



Psychometric properties of three measures assessing advanced theory of mind: Evidence from people with schizophrenia



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ABSTRACT

Patients with schizophrenia tend to have deficits in advanced Theory of Mind (ToM). The “Reading the mind in the eyes” test (RMET), the Faux Pas Task, and the Strange Stories are commonly used for assessing advanced ToM. However, most of the psychometric properties of these 3 measures in patients with schizophrenia are unknown. The aims of this study were to validate the psychometric properties of the 3 advanced ToM measures in patients with schizophrenia, including: (1) test-retest reliability; (2) random measurement error; (3) practice effect; (4) concurrent validity; and (5) ecological validity. We recruited 53 patients with schizophrenia, who completed the 3 measures twice, 4 weeks apart. The Revised Social Functioning Scale-Taiwan short version (R-SFST) was completed within 3 days of first session of assessments. We found that the intraclass correlation coefficients of the RMET, Strange Stories, and Faux Pas Task were 0.24, 0.5, and 0.76. All 3 advanced ToM measures had large random measurement error, trivial to small practice effects, poor concurrent validity, and low ecological validity. We recommend that the scores of the 3 advanced ToM measures be interpreted with caution because these measures may not provide reliable and valid results on patients’ advanced ToM abilities.

1. Introduction

Theory of mind (ToM) is an individual's ability to infer others' mental status (e.g., intention, desire, and beliefs) and interpret their behaviors (Olderbak et al., 2015). One assessment of ToM is the Sally-and-Anne test, which requires an examinee to judge where Sally will search for her marble given the situation that the examinee saw that the marble had been moved by Anne but Sally did not see that (Baron-Cohen et al., 1997). Advanced ToM refers to an individual's ability to understand more complex mental statuses (e.g., feelings) and social situations, such as faux pas (i.e., social blunder) and nonliteral expressions (e.g., lies and sarcasm) (Mathersul et al., 2013). Assessments of advanced ToM usually require examinees to infer others' feelings from their facial expressions (e.g., eye zone) or to recognize complex social situations (e.g., faux pas and lies) in stories.

Patients with schizophrenia tend to have deficits particularly in advanced ToM (Brune, 2005). The deficit in advanced ToM may limit patients' social function (e.g., working performance) and living independence (Brune, 2005; Pinkham and Penn, 2006; Roncone et al.,

2002). The advanced ToM deficits appear to be less responsive to pharmacological treatment (Sergi et al., 2007). However, some social cognitive training (e.g., training on understanding of social situations or identifying facial expressions) seems to have benefits on patients' advanced ToM (Kurtz and Richardson, 2012). To manage patients' advanced ToM, using reliable and valid measures is required.

Three advanced ToM measures are commonly used for patients with schizophrenia. They are the “Reading the mind in the eyes” test (RMET), the Faux Pas Task, and the Strange Stories (Baron-Cohen et al., 1999b; Happe, 1994; Pinkham et al., 2016). The RMET contains 36 multiple-choice questions that require participants to select the most accurate descriptor (one word about feelings or thoughts) for expressions of the eye zones presented in the photographs (Pinkham et al., 2016). The Faux Pas Task and the Strange Stories ask open-ended questions to examine participants' understanding of complex situations (e.g., lies and sarcasm) in each story.

However, the psychometric properties of the 3 advanced ToM measures are rarely examined in patients with schizophrenia. To the best of our knowledge, only one study has validated the test-retest

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reliability (Pearson's $r = 0.75$), internal consistency (Cronbach's $\alpha = 0.74$), ecological validity (Pearson's r from 0.13 to 0.43), and practice effect (Cohen's $d = 0.11$) of the RMET in patients with schizophrenia (Pinkham et al., 2016). Neither the Faux Pas Task nor the Strange Stories had been validated in patients with schizophrenia. Thus, whether the three measures can render reliable and valid results remains largely unknown. Furthermore, no study has simultaneously examined the psychometric properties of these 3 advanced ToM measures in individuals with schizophrenia. Without evidence of simultaneous examinations, it is difficult to compare the psychometric properties of these 3 advanced ToM measures because psychometric properties are generally sample dependent (Gliner et al., 2001). Accordingly, evidence with simultaneous examinations can be helpful to compare the psychometric properties of these measures (Calamia et al., 2013; Duffy et al., 2013; Reilly et al., 2015).

Minimal detectable change (MDC) is the smallest real difference score between consecutive assessments that is not due to random variations in assessments (Haley and Fragala-Pinkham, 2006). Difference scores between repeated assessments that are smaller than the MDC can be attributed to random measurement error at a certain confidence level (usually 95%) (Schreuders et al., 2003). To summarize, a useful measure should have a low MDC. The practice effect, which occurs when an individual repeatedly performs the same or a similar test, usually results in improvement of the individual's performance (McCaffrey et al., 2000). McCaffrey et al. (2000) have suggested that, in order to accurately evaluate changes in patients' performance in clinical settings, it is important to reduce the practice effect. Knowledge of the practice effect is essential and should be established for specific measures with particular patient populations.

The purposes of this study were to examine the test-retest reliability, random measurement error, practice effect, concurrent validity, and ecological validity of three advanced ToM measures (i.e., the RMET, the Faux Pas Task, and the Strange Stories) in patients with schizophrenia.

2. Methods

2.1. Participants

Participants were all inpatients and recruited from a psychiatric hospital in southern Taiwan. Convenience sampling was used. We included individuals who were at least 20 years old, had a diagnosis of schizophrenia according to the Diagnostic and Statistical Manual of Mental Disorders, 5th ed. (DSM-5), and were able to understand at least a one-step verbal instruction and follow it correctly. Each of the patients had his/her own prescribed medication, and their medications and dosages remained the same throughout the 4 weeks. We excluded patients who scored less than 27 points on the Chinese version of the Mini-Mental State Examination (C-MMSE), who had severe psychiatric symptoms (i.e., those who exceeded 5 points on the Clinical Global Impression – Severity scale, CGI-S), who had fluctuations in symptom severity during the study (i.e., any variation in CGI-S scores between the 2 visits), and who had substance abuse or other neurological deficits, such as dementia and mental retardation (Nasrallah et al., 2008). This study was approved by the Kaohsiung Municipal Kai-Syuan Psychiatric Hospital Ethics Committee.

2.2. Procedure

Before the collection of formal data, 3 licensed and experienced occupational therapists (raters A, B, and C) who worked in the hospital attended a 4-h training session on using the RMET, the Faux Pas Task, and the Strange Stories. The training session contained at least 5 independent practices and 4 joint practices. Patients who met our inclusion criteria were recruited as targets. Their data were not included in our formal analysis. In the joint practices, each rater took turns administering the 3 measures 4 times (one rater administered all the

measures and the other raters scored). In addition, raters had made sure that the patients understood the content of these measures. At the fourth practice, the test scores in the last practice of the 3 measures were the same among the 3 raters.

Each participant was assessed twice, 4 weeks apart: baseline assessment and re-assessment. In the baseline assessment, the CGI-S was administered to assess the patients' symptom severity, and the C-MMSE was given as a pre-screening test by one of the raters (A, B, or C). The raters had used the CGI-S and C-MMSE as their routine tests on patients with schizophrenia for years in psychiatric settings. Then the participants were sequentially assessed with the RMET, the Faux Pas Task, and the Strange Stories with a fixed assessment order at both sessions. From the shortest to the longest completion time, the 3 measures were assessed sequentially according to the assessment time (our patients seemed to complete the RMET in the shortest amount of time, followed by the Faux Pas Task and the Strange Stories). The standardized instructions of the 3 advanced ToM measures were provided to the participants on PowerPoint slides (projected on a liquid-crystal display screen) to ensure that each participant receives consistent instructions. These 3 advanced ToM measures were administered within one day because we hoped to minimize variations in our participants, such as mood swings or changes in motivation, which would interfere with the psychometric properties. The Revised Social Functioning Scale-Taiwan short version (R-SFST) was administered within 3 days following the baseline assessment. In the re-assessment, the CGI-S was re-administered to determine whether the symptom severity of the participants had fluctuated. If a participant's CGI-S score was the same as that of the baseline assessment, the 3 measures were administered.

2.3. Measures

2.3.1. Clinical Global Impression – Severity scale (CGI-S)

The CGI-S is commonly used for assessing symptom severity in patients with mental disorders (Busner and Targum, 2007). The CGI-S is a 7-point scale that requires the clinician to rate the severity of the patient's mental illness at the time of assessment (1 = normal, not at all ill; 2 = borderline mentally ill; 3 = mildly ill; 4 = moderately ill; 5 = markedly ill; 6 = severely ill; or 7 = extremely ill). The content validity of the CGI-S is good (Allen et al., 2012). The intra-class correlation coefficient (ICC) of inter-rater agreement is 0.75 (Haro et al., 2003).

2.3.2. Chinese version of the Mini-Mental State Examination (C-MMSE)

The MMSE is a widely used screening measure for cognitive functions (Folstein et al., 1975). The MMSE consists of 6 dimensions: orientation, attention, memory, language, verbal comprehension, praxis, and construction. It contains 11 questions and has a total score of 30. The Chinese MMSE (C-MMSE) used in this study has all the items and components of the original MMSE, but the total score is increased from 30 to 33 by adding one item on writing one's own name and two items on simple calculation ($2 + 4$ and $7 - 3$) (Guo et al., 1988). The three additional items were useful for discriminating those with high and low education when assessing cognitive impairment (Guo et al., 1988). A cut-point score of 27 (equivalent to 24 points in the original MMSE) is recommended for determining cognitive impairment in literate persons (Guo et al., 1988). The C-MMSE has discriminative validity in normal adults with different levels of education (Guo et al., 1988).

2.3.3. Reading the mind in the eyes task (RMET)

The RMET contains 36 black and white photographs of the eye region (Baron-Cohen et al., 1997). Participants view the photos and are asked to choose the most accurate descriptor (one word) for the emotion that is portrayed (Pinkham et al., 2016). Four possible choices are provided with each photo. The total number of correct responses ranges from 0 to 36.

The RMET has been validated in English-speaking (Olderbak et al.,

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