Article

Feasibility, Acceptability, and Effectiveness of a New Cognitive-Behavioral Intervention for College Students with ADHD

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Abstract

Objective: This purpose of this study was to assess the feasibility, acceptability, and effectiveness of a new group cognitive-behavioral treatment (CBT) to enhance executive function (EF) in college students with ADHD. **Methods:** Eighteen students meeting rigorous DSM-5 criteria for ADHD were enrolled in two nine-member groups. The treatment targeted time-awareness, distractibility, procrastination, and failure to plan, and included strategies to facilitate academic EF skills. **Results:** Eighty-four percent of students attended nine or more of the 12 weekly sessions. Repeated measures analyses of change from pre- to posttreatment yielded improvement in clinician- and self-ratings of DSM-5 ADHD inattentive symptoms, with robust effect sizes. Also improved were scores on standardized scales of time-management, concentration, and total EF. **Discussion:** Results provide support for the feasibility, acceptability, and effectiveness of a CBT program in reducing inattentive symptoms and enhancing EF in college students with ADHD, and warrant investigation on a larger scale.

Keywords

ADD/ADHD, cognitive behavioral therapy, college students, executive function

ADHD is a serious clinical disorder, affecting an estimated 8% of school-aged children in the US (Faraone et al., 2003). Nationwide, 4.4% of adults meet full criteria for diagnosis (Kessler et al., 2006). Longitudinal follow-up studies of children with ADHD have extensively documented impairment in academic, occupational, social, and emotional domains of functioning in adulthood (Barkley, 2002; Garcia Murillo et al., 2016; Kessler et al., 2006; Mannuzza et al., 1998; Weiss & Hechtman, 1993). In addition to completing fewer years of education, adults with ADHD have higher rates of unemployment and under-employment (Barkley, 2002). As a result, they have a lower standard of living than those without ADHD, even after controlling for educational differences (Klein et al., 2012). Adults with ADHD are also more likely to suffer from comorbid emotional disorders, including anxiety disorders (38.5%), mood disorders (47.1%) and substance/alcohol abuse (15.2%) (Kessler et al., 2006). A recently published follow-up of children with ADHD documented that negative health behaviors that are more prevalent in ADHD, including smoking, use of alcohol, poor sleep and eating habits, and risky driving, are associated with a reduction in estimated life expectancy of 8.4 years in young adulthood (Barkley & Fischer, 2019).

ADHD has a pronounced negative impact on the academic performance and emotional well-being of college students (Ramsay & Rostain, 2015b; Thomas et al., 2013). A national survey of 54,497 undergraduates on 98 US post-secondary campuses found that 8.6% reported having ADHD (American College Health Association, 2019). More formal prevalence studies indicate that 3% to 6% of college students exhibit significant symptoms of ADHD and that 4% meet strict DSM symptom criteria (Ramsay & Rostain, 2006). Significant academic impairment is evident in findings that college students with ADHD withdraw from more college courses (Advokat et al., 2011), have lower Grade Point Averages (GPAs) (Advokat et al., 2008, 2011; Blase et al., 2009) are more likely to be placed on academic probation (Heiligenstein et al., 1999), and are less likely to graduate from college (Barkley et al., 2006). Impairment and distress related to ADHD symptoms in college likely contribute to long-term occupational impairment, as described for adults. Furthermore, the negative socio-emotional outcomes reported for adults with ADHD accrue during the college years, as evidenced in higher rates of anxiety and depression for college students with

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ADHD than their peers without ADHD (Anastopoulos et al., 2016; Blase et al., 2009), approaching levels seen in adults.

Executive Dysfunction in College Students with ADHD

Executive dysfunction has been found to be a strong concurrent predictor of impairment in academic performance in children and adolescents with ADHD (Biederman et al., 2004) as well as a predictor of impairment in occupational functioning in adults with ADHD (Barkley & Murphy, 2010). The developmental tasks of emerging adulthood (typically age 18–24 years) require that young adults begin to take on many of the executive self-management tasks and responsibilities formerly implemented, supervised or cued by parents or teachers. These include: daily routines of self-care; planning and structuring time to meet deadlines for assignments and papers; organizing and keeping track of belongings; and managing money independently (Arnett, 2000). The problems associated with this transition to independent functioning are exacerbated for the student with ADHD whose executive self-management functions are less likely to have matured from either the experiential or neurological perspectives (Fleming & McMahon, 2012; Ramsay & Rostain, 2006). Without the structure and supports formerly provided by parents and teachers (which may have enabled them to gain admission to college), students with ADHD typically manifest difficulties in time-management, resulting in: procrastination; poor planning; missed deadlines; inadequate, incomplete, or inaccurate work; tardiness or non-attendance at class; and inefficiency. Similarly, problems of organization result in repeated loss or misplacement of items and a disorderly work- and personal space. Furthermore, the social context of college provides much greater salience of, and access to, immediate rewards (such as those associated with partying, using alcohol and drugs, or using social media), which may result in increased choices for those activities in preference to the pursuit of more important delayed rewards (studying, writing papers etc.), a phenomenon known as "temporal discounting" (Myerson & Green, 1995; Scheres et al., 2013).

Empirical research with college students with ADHD validates these clinical observations, finding that elevated scores on commonly used measures of executive self-management such as the Barkley Deficits in Executive Function Scale (BDEFS) (Dvorsky & Langberg, 2014) and the Brief Rating Inventory of Executive Function (BRIEF) (Weyandt et al., 2013) predicted significantly increased overall impairment in major life activities, as well as lower GPA during the subsequent academic year, and predicted impairment in multiple domains over and above that associated with ADHD symptoms alone (Fedele et al., 2010). College students also report difficulty implementing many of the more specific learning and study strategies required to succeed in school (Advokat et al., 2011; DuPaul et al., 2009; Norwalk et al., 2009). These include reading and note-taking with concentration and good retention; listening and note-taking during lectures; organizing and writing research papers and essays. and test preparation. Although these problems stem in part from the core attentional symptoms of ADHD (e.g., distractibility, short attention span, poor attention to detail), they are exacerbated by poor working memory (Gropper & Tannock, 2009) and weak cognitive organizational skills. It is important to note here that these difficulties are present even in students with ADHD who do not also have specific learning disabilities in reading, language, or math, and appear rather to be related to the core symptoms and executive dysfunction associated with ADHD. Furthermore, temporal discounting has been shown to be exacerbated in individuals with ADHD (Jackson & MacKillop, 2016; Patros et al., 2017) and to be associated with lower academic achievement (Lee et al., 2012).

Current Treatments for ADHD in College Students

Although stimulant medication is effective in reducing core ADHD symptoms in children and adults generally (Barkley, 2014), research on the effects of stimulants in college students is quite limited. In cross-sectional studies, stimulant treatment was shown ***not*** to be associated with a reduction in ADHD symptoms or impairment (Blase et al., 2009; Rabiner et al., 2008). Lisdexamfetamine reduced ADHD symptoms and executive dysfunction in a small randomized, placebo-controlled study (Dupaul et al., 2012); however, sizable differences in both domains persisted in those with ADHD compared to controls. Low adherence to stimulant medication in college students with ADHD further limits the utility of medication in these students (Gray et al., 2017), in addition to which there are concerns about the risks of diversion and misuse (Gray et al., 2017). Clearly more research is needed, but these preliminary results suggest that interventions in addition to medication are needed to target symptoms and executive dysfunction in college students with ADHD.

Cognitive-behavioral interventions have been developed that successfully address executive dysfunction in adults with ADHD in both individual (Safren et al., 2005) and group modalities (Solanto et al., 2010), and both with (Safren et al., 2010) and without (Solanto et al., 2010) concurrent medication. Both programs target poor time-management, and planning, as manifested in tardiness, procrastination, missed deadlines, inadequate, or inaccurate work; inefficiency; and failure to plan in the short and long-term. Randomized controlled trials comparing the active treatment against a supportive condition to control for non-specific effects of therapy (Safren et al., 2010; Solanto et al., 2010) have yielded effect

sizes greater than 0.70 for both programs, which is comparable to the effect size for long-acting stimulants (Faraone & Buitelaar, 2010). More recent studies have replicated benefits for similar CBT programs to address executive dysfunction both with and without medication in adults with ADHD (Cherkasova et al., 2016; Weiss et al., 2012; Young et al., 2015). In addition, treatments that incorporate traditional cognitive-behavioral approaches to address irrational beliefs and negative self-attributions have also been found to be effective for adults with ADHD (Ramsay & Rostain, 2015a; Rostain & Ramsay, 2006).

Contrasting with the development of CBT programs for adults with ADHD, research to develop CBT interventions specifically tailored to the needs of college students is still at an early stage (Fleming & McMahon, 2012; He & Antshel, 2016). The earliest studies included a case series of four students (Eddy et al., 2015) and an open trial of 12 students (LaCount et al., 2015). More recently, two studies of brief interventions (three or six sessions) to enhance time-management, organizational, and/or planning skills, yielded modest improvement in self-rated ADHD symptoms (LaCount et al., 2018; Van der Oord et al., 2020) . The most extensive study, by Anastopoulos et al., was an open clinical trial (Anastopoulos & King, 2015) and follow-up (Anastopoulos et al., 2018) of 43 undergraduate students who received an eight-session group treatment, with individual mentoring, that yielded pre- to post-treatment improvement in self-reported symptoms, organizational skills, and impairment on behavioral questionnaires.

Given the dearth of evidence-based treatment for college students with ADHD, we undertook to adapt and tailor our adult CBT intervention (Solanto, 2011; Solanto et al., 2008, 2010) for the specific needs of college students. As did our adult intervention, the intervention for college students targets the executive self-management functions of time-management, organization, and planning. However, the intervention is adapted to the contexts, cues, demands, distracters, reinforcers, and consequences of the academic environment. In particular, the strategies from our adult program for: enhancing time awareness; prioritizing; planning; scheduling; tracking and completing assignments; and overcoming procrastination were revised to synchronize with the daily academic routine and to facilitate resistance to the internal and external distracters typically encountered in the college setting.

As is also true in our adult program, two sessions are devoted to "traditional cognitive-behavior therapy"—that is, the identification and challenging of irrational depressogenic and anxiogenic automatic thoughts, drawing upon theory and methods first developed by Aaron Beck (1995), and utilized effectively in adult ADHD by Ramsay and Rostain (2006). Common irrational cognitions among individuals with ADHD include perfectionism, disqualifying the positive, overgeneralization, and excessive "should" statements. Not only are such thoughts distracting and distressing in the moment, but they undermine motivation and progress and thereby come to function as "self-fulfilling prophecies" (Strohmeier et al., 2016).

Of particular importance for college students is the inclusion of three sessions that explicitly present, discuss, and train the application of executive strategies to academic tasks including reading, listening and taking notes in lectures, and organizing and writing papers.

In summary, we framed our intervention as targeting a constellation of specific behaviors (including time-awareness, scheduling, prioritization, chunking, distraction control, and improved sleep hygiene) and their associated cognitions. We anticipated that changes in these proximal behaviors and associated cognitions would subserve improvements in organization, planning, and time-management functions, as well as learning/study strategies, which would also be reflected in improved inattentive symptoms of ADHD, as measured by the clinician and the participant. By increasing positive self-attributions, we also predicted improvement in anxiety, depression, and self-efficacy. Implementing this program on the college campus allowed us to directly assess its feasibility and acceptability. Finally, we recruited a sample of typical students attending the same university in order to document the degree of impairment experienced by the ADHD students relative to their peers, and to ascertain the extent to which the treatment was normalizing.

Method

The Intervention

The intervention, which was conducted in 12 sessions (Table 1) aimed to impart both cognitive and behavioral strategies to facilitate development of the executive self-management skills in such a way that they would become habitual. Cognitive components aimed to impart "rules" (i.e., adaptive internal speech) to guide daily scheduling, prioritizing, planning, and self-activation/initiation. Behavioral components utilized contingent self-reinforcement; breaking down complex tasks into manageable parts; distraction control, visualization to sustain motivation toward distant rewards (e.g., course grades); and application of these strategies to tasks involving reading, note-taking during lectures, and organizing/writing academic papers. Other proximal targets included improved sleep-hygiene, and two sessions devoted to identifying and challenging irrational/negative self-statements (Ramsay & Rostain, 2006; Strohmeier et al., 2016).

Generalization and maintenance. Generalization and maintenance of skills were fostered via the weekly home exercises, the use of "mantras" (maxims) to self-cue the relevant strategy in real-world academic settings, as well as rehearsal

Table 1. Treatment Modules and Home Exercises.

Session	Module	Home exercise
1.	Introduction/Orientation. What ADHD is; how college demands differ from high school; getting the semester off to a good start	Getting the semester off to a good start
2.	Care of the brain and body: sleep, exercise, effects of substances	Self-monitoring of sleep
3.	Time management I: planner use, scheduling, wearing a watch, class attendance; choosing where to study and getting there	Choose a planner. Time estimation, time-logging.
4.	Time management II: overcoming procrastination and staying on task; chunking, distraction control; contingent self-reward	Schedule and complete one procrastinated task
5.	Time management III: prioritization (urgency vs. importance); planning; pursuit of long-term goals	Complete urgency-importance grid
6.	Self-rating and review of time-management	Plan a week's tasks and activities
7.	Academic I: reading for retention	Outline a reading assignment
8.	Identifying negative automatic thoughts	Identify negative automatic thoughts
9.	Challenging/disputing negative automatic thoughts	Challenge negative automatic thoughts
10.	Academic II: getting the most out of lectures	Outline an on-line lecture
11.	Academic III: outlining, writing, and editing papers	Create an outline in Power Point
12.	Utilizing campus resources; looking to the future	Practice mindful breathing daily

and positive reinforcement within and between sessions, and the support of the group leader and the other group members.

Mantras. Some of the key "rules" to remind and guide the use of the strategies were crystallized as mantras, which were repeated strategically throughout the program in hope they would become internalized as automatic guides to behavior. One such example is: "If I'm having trouble getting started, then the first step is too big," which both cues the relevant situation—procrastination—and the solution, which is to break the task down into more manageable "chunks"—either by size of the portion or by the amount of time to be allocated. The rule may be re-iterated as often as necessary, breaking the task down into still smaller parts, until it is actually initiated.

Home exercises. Each session was accompanied by a Home Exercise (HE) to be completed in the intervening week before the next session. The HE is a particularly important part of the program as it is the student's opportunity to begin to practice the new strategy "in real life." Our research (Solanto et al., 2010), consistent with that of other CBT treatments (Kazantzis et al., 2000) has shown that completion of the HE is a strong predictor of the overall benefit derived from the intervention. We began with the easiest home exercises to increase the likelihood that the participant would experience success, thereby counteracting the defeatism, with which many participants begin the program. An early HE, for example, is to identify, schedule, and complete one procrastinated task of less than an hour, followed by a planned reinforcer. Examples of other HE included: identifying priorities via use of an Urgency × Importance matrix; planning daily and weekly activities using a template; and preparing a Power Point presentation as an exercise relevant to organizing thoughts and outlining papers.

Because the HE is so pivotal to the success of the intervention, fully the first hour of the next session is spent reviewing the results of the HE task with each participant in round-table fashion. The Group leader queried each participant about the process and outcome, addressing any difficulties that arose, and highlighting what the student might do similarly or differently next time.

Therapists and setting. The intervention was delivered by the first author, assisted by the second author. The study received the approval of the Institutional Review Board at the University where it was conducted, and all participants provided signed informed consent. The intervention was conducted in English, in which all students were fluent. The sessions were held in the evening (6:00–8:00 PM) on a Tuesday or Thursday, depending on Group assignment. Pizza was served.

Session format. Each weekly 2-hr session was comprised of four components: review of the previous week's home exercise; presentation (via the Socratic method) of the new skill or strategy; an in-class exercise(s) illustrating the application of the strategy to current problems as articulated by the participants; and review of the upcoming home exercise.

Design. Eligible students were assigned to one of two parallel CBT treatment groups, each enrolling nine or ten students. Response to treatment was assessed by comparison of pre- and post-treatment outcomes on the structured interview of ADHD symptoms (AISRS) clinical self-report questionnaires, and GPA. Students completed participant evaluations of the CBT program at the end of treatment. Students in the typical comparison group were evaluated once on the same questionnaire measures as the ADHD students.

ADHD Group

Recruitment. Prospective participants were referred to the study from among undergraduate and graduate students at the University. The study was announced via email to providers at the campus Student Counseling Center and in the Department of Psychiatry at the University Medical Center. In addition, flyers were emailed to all faculty advisors to students in the various departments of the University.

Eligibility criteria. Participants in CBT were required to be undergraduate or graduate students between the ages of 18 and 30 with a DSM-5 diagnosis of ADHD (Predominantly Inattentive or Combined subtype) (American Psychiatric Association, 2013). Exclusion criteria included: active substance abuse or dependence; suicidality; overtly hostile or aggressive behavior likely to alienate other group members; autism spectrum disorder, borderline personality disorder, or other serious psychiatric condition with treatment priority. Participants with anxiety or depression were otherwise eligible for participation. Individuals receiving medication to treat ADHD (stimulants, atomoxetine or guanfacine) or other psychotropics were eligible provided that they had been stabilized on a given drug for at least 2 months, and on a given dose for at least 1 month. Participants were instructed to defer non-essential changes in their therapeutic regimen (either medication or psychotherapy) until the end of the CBT intervention.

Diagnostic assessments. Individuals referred to the study were screened by phone for ADHD using the World Health Organization Adult ADHD Self-Report Scale (ASRS) Screener (Kessler et al., 2007). Those who screened positive were scheduled for the full evaluation, as follows. The diagnosis of ADHD was based on the Adult ADHD Clinical Diagnostic Scale (ACDS) to assess the childhood symptom criteria (Kessler et al., 2010), and the Adult Investigator Symptoms Rating Scale (AISRS) (Spencer et al., 2010) for the adult symptom criteria. The ACDS and AISRS are structured interviews developed to assess the 18 DSM symptoms of ADHD in childhood and adulthood, and were adapted for DSM-5 for use in this study. Childhood symptoms were corroborated by the student's endorsement of at least six inattentive and/or six hyperactive-impulsive symptoms on the Childhood ADHD Symptoms Scale (CSS)—Self-Report (Barkley & Murphy, 1998). Endorsement was defined as a rating of 2 ("often") or 3 ("very often") for a given symptom. Current adult symptoms were corroborated by a *T*-score of at least 65 (93rd percentile) on the DSM-IV Inattentive Symptom subscale of the Conners Adult ADD Rating Scale—Long Version Self-Report (CAARS-Self-DSM-Inattentive) (Conners et al., 1999). Comorbid conditions, including suicidality, were assessed using the MINI International Neuropsychiatric Interview (Sheehan et al., 1998). Current substance use was quantified via self-report on the AUDIT (alcohol) (Saunders et al., 1993; Selin, 2003) and DUDIT (drugs) (Berman et al., 2005) questionnaires, using the published cutoff scores of 8 and 25, respectively, to indicate excess usage. The presence of a specific learning disability such as dyslexia was ascertained on the basis of the participant's reported childhood/school history of evaluation.

Outcome assessments

Clinical outcomes. Participants were re-assessed immediately post-treatment on the AISRS, which served as the primary outcome measure. The number of inattentive symptoms endorsed, and the total severity score (rated 0–3 for each item), summed across the nine Inattention items (AISRS-IN) served as the primary outcome scores for the study. The Inattentive set of DSM symptoms was targeted given research showing that inattentive but not hyperactive-impulsive symptoms are associated with lower GPA in college students (Rabiner et al., 2008; Schwanz et al., 2007). The CAARS-Self-DSM Inattentive Symptoms subscale and the CAARS-Self-Inattention/Memory subscale (which contains more items reflecting executive skills) served as secondary outcome measures. In addition, the following self-report questionnaires of comorbid symptoms were completed pre-and post-treatment: Beck Depression Inventory-II (Beck et al., 1996); State-Trait Anxiety Inventory (STAI) (Spielberger, 1977); and the Penn State Worry Questionnaire (Meyer et al., 1990).

Executive function outcomes. Executive dysfunction was measured via the Barkley Deficits in Executive Function Scale (BDEFS) (Barkley, 2011) and The Learning and Study Skills Inventory (LASSI-3rd edition) (Weinstein et al., 2016). The BDEFS was developed on the basis of factor analysis in adults with and without ADHD and includes five subscales, from among which we preselected Self-Management to Time, Self-Organization, Self-Motivation, as well as Total Executive Function, as the functions most likely to reflect changes due to the intervention. The LASSI measures student awareness of and use of learning and study strategies on 10 scales related to skill, will, and self-regulation, from which

we pre-selected the following as targets of the intervention: Time-Management, Concentration, Motivation, and Anxiety. Note that on the BDEFS higher scores indicate greater dysfunction, whereas on the LASSI a higher score indicates better functioning.

Educational outcome. Grade Point Average (GPA) was obtained from each student for the semester prior to the treatment and for the first semester post-treatment. The student filed a request with the Registrar to send a copy of his/her grades to the Investigators.

Participant evaluations. At the end of treatment, participants were asked to anonymously rate each of the sessions and each of the strategies with respect to their helpfulness on a 4-point scale: 0 (not at all helpful); 1 (slightly helpful); 2 (moderately helpful) 3 (very helpful). In addition, they were asked to respond, in free narrative style, to the following question: "In what way did you change the most as a result of the program?"

Recruitment and Screening of Typical Comparison Group

Participants in the Typical Comparison group were recruited from among first-year students in Psychology at the University who were fulfilling a requirement to participate in a research study on campus. Students were recruited and initially screened for the study via the SONA Experiment Management System. Potential participants were seen in one face-to-face interview to assess eligibility and completed the same set of behavioral questionnaires as did the ADHD Group. Potential participants were screened to exclude individuals with likely or possible ADHD, as determined on the basis of either: (1) a symptom score of 4 or more (of 9) on the Inattentive or Hyperactive-Impulsive subscale of the Childhood ADHD Symptom Scale (CSS)—Self-Report, or (2) a *T*-score ≥ 60 on any of the eight subscales of the CAARS-Self -Long Version. Students exhibiting other psychopathology were also excluded, as determined on the basis of any of the following: BDI sore ≥ 13 (i.e., greater than "Minimal"); STAI score for Trait or State anxiety ≥ 1 *SD*); AUDIT score > 7; DUDIT score ≥ 25.

Statistical Analyses

Data were analyzed using SPSS-version 25. Comparisons between ADHD and Typical students were conducted via *t*-test for continuous variables and chi square for categorical variables. Pre- to post-treatment differences were analyzed via repeated measures analysis of variance (ANOVA) for AISRS scores and measures of comorbidity, and via separate multivariate analyses of variance (MANOVA) for the subscale scores from each questionnaire, with one factor of Time, with follow-up univariate tests. Effect size was measured as partial eta squared.

Results

Sample Characteristics

ADHD group. Demographic and clinical characteristics are summarized in Table 2. Of 19 students enrolled in the study, one student was forced to withdraw after the third treatment session in order to begin an internship in a different city and was not included in further analyses. Most students were referred to the study either by the Department of Psychiatry at the University Medical Center ($n=6$) or via an announcement from their faculty advisor ($n=7$). Two other students were referred from the Student Counseling Center, and three students were referred by word of mouth (friend, coach, faculty member). Slightly more students (56%) were female and slightly more participants (56%) were of the Predominantly Inattentive presentation. Mean age was 23.61 years ($SD=2.75$, range 19–31 years). Fifteen were enrolled in Bachelor programs and three in Master's programs. Among the Bachelor students, four were in their first year, three were in their second year, one in the third year, five in the fourth year, and two in the fifth year. Ten students had previously enrolled in a college program and had either failed out or dropped out at least once, which accounts for the sample's higher mean age than is typical for college students.

Six (33%) of the 18 students received their first diagnosis of ADHD in the current study. Twelve students had received prior diagnoses of ADHD, in all cases occurring after high school. In six cases the diagnostic evaluation had been accomplished at the University Medical Center and the six others had been diagnosed by a private practitioner or at a private center for ADHD.

Five students (28%) were taking stimulants concurrently with the study and two others (11%) were taking other psychotropics (bupropion, fluoxetine). A review of the history revealed that five additional students had previously received prescriptions of stimulants but had taken the medication not at all or only rarely, or had had significant side effects that resulted in termination of the treatment. Eight students (44%) had a comorbid diagnosis: Six students had a comorbid anxiety disorder, and two additional students had both an anxiety disorder and a mood disorder. Two students had been assessed as having dyslexia.

Comparison group. Twenty students were enrolled in the Comparison group. All except one student were female (95%) resulting in a significant difference from the ADHD group by Pearson Chi-Square (8.16, $p=.000$). Mean age

Table 2. Demographic and Clinical Characteristics of ADHD Participants.

Total sample	*n* = 18 Comprising two groups of nine students
Gender	
Females	10 (56%)
Males	8 (44%)
Age	
Mean (year)	23.63 (*SD* = 2.75)
Range (year)	19–31
University status	
Bachelor's students	15 (83%)
Master's students	3 (17%)
ADHD medication (concurrent)	
None	11 (61%)
Stimulants	5 (28%)
Non-stimulants	0
Other psychotropics	2 (11%) (buproprion, fluoxetine)
Psychotherapy (concurrent)	2 (11%)
Comorbid diagnoses	
Anxiety	6 (GAD, social phobia, OCD)
Depression	2 (MDD, dysthymia + anxiety)
ADHD subtype	
Predominantly inattentive	10 (53%)
Combined	8 (44%)
AISRS DSM-5	Mean = 6.78 (*SD* = 1.99)
Inattentive symptoms	
AISRS DSM 5	Mean = 2.89 (*SD* = 2.00)
Hyperactive-impulsive symptoms	
CAARS DSM-IV	Mean *T*-score = 70.28 (*SD* = 8.67)
Inattentive scale	
CAARS DSM-IV	Mean *T*-score = 56.83 (*SD* = 10.68)
Hyperactive-impulsive scale	

Note. AISRS = adult ADHD investigator symptom rating scale; CAARS-S = Conners adult ADHD rating scales-self-report, long version.

was 19.85 years (*SD* = 1.31, range 18–22 years), which was significantly less than that of the ADHD Group ($t = 5.63$, $p = .000$). All Comparison group students were in their first year of college.

Comparisons at Baseline Between ADHD and Typical Comparison Participants

Comparison of students with and without ADHD showed, as expected, that scores in the ADHD group were significantly elevated on clinical measures of ADHD (CAARS) and executive dysfunction (BDEFS and LASSI) (Table 3). There were large differences on the LASSI scores at baseline, with ADHD students performing at less than the 10th percentile relative to other college students on scales measuring Time-Management, Concentration, and Motivation, whereas typical students scored at the 55th percentile or above on these scales. Scores on measures of comorbid depression (BDI), state, and trait anxiety (STAI) were significantly higher in the ADHD group compared to the Typical Comparison group, but still within the normal range for college students. The Anxiety scale on the LASSI was not elevated, and the measure of Worry (Penn State) was only marginally elevated in the ADHD group relative to the Typical group.

Response to Treatment

Fifteen (83%) students attended nine or more sessions. Other than the student who moved to a different city, there were no study drop-outs (Table 4). Across sessions and participants, 67% of home exercises were completed partially or fully.

Repeated measures analysis of variance revealed significant reductions in both number and total score of DSM-5 Inattentive symptoms, with robust effect sizes (ES): On the clinician-rated AISRS. the number of inattentive symptoms decreased from 6.78 to 4.22 ($F = 31.01$, $p = .001$, ES = .646). At the end of treatment, 7 of the 18 students no longer met adult criteria for ADHD, based on a post-treatment

Table 3. Comparisons at Baseline Between ADHD and Typical Comparison Groups.

	ADHD ($n = 18$)		Comparison ($n = 20$)			
	Mean	(*SD*)	Mean	(*SD*)	*t*	*p*-value (two-tailed)
CAARS—Self-DSM inattentive symptoms (*T*-score)	80.22	(7.37)	42.40	(7.08)	16.13	.000****
CAARS—Self-inattention/memory subscale (*T*-score)	73.72	(8.30	43.30	(7.00)	12.26	.000****
CAARS—Self-self-concept (*T*-score)	57.94	(11.79)	45.40	(7.47)	3.87	.001***
BDEFS—Self-management to time (percentile)	95.67	(6.89)	54.45	(23.87)	7.39	.000****
BDEFS—Organization (%)	92.39	(7.14)	52.05	(17.50)	9.47	.000****
BDEFS—Motivation (%)	93.78	(11.66)	57.55	(22.70)	6.28	.000****
BDEFS—Total executive function (%)	93.50	(7.42)	49.00	(21.00)	8.88	.000****
LASSI—Time-management (percentile)	8.50	(13.02)	58.00	(27.79)	−7.14	.000****
LASSI—Concentration (%)	5.00	(5.99)	65.75	(20.79)	−12.50	.000****
LASSI—Motivation (%)	7.33	(13.54)	55.20	(29.46)	−6.45	.000****
LASSI—Anxiety (%)	52.83	(29.76)	64.65	(27.71)	−1.27	.213
Beck depression inventory—II	11.61	(7.22)	6.80	(6.00)	2.24	.031*
State-trait anxiety inventory—State	43.00	(9.05)	32.95.	(10.30)	3.18	.003**
State-trait anxiety inventory—Trait	49.83	(11.02)	37.55,	(10.38)	3.54	.001***
Penn state worry (percentile)	70.00	(26.51)	53.65	(32.72)	1.68	.102

Note. On the CAARS (*T*-score), BDEFS (percentile) and measures of comorbidity, a higher score indicates greater symptom severity, whereas on the LASSI (percentile), a higher score indicates better functioning. AISRS = adult ADHD investigator symptom rating scale; CAARS-Self = Conners Adult ADHD Rating Scales-Self-Report; Long Version; LASSI = Learning and Study Skills Inventory; BDEFS = Barkley Deficits in Executive Function Scale; ES = effect size, computed as partial eta squared.
*$p < .05$. **$p < .01$. ***$p < .005$. ****$p < .001$.

Table 4. Response on Pre- and Post-Treatment Measures of ADHD and Comorbidity.

	Pre		Post				
Measure	Mean	(*SD*)	Mean	(*SD*)	*F*	*p*-value (two-tailed)	ES[a]
AISRS—Number of inattentive symptoms	6.78	(1.97)	4.22	(1.90)	31.01	.000****	.646
AISRS—Total score for inattentive symptoms	18.56	(4.67)	13.28	(3.27)	23.442	.000****	.580
CAARS—Self-DSM inattentive symptoms (*T*-score)	80.22	(7.37)	70.28	(8.66)	30.232	.000****	.640
CAARS—Self-inattention/memory subscale (*T*-score)	73.72	(8.30)	62.17	(10.83)	17.997	.001***	.514
CAARS—Self-self-concept (*T*-score)	57.94	(11.79)	54.67	(10.87)	5.712	.029*	.251
BDEFS—Self-management to time (percentile)	95.67	(6.89)	87.22	(9.16)	18.739	.000****	.524
BDEFS—Organization (percentile)	92.39	(7.14)	86.83	(10.33)	7.422	.014*	.304
BDEFS—Motivation (percentile)	93.78	(11.66)	93.28	(6.61)	.035	.853	.002
BDEFS—Total executive function (percentile)	93.50	(7.42)	90.83	(7.54)	4.772	.043*	.219
LASSI—Time-management (percentile)	8.50	(13.02)	22.06	(24.85)	9.066	.008**	.348
LASSI—Concentration (percentile)	5.00	(5.99)	21.00	(18.05)	12.982	.002***	.433
LASSI—Motivation (percentile)	7.33	(14.54)	16.83	(24.38)	7.948	.012*	.319
LASSI—Anxiety (percentile)	52.83	(29.76)	64.72	(32,06)	10.269	.005**	.377
Beck depression inventory—II	11.61	(7.22)	11.00	(2.76)	.109	.745	.006
State-trait anxiety inventory—State	43.00	(9.05)	43.06	(11.59)	.000	.983	.000
State-trait anxiety inventory—Trait	49.83	(11.02)	47.22	(12.18)	3.005	.101	.150
Penn state worry (percentile)	70.00	(26.51)	57.28	(32.76)	6.862	.018*	.288

Note. On the CAARS (*T*-score), BDEFS (percentile) and measures of comorbidity, a higher score indicates greater symptom severity, whereas on the LASSI (percentile), a higher score indicates better functioning. Separate MANOVA's were conducted for the CAARS, BDEFS, and LASSI. As detailed in the text, the effect of Time was significant in each analysis and the MANOVA was therefore followed by the post-hoc tests listed above. AISRS = adult ADHD investigator symptom rating scale; CAARS-Self = Conners Adult ADHD Rating Scales-Self-Report; Long Version; LASSI = Learning and Study Skills Inventory; BDEFS = Barkley Deficits in Executive Function Scale.
[a]ES = effect size, computed as partial eta squared.
*$p < .05$. **$p < .01$. ***$p < .005$. ****$p < .001$.

Table 5. Participant Ratings of Helpfulness of CBT Program Sessions.

Session	Module	Mean rating (*SD*)	% Rating "very helpful" (3)	% Rating "moderately helpful" (2)
1	Introduction, psychoeducation about ADHD, how college differs from high school	2.33 (1.09)	28%	28%
2	Care of the brain and body: sleep, exercise, effects of substances	2.06 (1.16)	22%	39%
3	Time management I: planner use, scheduling, wearing a watch, class attendance	2.72 (0.83)	61%	17%
4	Time management II: procrastination, chunking, distraction control, contingent self-reward	2.44 (0.78)	44%	39%
5	Time management III: prioritization (urgency vs. importance), planning; pursuit of long-term goals	2.17 (0.79)	39%	39%
6	Self-rating and review of time-management strategies	2.00 (0.97)	11%	44%
7	Academic I: reading for retention	1.89 (1.49)	11%	22%
8	Identifying negative automatic thoughts	2.33 (0.84)	39%	39%
9	Challenging negative automatic thoughts	2.39 (1.09)	33%	22%
10	Academic II: getting the most out of lectures	2.28 (1.32)	11%	28%
11	Academic III: organizing, outlining, and writing papers	2.00 (1.24)	28%	22%
12	Utilizing campus resources, looking to the future	Not rated	Not rated	Not rated

Note. The helpfulness of each session was rated by each of the 18 participants on a questionnaire according to the following scale: 0 = not at all helpful; 1 = slightly helpful; 2 = moderately helpful; 3 = very helpful.

symptom score less than the DSM-5 adult criterion of five. Total score on the AISRS decreased from 18.56 to 13.28 ($F=23.442$, $p=.000$, ES=.580).

MANOVA of pre-selected CAARS subscale *T*-scores yielded a significant effect of Time as follows: Wilks' Lambda F (3,15)=13.302, $p=.005$, ES=.994. Follow-up univariate tests (Table 4) yielded significant improvement, with robust effect sizes for CAARS DSM-Inattentive Symptoms (*T*-score decrease from 80.22 to 70.28, $F=30.2$; $p=.000$, ES=.640). The decrease on the CAARS-Self-Inattention/Memory subscale was also significant (*T*-score decrease from 73.72 to 62.17, $F=18.0$, $p=.001$, ES=.514), as was a smaller decrease (improvement) in Self-Concept.

MANOVA of pre-selected BDEFS subscale (percentile) scores yielded a significant effect of Time as follows: Wilks' Lambda F (4,14)=6.089, $p=.005$, ES=.635. Follow-up univariate tests yielded significant reductions, with robust ES, for Self-Management to Time (Percentile decrease: 96.67–87.22, $F=18.7$; $p=.000$, ES=.524), with smaller but significant improvements in Organization and Total Executive Function, but no significant change on Motivation or on any other scale.

The MANOVA of pre-selected LASSI subscale (percentile) scores yielded a significant effect of Time as follows: Wilks' Lambda F (4,14)=9.090, $p=.001$, ES=.722. Follow-up univariate tests yielded significant improvement in Motivation (Percentile increase 7.33–16.83, $F=7.95$; $p=.012$, ES=.319), as well as improvements in Time-Management (8.5–22.06, $F=9.066$, $p=.008$, ES=.348), Concentration (5.00–21.00, $F=12.98$, $p=.002$, ES=.43), and Anxiety (52.83–64.72, $F=10.27$, $p=.005$, ES=.377). Among other measures of anxiety and depression, only the Penn State Worry Questionnaire showed a significant decrease, indicating improvement (percentile decrease from 70.0 to 57.28, $F=6.9$; $p=.018$; ES=.288).

There were no significant pre- to post-treatment changes in GPA. In the Dutch system, grades are reported on a 10-point scale in which 5.5 is passing. Mean pre- and post-treatment GPA scores for the ADHD group were 6.86 (SD=.89) and: 6.66 (SD=1.56), respectively, would be considered approximately equivalent to C+ in the American system.

Participant Evaluations

Ratings of sessions. All sessions (Table 5) were rated as at least moderately helpful (≥2.00), with the exception of Reading for Retention (1.89). Time-Management I and II received the highest ratings (2.72 and 2.44, respectively), followed by Identifying and Challenging Negative Automatic Thoughts (2.33 and 2.39, respectively). Among the Academic sessions, Getting the Most Out of Lectures was most highly rated (2.28).

Rating of strategies. Among strategies (Table 6), regular planner use (2.83), and breaking down aversive or unpleasant tasks into manageable chunks (2.56), were rated most highly, followed by wearing a watch (2.22), and identifying and challenging negative automatic thoughts (2.22 and 2.00, respectively). Contingent self-reward, visualization of long-term rewards and consequences, and sleep hygiene practices were rated as slightly to moderately helpful.

Table 6. Participant Ratings of Helpfulness of CBT Program Strategies.

	Strategy	Mean rating (*SD*)	% Rating "very helpful" (3)	% Rating "moderately helpful" (2)
1	Using a planner regularly for scheduling, prioritizing, planning	2.83 (0.51)	72%	22%
2	Wearing a watch	2.22 (0.88)	33%	39%
3	Sleep hygiene: regular bed-and wake-times; wind-down time before bed	1.72 (1.07)	33%	33%
4	Breaking down aversive or unpleasant tasks into parts ("chunking")	2.56 (0.71)	67%	22%
5	Contingent self-reward	1.28 (1.07)	6%	22%
6	Prioritization using urgency × importance matrix	1.89 (1.02)	33%	33%
7	Avoiding physical and social distractions	1.89 (1.02)	22%	33%
8	Visualization of long-term rewards	1.67 (0.97)	11%	33%
9	Visualization of long-term consequences	1.61 (0.92)	11%	22%
10	Identifying negative automatic thoughts	2.22 (0.73)	39%	44%
11	Challenging negative automatic thoughts	2.00 (0.84)	33%	33%

Note. The helpfulness of each session was rated by each of the 18 participants on a questionnaire according to the following scale: 0 = not at all helpful; 1 = slightly helpful; 2 = moderately helpful; 3 = very helpful.

Table 7. Participant Comments on Evaluations.

Verbatim responses to the following question from each of the 15 of 18 students who (anonymously) replied to: "In what way did you change the most as a result of the program?"

- I started working more in advance.
- Going to classes more often and doing work in small chunks, and getting a planner, and knowing how to use it.
- Use my planner. I am aware of my ADHD, I know where my problems are.
- Making me aware of what are symptoms of ADHD; being aware of those things now makes me feel unsure of a lot of things, how I do them, and what I do wrong, but gives me the opportunity to improve. I have already improved planning & starting with small chunks.
- The appreciation of the need for structure and physical objects that represent and trigger/cue structured thinking.
- More organized, which leads to making it easier to get things done, which leads to getting things done.
- Structure, more motivated to start on things, general feelings, am mostly proud of what I am getting done.
- I changed my way of organizing the most, by using the planner. And starting has become way easier due to chunking.
- Using an agenda more often; Overcoming procrastination by chunking.
- My way of scheduling/planning.
- Finding hope in simple solutions for people that have the same kind of complaints about themselves.
- I feel less powerless about my chaoticness (sic).
- My self-esteem benefitted the most; I learned that there are ways to cope with certain issues and I am not the only one who struggles. The latter has helped me to accept my flaws a bit better.
- I know now that I really want to make something from my life and that nobody can help me as much as I can help myself. More likely to keep up with the gym and make myself start and end academic tasks.

Self-report narratives. Narrative self-reports of the participants (Table 7) indicated that not only were the students successfully implementing the targeted strategies, but suggested that they experienced improved self-efficacy as a result.

Discussion

The students enrolled in this study were significantly impaired, consistent with the literature on college students with ADHD, as reflected in their high rates of interrupted studies due to dropping out or failing out of college, and their extremely low scores on the LASSI measure of study skills and strategies. Although the students were not diagnosed or treated with pharmacotherapy until college, it must be noted that when these students were, on average, aged between 6 and 12 years of age (between 1999 and 2005, respectively), rates of diagnosis and medication treatment of ADHD in Europe, and specifically in the Netherlands, lagged significantly behind those in the US (Bachmann et al., 2017).

This open trial of CBT demonstrated significant benefit to college students with ADHD. Attendance was good and there were no study dropouts, which speaks to the feasibility

and acceptability of this intervention on a college campus. DSM-5 symptoms of inattention were significantly improved on the basis of both clinician-rated and self-reported frequency and severity. At the end of treatment, seven of the 18 students no longer met DSM-5 symptom criteria for ADHD based on the number of inattentive symptoms. There was also significant improvement in executive function on subscales of time-management, organization, and total executive function, but no effect on motivation (BDEFS). The LASSI scales of EF which pertain more specifically to academic learning and executive functions, however, did yield significant improvement in motivation, as well as in time-management and concentration.

Measures of co-morbid depression and state- and trait-anxiety did not register significant change due to treatment, a result that may have been due to floor effects, since scores at baseline on these measures were not in the clinically significant range, although they did exceed values in the Typical group. The exception to this conclusion was the result on a measure of worrying, which was marginally elevated at baseline and was significantly improved by the treatment.

Our results are consistent with those of the larger, but otherwise comparable study by Anastopoulos and King (2015) with respect to improvement on self-report questionnaire measures of ADHD symptoms and executive function. Our study contributes to this literature by documenting improvement on a clinician-administered structured interview of DSM-5 symptoms. Although Anastopoulos et al. reported improvement in credit hours attempted and credit hours earned (Anastopoulos et al., 2018), neither that study nor the current one found significant improvement in GPA after treatment. This result suggests that additional practice is needed before the new strategies are fully internalized and implemented, and reflected in improved grades. This may be particularly applicable to the improvement of reading skills, which received a lower helpfulness rating compared to the other sessions in the current study, indicating a need for modified strategies of intervention and/or more sessions devoted to this goal. Potential moderators of response to reading intervention, such as undiagnosed dyslexia or slow processing speed should also be considered in future research.

Participant ratings of program components revealed that the most helpful strategies were: use of the planner, breaking down tasks into manageable chunks, and identifying negative automatic thoughts.. Among sessions, those related to time-management and to identifying and challenging negative automatic beliefs were most helpful.

Comparison with our CBT efficacy study in adults is instructive. In that study, 89% attended nine or more sessions and the mean full or partial homework completion rate was 71%, compared to 83% and 67%, respectively, for the college students. Of particular interest is that adults identified the same three strategies as most helpful as did the college students, with ratings that were nearly identical, to wit: "breaking down tasks into parts" (2.55), using a planner regularly (2.35), and identifying irrational beliefs (2.25). These data suggest that the maximally helpful strategies are the same for college students and adults with ADHD, and lend consensual validity to the intervention.

Although CBT effectuated significant improvement in ADHD inattentive symptoms and executive dysfunction, comparison with baseline scores for the Comparison group indicates that there is room for improvement, particularly with respect to the LASSI scores. Comparison with our adult study participants suggests that the college students may need additional supports to maximize attendance and HE completion. In future iterations, information from the LASSI subscale items and from the participant evaluations will be used to improve the effectiveness of the intervention, particularly as it relates to improving academic skills.

Study Limitations

Intended as a pilot study of a new CBT intervention for college students with ADHD rather than a formal RCT, we did not include a control group to ascertain whether changes in outcome were due to the intervention or to the effects of time or other variables. Furthermore, the lack of control group precluded blind assessments of outcome. Future research should include a wait list control group, and, in subsequent research an active comparator condition, such as a support group, to control for the non-specific effects of therapy.

Conclusion

In summary, results on empirical measures as well as the narrative self-reports of the participants, provide preliminary support for the feasibility, acceptability, and effectiveness of this cognitive-behavioral intervention to address the ADHD-related symptoms and executive dysfunctions that substantially impair the performance of college students with ADHD. Definitive demonstration of efficacy will require larger samples with random assignment of participants to either CBT or to an active comparison condition, ss described. It will also be important in future studies to ascertain the maintenance of these benefits beyond the termination of treatment, as well as to assess the relative efficacy of pharmacotherapy and CBT, separately and together, for the treatment of this condition in college students.

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