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Schizotypal traits and neurocognitive functioning among nonclinical young adults

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ABSTRACT

Neurocognitive deficits and their relationship with symptoms have been documented in schizophrenia and at-risk samples. Limited research has examined relationships of schizotypal traits with cognitive functioning among nonclinical samples. To expand this literature and elucidate a dimensional model of psychosis-proneness, we examined the relationship of schizotypal traits with estimated intellectual functioning, simple and complex attention/working memory, verbal fluency and visuospatial abilities in a nonclinical sample of 63 young adults. As hypothesized, aspects of neurocognition were more closely associated with negative (than positive or disorganized) schizotypal traits. For the total sample, poorer visuospatial performance was associated with more negative and overall schizotypal traits. The magnitude of the majority of findings was strengthened after controlling for depression and anxiety. No other findings were significant. Results partially support Meehl's (1962, 1990) view that processes underlying schizophrenia are expressed along a continuum. Findings suggest a relationship of schizotypal traits with neurocognition that is differentiated by trait dimensions, beyond the contribution of general psychiatric symptoms. Findings have implications for better understanding etiology and potential risk factors for psychosis. While sex distribution did not enable direct examination of sex effects, evidence in the field argues for continued exploration of differential patterns by sex.

1. Introduction

Schizophrenia is widely conceptualized as having neurodevelopmental origins (Weinberger, 1987; Walker et al., 2004). Meehl's (1962, 1990) seminal model proposed that schizotypal traits fall along a continuum ranging from asymptomatic (nonclinical) to severe, reflecting an underlying predisposition for schizophrenia. Research in the general population partially supports Meehl's dimensional model by demonstrating an attenuated factor structure of core positive, negative, and disorganized symptom dimensions (Raine et al., 1994; Vollema and Van den Bosch, 1995; Claridge et al., 1996) among healthy students (Gruzelier et al., 1995) and across cultures (e.g., Chen et al., 1997; Reynolds et al., 2000), gender, religious affiliation, family adversity, and psychopathology (Reynolds et al., 2000).

Neurocognitive deficits represent one core feature of schizophrenia (Walder et al., 2000; Nuechterlein et al., 2004; Heinrichs, 2005; Green, 2006; Kalkstein et al., 2010) that fit with a dimensional model. Namely, evidence indicates neurocognitive deficits among first-episode patients (Mesholam-Gately et al., 2009), individuals at genetic high-risk (Cannon et al., 1994; Sitskoorn et al., 2004; Snitz et al., 2006), psychometric high-risk (e.g., Cohen et al., 2006; Gooding et al., 2006) and clinical high-risk/prodrome (Brewer et al., 2006; Niendam et al., 2006; Seidman et al., 2006; Trotman et al., 2006). Moreover, at baseline, prodromals who later convert to psychosis generally perform worse than non-converters (Giuliano et al., 2012) and at-risk family members (Seidman et al., 2010), and at levels intermediate to patients and controls (Hawkins et al., 2004).

Studies examining the relationship of psychotic symptoms with neurocognitive functioning in clinical (Nieuwenstein et al., 2001; Bora et al., 2009) and at-risk (Trotman et al., 2006; Lindgren et al., 2010) samples largely demonstrate an inverse association of general intellectual functioning (Tandon et al., 2009) and aspects of neurocognition (e.g., verbal working memory, executive functioning, visuospatial abilities) (Trotman et al., 2006; Bora et al., 2009; Ventura et al., 2009) with negative (more so than positive and disorganized) symptoms, though findings are less consistent among clinical (Niendam et al., 2006) and psychometric (Noguchi et al., 2008) high-risk samples. Moreover, studies examining cognitive deficits in patients (Heinrichs and Zakzanis, 1998), first-degree relatives (Snitz et al., 2006) and high-risk individuals

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(Seidman et al., 2006) compared to controls suggest a decrease in effect size accompanies a decrease in illness severity. Collectively, this literature supports a dimensional model.

Less well understood is whether the pattern of relationships between symptoms and neurocognition observed among patients and at-risk samples holds among nonclinical samples. Examination of individuals from the general population has the methodological advantage of avoiding confounds such as treatment, stigma and hospitalization effects. Evidence of a consistent pattern would further bolster the dimensional model. To date, findings vary in part as a function of neurocognitive domain assessed. General intelligence has been posited to be intact among nonclinical samples with heightened schizotypal traits (Raine, 2006), though not uniformly. One study found poorer general intelligence among adolescents high in both positive and negative schizotypy (compared to elevated negative schizotypes, elevated positive schizotypes, and controls; Barrantes-Vidal et al., 2002). Another study found poorer general intelligence was associated with higher positive (not negative or disorganized) schizotypal traits among college students (Matheson and Langdon, 2008). Poorer attention and executive functioning has been demonstrated among a community-based sample of adolescents high in (both positive and negative, and negative only) schizotypy compared to positive schizotypes and controls (Barrantes-Vidal et al., 2002), though simple attention tends to be unrelated to schizotypal traits among college students (Matheson and Langdon, 2008) and community-based adults (Noguchi et al., 2008). Greater executive dysfunction has been associated with negative (not positive or disorganized) schizotypal traits among college students (Dinn et al., 2002; Matheson and Langdon, 2008).

Although psychosis is highly comorbid with depression (Buckley et al., 2009), anxiety (Achim et al., 2011), and general psychiatric symptoms (Lysaker et al., 1995; Emsley et al., 1999), evidence suggests affective symptoms are more strongly associated with positive than negative symptoms among clinical (Oosthuizen et al., 2002) and nonclinical (young adult) (Lewandowski et al., 2006) samples. Despite symptom and diagnostic comorbidity, neurocognitive deficits (in some domains) are more prominent in schizophrenia compared to other groups (e.g., bipolar patients; Krabbendam et al., 2005). Findings highlight the need to consider the degree to which schizotypal traits are related to neurocognition independent of affective and anxiety symptoms among nonclinical samples.

The current study examined the relationship of neurocognition with schizotypal traits in a nonclinical sample of young adults, with consideration of the contribution of general psychiatric symptoms. Based on existing literature and a dimensional perspective, it was hypothesized that: (1) greater positive and negative schizotypal traits would be associated with worse complex (but not simple) attention and (2) greater negative schizotypal traits would be associated with worse verbal fluency, visuospatial functioning, and lower estimated intellectual functioning. Findings were expected to extend above and beyond the contribution of depressive and anxiety symptoms.

2. Methods

2.1. Participants

Participants were 63 (54 female, nine male) undergraduate students ages 18–35 years ($M=21.70$, S.D.$=3.68$) recruited via the College human subject pool and psychology courses. The sample composition reflected the diversity of the college student population (46% White/Caucasian; 15.9% Black/African American; 11.1% Asian; 9.5% Hispanic/Latino; 9.5% Mixed; 3.2% Middle Eastern; 3.2% Other; 1.6% unidentified). Three outliers on age (i.e., >35 years) were excluded from this study. The study protocol received Human Subjects Institutional Review Board (IRB) approval. Participants provided Informed Consent in accordance with College IRB policies and procedures.

2.2. Materials and procedure

Participants completed self-report questionnaires and were administered neurocognitive measures in the context of a comprehensive battery of behavioral, neuropsychological, and neurobiological measures.

2.2.1. Measures of schizotypal traits, depression, and anxiety

Greater scores reflected more severe symptomatology. Analyses used raw scores for schizotypal traits and depression, and *T* scores for anxiety.

The Schizotypal Personality Questionnaire-Brief (SPQ-B; Raine and Benishay, 1995), an abbreviated version of the SPQ (Raine, 1991), is a 22-item self-report measure modeled after the DSM-III-R (largely unchanged in DSM-IV) SPD criteria used to assess schizotypal traits. It yields a range of possible scores from 0 to 22. The SPQ-B yields three subscales: Cognitive–Perceptual (SPQ-CP; magical thinking, unusual perceptual experiences, ideas of reference, and paranoid ideation), Interpersonal (SPQ-I; social anxiety, a lack of close friends, blunted affect, and paranoid ideation), and Disorganized (SPQ-D; odd or eccentric behavior, and odd speech), reflecting the three-factor symptom structure (i.e., positive, negative, disorganized) in attenuated form (Arndt et al., 1991; Raine et al., 1994; Vollema and Hoijtink, 2000).

The Beck Depression Inventory-II (BDI-II; Beck et al., 1996) is a 21-item measure of depressive symptoms. Items are endorsed using a Likert scale yielding a range of possible scores from 0 to 28. Consistent with DSM-IV criteria for depression, respondents report feelings present over the past two weeks.

The State-Trait Anxiety Inventory (STAI; Spielberger et al., 1983) consists of two 20-item subscales, each derived from ratings on a Likert scale yielding a range of possible scores from 20 to 80 of situational (or state) anxiety (STAI-S) and general (trait) anxiety (STAI-T).

2.2.2. Neurocognitive measures

A brief neuropsychological battery assessed estimated intellectual functioning, simple attention, complex attention/working memory, executive functioning, and visuospatial/construction abilities. Raw scores were transformed to standardized *z*-scores for analyses (e.g., Seidman et al., 2006).

Estimated intellectual functioning. The Wechsler Test of Adult Reading (WTAR; Wechsler, 2001) is composed of 50 words with irregular pronunciations intended to minimize current pronunciation abilities and maximize the assessment of previously acquired knowledge towards providing an estimate of intellectual functioning.

Simple and complex attention/working memory. The Digit Span subtest of the WAIS-III (Wechsler, 1997) indexed simple and complex attention/auditory working memory. The measure provides three scores; namely, Digits Forward, Digits Backward, and Total (comprised of the two former scores).

Executive functioning. The Controlled Oral Word Association Test (COWAT; Benton et al., 1994) assessed verbal fluency deficits associated with frontal/executive functioning. The measure is comprised of two subtests of verbal fluency; namely, phonemic fluency (FAS) and semantic fluency (Animals). FAS has high internal reliability ($r=0.83$), test–retest reliability ($rs>0.70$), interrater reliability ($rs>0.95$) and validity (Strauss et al., 2006). Semantic fluency tasks (e.g., Animals) have moderately high test–retest reliability ($r=0.56$) and validity (Strauss et al., 2006).

Visuospatial/construction abilities. The Block Design subtest of the WAIS-III (Wechsler, 1997) assessed visuospatial/construction abilities.

2.3. Data analysis

Pearson bivariate correlations were employed to examine relationships among SPQ-B indices, neurocognitive measures and age. Partial correlations were employed to control for general psychiatric symptoms. Pearson bivariate correlations were employed to examine the relationships among all symptoms to determine inclusion of depression and/or anxiety as covariates. Analyses examining semantic fluency were repeated excluding the one outlier on this measure. All tests conducted were two-tailed with alpha significance level set at 0.05.

3. Results

3.1. Descriptive statistics

As seen in Table 1, descriptive statistics (means and standard deviations) are provided for neurocognitive measures, schizotypal traits, and depression and anxiety symptom scores.