

Non-Pharmacological Treatment Approach to  
Attention Deficit Hyperactivity Disorder

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### Abstract

Attention Deficit Hyperactivity Disorder (ADHD) impacts as many as 1 in 10 children. ADHD can affect academic performance, social interactions, relationships, and self-esteem.

Pharmacological interventions with the use of stimulant medication is the first line of treatment.

Children who do not respond to medication trials and suffer adverse side effects need alternative treatment options to manage symptoms. New and emerging treatment options being studied to determine efficacy for symptom management is cognitive behavior therapy, social skills training, exercise and neuro feedback. They represent alternative options for non-pharmacological treatment. Evidence supports the use of these treatment options alone, or in conjunction with medication management. The evidence has led to an evidence base practice project conducted in a psychiatric outpatient clinic using Play Attention technology and quantitative behavior testing to determine the effectiveness of neurofeedback in treating children and adolescents with ADHD.

*Keywords:* attention deficit hyperactivity disorder, nonpharmacological, pharmacological, children

### Non-Pharmacological Treatment Approach to Attention Deficit Hyperactivity Disorder

Attention Deficit Hyperactivity Disorder (ADHD) is a medical diagnosis that affects both children and adults. The American Psychiatric Association (2013) notes that ADHD impacts 5-10% of children across all cultures. Children affected by ADHD suffer from reduced academic performance, social rejection, decreased self-esteem, depression, and anxiety which can lead to additional comorbidities across the lifespan (Sadock, Sadock & Ruiz 2015). Sadock et al. (2015) also notes that pharmacological treatment is considered the first line of treatment for ADHD. In the clinical setting, evidence has shown pharmacological treatment to be most effective; however, additional non-pharmacological options exist for treating symptoms (Shaw et al., 2012). Internal evidence has shown that often parent and children refuse pharmacological treatment for ADHD and then are not always presented with clear alternate treatments. There exists a gap between pharmacological treatment and non-pharmacological treatment options and the child and parents understanding of what treatment is available. When parents are not in agreement with giving their children medication despite its effectiveness, there needs to be additional non-pharmacological interventions and resources available for children and parents to consider.

Children with ADHD, and their families are impacted by not being properly educated regarding pharmacological and non-pharmacological interventions. This lack of understanding of treatment options impacts the child's success in school, at home, and in the community, as well as with relationships in these settings. Children with untreated or undertreated ADHD can experience increased frustration, anxiety and depression at home and at school. ADHD tends to impact the child most significantly in the school and home settings as they are not able to focus or complete necessary tasks due to impulsivity, inattention or a combination of both (American

Psychiatric Association, 2013). In a review of non-pharmacological interventions in school settings by Richardson et al. (2015), it was suggested that ADHD psychoeducation and relationship-building skills are potential implications for interventions and could provide beneficial outcomes for patients with ADHD.

### **Problem Statement**

Serrano-Troncoso, Guidi, and Alda-Diez (2013) state that ADHD is the most prevalent psychiatric disorder in children and adolescents. As many as 1 in 10 children are diagnosed with this disease, and it has a great impact on the psychological development of the patients it affects. Initially ADHD was thought to be simply a behavior problem. There remains a stigma attached to ADHD in our communities, school systems, and with parents and family members. Many believe that children simply have behavior problems or need additional discipline. Unfortunately, trying to discipline ADHD out of a child can worsen the patient's symptoms and additionally cause increased comorbidities (Sadock et al., 2015). ADHD cannot be "disciplined" out of children. ADHD is a medical diagnosis that can be treated effectively. Stakeholders, those impacted by the disease, such as the child and parents need to understand the disease and what options are available for treatment, including non-pharmacological interventions. Although stimulants are considered first line treatment, Shaw et al. (2012) identified that a combination of pharmacological and non-pharmacological treatment for patients with ADHD helps reduce the long term negative impact of untreated ADHD in as many as 72% of the outcomes reported. The diagnosis of ADHD continues to gain better understanding as a medical diagnosis. As such, it requires appropriate treatment. The use of non-pharmacological treatment options can be beneficial for patients who decline or have adverse reactions to pharmacological treatment options.

### **Purpose and Rationale**

The purpose of this paper is to identify and discuss non-pharmacological treatment options for children diagnosed with ADHD. Providers and patients have many different approaches to treating ADHD. This paper will identify various approaches to treatment including the benefits of nonpharmacological treatment compared with pharmacological treatment alone. It will include the benefits of educating patients and families about both pharmacological interventions and provide them with non-pharmacological interventions that can be readily accessible through group or individual settings. Educating patients concerning various modalities of treatment will provide the patient with a better understanding of medication management as well as skills training and therapy that could maximize the benefits of treatment.

Serrano-Troncoso et al (2013) identified several limitations with medication treatment for ADHD and stated that non-pharmacological treatments are considered a necessary component of treatment. Serrano-Troncoso et al. (2013) go on to identify the efficacy of alternative treatments including behavior therapy, parent training, cognitive therapy and social skills training. Medications are not the only option in treating ADHD. When medications don't work children and parents need to understand alternative options exist that can be utilized to treat and manage symptom.

### **Background/Significance**

It is observed at various clinical sites that many parents and children do not want to initiate pharmacological interventions to treat diagnosed ADHD. For those that do initiate pharmacological treatment, there are some that experience adverse side effects that make taking the medication problematic. Failure to initiate pharmacological interventions or discontinued use of medications due to side effects should not limit a child's ability to manage symptoms.

The role of pharmacological and non-pharmacological treatment of ADHD is to reduce symptoms and improve functional outcomes (Arnold, Hodgkins, Caci, Kahle, & Young 2015). Untreated ADHD typically presents with many comorbidities including anxiety and depression. Depressed mood and anxiety are often treated unnecessarily as these symptoms would be reduced or non-existent if the patient was properly treated for ADHD. Hauck, Lau, Wing, and Kurdyak (2017) presented a study conducted in a primary care setting, identifying that patients with ADHD were 12 times as likely to also be prescribed an antipsychotic medication and four times as likely to be prescribed an antidepressant. The primary care setting is not ideal for managing psychiatric health problems. Many primary care providers do not have sufficient understanding of the disease process. They utilize additional medications when non-pharmacological interventions may be more appropriate to treat the ADHD and help reduce or resolve comorbidities.

Schoenfelder and Sasser (2016) note that despite family concerns and lack of long term medication adherence, stimulant medications continue to be the first line for treatment for ADHD. Schoenfelder and Sasser (2016) also identify the growing evidence of implementing psychosocial treatment alone or in conjunction with pharmacological treatment. Behavior parent training, behavior classroom management and behavior peer interventions are being utilized to help children and adolescents with ADHD work on improving functional outcomes. These non-pharmacological interventions address staying on task, being compliant with instructions, increasing academic performance and working on social and family interactions and relationships (Schoenfelder & Sasser, 2016). Practitioners play a critical role in educating patients and parents about these treatment options and encourage family motivation and engagement in the treatment of the patient.

De Crescenzo, Cortese, Adamo, and Janiri (2017) conducted a meta review of 40 articles identifying pharmacological and non-pharmacological treatment of ADHD. They determined that pharmacological treatment is significantly more efficacious than placebo despite being less accepted or tolerated. They went on to state that more research and empirical support is needed to determine if non-pharmacological treatments are supported. Fabiano, Schatz, Aloe, Chacko, and Chronis-Tuscano (2015) performed a meta-analysis and determined that the use of non-pharmacological interventions and psychosocial treatments for ADHD are efficacious and consistent with many literature reviews that strongly endorse non-pharmacological treatment for youth with ADHD.

Neurofeedback is a non-pharmacological treatment that has mixed results in terms of efficacy. Neurofeedback is a tool used to display real-time brain activity and is used to teach individuals to self-regulate brain function. Gelade et al. (2016) compared the efficacy of neurofeedback treatment for ADHD in comparison to stimulant medication and physical activity. They determined based on the Strengths and Weakness of ADHD and Normal behavior (SWAN) hyperactive/impulsive scales that behaviors improved simply with intention to treat, per parental reports. SWAN inattention scales identified more improvement in patients who were receiving stimulant medication treatment over neurofeedback. This was true with parental reports and school reports. Interestingly, in another study Duric, Abmus, and Elgen (2014) identified significant improvement in attention, hyperactivity and school performance of children and adolescents in a randomized control trial based on a self-report of symptoms. This suggested that patients felt neurofeedback was helpful and offers a promising alternative to treatment in those who do not respond to pharmacological interventions or suffer from adverse side effects.

In addition to neurofeedback as a non-pharmacological treatment option, there is a belief that physical exercise can be efficacious for treatment of ADHD in children. Berwid and Halperin (2012) identify that non-pharmacological treatment options for ADHD have been expanding and indicate that intense aerobic exercise enhances brain structure and function which can be beneficial for children with ADHD. There is not sufficient evidence to recommend this as widespread treatment. Additional studies do need to be conducted.

A major area for concern with children and adolescents with ADHD is school performance and homework completion. Sitting down and completing homework can present significant problems for the child. The use of stimulant medication can be helpful but alternatives need to be available. In a study by Merrill et al. (2017), they identified that behavioral treatment that were homework focused resulted in clear benefits for homework completion. Accuracy and long acting stimulant medication resulted in nonsignificant effects on homework performance. Soderlund, Bjork, and Gustafsson (2016) added that auditory noise treatment (white noise) resulted in task performance improvement when compared to stimulant medications alone, adding to the conclusion that non-pharmacological interventions are a potential alternative treatment for cognitive ADHD symptoms.

The treatment of ADHD symptoms is complex. There are no perfect treatments that work the same for everyone. While pharmacological treatment utilizing stimulant medications is the recognized first line treatment, Serrano-Troncoso et al (2013) state there are clear indications that a combination of non-pharmacological and pharmacological treatment is recommended to treat ADHD symptoms, and additional studies must be completed.



This inquiry has led to the clinically significant PICOT question, “In children with ADHD, how does non-pharmacological interventions compared to usual care, affect attention, impulsivity and hyperactivity over a 3-month period?”

### **Search Strategies**

To answer this clinical question, an exhaustive literature search was conducted. The search of three databases including PsychInfo, PubMed, and CINAHL were utilized. Key words used in this search included *ADHD* (and) *non-pharmacological* (and) *pharmacological* (and) *treatment* (and) *children*. Search criteria was limited to include peer reviewed journal articles that were written in English and published between 2012 to 2017. The abstracts were reviewed and articles that addressed only pharmacological treatment for ADHD were excluded. Studies identifying non-pharmacological interventions included neurofeedback, psychological treatment, exercise, behavior parent training, skills training and cognitive behavioral therapy.

The initial search in PubMed was performed with the same search criteria and a yield of 46 articles resulted (Appendix A). Changing the search criteria to include only the title and not the abstract condensed the yield to 15 articles. Of those 15, two articles were selected which included one meta-analysis and one systematic literature review. PsychInfo yielded 342 results (Appendix B). After adding additional search criteria, a final yield of 66 articles resulted. Upon reviewing the abstracts and excluding various articles based on exclusion criteria, five final articles were chosen from this database, including three randomized control trials, one meta-analysis, and one systematic literature review. The initial search in CINAHL yielded 109 articles (Appendix C). With addition of search criteria, a final yield of 11 studies resulted. Upon further review, three were chosen, including one randomized control trial and two meta-analysis.

### **Critical Appraisal and Synthesis of Evidence**

Ten studies were selected for this review (Appendix D). The studies included four randomized control trials, four meta-analysis, and two systematic literature reviews. The level of evidence in these studies included four level I studies, four level II studies and two level V studies. Although these studies reviewed a variety of different non-pharmacological treatment options for ADHD, all studies demonstrated moderate homogeneity. Similar designs were implemented to provide strong validity and limit bias. Self-report, parental report, teacher report and testing for academic performance were utilized to capture outcome measurements. The primary outcome measurements included increased attention, increased academic performance, increased social functioning and decreased hyperactivity (Appendix E). Seven studies implemented a form of CBT, four studies implemented psychosocial therapy, three identified social skills training and neurofeedback and two identified exercise. Six of the studies included a control group utilizing pharmacological interventions to compare measurement outcomes between the control group and the test group. This allowed for added validity regarding outcome measures for nonpharmacological interventions as pharmacological treatment is the first line therapy for treating children with ADHD.

Data analysis was well presented in the randomized control trial studies. The meta-analysis and systematic literature reviews provided an overarching significance of the evidence as related to outcome measures but there were limited specifics as to what testing methods were utilized. The benefit of utilizing meta-analysis and literature reviews is that they examine a large number of studies and provide unbiased high levels of evidence. Two studies identified using the Chi-square, Analysis of variance and paired t-tests. Additional studies utilized surveys and questionnaires providing qualitative data that indicated effective treatment. These surveys and

questionnaires demonstrate strong validity but without additional information regarding study demographics and way these surveys and questionnaires were administered it is difficult to determine reliability.

All studies included a population of children and adolescents ranging from ages 5-18 years old. One study did include adults age 18 and older. It is not clear in the meta-analysis or systematic literature reviews as to the more specific demographics of the population studied. Gender, race, socioeconomic status, and additional demographic information would need to be obtained from the individual studies. This information will impact the heterogeneity, reliability and validity of the studies. As noted, this information can be obtained through the individual RCT's that were reviewed in the meta-analysis and literature reviews but it was difficult to identify specific test scores in the studies selected.

### **Conclusion from Evidence**

The major findings of the body of evidence reviewed indicates that nonpharmacological treatment plays a significant role in treating children with ADHD. Pharmacological interventions are more frequently studied and continue to be first line treatment. Data indicates that a combination of medication and non-pharmacological interventions or non-pharmacological interventions alone increase children's ability to manage ADHD Symptoms. Increased attention, increased academic performance, increased self-esteem, increased cognitive functioning, increased social interactions and decreased antisocial behavior and hyperactivity are indicated when implementing non-pharmacological interventions. CBT, exercise, neurofeedback, psychosocial therapy and social skills training all indicated improvement in outcome measures identified (Appendix E). ADHD symptoms can be debilitating for children. Untreated or undertreated ADHD can have a significant negative impact on a child's social, academic and

family interactions. Non-pharmacological interventions are an effective alternative to medication. Additional research is needed to provide more clinical evidence for initiating non-pharmacological treatment options into clinical practice.

### **Contribution of Theory and EBP Model to Guide Implementation of Evidence**

The theoretical framework varied from study to study, but the health promotions model (HPM) was the underlying framework for the majority of the studies. HPM was proposed by Nola Pender in 1982 and revised in 1996. HPM defines health as a positive dynamic state and not just an absence of disease. Through the HPM, patients reach a desired behavioral outcome that results in improved health, enhanced functional ability and increased quality of life in all stages of development (Butts & Rich, 2015). The application of the HPM in working with children with ADHD focuses on helping them reach a desired outcome of improved attention, focus, self-esteem and social interaction. The theory will guide the project by looking to improve quality of life for children with ADHD. The use of non-pharmacological treatment focuses on creating a positive dynamic state and symptom management in a variety of settings.

The implementation of this evidence into clinical practice will utilize the Rosswurm and Larrabee (1999) model for evidence based practice change (Appendix F). This model is selected as it outlines the steps needed to implement practice change. Treatment for children with ADHD has primarily focused on pharmacological treatment. Implementing practice change to incorporate non-pharmacological interventions will require provider buy-in and must be supported by evidence based practice in the clinical setting. This model is composed of six steps including 1) Assess the need for change in practice; 2) Locate the best evidence; 3) Critically analyze the evidence; 4) Design practice change; 5) Implement and evaluate change in practice; and 6) Integrate and maintain change in practice (MeInyk & Fineout-Overholt, 2011). As

previously identified, treatment for ADHD can include multiple modalities. There is a need for practice change to incorporate more treatment options, including non-pharmacological treatment. Evidence supports that non-pharmacological treatment is effective in reducing ADHD symptoms. Evaluating and analyzing the evidence will lead to design and implementation of practice change. Engagement with this model will allow the clinical team to work together to promote change.

### **Purpose Statement**

The purpose of this study is to determine the efficacy of neurofeedback training for treating children with ADHD. Many patients and their families are in search of non-pharmacological interventions to treat ADHD and avoid initiating medications. Providing additional studies to determine the efficacy of neurofeedback in treating ADHD can equip providers with additional, non-pharmacological treatment options for combating the symptoms of ADHD, including: activity, attention and impulsivity.

### **Project Methods / Applying Evidence to Practice**

An evidence base practice project, incorporating neurofeedback training; was conducted over a 20-week period in an outpatient psychiatric clinic in Gilbert, AZ. The project was reviewed and approved by the Arizona State University Institutional Review Board. Key stakeholders include the practice, psychiatrists, nurse practitioners, therapists, social workers, and the patients and families involved in the study. Instruments for this project include Quantitative Behavioral testing (Qb) and Play Attention neurofeedback treatment. Qb testing is a 15-minute test used to identify ADHD symptoms of inattention, impulsivity and activity; and provides objective data points to be used along with clinical evaluation to assist in diagnosing ADHD. Qb testing has proven reliability and validity, consistently measuring and recording

scores for attention, impulsivity and activity as previously mentioned. Play Attention is a neurofeedback software developed to help re-train the brain and improve/decrease ADHD symptoms.

Participants voluntarily enrolled in Play Attention treatment groups as part of the standard of care at the identified clinic. Treatment consists of 40 sessions, 2 sessions per week over a 20-week period. These sessions are one hour in duration and the participants are in groups not to exceed 6 participants. A baseline Qb test, a mid-point test, and a final Qb test were intended to be completed to track quantitative data points and mean scores in relation to attention, impulsivity and activity. Data analysis was conducted to identify statistical and/or clinical significance of pre and mid-point Qb scores.

### **Project Results/Outcomes**

Thirteen participants ( $N = 13$ ), nine males and four females all with an ADHD diagnosis, between the ages of 6 and 13 were involved in the project. These participants all completed at least 20 neurofeedback sessions as well as pre and mid-point Qb testing. Due to the small sample size, a Wilcoxon signed ranks test was utilized to compare the sample mean scores of the pre and mid-point test values for activity, attention and impulsivity. Wilcoxon signed ranks test indicated that midpoint test ranks were statistically significantly lower than pre-test ranks. Activity pre-score ( $M = 1.82$ ,  $SD = 1.12$ ), midpoint score ( $M = 1.14$ ,  $SD = 1.01$ )  $Z = -3.06$ ,  $p = .002$ . Attention pre-score ( $M = 2.47$ ,  $SD = 1.27$ ), midpoint score ( $M = 1.25$ ,  $SD = 0.93$ )  $Z = -2.97$ ,  $p = .003$ . Impulsivity pre-score ( $M = 1.55$ ,  $SD = 1.18$ ), midpoint score ( $M = .36$ ,  $SD = 1.05$ )  $Z = -3.18$ ,  $p = .001$ . A mean Qb score  $\geq 1.5$  indicates clinically significant symptoms for ADHD. For all three categories, the mean Qb scores decreased from a clinically significant score ( $\geq 1.5$ ) to a score indicating an absence of clinically significant ADHD symptoms ( $< 1.5$ ). The p-values also

indicate statistical significance with all values  $\leq .003$ . The effect size for the variables of activity, attention and impulsivity = 1.10, 1.27, and 1.43 respectively; indicating that Play Attention treatment has a large impact on all three dependent variables (activity, attention, and impulsivity).

### **Impact of the Project**

Neurofeedback as a non-pharmacological treatment option for ADHD shows clinical promise based on the reduction of midpoint mean Qb scores. Unfortunately, Play Attention neurofeedback treatment groups are not currently offered at the clinical site. Completion of all 40 sessions of Play Attention treatment and posttest Qb scores were not obtained because the Play Attention treatment group was discontinued. It was not anticipated that the Play Attention treatment group would be discontinued, however due to multiple complications with staff turnover, schedule conflicts, and decreased client participation the administrative staff discontinued the program.

The findings from this project warrant a discussion with the program director to discuss reorganizing and resuming Play Attention treatment groups. Neurofeedback provides an alternative treatment option for parents who do not want to medicate their children or for those children who have experienced unwanted side effects from pharmacological treatment. Providers can utilize the clinically significant data to determine non-pharmacological treatment options for their patients. The data can also be used to advocate for further studies to be conducted to determine if neurofeedback can be an evidenced based non-pharmacological treatment option for ADHD.

### **Conclusion**

Pharmacological treatment remains first line treatment for children diagnosed with ADHD. Children who struggle with ADHD and do not respond to medications need additional treatment options. Neurofeedback provides an alternative non-pharmacological treatment option that may help change the way children with ADHD are treated in the future. This pilot study provided clinically and statistically significant data regarding the efficacy of Play Attention and the use of neurofeedback to help re-train the brain and reduce ADHD symptoms. Additional studies are needed to determine long term efficacy of non-pharmacological treatment options and Play Attention studies need to be included in this process. If proven to be effective, Play Attention can be introduced at additional outpatient clinics and be implemented as a treatment option for children with ADHD who have previously failed medication trials or who are looking for an alternative to pharmacological interventions.



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Appendix A  
Search Strategy 1

PubMed

The screenshot shows a web browser window displaying the PubMed search results page. The search query is: `(((ADHD) AND non-pharmacological[Title/Abstract]) AND treatment[Title/Abstract]) AND children`. The results are sorted by 'Most Recent' and show 5 items out of 46 total results.

**Search results:**

- Pharmacological and non-pharmacological treatment of adults with ADHD: a meta-review.**  
De Crezenzo F, Corlese S, Adamo N, Janiri L. *Evid Based Ment Health.* 2017 Feb 20;1(4-11. doi: 10.1136/eb-2016-102415. PMID: 27993933
- Neurofeedback training effects on inhibitory brain activation in ADHD: A matter of learning?**  
Baumeister S, Wolf I, Holz N, Boecker-Schlier R, Adamo N, Holtmann M, Ruf M, Banaschewski T, Hohmann S, Brandeis D. *Neuroscience.* 2016 Sep 19. pii: S0306-4522(16)30463-8. doi: 10.1016/j.neuroscience.2016.08.025. [Epub ahead of print] PMID: 27039110
- Comparing Auditory Noise Treatment with Stimulant Medication on Cognitive Task Performance in Children with Attention Deficit Hyperactivity Disorder: Results from a Pilot Study.**  
Söderlund GB, Björk C, Gustafsson P. *Front Psychol.* 2016 Sep 5;7:1331. doi: 10.3389/fpsyg.2016.01331. PMID: 27655153 Free PMC Article
- The Effectiveness of Parent Training as a Treatment for Preschool Attention-Deficit/Hyperactivity Disorder: Study Protocol for a Randomized, Controlled, Multicenter Trial of the New Forest Parenting Program in Everyday Clinical Practice.**  
Lange AM, Daley D, Frydenberg M, Rask CJ, Soruga-Barko E, Thomsen PH. *JMBR Res Protoc.* 2016 Apr 13;3(2):e51. doi: 10.2196/resprot.5319. PMID: 27079499 Free PMC Article
- ADHD – Diagnostics and Treatment, Organization of the Health Care and Patient Involvement [Internet].**

**Search details:**  
`((("attention deficit disorder with hyperactivity"[MeSH Terms] OR ("attention"[All Fields] AND "deficit"[All Fields] AND "disorder"[All Fields] AND "hyperactivity"[All`

**Recent Activity:**  

- (((ADHD) AND non-pharmacological[Title/Abstract]) AND treatment[Title/Abstract]) AND children PubMed
- The pharmacological and non-pharmacological treatment of attention deficit PubMed
- The pharmacological and non-pharmacological treatment of attention PubMed
- (((ADHD[Title/Abstract]) AND Non-pharmacological[Title/Abstract])... (31) PubMed
- Is psychological treatment efficacious for PubMed

Appendix B  
Search Strategy 2

PsycINFO

The screenshot shows a web browser window displaying the ProQuest PsycINFO search results page. The search query entered is "ADHD AND ab((non-pharmacological OR pharmacological)) AND ab(treatment) AND ab(children)". The page indicates 342 results. The first result is a journal article titled "Reading outcomes of children and adolescents with attention-deficit/hyperactivity disorder and dyslexia following atomoxetine treatment" by Shaywitz, Bennett A.; Williams, David W.; Fox, Bethany K.; Wietecha, Linda A., published in the Journal of Child and Adolescent Psychopharmacology, 24(8), 419-425 (Oct 2014). The abstract snippet shows "(ADHD) symptoms in children and adolescents having ADHD with comorbid dyslexia ... in children with ADHD+D. Patients ages 10-16 years with ADHD or ADHD+D received ... reading in children with ADHD and dyslexia or dyslexia alone. (PsycINFO Database)". The interface includes navigation options like "Cite", "Email", "Print", and "Save", and a sidebar for filtering results by "Peer reviewed" and "Source type".

# Appendix C

## Search Strategy 3

### CINAHL

The screenshot shows a web browser window displaying the EBSCOhost search interface. The search results page shows 11 results for the query: **ADHD AND AB non-pharmacological AND AB pharmacological AND AB children AND AB treatment**. The first result is titled "Attention-deficit hyperactivity disorder (ADHD): an updated review of the essential facts." and is from the journal "Child: Care, Health & Development". The interface includes search filters, a search history table, and a taskbar at the bottom showing the date as Friday, 2/10/2017.

Search History/Alerts

Search ID#	Search Terms	Search Options	Actions
S1	ADHD AND AB non-pharmacological AND AB pharmacological AND AB children AND AB treatment	Search modes - Boolean/Phrase	<a href="#">View Results (11)</a> <a href="#">View Details</a> <a href="#">Edit</a>

Search Results: 1 - 11 of 11

1. Attention-deficit hyperactivity disorder (ADHD): an updated review of the essential facts.

(Includes abstract) Tarver, J.; Daley, D.; Sayal, K. *Child: Care, Health & Development*, Nov2014; 40(6): 762-774. (13p) (Journal Article - research, systematic review, tables/charts) ISSN: 0305-1802 AN: 103904615

Abstract: Attention-deficit hyperactivity disorder (ADHD) is a complex disorder that can affect individuals across the lifespan. It is associated with substantial heterogeneity in terms of aetiology, clinical presentation and treatment outcome and is the subject of extensive research. Because of this, it can be difficult for clinicians to stay up to date with the most relevant findings and know how best to respond to parents' questions and concerns about the disorder and interventions. This is a narrative review that aims to summarize key findings from recent research into ADHD and its treatment that clinicians can share with families in order to increase their knowledge about ADHD and intervention options. ADHD develops as a result of complex interplay between interdependent genetic and non-genetic factors. The disorder is associated with substantial impairments in functioning and poor long-term outcomes. Pharmacological and non-pharmacological treatment options are available for symptom management and to improve function, but functioning outcomes often fail to normalize in children with ADHD. Despite extensive advances in understanding this complex disorder, it is clear that there is still a long way to go. In particular, we address the need for future non-pharmacological interventions to be more specifically targeted for ADHD symptoms and its commonly associated functioning deficits in order to ensure the best long-term outcomes for children with ADHD.

Subjects: Attention Deficit Hyperactivity Disorder Familial and Genetic; Attention Deficit Hyperactivity Disorder Therapy; Child: 6-12 years; Adolescent: 13-18 years; Adult: 19-44 years

Appendix D  
Evaluation Table

Citation	Conceptual Framework	Design/Method	Sample/Setting	Major Variables Definitions	Measurements	Data Analysis	Findings	Decision for Use in Practice/Application to Practice
<p>Arnold, L. E. (2015)</p> <p>Effect of treatment modality on long-term outcomes in attention-deficit/hyperactivity disorder: A systematic review.</p> <p>Country: USA</p> <p>Funding: Shire Development LLC</p> <p>Bias: none reported</p>	<p>Health Promotion Model</p>	<p>Design: MA</p> <p>Method: systematic search of 12 literature databases to identify peer-reviewed, primary studies that reported long-term outcomes of individuals with ADHD.</p>	<p>N-51 studies looking at PT, NPT, and Com for ADHD</p> <p>Inclusion criteria: English language publications dated between Jan. 1980 and Dec 2011</p> <p>Exclusion criteria: MA, CS, and LR were excluded</p>	<p>IV1-NPT IV2-PT IV3- Com</p> <p>DV1-A DV2-AB DV3-driving DV4-NMDU DV5-O DV6- Occ DV7-services used DV8-SE DV9-SF</p>	<p>Data extraction from 51 identified studies.</p> <p>Survey questionnaire to identify improvement or no benefit in treatment</p>	<p>Qualitative Content Analysis</p> <p>Multiple tools used based on the various studies. Post-hoc analysis, chi-square, ANOVA To determine if improved outcomes for DV1-9</p>	<p>Highest improved outcomes in Com =83% increase in positive symptom outcomes NPT= 65% increase in positive symptom outcomes PT=56% increase in positive symptom outcomes</p>	<p>Level V</p> <p>Strengths: All studies used were peer reviewed. Each study was broken down to review treatment outcomes on the same 9 DV for consistency of outcomes based on treatment.</p> <p>Weaknesses: different study demographics and population types, different follow up intervals, different treatment types, publication bias</p> <p>Conclusion: NPT, PT, and Com all demonstrated improved symptom outcomes. Com was most effective for significant improvement in symptoms in both short term and long term follow up.</p>

Key: A-attention, AB- antisocial behavior, ADHD- attention deficit hyperactivity disorder, ANOVA-analysis of variance, AP-academic performance, ASD-autism spectrum disorder, BT-behavioral treatment, CANTAB-cambridge neuropsychological test battery CAS-cognitive assessment system, CBT-cognitive behavioral therapy, CCT-clinical control trial, CF-cognitive function, CG-control group, CI- Confidence interval, Com-combination treatment (pharmacological and non-pharmacological), CS-case studies, DV-dependent variable, E-Exercise, EBP-evidence based practice, GLMM-Generalized linear mixed model, H-hyperactivity, IV-independent variable, LR- literature reviews, MA-meta-analysis, MPH-methylphenidate, N- number of participants, NF-neurofeedback, NMDU- non-medical drug use, NPT- non-pharmacological treatment, O-obesity, Occ-occupation, PST-psychosocial treatment, PT-pharmacological treatment, RCT-randomized control trial, SDQ- strengths and difficulties questionnaire SE-self-esteem, SF-social functioning, SLR-systematic literature review, SM-symptom management, SMD- standard mean difference, SST-social skills training, SWAN-strengths and weaknesses of ADHD symptoms and normal behavior, WL-waitlist

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<p>Berwid, O. G. (2012)</p> <p>Emerging support for a role of exercise in attention-deficit/hyperactivity disorder intervention planning.</p> <p>Country: USA</p> <p>Funding: Grants from the National Institute of Mental Health</p> <p>Bias: none reported</p>	Health Promotion Model	<p>Design: Multiple RCT and CS to look at the impact of E on CF for children with ADHD</p> <p>Method: Investigate the impact of a set exercise program compared to a control group to determine if CF and A improve.</p>	Multiple RCT with N=64 healthy 5 and 6 year old N=171 sedentary 7-11 year old, N=40 school age children with ADHD, N=17 children grades K-3	IV- E DV- CF	<p>Spatial Span</p> <p>Spatial working memory</p> <p>CAS</p> <p>CANTAB</p> <p>Connor's Parent Rating Scale</p> <p>Woodstock-Johnson Test of Achievement</p>	<p>CANTAB scores showed improved CF and Parent rating scales indicated a decrease in inattention and disruptive behaviors</p>	<p>CAS scores did not show significant differences from the control group. Those receiving intense E showed improved parental ratings on cognitive problems and inattention. Evidence showed a correlation between E and improved behavioral symptoms and CF of school age children with ADHD</p>	<p>Level II</p> <p>Strengths: Multiple RCT were incorporated into this study. Participants were all school age children, both male and female</p> <p>Weaknesses: small sample size, unblind status of the researchers and raters of behavior, lack of designed control conditions, lack of actual statistical evidence (test scores, parental rating scores) available to the reader</p> <p>Conclusion: There needs to be more research and data to evaluate the impact of E on children with ADHD. Larger controlled double blind studies and longer follow up times are needed to determine the efficacy of E as it relates to symptom management of ADHD. These studies identified do correlate positive effects for E on ADHD symptoms but the data is not significant enough to make E a</p>

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								treatment option at this time.
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De Crescenzo, F. (2017)  Pharmacological and non-pharmacological treatment of adults with ADHD: A meta-review.  Country: England  Funding: Not identified  Bias: none reported	Systems Theory, Health Promotion Model	Design: MA, LR  Method: database search from 1 January 2010 to 31 May 2016 for systematic reviews on the pharmacological and non-pharmacological treatment of adults with ADHD	N=635 initial studies, N=40 final studies used in this MA to determine efficacy for PT and NPT for ADHD	IV1-NPT IV2-PT DV- SM	Data extraction from 40 identified studies ADHD Symptoms checklist	Qualitative Content Analysis Medication analysis comparing PT and NPT to placebo.	PT was more effective than placebo with a standard mean difference (SMD) 0.45, 95% CI 0.37 to 0.52 NPT was not shown to be clinically significant. CBT did show some improvement in ADHD symptoms.	Level I  Strengths: Multiple RCT selected, Multiple authors used in selection process. No language restrictions, only studies completed in the last 10 years were eligible for review. Only peer reviewed articles were included.  Weaknesses: RCT focused on PT and included adult trials. NPT was not thoroughly researched or included in this MA  Conclusion: PT is more efficacious than placebo, additional data is needed to include NPT as a clinical option for treating ADHD
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Duric, N. S. (2014)  Self-reported efficacy of neurofeedback	Structural Functional Theory. Health Promotion Model	Design: RCT  Method: children under the age of 18	N=91 Children and adolescents with ADHD	IV1-MPH IV2-MPH and NF IV3- NF	Self-report evaluation	General linear model	80% of participants completed the study. All treatment	Level II  Strengths: Randomized design, use of ICD-10 diagnostics with a multi-

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<p>treatment in a clinical randomized controlled study of ADHD children and adolescents.</p> <p>Country: New Zealand</p> <p>Funding: Grant money from the Department of Research, Helse Fonna Hospital, Norway</p> <p>Bias: none reported</p>		<p>participated in a 30-session program of intense NF treatment. Three groups were randomly selected. The CG was given MPH, the next group was given MPH and NF, and the third was treated with NF alone.</p>	<p>less than 18 years of age.</p>	<p>DV1-H DV2-Att DV3-AP</p>	<p>30 sessions of intense NF treatment</p>	<p>Analysis of Variance  Paired t-test</p>	<p>groups resulted in significant improvements regarding A and H (<math>p &lt; 0.001</math>) Only the NF group resulted in significant improvements in school performance (<math>p = 0.042</math>)</p>	<p>domain diagnostic assessment and acceptable follow up rate.</p> <p>Weaknesses: No well-established NF protocol for duration of treatment of number of sessions.</p> <p>Conclusion: MPH, MPH and NF, and NF groups all resulted in improved SM of A and H. The NF group was the only group to show significant improvement in school performance. NF is an effective NPT in treating ADHD in children</p>
<b>Citation</b>	<b>Conceptual Framework</b>	<b>Design/Method</b>	<b>Sample/Setting</b>	<b>Major Variables Definitions</b>	<b>Measurements</b>	<b>Data Analysis</b>	<b>Findings</b>	<b>Decision for Use in Practice/Application to Practice</b>
<p>Fabiano, G. A. (2015)</p> <p>A systematic review of meta-analyses of psychosocial treatment for attention-deficit/hyperactivity disorder.</p> <p>Country: USA</p>	<p>Integrated Conceptual model</p>	<p>Design: SLR</p> <p>Method: Synthesized outcomes across MA of NPT for ADHD.</p>	<p>N=12, MA</p> <p>This included a review of all MA of psychosocial interventions for children and adolescents with ADHD to be as inclusive as possible.</p>	<p>IV-NPT DV1-AP DV2-SF DV3-A, H</p>	<p>Data extraction of 12 MA</p> <p>Parent and teacher ratings</p> <p>AP</p> <p>Observation of behaviors</p>	<p>Variability across outcomes is apparent, Many categories of outcome measures yield significant as well as non-significant estimates</p>	<p>Due to effect size, little overlap in studies, diversity of inclusion and exclusion criteria and types of PST it was difficult to complete a quality literature</p>	<p>Level V</p> <p>Strengths: Thorough review of the literature, multiple authors determining inclusion criteria for this SLR</p> <p>Weaknesses: Little overlap in studies, diversity of inclusion and exclusion criteria, methodological differences.</p>

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Funding: Eunice K. Shriver National Institute for Child Health and Human Development  Bias: none reported						of effect size	review of the selected MA.	Conclusion: Using any one of the meta-analyses reviewed to make policy decisions or determine the efficacy of psychosocial treatments for ADHD appears unwise. There is a strong need for a comprehensive meta-analysis across all studies in the psychosocial treatment literature, reporting separate effect sizes for different psychosocial treatment approaches, so that the field can continue to move toward more evidence-informed practice in the treatment for ADHD.
<b>Citation</b>	<b>Conceptual Framework</b>	<b>Design/Method</b>	<b>Sample/Setting</b>	<b>Major Variables Definitions</b>	<b>Measurements</b>	<b>Data Analysis</b>	<b>Findings</b>	<b>Decision for Use in Practice/Application to Practice</b>

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<p>Gelade, K. (2016)</p> <p>Behavioral effects of neurofeedback compared to stimulants and physical activity in attention-deficit/hyperactivity disorder: A randomized controlled trial.</p> <p>County: USA</p> <p>Funding: Not identified</p> <p>Bias: None reported</p>	<p>Health Promotion Model</p>	<p>Design: RCT</p> <p>Method: A multicenter 3-way parallel-group study with balanced randomization was conducted. Children with ADHD, ages 7–13 years, were randomly allocated to receive neurofeedback (n = 39), methylphenidate (n = 36), or physical activity (n= 37) over a period of 10–12 weeks.</p>	<p>N=39, NF N=36, MPH N=37, E</p> <p>The study reviewed results of Parent and teacher ratings on the SDQ and SWAN</p>	<p>IV1-NF IV2-MPH IV3-E DV1-A DV2-H</p>	<p>SDQ</p> <p>SWAN</p> <p>Parental and teacher reports</p>	<p>Double-blind pseudo-randomized placebo controlled cross titration procedure.</p>	<p>Improved parental reports and scores on the SDQ and SWAN regardless of treatment method, including MPH, NF, and E</p> <p>Teachers reported a decrease in all ADHD measures of children taking MPH but not a decrease in all measures with children engaged in NF and E.</p>	<p>Level II</p> <p>Strengths: Random assignment to one of three groups, sufficient duration for observation of symptoms</p> <p>Weaknesses: Limited sample size, not aware if participants were male, female or a combination.</p> <p>Conclusion: The current study found that optimally titrated methylphenidate is superior to neurofeedback and physical activity in decreasing ADHD symptoms in children with ADHD.</p>
<p><b>Citation</b></p>	<p><b>Conceptual Framework</b></p>	<p><b>Design/Method</b></p>	<p><b>Sample/Setting</b></p>	<p><b>Major Variables Definitions</b></p>	<p><b>Measurements</b></p>	<p><b>Data Analysis</b></p>	<p><b>Findings</b></p>	<p><b>Decision for Use in Practice/Application to Practice</b></p>

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Merrill, B. M. (2017)  Improving homework performance among children with ADHD: A randomized clinical trial.  Country: USA  Funding: Not identified  Bias: None reported	Pender's Health Promotion Model	Design: RCT  Method: Children were placed in a behavioral treatment group or a waitlist group and also participate concurrently in a psychostimulant crossover trial	N=75 children with ADHD ages 5-12  Exclusion criteria: IQ <80, previous diagnosis of ASD, intolerability to stimulant medication, or currently receiving psychotropic medications for a diagnosis other than ADHD	IV1-BT IV2-WL DV1-homework completion DV2-homework accuracy	Objective measures  Parental reports  Homework completion and accuracy	GLMM  Behavioral parental treatment plan and Digital report card	Children who had BT and a digital report card did on average 2 letter grades better and completed homework with increase accuracy. Those placed on the WL or given PT showed no improvement in homework completion or accuracy.	Level II  Strengths: Random assignment to test group or WL, Low attrition rate.  Weaknesses: sample size included 71% males and 83% Hispanics. Limited diversity in sample size. Strength and type of medication was limited. Study was conducted in a controlled environment and not in a traditional school setting.  Conclusion: the current study indicated that children with ADHD benefitted more from a behavioral treatment plan and digital report cards than from PT with MPH. No improvement was noticed with PT as opposed to NPT.
<b>Citation</b>	<b>Conceptual Framework</b>	<b>Design/Method</b>	<b>Sample/Setting</b>	<b>Major Variables Definitions</b>	<b>Measurements</b>	<b>Data Analysis</b>	<b>Findings</b>	<b>Decision for Use in Practice/Application to Practice</b>
Schoenfelder, E. N. (2016)  Skills versus pills: Psychosocial treatments for ADHD in childhood and adolescence.	Pender's Health Promotion Model  Behavioral Parent Teaching, Behavioral Classroom	Design: Evidence based review of the effectiveness of Psychosocial treatments to improve functional	Not identified as a sample, rather presenting EBP on the increased functionality of children with ADHD based	IV-PST DV-SM	Behavior Parent Training  Behavioral Classroom Management	Multimodal treatment studies	Behavior Parent Training, Behavioral Classroom Management, Behavioral Peer Interactions, and	Level I  Strengths: Several peer reviewed articles referenced in this opinion paper with EBP to support claims

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Country: USA Funding: Not reported Bias: None identified	Management and Behavioral Peer Interventions	problems associated with ADHD  Method: EBP review of the benefits of psychosocial treatment and parent/adult training and involvement.	on behavioral training and treatment.		Behavioral Peer Interactions  Organized Skills Training		Organized Skills Training do have studies and evidence to support they are beneficial NPT for children with ADHD	Weaknesses: This is more of an opinion article and does not conduct any research to support its claim that PST for ADHD is effective treatment Conclusion: PST for ADHD are effective evidence-based approaches to improve functional problems associated with ADHD
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Serrano-Troncoso, E. (2013) Is psychological treatment efficacious for attention deficit hyperactivity disorder (ADHD)? review of non-pharmacological treatments in children and adolescents with ADHD.  Country: Spain	Health Promotion Model, Clinical Practice Guidelines	Design: MA  Method: MA of literature published between 1995 and 2010 on non-pharmacological treatment of ADHD	N=609 articles with search criteria including ADHD, parent training, CBT, SST, school based interventions, academic interventions, and multimodal treatment. Languages included English, Spanish, and French. These	IV-NPT DV1-SF DV2-A DV3-AP	Data extraction and literature review	Qualitative Content Analysis  Review of EBP articles addressing NPT for children with ADHD. A final number of 12 (N=12) were analyzed.	Data reviewed indicates beneficial affects of NPT for children with ADHD. Decreased symptoms of A and H as well as increase CF, AP, SF are indicated. Literature is still limited and additional studies need to be conducted.	Level I  Strengths: Multiple search databases were utilized to search for literature. Levels of evidence were determined by the Scottish Intercollegiate Guidelines Network and were determined by clinical guideline practices.  Weaknesses: Limited research articles available addressing NPT for ADHD  Conclusion: This current review indicated that there

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Funding: Shire Development, LLC  Bias: None identified			articles included SLR, MA, and CCT.			These included RCT looking at the efficacy of NPT including BT, parental training, CBT, and SST.		is clear scientific evidence of the efficacy of NPT for ADHD
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Shaw, M. (2012)  A systematic review and analysis of long-term outcomes in attention deficit hyperactivity disorder: Effects of treatment and non-treatment.  Country: England  Funding: Shire Development, LLC.  Bias: Only using English studies, search criteria exclusions,	Multi-modal Treatment Study	Design: SLR  Method: An exhaustive database search was performed to examine outcomes of participants with untreated ADHD and participants with treated ADHD. Studies were published between 1980 and 2010.	Sample: initial yield of 5467 studies that were manually reviewed and yielded 351 studies for inclusion in this analysis.  Outcome measures included NMDU, AP, AB, SF, Occ, SE, driving, services used, and O.	IV1-NPT IV2-PT IV3- Com  DV1-A DV2-AB DV3-driving DV4-NMDU DV5-O DV6- Occ DV7-services used DV8-SE DV9-SF	DSM-IV ADHD diagnostic criteria.  Data extraction and 351 studies were included and categorized into 9 major categories or symptoms of ADHD including AP, AB, driving, NMDU, O, Occ, service use, self-esteem, and SF	Qualitative Content Analysis	Outcomes of ADHD were identified by age, treated vs untreated ADHD and by region including North America as 1 region and the rest of the world as another region. Those treated for ADHD had better long term outcomes than those not treated.	Level I  Strengths: 12 databases were included in this search for literature. Studies were peer reviewed, primary studies with long term outcomes for ADHD symptom management.  Weaknesses: Only English language papers were searched. Relevant studies may have been omitted.  Conclusion: Without proper treatment, those with ADHD often experience poor long term outcomes. Treatment may improve long term outcomes but not

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researcher bias, changes over time  in diagnostic criteria								to the degree of healthy controls.
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Appendix E  
Synthesis Table

STUDIES		Arnold	Berwid	DeCrescenzo	Daric	Fabiano	Gelade	Merrill	Schoenfelder	Serrano - Troncoso	Shaw
		2015	2012	2017	2014	2015	2016	2017	2016	2013	2012
Basic Information	Year	2015	2012	2017	2014	2015	2016	2017	2016	2013	2012
	LOE	I	II	I	II	V	II	II	I	I	V
	Design	MA	RCT	MA	RCT	SLR	RCT	RCT	MA	MA	SLR
	Bias	∅	∅	∅	∅	∅	∅	∅	∅	∅	OELS
	# of participants /studies	51	64, 171, 17	40	91	12	112	75	∅	609	351
Interventions	CBT	X		X		X		X	X	X	X
	Ex		X				X				
	NF				X		X				X
	PST	X				X				X	X
	PT	X		X	X		X	X			X
	SST	X						X			X
Major Findings	AB	↓	↓				↓		↓		↓
	AP	↑	↑		↑	↑	↑	↑ w/CBT	↑	↑	↑
	ATT	↑	↑	↑	↑	↑	↑		↑	↑	↑
	CF	↑	↑				↑		↑	↑	↑
	HYP	↓	↓	↓	↓	↓	↓		↓	↓	↓
	SE	↑	↑						↑		↑
	SF	↑			↑	↑	↑		↑	↑	↑

Key: AB- antisocial behavior, AP-academic performance, ATT-attention, CBT-cognitive behavioral therapy, CF-cognitive function, , Ex-Exercise, HYP-hyperactivity, MA-meta-analysis, NF-neurofeedback, PST-psychosocial treatment, PT-pharmacological treatment, RCT-randomized control trial, SE-self-esteem, SF-social functioning, SLR-systematic literature review, SST-social skills training,

## Appendix F

## Rosswurm and Larrabee Model

