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Depression in Adults with Attention-Deficit/Hyperactivity Disorder (ADHD): The Mediating Role of Cognitive-Behavioral Factors

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Abstract

Adults with Attention-Deficit/Hyperactivity Disorder (ADHD) are at increased risk for depressive disorders but little is known about the potential cognitive and behavioral mechanisms of risk that could shape treatment. This study evaluated the degree to which cognitive-behavioral constructs associated with depression and its treatment—dysfunctional attitudes and cognitive-behavioral avoidance—accounted for variance in depressive symptoms and disorder in adults with ADHD. 77 adults clinically diagnosed with ADHD completed self-report questionnaires, diagnostic interviews, and clinician-administered symptom rating scales. Statistical mediation analysis was employed and indirect effects assessed using bootstrap analysis and bias-corrected confidence intervals. Controlling for recent negative life events, dysfunctional attitudes and cognitive-behavioral avoidance fully accounted for the variance between ADHD symptoms and depressive symptoms. Each independent variable partially mediated the other in accounting for depression symptoms suggesting overlapping and unique variance. Cognitive-behavioral avoidance, however, was more strongly related to meeting diagnostic criteria for a depressive disorder than were dysfunctional attitudes. Processes that are targeted in cognitive behavior therapy (CBT) for depression were associated with symptoms in adults with ADHD. Current CBT approaches for

ADHD incorporate active coping skills and cognitive restructuring and such approaches could be further tailored to address the ADHD-depression comorbidity.

Keywords

Attention-Deficit/Hyperactivity Disorder (ADHD); Depression; Depressive symptoms; Adults; Cognitive behavior therapy (CBT)

Introduction

Attention-Deficit/Hyperactivity Disorder (ADHD) in adults is associated with chronic impairment in nearly every domain of adult functioning including work performance, relationships, finances and driving (Barkley et al. 2008). The disorder is characterized by age-inappropriate levels of inattention and/or hyperactivity-impulsivity that occur across situations (American Psychiatric Association 2000). This chronic and impairing psychiatric disorder is also associated with increased rates of depressive disorders (Barkley et al. 2008; Kessler et al. 2006; Miller et al. 2007). Prevalence estimates of major depressive disorder (MDD) in samples of adults with ADHD range from 16 to 31 % (Wilens et al. 2008). Conversely, a substantial number of adults with depressive disorders also meet criteria for ADHD. The National Comorbidity Survey Replication estimated that 9.4 % of adults meeting criteria for MDD in the past year and 22.6 % meeting criteria for dysthymic disorder also met criteria for ADHD (Kessler et al. 2006).

Emerging literature indicates that the ADHD-depression comorbidity increases illness severity and functional impairment associated with either disorder alone (Barkley et al. 2008; Judd et al. 2000; Miller et al. 2007). ADHD-depression comorbidity is also associated with predictors of worse depressive outcome including earlier age of depression onset, longer duration of illness, increased symptom severity, and greater functional impairment in young adult women (Biederman et al. 2008). Chronis-Tuscano et al. (2010) found that 18.4 % of children diagnosed with ADHD at age 4–6 experienced recurrent depression by age 18 compared to only 1.6 % of a matched control group. ADHD has also been associated with increased frequency of suicidal ideation and attempts in adolescents and young adults (Biederman et al. 2008; Chronis-Tuscano et al. 2010).

As depression in the context of ADHD is often more severe and impairing, there is also evidence that this comorbidity complicates the treatment of both disorders (Biederman et al. 2008; Wilens et al. 2008). Although there are efficacious medication and psychosocial treatments for depressive disorders, a substantial proportion of patients do not follow through with treatment, do not respond to treatment, or do not experience remission of depressive symptoms (Rush et al. 2006, 2008). Psychiatric comorbidity in general is a key predictor of more treatment-resistant depression (Rush et al. 2008). In particular, symptoms of ADHD—disorganization, forgetfulness, distractibility, and impulsivity—might be expected to interfere with both structured psychosocial treatments for depression and antidepressant medication adherence. The chronic, multi-domain functional impairment associated with ADHD is also a negative predictor of treatment outcome, suggesting that comprehensive treatment approaches for this comorbidity are needed.

Cognitive-behavioral treatments for depression have strong research support for their efficacy (American Psychological Association Division 12 2012). None, however, have been studied in depressed adults with ADHD. Prior to undertaking such a treatment outcome study, it is reasonable to ask whether putative cognitive and behavioral targets in traditional CBT for depression are relevant for depressed adults with ADHD. Unfortunately, there are almost no empirical data on predictors of depression in adults with ADHD despite emerging research on children and adolescents (Chronis-Tuscano et al. 2010). Therefore, the goal of the current study was to evaluate whether CBT-relevant variables—maladaptive cognitions and behavioral avoidance—are related to depressive symptoms and current depressive disorder in a sample of adults with ADHD and whether these factors account for the variance in the relationship between ADHD symptoms and depressive symptoms. These data may establish an empirical basis which supports the use of cognitive-behavioral strategies for depression in this population. Furthermore, the recent development of empirically supported cognitive-behavioral approaches for ADHD (Safren et al. 2010; Solanto et al. 2010) presents the opportunity for a fully integrated treatment for the ADHD-depression comorbidity.

We examined the relationship of maladaptive cognitions and cognitive-behavioral avoidance with depression in adults with ADHD because each has been implicated in the development and maintenance of depression and both are directly targeted in empirically supported CBT approaches. The role of negative cognitions and dysfunctional attitudes in the development, maintenance, risk of recurrence, and treatment of depression is supported by several decades of literature (Beck 2008). Negative cognitive content such as dysfunctional attitudes is thought to reflect the operation of depressogenic self-schemas that shape information processing (Dozois and Beck 2008). One of the primary targets of cognitive therapy for depression is modification of these maladaptive automatic thoughts, dysfunctional attitudes, and core beliefs. Drawing upon the cognitive developmental model of depression, several ADHD researchers have speculated that a lifetime of perceived failure experiences might lead to the development of negative patterns of thinking, thus increasing vulnerability to depression (McDermott 2000; Murphy 2006; Ramsay and Rostain 2003; Safren et al. 2005). Direct empirical support for this hypothesis in children with ADHD has recently been accumulating (McQuade et al. 2011; Ostrander and Herman 2006). In adults, a recent chart review study of 81 patients diagnosed with ADHD found that inattentive symptoms were associated with negative automatic thoughts even after accounting for depression symptom severity, although patients with comorbid ADHD and depression showed even higher levels of negative automatic thoughts than patients with ADHD alone (Mitchell et al. 2013). These findings support further consideration of maladaptive cognitive processes in depression in adults with ADHD.

Behavioral avoidance is also an important factor in the development and maintenance of depression that is targeted by CBT. The behavioral repertoires of depressed adults are characterized by a dominance of avoidance-motivated behavior (Ferster 1973; Lewinsohn 1974). Depressed adults are more likely to respond to a stressor with coping strategies that allow them to escape the stressor and the negative affect it triggers rather than confronting and resolving it (Ottenbreit and Dobson 2004). Not only does avoidance often fail to resolve problems, but it contributes to a narrowing of the patient's range of behaviors, preventing

further access to positive reinforcement (Martell et al. 2001). Adults with ADHD may be particularly likely to rely on avoidant coping because of difficulties with executive functioning, which underlies planning and problem-solving (Barkley 1997; Boonstra et al. 2005). Helping clients re-engage with active coping and regularly scheduled events associated with pleasure and mastery are key strategies of cognitive-behavioral treatments for depression (Beck 1995; Dimidjian et al. 2006). We are not aware of any studies that have directly examined the impact of avoidant coping in the lives of adults with ADHD. We hypothesize that behavioral avoidance will be a key correlate of depression in this group.

The current study evaluated depressive symptoms and diagnoses, maladaptive cognitions, cognitive-behavioral avoidance, and ADHD symptom severity in 77 adults diagnosed with ADHD using both self-report and investigator ratings. We first examined whether ADHD symptoms were related to measures of depression and depressive symptoms and then examined whether depressive cognitions and behavioral avoidance mediated this relationship. Finally, we evaluated whether one cognitive-behavioral variable could account for the effects of the other in their relationship to depressive symptoms and diagnosis. We also measured recent stressful life events because they are an important proximal predictor of major depressive disorder (Mazure 1998) and because adults with more severe ADHD may experience a higher rate of stressful events and failures (Garcia et al. 2012; Müller et al. 2010). We chose to include life events as covariates in our analyses rather than examining them as mediators. Our focus was on treatment-relevant variables and the occurrence of these events is difficult to target directly in psychosocial treatment, which focuses more squarely on coping with such events by modifying thoughts and behaviors. Thus, we examined whether cognitions and avoidance were related to depression above and beyond proximal negative life events.

In sum, we sought to answer the following questions:

1. Is ADHD symptom severity related to current depression symptom severity and SCID-I depression diagnosis in adults with ADHD?
2. Do depressive cognitions and cognitive-behavioral avoidance statistically mediate relationships between ADHD and depression symptoms or diagnoses?
3. Is either factor—dysfunctional attitudes or avoidance—more strongly and uniquely related to depression symptoms or depressive diagnosis in this sample?

Methods

Participants

Seventy-seven adults meeting criteria for current and childhood *DSM-IV* ADHD met all inclusion criteria for the study. 43 % of participants were male and the mean age was 38 years. Self-reported race was 85.7 % White, 6.5 % Multiracial, and 7.8 % did not provide this information. 9 % of the sample reported that they were Hispanic or Latino. Level of education was as follows: 22 % high school diploma or GED, 17 % Associate's or technical school degree, 36 % bachelor's degree, 17 % Master's degree, 8 % doctoral, medical, or law degree. Sixty-six percent of the sample reported working for pay, 13 % reported currently

receiving disability benefits, and 14.5 % reported being unemployed (and not in school) without benefits. 34 % of participants were married or had a cohabiting partner and 25 % had children.

Measures

Diagnostic Interviews—The first author conducted all clinician-administered interviews and data collection using clinician-administered rating scales. To establish ADHD diagnosis in childhood, we used the clinician-administered Kiddie Schedule for Affective Disorders and Schizophrenia (K-SADS) structured interview (Orvaschel 1985). Patients were required to endorse at least 6 of 9 inattentive and/or 6 of 9 hyperactive-impulsive symptoms in childhood with two or more domains of impairment. Previous studies in the Pediatric Psychopharmacology Clinic at Massachusetts General Hospital using the ADHD module of this version of the K-SADS (e.g., Spencer et al. 1995) achieved excellent diagnostic reliability ($\kappa = 1.0$).

To determine whether patients met criteria for current or past depressive disorders, we used the corresponding modules from the research version of the Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I; First et al. 1995). The SCID-I is considered the “gold standard” for clinical diagnoses of depression. Basco et al. (2000) found the SCID-I to have moderate sensitivity of 84 % and moderate specificity of 91 % for Major Depressive Disorder. Zannarini and Frankenburg (2001) found that the SCID-I had excellent inter-rater reliability ($\kappa = .90$), fair to good test–retest reliability ($r = .73$), and excellent follow-up interrater reliability ($\kappa = .93$). Additional modules from the clinician version of the SCID-I were also administered to assess for the presence of comorbid bipolar, psychotic, anxiety, substance use, and eating disorders.

Clinician-Administered Symptom Rating Scales—The Adult ADHD Investigator Symptom Rating Scale (AISRS; Spencer et al. 2010) was used to assess current ADHD symptoms. The presence of at least 6 of 9 inattentive and/or 6 of 9 hyperactive-impulsive symptoms on both this measure and the telephone screen, described below, were required for eligibility. The AISRS requires the clinician to rate severity of each of the DSM-IV symptoms on a 4-point scale from None (0) to Severe (4) and includes suggested prompts for the interviewer to use to obtain the information necessary to rate each item. Evidence of the validity of the AISRS includes high correlations with Conners’ Adult ADHD Rating Scale- Screening Version ($r = .72-.90$) and the Clinical Global Impression-ADHD Severity Scale ($r = .50-.83$; Spencer et al. 2010). The AISRS has high test–retest reliability ($r = .91$), and strong internal consistency ($\alpha = .82-.95$; Spencer et al. 2010). See below for internal consistency in this sample.

The Montgomery-Asberg Depression Rating Scale (MADRS; Montgomery and Asberg 1979) was used to assess the severity of current depressive symptoms with each of 10 items rated on a 7-point scale (0 = none; 6 = extreme). To avoid contaminating this depression measure with ADHD symptoms, the MADRS item assessing concentration difficulties was not included in the total score. The clinician conducting the assessments (LEK) received ongoing supervision and reliability training in the use of the MADRS during the study. The

MADRS is a valid measure (Müller et al. 2003), highly correlated with the Hamilton Depression Rating Scale ($r = .94$), the Research Diagnostic Criteria for depression ($r = .70$), and the Inventory of Depressive Symptomology- Clinician Rated ($r = .81$). The MADRS is also a reliable measure, with high inter-rater reliability ($\kappa = .89-.97$) and internal consistency ($\alpha = .82$) (Bunevicius et al. 2012; Cusin et al. 2010; Montgomery and Asberg 1979). Internal consistency of both the AISRS and MADRS in this sample was good ($\alpha = .84-.85$).

Stressful Life Events—Stressful life events were assessed using an interview version of the Psychiatric Epidemiological Research Institute (PERI) Life Events Inventory (Dohrenwend et al. 1978). The PERI assesses the occurrence of 102 stressful life events in 10 domains during the past year. Each event has a weighted score and valence based on ratings from a normative sample. This interview measures the occurrence of recent discrete life events and therefore is not a multi-item scale in which items tap a theoretical construct. Therefore, internal consistency for this measure is not reported. In the current study, as expected, score for negative life events in the past year was significantly correlated with both measures of depressive symptoms (Table 1), providing evidence of criterion validity. Total negative event score was used as a covariate in all mediation analyses.

Self-report Questionnaires—Current ADHD symptom severity was assessed using the Current Symptoms Scale (CSS; Barkley and Murphy 2006), which asks participants to rate the frequency of each of the *DSM-IV* items on a four-point scale (0 = Never or Rarely; 3 = Very Often). Recent data from the CSS, now published as the Barkley Adult ADHD Rating Scale-IV (BAARS-IV; Barkley 2011), indicates that the total ADHD symptom score on this measure achieved excellent internal consistency ($\alpha = .91$) and good test-retest reliability ($r = .75$ across 2–3 weeks). The scale showed good convergent validity with an interview-based measure of *DSM-IV* ADHD symptoms ($r = .85-.87$) and evidence of criterion validity, significantly correlating with adverse outcomes in a variety of domains (Barkley 2011). Internal consistency in our sample was good ($\alpha = .86$).

Current depressive symptom severity was assessed using the 21-item Beck Depression Inventory (BDI; Beck et al. 1961). The BDI is highly correlated with clinical ratings of depression ($r = .72$) and has strong concurrent validity when compared to other scales measuring depression in clinical samples, such as the Hamilton Rating Scale for Depression ($r = .73$), the Zung Self-Reported Depression Scale ($r = .76$), and the Minnesota Multiphasic Personality Inventory Depression Scale (Aalto et al. 2012; Beck et al. 1988). Internal consistency ($\alpha = .87$) was also strong for the BDI (Beck et al. 1988). In the current study, internal consistency of the BDI was excellent ($\alpha = .92$). Depressogenic beliefs were measured using the 40-item version of the Dysfunctional Attitudes Scale (DAS; Beck et al. 1991). Participants rate each belief statement on a Likert scale from Totally Agree to Totally Disagree. Lower scores on the DAS represented greater agreement with dysfunctional beliefs. The DAS is a valid measure, having good correlation with the Research Diagnostic Criteria standards for diagnosis of clinical depression with 73 % of participants with high DAS scores also receiving an independent RDC diagnosis (Nelson et al. 1992). Internal consistency of DAS is high ($\alpha = .86-.94$) and the scale also has good test-retest reliability,

ranging from $r = .71$ to $.81$ (Nelson et al. 1992; Weissman and Beck 1978). Internal consistency for the DAS in this study was excellent ($\alpha = .94$).

Avoidance was measured using the Cognitive-Behavioral Avoidance Scale (CBAS; Ottenbreit and Dobson 2004). Participants read 31 statements describing ways that a person might deal with situations and problems in their lives and rate them according to how true the statement is for how they themselves typically respond (1 = Not at all true for me; 5 = Extremely true for me). Ottenbreit and Dobson (2004) found that the total CBAS score showed good psychometric properties including high internal consistency ($\alpha = .91$) and test-retest reliability ($r = .92$). The scale also showed reasonable convergent validity with other measures of coping styles ($r = .30-.63$) and criterion validity, correlating with measures of depression and anxiety symptoms ($r = .48$ and $.58$, respectively). Internal consistency of the CBAS in this sample was excellent ($\alpha = .94$).

Procedure

All study procedures were reviewed and approved by the Institutional Review Board at Massachusetts General Hospital.

Inclusion and Exclusion Criteria—Inclusion criteria for the study were: (1) prior diagnosis of ADHD from an outside provider, (2) 18–65 years old, (3) endorsed at least 6 of 9 inattentive symptoms and/or 6 of 9 hyperactive-impulsive symptoms as well as impairment from symptoms before age 12 and current impairment on a telephone screen version of the Diagnostic Interview Schedule for Children (DISC; Shaffer et al. 1997) ADHD module, (4) met criteria for ADHD in childhood based on retrospective report on the K-SADS (Orvaschel 1985), (5) endorsed at least 6 of 9 current inattentive symptoms and/or 6 of 9 current hyperactive-impulsive symptoms on the AISRS (Spencer and Adler 2004). Exclusion criteria were (1) major sensory or motor impairment, (2) major neurological condition, (3) current psychotic disorder, pervasive developmental disorder, mental retardation, or any history of bipolar disorder, (4) inability to complete interviews and self-report questionnaires in English. Of 85 participants who initially passed the telephone screening and attended the study visit, 8 were subsequently excluded for the following reasons: 5 did not meet childhood ADHD criteria on the K-SADS, 1 did not meet the current ADHD symptom threshold, 1 was found to have a psychotic disorder, and 1 was found to have a history of bipolar disorder.

Recruitment—Participants were recruited using the following methods: referrals from other providers and research centers in the health system where the research was conducted, invitations to eligible participants who had participated in previous ADHD studies in our research program, invitations to patients from a database who had previously expressed interest in ADHD research, and internet advertisements on Craigslist.

Screening and Study Visit—Upon contacting the study, participants completed the DISC (Shaffer et al. 1997) telephone screening supplemented by additional questions addressing inclusion and exclusion criteria listed above. Telephone screens were conducted by the first author or a research assistant under her supervision. Participants who passed the

screening were scheduled for a three-hour visit at the research clinic. Participants first completed informed consent procedures and signed the approved consent form. Next, the clinician administered the K-SADS and AISRS structured interviews followed by the PERI Life Events Scale and the SCID-I depressive disorder modules and other applicable modules. This was followed by the MADRS and the Columbia Suicide Severity Rating Scale (Posner et al. 2008). In a few cases, it was necessary to complete up to 30 min of interview measures over the telephone after a participant's visit due to time constraints. Self-reports were programmed using the Questionnaire Development System software so that participants completed all self-report questionnaires on a laptop computer. Participants received \$25.00 and validated parking for attending the visit. In addition, they were provided with information about resources for adults with ADHD, treatment referrals if appropriate, and an optional letter to a treatment provider of their choice outlining the diagnostic impression from the research assessment.

Results

Plan of Analysis

First, measures were examined to assess suitability for parametric analysis and bivariate correlations were examined to assess whether relationships warranted regression and mediation analysis (Table 1). Next we conducted statistical mediation analysis. It is important to note that, given our cross-sectional data, our analyses identify statistical mediators that are potential mediators of change over time that require verification using longitudinal data. To conduct mediation analyses, we used methods developed by Hayes (2009) that are increasingly preferred over the methods of Baron and Kenny (1986), the latter of which do not directly test the significance of the indirect effect of the independent variable on the dependent variable via the proposed mediator. We employed the modeling tool PROCESS for SPSS (Hayes 2012), which enabled us to assess multiple mediation for continuous (MADRS, BDI) or dichotomous (SCID-I current diagnosis) outcomes. Indirect effects were assessed by examining bias-corrected confidence intervals from bootstrap analysis with 10,000 resamples. The statistical test for indirect effects in this method involves examining whether resulting confidence intervals include zero. Negative stressful life events in the past year (PERI) were included as a covariate in all analyses. Gender was not correlated with any independent variables, dependent variables, or covariates in our models. Furthermore, when participant gender was included as a covariate in each analysis it did not change the pattern of results and was therefore not considered further.

Main analyses were repeated for pairs of ADHD symptom and depression measures (self-report: CSS and BDI; investigator rating: AISRS and MADRS, AISRS and SCID-I Current Diagnosis). We first evaluated whether ADHD symptoms were significantly related to depression by examining bivariate correlations (Table 1). If so, we next examined whether dysfunctional attitudes (DAS) and behavioral avoidance (CBAS) mediated each relationship between ADHD symptoms and depressive symptoms. Finally, we assessed dysfunctional attitudes and behavioral avoidance by examining whether each fully mediated the direct effect of the other.

Preliminary Analyses

Of the 77 eligible participants, complete data were available across all measures for 74. Descriptive statistics for model variables are displayed in Table 1. All variables conformed to normality assumptions as evidenced by skewness and kurtosis values greater than -1 and less than 1 . Bivariate correlations (Table 1) between variables indicated small to moderate relationships supporting further mediation analyses for selected ADHD and depressive symptom measures.

Sample Clinical Characteristics

From the K-SADS, 32 participants (42 %) met criteria for ADHD-Combined type in childhood with 42 participants (55 %) meeting criteria for the Predominantly Inattentive subtype in childhood. Consistent with prior research, only a small minority of participants met criteria for the Predominantly Hyperactive-Impulsive subtype (3 participants; 4 %). Age at ADHD diagnosis varied widely with only about one-third of the sample (32.5 %) receiving their diagnosis in childhood or adolescence. The median age at first diagnosis was 28. This is consistent with the age range of the sample and the lack of availability of ADHD diagnosis and treatment for adults prior to the late 1990s.

About half the sample (52 %) reported a history of both medication and psychosocial treatment for ADHD. Of the remaining participants, 38 % reported a history of medication treatment only, about 5 % reported psychosocial treatment only, and 5 % reported no ADHD treatment history. 78 % of participants for whom current medication data were available (74 participants) were taking some kind of psychotropic medication. 54 % were taking stimulant medication and 41 % were taking an antidepressant either alone or in combination with other medications. Of all participants, 35 % were taking a stimulant, 19 % both a stimulant and an antidepressant, 18 % an antidepressant but no stimulant, and 7 % atomoxetine (Strattera).

At the time of the study, 44 % of the sample met criteria for a current depressive disorder on the SCID-I. Of these, 16 met criteria for Major Depressive Disorder, 4 met for MDD-In Partial Remission, 4 met for Dysthymic Disorder, and one participant each met for Depressive Disorder NOS and Adjustment Disorder with Depressed Mood. Only a minority of participants (18 %) were free of lifetime depressive disorder with over half of participants (53 %) experiencing Recurrent Major Depressive Disorder. 25 % of participants experiencing Major Depressive Disorder reported >10 episodes in their lifetime. Consistent with other studies of rates of suicide attempts in people with Major Depressive Disorder (Chen and Dilsaver 1996), 17 % of those with lifetime SCID depressive disorder reported past suicide attempts or interrupted attempts on the standardized Columbia Suicide Severity Rating Scale (Posner et al. 2008). Across the entire sample, mean MADRS and BDI scores (Table 1) reflected mild-to-moderate severity of current depressive symptoms.

Of those with complete data for SCID-I non-depressive disorders ($n = 74$), it is notable that 58 % of the sample met criteria for at least one current comorbid anxiety disorder. The most prevalent diagnoses were GAD (26 participants), specific phobia (13), and social phobia

(12) followed by OCD (6), PTSD (3) and panic disorder (3). Only 5 % of the sample met criteria for a current substance use disorder but 42 % had a history of substance use disorder.

Dependent Variable: Depression Symptoms

Investigator-Rated Measures—Investigator-rated ADHD symptoms (AISRS) were moderately correlated with investigator-rated depression symptoms (MADRS; Table 1). In a mediation analysis with negative life events as a covariate (top half of Fig. 1), dysfunctional attitudes and cognitive-behavioral avoidance fully mediated the relationship between ADHD and depressive symptoms, as evidenced by a non-significant direct effect of AISRS on MADRS in this model, $b = 0.14$, $t = 1.58$, $p = .118$. The bias-corrected confidence interval for the indirect effect via DAS did not include zero, 95 % CI [.011, .187] while the parallel indirect effect for CBAS did include zero, 95 % CI [−.008, .134]. However, these indirect effects did not differ significantly from one another, 95 % CI [−.072, .142]. Thus, in this analysis, dysfunctional attitudes and cognitive-behavioral avoidance appear to mediate the relationship between investigator-rated ADHD and depression symptoms, although DAS may make a more reliable contribution. We next considered DAS and CBAS as possible mediators of one another in their relationship to depressive symptoms (bottom half of Fig. 1; note that only the analysis with CBAS as the mediator is depicted). Each measure was a partial mediator of the other when MADRS score was the dependent variable. When CBAS was considered as a mediator of the relationship between DAS and MADRS, the confidence interval for the estimate of its indirect effect did not include zero, 95 % CI [−.044, −.003] and the direct effect for DAS remained significant, $b = -0.06$, $t = -2.78$, $p = .006$. Similarly, when DAS was considered as a mediator of the relationship between CBAS and MADRS, the CI for the estimate of its indirect effect did not include zero, 95 % CI [.007, .080] and the direct effect for CBAS remained significant, $b = 0.09$, $t = 2.46$, $p = .017$.

Self-report Measures—ADHD symptoms (CSS) were correlated with self-reported depression symptoms (BDI). In a mediation analysis with negative life events as a covariate (top half of Fig. 2), dysfunctional attitudes and cognitive-behavioral avoidance again fully mediated the relationship between ADHD and depressive symptoms, as evidenced by a non-significant direct effect of CSS on BDI in this model, $b = 0.04$, $t = .38$, $p = .703$. The bias-corrected confidence interval for the indirect effect via DAS did not include zero, 95 % CI [.006, .223] and the parallel indirect effect for CBAS also did not include zero, 95 % CI [.012, .314]. These indirect effects did not differ significantly from one another, 95 % CI [−.235, .075]. When DAS and CBAS were considered as possible mediators of one another in relation to depressive symptoms (bottom half of Fig. 2), each measure again was a partial mediator of the other with BDI as the dependent variable. When CBAS was considered as a mediator of the relationship between DAS and BDI, the CI for the estimate of its indirect effect did not include zero, 95 % CI [−.084, −.012] and the direct effect for DAS remained significant, $b = -0.07$, $t = -2.82$, $p = .006$. When DAS was considered as a mediator of the relationship between CBAS and MADRS, the CI for the estimate of its indirect effect did not include zero, 95 % CI [.008, .096], and the direct effect for CBAS remained significant, $b = 0.20$, $t = 5.08$, $p < .001$.

In sum, across two different methods of symptom measurement, dysfunctional attitudes and cognitive-behavioral avoidance together fully accounted for the observed relationship between ADHD symptom severity and depression symptom severity in this sample of adults with ADHD. In addition, each appears to only partially mediate the other suggesting that each factor contributes both unique and shared variance in the association with depression symptom severity.

Dependent Variable: Current Depressive Disorder Diagnosis

Investigator-Rated Measures—Investigator-rated ADHD symptoms (AISRS) were significantly correlated with SCID-I current depressive disorder diagnosis (Table 1). In a mediation analysis using logistic regression with negative life events as a covariate and DAS and CBAS as mediators (top half of Fig. 3), the direct effect of AISRS on depression diagnosis was not significant, $z = 0.82$, $p = .411$. However, the bias-corrected confidence intervals for the indirect effect via both DAS and CBAS included zero, 95 % CI $[-.019, .048]$ and 95 % CI $[-.008, .076]$, respectively. When considering DAS and CBAS as possible mediators of one another in the relationship with depressive diagnosis (bottom half of Fig. 3), CBAS fully mediated the relationship of DAS to SCID-I depression diagnosis. With CBAS as a mediator, the direct relationship between DAS and SCID-I was not significant, $z = -1.09$, $p = .276$, and the CI for the estimate of the indirect effect of CBAS did not include zero, 95 % CI $[-.023, -.003]$. However, when DAS was considered as a mediator of the relationship between CBAS and SCID-I diagnosis, the CI for the estimate of its indirect effect included zero, 95 % CI $[-.003, .020]$ and the direct effect for CBAS remained significant, $z = 3.14$, $p = .002$.

Self-report Measures—Because self-reported ADHD symptoms (CSS) were not significantly related to SCID-I depression diagnosis (Table 1), we did not examine CBAS and DAS as mediators of this non-significant relationship.

In sum, the results for models of current SCID-I depressive disorder diagnosis contrasts with those for current depressive symptom severity. ADHD symptoms were not as consistently related to current SCID-I diagnosis as they were to current depressive symptom severity. In addition, CBAS and DAS did not mediate the relationship between investigator-rated ADHD symptoms and SCID-I depression diagnosis. Finally, cognitive-behavioral avoidance fully mediated the observed relationship between dysfunctional attitudes and current depressive disorder diagnosis.

Discussion

We found that, across methods of measurement, ADHD symptom severity was correlated with depressive symptoms in adults clinically diagnosed with ADHD and that this relationship was fully mediated by dysfunctional attitudes and behavioral avoidance. Maladaptive cognitions and avoidant behavior accounted for overlapping and unique variance in depressive symptoms; however, avoidance fully mediated the relationship between cognitions and depressive diagnosis suggesting that it bore a stronger relationship to whether adults with ADHD in this sample had comorbid depression. These data support the idea that well-studied cognitive-behavioral processes in the development of depression

are relevant to adults with ADHD and that depression is not merely a product of increased rates of stressful life events in these patients' lives.

Our results have implications for the treatment of depression in the context of ADHD. First, it is important to note that even within a group of adults meeting diagnostic threshold for ADHD, severity of ADHD symptoms was significantly correlated with severity of current depressive symptoms. Comprehensive treatment of ADHD symptoms may have an important downstream impact on mood symptoms and risk for comorbid mood disorder. Yet our results also support directly targeting depressogenic cognitive and behavioral processes.

Notably, the relative importance of dysfunctional attitudes and cognitive behavioral avoidance differed depending on whether the outcome of interest was symptom severity versus meeting diagnostic criteria for a depressive disorder. Both dysfunctional attitudes and cognitive-behavioral avoidance mediated the relationship between ADHD symptoms and depressive symptoms; however, avoidance fully mediated the effects of dysfunctional attitudes on depression diagnosis (Fig. 3, bottom half). Struggling with more severe ADHD symptoms may contribute to the development of negative self-schemas and increase the actual occurrence and salience of failure experiences, contributing to depressive symptoms. At the same time, ADHD symptoms may initially contribute to a more avoidant cognitive and behavioral style that becomes more pervasive and impairing as depressive symptoms worsen. If these results are reliable, they support focusing on both modification of dysfunctional attitudes and establishment of active coping patterns in adults with ADHD who are at-risk for depression or have elevated levels of depressive symptoms. However, as symptom severity increases to the level of meeting criteria for comorbid depression, the therapeutic focus may need to shift to more heavily emphasize behavioral activation and active coping strategies.

Our data suggest that two key processes relevant to treating depression from a cognitive-behavioral perspective are also important correlates of depression in adults with ADHD and may be key to the translation of ADHD into risk for depression. Prospective studies of depression in adult ADHD will be needed to further evaluate the causal nature of these relationships. However, given that: (1) only a few studies have examined predictors of risk for depression in people with ADHD (2) many of these studies focus on processes in childhood, and (3) identified predictors are often very hard to modify directly in treatment (e.g., stressful life events), our results may be the first empirical data obtained in clinically diagnosed adults that can guide clinicians in designing treatment for the ADHD-depression comorbidity.

Of course, our data are entirely consistent with current CBT approaches for depression, which begs the question of whether specialized approaches are really necessary for depressed adults with ADHD. This question could only truly be addressed by a treatment outcome study. However, evidence in the literature suggesting that depression in adults with ADHD may be more treatment-resistant (Biederman et al. 2008; Wilens et al. 2008) combined with the recent development of promising CBT approaches for ADHD supports pilot work on a tailored approach to the ADHD-depression comorbidity. A marriage between CBT for depression and CBT for ADHD is likely to be a happy one, as ADHD

treatment approaches with the most empirical support incorporate skills that address both active coping and adaptive thinking (Safren et al. 2010; Solanto et al. 2010) and some of the strategies employed may be identical (e.g., problem-solving, cognitive restructuring). Importantly, a combined approach should integrate modifications to such “standard” interventions in CBT for depression that accommodate the executive functioning difficulties experienced by adults with ADHD.

Additional attention to unique features of ADHD in the further development of CBT will also be necessary. For example, future studies should more thoroughly examine the presence and role of overly *positive* yet maladaptive automatic thoughts in adults with ADHD. Mitchell et al. (2008), for example, found that severity of ADHD symptoms predicted such overly optimistic thoughts over and above depressive symptoms and a measure of this construct has recently been developed (Anastopoulos et al. 2012). We have elsewhere speculated that overly positive thoughts may precipitate or correlate with avoidance behavior and failure to use compensatory skills (Knouse and Safren 2011). Thus, the client may need to learn to recognize these overly optimistic thoughts (i.e., “red flag thoughts”) as cues for cognitive reappraisal and active coping. Importantly, future studies of depression in ADHD should also examine this construct.

Additional directions for future research include more extensive investigation of possible links between ADHD and suicidality and also the relationship between ADHD subtypes and depression. More extensive exploration of links among ADHD, depression, and suicidality is particularly important given recent findings that identify an elevated risk of mortality by suicide among children diagnosed with ADHD and followed longitudinally to adulthood (Barbarese et al. 2013). In our sample of adults with ADHD, the percentage of participants with a history of depressive disorders who reported past suicide attempts was comparable to that found in general samples of people with depression (Chen and Dilsaver 1996). Yet there may be unique predictors of suicide risk in adults with ADHD that could be the target of prevention efforts. In addition, future studies should more thoroughly examine the relationship between depression and symptom dimensions of ADHD in adults (i.e., inattentive vs. hyperactive-impulsive) and future studies should include measures of sluggish cognitive tempo (SCT; Barkley 2012), as this dimension in particular may have unique relationships with risk for internalizing disorders (Bauermeister et al. 2012).

Limitations of our study must of course be noted. First, we were not able to obtain collateral reports of our patients’ ADHD and depressive symptoms, which would have provided a third source of data upon which to evaluate our hypotheses. Although self-reported ADHD symptoms in self-referred, clinically diagnosed adults tend to be more severe than ratings made by others these ratings are nonetheless reasonably correlated (e.g., .59–.77; Barkley et al. 2011) and, in a recent study, disparity was not associated with comorbid depression symptoms (Barkley et al. 2011). Therefore, we would predict similar relationships if collateral symptom reports were used and future studies should examine this question directly. Second, although we used standardized instruments and the clinician was trained and experienced in the use of these instruments, we were not able to obtain inter-rater reliability data for the clinician-administered measures due to resource limitations during the study. Although internal consistencies for multi-item measures were good we cannot rule

out the possibility that some non-significant relationships with investigator rated measures could be due to less reliable measurement of constructs. Future studies should employ multiple raters and measures of inter-rater reliability. Finally, as mentioned above, future prospective and treatment outcome studies will be needed to more fully evaluate the causal nature of the relationship between CBT-related constructs and depressive outcomes in adults with ADHD.

The current study underscores the importance of cognitive-behavioral processes in adults with ADHD at risk for developing depression or already experiencing a full-blown depressive disorder. Primary intervention targets for adults with the ADHD-depression comorbidity should include adequate treatment of ADHD symptoms, restructuring of maladaptive cognitions, and helping clients to learn, apply, and maintain active coping and engagement with activities associated with pleasure and mastery. Emerging skills-based cognitive-behavioral interventions for adult ADHD already include many of these elements and could be adapted to more directly address depressogenic cognitions and behavioral patterns. Finally, we recommend that clinicians working with adults presenting with either diagnosis carefully assess for the presence of the other disorder—particularly in adults who came of age before ADHD in adults was widely recognized. While this study verified that key cognitive and behavioral correlates of depression are also important to understanding the disorder in adults with ADHD, future research may also identify unique predictors that would help to further tailor treatment for this population.

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Fig. 1. Models with investigator-rated depressive symptoms (MADRS) as the dependent variable. *Top half* depicts multiple mediation analysis. *Bottom half* depicts mediation model with dysfunctional attitudes (DAS) as the independent variable and cognitive-behavioral avoidance (CBAS) as the mediator. Models with the role of these variables reversed described in-text

Fig. 2.

Models with self-reported depressive symptoms (BDI) as the dependent variable. *Top half* depicts multiple mediation analysis. *Bottom half* depicts mediation model with dysfunctional attitudes (DAS) as the independent variable and cognitive-behavioral avoidance (CBAS) as the mediator. Models with the role of these variables reversed described in-text

Fig. 3. Models with current depressive disorder diagnosis (SCID-I) as the dependent variable. *Top half* depicts multiple mediation analysis. *Bottom half* depicts mediation model with dysfunctional attitudes (DAS) as the independent variable and cognitive-behavioral avoidance (CBAS) as the mediator. Models with the role of these variables reversed described in-text

Table 1

Means, standard deviations, and zero-order correlations for model variables

	<i>M</i>	<i>SD</i>	1	2	3 ^a	4	5	6	7
1. MADRS	13.13	7.83	–						
2. BDI	12.28	9.25	.75**	–					
3. SCID-I Dep Dx ^a	–	–	.54**	.64**	–				
4. AISRS	30.48	9.30	.44**	.32*	.29*	–			
5. CSS	26.87	8.74	.23	.25*	.21	.73**	–		
6. DAS	143.76	37.52	-.41**	-.44**	-.26*	-.38*	-.28*	–	
7. CBAS	68.45	22.54	.40**	.59**	.47**	.24*	.27*	-.34*	–
8. Neg. life events	1,252.23	818.82	.41**	.25*	.20	.31*	.09	-.10	.12

Significance values represent two-tailed tests. *MADRS* Montgomery-Asberg Depression Rating Scale, *BDI* Beck Depression Inventory, *SCID-I Dep Dx* SCID-I Current Depressive Disorder (yes/no), *AISRS* Adult ADHD Investigator Symptom Rating Scale, *CSS* Current Symptoms Scale (ADHD), *DAS* Dysfunctional Attitudes Scale, *CBAS* Cognitive-Behavioral Avoidance Scale

* $p < .05$;

** $p < .001$

^aCorrelations for this dichotomous measure are Spearman rank-order correlations, all others Pearson