Brief report

The relation of depression and anxiety to measures of attention in young adults seeking psychoeducational evaluation

B.D. Hill a,b,∗, Todd A. Smitherman b, Russell D. Pella a, Judith R. O’Jile b, Wm. Drew Gouvier a

a Department of Psychology, Louisiana State University, Baton Rouge, LA 70803, USA
b Department of Psychiatry and Human Behavior, University of Mississippi Medical Center/VA, Medical Center, Jackson, MS 39206, USA

Accepted 21 July 2008

Abstract

The relation between mood and attentional functioning in young adults seeking psychoeducational evaluation has not been previously reported. This study examined the relation of self-reported depression and anxiety on attentional abilities among 161 young adults referred for psychoeducational evaluation. Depression and anxiety were measured with the Beck Depression Inventory-II and the State-Trait Anxiety Inventory, respectively. Attentional functioning was assessed using the Trail Making Test, the d2 Test of Attention, the Conners’ Continuous Performance Test, and the WAIS-III Working Memory and Processing Speed Indices. The unique variance accounted for by depression or anxiety was minimal (typically <1.5%); these null results were confirmed by diagnostic subgroup analyses and also after examining the interaction between depression and anxiety. These results suggest that performance on measures of attention within samples of young adults seeking psychoeducational evaluation is minimally related to self-reported depression and anxiety.

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Keywords: Attention; Anxiety; Depression; ADHD; Assessment

1. Introduction

The relation between mood symptoms and performance on neuropsychological tests has been the focus of considerable interest in recent years. While psychiatric populations tend to score below normative levels on a wide variety of neuropsychological measures (Basso & Bornstein, 1999; Burt, Zembar, & Niederehe, 1995; Kindermann & Brown, 1997; Sweet, Newman, & Bell, 1992; Tancer et al., 1990; Veiel, 1997), recent research has suggested that the relation of affective variables to neuropsychological performance is quite variable (Kaufman, Grossman, & Kaufman, 1994; Sherman, Strauss, Slick, & Spellacy, 2000; Rohling, Green, Allen, & Iverson, 2002; Tsushima, Johnson, Lee, Matsukawa, & Fast, 2005). Uncertainty regarding the specifics of this relation may also be due to the fact that few of these studies accounted for the effect of participant effort in their study methodology, with a few notable exceptions (Sherman et al., 2000; Rohling et al., 2002).

* Corresponding author at: Rhode Island Hospital, POB 110 Lockwood Street, Suite 430 Providence, RI 02903. Tel.: +1 401 444 4500;
fax: +1 401 444 6643.
E-mail address: bhill@lifespan.org (B.D. Hill).

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doi:10.1016/j.acn.2008.07.003
In particular, the literature on depressive symptoms as they relate to measures of attention is relatively equivocal. Some researchers have noted a significant relation between depression and impaired attentional performance (Gass, 1996; Ross, Putman, Gass, Bailey, & Adams, 2003; Watari et al., 2006), while others have not (Miller, Faustman, Moses, & Csernansky, 1991; Reitan & Wolfson, 1997; Rohling et al., 2002). By comparison to depression, the contribution of anxiety to cognitive impairment is understudied. Recent studies have suggested that self-reported anxiety symptoms have minimal effects on neuropsychological performance in both healthy (Waldstein, Ryan, Jennings, Muldoon, & Manuck, 1997) and assessment-seeking samples (Smitherman, Huerkamp, Miller, Houle, & O’Jile, 2007). However, there is some evidence suggesting that comorbid depressive and anxiety symptoms may exert a synergistic effect together (Kizilbash, Vanderploeg, & Curtiss, 2002).

Rarely has the relation between affective symptoms and attentional performance been examined in young adults seeking psychoeducational evaluations, despite the fact that young adults constitute a growing population seeking such services (Gallagher, Gill, & Sysco, 2000). The one located study (Morasco, Gfeller, & Chibnall, 2006) did not obtain significant decrements in neuropsychological performance related to depression or anxiety; rather, they reported a non-significant trend toward anxiety being associated with improved performance among a sample of 70 participants. However, this study focused on intellectual and memory functioning and did not address attentional functioning in-depth.

Although previous studies of this genre have focused on general aspects of attention, few have focused on more specific components of attentional functioning such as sustained attention and distractibility, which are highly relevant to ADHD (Barkley, Anastopoulos, Guevremont, & Fletcher, 1991). Prior studies have instead focused on variables more consistent with working memory, interference, and inhibition as well as other cognitive modalities such as memory and processing speed (Spreen & Strauss, 1991; Strauss, Sherman, & Spreen, 2006). Additionally, factor analytic studies have confirmed that attention is not a unitary construct (Shum, McFarland, & Bain, 1990), and many specific tests of attention (such as continuous performance tests, or CPTs) load on individual factors apart from more general tests that tap aspects of attentional functions (Kremen, Seidman, Faraone, Pepple, & Tsuang, 1992; Mirsky, Anthony, Duncan, Ahearn, & Kellam, 1991).

Clinical lore suggests that neurocognitive deficits should be interpreted cautiously when comorbid mood symptoms are present, and many clinicians thus are reluctant to interpret attentional impairments in the presence of depressive or anxiety symptoms (Groth-Marnat, 2000; Sweet et al., 1992). Empirical findings are needed to guide such decisions. The aim of this study was to evaluate the extent to which self-reported depressive and anxiety symptoms predict attentional performance in a young adult sample seeking psychoeducational evaluation after accounting for participant effort. Consistent with negative findings from recent studies focusing on other cognitive domains (O’Jile, Schrimsher, & O’Bryant, 2005; Smitherman et al., 2007), we hypothesized that self-reported symptoms of depression and anxiety would be minimally associated with performance on common measures of attention in the present sample.

2. Method

2.1. Participants

The sample consisted of archival data extracted from adult patients referred for comprehensive psychoeducational assessment to an outpatient mental health clinic located within a large southeastern university. Individuals having an IQ < 70 were excluded from data analysis, as were individuals scoring above 3.29 S.D. from the study sample as per Tabachnick and Fidell (2001), so as to minimize the influence of extreme outliers. These exclusions yielded a final sample size of 246 who had complete data for all variables of interest.

Three symptom validity tests (SVTs) were chosen to assess effort in this sample of 246 participants (see Bianchini, Mathias, & Greve, 2001 for a review of SVTs). Individuals giving insufficient effort during testing were identified and removed from further analysis if they met any of the following criteria: (1) Wechsler Memory Scale-III (Wechsler, 1997b) Auditory Recognition Delayed Index raw score <43 (Langeluddecke & Lucas, 2000), (2) Reliable Digits Score ≤7 (Giffenstein, Baker, & Gola, 1994; Mathias, Greve, Bianchini, Houston, & Crouch 2002), or (3) Mittenberg’s formula (Mittenberg, Theroux-Fichera, Zielinski, & Heilbronner, 1995) discriminant function score >0.21 (Greve, Bianchini, Mathias, Houston, & Crouch, 2003). These criteria identified 85 individuals (35% of sample) as likely not giving effort sufficient to consider their neuropsychological performance valid. These exclusions left a sample of 161 individuals who had passed all measures of effort and response bias.
The mean age of the final sample of 161 was 22.58 years (S.D. = 5.45; range = 17–51); 52.80% of the participants were male. One hundred forty-two were Caucasian, 12 were African-American, 5 were Hispanic, 1 was of Asian descent, and 1 was of Middle Eastern descent. The mean IQ was 106.89 (S.D. = 12.42).

2.2. Psychiatric diagnoses

Axis I diagnoses were made according to DSM-IV criteria (American Psychiatric Association, 2000), determined by the results of comprehensive psychoeducational assessment (including a thorough neuropsychological battery, clinical interview, and personality measures not described here), and confirmed by a licensed clinical neuropsychologist (WDG). The most common primary Axis I diagnoses of the sample were attention-deficit/hyperactivity disorders \( n = 31 \), learning disorders \( n = 24 \), depressive disorders \( n = 19 \), anxiety disorders \( n = 14 \), cognitive disorder NOS \( n = 13 \), amnestic disorders \( n = 5 \), bipolar disorders \( n = 5 \), adjustment disorders \( n = 4 \), and no diagnosis \( n = 41 \); the remaining 5 participants had other primary Axis I diagnoses. Within the above diagnoses, there were 17 secondary diagnoses of anxiety disorders and 9 secondary diagnoses of depressive disorders.

2.3. Materials and procedures

All patients provided informed consent for testing and for the potential use of their data for subsequent research studies. The study was approved by the local institutional review board. Patients were administered the following commonly used measures of attentional functioning as part of a larger neuropsychological battery: the Conners’ CPT (Conners, 1994), the d2 Test of Attention (d2; Brickenkamp & Zillmer, 1998), and the Trail Making Test (TMT A and B; Reitan, 1955). Additionally, the Wechsler Adult Intelligence Scale, 3rd edition (WAIS-III; Wechsler, 1997a) was given to acquire a full scale IQ score and obtain two index scores putatively germane to the attentional construct, the Working Memory Index and the Processing Speed Index.

The Conners’ Continuous Performance Test (CPT) is a computer-administered measure of attentional abilities that requires the participant to respond to all stimuli except the infrequent target stimulus. The Conners’ CPT can be considered an internally driven attentional task as the patient is given few external cues to attend to the stimulus. The Conners’ CPT primarily measures sustained attention and distractibility. It is the CPT used most commonly by clinical neuropsychologists (Rabin, Barr, & Burton, 2005) and reliably differentiates individuals with ADHD from those with mood disorders (Advokat, Martino, Hill, & Gouvier, 2007). Variables of interest were: standard error (S.E.) variability, hit reaction time (RT) block change (Block RT), hit RT SE block change (Block SE), hit RT interstimulus interval change (ISI RT), and hit RT SE interstimulus interval change (ISI SE). The last four variables, in particular, have been found to be sensitive to attentional impairment in ADHD (Aaron, Joshi, Palmer, Smith, & Kirby, 2002).

The d2 Test of Attention (d2; Brickenkamp & Zillmer, 1998) is a paper-and-pencil cancellation task that measures distractability, selective attention, and sustained attention. Although used less frequently than the Conners’ CPT, the d2 is a measure of specific attentional domains with strong psychometric properties (Spreen & Strauss, 1998). The respondent is presented with rows comprised of the letters “d” and “p” with varying numbers of marks surrounding the letters. The respondent is instructed to only mark the letter “d” that has two marks and to ignore all other stimuli. In comparison to the Conners’ CPT, the d2 can be considered an externally driven measure of attentional abilities as the examiner regularly prompts the respondent during the task. The variables of interest were: total number of items processed (TN), omission errors (OE), commission errors (CE), concentration performance (CP), and fluctuation rate of performance (FR).

The Trail Making Test (TMT; Reitan, 1955) is a timed task of rapid visual scanning and sequencing. The TMT part A is a task of rapid visual scanning and processing speed, in which the respondent connects randomly arranged numbers in consecutive order. In Part B, the respondent connects randomly arrange letters and numbers in consecutive order, alternating between numbers and letters. Part B thus measures the ability to alternate rapidly between cognitive tasks and to divide attention (Strauss et al., 2006). Although the TMT has traditionally been viewed as a measure of executive functioning, factor-analytic studies have demonstrated that it shares most of its variance with measures of attention (O’Donnell, McGregor, Dabrowski, Oestreicher, & Romero, 1994). Variables of interest were the \( t \)-scores of completion times for parts A and B.

The Full Scale IQ score and two index scores from the WAIS-III were also included in this study, the Working Memory Index (WMI) and the Processing Speed Index (PSI). While they do not primarily assess pure attentional
ability (Tulsky, Ivnik, Price, & Wilkins, 2003), these indices do measure related constructs and are commonly utilized in psychoeducational assessments, particularly adult ADHD evaluations, as indices of attention/concentration ability. Their inclusion in the present study was based on their indirect relation to the attentional construct and to determine whether other common aspects of the psychoeducational evaluation process are influenced by depressive and anxiety symptoms.

Patients were also administered the Beck Depression Inventory-II (BDI-II; Beck, Steer, & Brown, 1996) and the State-Trait Anxiety Inventory (STAI; Spielberger, 1983) as part of the evaluation procedure. The BDI-II is a 21-item self-report measure of depressive symptoms which asks respondents to rate the severity of symptoms for the past 2 weeks. The STAI is a 40-item self-report measure of general affective, cognitive, and physiological manifestations of anxiety; 20 items inquire about current symptoms (State subscale), and 20 assess more longstanding symptoms (Trait subscale). Though both of these inventories can be considered indices of negative affectivity, factor analytic data support the notion that these measures assess different constructs in young adults (Alzeghoul et al., 2001; Karagozoglu, Masten, & Baloglu, 2005).

All measures were administered in accordance with their standardized protocols. Prior to data analysis, raw scores on the CPT and STAI were converted into norm-referenced t-scores as outlined in their respective manuals (CPT: Conners, 1994; STAI: Spielberger, 1983). Raw scores on the TMT were likewise converted into norm-referenced t-scores using the norms established by Heaton, Miller, Taylor, and Grant (2004). Raw scores on the d2 were converted into norm-referenced scores ($M = 100; S.D. = 10$) as outlined in the d2 manual (Brickenkamp & Zillmer, 1998), and standard scores for the WAIS-III indices were calculated using the WAIS-III manual (The Psychological Corporation, 2002). Higher scores on the TMT, d2, and WAIS indices are indicative of better attentional performance. Higher scores on the Conners’ CPT are associated with poorer attentional performance; likewise, higher scores on the BDI and STAI are associated with increased depression and anxiety symptomatology, respectively. Additionally, as the BDI-II data were positively skewed, a square-root transformation was applied to this variable to normalize it for all further analyses.

2.4. Statistical analyses

To examine relations between measures of attention and self-reported symptoms of depression and anxiety, multiple regression analyses were utilized to determine the amount of unique variance in each criterion measure that the BDI-II and STAI scales individually predicted. Unique variance accounted for is expressed as point estimates of effect sizes (incremental change in $R^2$ values).

3. Results

3.1. Aggregate regression analyses

Table 1 displays the mean scores for the predictor and criterion measures. Although BDI-II and STAI scores were highly correlated with one another ($r$s ranged from 0.55 to 0.71), multicollinearity among regression predictor variables was not of concern because our analytic strategy evaluated the predictive utility of the BDI-II and STAI scores separately. Unique variance accounted for by self-reported depression or anxiety was typically very minimal, as depression or anxiety accounted for less than 1.5% of the variance in scores on almost every measure of attention. The two exceptions were that BDI-II scores accounted for 3.7% of the variance in WAIS-III Processing Speed and that STAI-Trait scores accounted for 2.0% of the variance in d2 CP scores; only the former was statistically significant ($p = .015$) but was rendered non-significant after correcting for multiple comparisons. Unique variance predicted by the BDI-II ranged from 0.000 to 0.037. Unique variance accounted for by the STAI-State ranged from 0.000 to 0.009, while that accounted for by the STAI-Trait ranged from 0.000 to 0.020.

3.2. Secondary analyses

To confirm the above results, we repeated all analyses after separating the sample into subgroups of those with a depressive disorder diagnosis ($n = 23$), those with an anxiety disorder diagnosis ($n = 29$), and those with neither a depression nor anxiety diagnosis ($n = 118$), allowing for overlap between groups in cases where both disorders were diagnosed. Using an interaction between effect-coded subgroup and each affective predictor ($Subgroup \times BDI-II,$...
Table 1  
Mean scores (and standard deviations) for the BDI-II, STAI, and attentional measures

<table>
<thead>
<tr>
<th>Measure</th>
<th>Mean (S.D.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BDI-II</td>
<td>13.42 (9.96)</td>
</tr>
<tr>
<td>STAI-State</td>
<td>56.28 (11.55)</td>
</tr>
<tr>
<td>STAI-Trait</td>
<td>59.45 (11.82)</td>
</tr>
<tr>
<td>WAIS working memory</td>
<td>104.96 (11.89)</td>
</tr>
<tr>
<td>WAIS processing speed</td>
<td>96.99 (12.82)</td>
</tr>
<tr>
<td>TMT A</td>
<td>43.86 (9.94)</td>
</tr>
<tr>
<td>TMT B</td>
<td>46.13 (10.04)</td>
</tr>
<tr>
<td>CPT SE variability</td>
<td>55.13 (11.58)</td>
</tr>
<tr>
<td>CPT Block RT</td>
<td>48.25 (14.00)</td>
</tr>
<tr>
<td>CPT Block SE</td>
<td>53.07 (9.76)</td>
</tr>
<tr>
<td>CPT ISI RT</td>
<td>59.85 (14.33)</td>
</tr>
<tr>
<td>CPT ISI SE</td>
<td>54.02 (10.81)</td>
</tr>
<tr>
<td>d2 total number</td>
<td>87.70 (10.99)</td>
</tr>
<tr>
<td>d2 omissions</td>
<td>103.00 (5.91)</td>
</tr>
<tr>
<td>d2 commissions</td>
<td>105.20 (5.83)</td>
</tr>
<tr>
<td>d2 CP</td>
<td>93.75 (7.68)</td>
</tr>
<tr>
<td>d2 FR</td>
<td>100.88 (7.27)</td>
</tr>
</tbody>
</table>

Note: BDI-II, Beck Depression Inventory-II; STAI, State-Trait Anxiety Inventory; WAIS, Wechsler Adult Intelligence Scale, 3rd Edition; TMT, Trail Making Test parts A and B; CPT, Conners’ Continuous Performance Test; d2, d2 Test of Attention Scores from the STAI, TMT, and CPT represent norm-referenced t-scores as described in the text. Scores from the d2 represent standardized scores with a mean of 100 and a standard deviation of 10.

Subgroup × STAI-State, Subgroup × STAI-Trait), the amounts of variance accounted for were similar to those found in the aggregate sample: Subgroup × BDI-II mean = 0.6%, Subgroup × STAI-State mean = 1.1%, and Subgroup × STAI-Trait mean = 1.4%. These small amounts of unique variance suggest that the previous regression analyses were not differentially influenced by diagnostic status. We also analyzed the aggregate data using an interaction analysis between BDI-II scores and STAI-State scores to assess possible synergistic effects of depression and anxiety. The interaction between BDI-II and STAI-State scores accounted for a mean of 0.8% of variance on the measures of attention.

4. Discussion

Relations between self-reported depressive and anxiety symptoms and specific measures of attentional functioning were examined in a young adult sample seeking psychoeducational assessment. This study improved upon existing literature by utilizing a large sample, taking into account both anxiety and depressive symptoms, excluding participants suspected of giving insufficient effort, and incorporating a variety of attentional measures. Our results suggest that self-reported depressive or anxiety symptoms minimally affect attentional performance in this population. Three lines of evidence support this conclusion: (a) $R^2$ point estimates indicating that self-reported depression and anxiety accounted for less than 1.5% of unique variance on almost every measure of attention; (b) confirmation of these results with diagnostic subgroup analyses; and (c) observation that depression and anxiety exerted minimal synergistic influence. These findings suggest that attentional deficits in this population, when they are observed, are most likely indicative of actual attention problems rather than epiphenomena associated with self-reported symptoms of depression or anxiety.

Previous research using different samples has indicated that self-reported mood symptoms exert minimal influence on tasks of verbal learning (O’Jile et al., 2005) and executive functioning (Smitherman et al., 2007). The present study extends those findings to tasks of attention within a younger sample referred for assessment of educational/learning difficulties. Our results coincide with those of Morasco et al. (2006), who examined the effect of mood on memory and intellectual functioning in a similarly aged assessment-seeking sample. However, our study did not confirm their report of a non-significant trend toward anxiety actually improving neuropsychological performance, perhaps because they did not focus specifically on attention and used a smaller sample.

It is plausible that psychopathology severity, versus the mere presence of symptoms, may account for disruptions in cognitive functioning. While the participants in this study included those who met criteria for an Axis I depressive or anxiety disorder, the sample also included individuals reporting subthreshold symptoms. However, attentional
functioning was unrelated to both symptom severity and diagnostic status in both the aggregate sample and diagnostic subgroups. We also failed to find evidence of any synergistic effect of self-reported depressive and anxiety symptoms. In conjunction with the extant literature (Grossman, Kaufman, Mednitsky, Scharff, & Dennis, 1994; Kaufman et al., 1994; Rohling et al., 2002), the present results challenge the conventional notion that symptoms of depression and anxiety detrimentally impact performance on attention-related measures.

Two limitations of our study are worth noting. First, our sample was comprised primarily of young college students who are likely to be higher-functioning than samples used by other studies of this genre. The present results thus should not be generalized to groups of individuals that differ greatly from the current population of interest, such as older adults or individuals with more severe psychopathology (e.g., inpatients or those with severe depressive or anxiety disorders). Secondly, the attentional measures used here may not be sensitive enough to detect extremely minor changes in cognitive performance that could result from symptoms of depression or anxiety. However, such possible minor changes are unlikely to be clinically significant. Ultimately, neither of these potential limitations greatly weakens the generalizability of our results to the sample of interest—young adults seeking psychoeducational evaluation.

Our incorporation of imbedded SVTs indicated that 35% of our sample was suspected of poor effort. This high percentage is likely a function of our conservative decision to exclude participants who failed any of three SVT indices, but the sheer prevalence of suboptimal effort underscores the need to assess effort in this population. Though our statistical results were similar whether including or excluding individuals giving suboptimal effort, SVTs likely constitute good clinical practice and may clarify the diagnostic picture in cases complicated by the presence of severe mood symptoms.

In summary, the current study has direct relevance to those who field referrals for evaluation of suspect ADHD and learning disorders in young adults. Within this context and population, the present findings indicate that when attentional deficits are observed, they are likely not accounted for by self-reported symptoms of depression or anxiety. Our results suggest that mood-related explanations for attentional impairments observed during psychoeducational evaluations should be entertained with great caution, particularly if such explanations are informed solely by patient self-report.

References


