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

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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.

Keywords

Neuropsychology; comorbidity; ADHD; depression

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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 (e.g., 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, 1981) and attentional performance was measured by the Trailmaking 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 Trailmaking 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, 1961) a self-report measure of depressive symptomatology, and scores on the Wisconsin Card Sorting Test (WCST; Heaton et al., 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 et al., 1987; Errico et al., 1990), as well as non-substance-using participants with depression (e.g., 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 (e.g., Carroll et al., 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 (SAMHSA, 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, 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.

1. Methods

1.1. 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 qualititative 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 (SD=6.61) and mean years of education was 12.9 (SD=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 (SD=8.4), and currently using cocaine 4.5 (SD=1.7) times per week ($282.4/wk [SD=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.

1.2. Design and Procedure

All assessments were conducted in one 2–3 hour 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 minutes 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.

1.3. Measures

Psychiatric Measures—The ADHD Rating Scale-IV (ARS-IV, Murphy & Barkley, 1996) is an 18-item self-report scale that requires participants to rates 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 15-2, including changes in sleep and appetite, loss of energy, fatigue, and crying) and a cognitive dimension of depression (Items 2, 3, 5–9, and 14, including suicidal thoughts, feelings of worthlessness, pessimism, guilt, punishment, and self-dislike).

Neurocognitive measures—Wechsler Adult Intelligence Scale- Third Edition (WAIS-III) Letter Number Sequencing subtest (Wechsler, 1997) assesses working memory capacity, and requires the participant to verbally organize an increasingly difficult string of random numbers and letter in alphabetical and numeric order. The primary dependent measure is the number of strings correctly sequenced.

Repeatable Battery for the Assessment of Neuropsychological Status (RBANS; Randolph, 1998) is a general cognitive screening measure that assesses a number of cognitive functions. Measures of attention and concentration consisted of Digit Span and Coding, and require the participant to repeat an increasingly lengthy string of numbers, and fill in numbers corresponding to a series of symbols. Measures of learning and memory consisted of List Learning, Story Memory, List Recall, Story Recall and Figure Recall, and require the participant to learn and recall word lists, stories and a geometric figure. Measures of visuospatial function consisted of Figure Copy and Line Orientation, and require the participant to copy a geometric figure, and judge the orientation of simple line drawings. Measures of language consisted of Picture Naming and Semantic fluency, and require the participant to generate words from a category quickly and identify pictures. Each subtest is scored separately based on number of items correct, and an overall cognitive score is computed from these scores.

Computerized Wisconsin Card Sorting Task (WCST; Heaton, 2005) assesses abstract concept formation and cognitive flexibility. It requires the participant to match a series of cards with geometric designs with one of four key cards, based on number (1–4), shape (circle, triangle, cross or star) or color (green, yellow, red or blue) over 128 trials. The matching rules are unknown to the participant and covertly shift after 10 consecutive correct responses, with accuracy feedback provided after each trial. The primary dependent measures are the number of categories completed and perseverative errors made.

Stroop Color-Word Test (Golden, 1978) assesses of cognitive control and response inhibition. This task requires the participant to name the color of ink that the names of colors (e.g., Red, Blue and Green) are written in, when the ink color and color-names are mismatched. The primary dependent measure is an interference score that is a ratio between the number of words completed in 45 seconds and baseline rates of color-reading and color-naming.

Trail Making Test (Reitan & Wolfson, 1985) assesses psychomotor speed (Part A) and cognitive flexibility (Part B). Part A requires the participant to quickly connect a series of numbers in ascending order, and Part B requires this as well as connecting a series of letters alphabetically, alternating between numbers and letters. The primary dependent measure is the completion time for each part.

Finger Tapping Test (Heaton et al.,1991) assesses motor speed and requires the participant to tap a key with his or her index finger as rapidly as possible. The primary dependent measure is the mean number of taps with the dominant hand completed within 10 seconds over a maximum of 10 trials.

Grooved Pegboard (Heaton et al., 1991) assesses motor dexterity and speed, and requires the participant to place grooved pegs into matching holes as quickly as possible. The primary dependent measure is the completion time to fill all the holes with the dominant hand.

The order of neurocognitive tasks was counterbalanced across subjects to control for potential order effects. Some participants had difficulty tolerating extensive testing, and therefore did not complete all measures. Additionally, only the composite self-report measure scores were recorded for some participants. Therefore, complete data sets were not available for all participants. The sample size for each neurocognitive measure and composite psychiatric measures are shown in Table 1. Self-report measure subscale scores were available for 71 participants for the ARS-IV and 59 participants for the BDI-II.

1.4. Data Analysis

Neurocognitive test scores were first examined for outliers, which were defined as≥3 SDs above or below the sample mean; all data from 2 participants were excluded from analyses for this reason. In replication of the data analytic strategy of the Horner et al. (1999) study, Pearson bivariate correlations were computed on the sample between total raw scores on the ARS-IV, BDI-II, all of the neurocognitive measures, and cocaine use variables. Pearson bivariate correlations were also computed on the sample between raw scores on the ARS-IV Inattention and Hyperactivity-Impulsivity subscales, the BDI-II Cognitive-Affective and Somatic Subscales, and all of the neurocognitive measures. In light of the nonnormal distribution of scores on some of the neurocognitive measures, all correlations were also recalculated non-parametrically (i.e., Spearman rank order).

To further investigate the relationship between subjective and objective neurocognitive function, first neurocognitive performance was examined as a function of self-reported attentional/depressive symptom scores at the ends of the distributions. Neurocognitive scores on all measures were compared between participants whose self-report scores were in the upper quartile (ARS-IV, n=21; BDI-II, n=23) and those whose were in the lower quartile (ARS-IV, n=21; BDI-II, n=24) of the sample range, via independent samples t-tests. Second, neurocognitively-impaired participants were identified using the criterion of scores≥1.5 SDs[1] below the estimated population mean[2] on two or more of the following measures (Stroop, Letter-Number Sequencing, Trail Making A and B, Finger Tapping, and RBANS Total). Mean scores on the ARS-IV and BDI-II were then compared between these mildly-impaired participants (N=19) and those not considered impaired (N=60), via independent samples t-tests.

2. Results

Mean scores on the composite self-report and neuropsychological measures, as well as their intercorrelations, are presented in Table 1. There was a widespread degree of intercorrelation between neurocognitive test scores, which was not presented for brevity's sake. In comparison to published normative data, mean raw scores on all neurocognitive measures were in the clinically average range, except for the Stroop Color-Word test, which was in the clinically low average range. The mean scores on both the BDI-II and ARS-IV were in the clinically mild range.

Total scores on the ARS-IV were not correlated with scores on neuropsychological tests ($p>0.05$), except for WCST Categories Achieved ($r=-0.26$, $p<0.05$) and Perseverative Errors ($r=0.29$, $p<0.05$), and RBANS Verbal Fluency ($r=-0.23$, $p<0.05$), prior to Bonferroni correction. After Bonferroni correction, no correlations between scores on cognitive tasks and the ARS-IV remained significant ($p>0.003$). This suggests that there was no robust association between the reported frequency of combined attention and hyperactive-impulsive symptoms and neuropsychological test performance. Prior to Bonferroni correction, scores on both the Inattention and Hyperactivity-Impulsivity subscales of the ARS-IV were correlated with scores on WCST Categories Achieved ($r=-0.25$, $p=0.05$; $r=-0.24$, $p=0.06$, respectively) and Perseverative Errors ($r=0.29$, $p<0.05$; $r=0.24$, $p=0.06$, respectively), but not other neuropsychological scores. After Bonferroni correction, no correlations between the ARS-IV subscales and cognitive tasks remained significant ($p>0.003$). Thus, contrary to expectations, reported frequency of only inattention symptoms was not robustly associated with neuropsychological test performance, including tests of attention, nor was the reported frequency of only hyperactivity-impulsivity symptoms associated with performance.

Similarly, scores on the BDI-II were not correlated with scores on neuropsychological tests, except for WCST Categories Achieved ($r=-0.37$, $p<0.003$) and Perseverative Errors ($r=0.29$, $p<0.003$), and RBANS List Learning ($r=-0.27$, $p<0.05$), prior to Bonferroni correction. After Bonferroni correction, the only correlations that remained significant were between

[1]The Horner et al. (1999) study defined impaired as 2 SDs below the population mean; 1.5 SDs was chosen for this study since relatively few participants had at least 2 scores ≥2 SDs below the population mean; these participants were considered "mildly" impaired

[2]Taken from the tests' respective manuals; age-corrected when available

the BDI-II and WCST Categories Achieved and Perseverative Errors ($p<0.003$). This indicates that participants who endorsed an increased intensity of depressive symptoms exhibited poorer performance only on measures of categorization and cognitive flexibility, relative to those who endorsed decreased intensity of depressed symptoms. Prior to Bonferroni correction, scores on both the Cognitive-Affective and Somatic subscales of the BDI-II were mildly correlated with scores on WCST Categories Achieved ($r=-0.30$, $p=0.05$; $r=-0.35$, $p<0.05$, respectively) and RBANS List Learning ($r=-0.33$, $p<0.05$; $r=-0.25$, $p=0.07$, respectively), and moderately correlated with WCST Perseverative Errors (both r's=0.46, $p<0.01$), but not other neuropsychological scores. After Bonferroni correction, these relationships did not remain significant ($p>0.003$). Thus, reported intensity of either cognitive-affective or somatic symptoms was not robustly associated with performance on measures of categorization, verbal learning or cognitive flexibility, or other neuropsychological domains.

Total scores on the ARS-IV and the BDI-II were correlated with each other ($r=0.51$, $p<0.003$), indicating that participants who reported an increased frequency of attentional and hyperactive/impulsive symptoms also reported an increased intensity of depressive symptoms, and vice versa. Additionally, the ARS-IV subscales were correlated with one another ($r=0.80$, $p <0.001$), as were the BDI-II subscales ($r=0.76$, $p<0.001$). These correlations remained significant after Bonferroni correction ($p<0.003$). There were also correlations between the reported amount of money spent weekly on cocaine and scores on WCST Categories Achieved ($r=-0.25$, $p<0.05$) and WCST Perseverative Errors ($r=0.30$, $p<0.05$); however these correlations did not survive Bonferroni correction ($p>0.003$).

When the data were reanalyzed with Spearman correlations (see Table 1) prior to Bonferroni correction, the pattern of results remained similar for correlations between ARS-IV (including subscales) and WCST scores, except there were no longer correlations between ARS-IV and RBANS Verbal Fluency scores ($p>0.05$). For the BDI-II, the pattern of results remained similar for correlations with WCST scores prior to Bonferroni correcction, except that there was no longer a correlation between the BDI-II composite scores and Categories Achieved ($p>0.05$); the subscale correlations remained similar. Further, the correlations between BDI-II scores (composite and subscale) and RBANS List Learning scores decreased in strength. After Bonferroni correction, none of the correlations between the ARS-IV, BDI-II, and neuropsychological test performance remained significant ($p>0.003$), except for the correlation between the ARS-IV and BDI-II ($p<0.003$).

When examining self-report psychiatric measures at the tails of the distribution, participants in the highest quartile on the ARS-IV had a mean score of 22.6 (SD=6.18; non-clinical range), and participants in the lowest quartile on the ARS-IV had a mean score of 0.1 (SD=0.3, non-clinical range). Participants in the highest quartile on the BDI-II had a mean score of 21.5 (SD=7.0; moderate depression range) and participants in the lowest quartile of the BDI-II had a mean score of 0.4 (SD=0.7; minimal symptoms range). Consistent with the correlational analyses, participants in the highest quartile on both of these measures (see Table 2 for ARS-IV data) exhibited a greater score on WCST Perseverative Errors than participants in the lowest quartile ($p<0.05$). No group differences were observed for scores on any other neurocognitive measure ($p>0.05$). This indicates that cocaine users who endorsed relatively increased levels of ADHD-like and/or mood symptoms exhibited decreased performance on a test of cognitive flexibility, but not in other neurocognitive domains, relative to those cocaine users who endorsed relatively decreased levels of these symptoms.

Out of 79 subjects who had complete data on the 6 criterion neurocognitive measures, 19 participants were identified as mildly cognitively impaired. When these participants were compared to the rest of the sample, no group differences were found on ARS-IV scores ($t = -0.37(68)$, $p>0.05$) or BDI-II scores ($t = -0.71$ (77), $p>0.05$). This indicates that cocaine users who met our criteria for mild cognitive impairment did not endorse an increased level of ADHD or mood symptoms than those who did not meet criteria for mild cognitive impairment.

3. Discussion

The results of this study indicated that there was a minimal pattern of association between the frequency of self-reported inattentive, hyperactive/impulsive and depressive symptoms, and performance on a broad range of neurocognitive tests in nontreatment-seeking cocaine users. Further, specific self-report indices of inattention did not correlate with specific measures of attentional performance, inconsistent with our hypothesis that narrowing the scope of the subjective indices would result in a stronger association with objective measures. There was, however, a moderately strong association between self-reported depression and ADHD symptoms. These findings are similar to the results of past studies in users of cocaine and other substances (Beatty et al., 1995; Horner et al., 1999; Shelton & Parson, 1987; Errico et al., 1990) and extended them to a relatively homogenous group of confirmed active cocaine users.

The general absence of correlation between self-reported frequency of ADHD-like behaviors and neurocognitive performance was confirmed by cross-sectional analyses that revealed that neuropsychologically “impaired” participants did not differ from neuropsychologically “intact” participants on self-reported inattention or depression scores. However, correlational analyses did reveal a robust association between BDI-II scores and WCST indices, which was confirmed by cross-sectional analyses comparing participants at the relative extremes of self-reported depressive symptomatology These results indicate a relationship between severity of depressive symptoms symptomatology and cognitive flexibility in cocaine users, consistent with a previous report (Beatty et al., 1995).

The most robust relationship in the present study was between ARS-IV scores and BDI-II scores, suggesting that ADHD-type symptoms and mood symptoms are moderately associated with each other in cocaine users. This relationship has aso been reported previously (Beatty et al., 1995) and extends to subjectively-rated cognitive symptoms other than inattention (Horner et al., 1999). This set of findings is not surprising, given that subjectively-rated inattention and psychomotor disturbance (e.g., fidgetiness) are hallmark symptoms of depressive disorders (APA, 2000). The source of these cognitive complaints in cocaine users, however, does not appear to be cognitive ability per se. Although causality

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cannot be determined in this study, it is possible that increased affective distress influences the subjective appraisal or experience of neurocognitive functioning.

In contrast to prior studies, the present study employed a fairly homogenous population of nontreatment seeking cocaine abusers, and more targeted self-report measures of inattention and hyperactivity-impulsivity. Yet one limitation of the present study was the inclusion of participants with relatively recent cocaine use, a characteristic that has been associated with increased neurocognitive performance (e.g., Woicik et al., 2009), possibly obscuring potential associations between subjective and objective measures. However, the participants' cocaine use patterns may more accurately reflect the use of individuals presenting for substance abuse research or treatment. Further, even participants with relatively greater decrements in neurocognitive performance did not exhibit elevations in self-report measures of inattention and hyperactivity-impulsivity, perhaps consistent with the notion of reduced self-awareness or insight in a subset of cocaine users (e.g., Moeller et al., 2010). Finally, no tests of performance effort were administered. However, the average-range performance of the sample, in combination with the low number of participants classified with cognitive impairment, suggests that this was not a major issue in the current study. Despite these methodological modifications, our study replicated and extended the results of prior studies, and contributed to our understanding of the relationship between subjective and objective neurocognitive measures in non treatment-seeking, active cocaine users.

In summary, self-report measures of inattention, hyperactivity-impulsivity and mood symptoms do not generally appear to be related to objective measures of attention in substance abusers. Thus, despite the ease of administration of self-report measures, they may not be useful screening tools for neuropsychological deficits.

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Table 1

Mean raw scores for the entire sample on neuropsychological and psychiatric measures, and Pearson correlations with the BDI-II and the ARS-IV.

Measure	Mean	SD	r with ARS-IV	rho with ARS-IV	r with BDI-II	rho with BDI-II	n
BDI-II	9.34	8.91	0.51[i]	0.59[i]	------------------	------------------------	89
ARS-IV	8.59	9.42	------------------	------------------------	0.51[i]	0.59[i]	83
Stroop Color-Word Test	36.40	9.28	−0.09	0.05	−0.15	−0.11	91
WAIS-III LNS subtest	9.44	2.27	0.11	0.14	−0.09	−0.07	88
Trail Making Test A	30.90	10.55	0.08	−0.01	−0.02	−0.06	91
Trail Making Test B	81.75	33.09	0.00	0.00	0.00	−0.02	91
WCST Categories Completed	5.38	1.33	−0.26	−0.27	−0.37[i]	−0.16	69
WCST Perseverative Errors	13.72	10.34	0.29	0.29	0.47[i]	0.31	69
Finger Tapping Test	40.47	10.80	−0.08	−0.01	0.00	0.08	88
Grooved Pegboard	81.86	22.34	−0.03	0.05	0.05	0.04	90
RBANS							
List Learning	25.81	4.61	−0.15	−0.14	−0.27	−0.19	86
Story Immediate Recall	15.00	3.74	−0.03	−0.00	−0.08	−0.01	86
Total Recall	23.02	6.77	−0.12	−0.08	−0.11	−0.06	86
Coding	45.42	9.77	−0.00	0.03	0.07	0.06	86
Digit Span	11.05	7.57	0.13	0.18	0.12	−0.05	86
Verbal Fluency	20.10	4.60	−0.23	−0.11	−0.15	−0.05	86

[+] $p<0.10$

$p<0.05$

$p<0.01$

[i] Bonferroni Corrected ($p<0.003$)

Table 2

Comparison of mean raw scores on self-report and neuropsychological measures between participants in the lowest and highest quartiles on the ARS-IV

Measure	ARS-IV Lowest Quartile (n=21)	SD	ARS-IV Highest Quartile (n=21)	SD	t (df)	p-value
BDI-II	4.33	5.69	17.00	7.80	−5.96 (39)	0.00
Stroop Color Word	33.20	10.56	33.90	9.66	−0.22 (38)	0.83
WAIS-III LNS Subtest	8.75	2.49	9.79	2.07	−1.41 (37)	0.17
Trail Making Test Part A	31.30	8.44	32.60	10.01	−0.44 (38)	0.66
Trail Making Test Part B	89.70	41.52	87.25	43.83	0.18 (38)	0.86
WCST: Perseverative errors	11.07	8.00	20.14	11.41	−2.46 (23)	0.02
Finger Tapping Test	38.39	10.92	39.12	9.84	−0.22 (36)	0.83
Grooved Pegboard	82.21	19.12	80.70	11.94	0.30 (37)	0.77
RBANS						
List Learning	26.11	5.12	24.61	4.65	0.92 (34)	0.36
Story Immediate	14.94	3.75	15.78	4.45	−0.61 (34)	0.55
Recall						
Total Recall	22.83	8.93	22.67	5.56	0.07 (34)	0.95
Coding	43.72	8.02	43.94	9.66	−0.08 (34)	0.94
Digit Span	9.67	2.30	14.39	15.80	−1.26 (34)	0.22
Verbal Fluency	20.78	3.75	18.50	4.73	1.60 (34)	0.12

$p<0.05$

$p<0.01$