



# Traditional Chinese version of the Mayer Salovey Caruso Emotional Intelligence Test (MSCEIT-TC): Its validation and application to schizophrenic individuals



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## ABSTRACT

Schizophrenia is an illness that impairs a person's social cognition. The Mayer Salovey Caruso Emotional Intelligence Test (MSCEIT) is the most well-known test used to measure emotional intelligence (EI), which is a major component of social cognition. Given the absence of EI ability-based scales adapted to Chinese speakers, we translated the MSCEIT into a Traditional Chinese version (MSCEIT-TC) and validated this scale for use in schizophrenia studies. The specific aims were to validate the MSCEIT-TC, to develop a norm for the MSCEIT-TC, and use this norm to explore the EI performance of schizophrenic individuals. We included in our study seven hundred twenty-eight healthy controls and seventy-six individuals with schizophrenia. The results suggest that the MSCEIT-TC is reliable and valid when assessing EI. The results showed good discrimination and validity when comparing the two study groups. Impairment was the greatest for two branches Understanding and Managing Emotions, which implies that the deficits of schizophrenia individuals involve ToM (theory of mind) tasks. Deficits involving the negative scale of schizophrenia was related to impaired performance when the MSCEIT-TC was used (in branch 2, 3, 4, and the area Strategic). Our findings suggest that the MSCEIT-TC can be used for emotional studies in healthy Chinese and in clinical setting for investigating schizophrenic individuals.

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## 1. Introduction

Schizophrenia is an illness that impairs a person's social cognition as well as some of the other most complex functions associated with the brain (Burns, 2004; Lee et al., 2004; Brunet-Gouet and Decety, 2006; Burns, 2006). Social cognition refers to the mental operations that underlie judgments and social behavior. Most social cognitive research related to schizophrenia has focused on the areas of emotional processing, the theory of mind

(ToM), social perception, social knowledge, and attributions (Leonhard and Corrigan, 2001; Green et al., 2005; Eack et al., 2007; Baas et al., 2008; Dawson et al., 2012), but the boundaries among these various types of social cognition are not definite. Emotional intelligence (EI) has been identified as an important component of social cognition (Kee et al., 2009; Lin et al., 2012). EI is defined as the ability to make accurate appraisals and expressions of emotions in oneself and others and the use of this understanding to enhance thinking and behavior (Mayer et al., 1990, 2001). EI is viewed as measurable and important across a fairly diverse set of tasks, which is reflected in the development of multi-factorial scales to assess emotional intelligence (Mayer et al., 2001; Caruso et al., 2002; Lopes et al., 2004).

A performance-based (or ability-based) questionnaire, the Mayer Salovey Caruso Emotional Intelligence Test, or the MSCEIT,

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is the most well-known and most frequently employed test for the measurement of EI (Mayer et al., 2001, 2003; Eack et al., 2009). The MSCEIT is comprised of 141 items and examines emotion-related social-cognitive abilities; it does this by having participants solve problems rather than through potentially biased self-reportings and observations. The MSCEIT consists of two tasks (sections) for each of the four branches: 1) perceiving emotions (from tasks Faces and Pictures): the ability to accurately recognize how you and those around you feel; 2) using (or generating) emotions to facilitate reasoning (from tasks Facilitation and Sensations) in cognitive tasks such as problem solving or creativity; 3) understanding complex emotions and emotional 'chains' (task Blends), and how emotions change over time or change over situations (task Changes); and 4) managing emotions (tasks Management and Relations) by assessing the ability to intelligently integrate the data of emotions in oneself and others in order to devise effective strategies for problem solving (Mayer et al., 2008; Maccann et al., 2014). These four branch sections are then divided into two different areas: 1) the area Experiential EI, which involves the degree to which one 'takes in' emotional experience, recognizes it, compares it to other sensations, and understand how it interacts with thought; and 2) the area Strategic EI, which indicates the degree to which one can understand emotional meanings, their implications for relationships, and how to manage emotions in oneself and others. Disparate area score differentiates the ability between perceiving/understanding emotions from utilizing/managing emotions, i.e., the ability to acquire vs. to manipulate emotional information. (Mayer et al., 2002). The MSCEIT can be generally scored at three levels: 1) as an overall EI score reflecting an individual's general level of EI; 2) two area scores; as Experiential EI which includes branches 1 and 2 and Strategic EI, which includes branches 3 and 4; and as the four branch scores (Mayer et al., 2002).

Concerns exist regarding the validity of the theoretical bases for the MSCEIT, operationalization of EI (Roberts et al., 2001, 2006), and the applicability of EI measures to only the clinical subsamples with below average EI values but not to be used for non-clinical population (Fiori et al., 2014). Fiori et al. (2014) affirmed that the MSCEIT is more sensitive an instrument for identifying patients of EI deficit rather than a probe for discriminating the EI ability of above-average normal individuals. In fact, the MSCEIT has been recommended by the National Institute of Mental Health Measurement and Treatment Research to Improve Cognition in Schizophrenia Committee (MATRICS) for use as a key measure of social cognition in schizophrenia (Mayer et al., 2003; Green and Nuechterlein, 2004; Kern et al., 2004; Marder and Fenton, 2004; Harvey, 2006). When studying schizophrenia, the MSCEIT has also been widely applied as a means of assessing social-cognitive deficits (Kee et al., 2009; Eack et al., 2010; Lo et al., 2010), treatment response and functional outcomes (Eack et al., 2011; Green et al., 2012; Horan et al., 2012; Gray et al., 2014). It is also contentious whether EI ability can be assessed and scored by one single correct answer for each item of MSCEIT. Fiori et al. (2014) reported that many of the answers for all 141 items had either skewed or dichotomous distributions, which indicated that the proposition of "one single correct answer" is not valid for some domains of EI measurements. Accordingly, the EI as an ability and personality trait is not hierarchical as originally conceived. Despite the absence of golden-standard in measuring the EI, the approach of consensus normative scoring as implemented by Mayer et al. is currently a widely accepted way in different translations of MSCEIT (Extramera et al., 2006; Curci et al., 2013).

The branch 'Understanding' measures a respondent's ability to comprehend emotional information about relationships, transitions from one emotion to another, and linguistic information about emotions. Since the branch "Understanding" correlated most

with IQ, Mayer et al. (2001) suggested that this branch is the most cognitive and has the highest relation to abstract processing and reasoning. Lopes et al. (2003) compared the correlations between the four branches of MSCEIT and some measurements of crystallized intelligence, and noted the strongest relations between the "Understanding" branch and verbal IQ ( $r=0.39$  vs.  $-0.03-0.06$ ) and verbal SAT (Scholastic Aptitude Test) ( $r=0.36$  vs.  $-0.22--0.1$ ) as compared to other three branches. Therefore, the "Understanding" branch of the MSCEIT can be deemed to tap abstract processing and reasoning for emotions and emotional information more than the other branches.

If one assume that the assessment of EI in schizophrenia research is fundamental, the cross-cultural conceptualization of EI and a valid translation of the questionnaire then become particularly crucial when carrying out studies on non-native English speakers. In East Asia, two other scales for measuring EI traits (Brannick et al., 2009) have been translated and validated: one is the Wong and Law Emotional Intelligence Scale in China and Korea (Wong and Law, 2002; Fukuda et al., 2012) and the other is the Bar-On Emotional Quotient Inventory in Japan (Fukunishi et al., 2001). These two EI scales involve the trait and self-reporting approaches; this contrast with the MSCEIT, which is ability-based and involves measurement by performance testing. We prefer the MSCEIT because it places a high value on the assessment of cognitive deficits during emotion processing as well as the treatment reactions of individuals with schizophrenia. Schizophrenia is a very puzzling and debilitating illness worldwide and therefore, researchers require a common tool when investigating EI in order to facilitate communication and collaboration when carrying out cross-ethnic group comparisons and analyses.

Given the absence of EI ability-based scales that are adapted to Chinese-speakers, we translated the MSCEIT into a Traditional Chinese version (MSCEIT-TC) based on the guidelines for cross-cultural adaptation of self-reported measures (Beaton et al., 2000). MSCEIT-TC was translated from the original MSCEIT 2.0 by two groups of bilingual native Chinese researchers, and then a third translation was synthesized from these two original translations by resolving any discrepancies. This was then blindly back-translated by another bilingual native Chinese researcher to ensure language equivalence. Three of the authors (CHC, CHL and WYH) possess backgrounds in psychology. They monitored and reviewed the attainment of semantic, idiomatic, experiential and conceptual equivalence between the MSCEIT and MSCEIT-TC during the appraisal process of the cross-cultural adaptation. The pre-final version of the MSCEIT-TC was tested and the item response pattern was addressed in order to check if it still retained its equivalence in an applied situation. After that, a reasonable and final version of the MSCEIT-TC was developed. Our intention was to validate this Chinese EI scale for use in future schizophrenia research. In this study, the psychometric properties, reliability and factor structure of the MSCEIT-TC and its clinical applications to schizophrenic patients to elucidate the psychopathology were assessed and discussed. Specifically, we set out to validate the MSCEIT-TC, to examine the range of factor structures of MSCEIT-TC by confirmatory factor analysis, to develop a norm for the MSCEIT-TC, and to assess the EI performance of individuals with schizophrenia as indexed to the established norm. The overall objective was to facilitate research on social cognition and emotional intelligence in areas across East Asia that uses Traditional Chinese for writing and reading purposes.

## 2. Methods

### 2.1. Participants

#### 2.1.1. Part 1: development of the norm

All the healthy control participants were recruited through advertisement or word-of-mouth referral and were excluded if they had a history of major medical or psychiatric illness. The Mini International Neuropsychiatric Interview was performed for each control participant to rule out significant psychopathology. In part 1, we included 728 control participants (426 women and 302 men) for the reliability and validity testing, and the norm development of the MSCEIT-TC.

To establish the normative data, the majority of control participants of younger age and higher education were mainly recruited through advertisements. Owing to the practical difficulty in recruiting participants of middle and old age, the “Snowball sampling” (Heckathorn, 2011) was adopted by which the younger participants invited their acquaintances, particularly the aged, to participate in this study. We eventually recruited 728 control participants with a wide coverage of age (18–76 years) and educations (6–20 years). The mean age of the participants was 36.1 years ( $SD=12.2$ ), and the age distributions were 51.7% below age 35 years old, 32.1% for 35–50 years old, 15.5% for 51–65 years old, and 0.7% above 65 years old. A regional norm of the MSCEIT-TC was then developed to best represent the population under such procedure.

#### 2.1.2. Part 2: clinical validation for individuals with schizophrenia

We invited 76 individuals with schizophrenia (41 women, 35 men, age:  $37.8 \pm 9$  years) to complete the MSCEIT-TC in order to assess the differences between the norm group and the schizophrenia group. The diagnoses of schizophrenia for these individuals had been made according to the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR) (American Psychiatric Association, 2000). Individuals with schizophrenia were assessed for any comorbidity using SCID-IV (the Structured Clinical Interview for DSM-IV Axis I Disorder), as well as PANSS (Positive and Negative Syndrome Scale) (Kay et al., 1987) and PSYRATS-H (Psychotic Symptoms Rating Scales-Hallucination Subscale) (Haddock et al., 1999) in order to identify any psychopathology. The SCID-IV, PANSS and PSYRATS-H ratings were carried out by the same physician who has a diploma in Psychiatry.

The protocol was approved by the Institutional Review Board of the Taipei Veteran General Hospital and the Tri-Service General Hospital and written consent was obtained from all participants.

### 2.2. Measures and procedures

The MSCEIT-TC retained the original 141 items and the 5-point rating scale response format originally used by the MSCEIT and was administered to every participant as a printed booklet. We briefly introduced to each participant the administration method of the MSCEIT-TC and the measure was then completed independently by each participant. No limitation was set in terms of the time taken by individuals to complete the measure, but usually 40–50 min were needed.

As recommended in the manual of the MSCEIT (Mayer et al., 2002), we used the consensus method for scoring the MSCEIT-TC. Each one of a respondent's answers was scored against the proportion of the sample that endorsed the same MSCEIT-TC answer. A norm was developed using this consensus method of scoring for the group of 728 control participants. Using the norm we had developed, a norm-reference method was then used to score individual with schizophrenia in part 2 of the study. The raw scores can be converted to norm-referenced scores with a mean of 100

and an SD of 15. This means that if a person obtains a normative MSCEIT score of around 100, then they are within the average range of emotional intelligence. A higher EI score thus reflects better emotional intelligence (Mayer et al., 2003).

We also assessed the test-retest reliability of the MSCEIT-TC by having 70 (41 women, 29 men, age:  $26 \pm 5.5$  years) of the 728 participants return and retake the MSCEIT-TC two weeks after the initial testing.

### 2.3. Analysis of the criterion-related validity

In order to further analyze the criterion-related validity, 100 participants (60 women, 40 men, age:  $25.9 \pm 3.7$  years) had completed the MSCEIT-TC together with two other relevant Chinese questionnaires, namely the Wong and Law Emotional Intelligence Scale (WLEIS) and the Emotional Quotient Scale (EQs).

The 16-item self-reported WLEIS (Wong and Law, 2002) was developed in Hong Kong and is based on the Mayer and Salovey (1997) EI model. It measures four dimensions: self emotional appraisal (SEA); others' emotional appraisal (OEA); use of emotion (UOE), and regulation of emotion (ROE).

Also based on the EI model of Mayer and Salovey, the 233-item self-reported EQs (Chen, 2000) was developed in Taiwan. The Cronbach's alpha coefficients for the 16 dimensions of the EQs range from 0.47 to 0.92 (Chen, 2000). The 16 dimensions are composed of four branches: 1). perception, appraisal, and expression of emotion; 2). emotional facilitation of thinking; 3). understanding and analyzing emotions, employing emotional knowledge; and 4). reflective regulation of emotions to promote emotional and intellectual growth.

### 2.4. Statistical analysis

Structural equation modeling (SEM) for confirmatory factor analysis (CFA) was conducted using IBM SPSS AMOS 20 (2011), and four measures of fit were used to evaluate the model adequacy: chi-square, comparative fit index (CFI), normed fit index (NFI) and the root mean square error of approximation (RMSEA). Values of  $\geq 0.9$  show an acceptable fit for the NFI and CFI, and values  $\leq 0.08$  are acceptable for the RMSEA. We tested one-factor, two-factor and four-factor solutions of the MSCEIT-TC domain, which is a similar approach to that used by Mayer et al. (2001, 2003). The one-factor model loaded all eight MSCEIT-TC tasks. The two-factor model divides the scale into an “Experiential” area and a “Strategic” area. The four-factor model loaded the two designed tasks into each of four branches. The confirmatory factor models shared the following characteristics: (a) the scores in the eight tasks were set as observed variables; (b) the different factor model and measurement error in each task were set as latent variables and unobserved variables, respectively; (c) the latent variable scale was constrained to a factor loading equal to one; and (d) the latent variables were correlated (that is, oblique).

Reliability analyses, bivariate correlations (for criterion-related validity), nonparametric tests (for comparison of the MSCEIT-TC results of the norm group and the individuals with schizophrenia), and *t*-tests for independent samples were performed using IBM SPSS (Statistical Package for the Social Sciences) Statistics for Windows, version 20 software (IBM Corp. 2011).

## 3. Results

### 3.1. Participant characteristics

The demographic characteristics, psychopathology, and MSCEIT-TC performance of the 728 control participants and the 76

**Table 1**  
Demographic characteristics, psychopathology, and MSCEIT-TC performance (SD).

Variables	Control (N=728)	Schizophrenia (N=76)	Between-group difference <sup>a</sup>	
			Z	p
<b>Demographics</b>				
Age (years)	36.1 (12.2)	37.8 (9.0)	–1.20	ns
Sex (females/males)	426/302	41/35		
Education (years)	16 (2.2)	13.2 (2.7)	–9.01	< 0.001
Duration since first episode (years)		13.1 (8.0)		
<b>MSCEIT-TC scores<sup>b</sup></b>				
Total score	65.6 (7.7)	59.2 (11.9)	–4.51	< 0.001
Area 1: Experiential	40.1 (6.0)	38.8 (8.3)	–3.42	0.001
Branch 1: perceiving emotions	26.3 (4.9)	24 (6.2)	–3.05	0.002
A: Faces	11.7 (1.9)	11.2 (2.7)	–1.22	ns
E: Pictures	14.5 (3.8)	12.8 (4.8)	–2.93	0.003
Branch 2: facilitating thought	13.8 (2.0)	12.8 (3.2)	–2.23	0.026
B: Facilitation	6.5 (1.2)	6.2 (1.7)	–1.04	ns
F: Sensations	7.3 (1.1)	6.6 (1.8)	–3.31	0.001
Area 2: Strategic	25.5 (3.0)	22.5 (4.8)	–5.43	< 0.001
Branch 3: understanding emotions	15.3 (1.9)	13.3 (3.3)	–5.16	< 0.001
C: Changes	9.9 (1.3)	8.7 (2.2)	–4.64	< 0.001
G: Blends	5.3 (1.0)	4.6 (1.4)	–4.67	< 0.001
Branch 4: managing emotions	10.2 (1.5)	9.2 (2.0)	–4.23	< 0.001
D: Emotion management	7.0 (1.1)	6.3 (1.5)	–3.68	< 0.001
H: Emotional relationships	3.2 (0.6)	2.9 (0.7)	–4.11	< 0.001
<b>PANSS</b>				
PANSS-positive		17.1 (5.4)		
PANSS-negative		18.1 (5.6)		
PANSS-general		33.9 (7.0)		
PANSS-total		68.7 (15.4)		
<b>PSYRATS-Hallucination subscale</b>				
		17.4 (13.3)		

MSCEIT: Mayer-Salovey-Caruso Emotional Intelligence Test

PANSS: Positive and Negative Syndrome Scale

PSYRATS: Psychotic Symptoms Rating Scales

<sup>a</sup> Mann-Whitney *U* test (two-tailed)

<sup>b</sup> Raw scores of MSCEIT-TC in each task, branch, area, and total score

individuals with schizophrenia are compared in Table 1. Individuals with schizophrenia were assessed while in a stable phase with a mean total PANSS score of 68.7.

For the control participants, there was no significant difference in the MSCEIT-TC scores in relation to gender. For the individuals with schizophrenia, females had higher scores in task Facilitation of the MSCEIT-TC (6.57 vs. 5.69,  $p=0.025$ ) and had lower scores in the PANSS-negative (16.59 vs. 19.89,  $p=0.009$ ). Age had a significant negative correlation with seven of the tasks (except the task Facilitation), four branches, two areas and the total score; this was true for both the control individuals ( $r=-0.08$ – $-0.29$ ,  $p=0.044$ – $<0.001$ ) and the individuals with schizophrenia ( $r=-0.23$ – $-0.49$ ,  $p=0.043$ – $<0.001$ ). Years of education had a strong positive correlation ( $p<0.001$ ) among the control individuals (in all tasks; branches; areas and the total score); and the individuals with schizophrenia (in all scores but the task Pictures) ( $r=0.27$ – $0.54$ ,  $p=0.017$ – $<0.001$ ). In addition, age and education showed significant intercorrelation ( $r=-0.45$ ,  $p<0.001$ ). Finally, those schizophrenic participants with a longer illness duration demonstrated significantly poorer EI scores (except for the tasks Faces, Facilitation and Changes) ( $r=-0.23$ – $-0.36$ ,  $p=0.044$ – $0.001$ ).

When the two study groups were compared, there was no significant difference in the demographic data except for education. Our schizophrenic participants had their first episode of psychosis at approximately twenty years of age on average. Although not a random sample from the population, this early onset of schizophrenic symptoms in late adolescence or young adulthood might very possibly have interfered with the cognition and academic learning of this group; this is a likely explanation for the difference between groups with respect to education. EI

performance in almost all dimensions was significantly higher in the control individuals than in the schizophrenia participants, except for the tasks Faces and Facilitation. The greatest difference was in the area Strategic ( $Z=-5.43$ ,  $p<0.001$ ) and the branch Understanding ( $Z=-5.16$ ,  $p<0.001$ ).

### 3.2. Test of reliability

Table 2 shows the reliability together with a comparison between our results and Mayer's original alpha coefficient for the full test, two areas, four branches and eight subset tasks. The total test and the area Experiential displayed excellent internal consistency. The alpha value for area Strategic was 0.79 which is quite acceptable. Among the four branches, the branch Perceiving had the best reliability, whereas the alpha values for the other branches varied from 0.76 to 0.68. Among the individual task, Changes, Blends, and Emotion Relationship displayed suboptimal levels of internal consistency. The tasks in the branch Understanding and Managing had lower alphas than normally thought to be desirable.

The test-retest reliability for whole scale was 0.85 ( $p<0.001$ ), which shows a high consistency and stability for the MSCEIT-TC. Other retest reliability results were Task Faces: 0.62 ( $p<0.001$ ); Task Facilitation: 0.6 ( $p<0.001$ ); Task Changes: 0.65 ( $p<0.001$ ); Task Emotion Management: 0.52 ( $p<0.001$ ); Task Pictures: 0.85 ( $p<0.001$ ); Task Sensations: 0.63 ( $p<0.001$ ); Task Blends: 0.56 ( $p<0.001$ ); Task Emotion relationships: 0.39 ( $p=0.001$ ); Branch 1 Perceiving: 0.86 ( $p<0.001$ ); Branch 2 Facilitating: 0.72 ( $p<0.001$ ); Branch 3 Understanding: 0.69 ( $p<0.001$ ); Branch 4 Managing Emotion: 0.611 ( $p<0.001$ ); Area Experiential: 0.85 ( $p<0.001$ ); and Area Strategic: 0.71 ( $p<0.001$ ).

**Table 2**  
Reliability analyses for MSCEIT-TC and comparison with MSCEIT.

2 Areas	4 Branches	8 Tasks	Reliability	
			Coefficient alpha	
			N=2112 <sup>a</sup>	N=728 <sup>b</sup>
<b>Total MSCEIT</b>			0.93	0.93
<b>1. Experiential</b>			0.90	0.94
	<b>1. Perceiving</b>		0.91	0.94
		<b>A. Faces</b>	0.80	0.87
		<b>E. Pictures</b>	0.88	0.92
	<b>2. Facilitating</b>		0.79	0.76
		<b>B. Facilitation</b>	0.64	0.67
		<b>F. Sensations</b>	0.65	0.73
<b>2. Strategic</b>			0.88	0.79
	<b>3. Understanding</b>		0.80	0.68
		<b>C. Changes</b>	0.70	0.57
		<b>G. Blends</b>	0.66	0.57
	<b>4. Managing</b>		0.83	0.70
		<b>D. Emotion Management</b>	0.69	0.61
		<b>H. Emotional Relationship</b>	0.67	0.57

<sup>a</sup> Original MSCEIT internal consistency reliability in general (N=2112) (Mayer et al., 2003)

<sup>b</sup> MSCEIT-TC internal consistency reliability in general (N=728) in our study.

### 3.3. Structural equation modeling of the MSCEIT-TC

Table 3 shows the results of the confirmatory factor analysis for the one-factor, two-factor, and four-factor models, and Figs. 1–3 represent the factor loadings for each model, respectively. The actual loading of the tasks ranged from 0.39 to 0.64 for the one-factor model, from 0.45 to 0.76 for the two-factor model, and from 0.49 to 0.75 for the four-factor model. The indices for the two-factor ( $\chi^2=41.02$ , CFI=0.979, NFI=0.963, RMSEA=0.042) and four-factor model ( $\chi^2=38.749$ , CFI=0.977, NFI=0.965, RMSEA=0.049) show that there are good fits to the observed data. The one-factor and two-factor models showed correlation between measurement errors in Task A and Task E, which often occurs because of similar item content or wording.

To examine improvement in model fit,  $\chi^2$  differences and NFIs were calculated for the nested models. The results suggest the two-factor and four-factor models provide significant improvements in model fit when compared to the one-factor model, but no statistical difference was found between the two-factor and four-factor models (Table 3).

### 3.4. Criterion-related validity of the MSCEIT-TC

We compared the MSCEIT-TC and two other Chinese questionnaires, the WLEIS and EQs, for criterion-related validity. The tasks Faces, Pictures, Facilitation, and Sensations; the branches Perceiving and Facilitating; the Experiential area, and the MSCEIT-TC as a whole were positively correlated with self emotional appraisal (SEA) of the WLEIS (see Table 4a). Otherwise, we did not

see any significant association either between the UOE (use of emotion) and Branch 2 (Facilitating); or between the ROE (regulation of emotion) and Branch 4 (Managing emotions), although some overlapping criteria did exist between them.

Furthermore, many aspects of the MSCEIT-TC showed a significant positive correlation with all branches of the EQs. Task Blends had the most significant associations with EQs branch 1 (perception, appraisal and expression of emotion), EQs branch 3 (understanding and analyzing emotion; employing emotional knowledge), and EQs branch 4 (reflective regulation of emotions to promote emotional and intellectual growth). Task Emotion Management, branch 4 Managing Emotion and the area Strategic of the MSCEIT-TC were mostly associated with the EQs branch 2 (emotional facilitation of thinking) (Table 4b).

### 3.5. MSCEIT-TC performance when comparing the norm group and individuals with schizophrenia

Significant differences were found between the norm group and the group consisting of individuals with schizophrenia (Table 1) for all sections (except the tasks Faces and Facilitation), branches, areas and total score. The statistical significance was even greater for the tasks ( $z=-3.68$  to  $-4.67$ ,  $p < 0.001$ ) and branches ( $z=-5.16$  and  $-4.23$ ,  $p < 0.001$ ) of the area Experiential ( $z=-5.43$ ,  $p < 0.001$ ). Such results suggest that the schizophrenic participants show poor performance when tested for emotional intelligence and the variance of the schizophrenia group was 3–13% lower than that for the control individuals.

We also checked the connection between the MSCEIT-TC and

**Table 3**  
MSCEIT-TC Parameter Estimates of the Observed Tasks on the Latent Variables and Goodness-of-Fit Statistics for the One-, Two-, and Four-Factor Models.

	Model tested				
	One-factor	Two-factor	Four-factor		
<b>Branch 1: Perceiving</b>	<i>I</i>	<i>I</i>	<i>I</i>		
Faces	0.42	0.47	0.66		
Pictures	0.40	0.45	0.64		
<b>Branch 2: Facilitating</b>			<i>II</i>		
Facilitation	0.39	0.48	0.49		
Sensations	0.64	0.76	0.75		
<b>Branch 3: Understanding</b>		<i>II</i>	<i>III</i>		
Changes	0.60	0.63	0.65		
Blends	0.57	0.60	0.62		
<b>Branch 4: Managing</b>			<i>IV</i>		
Emotion management	0.52	0.54	0.55		
Emotional relationships	0.63	0.66	0.68		
<b>Goodness-of-fit index</b>					
<b>Model fit</b>	One-Factor	Two-Factor	Four-Factor		
Chi-square ( $\chi^2$ )	113.315	41.020	38.749		
Degree of freedom (df)	20	18	14		
Probability level	< 0.001	0.002	< 0.001		
$\chi^2/df$	5.666	2.279	2.768		
Comparative fit index (CFI)	0.914	0.979	0.977		
Normed fit index (NFI)	0.898	0.963	0.965		
Root mean square error of approximation (RMSEA)	0.080	0.042	0.049		
N	728	728	728		
<b>Comparison of Factor Models for the MSCEIT-TC</b>					
Models	Comparison of Factor Models	$\Delta\chi^2$	$\Delta df$	$\Delta\chi^2/\Delta df$	p
Model 1: one-factor	1 vs. 2	72.295	2	36.148	$P < 0.001$
Model 2: two-factor	1 vs. 3	74.566	6	12.428	$P < 0.001$
Model 3: four-factor	2 vs. 3	2.271	4	0.568	$P = 0.87$

Note: Error terms were correlated between the Faces and Pictures tasks in the one- and two-factor models. In the four-branch model, the two within-area covariances (i.e., between Perceiving and Facilitating, and between Understanding and Managing) were constrained to be equal to one another. Boldfaced, italicized roman numerals indicate the factors specified in each model; beneath each Roman numeral are the estimated factor loadings for each of the tasks associated with that specific factor. All other loadings were fixed at zero. MSCEIT-TC= traditional Chinese version of Mayer-Salovey-Caruso Emotional Intelligence Test. CFI= comparative fit index; NFI= normed fit index; RMSEA= root-mean-square error of approximation.

clinical assessment using the PANSS and PSYRATS-hallucination subscale. There was no statistical significant correlation between the MSCEIT-TC and PSYRATS-hallucination subscale. However PANSS-negative scores were significantly negatively correlated with the MSCEIT-TC. Since age, education and duration of illness (DOI) have been implicated as independent predictors of EI scores, we calculated the relationship between the PANSS scores and the EI performance controlling for age, education and DOI as covariates. Using IBM SPSS stepwise multiple regression analysis, the PANSS scores (including PANSS-positive, PANSS-negative, PANSS-general and PANSS-total) were tested one at a time as the independent variable, while the EI scores (including the four branches and the two areas according to our four-factor and two factor models) were assessed one at a time as the dependent variables. The results showed that a direct relationship existed only between PANSS-negative and branch 2 Facilitation ( $B = -0.126$ ,  $SE = 0.053$ ,  $p = 0.02$ ), branch 3 Understanding ( $B = -0.118$ ,  $SE = 0.057$ ,  $p = 0.043$ ), branch 4 Managing Emotion ( $B = -0.070$ ,  $SE = 0.034$ ,  $p = 0.043$ ), and the area Strategic ( $B = -0.188$ ,  $SE = 0.078$ ,  $p = 0.018$ ). Although the data were cross-sectional, the statistical results did suggest that there was a relationship between EI performance and the negative symptoms of schizophrenia. Next we put these four MSCEIT-TC scores (branch 2, 3, 4 and area Strategic) and the seven items of the PANSS-negative into a correlation

analysis. N5 (difficulty in abstract thinking) in the negative scale was negatively correlated with the MSCEIT-TC in area Strategic after Bonferroni correction (Table 5). Such findings seem to suggest that those schizophrenics with more interruption and impairment in their cognitive functioning related to abstract reasoning have a poorer performance in terms of EI, particularly in the area Strategic.

#### 4. Discussion

The MSCEIT, a performance-based measure of emotional intelligence, has been recommended by MATRICS as a key measure of social cognition when assessing schizophrenia (Mayer et al., 2003; Green and Nuechterlein, 2004; Kern et al., 2004; Marder and Fenton, 2004; Harvey, 2006). Our intention has been to pave the way for schizophrenia research on emotional intelligence in Chinese speaking populations by validating the MSCEIT-TC for Chinese populations that use Traditional Chinese characters. In this study, the psychometric properties, reliability and factor structure of the MSCEIT-TC were investigated. A norm for the MSCEIT-TC was developed using the consensus method of scoring and involving 728 control participants. Using this norm, it is possible to calculate norm-referenced scores that can be applied in

further investigations; furthermore, this approach allowed a comparison with our study group of 76 schizophrenic participants.

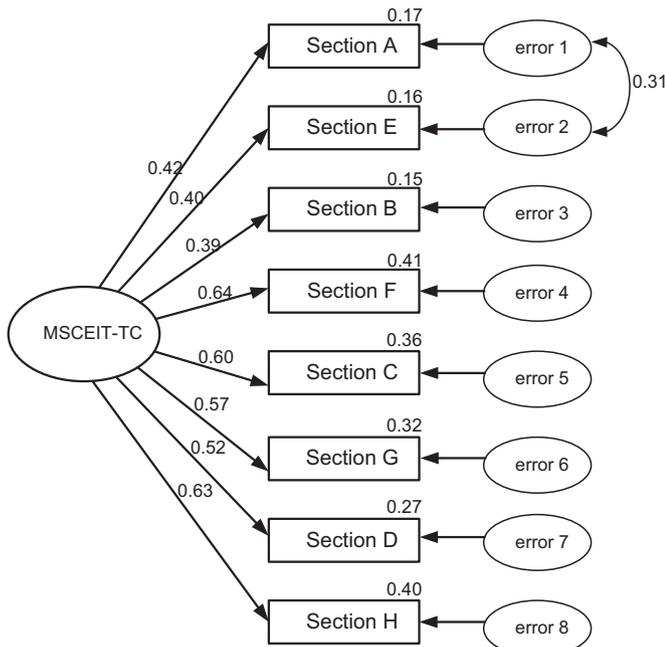
The results from this study provide important information regarding the strengths and limitations of the MSCEIT-TC. First of all, we found the MSCEIT-TC shared variance not only with age and education among the control individuals but also with illness duration among our schizophrenia group. Previous studies have suggested that males have a lower EI (Roberts et al., 2001; Brackett and Salovey, 2006; Extremera et al., 2006; Eack et al., 2010), but

there was no such finding for our control individuals. The high correlations of the MSCEIT-TC scores with age and education remind us that these may act as confounders in the statistical analysis.

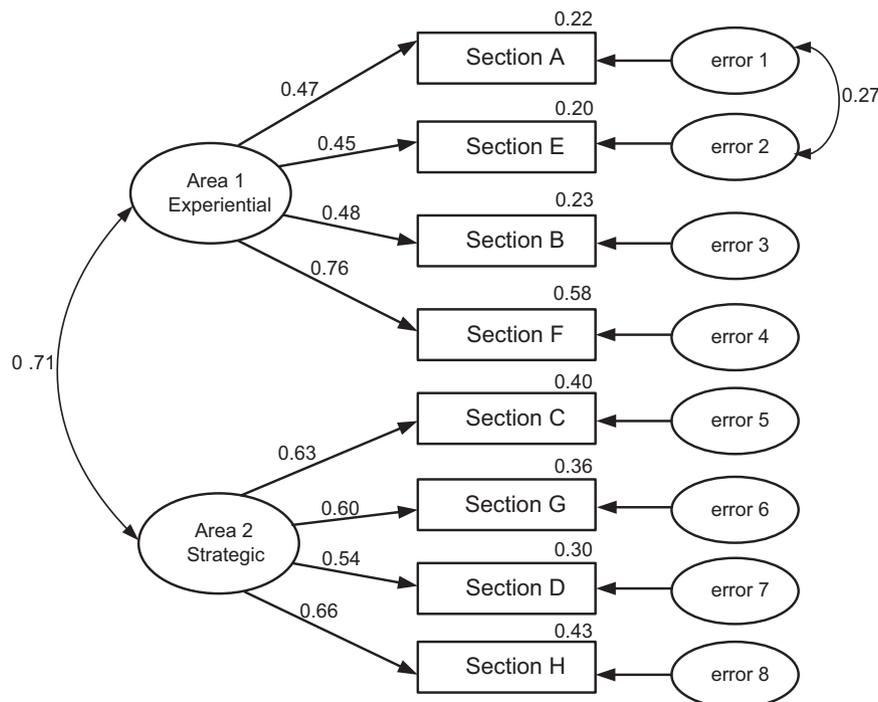
In terms of reliability testing, the MSCEIT-TC possesses high levels of internal consistency in relation to its total and area scores, moderate levels in relation to its branch scores, but suboptimal levels in relation to three of the eight tasks. Our reliability test results were similar to the results of the Lopes' report who targeted 103 German college students (Lopes et al., 2004), but better than those of the Roberts' study in Australia (Roberts et al., 2006). In addition, the results of the confirmatory factor analysis regarding the possible three models showed that the two-factor and four-factor models provide a significant improvement in terms of model fit compared to the one-factor model. Taken together, our results support the four-factor (four branches) and two-factor (two areas) solutions for the MSCEIT-TC.

The test of criterion-related validity helps to check if the MSCEIT-TC functions in a predictable manner in relation to other operationalized measures based upon the theory of the construct. The correlations between the overall scores obtained from the WLEIS and the MSCEIT-TC were lower than desirable, suggesting that there is substantial divergence between these two measures, despite similar choices in terms of the definition of EI. The lack of other available EI measures in Chinese version limits our further testing of the criterion-related validity. However, a previous study also found that the WLEIS and the MSCEIT do not correlate highly with one another (Brannick et al., 2009).

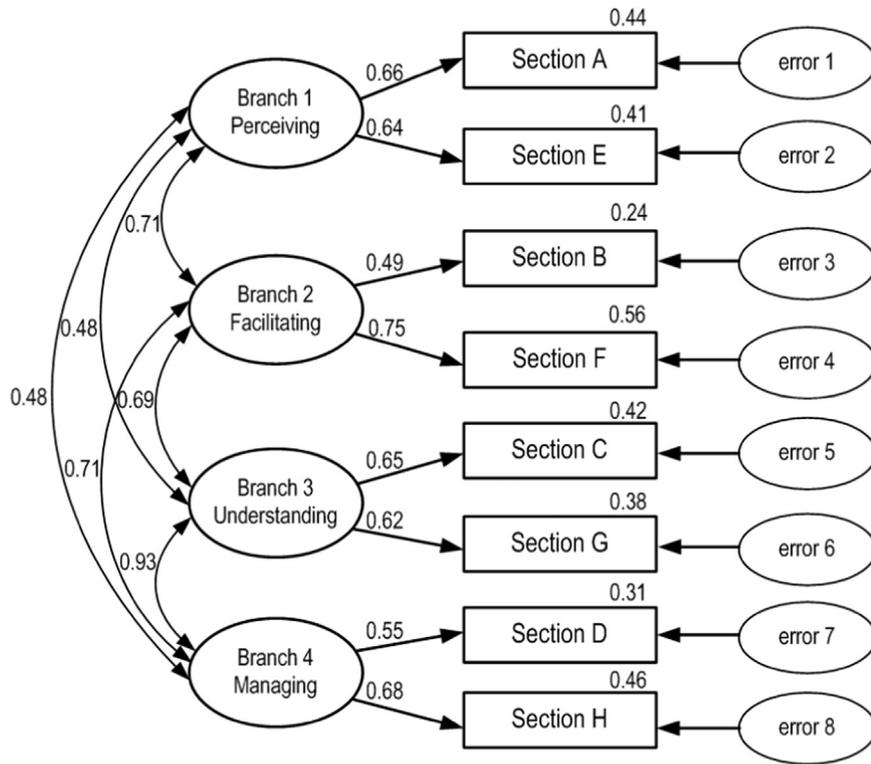
A comparison of our norm with the group of 76 individuals with schizophrenia showed good discrimination validity of the MSCEIT-TC. Significant differences were found for most of the tasks, for the four branches, for the two areas and for the total score. Impairment was greatest for the area Strategic (including the branches Understanding and Managing Emotions), which involves the cognitive abilities to recognize the meanings of emotion and the complex relationships between emotions; reasoning, and problem solving on the basis of this information for personal and interpersonal growth (Mayer et al., 2001). Such cognitive



**Fig. 1.** One-factor confirmatory factor analysis model of the Mayer-Salovey-Caruso Emotional Intelligence Test – traditional Chinese version (MSCEIT-TC). (Section A: Faces; Section B: Facilitation; Section C: Changes; Section D: Emotion Management; Section E: Pictures; Section F: Sensations; Section G: Blends; Section H: Emotion Relationships).



**Fig. 2.** Two-factor confirmatory factor analysis model of the Mayer-Salovey-Caruso Emotional Intelligence Test – Traditional Chinese version (MSCEIT-TC). (Section A: Faces; Section B: Facilitation; Section C: Changes; Section D: Emotion Management; Section E: Pictures; Section F: Sensations; Section G: Blends; Section H: Emotion Relationships).



**Fig. 3.** Four-factor confirmatory factor analysis model of the Mayer-Salovey-Caruso Emotional Intelligence Test – Traditional Chinese version (MSCEIT-TC). (Section A: Faces; Section B: Facilitation; Section C: Changes; Section D: Emotion Management; Section E: Pictures; Section F: Sensations; Section G: Blends; Section H: Emotion Relationships).

**Table 4a**  
Intercorrelations for MSCEIT-TC and WLEIS scoring.

MSCEIT-TC		Task A	Task B	Task E	Task F	B1	B2	EXP	TOT
WLEIS									
SEA		0.273**	0.260**	0.264**	0.256*	0.325**	0.299**	0.365**	0.358**

MSCEIT-TC: the traditional Chinese version of Mayer-Salovey-Caruso Emotional Intelligence Test, Task A: Faces; Task B: Facilitation; Task E: Pictures; Task F: Sensations; B1: Perceiving emotions; B2: Facilitating thought; EXP: Experiential area; TOT: Total MSCEIT-TC score;  
WLEIS: the Wong and Law Emotional Intelligence Scale, SEA: Self Emotional Appraisal;

\*  $p < 0.05$   
\*\*  $p < 0.01$ , (in two-tailed correlations)

impairment may impede mentalization ability, which implies that the deficits associated with schizophrenia are associated with ToM tasks as seen in previous studies (Bora et al., 2009; Dawson et al., 2012).

Previous study results have been inconsistent regarding the relationship between the negative symptoms of schizophrenia and EI performance. Some studies have shown that either negative symptoms (using the Scale for the Assessment of Negative Symptoms) are mediated via an effect on general EI (total score of MSCEIT) in relation to independent living/self-care (Kee et al., 2009); or show a negative correlation between PANSS-negative and the Managing Emotion branch of the MSCEIT (O'Reilly et al., 2015). On the other hand, most other studies have not shown a relationship or only showed a low correlation (Eack et al., 2010; Lin et al., 2012; Bell et al., 2013; Gohar et al., 2013). Our results in regression analysis suggested a significant and direct relationship between impaired performance on the MSCEIT-TC (in branch 2, 3, 4 and area Strategic) and deficits in the negative scale of

**Table 4b**  
Intercorrelations for MSCEIT-TC and EQs.

MSCEIT-TC		Task D	Task F	Task G	B2	B4	STR
EQs							
Branch 1		-0.111	0.114	0.305**	0.125	-0.031	0.087
Branch 2		0.307**	0.238*	0.115	0.235*	0.284**	0.283**
Branch 3		0.127	0.152	0.293**	0.127	0.151	0.220*
Branch 4		0.007	0.110	0.248*	0.088	0.049	0.135

MSCEIT-TC: the traditional Chinese version of Mayer-Salovey-Caruso Emotional Intelligence Test, Task D: Emotion management; Task F: Sensations; Task G: Blends; B2: Facilitating thought; B4: managing emotions; STR: Strategic area;  
EQs: Emotional Intelligence Scale; Branch 1: Perception, appraisal and expression of emotion; Branch 2: Emotional facilitation of thinking; Branch 3: Understanding and analyzing emotion; Employing emotional knowledge; Branch 4: Reflective regulation of emotions to promote emotional and intellectual growth.

\*  $p < 0.05$   
\*\*  $p < 0.01$ , (in two-tailed correlations)

schizophrenia. Correlation analysis of these four EI scores and seven items of PANSS-negative suggested that the N5 (difficulty in abstract thinking) is negatively correlated with the score in area Strategic. Deficits in abstract thinking resulting in social behavior dysfunction in patients with schizophrenia were noted as early as the 1950s (Flavell, 1956). Our results suggest that specific negative symptoms, namely conceptualizing or generalizing difficulties may connect with impaired EI performance.

There are a few limitations that should be addressed. Due to the inevitable difficulties in recruiting middle and particularly aged participants (many of them had no access to the advertisements as posted on the electronic bulletin), we had adopted in this study the opportunistic snowball sampling procedure to enroll friends and families of the young participants for the wide coverage of age distributions so that the established control norm

**Table 5**  
Intercorrelations for MSCEIT-TC and PANSS.

Negative profile of the PANSS	MSCEIT-TC			
	B2	B3	B4	STR
N1: Blunted affect	−0.106	−0.153	−0.109	−0.151
N2: Emotional withdrawal	−0.306	−0.213	−0.198	−0.229
N3: Poor rapport	−0.107	−0.013	0.034	0.005
N4: Passive/apathetic social withdrawal	−0.244	−0.241	−0.206	−0.252
N5: Difficulty in abstract thinking	−0.315	−0.350 <sup>a</sup>	−0.341	−0.382 <sup>*</sup>
N6: Lack of spontaneity and flow of conversation	−0.270	−0.296	−0.280	−0.320
N7: Stereotyped thinking	−0.193	−0.139	−0.223	−0.187

MSCEIT-TC: traditional Chinese version of Mayer-Salovey-Caruso Emotional Intelligence Test; B2: Branch 2 (Facilitating thought); B3: Branch 3 (Understanding emotions); B4: Branch 4 (Managing emotions); STR: Strategic area; PANSS: Positive and Negative Syndrome Scale;

<sup>\*</sup>  $p < 0.001785$ , Bonferroni correction (0.05/28 individual correlations)

<sup>a</sup>  $p = 0.00193$

could be more representative for the population. Thus, some bias from random sampling could not be discerned. There are lower alpha coefficient values for the MSCEIT-TC in the area Strategic than in the area Experiential. In the branch Understanding, the participant must answer multiple-choice questions related to how emotions change over time and vocabulary definitions of emotion. Cultural differences could very possibly affect the participants' answers regarding prior events, the way they are experienced, the reactions they provoke and the way they are perceived by surrounding society. The tasks Changes and Blends that compose the branch Understanding; this branch measures the ability to comprehend emotional information regarding relationships, transitions from one emotion to another, and linguistic information regarding emotions. These measures are supposed to be related to abstract processing and reasoning about emotions and emotional information (Mayer et al., 2001). In other words, there seems generally to be a clear logical basis for justifying the correctness of an answer in some of the "what-if" scenarios when making an analysis regarding people (the task Changes), when making effective decisions (the tasks Emotion Management and Emotional Relationship) and when identifying the emotions that are involved in a more complex affective state (the task Blends). However, taking one example, in section F, namely question 2: this gives three options of "warm", "purple" and "salty" as the possible answer to the question "Imagine feeling content on a wonderful day, with terrific news about your job and family, how much is this feeling of contentment like?" In such a case, Chinese respondents are very likely to have difficulty in connecting the perception of color and the sensation of taste to a specific emotion in the same manner as English speakers do. In the MSCEIT-TC, we had to translate such individual items semantically rather than explore their literal meanings. However, despite the effort we made to retain the psychometric properties, we could have ended up using a different approach to such tasks that might have changed to some degree the validity of item-level analyses. Cultural differences thus could account for the lower Cronbach's alpha values for the tasks of Changes, Blends and Emotion Management.

Our findings initially suggested an existing link between the PANSS negative profile and EI performance. However, further correlation analysis for each item of the negative profile and the EI scores did not provide strong statistic power specifying which negative symptom interfered most with the EI performance. Verbal abstract reasoning was assessed utilizing proverb and similarity tasks when evaluating the PANSS, which is not a comprehensive test in terms of "abstract thinking" and may also have limited the generalizability of our findings. Nevertheless, it needs to be noted that "difficulty in abstract thinking" did possess a higher association with impaired EI performance than the rest of the PANSS-negative items.

Another limitation is the cross sectional design of our study, which cannot establish the causal pathway of the findings. A more sophisticated study, which would involve a prospective, longitudinal design; or a comparison of effect of treatment on the interactions between negative symptoms of schizophrenia and the EI performance, is required before firm conclusions can be drawn in this area.

Thus we would recommend exercising caution when interpreting and integrating cross-cultural assessments of emotional intelligence. Issues might not arise from the difficulties associated with literal translation of test items, but come from the precision or consistency of the questions being asked across languages and cultures.

The current study very comprehensively examined the reliability and validity of the MSCEIT-TC, as well as its major clinical application in the area of individuals with schizophrenia. The results suggest that the poor performance in terms of EI in schizophrenics is probably due to the impairment related to negative symptoms such as abstract thinking, and is not related to positive symptoms such as hallucination or delusion. Although the MSCEIT-TC is not as convergent in the area Strategic as in the area Experiential, we consider that measurements obtained using the MSCEIT-TC are valid and it should be possible to widely apply this test to Chinese populations in practical situations, especially when carrying out research into schizophrenia.

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## References

- American Psychiatric Association, 2000. Diagnostic and statistical manual of mental disorders (DSM-IV -TR), (4th ed). Authors, Washington, D.C.
- Baas, D., van't Wout, M., Aleman, A., Kahn, R.S., 2008. Social judgement in clinically stable patients with schizophrenia and healthy relatives: behavioural evidence of social brain dysfunction. *Psychol. Med.* 38 (5), 747–754.
- Beaton, D.E., Bombardier, C., Guillemin, F., Ferraz, M.B., 2000. Guidelines for the process of cross-cultural adaptation of self-report measures. *Spine (Phila. Pa 1976)* 25 (24), 3186–3191.
- Bell, M.D., Corbera, S., Johannesen, J.K., Fiszdon, J.M., Wexler, B.E., 2013. Social cognitive impairments and negative symptoms in schizophrenia: are there subtypes with distinct functional correlates? *Schizophr. Bull.* 39 (1), 186–196.

- Bora, E., Yucel, M., Pantelis, C., 2009. Theory of mind impairment in schizophrenia: meta-analysis. *Schizophr. Res.* 109 (1–3), 1–9.
- Brackett, M.A., Salovey, P., 2006. Measuring emotional intelligence with the Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT). *Psicothema* 18, 34–41.
- Brannick, M.T., Wahi, M.M., Arce, M., Johnson, H.A., Nazian, S., Goldin, S.B., 2009. Comparison of trait and ability measures of emotional intelligence in medical students. *Med. Educ.* 43 (11), 1062–1068.
- Brunet-Gouet, E., Decety, J., 2006. Social brain dysfunctions in schizophrenia: a review of neuroimaging studies. *Psychiatry Res.* 148 (2–3), 75–92.
- Burns, J., 2006. The social brain hypothesis of schizophrenia. *World Psychiatry* 5 (2), 77–81.
- Burns, J.K., 2004. An evolutionary theory of schizophrenia: cortical connectivity, metarepresentation, and the social brain. *Behav. Brain Sci.* 27 (6), 855–885; 831–855; discussion.
- Caruso, D.R., Mayer, J.D., Salovey, P., 2002. Relation of an ability measure of emotional intelligence to personality. *J. Personal. Assess.* 79 (2), 306–320.
- C.Y., Chen, 2000. The development of emotional intelligence scale: reliability and validity estimation and norm development (E87115), Survey Research Data Archive. Acad. Sin., Taipei, Taiwan.
- Curci, A., Lanciano, T., Soletti, E., Zammuner, V.L., Salovey, P., 2013. Construct validity of the Italian version of the Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT) v2.0. *J. Personal. Assess.* 95 (5), 486–494.
- Dawson, S., Kettler, L., Burton, C., Galletly, C., 2012. Do people with schizophrenia lack emotional intelligence? *Schizophr. Res. Treat.* 2012, 495174.
- Eack, S.M., Greeno, C.G., Pogue-Geile, M.F., Newhill, C.E., Hogarty, G.E., Keshavan, M.S., 2010. Assessing social-cognitive deficits in schizophrenia with the Mayer-Salovey-Caruso Emotional Intelligence Test. *Schizophr. Bull.* 36 (2), 370–380.
- Eack, S.M., Hogarty, G.E., Greenwald, D.P., Hogarty, S.S., Keshavan, M.S., 2007. Cognitive enhancement therapy improves emotional intelligence in early course schizophrenia: preliminary effects. *Schizophr. Res.* 89 (1–3), 308–311.
- Eack, S.M., Pogue-Geile, M.F., Greeno, C.G., Keshavan, M.S., 2009. Evidence of factorial variance of the Mayer-Salovey-Caruso Emotional Intelligence Test across schizophrenia and normative samples. *Schizophr. Res.* 114 (1–3), 105–109.
- Eack, S.M., Pogue-Geile, M.F., Greenwald, D.P., Hogarty, S.S., Keshavan, M.S., 2011. Mechanisms of functional improvement in a 2-year trial of cognitive enhancement therapy for early schizophrenia. *Psychol. Med.* 41 (6), 1253–1261.
- Extremera, N., Fernandez-Berrocá, P., Salovey, P., 2006. Spanish version of the Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT). Version 2.0: reliabilities, age and gender differences. *Psicothema* 18, 42–48.
- Fiori, M., Antonietti, J.P., Mikolajczak, M., Luminet, O., Hansenne, M., Rossier, J., 2014. What is the Ability Emotional Intelligence Test (MSCEIT) good for? An evaluation using item response theory. *PLoS One* 9 (6), e98827.
- Flavell, J.H., 1956. Abstract thinking and social behavior in schizophrenia. *J. Abnorm. Psychol.* 52 (2), 208–211.
- Fukuda, E., Saklofske, D.H., Tamaoka, K., Lim, H., 2012. Factor structure of the Korean version of Wong and Law's Emotional Intelligence Scale. *Assessment* 19 (1), 3–7.
- Fukunishi, I., Wise, T.N., Sheridan, M., Shimai, S., Otake, K., Utsuki, N., Uchiyama, K., 2001. Validity and reliability of the Japanese version of the Emotional Intelligence Scale among college students and psychiatric outpatients. *Psychol. Rep.* 89 (3), 625–632.
- Gohar, S.M., Hamdi, E., El Ray, L.A., Horan, W.P., Green, M.F., 2013. Adapting and evaluating a social cognitive remediation program for schizophrenia in Arabic. *Schizophr. Res.* 148 (1–3), 12–17.
- Gray, B.E., McMahon, R.P., Green, M.F., Seidman, L.J., Mesholam-Gately, R.I., Kern, R.S., Nuechterlein, K.H., Keefe, R.S., Gold, J.M., 2014. Detecting reliable cognitive change in individual patients with the MATRICS consensus cognitive battery. *Schizophr. Res.* 159 (1), 182–187.
- Green, M.F., Bearden, C.E., Cannon, T.D., Fiske, A.P., Helleman, G.S., Horan, W.P., Kee, K., Kern, R.S., Lee, J., Sergi, M.J., Subotnik, K.L., Sugar, C.A., Ventura, J., Yee, C.M., Nuechterlein, K.H., 2012. Social cognition in schizophrenia, Part 1: performance across phase of illness. *Schizophr. Bull.* 38 (4), 854–864.
- Green, M.F., Nuechterlein, K.H., 2004. The MATRICS initiative: developing a consensus cognitive battery for clinical trials. *Schizophr. Res.* 72 (1), 1–3.
- Green, M.F., Olivier, B., Crawley, J.N., Penn, D.L., Silverstein, S., 2005. Social cognition in schizophrenia: recommendations from the measurement and treatment research to improve cognition in schizophrenia new approaches conference. *Schizophr. Bull.* 31 (4), 882–887.
- Haddock, G., McCarron, J., Tarrier, N., Faragher, E.B., 1999. Scales to measure dimensions of hallucinations and delusions: the psychotic symptom rating scales (PSYRATS). *Psychol. Med.* 29 (4), 879–889.
- Harvey, P.D., 2006. Current status of the MATRICS/TURNS initiative. *Psychiatry (Edgmont)* 3 (10), 24–33.
- Heckathorn, D.D., 2011. Snowball versus respondent-driven sampling. *Socio Method.* 41 (1), 355–366.
- Horan, W.P., Green, M.F., DeGroot, M., Fiske, A., Helleman, G., Kee, K., Kern, R.S., Lee, J., Sergi, M.J., Subotnik, K.L., Sugar, C.A., Ventura, J., Nuechterlein, K.H., 2012. Social cognition in schizophrenia, Part 2: 12-month stability and prediction of functional outcome in first-episode patients. *Schizophr. Bull.* 38 (4), 865–872.
- Kay, S.R., Fiszbein, A., Opler, L.A., 1987. The positive and negative syndrome scale (PANSS) for schizophrenia. *Schizophr. Bull.* 13 (2), 261–276.
- Kee, K.S., Horan, W.P., Salovey, P., Kern, R.S., Sergi, M.J., Fiske, A.P., Lee, J., Subotnik, K.L., Nuechterlein, K., Sugar, C.A., Green, M.F., 2009. Emotional intelligence in schizophrenia. *Schizophr. Res.* 107 (1), 61–68.
- Kern, R.S., Green, M.F., Nuechterlein, K.H., Deng, B.H., 2004. NIMH-MATRICS survey on assessment of neurocognition in schizophrenia. *Schizophr. Res.* 72 (1), 11–19.
- Lee, K.H., Farrow, T.F., Spence, S.A., Woodruff, P.W., 2004. Social cognition, brain networks and schizophrenia. *Psychol. Med.* 34 (3), 391–400.
- Leonhard, C., Corrigan, P.W., 2001. Social perception in schizophrenia. In: Corrigan, P.W., Penn, D.L. (Eds.), *Social Cognition and Schizophrenia*. American Psychological Association, Washington, DC, pp. 73–95.
- Lin, Y.C., Wynn, J.K., Helleman, G., Green, M.F., 2012. Factor structure of emotional intelligence in schizophrenia. *Schizophr. Res.* 139 (1–3), 78–81.
- Lo, C.H., Tsai, G.E., Liao, C.H., Wang, M.Y., Chang, J.P., Tsuang, H.C., Lane, H.Y., 2010. Emotional management and 5-HT2A receptor gene variance in patients with schizophrenia. *Biol. Psychol.* 83 (2), 79–83.
- Lopes, P.N., Brackett, M.A., Nezlek, J.B., Schutz, A., Sellin, I., Salovey, P., 2004. Emotional intelligence and social interaction. *Pers. Soc. Psychol. Bull.* 30 (8), 1018–1034.
- Lopes, P.N., Salovey, P., Straus, R., 2003. Emotional intelligence, personality, and the perceived quality of social relationships. *Pers. Individ. Dif.* 35 (3), 641–658.
- Maccann, C., Joseph, D.L., Newman, D.A., Roberts, R.D., 2014. Emotional intelligence is a second-stratum factor of intelligence: evidence from hierarchical and bifactor models. *Emotion* 14 (2), 358–374.
- Marder, S.R., Fenton, W., 2004. Measurement and Treatment Research to Improve Cognition in Schizophrenia: NIMH MATRICS initiative to support the development of agents for improving cognition in schizophrenia. *Schizophr. Res.* 72 (1), 5–9.
- Mayer, J.D., DiPaolo, M., Salovey, P., 1990. Perceiving affective content in ambiguous visual stimuli: a component of emotional intelligence. *J. Personal. Assess.* 54 (3–4), 772–781.
- Mayer, J.D., Roberts, R.D., Barsade, S.G., 2008. Human abilities: emotional intelligence. *Annu. Rev. Psychol.* 59, 507–536.
- Mayer, J.D., Salovey, P., Caruso, D.R., 2002. *Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT) User's Manual*. MHS Publishers, Toronto.
- Mayer, J.D., Salovey, P., Caruso, D.R., Sitarenios, G., 2001. Emotional intelligence as a standard intelligence. *Emotion* 1 (3), 232–242.
- Mayer, J.D., Salovey, P., Caruso, D.R., Sitarenios, G., 2003. Measuring emotional intelligence with the MSCEIT V2.0. *Emotion* 3 (1), 97–105.
- O'Reilly, K., Donohoe, G., Coyle, C., O'Sullivan, D., Rowe, A., Losty, M., McDonagh, T., McGuinness, L., Ennis, Y., Watts, E., Brennan, L., Owens, E., Davoren, M., Mullaney, R., Abidin, Z., Kennedy, H.G., 2015. Prospective cohort study of the relationship between neuro-cognition, social cognition and violence in forensic patients with schizophrenia and schizoaffective disorder. *BMC Psychiatry* 15, 155.
- Roberts, R.D., Schulze, R., O'Brien, K., MacCann, C., Reid, J., Maul, A., 2006. Exploring the validity of the Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT) with established emotions measures. *Emotion* 6 (4), 663–669.
- Roberts, R.D., Zeidner, M., Matthews, G., 2001. Does emotional intelligence meet traditional standards for an intelligence? Some new data and conclusions. *Emotion* 1 (3), 196–231.
- Wong, C.S., Law, K.S., 2002. The effects of leader and follower emotional intelligence on performance and attitude: an exploratory study. *Leadersh. Q.* 13, 243–274.