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Predictors of neuropsychological effort test performance in schizophrenia

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ABSTRACT

There is some evidence that insufficient effort may be common in schizophrenia, posing significant threats to the validity of neuropsychological test results. Low effort may account for a significant proportion of variance in neuropsychological test scores and the generalized cognitive deficit that characterizes the disorder. The current study evaluated clinical predictors of insufficient effort in schizophrenia using an embedded effort measure, the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) Effort Index (EI). Participants were 330 patients meeting DSM-IV-TR criteria for schizophrenia, schizoaffective disorder, or another psychotic disorder who received a battery of neuropsychological tests, including: Wechsler Test of Adult Reading (WTAR), Wechsler Abbreviated Scale of Intelligence (WASI), and RBANS. Clinical assessments designed to measure functional outcome and symptoms were also obtained. Results indicated that 9.4% of patients failed the EI. Patients who failed had lower full-scale, verbal, and performance IQ, as well as poorer performance on RBANS domains not included in the EI (immediate memory, language, and visuospatial/construction). Patients who failed the EI also displayed poorer community-based vocational outcome, greater likelihood of having "deficit schizophrenia" (i.e., primary and enduring negative symptoms), and increased severity of positive symptoms. Regression analyses revealed that insufficient effort was most significantly predicted by a combination of low IQ, negative symptoms, and positive symptoms. Findings suggest that although insufficient effort may be relatively uncommon in schizophrenia, it is associated with important clinical outcomes. The RBANS EI may be a useful tool in evaluating insufficient effort in schizophrenia.

1. Introduction

Neuropsychological impairment is common in schizophrenia, and has long been considered a core feature of the illness (Kraepelin, 1919). Meta-analyses indicate that individuals with schizophrenia display neurocognitive impairments approximately one standard deviation below the mean for healthy controls (Fioravanti et al., 2005; Dickinson et al., 2007). Despite such pervasive cognitive impairments, there is no distinct pattern of differential deficits that characterizes most individuals with schizophrenia (Reichenberg and Harvey, 2007). Rather, schizophrenia patients display neurocognitive impairments of similar magnitude across most cognitive domains, suggesting a generalized neurocognitive deficit (Dickinson et al., 2004; Dickinson, 2008; Dickinson et al., 2008).

Several theories have been proposed to account for this generalized neurocognitive deficit, including central nervous system (e.g., gray and white-matter abnormalities, impaired integration of signals across neural networks, and cellular-level neuropathology) and "general systems" (e.g., inflammatory, metabolic, and oxidative stress processes) abnormalities that can negatively impact cognition (Dickinson and Harvey, 2009). However, it is also possible that psychological factors contribute substantially to the neurocognitive impairments observed in schizophrenia. One possibility is that problems with motivation result in inadequate effort on measures of neurocognition, particularly on tasks that are more cognitively demanding. To date, relatively few studies have examined insufficient effort during neuropsychological testing in schizophrenia and whether such abnormalities are associated with motivational problems. Those studies that have been conducted have produced inconsistent results, with the majority indicating that a small proportion of individuals with schizophrenia (~20%) perform below clinically established cut-off scores for valid effort (Back et al., 1996; Egeland et al., 2003; Arnold et al., 2005; Duncan, 2005; Gierok et al., 2005; Avery et al., 2009; Pivovarova et al., 2009; Schroeder and Marshall, 2011; Moore et al., 2013; Hunt et al., 2014), and other studies indicating that up to 60–72% of the sample may fail effort testing (Gorissen et al., 2005; Hunt et al., 2014).

Despite these inconsistencies regarding rates of effort test failure, there is reliable evidence that certain clinical variables predict low effort in schizophrenia. For example, multiple studies have found that global scores on negative symptom rating scales, such as the Scale for the

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Assessment of Negative Symptoms (Andreasen, 1983) or the Brief Negative Symptom Scale (Kirkpatrick et al., 2011), account for a substantial proportion of variance in effort test performance (Gorissen et al., 2005; Avery et al., 2009; Strauss et al., 2014). Several psychological variables also differentiate patients who pass and fail effort measures, including self-reported anhedonia and the perception of low cognitive resources (Avery et al., 2009; Strauss et al., 2014). These findings suggest that negative symptoms and psychological processes associated with negative symptoms may be core to diminished effort during neuropsychological testing.

However, negative symptoms are both multi-dimensional and multi-determined and it is currently unclear which aspects of negative symptoms are associated with low effort. There is consistent evidence for the multi-dimensionality of negative symptoms, such that 2 distinct negative symptom factors are commonly identified, one reflecting diminished motivation (anhedonia, avolition, asociality) and the other diminished expressivity (alogia and restricted affect) (Blanchard and Cohen, 2006; Horan et al., 2011; Strauss et al., 2012). These two dimensions have different demographic and clinical correlates (Strauss et al., 2013), with more severe volitional pathology generally predicting worse outcomes. Given that neuropsychological impairment has been associated with the motivational dimension more strongly than the diminished expressivity dimension (Fervaha et al., 2014), one might expect effort test performance to be specifically linked to greater severity of motivational symptoms. Furthermore, it is now generally accepted that negative symptoms are multi-determined — two patients can display identical scores on negative symptom rating scales for very different reasons. This notion was highlighted in the seminal work of Carpenter et al. (1988), which demonstrated that negative symptoms can result from either primary or secondary factors. Primary negative symptoms are those that are idiopathic to the illness, whereas secondary negative symptoms result from processes such as paranoid social withdrawal, depression, disorganization, hallucinations, and suspiciousness. If low effort is indeed critically linked to true motivational problems in schizophrenia, one might expect higher rates of effort test failure in patients who meet clinical diagnostic criteria for “deficit schizophrenia”, i.e., those with primary and clinically stable negative symptoms (Carpenter et al., 1988; Kirkpatrick et al., 2001). Patients with deficit schizophrenia typically fall 1 SD below nondeficit schizophrenia patients and 2 SD below healthy controls on standard neuropsychological tests (Buchanan et al., 1994; Cohen et al., 2007); however, it remains to be seen whether patients meeting clinical criteria for deficit schizophrenia are more likely to fail effort tests than nondeficit patients.

In the current study, we explored rates of effort test failure in a large sample of individuals with schizophrenia using an embedded effort measure that has been well-validated in clinical populations, the RBANS Effort Index (Silverberg et al., 2007). Clinical predictors of insufficient effort were examined, with an emphasis on determining whether the motivational dimension and primary negative symptoms are most predictive of effort test failure. It was hypothesized that a small percentage of individuals with schizophrenia (<20%) would fail the RBANS Effort Index and that patients falling below the low-effort cut-off would be more likely to meet clinical criteria for deficit schizophrenia, have greater severity of motivational symptoms, and poorer community-based functional outcome.

2. Method

2.1. Participants

Participants included 330 individuals meeting DSM-III or DSM-IV criteria for schizophrenia (n = 289), schizoaffective disorder (n = 32), or another psychotic disorder (n = 9). Outpatients were recruited from the Maryland Psychiatric Research Center (MPRC) outpatient clinics and other local outpatient clinical care centers. Inpatients were recruited from the Treatment Research Program unit of the MPRC. Participants were excluded for: (1) history of substance abuse or dependence in the past 6 months, (2) history of a head injury, and (3) history of a neurological disorder. All patients were assessed in a research (rather than clinical) context, and therefore did not have any identifiable motivation to feign or exaggerate clinical and/or cognitive symptoms. Patients were not using results of neuropsychological evaluations for disability compensation or litigation purposes.

Participants were divided into those who passed (SZ-PASS) and failed (SZ-FAIL) the RBANS Effort Index according to established procedures (Silverberg et al., 2007). Demographic characteristics of the SZ-PASS and SZ-FAIL groups are presented in Table 1. The two groups did not differ on sex, race, or years of parental education. However, the SZ-FAIL group was significantly older and had fewer years of personal education than SZ-PASS.

2.2. Measures

Participants completed a clinical interview, after which psychiatric rating instruments designed to measure community-based functional outcome, psychosis, disorganization, and negative symptoms were completed. Neuropsychological tests were also administered. Consensus diagnosis was established via a best-estimate approach based upon multiple interviews and a detailed psychiatric history. This diagnosis was subsequently confirmed using the Structured Clinical Interview for DSM (SCID). Symptom rating scales were completed by clinicians trained to MPRC reliability standards (reliability > 0.80; Schedule for the Deficit Syndrome kappa > 8/10).

Symptom severity measures included the Schedule for the Deficit Syndrome (SDS: Kirkpatrick et al., 1989) and the Scale for the Assessment of Positive Symptoms (SAPS: Andreasen, 1984). The SDS assesses the severity of six negative symptoms (restricted affect, poverty of speech, diminished emotional range, curbed interests, diminished sense of purpose, and diminished social drive), and whether those symptoms are primary/secondary and enduring (stable > 1 year). The measure is primarily intended to yield a categorization of “deficit” or “nondeficit” schizophrenia. Individuals meet criteria for the deficit syndrome if they have 2 or more negative symptoms that are clinically significant, and those symptoms are considered primary and stable. The SDS demonstrated good psychometric properties in the original study and subsequent studies have indicated strong inter-rater reliability and convergent validity (Kirkpatrick et al., 1989; Fenton and McGlashan, 1992; Amador et al., 1999). Factor analytic studies suggest that the SDS items assessing symptom severity load onto two coherent factors — avolition and diminished emotional expressivity (Kimhy et al., 2006; Strauss et al., 2013).

The SAPS consists of 30 items that assess hallucinations, delusions, and disorganization (Andreasen, 1984). Each SAPS item is scored on a 6-point scale (0–5). The Level of Function Scale (Hawk et al., 1975) measures community-based functional outcome in eight areas: Duration of Hospitalization, Frequency of Social Contacts, Quality of Social Relations,

Table 1
Participant demographics by group.

	SZ-PASS (N = 299)	SZ-FAIL (N = 31)	Test statistic, *p* value
Age	35.04 (10.36)	41.55 (14.45)	$F = 10.20$, $p < 0.01$
% Male	72.6%	77.4%	$\chi^2 = 0.34$, $p = 0.56$
Ethnicity			$\chi^2 = 1.48$, $p = 0.83$
Caucasian	53.8%	61.3%	
African American	41.8%	32.3%	
American Indian	0.3%	0%	
Asian	1.7%	3.2%	
Other	2.3%	3.2%	
Parental education	12.48 (3.11)	11.46 (2.54)	$F = 2.32$, $p = 0.13$
Participant education	12.24 (2.10)	11.38 (2.34)	$F = 4.39$, $p = 0.04$

Notes: SZ-PASS = participants with an EI > 3, SZ-FAIL, participants with an EI ≤ 3.