

# General and social cognition in first episode schizophrenia: Identification of separable factors and prediction of functional outcome using the IntegNeuro test battery

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## Abstract

**Objective:** It is increasingly recognized that cognitive assessments, unlike symptom ratings, provide a reliable predictor of functional outcome in schizophrenia. This study evaluated the utility of the 'IntegNeuro' computerized test battery for assessing cognition in first episode schizophrenia. We determined the presence of separable factors of general and social cognition, their equivalence to the consensus domains identified by the NIMH MATRICS project, and their effectiveness in predicting real world functional outcomes.

**Method:** Fifty six first episode schizophrenia (FES) patients and 112 matched healthy controls were assessed on the touchscreen-based 'IntegNeuro' cognitive test battery and FES patients for social functioning (SOFAS) and quality of life (WHOQOL-BREF).

**Results:** Principal components analysis identified i) six factors corresponding to MATRICS domains of general cognition ('Information Processing Speed', 'Verbal Recall', 'Working Memory Capacity', 'Sustained Attention/Vigilance', 'Verbal Processing', 'Executive Function'), ii) an 'Emotional Intelligence' factor corresponding to the MATRICS social cognition domain, and iii) an additional 'Sensori-Motor Function' factor of general cognition and 'Negativity' factor of social cognition. Patients showed impairments relative to controls across all factors, but especially for Working Memory Capacity, followed by Verbal Memory, Sustained Attention/Vigilance and Negativity. These factors strongly predicted poorer social functioning in FES, along with poorer quality of life in psychological, social, and health satisfaction facets.

**Conclusion:** The IntegNeuro battery has utility for assessing separable domains of general and social cognition in FES, which are predictive of real world outcomes. Thus, it may be appropriate for clinical application, including in multi-center trials targeting new treatments for cognition in schizophrenia.

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**Keywords:** First episode schizophrenia; General and social cognition; Social functioning; Quality of life; IntegNeuro test battery

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## 1. Introduction

The World Health Organization ranks schizophrenia second in burden of disease from mental illness, and cognitive impairments contribute substantially to this burden. These impairments predict real-world functional outcomes more robustly and consistently than florid, positive symptoms (Green et al., 2004a). Yet, clinical trials and diagnostic criteria typically focus on positive symptoms, such that identification of new pharmacological targets for cognitive impairment lags behind the evidence for its importance (Buchanan et al., 2005).

This gap has been exacerbated by lack of agreed domains and tests for evaluating cognition in schizophrenia. A landmark initiative in closing the gap has been the NIMH Measurement and Treatment Research to Improve Cognition in Schizophrenia (MATRICS) project, which developed the MATRICS Consensus Cognitive Battery (MCCB) (Neuchterlein et al., 2004; Green et al., 2004b). Here, we report on a computerized test battery, 'IntegNeuro' which assesses equivalent domains to the MCCB, and its application in first episode patients.

The MCCB was developed through a consensus of experts who identified seven core dimensions of deficit in schizophrenia, from an extensive review of the cognitive literature and factor analytic studies (Neuchterlein et al., 2004): Speed of Processing, Attention/Vigilance, Working Memory, Verbal Learning and Memory, Visual Learning and Memory, Reasoning and Problem Solving, and Verbal Comprehension. While there are fewer studies of first episode schizophrenia, a similar factor structure has been revealed (Friis et al., 2002; Saykin et al., 1994). Given evidence of resistance to change, the Verbal Comprehension factor was later excluded (Neuchterlein et al., 2004). However, the MCCB still assesses verbal functions within the Speed of Processing and Verbal Learning and Memory domains.

While social cognition has received less attention, accumulating evidence indicates that it enhances the utility of cognitive testing in schizophrenia. Social cognition encompasses constructs of emotion processing, theory of mind, social perception, social knowledge, and attributional bias. In light of the evidence the Mayer–Salovey–Caruso Emotional Intelligence Test (MSCEIT; Green et al., 2005) was subsequently added to the MCCB to represent this domain. Individuals with schizophrenia show decrements on the MSCEIT, as well as in theory of mind, emotion recognition and negative attributional bias tests (Mueser et al., 1996; Penn et al., 2006; Sachs et al., 2004; Brune, 2005; Frith and

Corcoran, 1996). First episode patients show corresponding, albeit milder, deficits in emotional intelligence, recognition and prosody, as well as biases which reflect a depressive attributional style (Edwards et al., 2001; Eack et al., 2007; Humphreys and Barrowclough, 2006).

Several studies have suggested that deficits in domains of cognition are associated with distinct functional outcomes: attention/vigilance with social functioning, verbal learning and memory with social, occupational and independent living capacity, executive function with independent living, and processing speed with employment (Green et al., 2004a for review). In first episode patients, progressive decline in visuo-spatial executive tasks has been found to predict poor outcome (Stirling et al., 2003). Poor quality of life has been related to cognitive impairment in working memory and executive function in chronic patients (Alptekin et al., 2005), and is predicted by executive function and processing speed in first episode patients (Addington et al., 2005). Tests of social cognition may also mediate or enhance the prediction of functional outcome (Brune, 2005; Kee et al., 2003; Mueser et al., 1996).

While cognitive assessment of schizophrenia has traditionally made use of paper-and-pencil batteries, such as the Repeatable Battery for the Neuropsychological Assessment of Schizophrenia (RBANS; Gold et al., 1999) and Brief Assessment of Cognition in Schizophrenia (BACS; Keefe et al., 2004), computerized cognitive test batteries have received increasing recent attention for both research and clinical application. Six major benefits, including automation, efficiency, standardization and additional test measures, have been highlighted (American Psychological Association, 1986). Using the computerized Cambridge Neuropsychological Test Automated Battery (CANTAB) first episode patients show deficits on tests of executive planning, working memory and recognition memory, implicating the frontal cortex (eg., Hutton et al., 1998; 2004; Joyce et al., 2005; Levaux et al., 2007 for review). Working memory deficits have also been identified in ultra high risk subjects (Bartok et al., 2005; Wood et al., 2003). In chronic schizophrenia, performance on several CANTAB tests has been found to predict social and community functioning (Proteau et al., 2004, 2005). Yet, relationships between general and social cognition and functional outcome in first episode patients have not been assessed using computerized testing.

Consistent with APA guidelines, the touchscreen-based 'IntegNeuro' test battery was designed for reproducibility with efficiency. Standardization norms have

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