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# The Effectiveness of Medicinal and Non-medicinal Treatments of Attention-Deficit/Hyperactivity Disorder

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THE EFFECTIVENESS OF MEDICINAL AND NON-MEDICINAL TREATMENTS OF  
ATTENTION-DEFICIT/HYPERACTIVITY DISORDER

by

Nathan Seals

B.S., Southern Illinois University at Carbondale, 2010

A Research Paper

Submitted for the Partial Fulfillment of the Requirements for the  
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THE EFFECTIVENESS OF MEDICINAL AND NON-MEDICINAL  
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A Research Paper Submitted in Partial

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in the field of Rehabilitation Counseling

Approved by:

Dr. James Bordieri

Graduate School

Southern Illinois University Carbondale

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## AN ABSTRACT OF THE RESEARCH PAPER OF

Nathan Seals, for the Master of Science degree in Rehabilitation Counseling, presented on April 12, 2013, Southern Illinois University Carbondale.

**TITLE: THE EFFECTIVENESS OF MEDICINAL AND NON-MEDICINAL TREATMENTS OF ATTENTION-DEFICIT/HYPERACTIVITY DISORDER**

**MAJOR PROFESSOR: Dr. James Bordieri**

The purpose of this paper is to review the effectiveness of medicinal and non-medicinal treatments of attention-deficit/hyperactivity disorder (ADHD). This was accomplished through a comprehensive review of the literature related to this topic. ADHD affects a large amount of the population with prevalence rates reported to be between 2% and 7% (Bruchmuller, Margraf, & Schneider, 2012). Unfortunately, of the children who have been diagnosed with ADHD, 60% - 85% of them continue to exhibit these symptoms in adolescence and 60% of those diagnosed with pediatric ADHD will see their symptoms persist into their adult lives (Madaan, Daughton, Lubberstedt, Mattai, Vaughan, & Kratochvil, 2008). Moreover, contrary to popular belief, ADHD impairments extend far beyond the classroom to other additional facets of one's life including peer interactions as well as in extracurricular activities that take place after school. This paper will examine the effectiveness of multiple treatment methods commonly used for this disorder as well as issues concerning the effects and over-prescription of stimulant medications has become more prominent in recent years and should be further discussed.

*Key words:* ADHD treatments, prescription medication, alternative treatments

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## CHAPTER 1

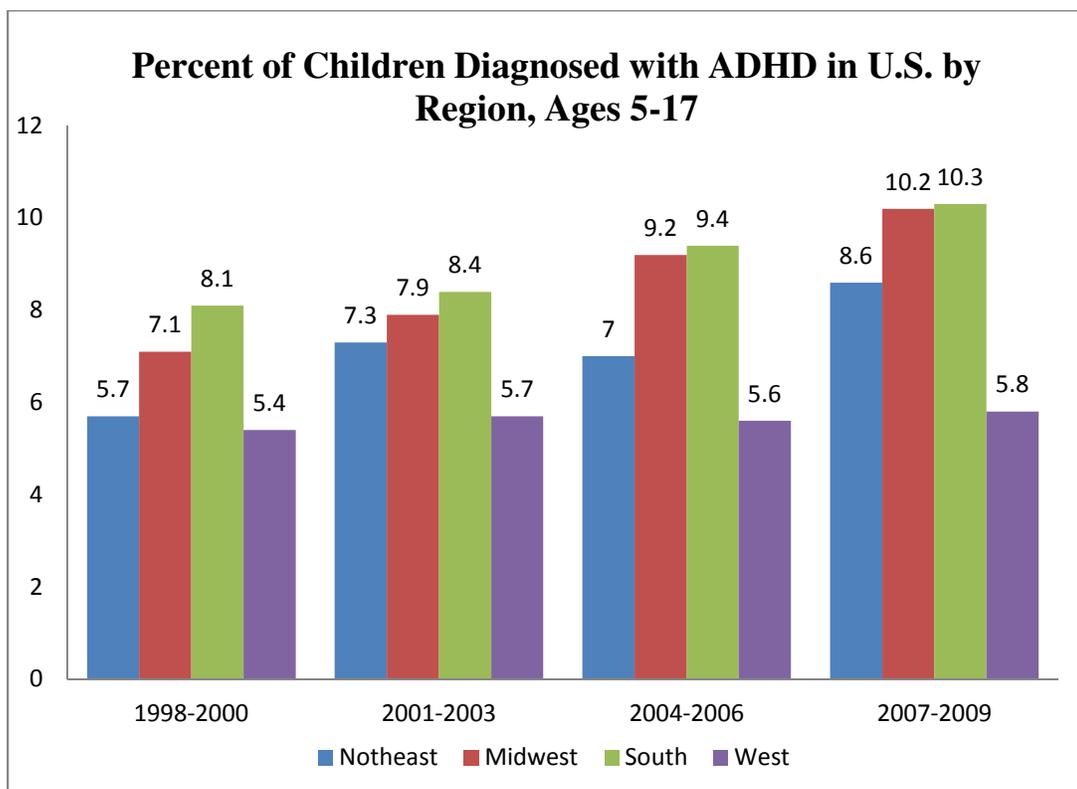
### INTRODUCTION

There have been several studies that have reviewed the effectiveness of both medicinal and non-medicinal treatments for ADHD. Moreover, many important advances have been made in the treatment of ADHD including the formulation of new stimulant medications and positive effects of medicinal combined with behavioral treatments. We have also gained a better understanding of the neurobiology of ADHD patients as well (Wigal, 2009). Medicinal treatments for ADHD are plentiful in selection, but many can cause unwanted side-effects or sometimes discontinuation of the drug can become difficult over time. Stimulants have been used to help people manage the symptoms of ADHD in children since the 1930s (Wigal, 2009). While stimulants are considered safe and effective forms of treatment by current standards, they may not be appropriate for people with comorbid diagnoses, and they also have abuse potential (Wigal, 2009). The selection of non-medicinal treatments is numerous as well, but they can cause more effort and time. Unfortunately, many people do not have any more time or effort to spare in their everyday lifestyles. In order to obtain more immediate results, pharmaceutical treatments are usually used instead.

The over-diagnosis and medicating of children and adults with ADHD has been a very prominent issue for quite some time now. ADHD is said to affect 1 in 20 children in the United States, and 80% of these children diagnosed with ADHD will see their symptoms persist into adolescence (Faraone, Sergeant, Gillberg, & Biederman, 2003). Although, it seems that even with as much attention this issue gets, it still does not garner as much it should. Figure 1 (page 4) illustrates how a rise in ADHD diagnoses has occurred in the U.S. between the years of 1998 and 2009. With the exception of the western region of the U.S., every part of the country has seen an increase in ADHD diagnoses of at least 2.1% over an eleven year span. As a result of

this large number of ADHD diagnoses, some researchers believe that the heart of this issue lies among the imperfections within the diagnostic criteria that have been used for ADHD since 1994. One research study conducted in 1990 found that only 30% of children who were officially diagnosed with ADHD actually met the diagnostic criteria (Santich, 2008).

Futhermore, Bruchmuller et al. discussed several studies that support improper diagnoses. One study involved the re-examination of 92 children that had been referred to an ADHD clinic, they found that only 22% of the sample had a primary diagnosis of ADHD and only 37% had a secondary ADHD diagnosis (Bruchmuller, et al., 2012). Results from these studies may suggest a need for a change in the present diagnostic process or criteria. This issue should be a major concern among professionals. How can we identify and implement effective treatments for ADHD if we are unable to properly diagnose the disorder itself?



**Figure 1.** Retrieved from Center for Disease Control [CDC]/National Center for Health Statistics [NCHS], Health Data Interactive and National Health Interview Survey

## **Background on ADHD**

The first documented description of ADHD-like symptoms was made by a German psychiatrist named Dr. Heinrich Hoffman, who published a poem entitled “Zappel Philip” (or “Fidgety Phillip”) in a children’s book in 1846 (Santich, 2008). Following this, Dr. George Still made a series of lectures in 1902 where he discussed children who exhibit a lack of moral control without any physical impairment (Rowland, Lesesne, & Abramowitz, 2002). The name of the disorder has also changed over the years. Previous titles for what we now call ADHD include: minimal brain dysfunction, minimal brain damage syndrome, and hyperkinetic reaction of children (Rowland et al., 2002). Names such as minimal brain damage syndrome and minimal brain dysfunction were early attempts to link the disorder to an epidemic of encephalitis that occurred between 1917 and 1918, subsequent research eventually proved this theory to be incorrect (Rowland et al., 2002).

## **History of ADHD Diagnosis**

Since the first discussions and observations of ADHD were made, the symptoms have been described in great detail in *The Diagnostic and Statistical Manual (DSM)*, which is widely known as the gold standard tool for the identification of disorders in the United States. By the time the second edition of the DSM had been written the first version of ADHD was included, and as previously mentioned, at that time it was called “hyperkinetic reaction of children” (Santich, 2008, p. 91). The term attention deficit disorder (ADD) was used in the third edition of the DSM in the early 1980s. Since its inclusion into the DSM, as with many of the included disorders, the diagnostic criteria for ADHD has evolved and become more complex. With each new addition of the DSM the criteria has had some major additions made to it. The diagnostic criteria and descriptions of ADHD from the second version of the DSM (DSM – II) and the most

recent version of the DSM (DSM – IV – TR) are included to illustrate the significant evolutionary changes that have been made to its criteria since its inclusion to the manual. The newest edition of the DSM, the DSM – V, is scheduled to be released in May of 2013; which makes one wonder: what changes, omissions, or additions (if any) will be made to the diagnostic criteria in the new edition?

### **DSM – II Diagnostic Criteria for Hyperkinetic Reaction of Childhood (or adolescence)**

This disorder is characterized by over-activity, restlessness, distractibility, and short attention span, especially in young children; the behavior usually diminishes in adolescence. If this behavior is caused by organic brain damage, it should be diagnosed under the appropriate non-psychotic *organic brain syndrome* (q.v.) (American Psychiatric Association [APA], 1968, p. 50).

### **DSM – IV – TR Diagnostic Criteria for Attention-Deficit/Hyperactivity Disorder**

A. Either (1) or (2):

(1) Six (or more) of the following symptoms of inattention have persisted for at least 6 months to a degree that is maladaptive and inconsistent with developmental level:

#### *Inattention*

- (a) Often fails to give close attention to details or makes careless mistakes in schoolwork, work, or other activities
- (b) Often has difficulty sustaining attention in tasks or play activities
- (c) Often does not seem to listen when spoken to directly
- (d) Often does not follow through on instructions and fails to finish schoolwork, chores, or duties in the workplace (not due to oppositional behavior or failure to understand instructions)
- (e) Often has difficulty organizing tasks and activities

(f) Often avoids, dislikes, or is reluctant to engage in tasks that require sustained mental effort (such as schoolwork or homework)

(g) Often loses things necessary for tasks or activities (e.g., toys, school assignments, pencils, books, or tools)

(h) Is often easily distracted by extraneous stimuli

(i) Is often forgetful in daily activities

(2) Six (or more) of the following symptoms of hyperactivity/impulsivity have persisted for at least 6 months to a degree that is maladaptive and inconsistent with developmental level:

*Hyperactivity*

(a) Often fidgets with hands or feet or squirms in seat

(b) Often leaves seat in classroom or in other situations in which remaining seated is expected

(c) Often runs about or climbs excessively in situations in which it is inappropriate (in adolescents or adults, may be limited to subjective feelings of restlessness)

(d) Often has difficulty playing or engaging in leisure activities quietly

(e) Is often "on the go" or often acts as if "driven by a motor"

(f) Often talks excessively

*Impulsivity*

(g) Often blurts out answers before questions have been completed

(h) Often has difficulty awaiting turn

(i) Often interrupts or intrudes on others (e.g., butts into conversations or games)

B. Some hyperactive-impulsive or inattentive symptoms that caused impairment were present before age 7 years.

- C. Some impairment from the symptoms is present in two or more settings (e.g., at school [or work] and at home).
- D. There must be clear evidence of clinically significant impairment in social, academic, or occupational functioning.
- E. The symptoms do not occur exclusively during the course of a Pervasive Developmental Disorder, Schizophrenia, or other Psychotic Disorder and are not better accounted for by another mental disorder (e.g., Mood Disorder, Anxiety Disorder, Dissociative Disorder, or a Personality Disorder) (APA, 1996, p. 91-93).

### **Can Improper Diagnoses Lead to Ineffective Treatment Outcomes?**

Recently, disputes have become unavoidable concerning the controversy of whether to revise the DSM criteria for ADHD; much of this controversy discusses criticism of ADHD subtypes as well as including age specificity within the DSM – V criteria (Ghanizadeh, 2012). There are certain levels of subjectivity that are placed in the criteria of several different disorders, including ADHD, to help the clinician use his or her professional judgment or expert opinion regarding the degree to which the symptoms are being exhibited. However, when considering ADHD, the level in which subjectivity is present in the criteria seems to be far too prominent. The current system in which ADHD is diagnosed should have more concrete criteria to help provide a more standardized method to the diagnostic process. As described by the APA DSM – V ADHD and disruptive behavior disorders work group, a criticism of the DSM-IV criteria is that it is “sparsely described, and this enhances criterion variance, which is a major problem in everyday use” (Coghill & Seth, 2011, p. 79). Another critique of the criteria is that it is too lengthy and difficult for clinicians to remember (Coghill & Seth, 2011). The validity of the age of onset that is currently has been questioned as well. In the DSM – IV – TR, criterion B

states “some hyperactive-impulsive or inattentive symptoms that caused impairment were present before age 7 years” (APA, 1996, p. 93). However, DSM – IV field trials revealed that 75% of the participants reported an age of onset of 9 to 14 years for the inattentive group of symptoms (Tannock, 2013). Moreover, Tannock discussed a study that involved an adult population with ADHD retrospectively recalling their age of onset, the study revealed that only 50% of the participants could recall an age of onset prior to the age of 7; 95% could confirm an age of onset before the age of 12; 99% could recall an age of onset before 16 years old (2013).

Some authors have made suggestions as to what changes should be made to the diagnostic criteria of ADHD. A few examples of these proposed changes include: a reduction in symptom threshold in adults, a replacement of subtypes with specifications of current presentation of symptoms, and elaboration of symptoms examples in criteria A1 and A2 (Coghill & Seth, 2011; Tannock, 2013). Does treatment effectiveness depend upon proper diagnoses? When someone is being treated as if they have ADHD, but in all actuality they have Oppositional Defiance Disorder or Conduct Disorder, the effectiveness of the treatment being provided may provide some skewed results.

### **Medicinal Treatments for ADHD**

The treatments for ADHD are very plentiful in their selection. Medicinal treatments are the most popular form of treatment used for ADHD. Medicinal treatments are any interventions that utilize pharmacological properties. There are two main categories of medicinal treatments for ADHD: stimulants and non-stimulants. Some examples of popular stimulant medications for ADHD include: Vyvanse, Adderall, and Ritalin. Vyvanse is a type of amphetamine treatment called lisdexamfetamine (described on page 15), Adderall is a mixed-amphetamine salt treatment (described on page 16), and Ritalin is a methylphenidate (described on page 18). Some

examples of non-stimulant medications include: Strattera, Intuniv, and Kapvay. Strattera is a type of atomoxetine treatment (described on page 21), Intuniv is a guanfacine treatment (described on page 23), and Kapvay is a clonidine treatment (described on page 24). Medicinal treatments have much more research citing their efficacy than non-medicinal treatments. Even though medicinal treatments are widely used and numerous studies have been conducted proving their effectiveness, the list of possible side effects could be lengthy and potentially dangerous.

### **Possible Side Effects for Medicinal Treatments**

There are several different side effects that could occur when taking any of the previously listed medicinal treatments. According to the National Institute of Mental Health (NIMH), there are several different possible side effects that could occur, but in most instances they are minor and vanish with decreases in dosages (NIMH, 2012). Some of the most common side effects for medicinal treatments include: a decrease in appetite, problems with sleeping, headaches, and stomach aches (NIMH, 2012). Some other side effects that are less common include the development of tics or suddenly appearing to have an emotionless personality or flat affect (NIMH, 2012). One article stated that the U.S. has a warning of possible death with misuse listed in the labeling for the d-amphetamine and mixed amphetamine salts combination (Elia & Vetter, 2010). The authors then pointed out that “a warning to avoid use in pediatric patients with cardiac problems is also included for the amphetamine preparation as well as for methylphenidate” (Elia & Vetter, 2010, p. 169). According to NIMH, in 2007 the Food and Drug Administration (FDA) required that all creators of ADHD medications provide medication guides for patients (NIMH, 2012). The mandatory inclusion of these medical guides followed a review that found patients who have pre-existing heart conditions have a slightly higher risk for heart attack, strokes or even sudden death when taking ADHD medications (NIMH, 2012).

## **Non-medicinal Treatments for ADHD**

There are also several different types of non-pharmacological treatments that are widely used to help people with ADHD. When treating children at a young age, treatment usually begins with behavioral interventions including: child, teacher, or parent training or parent education programs (Sonuga-Barke et al., 2013). Parent training deals with helping parents to: find ways to identify and control the antecedents and consequences pertaining to the child's behaviors, identifying problematic behaviors, positively reinforce appropriate social behavior, as well as using time-out and planned ignoring to help decrease undesired behaviors (Rajwan, Chacko, & Moeller, 2012; Young & Amarasinghe, 2010). Other non-medicinal treatments for ADHD include: fatty acid/vitamin and mineral supplements, exclusion of artificial food colorings, neurofeedback, cognitive training, and restricted elimination diets (Sonuga-Barke et al., 2013). Dietary interventions (i.e. supplements and elimination/exclusion diets) are described more fully on page 26 and 27. Neurofeedback (described on page 25) is where someone with ADHD is taught to efficiently control specific brain activity patterns in order to improve behavioral regulation. Cognitive training is accomplished by learning how to identify and control the antecedents and consequences. Methods used for accomplishing this include: the child's behaviors, identifying problematic behaviors, positively reinforcing appropriate social behavior, and utilizing time-out/planned ignoring to help decrease undesired behaviors (cognitive treatments are described on page 27 and 28). The goal of this paper is to identify treatment options that have proven to effectively treat ADHD efficiently as well as provide suggestions as to what treatment or combination of treatments may be the safest and most efficient options. This will be done by providing results and discussion regarding the efficacy or treatment outcomes of several different options used to treat ADHD, reviewing common

critiques of DSM – IV –TR diagnostic criteria, and thoughts/suggestions will be given regarding criteria changes in DSM – V.

## Definition of Terms

Adderall: Stimulant medication used to treat ADHD

Attention-Deficit/Hyperactivity Disorder: A neurobehavioral disorder that is characterized by noticeable difficulties in impulsivity, hyperactivity, or inattention

Cognitive Training: Identification and controlling of the antecedents and consequences that involve: the child's behaviors, identifying problematic behaviors, positively reinforcing appropriate social behavior, and utilizing time-out/planned ignoring to help decrease undesired behaviors

Neurofeedback: A treatment which involves learning to acquire control over specific patterns in brain activity in order to successfully improve self-regulation of behaviors more efficiently throughout daily life

Non-pharmacological Treatment: Any form of treatment that does not involve the use of medicinal interventions or supplements

Restricted Elimination Diet: The practice of eliminating certain things from one's diet (i.e. sugar) in the hopes that it will result in a reduction in ADHD symptom presentation

Ritalin: Stimulant form of medication used to treat ADHD

Strattera: Non-stimulant form of medication used to treat ADHD

Vyvanse: Stimulant form of medication used to treat ADHD

## Summary of Chapter 1

Studies have shown that there is some cause for concern regarding the effectiveness of treatment options for ADHD. One study showed that 60% of the children who are diagnosed with ADHD will ultimately see their symptoms persist well into their adult lives (Madaan et al., 2008). Moreover, with the percentage of ADHD diagnoses on a constant rise in the U.S., a review of the available treatments and their efficacy should be conducted to help identify what options are the most effective. Both medicinal and non-medicinal treatments will be considered as well as pairing medicinal treatment with supplemental non-medicinal interventions also. Another issue in delivering treatment effectively to people with ADHD is properly diagnosis. Providing effective treatments is heavily dependent upon accurate diagnoses. One critique of the DSM criteria for ADHD is that it is not described with enough detail which can lead to greatly enhanced criterion variability (Coghill & Seth, 2011). Studies have also been conducted that call into the question the validity of the age of onset currently being used in the DSM as well. The following chapter will provide examples of studies that have tested and reviewed the efficacy of medicinal and non-medicinal treatments for ADHD.

## CHAPTER 2

### OVERVIEW OF LITERATURE

Important advances in cognitive neuroscience fields, molecular/behavioral genetics, and neuroimaging have allowed us to obtain much more evidence that ADHD is a complicated neurobiological disorder that involves many different regions of the brain and a complex network of neurotransmitters (Antshel, Hargrave, Simonescu, Kaul, Hendricks, & Faraone, 2011). This makes understanding and treating the disorder a very individualized and complex process. The long term effectiveness and safety of the treatments being used are both main concerns for people who have any kind of disorder, including ADHD. The importance for people who have ADHD, and for the family of loved ones who have ADHD, to have a safe and effective treatment outcome is vital. A study was conducted that reviewed the long term outcomes of ADHD treatments, the authors found that people who have ADHD who did not receive treatment often times had poorer long term outcomes and that treatment may improve the lives of people with ADHD, but not necessarily to the point of healthy controls (Shaw et al., 2012). While on the surface this may seem like very basic information, but it is important to establish that any kind of treatment being provided improves the quality of life in the targeted areas for the individual utilizing it.

Achieving effectiveness over a long period of time is the goal for any treatment, especially when considering treatments that are costly in nature. A study was conducted that estimated the annual amount of money spent on ADHD treatment in the U.S. found that between \$12,005 and \$17,458 was spent per child diagnosed (Kovshoff, Williams, Vrijens, Danckaerts, Thompson, Yardley, Hodgkins, & Sonuga-Barke, 2011). Keeping these numbers in mind, providing effective treatment is a very important goal; especially for families who are already

living on a fixed income. This leaves some clinicians in a bind when providing treatment for individuals with ADHD. Due to the potentially high cost for several of the treatment options for ADHD, clinicians are forced to take the socio-economic status of their patients into account when providing treatment (Kovshoff et al., 2011). Unfortunately, the issue of treatment cost may also force clinicians to overlook more effective, but costly treatment options for some patients.

### **Medicinal Treatments for ADHD**

For a long time now, pharmacological interventions have been at the forefront of ADHD treatment, and this still remains true today. Pharmacological treatments are usually considered first because they treat the main symptoms of the disorder, thusly helping the person function more efficiently in academic, social, and home settings (Madaan et al., 2008). Also, recent studies have shown that stimulants and non-stimulants have proven to be continuously effective beyond two year treatment periods while providing adverse effects that are both few and tolerable (Huang and Tsai, 2011). Another article stated that when selecting pharmacological treatments, one must also take into consideration the medication's demonstrated effect on: "health-related quality of life" of the individual, persistence and adherence, and cost-effectiveness of the treatment (Hodgkins, Shaw, McCarthy, & Sallee, 2012, p. 263).

### **Stimulant Medications**

The first type of medicinal treatments that were approved by the Food and Drug Administration (FDA) to be prescribed to individuals with ADHD, were stimulant medications (Bitter, Angyalosi, & Czobor, 2012). Pharmacological treatments are the most widely relied upon methods for treating ADHD, but there are several different variations of medicinal treatments that allow clinicians to individually tailor the duration of the treatment (i.e. active isomer or a mixture of active/less active isomers; medications that have immediate release,

intermediate release, or extended release options) to the specific needs of the patient (Antshel et al., 2011). Many of the immediate release amphetamine treatments have been safely and effectively used to treat ADHD since the 1930's, however, many of the studies conducted evaluating the safety and efficacy of these treatments were done prior to the formulation of diagnostic criteria (Hodgkins et al., 2012).

Some of the more widely used stimulant medication treatment options include: osmotic-release oral system methylphenidate (OROS – MPH), amphetamines, mixed amphetamine salts, and methylphenidates. Amphetamines have been known to induce calming, relaxing effects for several decades. In the 1930's, it was then first noted that amphetamines produced a paradoxically relaxing sensation among “severely disruptive, institutionalized, hyperactive boys” (Hodgkins et al., 2012, p.247). This observation helped to cause many to take note of the benefits that stimulants may have when treating people with ADHD (Hodgkins et al., 2012). However, the pharmaceutical compositions that were used to treat those same symptoms are far different than they are today (Hodgkins et al., 2012). As it was briefly mentioned earlier, stimulant medications have been pharmacologically modified so that they can immediately release, intermediately release, or provide an extended release of the active ingredients to help meet the needs of the individual with a great deal of specificity.

**Amphetamines.** This form of medicinal treatment for ADHD has been a well-known option for people with ADHD for many years. One popular ADHD amphetamine treatment is lisdexamfetamine, more widely known as Vyvanse. One study that reviewed the efficacy and safety of lisdexamfetamine among 310 adolescents, between the ages of 13 and 17, the authors found that 49 of the 310 (15.8%) subjects discontinued treatment due to: “treatment-emergent adverse events”, “lack of efficacy”, or “treatment/baseline ECG abnormalities” (Childress &

Berry, 2012, p. 313). The most commonly experienced side effects included: decreased appetite (33.9%), headaches (14.6%), insomnia (11.2%), and decreased weight (9.4%) (Childress & Berry, 2012). A study conducted by DuPaul et al. on lisdexamfetamine found that treatment greatly reduced the symptoms and improved executive functioning among 24 college students, however, functioning was not equivalent to healthy controls (Bitter, Angyalosi, and Czobor, 2012). One positive aspect of lisdexamfetamine is that attempts to hasten the metabolic rate by administering the drug intravenously or crushing it for intranasal inhalation proved to be unsuccessful, this means getting a “quick high” for recreational purposes is not an option (Hodgkins et al., 2012). This inability to speed up the metabolism rate for lisdexamfetamine also decreases the likelihood of someone overdosing from the drug (Antshel et al., 2011). One interesting study using lisdexamfetamine to help increase driving efficiency, conducted by Biederman et al., found that the drug helped to reduce accidents, produce faster reaction times, and lower the rate of simulated driving collisions among 69 participants using a validated driving simulation paradigm (Bitter et al., 2012).

Another variation of amphetamines are mixed-amphetamine salts IR or XR (immediate release or extended release), a popular brand name of this treatment is Adderall. A study conducted in 2005 found that improvements of 30% or greater on Conner’s Global Index Scale were maintained while using mixed-amphetamine salts IR and XR during long term treatments (Findling, Biederman, Wilens, Spencer, McGough, Lopez, & Tulloch). Also, the cardiovascular effects for long and short- term mixed-amphetamine salt treatments were minimal when using doses that were less than or equal 30 mg per day on otherwise healthy participants (Findling et al., 2005). Another study that reviewed the efficacy of Adderall concluded that “the efficacy of Adderall remained statistically significant even after adjusting for heterogeneity of study design,

methodology, and additional factors that could have influenced the outcomes” (Faraone & Biederman, 2002, p. 73). Faraone & Biederman (2002) also found that the use of Adderall proved to be efficacious when treating the following symptoms: inattention, hyperactivity, and aggression. Another study attempting to test the efficacy of mixed-amphetamine salts IR showed that, with doses of 5 mg. or higher, quick improvements in teacher ratings as well as mathematical performance were noticed within 1 ½ hours following treatment administration (Hodgkins et al., 2012). In 2007, a study was conducted that evaluated the cardiovascular safety in children taking mixed-amphetamine salts XR. The study evaluated 2,968 children between the ages of 6 and 12 years old, the authors found that only about 2.5% of the participants had two consecutive systolic blood pressure and diastolic blood pressure values greater than the 95<sup>th</sup> percentile (in age, sex, and height), and 3.6% had their pulse rate increase by at least 25 beats per minute to a value of at least 110 beats per minute (Donner, Michaels, & Ambrosini, 2007). Another research study that examined the long-term effects of mixed-amphetamine salts XR found that, based on norms provided by the Centers for Disease Control (CDC), growth deficits occurred in weight, height, and body mass index during year one of treatment but deficits in growth were not significant in the second year of treatment (Faraone, Biederman, Monuteaux, & Spencer, 2005). A research study was conducted in 2001 that reviewed the effectiveness of Adderall treatments for adults with ADHD. The authors found that an average oral dose of 54 mg administered twice per day was both effective and well tolerated among the 27 participants (Spencer et al., 2001). A significant reduction in the ADHD rating scale results (at least a 30% reduction) were found in 70% of the participants who were taking Adderall (Spencer et al., 2001). The authors concluded that Adderall is an effective short-term treatment for adults with ADHD, but more studies evaluating long-term treatment effects in adults with ADHD need to be

conducted (Spencer et al., 2001). One study that evaluated the long-term effectiveness and tolerability of mixed-amphetamine salts resulted in treatment discontinuation, prior to the end of the 24 month treatment duration, in 52% of the 568 total initial enrollments (McGough et al., 2005). However, of the 52% who discontinued treatment only 16% did so due to adverse effects or because the treatment was lacking in efficacy, although, of the 568 total participants 525 of them (92%) reported experiencing at least one adverse effect (McGough et al., 2005).

**Methylphenidates.** Methylphenidates (MPH) are a very widely used option for treating ADHD, a brand of MPH treatment is Ritalin. Often times, MPH is one of the first forms of treatment that is suggested for people with ADHD, but efficacy studies have found a wide variety of results ranging from significant improvement to no effect at all (Castells, Ramos-Quiroga, Rigau, Bosch, Nogueira, Vidal, & Casas, 2011). A study examining the efficacy of MPH found that the efficacy of the treatment increased for every 10 mg incremental increase in dosage of MPH (Castells et al., 2011). Conversely, there was a decrease in efficacy for MPH treatment in participants with co-morbid substance use disorders and with continuous-release formulations (Castells et al., 2011). A study that was conducted evaluating the effectiveness of MPH treatment in adults with ADHD found that MPH alleviated symptoms of anxiety and appeared to show trends toward significant alleviation of depressive symptoms (Bouffard, Hechtman, Minde, & Iaboni-Kassab, 2003). Bouffard et al. also found that MPH had no significant clinical effects on blood pressure, pulse, and weight and minimal side effects were reported by the participants on MPH treatment as well (2003). A randomized, placebo controlled, 24 week study on MPH – ER found that treatments resulted in statistical and clinically significant decrease in symptoms as measured by the Wender – Reimherr adult attention deficit disorder scale (WRAADDS) as well as with symptoms of

hyperactivity/impulsivity and inattention in accordance with DSM – IV criteria (Rosler, Fischer, Ammer, Ose, & Retz, 2008). At the end of treatment, 61% of the participants experienced a 30% reduction in their WRAADDS score, moreover, 55% reportedly felt much or very much improved according to results from the clinical global impression scale (Rosler et al., 2008).

A well-known stimulant treatment option for people with ADHD is dexamethylphenidate (DMPH), a well-known brand name of this treatment is Focalin. Several studies have been conducted reviewing the efficacy and safety of DMPH. One of the studies that evaluates DMPH looked at 253 pediatric outpatient participants diagnosed with ADHD, the authors found that all three dosages of DMPH (10, 20, and 30 mg) were effective and safe in treatment stating that DMPH elicited “comparable positive therapeutic responses for all assessed doses when compared with placebo” (Childress, Spencer, Lopez, Gerstner, Thulasiraman, Muniz, & Post, 2009, p. 359). Another study that examined the safety and efficacy of DMPH – extended release (ER) in children with ADHD found that nearly 67.3% of the participants who were taking DMPH – ER rated as “very much improved” on the Clinical Global Impressions – Improvement (CGI – I) scale, while 32.7% had a CGI – I scale rating of “minimally improved, no change, or minimally worse” (Greenhill, Muniz, Ball, Levine, Pestreich, & Jiang, 2006, p. 820). However, 75% of the people who took DMPH – ER reported adverse events (i.e. decreased appetite [30.2%], headaches [24.5%], abdominal pain [13.2%], nausea [11.3%], etc.) (Greenhill et al., 2006). Another study that reviewed the safety and efficacy of DMPH found that a reduction in overall symptom ratings on the DSM – IV ADHD – Rating Scale (RS) was demonstrated; with a mean decrease of 13.7 (from 36.8 to 23.1, on a scale of 0 to 54) from baseline (Spencer, Adler, McGough, Muniz, Jiang, & Pestreich, 2007). Based on the results from their research study,

Spencer et al. concluded that DMPH – ER is an effective treatment for adults with ADHD and the efficacy was noted by teachers, observers, patients, and clinicians consistently (2007).

Another popular form of methylphenidate treatments are OROS – MPH medications, a popular brand name for this treatment is Concerta. One study that looked at the effectiveness of OROS – MPH treatment found that out of 40 participants, 4 claimed to notice substantial improvement, 14 noticed moderate improvement, 12 had mild improvement, and 9 having no improvement or felt worse (Miller – Horn et al., 2008). Of the 40 participants who took OROS – MPH: only 12.5% did not experience significant bouts with insomnia, only 2.5% had no significant problems with tics, 17.5% had no significant problems with a decreased appetite, and 10% experienced no significant issues with headaches (Miller – Horn et al., 2008). A study conducted by Hoare et al. (2005) assessing the 12 month efficacy and safety of OROS – MPH was done using the Global Assessment of Satisfaction and Adequacy scales (GAS and GAA). The authors found that the GAS satisfaction rate varied from 69% to 49%, also satisfaction was more common in higher dosage groups (54 or 36 mg), higher age groups (10 – 16 years old), and with those who had a diagnosis of predominantly inattentive subtype (Hoare et al., 2005). When considering the safety of OROS – MPH, interestingly enough, Hoare et al. found that more treatment-related adverse events occurred in the two lower dosage treatment groups, occurring in 65% of the people taking 18 mg, 64.4% of the participants taking 36 mg, and only 38.5% in the subjects taking 54 mg (2005). Another study regarding the efficacy of OROS – MPH used the Adult ADHD Investigator System report scale (AISRS) to evaluate its effectiveness (Biederman et al., 2007). The authors found that of the 67 participants to take OROS – MPH treatment, 46 (69%) attained at least a 30% reduction in AISRS scores at the end of treatment when compared to baseline scores (Biederman et al., 2007). There were no serious adverse events, although

some of the adverse events that occurred which eventually lead to discontinuation of the treatment jitteriness, irritability, depression, anxiety, elevated blood pressure, and increases in heart rate (Biederman et al., 2007).

### **Non-stimulant Medications**

According to research studies, between 10% and 30% of the people with ADHD seeking treatment either respond poorly to stimulant treatment or they experience serious adverse effects as a result of the treatment (Huang & Tsai, 2011). Many of the people who fall into this category may find themselves taking non-stimulant medications to treat their ADHD symptoms. There are several different non-stimulant treatment options for people to choose from, including: guanfacine, bupropion, and atomoxetine (ATX). However, only three types of non-stimulant medications have been approved by the FDA, they are ATX (Strattera), guanfacine (Intuniv), and clonidine (Kapvay).

**Atomoxetine.** ATX is a non-stimulant medicinal treatment for ADHD that inhibits the adrenaline transporter specifically (Santosh, Sattar, & Canagaratnum, 2011). One study that involved ATX used the Wender – Reimherr adult attention deficit disorder scale (WRAADD) (which was used to evaluate “temper, affective lability, and emotional overactivity”) to help them identify emotional dysregulation (Santosh et al., 2011, p. 752). The authors found that patients with emotional dysregulation “exhibited a greater treatment effect to ATX for symptoms of ADHD than the rest of the sample” (Santosh et al., 2011, p. 755). One of the studies conducted that examined the efficacy of ATX involved 384 patients receiving up to 221 weeks of treatment (Adler, Spencer, Williams, Moore, and Michelson, 2008). Conners’ Adult ADHD Rating Scale – Investigator Rated: Screening Version (CAARS) Total ADHD Symptom scores were used to evaluate the efficacy of the treatment (Adler et al., 2008). What Adler et al. found

was that, during treatment, the CAARS scores dropped 30.2%, and adverse events mainly consisted of expected pharmacological effects; these results caused them to support the long-term safety, tolerability, and efficacy of ATX treatment for adults with ADHD (2008). Another study that involved an assessment of the efficacy of ATX treatment involved a comparison of 220 people taking ATX to 225 people taking a placebo, and symptom variations prior to and following treatments were assessed using the CAARS – Investigator Rated: Screening Version scores (Durell et al., 2013). They found that on average, the participants taking the ATX treatment had their CAARS scores decrease 13%, from 39% to 26% (Durell et al., 2013). The authors concluded that ATX treatment efficacy, safety, tolerability, and clinical response outcomes were consistent with the results of previously conducted adult studies (Durell et al., 2013).

**Bupropion (BPN).** Another non-stimulant form of medicinal treatment for ADHD is BPN. BPN is an antidepressant that is metabolized by three pharmacologically active properties and BPN can cause “noradrenergic, anticholinergic, and indirect dopaminergic effects” (Banaschewski, Roessner, Dittmann, Santosh, & Rothenberger, 2004, p. 107). An interesting research study by Santosh et al (2011) found two conflicting articles that tested the efficacy of BPN. One study that involved 40 participants found that BPN Sustained Release (SR) was both statistically and clinically superior to placebos in regard to the improvements of ADHD symptoms in adults, conversely, a seven week study involving 30 adults found no evidence of any statistical differences concerning the efficacy in the use of BPN SR, MPH, and placebos (Santosh et al, 2011). One study conducted by Upadhyaya et al (2004) found that, when treating 11 people with ADHD and nicotine dependent diagnoses with BPN, noticeable improvements were made in smoking behaviors but not in symptoms of ADHD (Adragna, 2012). However,

another study that involved 13 participants, who were substance abusing adolescents diagnosed with ADHD and a mood disorder, completed a 6 month long treatment program that resulted in improvements in ADHD, substance use, and depression (Adragna, 2012). Another study that reviewed the effectiveness of BPN made some very interesting finds. Acheson and de Wit found that the use of BPN made significant improvements in measurements of lapses in attention with individuals who had poor baseline performances, however, BPN had no effects on the three standardized impulsivity measurements, including: risk taking, delay discounting, and behavioral inhibition (2008). This study may lead one to conclude that BPN is effective when treating healthy adults, but only the symptoms involving attention.

**Guanfacine (GFN).** Much like CDN, GFN is a  $\alpha_2$ -adrenoceptor agonist. Although, GFN is considered to be a much more selective  $\alpha_2$ -adrenoceptor agonist than clonidine treatments are; where CDN binds with  $\alpha_{2A}$ ,  $\alpha_{2B}$ , and  $\alpha_{2C}$ -adrenoceptors, GFN preferentially binds with postsynaptic  $\alpha_{2A}$ -adrenoceptors located specifically in the prefrontal cortex (Biederman et al, 2008). A study that reviewed the treatment effectiveness of GFN involved 345 participants who were randomly assigned GFN Extended Release (ER) or a placebo (259 received GFN ER and 86 had the placebo) (Biederman et al, 2008). Efficacy was measured by comparing the statistical treatments of the participants ADHD – RS – IV scores prior to and following treatments. They found that a mean reduction in ADHD – RS – IV scores at the end of treatment was 16.7 compared to an 8.9 reduction in the placebo group (Biederman et al, 2008). Another placebo controlled study looking at the efficacy of GFN compared four different treatment dosages: 1mg, 2 mg, 3 mg, and 4 mg each daily (Sallee, McGough, Wigal, Donahue, Lyne, & Biederman, 2009). They found that the most dramatic reductions in ADHD – RS – IV scores were among the 1 mg (20.4 reduction) and 4 mg (20.9 reduction) dosages (Sallee et al, 2009).

Another study that involved a randomized placebo controlled study of 217 children ranging in age from 6 – 12 years old, 138 were randomly chosen to receive GFN ER and 79 would receive a placebo (Connor et al, 2010). The treatment efficacy was measured using the CPRS. The authors found that there was a mean reduction in CPRS scores of 10.9 in the GFN ER group compared to 6.8 in the placebo group (Connor et al, 2010). Also, a significant reduction in the ADHD – RS – IV scores were recorded, with a reduction of 23.8 in the GFN ER group compared to only 11.5 in the placebo group (Connor et al, 2010).

**Clonidine (CDN).** Clonidine is a  $\alpha_2$ -adrenergic agonist that is approved for the treatment of ADHD for people between the ages of 6 and 17 (Croxtall, 2011). There have been several different studies that have been conducted with the goal of measuring the efficacy of CDN. One study that measured the effectiveness of CDN found that the ADHD – RS – IV scores reduced by 15.6 in a group taking 0.2 mg/day and 16.5 in the group taking 0.4 mg/day compared to a reduction of 7.5 in the placebo group (Croxtall, 2011). A research study that looked only at ECG changes and the occurrence rate of adverse events caused by the use of CDN found that severe or moderate adverse events were seemingly common among the children randomly selected to utilize the treatment (Daviss et al, 2008). Thirty-one people were selected to take CDN and 30 were taking the placebo; of the 31 on CDN 79.4% experienced a moderate or severe adverse event compared to 49.2% of the placebo group (Daviss et al, 2008). Despite these conclusions, the authors came to the conclusion that CDN was, overall, safe and well tolerated (Daviss et al, 2008). Although, they recommended that any physician prescribing the drug should be aware of the risk for the occurrence of bradycardia and to closely monitor the heart rate of their patients as well as advising them on the high likelihood that drowsiness or fatigue may occur (Davis et al, 2008). Also, Davis et al found that CDN caused 83.9% of the participants taking the treatment to

experience some kind of adverse event as a result of the drug, higher than any other treatment that was reviewed in the study and 25.3% higher than the participants taking MPH (2008). Another study that looked at the safety and efficacy of CDN ER reviewed 2 separate 8 week, double-blind placebo controlled multicenter trials of children aged between 6 – 17 years old (Ming, Mulvey, Mohanty, & Patel, 2011). The researchers found that there was significant clinical improvement in the ADHD – RS – IV and CPRS – Revised scores for all participants who were taking 0.2 or 0.4 mg daily doses of CDN ER in comparison to those who took the placebo (Ming et al, 2011). The other 8 week study found that, with the CDN ER group, ADHD rating scale score improvements were made starting from week 2 and reached its peak by week 5 at the latest, and maintained that level until week 7 (Ming et al, 2011).

### **Non-medicinal Treatments for ADHD**

There are a wide number of available treatments for people who have ADHD and are opposed to taking any kind of prescription medications. One non-medicinal treatment is neurofeedback (NF). NF is a treatment for ADHD that involves the participants learning to acquire control over specific patterns in brain activity in order to successfully improve self-regulation of behaviors more efficiently throughout their daily lives (Wangler et al, 2011). Other non-medicinal treatments for ADHD require people to make changes in their diets, such as the exclusion of specific items or the addition of dietary supplements. Both of these methods have studies that have been conducted showing improvements in common symptoms associated with the ADHD. However, early studies using a highly restrictive elimination diets that have shown promising findings with treating children with ADHD have failed to be supported when a review of controlled studies were conducted (Lake, 2010). There are also a number of interventions that

put an emphasis on cognitive areas through the use of cognitive behavioral treatment or cognitive based interventions.

### **Neurofeedback**

There have been many studies that examine the effectiveness of NF as a treatment for ADHD, but not many studies have been conducted that review the long-term sustainability of the treatment. Although, there was at least one study that performed a 6 month follow-up on people with ADHD who had received NF training to help determine the sustainability of its effectiveness (Gevensleben et al, 2010). They found that 38 of the participants who participated in the follow-up not only sustained the mean scores they attained immediately following NF training, but the mean score improved in every measured category over the 6 month period (Gevensleben et al, 2010). The authors concluded that because of the behavioral affect that NF training had on the participants was successfully maintained, the clinical efficacy of this method is more firmly supported and NF may be more recommended as a viable treatment option over other behavioral treatments or medicinal treatments (Gevensleben et al, 2010). Another study that looked at the effectiveness of NF used the German ADHD Rating Scale (GARS) to measure changes in mean scores in areas of: attention deficit, hyperactivity, impulsivity, and a total score (Bakhshayesh, Hansch, Wyszkon, Rezai, & Esser, 2011). The authors found that all measured areas improved following NF treatment. A mean improvement of 1.978 to 1.400 was made in attention deficit, 1.289 to 0.644 in hyperactivity, 1.650 to 0.978 in impulsivity, and 1.689 to 1.072 in total score between pre and post treatment (Bakhshayesh et al, 2011). In comparison, the biofeedback group in the same study made improvements in all measured areas but attention deficit, but the improvements were not as significant as with NF (1.147 to 0.800 in hyperactivity, 1.594 to 1.200 in impulsivity and 1.512 to 1.329 in total score) (Bakhshayesh et al, 2011). One

study that compared the treatment effectiveness of NF in comparison to medication and a combination of NF plus medication made some interesting findings. The authors found that when treating with NF alone, while not extremely significant, it was more effective than using medication or the combination of NF and medication (Duric, Assmus, Gundersen, & Elgen, 2012). One may come to the conclusion that NF is an efficacious treatment that seems to be producing results at a level that is comparable to the standard that has been set by stimulant medications.

### **Dietary Interventions**

Dietary interventions have been utilized in the treatment of ADHD for several years now. As previously discussed, some restrictive diets have been shown to be not as effective as it was once thought to be, but there are some studies that have been conducted that have shown that some restrictive or few foods diets can prove to be efficacious by causing a significant reduction in symptoms of ADHD (Pelsser, Frankena, Toorman, Savelkoul, Pereira, & Buitelaar, 2009). In one study, of the 27 total children that participated in a few foods diet resulted in 70% of them experiencing a reduction in symptoms of ADHD, according to parental and teacher ratings, by at least 50% (Pelsser et al, 2009). The authors went on to state that the extent to the diet restriction may affect the degree to which behavioral improvements are exhibited in that excluding too many foods may reduce the number of responders to the treatment and excluding a small number of foods (i.e. sugars or additives) may prove to be non-beneficial for children with ADHD (Pelsser et al, 2009). Another study discussed some of the many vitamin and mineral supplements that have studies supporting their positive effects on the symptoms of ADHD including: zinc, magnesium, iron, and vitamin B6 (Loscalzo, 2004). Certain minerals, like zinc, are known to have an indirect effect on dopamine metabolism, which is well-known to be

associated with ADHD (Loscalzo, 2004). A 12 week study that was conducted involved the supplementation of 150 mg of zinc sulfate per day in 72 girls and 338 boys, the authors found that zinc was superior to the placebo in the reduction of ADHD symptoms concerning areas of: hyperactivity, impairments of socialization, and impulsivity (Loscalzo, 2004). Another study that looked at the effects that magnesium has on ADHD symptoms found that, out of 50 children aged 7 to 12 who met criteria for ADHD and had documented magnesium deficiencies, after providing 200 mg of magnesium supplements for 6 months symptoms of hyperactivity significantly decreased in comparison to the control group (Loscalzo, 2004). A study involving changes in ADHD symptoms as a result of iron deficiencies found that there was a 30% improvement in ADHD symptoms according to the Conners rating scale (Loscalzo, 2004). Another study that reviewed the effect that supplementing fatty acids into the diet of a person with ADHD might result in made some interesting conclusions. The authors stated that out of a randomized controlled trial, consisting of 63 children aged 6 to 12 years old taking polyunsaturated fatty acids, docosahexonic, or a placebo for 4 months, fatty acid supplementation does not have a significant effect in improving any ADHD symptom (Ballard, Hall, & Kaufmann, 2010). This conclusion was made through objective attention evaluations (via computers and written tests) and interpretation of Conners Rating Scale scores (Ballard et al, 2010).

### **Cognitive Treatments**

Cognitive treatments are popular options for improvement of ADHD symptoms and can include: cognitive-behavioral therapy or cognitive retraining. A study that incorporated cognitive-behavioral treatment (CBT) methods for adolescents that specifically worked on communication training, cognitive restructuring, and problems solving to help adolescents with

parental conflicts, the authors found that CBT showed a pre and post treatment improvement in several behavioral measures including a decrease in symptoms for ADHD and ODD (Toplak, Connors, Shuster, Knezevic, & Parks, 2008). Another study examined the efficacy of meta-cognitive treatments on adults with ADHD. The meta-cognitive approach uses cognitive-behavioral techniques help develop skills in: time management, planning, and organization (Solanto et al, 2010). This study compared meta-cognitive therapy with supportive therapy; they found that the higher the CAARS – S subscale baseline scores for inattention and memory were resulted in a more prominent differential improvement with the use of meta-cognitive therapy (Solanto et al, 2010). Another study examining the efficacy of cognitive retraining found that it had positive effects on selective attention, divided attention, and sustaining of attention (Rajender, Malhotra, Bhatia, Singh, & Kanwal, 2012). In this study, participants were given 36 manualized cognitive retraining sessions that incorporated activities that focused the three previously mentioned areas of attention, the authors found that a change in The Attention Deficit/Hyperactivity Disorder Test (ADHDT; a norm based test for the diagnosis of ADHD) mean score total between pre and post treatment was from 128.0 to 108.3, respectively (Rajender et al, 2012). This led the authors to conclude that at least 36 hours of manualized cognitive retraining can partially improve cognitive deficits in children with ADHD (Rajender et al, 2012).

## Summary of Chapter 2

Several studies are available that evaluate, discuss, and measure the efficacy and safety of stimulant and non-stimulant medicinal treatments for ADHD, but not quite as much for the non-pharmacological treatments. The efficacy for medicinal treatments are well supported, however, the amount of adverse events that occur with each prescription treatment can vary in frequency and intensity. Non-medicinal treatments like NF and cognitive interventions seem to be just as effective, and in some cases with NF, slightly superior to medicinal treatments. Although, more research is needed that evaluates the efficacy of NF and CBT for treating people with ADHD. Dietary interventions were also shown to exhibit improvements in symptoms of ADHD in participants. However, the results from the dietary interventions seem to be quite variable in their findings and conclusions at times.

## CHAPTER 3

### DISCUSSION AND IMPLICATIONS

In a society where it is customary to have what you want at the exact moment that you need it causes treatment effectiveness to be largely based upon the time it takes to notice the expected changes. Unfortunately, this mindset may lead many to seek out pharmaceutical interventions when treating ADHD. The main problem with this fact is that many of the people who are affected by ADHD are children under the age of 12, not to mention that many medicinal treatments produce a myriad of side effects that could occur to varying degrees of severity and frequency. However, some of the side effects are seemingly covert to parents or teachers around the children so they can be easily overlooked or diminished by the immediate and positive improvements of the treatment. Based on the research on non-medicinal treatment options compiled for this paper, NF appeared to be the most efficacious and produced the most significant improvements on symptoms of ADHD. Medicinal treatment comparison studies will be discussed to help evaluate and determine conclusions as to which pharmacological intervention exhibits superior effectiveness.

#### **Treatment Comparison Studies**

Many studies have been conducted that have compared the overall efficacy of stimulant versus non-stimulant medications. In a study that compared the effectiveness of OROS – MPH with ATX found that CGI – I scores at the end of treatment was 83.3% to 63.6%, respectively, indicating that a more significant response in the OROS – MPH group (Yildiz, Sismanlar, Memik, Karakaya, & Agaoglu, 2011). Yildiz et al then go on to state that while both types of medications are effective in the treatment of ADHD, the results show that much more prominent positive effects were reported by teachers and parents (2012). In another study, a comparison

was made between the effectiveness of MPH with buspirone (BSP) found that, out of 34 children, there were no significant statistical differences in the effectiveness of the treatments, but MPH did prove to be more effective than BSP with improving symptoms of inattention (Davari-Ashtiani, Shahrabaki, Razjouyan, Amini, & Mazhabdar, 2010). While there were no serious adverse side effects, more occurrences of side effects were reported from the MPH group (most commonly reported side effects were decreased appetite [11] and sleep [7]) than in the BSP group (most commonly reported side effects were tics [4] and dizziness [3]) (Davari-Ashtiani et al, 2010). Based on the available treatment comparison studies OROS – MPH seems to have the best efficacy and safety among medicinal treatments.

### **Medicinal and Non-medicinal Treatment Combination Studies**

Some studies have been conducted that involve the use of medicinal treatments along with psychosocial interventions and treatments. One study randomly assigned 103 children between the ages of 7 – 9 with ADHD, who have responded to short-term MPH treatment, one of the following three treatments for 2 years: only MPH, MPH with psychosocial treatment (i.e. psychotherapy, training in organizational skills, and academic remediation), or MPH with attention control (Hechtman et al, 2004). The functioning levels of the participants were assessed through academic tests, parental ratings, and self-ratings (for self-esteem and depression) (Hechtman et al, 2004). The authors found that there was no significant differences in the treatment effectiveness for MPH in comparison with MPH plus psychosocial treatment or MPH with attention control, although, there were prominent improvements among all treatment options that were successfully sustained over a 2 year period (Hechtman et al, 2004). Another study that was conducted by NIMH randomly assigned 579 children with ADHD one of four following treatments: intensive behavioral interventions, medication management, a combination

of the previous two interventions, and community treatment (the control group) (Brown et al, 2005). They found that, over time, there were improvements in all four treatment groups with the combined treatment and medication management showing the greatest improvements (Brown et al, 2005). Interestingly enough, only the treatment group that had the combination treatment proved to maintain consistently greater improvements over the community treatment method across areas like parent/child relations, social skills, or disruptive behaviors (Brown et al, 2005).

### **Research Limitations**

The efficacy of medicinal treatments has been extensively reviewed over the years. This is largely because medicinal treatments are very widely used, and they have been used to treat ADHD for several decades now. While there are some studies that have directly compared the effectiveness of multiple different treatments, there is limited research on comparisons of different medicinal treatments as well as medicinal treatments compared to non-medicinal treatments. The need for more updated research in these areas would help to bolster the evidence of treatments that are superior over others. Also, this may help to inform anyone who is affected by the disorder what treatment methods may best for them or their loved ones. Another issue with the existing research is that there is a lack of efficacy studies on non-medicinal treatments. There are several well supported non-medicinal treatments (i.e. NF and CBT), but many dietary interventions (i.e. supplements) go unnoticed that could prove to be effective for those who are do not want to deal with the side effects of medications. Conducting studies that compare non-medicinal treatments would also help to pinpoint non-pharmacological treatments that prove to be superior to others. It would also be interesting to see a study that combined non-medicinal treatments for ADHD (i.e. NF plus dietary interventions) to test if this could be a possible option for some, or perhaps researchers could find that doing so increases the efficacy of the selected

non-medicinal treatments. In summation, more research is needed that compares medicinal and non-medicinal treatments. Moreover, comparison studies for different medicinal drugs and comparison studies of non-medicinal methods may prove to be beneficial as well.

### **Future Implications for Treatment**

Treatment for people with ADHD, as with treatment for any neurological disorder, will certainly evolve and progress over time. With the improvements of computers that monitor brain activity and with the creations of better medications that treat the symptoms more efficiently, ADHD could and most likely will be treated in a completely different way 25 years from now. Moreover, the newest edition of the DSM is scheduled to be released in May of 2013. There have been many professionals clamoring for a change to the way in which we currently diagnose people with ADHD, and until the new DSM is released we will be using the criteria that are already in place. An article that discussed rumored changes to the way in which ADHD is diagnosed cited three major changes which included: the expansion of criterion A to include a higher number of symptoms for hyperactivity/impulsivity and more in-depth descriptions, changing the maximum age of onset in criterion B to 12 years old, and reformulation of the subtypes as well (Sibley, Waxmonsky, Robb, & Pelham, 2013). According to the authors, these proposals are currently under review (Sibley et al, 2013). One interesting point made by the authors was that recent studies involving genetics and imaging results have not found any clear evidence supporting the existence of ADHD subtypes as separate and distinct entities (Sibley et al, 2013). Keeping all of this in mind, the diagnosis, and therefore the way in which we treat people with ADHD has a high likelihood that it will change in some aspect or another.

When considering the treatments that professionals have at their disposal for treating people with ADHD, it is very likely that most people will choose medications over non-

medicinal treatments. Due to the immediacy in which medicinal treatments work, more people are likely to choose to medicate versus waiting several days before noticing results. Many people will be forced to weigh out the benefits of the medications with the adverse effects that the medications cause for the person taking it in order to decide if the immediate effects are worth the risk of experiencing serious side effects. As previously mentioned, NF was a very effective form of non-medicinal treatment for ADHD, even when compared to some proven effective medications. While the effect of NF takes time it does not, however, cause any side effects.

Unfortunately, in the opinion of this writer, we will not see an end to medicinal treatment for ADHD any time soon. Acquiring prescription medications is far easier, and produces results in a much more timely fashion than treatments like NF or CBT. Because of this more people will turn to medications, despite the occurrence of adverse side effects that they may cause. While it is extremely rare, there have been some documented sudden deaths of people who were taking stimulant medications. According to the World Health Organization, between the years of 1999 and 2003 there were 25 people who were taking stimulant medications who suddenly died (8 of them [7 pediatric; 1 adult] on MPH and 17 [12 pediatric; 5 adults] on amphetamine) (Wilens, Prince, Spencer, & Biederman, 2006). Even though this is considered to be a very rare risk, there still is a chance that it could happen. No matter how minimal the risk, for some, it is going to be too high when it involves someone they love. Parents, teachers, and clinicians should be certain to take into consideration the patient's personal pre-existing health conditions before deciding upon a specific type of treatment. For example, if someone has a pre-existing heart condition, it would be a good idea if he/she did not take any medications where any cardiovascular effects are a possibility. We should be moving in a direction where medicinal

treatments used solely as a short-term solution as opposed to an ongoing problem, but in order to do that we need to conduct more studies that prove the efficacy of non-medicinal treatments.

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