



Neurocognition and occupational functioning in schizophrenia spectrum disorders: The MATRICS Consensus Cognitive Battery (MCCB) and workplace assessments



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ABSTRACT

The MCCB is widely used in clinical trials of schizophrenia, but its relationship to occupational functioning still needs further elaboration. While previous research has indicated that various domains of neurocognition assessed by individual tests are related to work functioning, these reports preceded the development of the MCCB as the standard neurocognitive test battery in the field. In the current study, the vocational functioning of 131 Norwegian participants with schizophrenia spectrum disorders who were enrolled in a vocational rehabilitation program were assessed on the Vocational Cognitive Rating Scale (VCRS), the Work Behavior Inventory (WBI), and the Complexity Scale (CS) as well as on the MCCB. Significant correlations were found between most MCCB domains and VCRS Total Score. MCCB processing speed and attention were most powerfully related to and predictive of WBI scores. When participants were divided into “low complexity” or “higher complexity” work categories, participants in the “low-complexity” group performed significantly worse than participants in the “higher-complexity” group regarding processing speed, working memory, visual learning and the composite score. The same pattern emerged for participants working sheltered compared to competitive jobs. The VCRS, WBI and CS may be useful in vocational rehabilitation. They bridge an important gap between test- and occupational-setting, providing valuable information about impairments related to occupational functioning. We found the MCCB to be sensitive to occupational functioning as measured by VCRS, WBI and CS, with neurocognition accounting for a small but significant proportion of the variance in these different measures of occupational functioning.

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1. Introduction

Impaired neurocognition and functional loss are prominent in schizophrenia (August et al., 2012; Bowie and Harvey, 2005; Green et al., 2004; Lystad et al., 2014; Shamsi et al., 2011). Neurocognitive deficits contribute significantly to functional impairment in general (Bowie and Harvey, 2005; Shamsi et al., 2011) and impaired occupational status and occupational functioning in particular (August et al., 2012; Christensen, 2007). Employment rates for people with schizophrenia

are consistently low, typically ranging from 10% to 25% (Bond, 2004; Marwaha and Johnson, 2004; Melle et al., 2000; Rosenheck et al., 2006; Tandberg et al., 2013).

The MCCB is widely used as an endpoint in clinical trials aiming to alleviate neurocognitive impairments in schizophrenia (Kern et al., 2008; Nuechterlein et al., 2008) and the relationship to functional outcome was an important criterion in the selection of tests for the battery (Nuechterlein et al., 2008). Functional outcome encompasses both *functional capacity*, the ability to perform a task if given the opportunity, and *real world functioning*, actual performance, such as occupational functioning (Bromley and Brekke, 2010; Gupta et al., 2012). Occupational functioning is frequently defined as paid work (McGurk and Mueser, 2004), number of hours worked or dichotomized in terms of employed

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versus not employed (Marwaha and Johnson, 2004). Different concepts related to employment status are thus used as proxy measures for occupational functioning, yielding sparse information about actual work performance. As supported employment programs for people with schizophrenia such as Individual Placement and Support (IPS) gain momentum (Bejerholm et al., 2014; Mueser and McGurk, 2014; Rinaldi et al., 2010), there is a need for assessment tools measuring functioning on-the-job. Prior to the implementation of the MCCB, numerous studies had related various neurocognitive domains to work function in persons with schizophrenia participating in vocational rehabilitation, reporting a number of meaningful relationships (Bell et al., 2009; Bell and Bryson, 2001; Bryson and Bell, 2003; Bryson et al., 1998; Lysaker et al., 1995a; Lysaker et al., 1995b). Since the launch of the MCCB as the standard neurocognitive assessment battery for schizophrenia trials, it has been linked to occupational outcome in a few studies (August et al., 2012; Durand et al., 2015; Gould et al., 2015; Kern et al., 2011; Shamsi et al., 2011; Vargas et al., 2014). Specifically, the battery has proven sensitive in differentiating between employed and unemployed persons (August et al., 2012; Kern et al., 2011) as well as predictive of work and education (Shamsi et al., 2011). Although several studies have tied MCCB performance to occupational status, the issue concerning associations between the MCCB and occupational performance still needs elaboration.

The purpose of the current study was to explore the relationship between MCCB performance and different measures of occupational functioning in a sample of adult patients with broad schizophrenia spectrum disorders using the Vocational Cognitive Rating Scale (VCRS), the Work Behavior Inventory (WBI) and the Complexity Scale (CS). We hypothesized that MCCB scores would predict VCRS and WBI scores and that participants carrying out low complexity tasks or working in a sheltered environment would perform more poorly on the MCCB than participants having average or higher complexity jobs or working in a competitive environment at the beginning of a vocational rehabilitation program.

2. Methods

2.1. The job management program (JUMP) study

The current study is part of the JUMP study, a multisite vocational rehabilitation program for adults with psychotic disorders in Norway. JUMP is a collaborative effort between health and welfare services with the overall goal of enhancing occupational outcomes for persons with psychotic disorders. Participants were offered a 10 month extensive vocational rehabilitation program consisting of competitive or sheltered work, close collaboration between health and vocational services, employers and employment specialists in addition to either cognitive remediation (CR) or cognitive behavioral therapy techniques (CBT). The CR and CBT interventions were carried out by trained employment specialists.

The study was approved by the Regional Committee of Medical Research Ethics and the Norwegian Data Protection Authority. ClinicalTrials.gov Identifier: NCT01139502.

2.2. Participants

Participants were referred from local mental health centers and vocational services. Self-referral was also possible. All participants provided written informed consent. Exclusion criteria were head injury with loss of consciousness for more than 10 min or requiring medical treatment, neurological disorder, IQ below 70, unstable or uncontrolled medical condition interfering with brain function and age outside the range of 18–65. Further, a score of 3 or more regarding violent behavior, severe alcohol and/or drug dependence and suicidal ideation as measured with the Health of the Nation Outcome Scales (Wing et al., 1998) were also exclusion criteria. Participants were required to

understand and speak Norwegian to assure valid neurocognitive test performance.

One hundred and forty eight participants meeting the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (DSM-IV) (APA, 1994) criteria for a broad schizophrenia spectrum disorder were included. Of these, 137 participants completed the neurocognitive assessment. Six non-native speakers were excluded from analyses due to poor language abilities. This left 131 to be included: 88.5% with schizophrenia, 7.6% with schizoaffective disorder, 2.3% with delusional disorder and 1.6% with psychotic disorder not otherwise specified. Norwegian was the first language for 90%, and the remaining 10% could still be validly assessed in Norwegian. All analyses were conducted both with and without the 10% non-native speakers. The exclusion of the 10% did not substantially influence any findings (Fig. 1).

2.3. Assessments

2.3.1. Clinical assessments

Clinical assessment was carried out by trained and calibrated clinicians. M.I.N.I. PLUS (Sheehan et al., 1998) was used for diagnostic evaluation. Levels of present psychotic symptoms were evaluated using the Structural Clinical Interview of the Positive and Negative Syndrome Scale (SCI-PANSS) (Kay et al., 1987). Demographic data were also collected.

2.3.2. Neurocognitive assessment

Neurocognitive assessments were carried out by clinicians trained in standardized neuropsychological testing.

Current IQ was estimated with the Wechsler Abbreviated Scale of Intelligence, two subtests form (WASI, 2007). This form includes Vocabulary and Matrix.

Neurocognition was assessed with the 9 MCCB subtests excluding their measure of social cognition. These 9 subtests assess 6 cognitive domains; *Speed of processing, Attention/Vigilance, Working memory, Verbal learning, Visual learning and Reasoning and problem solving*. A modified MCCB neurocognitive composite score was calculated using the mean of the nine demographically corrected domain T-scores. There were missing MCCB data for 4 participants on three subtests. For these cases, the group mean was inserted.

2.3.3. Functional assessment

2.3.3.1. Previous employment and education. Educational level and employment history were gathered as self-report information during structured interview performed by site coordinators. Employment history was recorded as total lifetime number of months in part- or full-time competitive employment or work placement in a competitive setting.

2.3.3.2. The Vocational Cognitive Rating Scale (VCRS). The VCRS (Greig et al., 2004) was developed to assess neurocognitive demands on-the-job in persons with severe mental illness. It consists of 16 items anchored along a five point scale, 1 = *consistently inferior performance* to 5 = *consistently superior performance*, giving a total score, ranging from 16 to 80. The VCRS was rated by trained employment specialists after a 15 min observation of the participant at work and an interview with the immediate supervisor.

2.3.3.3. The Work Behavior Inventory (WBI). The WBI was developed (Bryson et al., 1997) for the assessment of occupational functioning for people with severe mental illness. It consists of 36 items distributed on five sub-scales, and one global score rating general occupational functioning. The five sub-scales are Social skills, Cooperativeness, Work quality, Work habits and Personal presentation. Items are rated on a five-point scale, 1 = *“Consistently an area needing improvement”* to 5 = *“Consistently an area of superior performance”*. The WBI Total

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