits in social-skills is one of the hallmarks of schizophrenia which affect the ability to achieve meaningful social relationships, maintain employment, and fulfill personal needs through appropriate interactions with the environment (Addington and Addington, 1999; Bellack, Morrison, Wixted and Mueser, 1990). These deficits are evident in individuals at-risk for developing schizophrenia and at illness onset (e.g., Pinkham, Penn, Perkins, Graham and Siegel, 2007), are stable over time (Mueser, Bellack, Douglas, & Morrison, 1991), and are refractory to pharmacologic intervention (Bellack et al., 1990). Moreover, impairment in social functioning may affect patients' quality of life (Penn, Corrigan, Bentall, Racenstein and Newman, 1997; Tien & Eaton, 1992). Therefore, social malfunctioning is one of the fundamental features of schizophrenia which has significant implications on the initiation, the progression and outcome of the disorder.

Interventions targeting functional impairment should be guided by research on the factors that contribute to problems in functioning. Several factors have been theoretically and empirically linked with social functioning. Neurocognition and social cognition are significantly associated with social functioning in prior research. The empirical support for each of these constructs is outlined in the following paragraphs.

Neurocognition, a constellation of cognitive abilities including processing speed, working memory, visual and verbal learning and memory, and executive functioning, has been reliably associated with functional impairment both concurrently and prospectively (Couture, Granholm and Fish, 2011). Research has shown that neurocognitive impairment is a well-established feature of schizophrenia (Heinrichs and Zakzanis, 1998; Hoff and Kremen, 2002), with some proposing

neurocognitive impairment plays a role in most of the disturbances observed in schizophrenia (Cornblatt, Green, Walker and Mittal, 2009).

Although neurocognitive impairment may account for 20–60% of the variance in real-world outcomes (Green, Kern, Braff and Mintz, 2000), 40–80% of the variance in functional outcome is unaccounted for by traditional neurocognitive measures. Clearly other relevant factors contribute to functional impairment in schizophrenia. In line with this notion, independent research groups have suggested that attention must focus on identifying factors that mediate the relationship between neurocognition and social functioning in order to enhance predictive value and identify further treatment targets (Green et al., 2000).

Social cognition, "a domain of cognition that involves the perception, interpretation, and processing of social information" (Ostrom, 1984), clearly requires neurocognitive skills (e.g., reasoning, attention, basic perception) and has obvious links with social behavior. Thus, it is not surprising that social cognition has been proposed as likely candidate for mediation. Specifically, it has been demonstrated that social cognition is distinct from neurocognition, and that it is significantly associated with functional outcome (Couture et al., 2011). The most important components of social cognition are considered as emotions perception, theory of mind and attribution style, and social perception.

One important component of social cognition that has been widely studied in schizophrenia is the ability to recognize affect in the faces of others. It has been relatively well established in the literature that individuals with schizophrenia generally show deficits in both identification and discrimination of facial affect (Edwards, Jackson and Pattison, 2002; Mandal, Pandey and Prasad, 1998; Pinkham, Penn, Perkins and Lieberman, 2003). On the other hand, results of other studies indicate that impairment in recognizing social symptoms and particularly emotion recognition explains part of social performance variance that cannot be examined by cognitive components (Brune, 2005; Corrigan & Toomey,

1995; Pinkham & Penn, 2006; Roncone et al., 2002). Affect recognition skills play a central role in any model of social cognition specifically, as well as any integrated model of social competence more generally (Bellack et al., 1990). Despite this fact, data on the relationship between affect recognition, performance-based social skill and elementary neurocognition remains limited.

Therefore, findings of some studies suggest that emotion recognition is associated with social performance on one hand and cognitive functions on the other hand; hence, these findings indicate that face emotion recognition can play an important role in connection with the relationship between social and cognitive functions (Addingtone, Saeedi & Addington, 2006).

Since there is little support on improving social cognition in schizophrenia patients through prescribed drugs, a keen interest has been emerged in psychosocial treatments to improve facial emotion recognition in this group of patients. As a result, with the understanding that the components effect of this important structure on social function, fruitful steps can be taken in the treatment process of this group of disorders.

The purpose of this study is to test the hypothesis that facial affect recognition is a mediator between cognitive and social functioning. Based on the prior research, mediator model was used to test a model of social functioning in schizophrenia that includes relationships among neurocognition, social cognition (as measured by facial affect recognition), and social competence in schizophrenia. To determine whether facial affect recognition may be an important focus for treatments that target

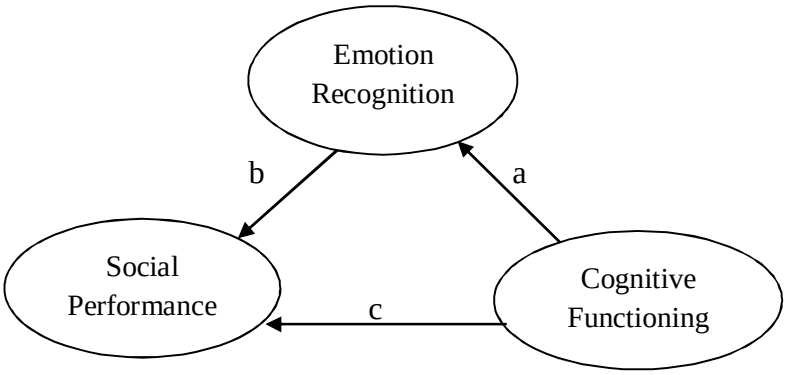

Figure 1. The Research Model Presentation

functioning and based on the above mediator model, it is predicted that: People who are impaired in cognitive functions have a weak performance in emotion recognition (path a) and due to the defect in emotion recognition, their social performance in this group of individuals is reduced (path b). Eventually, it is assumed that if the mediator variable is controlled, the relationship between cognitive functions and social performance is reduced (path c).

Material and Method

Participants include 51 patients (18 men and 33 women) with schizophrenia; patients admitted and hospitalized in psychiatric hospitals in Shiraz were selected by available sampling. They had been received diagnosis of the disorders by the psychiatrist. After that, they were interviewed and diagnosed by experienced psychiatrist on the basis of the structured clinical interview for the Diagnostic and Statistical Manual of Mental Disorders Fourth Edition DSM-IV (1994). Exclusion criteria were diagnosing the disorder in axis 1 based on diagnostic criteria of the Diagnostic and Statistical Manual of Mental Disorders Fourth Edition DSM-IV (1994), history of drug addiction, physical illness and neurological disorders such as epilepsy, any type of brain injury and

mental illness other than the original diagnosis (such as mental retardation or schizoaffective) (Meyer, Krutz, 2009). It should be mentioned that all human studies have been approved by the appropriate ethics committee.

The following instruments were used in the present study:

Cognitive functions including, short-term verbal memory, understanding nonverbal interpersonal situations and sustain attention were assessed, respectively, through paired associated verbal subtests of the Wechsler Memory Scale Revised, The Wechsler Intelligence Scale subtests set of images and continuous performance test.

Continuous Performance T (CPT). The Persian form of continuous performance (Hadianfard, Najarian, Shokrkon, and Mehrabizadeh Honarmand, 2000) which is run through the Internet has 150 Persian numbers as stimulus among which 30 are as target stimulus. The interval between stimulus presentations is 500 milliseconds and time of stimulus presentation is 150 milliseconds. The researchers reported that reliability coefficient of the test varies between .59 and .93 for different parts of the range through retest with 20-day intervals. All the calculated coefficients were significant at the level of .001 and also a desirable validity was reported through criterion-validity for the test. The test is run in a very favorable time and position. The test starts with one example. At this time, by pointing to the screen the subjects were told that this was an accuracy test, and different numbers appeared in the computer screen consecutively (numbers were shown to subjects) and they were supposed to look at the numbers carefully. While number six was shown to them, they had to press the key (space key). Beside they had to be aware of not pressing the key whenever the other numbers appeared on the screen. After the work being informed to the subject and reported on readiness by the subject, the test was started. In addition to the overall score of correct answers in this test, the two errors of eliminating and response providing were scored. Eliminating error occurred when the subject did not respond to target

stimulus, and response providing error occurred when the subject responded to non-target stimulus. Upon completion of the test, performance results of the subject were registered as a record on the computer screen (Hadianfard et al., 2000).

Wechsler Memory Scale Revised (WMS-R). In the WMS-R, eight groups of words are read for the subject and asked to complete the second word by heart (Orangi, 2006). We used Persian version of this scale that Orangi, Atefvahid and Ashayeri (2002) reported a good validity and reliability for this scale. The reliability of the scale was measured through a test-retest method. The reliability coefficients of the retests ranged from .28 to .98 for the subtests and for the composite tests, which are satisfactory. The standard error of measurement was calculated as well. To investigate the validity of the new version of the Scale, it was administered to a clinical group who were either diagnosed with or suspected of memory impairment. In comparison with the normative sample in terms of the five indices, the clinical group scored lower in the scale indices

Wechsler Adult Intelligence Scale (WAIS). Wechsler Adult Intelligence Scale (WAIS) subtests set of images consists of eight set of cards from three sets of the subtests. Each batch of scattered card was presented to the subject, and he/she had to put them together regularly to show a story.

Facial Affect Recognition Task

In this study, facial emotion recognition was studied by 41 images that measured 6 different emotional states (sadness, happiness, fear, anger, disgust, surprise) and also the neutral state. In order to adapt this test to the Persian culture, first 110 images of Ekman and Friesen (1976) facial emotion images were prepared which include images of the faces of people of different ages and both sexes with emotional state of happiness, sadness, anger, fear, disgust, surprise and the neutral state. Then, the

images were executed in a 41-person group composed of students of clinical psychology of Shiraz University in the age range of 19 to 22 years.

Then, in respect of the 41 selected images (6 images for each emotion except for the fear emotion to which 5 images were allocated) more than 85 percent of those who were in the initial screening agreed to the correct diagnosis of the emotions related to the images as stimuli recognition. There were 7 images (related to 6 emotional states and the neutral state) on which subjects had 100 percent agreement as main options. Therefore, a multiple choice test was designed with the 41 items, and the 7 images with 100 percent agreement and each specifically representing one of the six main emotions (sadness, happiness, fear, surprise and anger) and the neutral state were considered as the test options. Other images of the test items were considered as test options and were placed constantly in front of the subjects in the form of 7 cards of 20*30 cm and other images were consecutively passed by on the monitor of the computer in front of subjects. It is noteworthy that these images were randomly numbered and then were shown to the subjects with the same number (Ekman &Friesen, 1976). After communicating with each subject and inform him/her satisfactorily, he/she sat at a 40±5 cm distance from the computer monitor on a comfortable chair and the procedure was explained to him/her. The test was run using the computer.

The test procedure was such that one of the 7 images including test options were shown to the subject, and then one of the other 41 images was shown on the 16-inch handled computer with 800*1280 pixels for 500 milliseconds.

After presenting each image, the subjects had 5 seconds (Pan et al., 2009) to name the intended emotional image or show the one which is similar emotionally to the target image among the 7 images in front of him/her which represents one of the 6 emotions and the neutral states. Subjects' performances were measured based on the total number of their Figure 2 shows an example of the images.

Figure 2. An Example of Ekman and Friesen (1976) Emotional Images

correct answers.

Personal and Social Performance Scale (PSP). PSP presents an estimation of the general social performance through the four separate subscales of social functioning based on performance levels during the last month. PSP subscales include 1) Social role implementation (PSP-SR): socially useful activities including occupation and education, 2) Interpersonal interactions (PSP-IP): social and personal communications, 3) Self-caring (PSP-SC) and 4) Aggressive and disturbing behaviors (PSP-AG). Each of these performance subscales can be evaluated independently in the Likert 6-scale (0: absent; 1: mild; 2: evident; 3: tangible; 4: severe and 5: very severe). Higher scores indicate poorer performance. Next, the general social performance (PSP-GL) can be obtained through calculation of the four main PSP subscales. PSP-GL scoring varies from 0 to 100; higher scores indicate better general social performance. Related information is collected through observations of nurses and psychologists who are directly in contact with the patients and PSP subscales and then

general social performance are scored based on the obtained information (Morosini et al., 2000). This scale has been normalized in different countries with good reliability and validity. For example, its German version Cronbach's alpha has been reported to be .84 and high retest reliability, and also a good validity which has been obtained from the high correlation with other social performance measuring tests such as GAF (r= .91), SOFAS (r= .91) (Juckle, et al., 2008). With respect to the Spanish version of this scale the Cronbach's alpha has been reported to be .84 and high validity which has been obtained from correlation with GAF test (Apiquian et al., 2009). Since PSP has not been normalized in Iran, the researchers sought to obtain psychometric properties of this questionnaire in the normal population of Iran.

Therefore, after translating the text into Persian and confirming it by two MA English students, it was translated back into the original language, and the accurate translation was selected. The reliability and validity of this questionnaire were calculated in a sample of 30 patients with schizophrenia. An internal consistency of .78 was obtained by calculating the Cronbach's alpha. To assess its validity, the convergent validity, which is shown in Table 1, was used. The correlations vary from .33 to .63 showing the validity of this instrument.

Table 1

Correlation Matrix of Personal and Social Performance Scale Components

Components	1	2	3	4
1. Social Activity	1			
2.Self-Caring	.45**	1		
3.Social and Personal Relations	.58**	.37*	1	
4. Aggressive Behavior	.63*	.33*	.44**	1

**: P< .01, *: P< .05

Descriptive statistics of the study include mean and standard deviation. After preparing the correlation matrix, Moshiro's hierarchical multiple regression analysis was used to investigate the existing relationship in the proposed model of the study based on Baron and Kenny's (1986) method. According to Baron and Kenny (1986), the instruction states that the following steps are necessary to establish mediated relationship:

1. The correlation between the predictor variable (cognitive functions) and the criterion variable (social performance) must be significant.
2. The correlation between the predictor variable (cognitive functioning) and the mediator variable (emotion recognition) must be significant.
3. The correlation between the mediator variable (emotion recognition) and the criterion variable (social performance) must be significant.
4. The correlation between the predictor variable (cognitive functions) and the criterion variable (social performance) must be reduced after controlling the mediator variable (emotion recognition) (Ostovar, 2007).

The SPSS16 software was used to run the above operations.

Then, the structural equation model was evaluated using LISREL software. The compliance parameters have been extracted using the same software. In addition to the above operations in the entire model, direct and indirect effects of each of the model variables on the criterion variable were calculated (Alborzi, 2008).

Results

The subjects were in the age range of 21 to 55 years with an average age of 37.3, and a standard deviation of 8.7; 64.7 percent of the subjects

were males and the other remaining 35.3 percent were females; 60 percent of them were single, 23 percent married and 15 percent divorced. Education in guidance and high schools had the highest frequencies (37.3, 37.3) and then primary and upper diploma, respectively.

Before performing regression analysis, correlation was evaluated between the variables through assessing the correlation matrix. In Table 2, correlation matrix of the interval variables of the study is presented.

Table 2

Correlation Matrix of the Interval Variables of the Study

Variables	1	2	3	4	5	6
1.Social Performance	1					
2.Emotion Recognition	.52**	1				
3.Verbal Short-Term Memory	.42**	.58**	1			
4.Sustain Attention	.34*	.54**	.59**	1		
5.Understanding Non-Verbal Positions	.35*	.56**	.53**	.42**	1	
6.Total Score of Cognitive Performance	.41**	.64**	.77**	.95**	.62**	1

**: P< .01, *: P< .05

In the following paragraphs, the mediator model was examined and the model results were reported in detail.

According to Baron and Kenny's (1986) instructions, three sets of regression were used to test the hypothesized mediator model. In the first set, a separate regression model was used to determine the relationship between the predictor variable (cognitive functioning) and the criterion variable (social performance). The analysis has been reported in Table 3 in the part of stage 1. According to the results, the predictor variable

(cognitive functioning) has a significant relationship with the criterion variable (social performance) (β= .56, P< .0001).

Table 3

Results of Baron and Kenny's Regression Analysis of the First and Third Stages

Variables	Social Performance **Stage 1**				Social Performance **Stage 3**			
	B	T	β	P<	B	t	β	P<
Cognitive Functioning	.60	4.44	.56	.0001	.30	1.78	.28	NS
Emotion Recognition					1.18	2.73	.41	.009
R	.60				.67			
R^2	.37				.45			
Adjusted R^2	.31				.40			

NS=Non-Significant

In the second stage of the analysis, regression of the mediator variable (emotion recognition) on the predictor variable (cognitive functioning) was studied to determine the relationship between the predictor variable (cognitive functioning) and the mediator variable (emotion recognition). The results of this analysis presented in Table 4. The predictor variable (cognitive functioning) as presented in Table 4, significantly predicts the mediator variable (emotion recognition) (β= .68, P< .0001).

Table 4

Results of Baron and Kenny's (1986) Regression Analysis of the Second Stage

Variables	**Stage2** Emotion Recognition			
	B	t	β	P<
Cognitive Functioning	.25	5.91	.68	.0001
R	.68			
R^2	.46			
Adjusted R^2	.42			

In the third stage of the analysis, a regression model was used to test the effect of the mediator variable (emotion recognition) on the relationship between the predictor variable (cognitive functioning) and the criterion variable (social performance). In this model, the regression of social performance on emotion recognition was calculated by controlling cognitive functioning and its results were reported in Table 3 as the third stage.

By controlling emotion recognition variable (mediator variable) as it is shown in Table 3, level of social performance variable (criterion variable) has been reduced through cognitive functioning variable (predictor variable) and it is not significant any more (β= .28, P=NS). Moreover, the results of this stage showed that emotion recognition variable (mediator variable) has a significant relationship with social performance variable (criterion variable) by controlling cognitive functioning variable (β= .41, P< .009).

Results of regression analysis in Figure 3 can be summarized as follows:

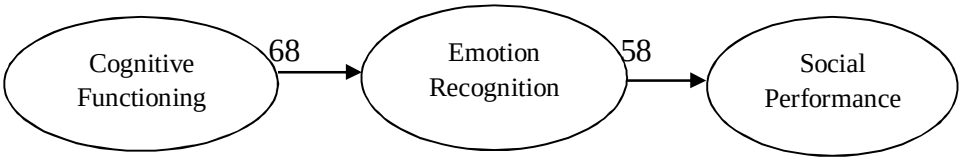

Figure 3. Presenting the Final Model of the Study based on Regression Analysis According to Baron and Kenny's (1986) Instructions

The above mediator model was investigated through regression analysis. In the model, cognitive functioning was analyzed as the predictor variable (independent), emotion recognition as the mediator variable and social performance as the criterion variable (dependent). In order to investigate direct and indirect effects of cognitive functioning variable on social performance variable, two separate regression models were used. In the first model, regression of the cognitive functioning variable was analyzed as the predictor variable and social performance as the criterion variable. As it can be seen in the Table 3, the cognitive functioning variable with β coefficient of .56 explained 37 percent of the variance of the social performance variable (R^2= .37). In the second regression model, social performance regression (the criterion variable) on emotion recognition (the mediator variable) by controlling cognitive functioning variable (the predictor variable) was evaluated to test indirect effects of cognitive functioning variable (the predictor variable) on social performance (the criterion variable). As figure 3 shows, by controlling emotion recognition variable (the mediator variable), the coefficient of cognitive functioning variable (the predictor variable) has been reduced to 0.28 and is not significant anymore.

The Final Model Fitness

According to the various stages of the path analysis and removing non-significant paths, the final model of the effect of cognitive functioning on social performance mediated by emotion recognition is displayed in Figure 4.

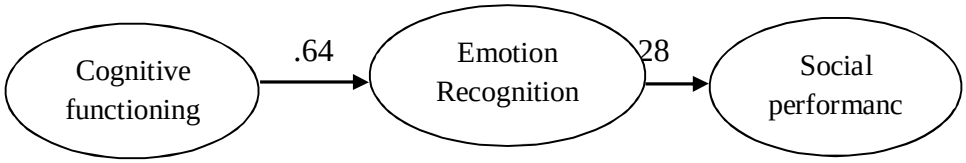

Figure 4. Presenting the Final Model of the Study based on the Final Model Fitness

The obtained results from the structural equation model in the field of model fitness indicators represent the optimal matching of the obtained model. In this model, chi square (P= .11, df =1, X^2=2.74) was calculated. Goodness of fit index (GFI) which represents the explained variance and covariance value by the model was calculated .97. It should be mentioned that GFI more than .90 represents compliance of the model with the data. Adjusted goodness of fit index (AGFI) that adjusts goodness of index, to some extent, to the sample size and degrees of model freedom can vary from 0 to1.0 and values close to one indicate better goodness of fit of the model (Khormayi, 2006). AGFI was calculated .83 for the model that confirms goodness fitted. Mean of the explained variance and covariance of the model was calculated by the root mean square residual (RMR). The more this value is closer to zero, the better fitness the model will have and values less than .1 are acceptable (Hosseini, 2011). RMR value was calculated 0.06 for the model that represents the model's fitness with the real sample. Table 5 presents all the model fitness indices.

Table 5
The Model Fitness Indices

indices	GFI	AGFI	RMR	CN	CFI	IFI	NFI
Values	.97	.83	.06	146	.95	.96	.93

In Table 6, direct, indirect and total significant effects are listed for the model.

Table 6
Direct, Indirect and Total Significant Effects of the Model

Variables	Direct Effects	Variables	Indirect Effects	Total Effects
Cognitive Functioning	.64	Emotion Recognition	-----	.64
Cognitive Functioning	-----	Social Performance	.21	.21
Emotion Recognition	0.32	Social Performance	-----	.32

Discussion and the Overall Conclusion

In line with previous studies (Addington et al., 2006; Meyer and Kurtz, 2009), social cognition appears to serve a meditational role between neurocognition and social competence. In the present study, consistent with results of the previous studies, the mediating role of facial emotion recognition on the relationship between cognitive functions and social performance was confirmed (Brune, 2005; Corrigan & Toomey, 1995; Pinkham & Penn, 2006; Roncone et al., 2002; Meyer & Krutz, 2009). Based on the above reported results, cognitive functions as the predictor variable did not directly affect social performance as the criterion variable

and it only had 21 percent indirect effect on social performance mediated by emotion recognition, while emotion recognition played 31 percent direct effect on social performance. All findings confirmed the mediating role of emotion recognition and represented that if cognitive functions have a relationship with social performance, it will be indirect. And it only mediated by emotion recognition, that is to say, increasing cognitive skills will be followed by better recognition of emotions and better recognition of emotions will be led to improvement in social performance in this group of patients.

The finding indicates that this is the facial emotion recognition that has a direct relationship with social performance not the cognitive functions. Therefore, in order to increase social performance in the group of patients, improvement of facial emotion recognition is prioritized.

Our knowledge of the relationship between cognition and social functioning is limited. We have evidence of the importance of cognition in determining outcome and examining potential mediators such as affect recognition holds promise for increasing our understanding. Additionally it is possible that such mediators may be the targets for intervention, although the potential of such treatments are in the early stages of development (Hogarty et al., 2004; Medalia et al., 2002).

Thus , these results suggest that improvements in social cognition leads to improvements in daily social functioning, which makes interventions such as the ones listed below essential in the quest for improvement in this area: Training of Affect Recognition (TAR; Fromann, Streit and Wölwer, 2003; Wölwer et al., 2005), Emotion Management Training (EMT; Hodel Brenner, Merlo and Teuber, 1998); Psychological Integrate Therapy for Schizophrenia (IPT; Roder, Brenner, Kienzle and Fuentes 2007; Cognitive Enhancement Therapy (CET; Hogarty and Flesher, 1999); and Social Cognition and Interaction Training (SCIT; Penn et al., 2005).

The generalizability of our results is limited by this factor that in the natural environment, facial expressions are not static like photographs, but

it represents ever-changing events. Some investigators suggest that because the lack of important dynamic information that facial photographs have, patients need to interpret facial expressions more accurately. It suggests that future studies that make use of videotaped representations of facial expressions of emotions could address this issue (Hargarave, Maddock & Stone, 2002).

Although the findings of this study suggest the facial emotion recognition has a direct relationship with social performance not cognitive function, there is a need that the future research use the current research model on other mental disorder, other subdivision of schizophrenia and on acute and chronic schizophrenia independently, until the underlying mechanisms of social dysfunction as one of the vital characteristics of this disorder clearly be evaluated.

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