Psychiatry Research 219 (2014) 598–603

Contents lists available at ScienceDirect

Psychiatry Research

journal homepage: www.elsevier.com/locate/psychres

Self-reported attention and mood symptoms in cocaine abusers: Relationship to neurocognitive performance

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ARTICLE INFO

Article history:
Received 18 June 2013
Received in revised form
2 March 2014
Accepted 8 June 2014
Available online 14 June 2014

Keywords:
Neuropsychology
Comorbidity
ADHD
Depression

ABSTRACT

Objective: This study examined the relationship between subjective measures of inattention/hyperactivity – impulsivity and mood and objective measures of neurocognitive function in cocaine users. *Design*: Ninety-four active cocaine users not seeking treatment (73 male, 21 female) were administered two self-report psychiatric measures (the ADHD Rating Scale – Fourth Edition; ARS-IV), and the Beck Depression Inventory – Second Edition; (BDI-II), and a battery of tests measuring attention, executive, psychomotor, visual and verbal learning, visuospatial, and language functions. Correlations between scores on the psychiatric measures (total and subscale) and the neurocognitive measures were examined. *Results*: While scores on the BDI-II and ARS-IV were correlated with each other ($p < 0.01$), scores on both self-report measures were largely uncorrelated with neurocognitive test scores ($p > 0.05$). *Conclusion*: There was a minimal relationship between psychiatric measures that incorporate subjective assessment of cognitive function, and objective neurocognitive measures in nontreatment-seeking cocaine users, consistent with previous findings in other samples of substance users. This suggests that self-report measures may have limited utility as proxies for neurocognitive performance.

1. Introduction

Attention is a neurocognitive function that is considered relevant to the understanding of antecedents and consequences of cocaine abuse. Attention Deficit-Hyperactivity Disorder (ADHD), characterized by marked inattention, hyperactivity and impulsivity symptoms, may be present in approximately 12% of treatment-seeking cocaine abusers (Levin et al., 1998). However, even cocaine users in treatment without ADHD or other explicit psychiatric comorbidities have been found to exhibit elevations on ADHD symptom scales compared to healthy control participants (Beatty et al., 1995), suggesting that cocaine use itself may be associated with some degree of attentional symptomatology.

Performance on neurocognitive tests of attention has also been found to be impaired in cocaine-using participants. According to a meta-analysis of 15 studies of neurocognitive performance in cocaine users (Jovanovski et al., 2005), the largest overall effect size was seen for attention ($0.4 < d < 1.10$) when compared to other standard neurocognitive functions such as executive function and memory. Performance impairments in attention have been documented in cocaine abusers both seeking treatment (Beatty et al., 1995) and not seeking treatment (Bolla et al., 1999; Kalapatapu et al., 2011), relative to control participants. Attentional test performance has been found to be inversely correlated with the frequency of recent reported cocaine use (Bolla et al., 1999), and positively associated with success in substance treatment (Aharonovich et al., 2006; Streeter et al., 2008). Thus, attention problems can be observed in cocaine users with both subjective and objective measures, and attention performance appears to be related both to cocaine use severity and clinical outcome.

In one study (Beatty et al., 1995), self-report psychiatric scales and a comprehensive battery of neuropsychological tests were administered to groups of abstinent cocaine users ($n=23$) and alcohol abusers ($n=24$) who were in treatment, and healthy control participants ($n=22$). Attentional symptoms were measured by the Residual Attention Deficit Disorder Scale (RADDS; Wender et al., 1981) and attentional performance was measured by the Trail Making Test (Reitan & Wolfson, 1985), WAIS-R Digit Symbol test (Wechsler, 1981), and the Gordon Distractibility test (Gordon & Mettleman, 1987). Relative to the controls, the cocaine and alcohol users exhibited elevated scores on the RADDS and decreased performance on the Digit Symbol test and the Trail

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http://dx.doi.org/10.1016/j.psychres.2014.06.011
0165-1781/

Making Test (cocaine users only). However, in secondary analyses, no correlations were detected between scores on the RADDS and scores on any neurocognitive test, either when the groups were analyzed together or separately. Correlations (r's = 0.37–0.52, $p < 0.01$) were only detected between scores on the Beck Depression Inventory (BDI; Beck et al., 1961) a self-report measure of depressive symptomatology, and scores on the Wisconsin Card Sorting Test (WCST; Heaton, 1981), a performance measure of executive function. These findings suggest that while cocaine and alcohol users exhibited evidence of both subjective and objective attentional impairment, scores on the two types of measures were not related to each other. Further, scores on a subjective measure of depression were moderately associated with categorization performance. Thus, self-report of attentional problems in the everyday environment may be measuring a different construct than neurocognitive tests of attention in substance users.

A subsequent study (Horner et al., 1999) of the relationship between subjective and objective neurocognitive function in substance abusers partially addressed these concerns. This study employed a mixed group of substance abusers ($n = 86$) that were treatment-engaged and abstinent. Participants' Axis I disorders, including substance use disorders, were clinically assessed at intake (37 were cocaine-dependent) and participants were given random urine and breathalyzer tests during treatment to insure abstinence. Participants were administered the modified Cognitive Failures Questionnaire (mCFQ; Broadbent et al., 1982), a multi-domain subjective measure of cognitive impairment. Results indicated that mCFQ scores were not correlated with scores on any neuropsychological test ($p > 0.05$); rather mCFQ scores were moderately correlated with scores on measures of depression (BDI; $r = 0.56$, $p < 0.01$). Thus, self-reported neurocognitive symptoms were not associated with neurocognitive performance but were moderately associated with self-reported depressive symptoms. This study (Horner et al., 1999) provided further evidence that subjective and objective measures of neurocognitive functioning are unrelated to each other in a mixed group of substance users.

Results from studies in users of other substances who were treatment-engaged (Richardson-Vejlgaard et al., 2009; Shelton and Parsons, 1987; Errico et al., 1990), as well as non-substance-using participants with depression (Farrin et al., 2003), are consistent with these results. For example, Errico et al. (1990) study, it was found that among measures of depression, anxiety, and neuropsychological impairment (all subjective), as well as objective measures of neurocognitive functioning, the strongest correlations were among the subjective measures, in participants with alcohol dependence. Thus, it seems well-established in the literature that subjective measures of cognitive functioning tend to more strongly related to subjective measures of psychological distress than to objective measures of cognitive performance.

However, in these studies (Horner et al., 1999; Beatty et al., 1995; Errico et al., 1990), the self-report measures conflated cognitive functioning in multiple domains, and relatively heterogeneous participant groups were employed for the correlational analyses. These factors could have potentially obscured the relationship between subjective and objective measures of attention (see Vadhan et al. (2001)) in cocaine users. Additionally the cocaine users in both studies were all treatment-seeking and abstinent (up to 116 days), factors that may influence neuropsychological and psychiatric characteristics (Carroll and Rounsaville, 1992; Vadhan et al., 2007, Bartzokis et al., 2000; Woicik et al., 2009). These factors may limit generalizability, since the majority of cocaine users in the population are not engaged in or seeking treatment (USDHHS, 2011).

Thus, the purpose of the current study was to examine the association between self-reported attention symptoms and performance on objective measures of attention in a sample of nontreatment-seeking and non-abstinent cocaine users. Based on the literature, we hypothesized that scores on a self-report measure specifically of attentional symptoms would be more strongly correlated with performance on tests of attention than tests of other neurocognitive functions, whereas composite scores on the self-report measure (that includes hyperactivity/impulsivity symptoms) would be correlated with scores on a self-report measure of mood symptoms.

2. Methods

2.1. Participants

Ninety-four cocaine users selected from a larger study of the neurocognitive sequelae of cocaine use at the Substance Use Research Center (SURC) at the New York State Psychiatric Institute (NYSPI) were recruited from the community through newspaper, Internet, and word-of-mouth advertising. Participants first completed substance use and psychiatric questionnaires, and qualitative urine toxicology tests (iScreen, Instant Technologies, Inc.) to confirm the reported substance use/nonuse of the participants. Participants were then administered the Structured Clinical Interview for DSM-IV Disorders (SCID; First et al., 1995) by trained masters- or doctoral-level clinicians, to assess for Axis-I disorders (including substance use disorders). Participants were administered the CAADID when clinically relevant to rule out a prior history of ADHD.

Participants were included if they were between the ages of 21–60, and reported that cocaine was their primary substance of abuse. They also had to report that they used cocaine at least twice per week (minimum $50 per week) for at least the past 6 months, and their urine sample during screening had to be positive for cocaine metabolites. Participants were excluded if they met DSM-IV criteria for any current or lifetime bipolar or psychotic disorder, reported using any other psychoactive substance (including prescription medication) besides cocaine, alcohol, marijuana, caffeine or tobacco within the past 30 days, or had any history of CNS disturbance (including seizures, HIV/AIDS, head injury or loss of consciousness), prior history of ADHD, or developmental complications.

Participants' mean age was 40.48 (S.D. = 6.61) and mean years of education was 12.9 (S.D. = 1.8). 73 participants (77.7%) were male and 21 (22.3%) were female; 75 (79.8%) were African American, 10 (10.6%) were Hispanic and 8 (8.5%) were Caucasian. Regarding current cocaine use, participants reported having used cocaine for 17.0 years (S.D. = 8.4), and currently using cocaine 4.5 (S.D. = 1.7) times per week ($282.4 per week) [S.D. = 214.8]. 83 (88.3%) participants met criteria for cocaine dependence, 1 (1.1%) met for cocaine abuse only, and 7 did not meet criteria for any cocaine use disorder. Regarding other current substance use disorders, 3 (3.2%) participants met criteria for alcohol abuse, 1 participant (1.1%) met criteria for alcohol dependence, 1 (1.1%) met criteria for marijuana abuse and 1 (1.1%) met criteria for marijuana dependence. 16 (17.4%) participants met criteria for other Axis I mood or anxiety disorders, with 9 (9.8%) participants meeting criteria for a mood disorder, and 7 (7.6%) meeting criteria for an anxiety disorder.

This study was approved by the NYSPI IRB, and informed consent was obtained for all participants.

2.2. Design and procedure

All assessments were conducted in one 2–3 h outpatient session. Participants were instructed not to use any psychoactive substances on the morning of testing (except usual caffeine or nicotine). They were also required to pass field sobriety and alcohol breathalyzer tests and spent 30–40 min completing self-report instruments prior to testing, to insure that they were not acutely intoxicated. Participants also submitted a urine sample on the day of testing, with 89 (94.7%) participants testing positive for cocaine metabolites.

2.3. Measures

Psychiatric measures

The *ADHD Rating Scale-IV (ARS-IV*, Murphy & Barkley, 1996) is an 18-item self-report scale that requires participants to rate the frequency of their attentional (e.g., "I am easily distracted") and hyperactive–impulsive symptoms (e.g., "I am "on the go" or act as if "driven by a motor") on a scale ranging from 0 (Never or Rarely) to 4 (Very Often). Items are summed to generate a total score, and two subscales (Inattention and Hyperactivity/Impulsivity).

Beck Depression Inventory-II (BDI-II, Beck et al., 1996) is a 21-item self-report scale that requires participants to rate the intensity of their depressive symptoms on a scale of 0 ("I do not feel sad") to 3 ("I am so sad or unhappy that I can't stand it"). Items are summed to generate a total score. There are also two subscales derived from factor analysis (Beck et al., 1996; Steer et al., 1999) that reflect a somatic-affective dimension (Items 1, 2, 10–13, and 15 – 21, including changes in