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**Does Cognitive Behavioral Therapy (CBT) reduce symptoms of  
Attention Deficit Hyperactivity Disorder (ADHD) in patients older  
than 12 years old who are diagnosed with ADHD?**

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A SELECTIVE EVIDENCE BASED MEDICINE REVIEW

In Partial Fulfillment of the Requirements For

The Degree of Masters of Science

In

Health Sciences – Physician Assistant

Department of Physician Assistant Studies  
Philadelphia College of Osteopathic Medicine  
Philadelphia, Pennsylvania

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## **Abstract**

**Objective:** The objective of this selective EBM review is to determine whether or not “Does cognitive therapy reduce symptoms of Attention Deficit Hyperactivity Disorder (ADHD) in patients older than 12 years old who are diagnosed with ADHD?”

**Study Design:** Systematic review of three randomized controlled trials (RCTs) published in peer-reviewed journals in 2016, all English language

**Data Sources:** Three randomized controlled trials were found using PubMed.

**Outcomes Measured:** ADHD symptoms and patients’ response to cognitive therapy were measured by patients, parents of patients, and independent evaluators with Disruptive Behavior Disorder rating scales that included four scales of the Diagnostic and Statistical Manual for Mental Disorders 4<sup>th</sup> edition including (1) ADHD Inattention, (2) ADHD Hyperactivity/impulsivity, (3) Oppositional Defiant Disorder, and (4) Conduct Disorder.

**Results:** Boyer et al found no significant differences between groups receiving PML and SFT; instead, they found that patients with more ADHD symptoms benefited more from PML while patients with less ADHD symptoms benefited more from SFT. Spirch et al found a statistically significant reduction in parent-rated, patient-rated ADHD symptoms scores and evaluator-rated CGI scores for participants who received cognitive behavior therapy as opposed to the waitlisted group. Likewise, Young et al also found a statistically significant and precise reduction and difference in ADHD symptoms scores between an experimental group receiving CBT and an experimental group continuing with TAU.

**Conclusions:** All three Randomized Controlled Trials indicate that CBT is effective in treatment of ADHD in patients >12 years old by reducing symptoms of impulsivity, hyperactivity, and inattention as outline in the DSM-IV criteria.

**Key Words:** cognitive therapy, behavioral therapy, Attention Deficit Hyperactivity Disorder

## Introduction

Attention Deficit Hyperactivity Disorder (ADHD) is a neurocognitive disorder that presents during childhood development and is associated with symptoms of impulsivity, inattention, and hyperactivity.<sup>1</sup> ADHD is common, affecting 7-8% of children and 2.5% of adults.<sup>1</sup> Furthermore, 65% of patients diagnosed with ADHD during childhood will continue to meet the criteria for diagnosis through adolescent life.<sup>2</sup> ADHD is often comorbid with other psychiatric and mental disorders, leading to impairment in social, academic, and occupational settings.<sup>3</sup> The cost of ADHD in the United States ranges between \$143 billion-\$266 billion and is mostly incurred by education and healthcare expenses. The healthcare costs per American patient 0-21 years old can range \$621-\$2,270 annually.<sup>3</sup> In January 2017, the CDC reported a total visit rate of 105 out of 1000 persons in one year.<sup>4</sup> A Physician Assistant could be directly involved in the care for a patient with ADHD, as it is a common condition among patients.

ADHD is categorized based on the symptoms a patient most commonly experiences. Typically, it is thought that features of hyperactivity and impulsivity are manifested together so patients exhibit and experience feelings of inner restlessness, impatience, or the desire to be “on the go”.<sup>5</sup> Patients with ADHD that is predominantly inattentive will be disorganized, distracted, or have difficulty focusing.<sup>5</sup> In either instance, ADHD is a disease that has the potential to impair a patient’s functional ability to carry out advanced Activities of Daily Living (ADL). It is known that ADHD is related to multi-gene mutations and common genetic disorders such as fragile X, Turner, and Klinefelter syndromes. Though it is often associated with genetic abnormalities, the exact etiology of the disease is unknown and often considered to be multifactorial.<sup>1</sup>

Currently, Cognitive Behavioral Therapy (CBT) is the first line treatment for ADHD because of the conservative means to control symptoms. Often, this diagnosis is made during

childhood, so there is a desire to initially attempt modalities other than pharmacologic measures such as environmental modification and behavioral training.<sup>1</sup> As patients grow older, they could still be affected by similar ADHD symptoms they experienced as a child, and it is important to study the effects of CBT in an older population. Supplemental pharmacologic therapies include stimulant medications such as methylphenidate and mixed amphetamine.<sup>1</sup> Other alternative medications include clonidine, guanfacine, and atomoxetine.<sup>1</sup> While there are medical treatment modalities for ADHD, this paper evaluates three randomized controlled trials comparing the efficacy of CBT as opposed to pharmacotherapy.

### **Objective**

The objective of this selective EBM review is to determine whether or not “Does Cognitive Behavioral Therapy (CBT) reduce symptoms of Attention Deficit Hyperactivity Disorder (ADHD) in patients older than 12 years old who are diagnosed with ADHD?”

### **Methods**

Three Randomized Controlled Trials (RCTs), including male and female participants greater than 12 years old who were diagnosed with ADHD, were selected for this study. Patients included in the participant pool were required to be previously diagnosed with ADHD by a primary care provider using criteria found in Diagnostic and Statistical Manual of Mental Disorders (DSM). During the course of the three trials, participants had the potential to be selected for CBT so that ADHD-related symptoms and patient function could be monitored. The basis of this review is to understand if CBT can reduce symptoms of ADHD in adolescents and adults. CBT is the primary intervention used in all three studies, and therapy programs were designed by the authors of each study. Areas of focus included planning, problem solving, reasoning, rehabilitation, and functional impairment reduction. In order to measure the effects of

therapy, parent-interviews, patient-interviews, and independent evaluators were utilized to quantify and qualify results. For this review, the outcomes measured were compared with pre-trial assessments of each participant's symptom-related and function-related scores and further compared to control groups. Patient outcomes were also measured against control groups, comprised of participants who were receiving different kinds of CBT, their Treatment as Usual (TAU), or no intervention for ADHD-related symptoms. Patient outcomes were measured based on DSM-IV criteria scales for ADHD inattention, ADHD hyperactivity/impulsivity, Oppositional Defiant Disorder, and Conduct Disorder. In addition, scaled criteria for factors related to function and ADLs were differentiated in subscales including ADHD symptoms, emotional control, antisocial behavior, and social functioning.

Each study evaluated in this review was a RCT found in the PubMed database by searching key-words such as cognitive therapy and Attention Deficit Hyperactivity Disorder. All studies were published in the English language in peer-review journal articles in 2016. The author completed all research for this review and selected articles based on relevance to the topic and if the outcomes measures were patient-oriented. In order for these studies to be applicable to this review, inclusion criteria included RCTs studying patient-oriented outcomes after receiving CBT for ADHD. Studies were excluded from the review if they contained criteria such as participants under 12 years old, patients with suicidal ideation, patients with organic mental disability or autism spectrum disorders. Statistical means by which studies were analyzed include  $F$ ,  $\omega_p^2$ ,  $p$ , NNT, Coef. ( $\beta$ ), and a study-developed method called QUINT.

Table 1: Demographics &amp; Characteristics of Included Studies

Study	Type	# Pts	Age (years)	Inclusion Criteria	Exclusion Criteria	W/D	Interventions
Boyer <sup>2</sup> , 2016	RCT	159	12-17	-adolescents 12-17 years old -attend secondary school -diagnosis with ADHD with DSM-IV criteria -IQ >80	-autism spectrum disorder -depression with suicidal ideation -familial crisis -Crohn's -addiction	44	Planning focused cognitive therapy (PML) & Solution focused cognitive therapy (SFT)
Spirch <sup>6</sup> , 2016	RCT	46	14-18	-adolescents 14-18 years old -ADHD with CGI >3 -on stable dose of FDA approved medications for ADHD -no change in dose for at least 2 months	-comorbid disorders -suicidality -conduct disorder -active substance abuse or dependence -mental disorder -mental retardation -pervasive developmental disorder -history of CBT for ADHD	10	Therapy modules including: Psycho-education & organized planning, distractibility, adaptive thinking, procrastination, parent-adolescent sessions, parent-only sessions, relapse prevention
Young <sup>7</sup> , 2016	RCT	95	>18	->18 years old -diagnosis of ADHD -self-reported stability on prescribed ADHD medication for >1 month	-mental illness -suicidal ideation -eating disorder -drug abuse -intellectual impairment	39	Revision of Reasoning and Rehabilitation pro social competence training program

### Outcomes Measured

The outcomes measured in the selected studies were based on subjective scores of ADHD symptoms from the perspectives of patients, parents, and third party independent evaluators and were centered on patient-oriented outcomes.

Boyer et al measured ADHD symptoms from four scores of the Disruptive Behavior Disorder (DBD) rating scale, which included (1) ADHD Inattention, (2) ADHD Hyperactivity/impulsivity, (3) Oppositional Defiant Disorder, and (4) Conduct Disorder, based on DSM-IV criteria.<sup>2</sup> In this study, planning problems were evaluated using the Behavior Rating Inventory of Executive Functioning and the Planning/Organizing Scale. Outcomes were measured via parent-reporting at a pre-test period (one week before intervention), a post-test period (one week after intervention), and a maintenance period (three months after intervention).

Spirch et al measured outcomes using the results of an independent evaluator ADHD severity rating scale based on DSM-IV criteria for ADHD-symptoms.<sup>6</sup> Scores ranged from 0-3; a score of zero indicated that the symptom was not present while three indicated that the symptom was most severe. Spirch et al also used an independent evaluator Clinical Global Impression (CGI) scale which analyzed the severity of the patient's symptoms ranging from 1 (indicating not ill) to 7 (indicating extremely ill). Evaluations were made to identify a patient's baseline before treatment, a post-treatment period (four months after treatment) and a maintenance-period (eight months after treatment).

Young et al utilized a 32 item participant-reported inventory called RATE-S, which encompassed 4 subscales including (1) ADHD symptoms, (2) emotional control, (3) antisocial behavior, and (4) social functioning.<sup>7</sup> Items were reported on an 8-point scale; a score of zero indicated "not at all" while a score of eight indicated "most of the time". Young et al also utilized the CGI scale to quantify the severity of patients' ADHD symptoms and related impairment. The CGI scale was conducted by independent evaluators who were blind to the population. Analysis was conducted at the participant's baseline before intervention was

initiated, immediately after treatment was completed as a post-intervention assessment, and a follow up score (three months after treatment was ended).

## Results

QUINT is a method of statistical analysis Boyer et al devised to understand the interaction and trajectories of two subgroups – those that received Plan My Life (PML) CBT and those that received Solution Focused Treatment (SFT) CBT.<sup>2</sup> QUINT is a means to evaluate the qualitative outcomes of a total population's division into optimal subgroups.<sup>2</sup> QUINT analysis was achieved by separating patients based on pre-test symptom scores and cross-analyzing data to better predict what would best benefit patient outcomes. Using QUINT trajectories, Boyer et al found that there was no qualitative treatment-subgroup interaction between the pre-test to post-test periods.<sup>2</sup> Though, QUINT analysis did find that there was a qualitative treatment-subgroup interaction present during the period between the post-test to 3-month follow up period.

The final analysis of QUINT is shown in Table 2 and revealed that participants who began the trial with better symptom-related scores (DBD <24.82) were more likely to benefit from SFT over PML treatment methods with a moderate effect size shown by  $d=0.34$ . The study shows that patients with less ADHD symptoms had an improvement of symptom scores by 2.98 points when assigned to SFT over PML. Conversely, patients who began with a worse symptom-related score (DBD >24.82) were more likely to have better responses to the PML treatment than the SFT treatment with a moderate effect size shown by  $d=-0.37$ . The trial shows that patients with more ADHD symptoms had an improvement of symptom scores by 3.29 points when assigned to PML over SFT.

Table 2: Results of QUINT Analysis Showing Optimal Trajectories of Population Subgroups

Parent-rated ADHD pretest score (DBD)		QUINT-projected benefit	Score improvement from preferential program	Cohen's d
<24.82	Less symptoms	SFT	2.98	0.34
>24.82	More symptoms	PML	3.29	-0.37

Even though the initial QUINT analysis showed that there would be beneficial responses to CBT for participants based on pre-test ADHD symptom scores, ad hoc analysis of the data shows that there was actually no statistically significant differences between groups in response to treatments, as shown in Table 3.<sup>2</sup> Statistical data analysis revealed that there was little precision about the outcomes of the data set, exhibited by a  $p=-0.177$  for pre to post test results, and  $p=0.311$  for post-test to follow up treatment outcomes. Both  $\omega_p^2$  of 0.006 and 0.000 show a small effect size, which means that the responsiveness to treatment was not in strong association with specific treatment modalities and the difference in response between groups was minimal.

Table 3: Precision and Effect Size of Pre-test to Post-test and Post-test to Follow-up Periods

Time of Evaluation	F	p	$\omega_p^2$
Pre-test to Post-test	(1,144) = 1.84	-0.177	0.006
Post-test to Follow up	(1,114) = 1.03	0.311	0.000

Spirch et al held a trial that randomized 46 total participants into a group of 24 participants who would receive CBT at the start of the study and another group of 22 patients who would be placed on a wait list and have treatment delayed for four months after the start of the study.<sup>6</sup> The study followed a cross-over design in which participants were evaluated within their randomly assigned group after the intervention was applied. An intent-to-treat analysis was conducted using a linear mixed model and included all available data from those who did or did not complete the trial.

Spirch et al found that there was no significant difference between CGI scores of both groups at baseline, shown in Table 4. A reduction of symptoms, shown by the mean in Table 4 occurs in all groups after the initiation of CBT. This is seen by a reduction of mean score of 4.55

at four months post-trial to a mean score of 3.20 mean score at the eight months follow up for the waitlisted group. In the experimental group, there is a reduction in mean score from baseline to four months post-trial, and again to eight months post-trial, comprising an overall mean score reduction of 4.75 to 3.71. These results were found to be statistically significant and precise, given the CI and p values reported of 1.17 (1.39, 0.94) and <0.0001, respectively.<sup>6</sup>

Table 4: Outcomes of CGI for waitlist (control) and CBT groups

	Wait List		CBT		95% CI	p value
		Mean ± SD		Mean ± SD		
Baseline	Baseline	4.64 ± 0.85	Baseline	4.75 ± 0.68	1.17 (1.39, 0.94)	<0.0001
Post-trial (4 months)	Waitlist	4.55 ± 0.80	CBT	3.71 ± 0.85		
Follow up (8 months)	CBT	3.20 ± 0.86	CBT	3.71 ± 0.96		

Parent and adolescent reported scores are shown in Table 5 and mirror the trends seen with CGI scores: a statistically significant reduction in symptoms after the initiation of CBT in both the experimental and control groups.<sup>6</sup> The reductions shown in Table 5 are validated by the strong correlation and precision of the CI of 10.93 (12.93, 8.93) and p value of <0.0001.

Table 5: Outcomes of parent-rated scores and adolescent-rated scores for waitlist (control) and CBT (experimental) groups

		Wait List		CBT		95% CI	p value
			Mean ± SD		Mean ± SD		
Parent - ratings	Baseline	Baseline	28.05 ± 9.57	Baseline	25.30 ± 9.17	10.93 (12.93, 8.93)	<0.0001
	Post-trial (4 months)	Waitlist	24.18 ± 8.23	CBT	16.76 ± 10.40		
	Follow up (8 months)	CBT	12.82 ± 6.51	CBT	13.71 ± 9.65		
Adolescent - ratings	Baseline	Baseline	14.41 ± 8.35	Baseline	16.46 ± 10.90	5.34 (7.21, 3.28)	<0.0001
	Post-trial (4 months)	Waitlist	13.86 ± 8.12	CBT	11.95 ± 8.89		
	Follow up (8 months)	CBT	7.42 ± 3.71	CBT	9.71 ± 7.21		

Absolute Benefit Increase and Numbers Needed to Treat (NNT) were also used to analyze the efficacy of the trial’s outcomes.<sup>6</sup> This trial reveals an especially effective NNT, which was calculated to be 4. Though, the study provided data that showed only a 32% increase in benefit as a result of the intervention.

Young et al conducted a study with 95 participants (N=90) that were randomized into a control group containing 47 participants (N=47) and an experimental group of 48 participants (N=48).<sup>7</sup> All participants of the controlled trial were analyzed in the group they were randomly assigned. An intent-to-treat analysis was conducted. Data was analyzed using a linear mixed model while controlling for age as a variable.

Outcomes of ADHD-related symptoms and CGI scores at baseline showed no statistically significant difference in scores between the experimental group that received CBT and the control group who maintained treatment as usual, as shown in Table 6. Table 6 also shows a steady reduction in both RATE-S and CGI scores for the experimental group depicted by an overall reduction in mean score of 41.76 to 29.28 for RATE-S and 3.96 to 3.14 for CGI. Though, the patients who resumed TAU showed no or minimal reduction in these scores throughout the progression of the trial, as seen by comparing RATE-S score at baseline (40.39) to follow up (38.66) or CGI score at baseline (3.91) to follow up (3.80).

Table 6: Outcomes measured by RATE-S Scores and Clinical Global Impression Scores at baseline, end of treatment, and follow up

	CBT (Mean $\pm$ SD)			TAU (Mean $\pm$ SD)		
	Baseline Mean	End of Treatment Mean	Follow up Mean	Baseline mean	End of Treatment Mean	Follow up Mean
RATE-S	41.76 $\pm$ 11.05	34.30 $\pm$ 10.30	29.28 $\pm$ 11.47	40.39 $\pm$ 11.56	38.77 $\pm$ 11.56	38.66 $\pm$ 11.93
CGI	3.96 $\pm$ 0.81	3.03 $\pm$ 1.05	3.14 $\pm$ 0.79	3.91 $\pm$ 1.10	3.79 $\pm$ 0.77	3.80 $\pm$ 0.96

Young et al compared baseline scores to the end-of-treatment scores and also made comparisons between end-of-treatment scores and the follow-up scores.<sup>7</sup> Both comparisons show a reduction in ADHD symptoms for participants receiving CBT. Table 7 indicates the highly significant reducing trends with highly precise estimates for RATE-S outcomes in patients, as noted by the significant p values of <0.05. The criteria of ADHD-symptoms and social functioning, noted by large Coef ( $\beta$ ) calculations of -5.4 and -5.31, respectively shows that these variables strongly influenced the outcome of improving ADHD symptoms and ADLs of patients with ADHD. The largest effect sizes were noted in the ADHD symptoms and antisocial behavior, noted by the large effect sizes,  $d= 0.55$  and  $0.50$ , respectively. Overall, Young et al found that participants who received CBT showed a greater reduction in symptoms and functional scores than those participants who were in the TAU group.<sup>7</sup>

Table 7: Estimated treatment effect for Rate-S symptoms

RATE-S Outcome	Coef ( $\beta$ )	Standard error	P value	95% CI	Effect Size (d)
ADHD symptoms	-5.64	1.58	<0.001	(-8.75, -2.53)	0.55
Social functioning	-5.31	1.48	<0.001	(-8.21, -2.41)	0.41

Patients who had previously received a formal diagnosis of ADHD met with evaluators and cognitive behavioral therapy coaches in an outpatient setting. No study reported any adverse events associated with receiving CBT.

**Discussion**

Cognitive Behavioral Therapy is an emerging treatment for psychological and psychosocial disorders in the United States. As a supplemental treatment, there is no harm or contraindications to engaging in CBT. CBT is a treatment modality that combines the techniques of cognitive and developmental therapies and theories of human behavior.<sup>7</sup> In the literature, CBT has been utilized to aid in the treatment of multiple psychological and neurocognitive disorders.

For example, CBT has been studied to be a supplemental treatment of borderline personality disorder, schizophrenia, obsessive compulsive disorder, post-traumatic stress disorder, eating disorders, and addictive disorders.<sup>7</sup> Because CBT is a developing modality of treatment, there is much that needs to be studied in relation to CBT and efficacy. The selected studies were limited mostly by the ability to blind participants from treatment groups. Patients and parents were aware of the which participants received CBT and represented a potential source for bias in reported results. Though a relatively new method of treatment, CBT is recommended as first-line for treatment of psychosocial disorders, especially ADHD.

### **Conclusion**

The results of these studies shows that CBT is effective in reducing the symptoms of ADHD and aids in the functional improvement of ADLs. Though, further studies should be conducted to overcome some of the barriers that these trials faced. For example, these studies did not address the differences in which pre-trial ADHD symptoms predominated in patients and thus did not consider how this would factor into response to CBT. Further studies could assess the response to CBT in patients with ADHD and separate data for 3 patient populations where ADHD symptoms are predominantly (1) hyperactive, (2) inattentive, or (3) impulsive. The study could then measure how these three ADHD-subgroups respond to treatment and ensure that cognitive behavioral therapy could be universally utilized as treatment. In addition, these studies utilized patient and parent-based scores to determine the efficacy of the treatments, even though patients and parents were not blind to treatment. This factor is a potential source for bias in the study; thus, possibly influencing the outcome measurements of the effectiveness of the therapy. Further research should better utilize independent evaluators as the means for analysis.

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