

Analytic Dissertation Proposal

Emerging Treatments for Children with Attention-Deficit/Hyperactivity Disorder

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Chapter I. Introduction

Children with significant deficits in areas of focus, impulsivity, and excess body energy may be identified as having attention deficit/hyperactivity disorder (ADHD) (Barkley, 2015; Centers for Disease Control and Prevention [CDC], 2016). ADHD is the neurodevelopmental disorder that encompasses developmental deficits related to executive functioning and self-regulation (Tarver, Daley & Sayal, 2014). Symptoms of the disorder can have significant impact on a child's ability to attend to schoolwork, regulate impulses, and develop positive social relationships (American Psychological Association [APA], 2013). ADHD is a complex disorder requiring an individualized, multimodal treatment approach to help alleviate symptoms for children (Barkley, 2015). Emerging treatments hold the potential for adding additional intervention options for parents and clinicians. In this analytic dissertation I will explore the efficacy of neurofeedback, executive function training, and self-regulation strategies as emerging treatment options for children with ADHD.

ADHD is thought to either be congenital, or manifest in the early years of development (APA, 2013). It also is now understood to have a lifelong prevalence (Barkley, 2015). It is a disorder that affects both males and females (though not equally), with symptomatology that presents on a continuum of severity from mild to very severe (Tarver et al., 2014). Symptoms often impact a child's main areas of functioning (school, family and social) and can include many additional functional impairments, such as learning, behavioral, and developmental disorders (American Academy of Pediatrics [AAP], 2011). The etiology of the disorder is complex and it is thought to represent an extreme of a continuously varying genetic trait that occurs in the general population (Lange, Reichl, Lange, Tucha, & Tucha, 2010). Diagnosis of ADHD is based on behavioral observation, as there is not yet a reliable physical or genetic test

available (AAP, 2011). This has led some researchers to question whether ADHD is a separate neurobehavioral disease entity or whether it is instead a syndrome consisting of traits from multiple causal factors (Bunford, Evans, & Wymbs, 2015; Seidler, 2006).

ADHD is the most common neurobehavioral disorder of childhood, with estimated prevalence rates reported in the literature between 2% and 12% for children (most sources averaging 5% to 8% prevalence) (Balázs, & Keresztény, 2014; Barkley, 2015). The disorder occurs in similar rates across cultures and is approximately twice as likely to present in male vs. female children (Tarver et al., 2014). According the Diagnostic and Statistical Manual 5th edition, *DSM 5* (APA, 2013), the main symptoms of ADHD involve behavioral difficulties stemming from inattention, hyperactivity and impulsivity. Inattention is defined as the inability to sustain attention to given tasks and a lack of persistence for task completion (APA, 2013). Difficulties with attention also impact the child's ability to listen when spoken to, and organize and remember important information (APA, 2013; Rapport, Orban, Kofler, & Friedman, 2013). Symptoms of hyperactivity include excess body energy and the tendency for the child to fidget or need to be in constant motion (APA, 2013). Hyperactivity can also manifest as excessive talking, blurting out of answers, or the inability to play or engage in quiet leisure activities (Barkley, 2015). Symptoms of impulsivity are based on the presence of impulsive behaviors, such as interrupting, difficulty waiting or taking turns, intruding in others' personal space, and reactions that lack forethought (APA, 2013; Bikic, Leckman, Lindschou, Christensen, & Dalsgaard, 2015). To receive a DSM diagnosis, symptoms in the areas above must present in sufficient severity before the age of 12 and be observed in more than one environment (APA, 2013).

The symptoms associated with ADHD range in severity and functional impact (APA, 2013). Even mild symptom profiles can have a significant effect on personal, family and social relationships for the child. Symptoms also present uniquely in each child, with substantial variance in clinical presentation and treatment outcomes for children (Armstrong, Lycett, Hiscock, Care, & Sciberras, 2015). Symptoms of ADHD are also associated with substantial impairments in functioning and poor long-term outcomes (Tarver et al., 2014). In addition the diagnosis often creates functional impairment in other areas for children, such as school performance, peer relationships, personal conduct, substance use, physical injuries, obesity, cognitive performance, and parent-child relations (Bikic et al., 2015; Bunford et al., 2015; Theule, Wiener, Rogers, & Marton, 2011).

ADHD also has high comorbidity rates with other disorders and poor health outcomes (Nigg, 2013). This is primarily due to the early onset and chronic nature of the disorder, which create vulnerabilities for negative psychiatric and health impairments (Nigg, 2013; Steinberg & Drabick, 2015). ADHD is associated with increased rates of oppositional defiant disorder, conduct disorder, mood disorders, poor emotional regulation, anxiety disorders, difficulty with executive functioning (working memory, response inhibition, organization), and learning disorders (Armstrong et al., 2015; Tarver et al., 2014).

Treatment for ADHD varies considerably depending on the child's age, developmental level, and the scope and severity of his or her symptoms. Despite these variables, there are general treatment recommendations for children who meet the diagnostic criteria for ADHD that are between the ages 4 and 18. For preschool children (4-5 years of age) the first-line treatment recommendation is evidenced-based behavior therapy administered by parents or teachers (AAP, 2011). If behavioral therapy is not providing sufficient symptom management, the American

Association of Pediatrics recommends prescription stimulant medication (methylphenidate) (AAP, 2011). For children ages 6-18 years, federal drug administration (FDA) approved medications and/or evidence-based parent and/or teacher-administered behavior therapy are recommended (AAP, 2011; CDC, 2016). For this age range, the recommendation is often that both medication and behavior therapy be used together (AAP, 2011; CDC, 2016).

General treatment guidelines for children with ADHD are fairly narrow in scope and fail to address several relevant factors, such as recommendations for children who cannot tolerate traditional medications, or do not have access to prescription medication and/or behavioral therapy (Sonuga-Barke et al., 2013). In addition, guidelines do not present information on emerging treatment options that are gaining an evidence base through current research (Cerrillo-Urbina et al., 2015; Evans, Owens & Bunford, 2014). Interventions such as neurofeedback, executive function training, and self-regulation strategies may provide additional means to address core symptoms of inattention, hyperactivity, self-regulation, and working memory deficits (Chacko et al., 2014; Vollebregt et al., 2014).

Chapter II. Review of Literature

Emerging treatments hold the potential for adding additional effective, evidence-based interventions for children with attention deficit/hyperactivity disorder. The literature review in this dissertation will take an in-depth look at three areas of emerging research: neurofeedback, executive function training, and self-regulation strategies for the treatment of ADHD. In addition, a brief history of the evolution of the ADHD diagnosis will be presented, along with current research findings on the etiology of the disorder.

The combination of high rates of comorbidity, complex etiology, and chronic presentation of symptoms necessitate inquiry into all viable avenues of help for this disorder.

Traditional treatment approaches have been focused primarily on use of stimulant medications and behavioral therapies, such as behavioral reinforcement, parent education, child therapy and social skills training (Barkley, 2013; Deault, 2010). But medication side effects are sometimes not well tolerated and there are questions regarding their safety and efficacy with young children (Tarver et al., 2014; Wigal, 2009). In addition, long-term effectiveness of medications has not been reliably established and there are rare but potentially serious adverse effects on sleep, appetite and growth (Wilson, 2013). Similarly, psychosocial treatments, which include various forms of child psychotherapy, social skills training, and parent education, have shown limited efficacy in some studies (Sonuga-Barke et al., 2013). However, other studies point to efficacy in psychological and behavioral interventions, especially if they are categorized as *evidence-based* (Carr, 2014; Evans et al., 2014).

Research in the last decade presents promising evidence for the use of interventions beyond traditional medications and behavioral therapies (Evans et al., 2014; Gevensleben et al., 2010). Neurofeedback has been explored as a form of neurocognitive training to help ADHD children strengthen specific cognitive skills such as sustained attention and improved reaction time (Gevensleben et al., 2010; Vollebregt et al., 2014). Results among several studies were mixed, but some did show promise in improving attention and reaction times on psychometric measures (Bakhshayesh, Hänsch, Wyszkon, Rezai, & Esser, 2011; Gevensleben et al., 2010; Vollebregt et al., 2014).

Executive function deficits, which include impairments in working memory, response inhibition, organization, and set shifting are now understood to be core components of ADHD (Barkley, 2015). Interventions are being explored that may improve cognitive abilities of children with the disorder (Rapport et al., 2013). Some executive function therapies utilize

advances in technology, such as computer-based programs designed to improve ADHD symptoms in children (Gray et al., 2012). An increasing number of randomized trials are showing the benefit of computer-based cognitive training for children in this area (Prins, DAVIS, Ponsioen, Brink, & van der Oord, 2011). One example of this is a current study being piloted by Bikic and colleagues, (2015). The authors are conducting a randomized clinical trial to investigate the efficacy of the ACTIVATE computer program, which is designed to improve a range of cognitive skills. The study has yet to be completed, but the authors hope to publish results this year clarifying the efficacy of this intervention (Bikic et al., 2015).

Deficits in emotional self-regulation have emerged as a definitive component of ADHD, and interventions that facilitate regulation are now being explored (Steinberg & Drabick, 2015). Emotion regulation is related to executive functions in that it is an aspect of behavioral inhibition, which is facilitated by top-down influence of executive controls (Barkley, 2015). In children with ADHD, deficits in executive function impair self-regulation and vice versa (Barkley, 2015). Self-regulation is also influenced by the limbic response that involves the activation of the sympathetic branch of the autonomic nervous system (ANS) (Siegel, 2012). Therapies such as mindfulness meditation have shown promise in improving attention and reducing negative behaviors in children with ADHD (Bunford et al., 2015). Self-regulation strategies for parents have also shown promise, as high heritability rates increase the likelihood that parents are also struggling with emotional control (Tarver et al., 2014). Enhancing parental self-regulation skills through programs such as the evidence-based Positive Parenting Program has shown promise in helping parents learn regulation strategies (SAMHSA, 2017; Sanders & Mazzucchelli, 2013). Improving regulation skills for parents provides important modeling for

children with ADHD and may facilitate improved self-regulation for children with the disorder (Sanders & Mazzucchelli, 2013).

Chapter III. Methodology

In this study I will review several emerging treatment options for children with ADHD. I will gather articles through a search of databases including, PubMed, EBSCO host, Google Scholar, LIRN, CDC, NIMH, and PsycINFO. I intend to use peer-reviewed articles within the last five years and review seminal works, which provide additional information and background on the disorder. Search criteria will use the base terms “ADHD” or “attention deficit hyperactivity disorder” with additional limits that follow the content outline e.g. *comorbidity, neurobiology, emerging treatments, etc.* Additional studies will also be obtained through the reference lists of relevant research papers. Studies will be sorted for exclusion based on relevance to the scope of this review—emerging treatments for children with ADHD. Findings on specific demographic groups not included in this study, such as adult/elderly ADHD will be excluded. In addition, studies relevant only to specific ADHD populations, such as runaway teens with ADHD, will also be excluded as their results have limited generalizability. Texts by authors whose research contributes to the understanding and treatment of ADHD will also be used.

Chapter IV. Discussion

This study begins with an overview of historical foundations for the identification and treatment of ADHD symptoms in children. Current theory regarding etiology and neurobiological functions related to the disorder will then be summarized and lay the groundwork for analysis of several emerging treatments. The literature review will survey the current evidence base regarding these treatments and will identify efficacy outcomes for the

identified interventions. Discussion of the literature review will also consider limitations of current studies and identify areas where continued research is warranted.

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V. Conclusion

VI. References

References

- American Academy of Pediatrics (2011). ADHD: clinical practice guideline for the diagnosis, evaluation, and treatment of attention-deficit/hyperactivity disorder in children and adolescents. *Pediatrics*, *128*(5), 1007-1022. DOI: 10.1542/peds.2011-2654
- American Psychiatric Association (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: American Psychiatric Association.
- Armstrong, D., Lycett, K., Hiscock, H., Care, E., & Sciberras, E. (2015). Longitudinal Associations Between Internalizing and Externalizing Comorbidities and Functional Outcomes for Children with ADHD. *Child Psychiatry & Human Development*, *46*(5), 736-748.
- Bakhshayesh, A., Hänsch, S., Wyschkon, A., Rezai, M. J., & Esser, G. (2011). Neurofeedback in ADHD: a single-blind randomized controlled trial. *European Child & Adolescent Psychiatry*, *20*(9), 481-491. DOI: 10.1007/s00787-011-0208-y
- Balázs, J., & Keresztény, Á. (2014). Subthreshold attention deficit hyperactivity in children and adolescents: a systematic review. *European Child & Adolescent Psychiatry*, *23*(6), 393-408. DOI 10.1007/s00787-013-0514-7
- Barkley, R. A. (2015). *Attention-deficit hyperactivity disorder: A handbook for diagnosis and treatment* (4th Ed.). The Guilford Press: New York.
- Bikic, A., Leckman, J. F., Lindschou, J., Christensen, T. Ø., & Dalsgaard, S. (2015). Cognitive computer training in children with attention deficit hyperactivity disorder (ADHD) versus no intervention: study protocol for a randomized controlled

- trial. *Trials*, 16, 480. DOI: .org/10.1186/s13063-015-0975-8
- Bunford, N., Evans, S., & Wymbs, F. (2015). ADHD and emotion dysregulation among children and adolescents. *Clinical Child & Family Psychology Review*, 18(3), 185-217. DOI: 10.1007/s10567-015-0187-5
- Burcu Ayaz, A., Gökçe, S., Gümüştas, F., & Ayaz, M. (2014). Symptoms of autism spectrum disorder in subtypes of attention-deficit/hyperactivity disorder. *Journal Of Intellectual & Developmental Disability*, 39(3), 290-297. DOI: .org/10.3109/13668250.2014.916184
- Carr, A. (2014). The evidence base for family therapy and systemic interventions for child-focused problems. *Journal of Family Therapy*, 36(2), 107-157. DOI: 10.1111/1467-6427.12032
- Centers for Disease Control, (2016). Guidelines for ADHD treatment. Retrieved from: <http://www.cdc.gov/ncbddd/adhd/guidelines.html>
- Chacko, A., Bedard, A., Marks, D., Feirsen, N., Uderman, J., Chimiklis, A., & ... Ramon, M. (2014). A randomized clinical trial of Cogmed Working Memory Training in school-age children with ADHD: a replication in a diverse sample using a control condition. *Journal of Child Psychology & Psychiatry*, 55(3), 247-255.
- Deault, L. C. (2010). A systematic review of parenting in relation to the development of comorbidities and functional impairments in children with attention-deficit/hyperactivity disorder (ADHD). *Child Psychiatry & Human Development*, 41(2), 168-192. DOI: 10.1007/s10578-009-0159-4

- DuPaul, G. J., Weyandt, L. L., & Janusis, G. M. (2011). ADHD in the Classroom: Effective Intervention Strategies. *Theory Into Practice*, 50(1), 35-42. DOI: 10.1080/00405841.2011.534935
- Evans, S. W., Owens, J. S., & Bunford, N. (2014). Evidence-based psychosocial treatments for children and adolescents with attention-deficit/hyperactivity disorder. *Journal Of Clinical Child & Adolescent Psychology*, 43(4), 527-551. doi:10.1080/15374416.2013.850700
- Fiks, A.G., Mayne, S., DeBartolo. E., Power, T. J., Guevara, J. P. (2013). Parental preferences and goals regarding ADHD treatment. *Pediatrics*, Aug. 2013. DOI: 10.1542/peds.2013-0152
- Gevensleben, H., Holl, B., Albrecht, B., Schlamp, D., Kratz, O., Studer, P., & ... Heinrich, H. (2010). Neurofeedback training in children with ADHD: 6-month follow-up of a randomised controlled trial. *European Child & Adolescent Psychiatry*, 19(9), 715-724.
- Gualtieri, C. T., & Johnson, L. G. (2005). ADHD: Is objective diagnosis possible? *Psychiatry*, 2(11), 44–53.
- Galanter, C. A. (2013). Limited support for the efficacy of nonpharmacological treatments for the core symptoms of ADHD. *American Journal of Psychiatry*, 170(3), 241– 244. doi.org/10.1176/appi.ajp.2012.12121561
- Gray, S., Chaban, P., Martinussen, R., Goldberg, R., Gotlieb, H., Kronitz, R., & ... Tannock, R. (2012). Effects of a computerized working memory training program on working memory, attention, and academics in adolescents with severe LD and comorbid ADHD: a randomized controlled trial. *Journal Of Child Psychology & Psychiatry*, 53(12), 1277-1284. DOI: 10.1111/j.1469-7610.2012.02592.x

- Gunkelman, J., & Johnstone, J. (2005). Neurofeedback and the Brain. *Journal Of Adult Development, 12*(2/3), 93-98. DOI: 10.1007/s10804-005-7024-x
- Johnston, C., Mash, E. J., Miller, N. & Ninowski, J. E. (2012) Parenting in adults with attention-deficit/hyperactivity disorder (ADHD). *Clinical Psychology Review, 32*, 215–228.
- Karpouzis, F., & Bonello, R. (2012). Nutritional Complementary and Alternative Medicine for Pediatric Attention-Deficit/Hyperactivity Disorder. *Ethical Human Psychology & Psychiatry, 14*(1), 41-60. DOI: 10.1891/1559-4343.14.1.41
- Lange, K.W., Reichl, S., Lange, K.M., Tucha, L., Tucha, O. (2010). The history of attention deficit hyperactivity disorder. *ADHD Attention Deficit Hyperactivity Disorder, 2*, 241-255. doi:10.1007/s12402-010-0045-8
- Nigg, J. (2013). Attention-deficit/hyperactivity disorder and adverse health outcomes. *Clinical Psychology Review, 33*(2), 215–228. doi.org/10.1016/j.cpr.2012.11.005
- Oord, S., Bögels, S., & Peijnenburg, D. (2012). The Effectiveness of Mindfulness Training for Children with ADHD and Mindful Parenting for their Parents. *Journal Of Child & Family Studies, 21*(1), 139-147. DOI: 10.1007/s10826-011-9457-0
- Prasad, V., Brogan, E., Mulvaney, C., Grainge, M., Stanton, W., & Sayal, K. (2013). How effective are drug treatments for children with ADHD at improving on-task behaviour and academic achievement in the school classroom? A systematic review and meta-analysis. *European Child & Adolescent Psychiatry, 22*(4), 203-216. DOI: 10.1007/s00787-012-0346-x.
- Prins, P. J., Dovis, S., Ponsioen, A., ten Brink, E., & van der Oord, S. (2011). Does

computerized working memory training with game elements enhance motivation and training efficacy in children with ADHD? *Cyberpsychology, Behavior & Social Networking*, 14(3), 115-122. DOI: 10.1089/cyber.2009.0206

Rapport, M.D., Orban, S.A., Kofler M. J., & Friedman L. M. (2013). Do programs designed to train working memory, other executive functions, and attention benefit children with ADHD? A meta-analytic review of cognitive, academic, and behavioral outcomes. *Clinical Psychology Review*, 33(8), 1237-52. doi: 10.1016/j.cpr.2013.08.005

Substance Abuse and Mental Health Services Administration (SAMHSA), (2017). Risk factors, treatment options, and support activities related to attention deficit hyperactivity disorder. Retrieved from <https://www.samhsa.gov>.

Sanders, M., & Mazzucchelli, T. (2013). The Promotion of Self-Regulation Through Parenting Interventions. *Clinical Child & Family Psychology Review*, 16(1), 1-17. DOI: 10.1007/s10567-013-0129-z

Seitler, B. N. (2006). On the implications and consequences of a neurobiochemical etiology of attention deficit hyperactive disorder (ADHD). *Ethical Human Psychology & Psychiatry*, 8(3), 229-240.

Sonuga-Barke, E. J., Brandeis, D., Cortese, S., Daley, D., Ferrin, M., Holtmann, M., ... & Dittmann, R. W. (2013). Nonpharmacological interventions for ADHD: systematic review and meta-analyses of randomized controlled trials of dietary and psychological treatments. *American Journal of Psychiatry*, 170(3), 275-289. doi: 10.1176/appi.ajp.2012.12070991

Steinberg, E., Drabick, D., Steinberg, E. A., & Drabick, D. G. (2015). A developmental

- psychopathology perspective on ADHD and comorbid conditions: The role of emotion regulation. *Child Psychiatry & Human Development*, 46(6), 951-966.
- Tarver, J., Daley, D., & Sayal, K. (2014). Attention-deficit hyperactivity disorder (ADHD): an updated review of the essential facts. *Child: Care, Health & Development*, 40(6), 762-774. doi:10.1111/cch.12139
- Tarver, J., Daley, D., & Sayal, K. (2015). Beyond symptom control for attention-deficit hyperactivity disorder (ADHD): what can parents do to improve outcomes? *Child: Care, Health & Development*, 41(1), 1-14. DOI: 10.1111/cch.12159
- Thapar, A., Langley, K., & Muñoz-Solomando, A. (2013). The ADHD debate: being mindful of complexity and wary of reductionist explanations and polarization. *Journal Of Family Therapy*, 35(2), 219-223. doi: 10.1111/j.1467-6427.2012.00608.x
- Theule, J., Wiener, J., Rogers, M., & Marton, I. (2011). Predicting parenting stress in families of children with ADHD: Parent and contextual factors. *Journal of Child & Family Studies*, 20(5), 640-647.
- Vallerand, I. A., Kalenchuk, A. L., & McLennan, J. D. (2014). Behavioural treatment recommendations in clinical practice guidelines for attention-deficit/hyperactivity disorder: a scoping review. *Child & Adolescent Mental Health*, 19(4), 251-258. doi:10.1111/camh.12062
- Vollebregt, M. A., Dongen-Boomsma, M., Buitelaar, J. K., & Slaats-Willemse, D. (2014). Does EEG-neurofeedback improve neurocognitive functioning in children with attention-deficit/hyperactivity disorder? A systematic review and a double-blind

placebo-controlled study. *Journal Of Child Psychology & Psychiatry*, 55(5), 460-472.
doi:10.1111/jcpp.12143

Vostal, B. R., Lee, D. L., and Miller, F. (2013). Effects of environmental stimulation on students demonstrating behaviors related to attention deficit/hyperactivity disorder: A review of the literature. *International Journal of Special Education*, 28(3), 32-43.

Wigal, S. B. (2009). Efficacy and safety limitations of attention-deficit hyperactivity disorder pharmacotherapy in children and adults. *CNS Drugs*, 23, 21-31.

Wilson, J. (2013). A social relational critique of the biomedical definition and treatment of ADHD; ethical practical and political implications. *Journal Of Family Therapy*, 35(2), 198-218. doi: 10.1111/j.1467-6427.2012.00607.x