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Relationship between insight and theory of mind in schizophrenia: A meta-analysis

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ABSTRACT

Poor insight in schizophrenia has been associated with executive dysfunction and deficits in general cognitive ability. The overall outcome of available neurocognitive studies suggests that there is a significant but modest relationship between cognitive deficits and poor insight in schizophrenia. However, social cognitive abilities, particularly, theory of mind (ToM), might also play a role in poor insight in schizophrenia. A novel meta-analysis of the relationship between ToM and insight in schizophrenia was conducted. Current meta-analysis included 16 studies including 1085 patients with schizophrenia-spectrum disorders. There was a significant association between ToM and clinical insight ($r = 0.28$, $CI = 0.20-0.36$). By contrast, there was no significant relationship between ToM and cognitive insight. Current findings suggest that there is a small but significant relationship between ToM and clinical insight in schizophrenia. ToM impairment is one of the factors contributing to poor insight in schizophrenia.

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1. Introduction

Poor insight into illness in schizophrenia is a very common and clinically relevant problem (Amador et al., 1994; David, 1990; David et al., 1992). Generally, the concept of poor insight refers to a multidimensional clinical construct (clinical insight) (Amador et al., 1994; Pousa et al., 2017). Poor clinical insight is an important problem as it leads to delay in access to treatment and poor treatment compliance at follow-up (Ayasa-Arriola et al., 2011; Beck et al., 2011; Sendt et al., 2015). Most patients with schizophrenia present with difficulty in making sense of their experiences such as hallucinations and/or they have unawareness of many aspects of their illness including the need for treatment and negative social consequences (Arango and Amador, 2011). In recent years, the field of insight research in schizophrenia expanded beyond the concept of clinical insight to a new metacognitive construct (cognitive insight) (Beck et al., 2004). Cognitive insight is defined as patients' capacity and willingness to reflect on their unusual experiences, and their level of certainty about their beliefs and interpretations about their experiences are correct. Beck cognitive insight scale (BCIS) is the most commonly used scale to assess cognitive insight (Beck et al., 2004).

The insight is a complex concept and number of factors including severity of symptoms, psychological denial and neurocognitive deficits

play a role in poor insight in schizophrenia (Cooke et al., 2005). Meta-analytical evidence suggests that positive symptoms and general psychopathology are significantly but only mildly ($r = 0.25-0.27$) associated with poor insight and state-dependent factors can explain a small amount of the variance in the level of insight deficits in schizophrenia (Mintz et al., 2003). Similarly, longitudinal studies provided only a modest evidence of a relationship between change in the level of insight and positive symptoms (Lincoln et al., 2007). Therefore, poor insight in schizophrenia can be considered as a trait feature which can be modestly exacerbated during acute psychosis. Persisting negative symptoms, denial and preference of some coping styles can contribute to insight deficits persisting beyond psychotic episodes (Cooke et al., 2005; Cooke et al., 2007; Mintz et al., 2003; Moore et al., 1999). Cognitive impairment is another factor which can explain trait-related insight deficits in schizophrenia. Meta-analyses of neuropsychological studies found a significant but modest relationship between cognitive deficits and poor insight in schizophrenia (Aleman et al., 2006; Nair et al., 2014). In the most recent meta-analysis of 72 studies, estimated correlation coefficient for the association between poor insight and cognitive impairment was rather small ($r = 0.16$) but significant (Nair et al., 2014).

Deficits in social cognition, particularly impairment in theory of mind (ToM), might be also relevant for explaining poor insight in schizophrenia. ToM is the ability to attribute mental states (beliefs, intentions, thoughts, desires and emotions) to others and predict and understand their actions based on their mental states (Premack and Woodruff, 1978). ToM is a multidimensional concept and one

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component of ToM include perspective taking and reasoning about mental states of others and other component include decoding others' mental states based on perceptual information (Sabbagh and Taylor, 2000; Sabbagh et al., 2004; Bora and Köse, 2016). Perspective taking for understanding and taking account of the others' beliefs towards the self is important for objective self-evaluation. Therefore, the perspective-taking component of ToM might be particularly relevant for insight in schizophrenia. Schizophrenia is associated with significant impairment in ToM (Frith, 1992; Corcoran et al., 1995; Bora et al., 2009; Bora and Pantelis, 2013). The outcome of studies investigating the relationship between ToM and insight in schizophrenia has been inconsistent, with some studies finding a positive association (Bora et al., 2007; Konstantakopoulos et al., 2014; Langdon and Ward, 2009), and others found no significant relationship (Drake and Lewis, 2003; Stewart et al., 2010).

The mixed findings of studies investigating the relationship between ToM and insight in schizophrenia might be related to the low statistical power as many of the available studies have small sample sizes. Also, the heterogeneity of insight measures used might potentially have an effect on the relationship between insight and neuropsychological assessments (Nair et al., 2014). In this paper, a meta-analysis of the relationship between ToM impairment and poor insight in schizophrenia was conducted for providing a reliable estimate of the strength of the potential relationship. The primary hypothesis of the current meta-analysis was that insight would be associated with ToM in schizophrenia. A secondary aim of this meta-analysis was to explore which type of insight (clinical vs cognitive) would be more strongly associated with ToM.

2. Methods

2.1. Study selection

PRISMA guidelines were used in conducting this meta-analysis (Moher et al., 2009). A literature search was conducted using the databases PubMed and Scopus to identify the relevant studies (January 1980 to December 2016) using the combination of keywords as follows: (schizophrenia AND ("Theory of mind") AND ("insight" OR "unawareness")). Reference lists of published reports were also searched for additional studies. Inclusion criteria for the studies were: (1) correlations between ToM and clinical or cognitive insight were investigated in a sample of patients with schizophrenia spectrum disorders; (2) reported sufficient data to calculate the effect size and standard error for the strength of relationship between insight and ToM; (3) a valid measure of clinical insight or BCIS (cognitive insight) was used. The clinical insight scales used in studies investigating the relationship between ToM and insight included Positive and Negative Syndrome Scale (PANSS G12) (Kay et al., 1987), the schedule for the assessment of insight-extended (SAI-E) (Kemp and David, 1996), the Scale to Assess Unawareness of Mental Disorder (SUMD) (Amador et al., 1993) the Birchwood insight scale (BIS, Birchwood et al., 1994). BIS and BCIS scales were self-report measures, other scales were expert-rated instruments. Correlation coefficients for cognitive insight and clinical insight were coded separately. In addition to the coding of effect size for clinical insight, correlation coefficients for each of the four different clinical insight scales (three expert-rated and one self-rated) were coded separately. Other than total insight score, correlation coefficients for three dimensions of insight including awareness of illness, awareness for the need for treatment, relabeling of symptoms were also coded.

2.2. ToM tasks

Several different ToM tasks have been utilized across studies, and the Hinting task was the most commonly used measure (Corcoran et al., 1995). The Hinting task is a theory of mind (ToM) assessment that requires clients to make social judgments about the intentions of

protagonists in 10 brief stories (Corcoran et al., 1995). Other ToM measures used in included studies were false belief tasks (stories and picture sequencing), Happe stories, Faux pas recognition and Yoni Task (Happe, 1994; Shamay-Tsoory et al., 2007; Stone et al., 1998). All of these tasks were measuring reasoning (perspective taking) aspect of ToM. Reading mind in the eyes test (RMET) (Baron-Cohen et al., 2001) was the only measure for decoding aspect of ToM (Sabbagh et al., 2004; Bora and Köse, 2016) used in studies investigating insight in schizophrenia. This measure was not included in the meta-analysis as ToM-decoding was investigated only in very few studies investigating clinical (Bora et al., 2007) or cognitive insight (Giusti et al., 2013; Lysaker et al., 2011a).

2.3. Statistical analyses

The effect sizes for ToM-insight correlations (Pearson r coefficients) were pooled to calculate a single effect size for each study when more than one ToM tests were used. Meta-analyses were performed using packages in R environment (Metafor) (Viechtbauer, 2010). Pearson r correlations were analyzed after Fisher's Z transformation was applied (Hedges and Olkin, 1985). Effect sizes were weighted using the inverse variance method and a random effects model (DerSimonian-Laird estimate) (p -value for significance < 0.05). Homogeneity of the distribution of weighted effect sizes was tested with the Q -test. Tau-squared (τ^2), an estimate of between-study variance, was used as a measure of the magnitude of heterogeneity in the random effects model. The possibility of publication bias was assessed by inspection of funnel plot of Fisher's Z -transformed correlation coefficient and standard error. For analyses including at least 6 studies, Egger's test was also used to assess asymmetry of funnel plots.

Subgroup analyses for different clinical insight scales were also conducted. Meta-regression analyses were conducted to investigate the effect of demographic (age and ratio of males) and clinical variables on the strength of the association between ToM and insight. The clinical variables included were the duration of illness, positive and negative symptoms and general psychopathology as measured with PANSS (Positive and Negative Syndrome Scale). Meta-regression analyses performed with a random-effects model were conducted using the restricted-information maximum likelihood method with a significance level set at $p < 0.05$.

3. Results

The selection process is summarized in Fig. 1. One first-episode study which included patients with affective psychosis (Wiffen et al., 2013) and another study which reported non-parametric correlation coefficients (Pousa et al., 2008) were excluded. A total of 16 studies consisting of 1085 patients with schizophrenia spectrum disorders (72.2% males, mean age = 35.7) were included in the meta-analysis (Table 1). Nine of the studies included only schizophrenia patients and others also included some patients with other schizophrenia-spectrum disorders. The vast majority of patients included have a diagnosis of schizophrenia ($n = 876, 80.7\%$). 159 patients (14.7%) had a diagnosis of schizoaffective disorder and 50 patients had other SSD diagnoses (delusional disorder, schizophreniform disorder and psychotic disorder NOS).

3.1. Clinical insight

ToM was significantly correlated with level of insight ($r = 0.28, CI = 0.20-0.36$) (Fig. 2; Table 2). For studies that used samples only consisting of patients with schizophrenia, the mean weighted correlation co-efficient between insight and ToM was $r = 0.34$ ($CI = 0.21-0.46, Z = 4.96, p < 0.001, Q = 13.3, p = 0.06$). All of three subdomains of insight were significantly correlated with ToM. Mean weighted correlations were $r = 0.32$ ($CI = 0.14-0.48$) for relabeling of symptoms, $r =$

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