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**Faculty of Community and Health Sciences**

**A Systematic Review of Recent Interventions for Adults with ADHD**

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## ABSTRACT

Attention deficit/hyperactivity disorder (ADHD) has been accepted as a well-established neurodevelopmental disorder. From being viewed as affecting children only, it is now understood as being prevalent among adults as well. Adults living with ADHD can experience severe impacts on their daily lives in the form of emotional, physical, interpersonal, familial, and financial distress. Therefore there is a need for interventions which deal with the predominant symptomatology as well as relevant comorbidities. This review aimed to identify high-quality evidence-based intervention studies for adults with ADHD and describe the effectiveness of these interventions. The systematic review was conducted in a four phased approach, consisting of a Title Search, Abstract Search, Appraisal and Summation. Articles were sourced on two levels, first by title and second by abstract identified through the University of the Western Cape databases using Academic Search Complete, APA PsycArticles, MEDLINE, and SocIndex with a set of identified keywords. The identified articles that fulfilled the inclusion criteria were extracted and appraised using the Smith Franciscus Swartbooi appraisal tool to ensure that only high-quality articles with a prerequisite threshold score of higher than 61% were identified for summation by means of thematic meta-synthesis. Two independent reviewers engaged in the review process. All ethical principles pertaining to systematic review methodology were adhered to. A total of 40 studies were identified, and included pharmacological and non-pharmacological treatments, interventions with a focus on neuro-stimulation, and combined approaches. Results indicated that the most effective pharmacological interventions are the stimulant methylphenidate and the non-stimulant atomoxetine. The most effective non-pharmacological interventions were identified as cognitive-behavioural therapy (and variations), mindfulness-based therapy (and variations), dialectical-based therapy and psychoeducation. The most effective methods using neuro-stimulation were reported as bright light therapy and neurofeedback.

## DECLARATION

I, Candice Wakelin, hereby declare that the thesis entitled, '**A systematic review of recent interventions for adults with ADHD**' is my own work. It has not been submitted before for any degree or examination in any other university. All the sources used or quoted were acknowledged and fully referenced.



Candice Wakelin

Date: 01 March 2022

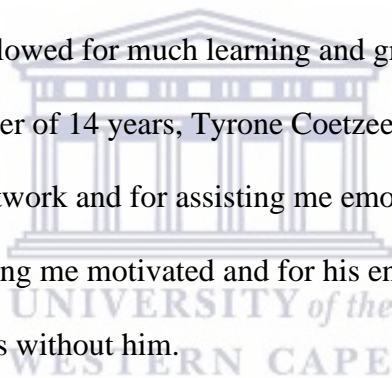


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## LIST OF ACRONYMS

<b>ACRONYM</b>	<b>FULL TITLE</b>
ADHD	Attention deficit/hyperactivity disorder
APA	American Psychiatric Association
ATX	Atomoxetine
BAP	British Association of Psychopharmacology
CBT	Cognitive-behavioural therapy
CCT	Computerised cognitive training
DBT	Dialectical behaviour therapy
DSM-5	Diagnostic and Statistical Manual of Mental Disorders – Fifth Edition
LDX	Lisdexamphetamine
MAP	Mindful awareness practices
MBCT	Mindfulness-based cognitive therapy
MBT	Mindfulness-based training
MPH	Methylphenidate
MVAs	Motor vehicle accidents
NICE	National Institute for Health and Care Excellence
NMDA	N-methyl-D-aspartate
OROS MPH	Osmotic release oral system methylphenidate
PCIT	Parent-child intervention therapy
PRISMA	Preferred Reporting Items for Systematic reviews and Meta-Analyses
RCT	Randomised controlled trials
SFS	Smith Fransciscus Swartbooi Critical Appraisal Tool
TCA	Tricyclic antidepressant
Tdcs	Transcranial direct current stimulation
UWC	University of the Western Cape
WHO	World Health Organization

## CHAPTER ONE: INTRODUCTION

### Background to the Review

#### *Understanding Neuro-Developmental Disorders in Context*

More than 650 million people worldwide are living with a mental or behavioural disorder (World Health Organization [WHO], 2013). The emotional, financial, and societal burden of mental distress is extensive (Eklund et al., 2018). The distress impacts on the quality of life of individual and caretaker, the ability to be productive in the workplace, to sustain employment, and to be a contributing member of society (WHO, 2013). The gap between the treatment that is required and the treatment resources available still remains wide, especially in low- to middle-income countries (WHO, 2013).

Neuro-developmental disorders typically manifest during the developmental period, that is, during the pre-, ante-, post-natal, infancy and early childhood periods (American Psychiatric Association [APA], 2013; Bakare et al., 2016). Although the disorder aetiology is developmental in nature, research indicates that it has a lifelong developmental trajectory., Families thus need to learn to live and cope with neuro-developmental disorders as they can become a significant burden to families and society, both emotionally and financially (Castrén et al., 2012; Eklund et al., 2018). However, accurate data about the effect that this cluster of disorders has on individuals, families, and the communities in which they function, and more specifically in the context of low- and middle-income countries, are still lacking (Bitta et al., 2018). Attention deficit/hyperactivity disorder (ADHD) is a disorder that is classified in the Diagnostic and Statistical Manual of Mental Disorders – Fifth Edition (DSM-5) under neuro-developmental disorders (APA, 2013).

### ***ADHD – Global and Local Prevalence Rates***

ADHD is defined as a neuro-developmental disorder that presents with the core symptoms of inattention, hyperactivity, and impulsivity (Gómez-Benito et al., 2019; Rogers et al., 2017). ADHD is found to be an extremely common and challenging disorder in the child and adult population. Studies show global prevalence rates for ADHD as 5% to 6% in children and 2% to 5% in adults (Hansson Halleröd et al., 2015; Ramsay & Rostain, 2016). However, it is important to note that variability in prevalence does exist, in part due to the overlapping of symptoms with psychiatric comorbidities such as mood disorders, anxiety disorders, intermittent explosive disorder, substance use disorder, antisocial personality disorder and other personality disorders (APA, 2013; Hansson Halleröd et al., 2015; Miranda et al., 2014). Additionally, there may be a difference in the clinical presentation of symptoms, as symptoms may fluctuate or vary between individuals (Katzman et al., 2017; Küpper et al., 2012; Treuer et al; 2017). Moreover, making a clinical diagnosis of ADHD is considered complicated due to the need for a thorough history which includes the presentation of symptoms in two to three contexts in childhood (Geffen & Forster, 2018). Research indicates that ADHD is universally under-reported and under-treated in adults (Geffen & Forster, 2018; Katzman et al.,2017).

In South Africa, 2% to 8% of children present with the disorder while adult rates are estimated at 1%. It is noted that the South African adult rates are significantly lower when compared with the global numbers, which may be due to a variety of reasons. These include underdiagnosis through lack of knowledge by health professionals and the public, as well as a lack of adequate resources or the financial means to be able to seek treatment (Schoeman et al., 2017; van Dyk et al., 2015).

### ***Negative Impact of ADHD on the Individual, Family, and Society***

Children with ADHD are negatively affected in various ways. There can be a cognitive impact which can lead to poorer executive functioning or developmental delays, as well as an emotional impact which can affect one's self-esteem, psychosocial health, levels of anxiety and overall quality of life (Ahn & Hwang, 2018; Biederman et al., 2004; Peasgood et al., 2016). Children can be affected socially in that they are more likely to display ineffectual social skills and struggle with peer and familial relationships, as well as experiencing schooling challenges such as higher risks of academic underperformance or school expulsion or drop out (Peasgood et al., 2016).

Recent research acknowledges adults and their experiences of living with ADHD, which often contributes to challenges experienced on personal, occupational, and financial levels (King et al., 2016; Schoeman et al., 2017). These effects may lead to cognitive, behavioural, emotional, and social problems in the home, the social context or in the workplace (Schoeman & Liebenberg, 2017). Research indicates that adults may be affected by symptoms on an individual level which includes consequences relating to poor self-esteem, emotional dysregulation, increased irritability, poor decision-making and deficits in memory and inhibition (APA, 2013; Katzman et al., 2017). The last can contribute to high levels of daily stress which are subsequently linked to higher levels of depression and substance use disorders. Adults may experience increased conflict, discord, and negativity permeating into interpersonal and familial relationships (APA, 2013; Miranda et al., 2014). Moreover, these individuals' difficulties with maintaining attention on tasks often impacts significant others around them. They might be perceived as lazy or defiant in the home and work contexts, thereby having an impact on these relationships (APA, 2013). The relatives of these individuals have shown increased use of health care services which has been ascribed to higher incidence of mental illness and has reflected the increased levels of stress and

demands of living experienced (Harpin, 2005). The presence of ADHD in adults can lead to sub-standard occupational performance, increased absenteeism, and a greater likelihood of unemployment (APA, 2013; Ramsay & Rostain, 2007). Due to the loss in productivity and increased absenteeism seen in these individuals, this disorder has, and continues to have, a substantial economic impact (Eklund et al., 2018; Holst & Thorell, 2020). The economic costs increase greatly when considering the rise in antisocial behaviour and criminality associated with adult ADHD, thus causing an elevation in arrests and incarcerations (Holst & Thorell, 2020). Additionally, individuals with ADHD are said to use health care services more frequently than those without, thus creating increased costs with regard to treatment (Treuer et al., 2017). The reasons for the increased use of health care also relate to increased rates of motor vehicle accidents (MVAs) and the probability of sustaining injuries from MVAs, increased workplace accidents, as well as risky practices such as substance use and risky sexual behaviours (Canela et al; 2017; Janssen et al., 2015; Treuer et al., 2017).

Although the impact of ADHD on children and their family have been the focus of ongoing research abroad and locally (Schoeman & Liebenberg, 2017; van Dyk et al., 2015), research on the diagnosis and treatment of adults with ADHD has only begun to receive attention in more recent studies (King et al., 2016; Schoeman et al., 2017).

### ***Types of Interventions that Address ADHD in Adults***

An intervention has been defined as ‘A deliberate involvement in a process or system intended to influence events or consequences’ (Belcher & Palenberg, 2018, p. 479).

According to Schoeman and Liebenberg (2017), interventions function initially by easing symptoms, and aim to continue to mitigate symptoms in the long-term to enable individuals to move towards optimal functioning. Moreover, they aim to assist in preventing relapse, treat comorbidity, and offer assistance to families, and are thus of extreme importance.

Research conducted on ADHD in children indicates that both pharmacological and non-pharmacological approaches to treatment were found to be useful. The most popular pharmacological treatment appear to be the stimulant, methylphenidate (MPH) and non-stimulant atomoxetine (ATX; Cao et al., 2021; Doulou & Drigas, 2022). Moreover, neurocognitive training methods such as neurofeedback have been reported to be effective. The most widely accepted non-pharmacological interventions for children include a variety of behavioural therapies including individual behavioural interventions, behavioural sleep interventions, behavioural parenting strategies and behavioural teacher training (Cao et al., 2021; Pratiwi et al., 2021; Staff et al., 2022). Additional interventions include cognitive-behavioural therapy (CBT), parent-child intervention therapy (PCIT), as well as alternative therapies such as herbal remedies, dietary supplementations, diet restriction, and physical therapy (Doulou & Drigas, 2022; Pratiwi et al., 2021; Rofiah et al., 2021; Zheng, 2022).

Global studies conducted on interventions to assist with adult ADHD appear to support a combination of pharmacological and non-pharmacological approaches to intervention (Bachmann et al., 2016; Emilsson et al., 2011; Vidal-Estrada et al., 2012). Common pharmacological treatments for ADHD include using either psychostimulants or non-stimulants depending on individual variability. Types of psychostimulants typically refer to MPH and amphetamines while non-stimulants are ATX, alpha2-adrenoceptor agonists (which inhibit the firing of presynaptic neurons, thereby reducing levels of norepinephrine in the prefrontal cortex and improving levels of impulsivity/hyperactivity), tricyclic antidepressants (TCAs), bupropion, modafinil and venlafaxine (Giovannitti et al., 2015; Pozzi et al., 2020; Schoeman & Liebenberg, 2017). However, not all individuals are open to taking medication for reasons such as stigma, concern over addiction, high cost, and side effects. Many of these individuals opt for alternative treatments such as psychosocial interventions.

According to research, psychosocial interventions are typically used to assist with ADHD symptoms in adults and involve mainly CBT, mindfulness based training (MBT), dialectical behaviour therapy (DBT), psychoeducation and coaching (Knouse et al., 2008; Ramsay & Rostain, 2016; Schoeman & Liebenberg, 2017; Treuer et al., 2017). Despite this information, evidence remains sparse and proven effectivity is mostly for structured, skill-based CBT interventions used in conjunction with medication (Knouse et al., 2008; Schoeman & Liebenberg, 2017). These interventions focus on methods to improve memory, reduce impulsivity, control anger, time management and organisation, and enhanced attention, social and communication skills. Additionally, mindfulness training has been found to assist with emotional dysregulation and poor attention, and can be a supplementary component (Poissant et al., 2019; Schoeman & Liebenberg, 2017; Treuer et al., 2017).

### **Rationale**

Research with regard to the full impact that ADHD has on adults is still lacking when compared with the volume of research on ADHD in children, which has been the focus of various studies internationally and locally. (Janssen et al., 2015; King et al., 2016; van Dyk et al., 2015). Research confirmed that ADHD can continue to move through the lifespan to affect adults (Bachmann et al., 2016; Gómez-Benito et al., 2019; Treuer et al., 2017). Adults are typically expected to be independent and have greater accountability, and thus have greater demands placed on them. Therefore, failure in their occupational and personal endeavours are costly and cause considerable burden and limitations in their life (Ramsay & Rostain, 2016; Schubert & Lehmkuhl, 2017). Additionally, studies have shown that there may be a need to raise awareness of the relevant treatment modalities among communities, including medical and mental health personnel at primary healthcare level (Schoeman et al., 2017). These health and mental health professionals may not be adequately trained and have limited awareness of the clinical presentation in, and treatment of, ADHD in adults.

According to the research, many countries have limited or no mental health professionals trained for working with adults presenting with ADHD symptoms. This can contribute to both under-diagnosis and a lack of effective treatment (Schoeman et al., 2017; Treuer et al., 2017). Various authors have identified the gap in the research pertaining to treatment of ADHD in adults (Janssen et al., 2015; Knouse et al., 2008; Poissant et al., 2019; Schoeman & Liebenberg., 2017; Stevenson et al., 2003; Treuer et al., 2017). This systematic review therefore aimed to identify and report on high-quality, evidence-based intervention strategies/models or programmes for adults living with ADHD. This review provides up-to-date information on the most effective interventions available for adults with ADHD thus allowing considerations for relevant changes to be made in the review of general policy pertaining to mental health, and more specifically, workplace policies and dispensations pertaining to the treatment of adults living with ADHD. Lastly, this research may also assist in the creation of jobs for individuals by providing areas for further research and intervention.

### **Problem Statement**

ADHD has an impact on adult functioning whether it be the individual, family, relational or academic components (Canela et al., 2017; Miranda et al., 2014; Young et al., 2017). Global research revealed adult ADHD prevalence rates ranging between 3 and 5% (Chen et al., 2018; Gómez-Benito et al., 2019; Poissant et al., 2019). Research showed that at least 1% of adults in the South African context are living with this disorder although it is more likely that this number is greater (Regnart et al., 2019; Schoeman et al., 2017).

Internationally and locally, negative effects of living with ADHD are identified and include, but are not limited to, poor decision-making, increased anxiety, risky sexual behaviour, comorbid substance use, marriage discord and relational difficulties, interrupted education, job loss or unemployment, as well as an increased chance of MVAs (Coetzee et al., 2020; Gómez-Benito et al., 2019; Janssen et al., 2015; Ramsay & Rostain, 2016). Thus, this



disorder can have devastating consequences for the individual and their support system, emphasising the need for interventions that deal with the negative effects on the individual, family, and communities. Although research on interventions treating ADHD do exist, there is a lack of filtered information in this area (Hoagwood et al., 2007), therefore there is a need for high-quality synthesised available research in the form of a systematic review. To this end, this study aimed to synthesise such information.

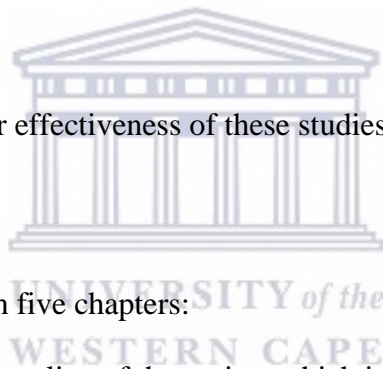
### **Research Questions**

1. What is the methodological standard of the studies related to the intervention models programme or strategies?
2. Which intervention models, programmes or strategies are currently available to treat adult ADHD?
3. What are the outcomes or effectiveness of these studies?

### **Chapter Organisation**

This thesis is presented in five chapters:

1. Chapter One provides an outline of the review which includes the background, rationale, problem statement, and research questions the research attempted to address.
2. The second chapter provides a brief overview of the literature which functions to provide a framework to operationalise the review which includes ADHD symptomatology, the impact of ADHD on adults, and the types of available interventions including pharmacological and non-pharmacological modalities.
3. Chapter Three describes the methodology and process undertaken in conducting the review and aims to provide enough information thereby ensuring methodological



rigour and replication. This chapter concludes with reporting on ethical considerations.

4. The fourth chapter reports on the results and provides a discussion of the review.
5. Lastly, Chapter Five describes the conclusion of the findings, limitations, as well as providing recommendations for future research.

This study used the APA 7<sup>th</sup> edition style as a general guideline, within the framework of the University of the Western Cape (UWC) requirements for the layout of the master's mini thesis. Furthermore, it was subjected to an extensive and thorough editing process to ensure accuracy.



## CHAPTER TWO: LITERATURE REVIEW

### Introduction

Historically, ADHD was viewed as a childhood disorder, which typically disappeared by late adolescence. However, after extensive research it is now widely accepted as continuing into adulthood (Stanton et al., 2018; Young et al., 2017). Adults are impacted greatly by having to live with and deal with ADHD. The need for interventions to address and treat adult ADHD and to assist and improve the life quality of adults who are living with the disorder is widely acknowledged and documented (Poissant et al., 2019; Schoeman & Liebenberg., 2017; Stevenson et al., 2003). This literature review will focus primarily on adult ADHD, and begins with a discussion on ADHD symptomatology. It then proceeds to focus on the challenges it poses to the lives of those adults affected. Lastly, it pays attention to, and reports on, interventions available to assist adults living with ADHD. These include both pharmacological and non-pharmacological interventions.

### ADHD Symptomatology

Attention deficit/hyperactivity disorder (ADHD) has been defined as a neuro-developmental disorder that begins in childhood and presents with the core symptoms of inattention, hyperactivity, and impulsivity (Gómez-Benito et al., 2019; Rogers et al., 2017).

In the DSM-5, the APA (2013) defines symptoms as fitting into one or more of three categories. The first category looks at inattention and is described as difficulty with organisation, time management, sustaining focus and procrastination. The second category focuses on hyperactivity which includes fidgeting, excessive talking and constantly moving. The third category describes impulsivity as decisions or actions taken without thinking, such as interrupting others, difficulty waiting for one's turn in a conversation, and answering

questions before they have been fully asked (Canela et al., 2017; Gómez-Benito et al., 2019; Hansson Halleröd et al., 2015). However, the DSM-5 symptoms are primarily based on the description of symptoms in children, whereas adult symptoms have been found to manifest differently.

Adults displaying *inattention* may have difficulties within the home environment. They may appear to not be listening when having a direct conversation, or easily forgetful in their engagement with family members or romantic partners. This could come across as insensitive or uncaring which could lead to subsequent relationship difficulties, separation, or divorce (Harpin, 2005; Mörstedt et al., 2015). These adults are more likely to engage in maladaptive self-talk within their romantic relationships which can impact on the level of satisfaction in their romantic relationships (Ben-Naim et al., 2017). Spouses of these individuals may be required to cope with or compensate for their difficulties, which could place further strain onto the relationship and family unit (Rösler et al., 2010). Furthermore, research indicates that inattention may affect the emotional responsiveness of a parent with ADHD to their child, thereby negatively influencing the child-parent relationship (Johnston et al., 2012). Within the occupational context, adults with inattentive deficits may regularly present work that is inaccurate or showing careless mistakes. They may find meetings, conversations, and training difficult due to their reduced ability to focus (Canela et al., 2017). These individuals may lack in their ability to follow particular instructions set for them in the workplace. Alternatively, they will not be able to follow instructions as they become easily bored or distracted affecting completion of work tasks, and therefore productivity (Küpper et al., 2012; Miranda et al., 2014). Challenges they are presented with may include being unable to organise particular tasks or activities, not being able to manage their time therefore being constantly late for work, forgetting important dates, or struggling to adhere to deadlines (Schoeman & Liebenberg, 2017). Their ability to follow a sequence of tasks set out for them

effectively may present as a difficulty. Subsequently, this may lead them to avoiding tasks that require a particular amount of mental effort, which can affect their completion of reports or tasks. The problems with inattention can particularly impair the individual within the context of complex demands and the expectation that one needs to function independently (Hansson Halleröd et al., 2015).

*Hyperactivity* refers to excessive motor activity when it is not appropriate. Adults living with ADHD are more inclined to show excessive restlessness, as opposed to increased motor activity (Coetzee et al., 2020). These individuals may struggle with sleep disturbances and increased tension in their home environments. Poor time management, regular lateness, increase in restless behaviour, and regular interruption of conversations with their partners are some of the identified barriers within the family context and can lead to significant stress for everyone (Ben-Naim et al., 2017; Rösler et al., 2010). Additionally, the tendency to feel bored and uninterested can contribute to existing conflict (Ben-Naim et al., 2017). Within the occupational context, adults with ADHD may display workaholic behaviour and tend to overschedule and overcommit leading to feelings of being overwhelmed. These individuals may seem fidgety, being unable to sit still and focus on work, leading to the tendency to wear others out with exerting an excess of energy (Schoeman & Liebenberg, 2017).

Adults who display *impulsivity* often have temper outbursts and become easily irritable and agitated, therefore having an increased risk for criminality and anti-social behaviours (Holst & Thorell, 2020). They may engage in various sexual relationships and risky sexual practices, with implications for themselves and their sexual partners. (Gómez-Benito et al., 2019; Miranda et al., 2014). They may change jobs, move home frequently, make major life decisions without thinking them through fully, often resulting in conflict and intra- and interpersonal distress (Canela et al., 2017; Hansson Halleröd et al., 2015; Treuer et al., 2017). These individuals may struggle with limited ability to delay gratification thus

increased risky behaviours are common, for example MVAs, as well as an increase in substance use generally found to be highly comorbid with ADHD (Canela et al., 2017; Küpper et al., 2012)

### **Impact of ADHD on Adults**

Adults living with ADHD have been shown to suffer significant impairment in their personal and interpersonal daily functioning. On a personal level, these individuals may be more sensitive to stress, show increased mood lability, be easily angered, display low frustration tolerance, and present with low self-esteem (Gómez-Benito et al., 2019; Hansson Halleröd et al., 2015). Research indicates that these individuals have a greater likelihood of developing mood and anxiety disorders (Katzman et al., 2017). Although they do not necessarily experience emotions more intensely than others, the behaviour displayed as a result of the emotions is shown reactively and thus appears more vehement (Küpper et al., 2012).

Research has indicated an association between ADHD and neuropsychological deficits in executive functioning (Ben-Naim et al., 2017; Faraone, 2018; Holst & Thorell, 2020; Silverstein et al., 2020). Executive functioning is regarded as one's higher order cognitive processes. Various studies suggest that the challenges experienced in the executive functioning domain, for example impaired inhibition, might contribute to interpersonal difficulties. Individuals displaying disinhibition find it difficult to effectively regulate emotions, increasing the likelihood of conflict with others (Ben-Naim et al., 2017; Silverstein et al., 2020). Furthermore, adults living with ADHD might also have deficits in cognition which could affect working memory, switching between tasks, and planning activities, causing difficulties in their everyday functioning (Holst & Thorell, 2020; Küpper et al., 2012). This may translate to everyday behaviour such as unpaid bills, boredom during chores,

unfinished laundry, lost keys and forgotten events which can result in conflict within their relationships (Ben-Naim et al., 2017).

ADHD symptoms have been found to negatively influence interpersonal relationships relating to family and significant others. Adults with ADHD typically show increased levels of dissatisfaction within their family life (Rösler et al., 2010). These individuals may have considerable difficulty with adjustment to marriage and are more likely to hold negative perceptions about their marriage (Rösler et al., 2010). They often experience years of criticism and rejection from peers, teachers, or parents due to their difficulty to manage behaviour, which in turn can create a poor self-image and result in certain relational deficits (Ben-Naim et al., 2017). They may become fearful of relationships and the potential of experiencing rejection. Disruptions that are experienced within relationships have also been ascribed to the tendency towards misattributions relating to ADHD symptoms. Ben-Naim and colleagues (2017) give an example of when a person is consistently late due to inability to manage time, but this then becomes ascribed to selfishness or laziness. Studies show an increased divorce rate, multiple marriages, and marital conflict as well as a greater likelihood of deficiencies in the familial environment (Canela et al., 2017; Miranda et al., 2014; Schoeman & Liebenberg, 2017). The abovementioned behaviours are likely to be more poorly tolerated in the workplace (Küpper et al., 2012; Regnart et al., 2019). As a result, individuals may have difficulties related to occupational performance such as decreased productivity and increased absenteeism which have been found to be related to mental or somatic health problems, resulting in the likelihood of unemployment (Emilsson et al., 2011; Küpper et al., 2012; Ramsay & Rostain, 2016; Schoeman et al., 2017). This may have additional financial implications and combine with money management difficulties to create a severe burden and further affect their ability to support their families.

The impact of ADHD on the individual's physical health should also be noted. According to a study reported by Katzman and colleagues (2017), adults with ADHD in Japan were 10 times more likely to be admitted to hospital or to visit an emergency room compared to their control group. Moreover, in a second study adults with ADHD in Denmark were expected to have a lower life expectancy and more than double the chance of early death when compared with the general population mainly due to their increased risk-taking behaviours (Katzman et al., 2017). As already mentioned, adults living with ADHD have a greater likelihood of MVAs, unplanned pregnancies, and sexually transmitted diseases (Canela et al., 2017; Janssen et al., 2015; Schoeman & Liebenberg, 2017). This may be due to the risks associated with increased substance abuse which has been identified in the literature (Emilsson et al., 2011; Miranda et al., 2014). On the occupational front, research suggests that individuals are more likely to experience trauma and workplace accidents, thereby further impacting on their mental and physical health (Küpper et al., 2012). Combined with these functional and psychosocial impairments, adults living with ADHD are at a higher risk of experiencing mental distress in the workplace. This significantly impacts their abilities to function adequately in the work environment and to ultimately contribute positively to society.

### **Interventions for Adults Living with ADHD**

An intervention has been defined as a standardised process of assessment and planning engaged in to remediate or prevent a social, educational or developmental issue (Johnson, 2003). According to Verdam and colleagues (2021), interventions play a vital role in the promotion of good health, which has been defined by the WHO (2013) as 'a state of complete physical, mental, and social well-being'.

There are two main types of intervention (or experimental) studies used in research settings, namely randomised controlled trials (RCT) and non-randomised or quasi-



experimental trials (Aggarwal & Ranganathan, 2019). RCTs are known as the gold standard in effectiveness research due to the randomisation procedure which minimises confounding factors, thereby increasing reliability of results and decreasing bias (Akobeng, 2005; Hariton & Locascio, 2018). Researchers may decide to use non-randomised trials when the particular research question cannot be answered by using RCTs; however potential biases and confounding variables must be identified and accounted for (Reeves et al., 2019). Two main types of treatment for ADHD have been identified within the research namely, pharmacological and non-pharmacological treatments. Interventions with a focus on neuro-stimulation techniques have been categorised within the non-pharmacological intervention group.

This review focused on pharmacological and psychological interventions used to address ADHD in adults. Pharmacological interventions refer to a type of treatment that involves the use of drugs (McCarthy, 2014). A psychological intervention functions to bring about behavioural, cognitive and/or emotional changes that are targeted to assist in achieving good health, improved general well-being, and quality of life (Verdam et al., 2021). An intervention can be applied at the individual, family, or group level (Macarthur et al., 2018). Literature shows evidence for research on interventions that deal with ADHD in children, however this is lacking in the area of adult ADHD (Poissant et al., 2019; Schoeman & Liebenberg., 2017; Stevenson et al., 2003). Intervention studies are utilised to determine the effectiveness of an intervention or the effectiveness of a health service delivery. They may also be used to determine safety, cost effectiveness, and acceptability of an intervention (Aggarwal & Ranganathan, 2019; Thiese, 2014).

### ***Pharmacological Interventions***

Drugs that have been identified in the literature as effective for ADHD in adults include stimulants and non-stimulants (Pozzi et al., 2020; Schoeman & Liebenberg, 2017).

Stimulants work by targeting the central nervous system, in particular the neurotransmitter dopamine. Non-stimulants do not target the central nervous system but rather the peripheral nervous system, in particular the neurotransmitter, norepinephrine. (Weyandt et al., 2014). Both types function by modulating the dopaminergic system (which regulates memory, learning, motivation and ability to set goals) and the noradrenergic system (responsible for keeping one alert and attentive) within the frontal cortex, as well as the dopaminergic system in the basal ganglia (Pozzi et al., 2020; Schellack & Meyer, 2012). According to the guidelines from the National Institute for Health and Care Excellence (NICE) and the British Association of Psychopharmacology (BAP), stimulants are the first line treatment choice in adults with ADHD (Geffen & Forster, 2018; Roh & Kim, 2021; Schoeman & Liebenberg, 2017).

Research indicates that stimulants are more effective in treating inattention, hyperactivity and impulsivity and are faster acting, but are associated with certain side effects such as decreased appetite, sleep disturbance, headaches, and nausea (Pozzi et al., 2020; Roh & Kim, 2021). Methylphenidate has been found to be the most commonly prescribed and studied stimulant drug within this population and it has been found to be efficacious in treating the core symptoms of impulsivity and hyperactivity (De Crescenzo et al., 2017; Faraone, 2018; Roh & Kim, 2021). Other stimulants include amphetamines such as dextroamphetamine, lisdexamphetamine (LDX) and mixed amphetamine salts.

Amphetamines are central nervous system stimulants which increase dopamine and norepinephrine (noradrenaline) concentrations at the neural synapse (Castells et al., 2018). Lisdexamphetamine is a prodrug made up of a combination of dextroamphetamine and the amino acid, L-lysine (Popovic et al., 2009). After ingestion, the compounds are broken down, making the dextroamphetamine active. This process ensures a gradual release of

dextroamphetamine which assists in long longer-lasting effects, increased compliance and a decrease in abuse potential (Adler et al., 2017; Popovic et al., 2009).

The most studied and recommended non-stimulant is ATX; however other types include alpha2-adrenoceptor agonists, TCAs, bupropion (norepinephrine-dopamine reuptake inhibitor which boosts levels of norepinephrine), modafinil (wakefulness promoting agent), venlafaxine (serotonin-epinephrine reuptake inhibitor), cholinesterase inhibitors, and nicotinic agonists (Geffen & Forster, 2018; Giovannitti et al., 2015; Pozzi et al., 2020). Atomoxetine is a selective noradrenaline reuptake inhibitor which stimulates dopamine and norepinephrine levels in the brain. It can be taken individually or in combination with a stimulant drug (Camp et al., 2021). Cholinesterase inhibitors such as memantine and donepezil function by blocking cholinesterase, an enzyme that is responsible for breaking down acetylcholine (part of the norepinephrine system) and help increase levels thereof in the body (Burt, 2000). Nicotinic agonists are drugs that mimic the effects of acetylcholine at nicotine acetylcholine receptors. According to Potter and colleagues (2014), stimulation of acetylcholine may improve certain cognitive deficits and reduce symptoms of ADHD. Research indicates that non-stimulants are more suitable for individuals with substance use disorders due to their non-addictive qualities. The same is said for adults with anxiety disorders, tic disorders, those who have a condition in which stimulants are contra-indicated, or those who do not respond to stimulants (Roh & Kim, 2021; Schoeman & Liebenberg, 2017). The literature revealed pharmacological interventions to be extremely valuable in terms of assisting with the management of ADHD in adults. However, medication may not be effective for all individuals and possible side effects and the potential for misuse have encouraged the innovation of non-pharmacological interventions.

### ***Non-Pharmacological Interventions***

According to Akintola (2019), a non-pharmacological intervention implies that no medication is used directly in methods to optimise or manage an individual's health. Non-pharmacological interventions include both psychosocial interventions and those with a neuropsychological focus. After a brief review of the literature on psychosocial ADHD intervention strategies that do not utilise medication, it was noted that certain modalities were identified as more effective in treating ADHD than others. A short synopsis on these modalities is presented below.

**Cognitive-Behavioural Therapy (CBT).** Cognitive-behavioural therapy is defined as a therapeutic modality which can assist one in identifying and modifying maladaptive patterns of thinking that are essentially disrupting the ability to cope in daily life (Knouse et al., 2008). Research on the treatment of ADHD in adults identifies CBT and variations, or adaptations of CBT, as a useful modality (Ramsay & Rostain, 2016; Schoeman & Liebenberg, 2017; Vidal-Estrada et al., 2012). These include metacognitive therapy which uses CBT principles to assist in building time management, organisation and planning skills effectively, focusing on self-management. Other interventions are brief therapy, cognitive behavioural group rehabilitation and computerised cognitive training (CCT; Janssen et al., 2015; Solanto et al., 2010; Vidal-Estrada et al., 2012). Computerised cognitive training is a method used to attempt to rectify cognitive process deficits by using direct online tasks to increase inhibition, working memory, and attention by repeated exposure to certain stimuli (Stern et al., 2016).

Cognitive-behavioural therapy interventions focus on methods to improve memory, reduce impulsivity, control anger, improve time management and organisation, and enhance attention, as well as social and communication skills. (Poissant et al., 2019; Treuer et al., 2017). Cognitive-behavioural therapy can be applied in an individual or group setting with advantages noted for both modalities. Group interventions are considered to be cost-effective

and less isolating, whereas individual interventions can be tailored to the specific needs of the person (Janssen et al., 2015; Ramsay & Rostain, 2016). An example of such an intervention was conceived by Emilsson and colleagues (2011) and Young and colleagues (2017) as the Reasoning and Rehabilitation for ADHD youth and adults (R&R2ADHD). This intervention was considered effective in improving symptoms of ADHD, however was recommended as needing to be supplemented with psychopharmacology. CBT has been considered a valuable approach in treating ADHD in adults (Bachmann et al., 2016; Knouse et al., 2008; Ramsay & Rostain, 2016).

**Mindfulness-Based Therapy (MBT).** Mindfulness-based therapy has its main focus on being able to remain alert, in the present moment, without judgement (Bachmann et al., 2016; Janssen et al., 2015). Studies suggest that it leads to an improvement in emotional dysregulation, inattention, poor executive functioning, and distractibility (Knouse et al., 2008; Ramsay & Rostain, 2016; Schoeman & Liebenberg, 2017). Additionally, it may help improve one's ability to cope with stress, anxiety and depression which often occurs in individuals with ADHD (Janssen et al., 2015). Furthermore, there is evidence for the effectiveness of treatment that combines both CBT and mindfulness meditation to form mindfulness-based cognitive therapy (MBCT; Bachmann et al., 2016; Poissant et al., 2019) as well as mindful awareness practices (MAP) which proposes to teach individuals to have a mindful attitude and increase their ability to self-regulate and handle negative emotional states (Bachmann et al., 2018).

**Dialectical Behaviour Therapy (DBT).** Dialectical behaviour therapy is a combination of skills focusing on acceptance, change, and mindfulness, and is considered a type of CBT (Knouse et al., 2008). It uses psychoeducation, organisation skills, distress tolerance skills, emotional regulation, and impulse control and mindfulness meditation to improve symptoms of ADHD (Knouse et al., 2008; Vidal-Estrada et al., 2012). Certain

studies show that DBT is an effective approach to lessen prominent symptoms of ADHD in adults (Emilsson et al., 2011; Schoeman & Liebenberg, 2017; Vidal-Estrada, 2012).

**Psychoeducation.** Psychoeducation is mentioned as a possible approach to the treatment of ADHD in adults (Treuer et al., 2017; Vidal-Estrada et al., 2012). It typically entails information about the neurobiology behind ADHD and how such results in issues of functioning experienced daily (Ramsay & Rostain, 2007). Although there are limited studies on the effectiveness of psychoeducation, there are multiple anecdotal reports on the positive benefits of this type of treatment (Knouse et al., 2008; Ramsay & Rostain, 2007; Schoeman & Liebenberg, 2017).

**Coaching.** Coaching is a structured, supportive approach that focuses on learning problem-solving and goal-setting methods to better equip individuals with the tools for everyday life, better known as adaptive functioning (Ramsay & Rostain, 2007; Schoeman & Liebenberg, 2017). Although formal studies on effectiveness of coaching as a primary focus of intervention are limited, there is evidence of the benefits of this approach (Schoeman & Liebenberg, 2017; Vidal-Estrada et al., 2012).

**Interventions with a Focus on Neuro-Stimulation.** According to Chun Wong and Zaman (2019, p.1), 'Neuro-stimulation techniques are potential methods of treating ADHD, involving stimulation of brain areas showing abnormal activity in ADHD'. Neuro-stimulation may be effected through invasive or non-invasive means. Interventions with a focus on neuro-stimulation can include the use of neurofeedback, bright light therapy and transcranial direct current stimulation (tDCS) in targeting ADHD in adults.

Neurofeedback is a type of biofeedback which measures brain waves and provides a feedback signal. It assists with acquisition of skills to self-regulate brain patterns thereby influencing behaviour. This relates particularly to the reduction of symptoms of impulsivity and hyperactivity in adults living with ADHD (Marzbani et al., 2016; Schoeman &

Liebenberg, 2017). Bright light therapy uses exposure to various light sources to modify circadian system dysfunctions that are often present in individuals with ADHD with difficulties with sleep disturbance (Fargason et al., 2017; Mayer et al., 2018). Conductive electrodes are used in tDCS to apply weak electric currents to an individual's scalp. According to Allenby et al (2018), this intervention can improve cognition through increased memory ability, planning ability, inhibitory control and neural efficiency with minimal side effects.

### ***Multimodal Approach***

A multimodal approach as treatment for ADHD encompasses both pharmacological and non-pharmacological methods to combat symptoms of ADHD as well as accompanying comorbidities (Bachmann et al., 2016; Ramsay & Rostain, 2017; Young et al., 2017). A combined approach has been the universally recommended guideline for treatment of ADHD in adults, although effectivity has only been established and researched primarily in child populations (Schoeman & Liebenberg, 2017; Seixas et al., 2012; Young et al., 2017). A study conducted by Lam and colleagues (2019) reported a long-term reduction in ADHD symptoms when combining group CBT and MPH as an intervention for adults. Rostain and Ramsay (2006) conducted a study in which they combined CBT and dextroamphetamine as an intervention for adult ADHD. The authors reported a significant reduction in ADHD symptoms, as well as in comorbid anxiety and depression. Lastly, in a study conducted by Emilsson and colleagues (2011), CBT was combined with various pharmaceuticals including MPH, amphetamine-sulphate, ATX or bupropion in an intervention. It was found to be effective in reducing ADHD symptoms as well as comorbidities in adults.

### **Summary**

This brief literature review has shown that due to the recognition of ADHD as a disorder that continues into adulthood, as well as the substantial emotional, occupational, interpersonal, physical, and cognitive impact upon living with this disorder, the need to locate evidence-based, effective treatment is of vital importance. Both pharmacological and non-pharmacological methods have been identified as suitable treatment, however research indicates a multimodal approach where both methods are combined as the most effective intervention for adults with ADHD.





## CHAPTER THREE: METHODOLOGY

### Introduction

Methodology is the practical process of applying methods to investigate a particular research problem in order to be able to understand and critically evaluate it (Blanche et al., 2006). This chapter covers the aim of the review, review questions, research design, inclusion criteria, database use, exclusion criteria, review procedure, search strategies and the ethical considerations pertaining to this review.

### Aim

The aim of this review was to consolidate the literature reporting on recent interventions used to assist in the treatment of adult ADHD.

### Review Questions

1. What is the methodological standard of the studies related to the intervention models/programmes or strategies?
2. Which intervention models, programmes or strategies are currently available to treat adult ADHD?
3. What are the outcomes or effectiveness of these studies?

### Research Design

The research design is a strategic system to be followed which assists in guiding the execution of the research (Blanche et al., 2006). The research design for this project is a systematic review, an evidence-based approach which collects primary information to inform secondary research (Boyle et al., 2016). This type of review is advantageous in that it reduces the potential for bias as it is able to be replicated (Ham-Baloyi & Jordan, 2016). It attempts to identify, assess, and summarise findings from relevant studies and make it accessible for use,

and therefore assists with decision-making (Akers, 2009). Systematic reviews aid with identifying gaps in current research which helps to guide future research studies (Higgins & Green, 2011). In a systematic review, existing studies are carefully reviewed by using pre-determined steps to filter and report upon high-quality articles (Crombie & Davies, 2009). A systematic review was the appropriate choice for this study as it presented a summation of interventions that were reliable and conclusions that were justifiable (Akers, 2009). In addition, a systematic review allowed for a quality assessment of current interventions being used, and subsequently identified gaps within current interventions for treatment of adults with ADHD. The utilisation of a systematic review systematically assessed and summarised current psychosocial and psychopharmacotherapeutic interventions available for adults with ADHD.

### **Inclusion Criteria**

#### ***Target Group***

The systematic review considered studies pertaining to adult ADHD only. Studies needed to address intervention models or programmes or strategies that dealt with treatment of adult ADHD. According to the Bill of Rights (1996), an adult constitutes those who are aged 18 and above, thus the sample population consisted of adults aged 18 years and above, inclusive of males and females.

#### ***Time Period***

Studies that were conducted over a 10-year period, between 2009 and 2019, were considered for the review. This was to ensure a thorough search had been conducted in which all recent articles pertaining to the study had been included and any new developments had been captured.



### ***Type of Studies***

Studies were primary studies that had been published in the public domain. The linguistic range included English articles only. Articles were peer-reviewed and full text. The studies were both quantitative and qualitative in nature and drawn from observational (case-control studies and cross-sectional studies) and experimental designs (randomised control studies as well as pre- and post-tests).

### **Exclusion Criteria**

Studies that were excluded from this review included those that did not involve adults as the target group. All non-English studies were excluded. Studies that were not available in the public domain and fell outside of the period 2009–2019 were not included. Lastly, systematic reviews, articles that were not peer reviewed and not focused on interventions relating to ADHD were not included.

### **Retrieval Strategy**

#### ***Database***

The University of the Western Cape (UWC) online Library Database system was used as the main source to identify articles that fulfilled the basic inclusion criteria. A literature search was conducted using EBSCOhost. Databases which had a psychological and medical focus were used, and consisted of Academic Search Complete, APA PsycArticles, MEDLINE and SocINDEX.

#### ***Key Word Identification***

A preliminary list of keywords was constructed from literature related to this topic. This list contained the following terms: Adult ADHD, intervention programmes, and treatment. After engaging in an exploratory search to ascertain the number of articles related to this research, the list was tested and refined until a final list of search terms was identified:

ADHD, adult, intervention, programme, management, treatment, therapy, intervention models, intervention programmes, psychological interventions, psychological treatment, psychosocial strategies, modalities, and psychotherapeutic approaches.

This study utilised Boolean Phrases which consisted of a combination of search terms linked together by Boolean operators such as ‘AND’ or ‘OR’. These Boolean phrases allowed for the broadening or narrowing of the search which contributed towards more focused and relevant search results (Bui, 2020).

The final keywords were integrated into 12 Boolean phrases that were utilised within the identification stage:

- Adult ADHD AND treatment
- Adult ADHD AND intervention
- Adult ADHD AND therapy
- Adult ADHD AND psychosocial strategies
- Adult ADHD AND psychotherapeutic approaches
- Adult ADHD AND modalities
- Adult ADHD AND management
- Adult ADHD AND psychological interventions
- Adult ADHD AND psychological treatment
- Adult ADHD AND programme
- Adult ADHD AND intervention model
- Adult ADHD AND intervention programmes

The above list of Boolean phrases was used to conduct a comprehensive search across the abovementioned specific databases.

## **Review Process**

The systematic review was completed on four levels: title search (identification), abstract search (screening), appraisal (eligibility) and summation, as discussed in the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) cited in Moher et al. (2009).

### ***Identification***

In order to identify relevant literature relating to the topic of inquiry, a title search was conducted. The articles that fulfilled the inclusion criteria were tabularised on the Title Extraction Sheet (Appendix B) according to author, title, date of publication, date of extraction, database used, location stored. Articles that met the criteria of level one were then subjected to the screening stage.

### ***Screening***

The articles that fulfilled the inclusion criteria are tabulated on the Abstract Extraction Sheet (Appendix C) under author, publication date, title, type of intervention, study population, methodology (data collection and analysis), type of design and outcome. Articles that met the aforementioned criteria were then subjected to the eligibility stage.

### ***Eligibility***

Eligibility entailed assessing the quality of the articles with a quality appraisal tool, which ensured methodological rigour and relevance to the research topic. The tool needed to be adequate for both quantitative and qualitative studies. The Smith Franciscus Swartbooi (SFS) Critical Interventions Appraisal Tool (Appendix D) was employed once the necessary permissions were granted. The pre-requisite threshold score was decided upon once the review commenced. Articles that obtained a pre-requisite threshold score of higher than 61% were extracted for summation by means of thematic meta-synthesis. A thematic meta-

synthesis involves systematic coding and identification of key themes from primary studies (Lachal et al., 2017). The resulting descriptive themes were then analysed and used towards greater understanding of the topic (Nicholson et al., 2016).

The Smith Fransciscus Swartbooi (SFS) Quality Appraisal Tool consists of eight sections with a total of 42 questions. Each section assesses specific aspects and qualities in order to appraise the included articles.

The first section relates to the purpose of the measure. An example of a question is the following: ‘Is a clear rationale provided for the study?’ This section consists of five questions and an article can receive a maximum score of five points.

The second section refers to questions relating to the study and revolves around questions describing the intervention used. An example of a question is: ‘Did the authors report on the development of the intervention?’ It is made up of eight questions and an article can receive a maximum of nine points.

The third section relates to questions around the sample. An example of a question is: ‘Was the sampling method appropriate?’ This section consists of nine questions and an article can receive a maximum of 15 points.

The fourth section refers to ethics. An example of a question used is: ‘Was informed consent obtained from participants of the study?’ It consists of three questions and an article can receive a maximum of six points.

The fifth section relates to the instruments mentioned in the study and an example of a question is: ‘Did the instruments produce data that supported the proposed analysis?’ It has a total of four questions and studies can achieve a maximum of seven points.

The sixth section refers to data analysis and a question example is: ‘Was the method of analysis made explicit?’ It consists of five questions and a maximum score of five is allowed.

The seventh section refers to the results. An example of a question is: ‘Were the results clearly linked to the research questions?’ It is made up of five questions with a maximum of five points.

The eighth and final section refers to the conclusion of the study. An example of a question from this section is: ‘Were results correctly interpreted?’ It consists of five questions with a maximum of five points able to be achieved. An article appraised could score a maximum of 55 points.

The final score attained is converted into a percentage. Each article has the potential to obtain a total score (percentage) based on the overall quality of the article categorised as weak (0–40%) , moderate (41–60%), strong (61–80%) or excellent (80–100%). In order to be included in the current study, each article had to achieve 61% or above to ensure that only high-quality articles were used to extract relevant information in the summation phase.

### ***Summation***

Only articles which were able to satisfy the threshold score of above 61% in the appraisal stage were included in the summation. The process of summation is explained in the meta-synthesis section below.

### **Method of Review**

The primary reviewer (master’s student) was briefed on systematic review methodology in supervision by both her supervisor and co-supervisor and given permission to ask questions about the methodology to obtain a clear understanding of the processes involved in a systematic review. A pilot search was conducted before the review commenced and the SFS Critical Appraisal Tool was discussed to ensure that the author was familiar with all levels of review, inclusive of the process of appraisal before the review commenced. Regular supervision took place once a week, both in person and using the online Zoom video

communications platform. These meetings were used to discuss process issues and to clarify and to reach consensus when differences arose in each level of the review. The review process was conducted by the primary researcher (primary reviewer) and her supervisor (secondary reviewer). Both reviewers were involved in the title search, abstract search, and appraisal processes. To ensure methodological rigour, each reviewer completed the work at each level of filtration independently and then met to discuss their findings and any discrepancies that arose. During the appraisal process, both reviewers' scores were compared, and decisions made regarding inclusion and exclusion. Most discrepancies were due to variations in scoring, one or two questions within the instruments, sample, and data analysis sections. These were mostly related to whether enough motivation was given for sample choice, method of analysis and psychometric properties contained in the articles. Both reviewers read through these sections separately and then together they noted the differences as well as the reasoning for these variations. Discussions were used to reach a point of resolution which increased the rigour within the study. A third reviewer (co-supervisor) provided assistance when a discrepancy was unable to be resolved between the two reviewers. Once resolution was reached, only articles with a score of above the 61% threshold progressed to the summation phase where relevant data were extracted and subjected to meta-synthesis.

### **Meta-Synthesis**

The extracted data from the included studies were subjected to a meta-synthesis. According to Hoon (2013), a meta-synthesis is explained as a type of exploratory, inductive research design, with the aim of synthesising primary studies to be able to make more relevant, meaningful contributions that extend beyond the original studies. It has been described as a qualitative method with a more interpretative intent in that it deepens or expands on original understanding as opposed to being simply aggregative, which is in



contrast to meta-analysis in quantitative studies (Grant & Booth, 2009). There are numerous ways to conduct a meta-synthesis with three main types used for systematic reviews as mentioned by Sandelowski and colleagues (1997). The first type involves *theory building* which is generating new theory or refining or extending existing theory (Hoon, 2013). The second type is *theory explication*, in terms of reconceptualisation of the original phenomenon while the third is *theory development* or descriptive meta-synthesis which entails the synthesising of findings resulting in a comprehensive analysis of the phenomena (Finfgeld, 2003; Hoon, 2013). The third type of descriptive meta-synthesis was used in this review.

### **Ranking**

The articles that were included in the final summation received a ranking which was based on their composite score. The scores received for each subsection of the SFS critical appraisal tool were added, thereby receiving an overall methodological quality score. The research questions were used as a guide to synthesise information extracted from the articles.

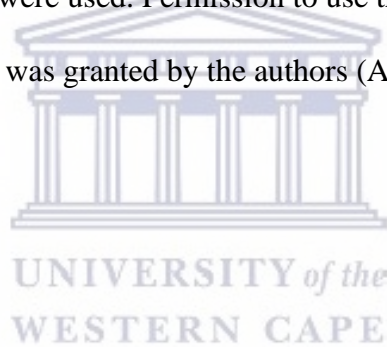
### **Data Extraction**

The reviewer utilised data extraction sheets (Appendices B and C) to assist in reviewing and making comparisons between data. Additionally, these assisted in providing guidance in ensuring that articles adhered to the inclusion criteria. An adapted flow chart was used which reflects the levels of the review and the operational steps included at each level. This flow chart was obtained from the PRISMA reference for preferred ways of reporting systematic review processes and adapted accordingly (Moher et al., 2009).

### **Ethical Considerations**

Permission to conduct the study (HS20/5/6) was obtained by the Humanities and Social Sciences Research Ethics Committee (HSSREC) at the University of the Western Cape (Appendix A). The researcher was a registered student at the institution thereby able to

lawfully gain access to the online university library and resources for data collection. The review utilised published articles considered to be in the public domain and therefore no further permission for access was required. A systematic review is secondary research and therefore no human participants were required. Nevertheless, all ethical considerations pertaining to a systematic review such as adherence to the protocols were maintained throughout. It was therefore ensured that during the systematic review process, methodological, rigorous, accurate and thorough research procedures were adhered to in the inclusion and exclusion of particular articles. This further implied that the researcher followed the strict, unbiased protocol, and that validity and reliability were consistently adhered to. To ensure this reliability and validity, search databases endorsed by the University of the Western Cape were used. Permission to use the Smith Fransciscus Swartbooi (SFS) scoring system was granted by the authors (Appendix E).

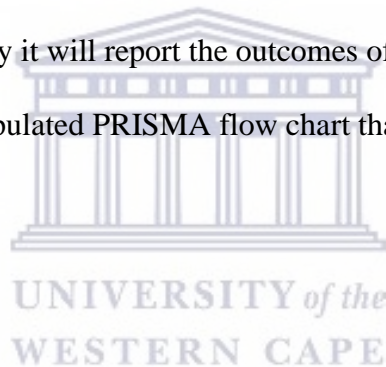


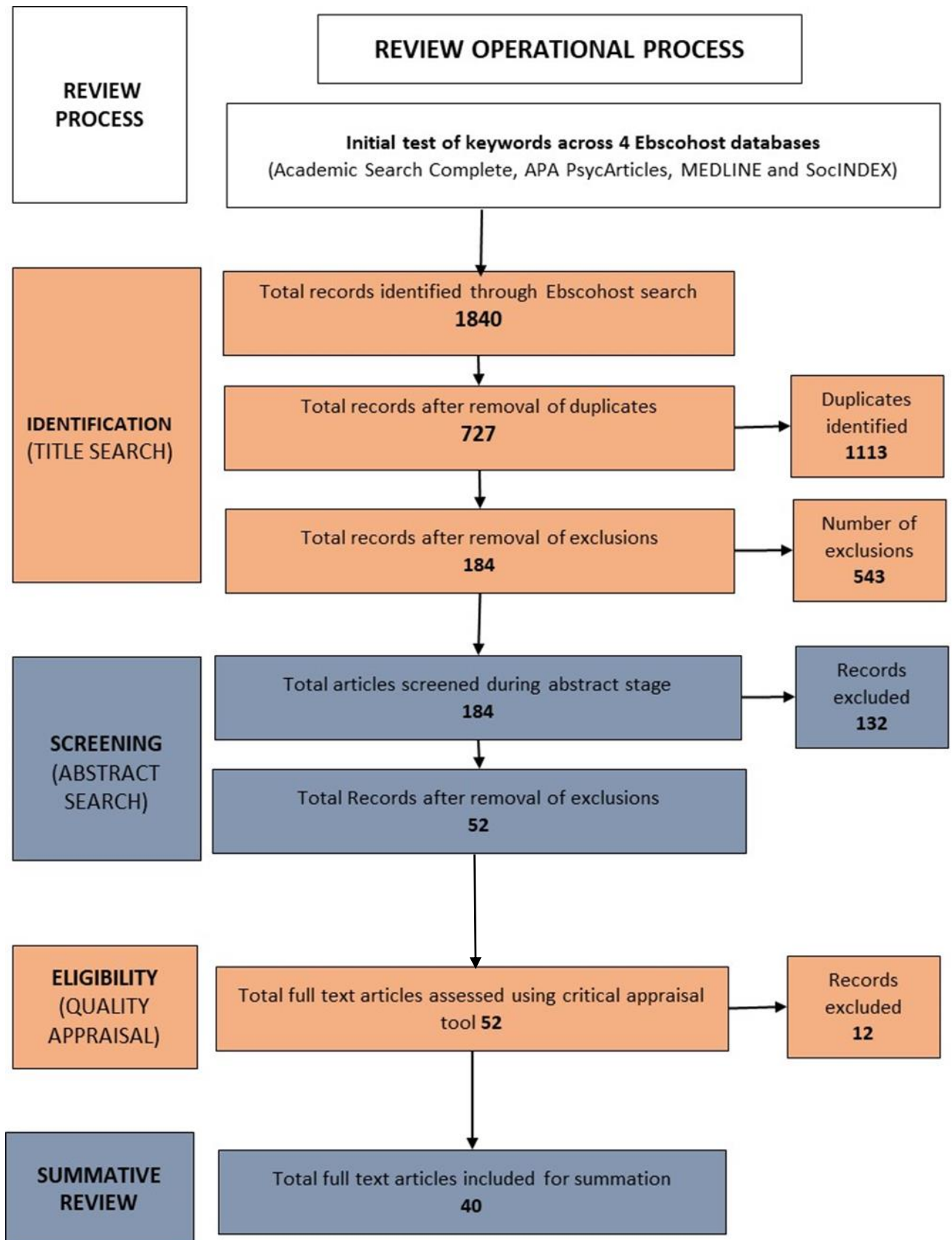
## CHAPTER FOUR: RESULTS AND DISCUSSION

This chapter has integrated the results and discussion. It consists of two main sections, namely *Process Results* and a *Descriptive Meta-Synthesis*. The Process Results section presents reports on the findings at each level of the review as well as the operational steps undertaken.

The Descriptive Meta-Synthesis comprises a summary and discussion of all articles identified for inclusion in the meta-synthesis. The meta-synthesis attempts to answer the three review questions identified as the focus for this thesis. Firstly, this includes describing the methodological standard of the studies related to the interventions; secondly, it identifies and describes the intervention models programmes or strategies that are researched in the treatment of adult ADHD; finally it will report the outcomes of the studies.

Figure 1 below is the populated PRISMA flow chart that graphically represents the process of filtration.



**Figure 1***Adapted Populated PRISMA Flow Chart*

### ***Identification***

The identification involved a title search across four UWC EBSCOhost databases (Academic Search Complete, APA PsycArticles, MEDLINE and SocINDEX). Using the keyword combinations discussed previously, 1840 potential articles were identified. A total of 1113 duplicates (articles appearing in more than one database) were identified and removed, leaving 727 potential titles. A total of 543 titles were excluded because they did not comply with the inclusion criteria. The main reasons for exclusion were that titles were focused on (a) the incorrect population such as children and adolescents; (b) screening and assessment tools for ADHD; (c) not treatment or intervention related; (d) adults and ADHD were not mentioned in the title; (e) secondary research. A total of 184 articles were identified as appropriate for this review and were included in the abstract review. The process results were tabularised on the title search document under author, date published, date obtained, title, source, database and location stored (Appendix B).

### ***Screening***

The 184 articles that were deemed relevant during the previous step were screened using the stipulated inclusion and exclusion criteria. After the screening, 125 abstracts were excluded. The primary reasons for the exclusion of articles were that they did not include adults as participants, they did not focus on ADHD, or they were not treatment or intervention focused. A further seven articles were excluded due to not allowing for open access on the UWC database.

At the end of the screening stage, 52 articles were retained for quality appraisal using the SFS Critical Appraisal Tool. The abstract search process results were tabularised on the abstract search document under author, title, type of design, study population, method of data analysis, and outcomes (Appendix C).

### *Eligibility*

The 52 articles were evaluated and appraised according to specific criteria for eligibility using the SFS critical appraisal tool (Smith et al., 2015). Each article received a score based on their overall quality according to the criteria in the critical appraisal tool scoring system. For this review, full-text articles had to obtain a predetermined threshold score of 61% or more to be included in the review. Out of the 52 articles that were evaluated, 40 articles were included in the study, and 12 were excluded. Articles were excluded for a range of reasons including not having achieved the specified 61% or more threshold score (Dittner et al., 2014; Fuermaier et al., 2014; Gerhard et al., 2010; Muit et al., 2020). Some articles were found to be retrospective studies (Adler et al., 2010; Kabul et al., 2015) while others were not identified as intervention studies (Antshel et al., 2011; Caballero-Puntiverio et al., 2019; Mette et al., 2013; Newark et al., 2012). A particular article focused on populations without ADHD which was inconsistent with research objectives (Rosenberg et al., 2016). Lastly, one of the articles lacked detail within the specific sections relating to the study and sample in that they did not discuss the development or elements of the intervention as well as not mentioning the sampling choice, frame or method (Sobanski et al., 2015).

Table 1 below illustrates the total scores and ranking of the 40 articles that were included for the review process.

**Table 1***SFS Critical Appraisal Scores*

Authors	Rank No.	Purpose (Max score =5)	Study (Max score =9)	Sample (Max score =15)	Ethics (Max score =6)	Instruments (Max score =7)	Data Analysis (Max score =5)	Results (Max score =4)	Conclusion (Max score =4)	Total Score (55) / Percentage
Hoxhaj et al., 2018	1	5	7	13	3	5	5	4	4	46/ 84%
Hepark et al., 2015	2	5	6	13	3	5	5	4	4	45/ 81%
Jucaite et al., 2014	3	5	6	13	3	4	5	4	4	44/ 80%
Potter et al., 2014	4	5	6	13	2	4	5	4	4	43/ 78%
Gu et al., 2018	5	5	6	7	3	6	5	4	4	40/ 73%
Solanto et al., 2010	5	5	7	8	3	4	5	4	4	40/ 73%
Stern et al., 2014	5	5	6	7	3	6	5	4	4	40/ 73%
Low et al., 2018	5	5	6	8	3	5	5	4	4	40/73%
Verster et al., 2010	5	5	4	11	3	4	5	4	4	40/ 73%
Apostol et al., 2012	5	5	6	10	3	4	5	4	3	40/ 73%
Ni et al., 2013	6	5	6	7	4	5	5	4	4	40/ 73%
Solanto et al., 2018	7	5	6	8	3	4	5	4	4	39/ 71%
Emilsson et al., 2011	7	5	6	7	3	5	5	4	4	39/ 71%
Mitchell et al., 2013	7	5	5	9	2	5	5	4	4	39/71%
Ni et al., 2016	7	5	6	7	3	5	5	4	4	39/71%
Chronis-Tuscano et al., 2010	7	5	6	6	3	6	5	4	4	39/71%
Agay et al., 2010	8	5	5	9	2	4	5	4	4	38/ 69%
Biederman et al., 2017	9	5	6	7	3	4	5	4	4	38/ 69%
Morgensterns et al., 2016	9	5	6	6	3	5	5	4	4	38/69%
Fleming et al., 2015	9	5	6	7	2	5	5	4	4	38/69%
Lin et al., 2015	9	5	6	7	2	5	5	4	4	38/ 69%
Allenby et al., 2018	9	5	6	7	2	5	5	4	4	38/69%
Bettis et al., 2017	9	5	7	4	3	6	5	4	4	38/69%
Bueno et al., 2015	10	5	5	7	3	4	5	4	4	37/ 67%

Authors	Rank No.	Purpose (Max score =5)	Study (Max score =9)	Sample (Max score =15)	Ethics (Max score =6)	Instruments (Max score =7)	Data Analysis (Max score =5)	Results (Max score =4)	Conclusion (Max score =4)	Total Score (55) / Percentage
Groeneveld et al., 2019	10	5	6	7	2	5	5	4	3	37/ 67%
Adler et al., 2017	10	5	6	5	3	5	5	4	4	37/ 67%
Fan et al., 2017	11	5	5	7	2	4	5	4	4	36/ 65%
Fargason et al., 2017	12	5	6	5	3	4	5	4	4	36/ 65%
Brams et al., 2012	12	5	6	6	3	3	5	4	4	36/65%
Biederman et al., 2012	12	5	5	7	2	4	5	4	4	36/65%
Nielsen et al., 2017	12	5	6	4	2	6	5	4	4	36/65%
Edel et al., 2017	13	5	6	5	2	5	4	4	4	35/ 64%
Ramos-Quiroga et al., 2014	13	5	6	5	3	3	5	4	4	35/ 64%
Arvidsson et al., 2019	13	5	6	4	2	5	5	4	4	35/ 64%
Volkow et al., 2012	13	5	5	5	2	5	5	4	4	35/64%
Arns et al., 2012	13	5	6	4	2	5	5	4	4	35/64%
Bachmann et al., 2018	14	5	5	7	2	3	4	4	4	34/ 62%
Schranter et al., 2016	14	5	6	6	0	4	5	4	4	34/62%
Franzen et al., 2013	14	5	6	4	2	4	5	4	4	34/62%
Coppola et al., 2018	14	5	6	4	2	5	5	4	3	34/ 62%



The 40 articles that were included for the final meta-synthesis and of which scoring was summarised in Table 1 above, were assessed using the SFS Critical Appraisal Tool (Smith et al., 2015). This tool assesses each article individually by asking a series of questions and then allocates a score. It consists of eight sections covering several topics. The results for each section are discussed below.

**Purpose.** The first section described the purpose of the study and required the reviewers to comment on whether literature had been consulted to inform the research process, as well as whether a problem statement, rationale and aims had been described in the study. This section was scored out of a maximum of five points. All 40 studies received five points for this section, as all provided comprehensive information consistent with good reporting principles and is in line with the requirements of journals for publication.

**Study.** The second section described questions related to the study. This required reviewers to comment on whether the article was an intervention study, provided a theoretical orientation, reported on the development, elements, and implementation of the programme, as well as having made mention of fidelity and relevance to the research question. This section was scored out of a maximum of nine points. Articles were distributed across the range, 4–7 points, with three out of the 40 studies scoring in the high range, and one out of the 40 articles scoring in the low range. The majority of studies (29 studies) received six points out of a possible nine. These studies lost points for not reporting and describing a theoretical orientation for the intervention they researched and they failed to describe whether fidelity to the implementation of the programme was adhered to. This had a negative effect on the replicability of the study, which is necessary in good quality reporting and thus, in good quality research.

**Sample.** The next section described questions related to the sample. This required reviewers to comment on the source population, inclusion/exclusion criteria, sampling

choice, frame, and method as well as random assignment and sample size. This section was scored out of a maximum of 15 points. Articles were distributed across the range, 4–13 points with four out of the 40 studies scoring in the high range, and six out of the 40 studies scoring in the low range. Studies in the low range typically did not motivate the reasons for their sampling choice, failed to explain how the size of the sample was determined, and did not report on techniques used to ensure optimal sample size. A score of seven was the most common score received (14 of 40 studies). According to academic and public conventions, reporting on sampling strategies and on the samples included is of vital importance (Bornstein et al., 2013; Setia, 2016). This assists the reader in being able to assess the validity and generalisability of the results. Additionally, if the sampling methods are reported upon, readers will then be able to determine applicability and reasons for the chosen method, leading to a greater understanding of the study. Once again it speaks to the veracity of reporting which might be influenced by the criteria that journals require to publish an article.

**Ethics.** The next section described questions related to ethics. This required reviewers to comment on whether an identifiable ethics committee was used, as well as informed consent obtained and other ethical issues reported. This section was scored out of a maximum of six points. Articles were distributed across the range, 0–4 with one out of the 40 studies scoring in the high range, and one out of the 40 studies scoring in the low range. A study by Schrantee and colleagues (2017) received zero points in that they did not make mention of gaining ethical approval, informed consent from participants or make mention of other ethical concepts. The majority of articles received a score of three (21 of 40 studies) and two (17 of 40 studies) points. The lack of engagement with ethics throughout the studies could be seen as an effort by researchers to avoid unnecessary difficulties in the research process by only highlighting positive expectations, and these studies could therefore be in danger of harming participants. Another possible explanation could be that researchers followed the correct

ethical procedures and guidelines, however no space was allowed to adequately report these procedures by journals.

**Instruments.** The next section described questions related to instruments. This required reviewers to comment on whether instruments were identified and referenced, outcomes identified, and psychometric properties reported on. This section was scored out of a maximum of seven points. Articles were distributed across the range of 3–6 points, with five out of the 40 studies scoring in the high range, and three scoring in the low range. The lowest-scoring studies did not report on psychometric properties, type of data produced by the instruments, and whether the data supported the analysis. Reporting of psychometric properties is important when attempting to understand whether an instrument has suitable reliability and validity scores and is appropriate for the particular population being researched (Draugalis et al., 2008; Zangaro, 2019). It may be that the authors opted not to describe these characteristics of the instruments due to the well-known acceptance of validity. The majority of articles received a score of five (18 studies) and four (14 studies) points.

**Data analysis.** The next section described questions related to data analysis. This required reviewers to comment on the identification and motivation of method of analysis. This section was scored out of a maximum of five points. Articles were distributed across the range of 4–5 points. The majority of articles received five points (38 studies) with the remainder receiving four points (two studies). Both studies receiving the lowest points did not report on the motivation for the method of analysis. It is possible to see the emphasis placed on reporting data analysis by the high scores that were achieved for most articles.

**Results.** The following section described questions related to results. This required reviewers to comment on alpha levels as well as correct interpretation and presentation of results. This section was scored out of a maximum of four points. All 40 articles received

four points. Once again, the emphasis on reporting thoroughly on outcomes may be seen as prioritised by authors who aim to have their research published.

**Conclusion.** The final section described questions related to the conclusion. This required reviewers to comment on whether the conclusion was supported by the findings as well as identification of limitations and recommendations. This section was scored out of a maximum of four points. Articles were distributed across the range of 3–4 points, with the majority receiving a score of four points (37 studies) and the remainder receiving three points (three studies). The articles receiving the low score did not provide recommendations based on the study. This could be related to an effort to adhere to strict word count requirements which might influence the amount of detail reported on.

### ***Ranking***

Table 2 below illustrates the ranking of each of the 40 articles included for the meta-synthesis. The ranking process consisted of the ranking of studies and the tabularisation of extracted data and the final scores captured on a rating form. The articles were ranked in descending order based on their overall score obtained on the SFS Critical Appraisal Tool. Thus, the higher ranks reflect articles that scored higher on methodological rigour. The scores of the 40 articles that were appraised are presented. They were ranked in order from highest to lowest threshold score obtained based on the total scores acquired from the various sections. The range of scores on the appraisals varied between 84% and 61% in the strong to excellent category which suggests good quality articles with a strong emphasis on methodological rigour. The majority (38) of the eligible articles scored in the strong category (61–80%). The remaining two scored in the excellent category (81–100%).

A total of 40 articles met the threshold score of 61% and were included to advance to the summation phase of the study.

### **Table 2**

*Ranking of Articles According to Appraisal Results*

<b>Rank No.</b>	<b>Authors</b>	<b>Appraisal Category</b>	<b>Final Appraisal Score</b>
1	Hoxhaj et al., 2018	Excellent	84%
2	Hepark et al., 2015	Excellent	81%
3	Jucaite et al., 2014	Strong	80%
4	Potter et al., 2014	Strong	78%
5	Gu et al., 2018	Strong	73%
	Solanto et al., 2010		
	Stern et al., 2014		
	Low et al., 2018		
	Verster et al., 2010		
	Apostol et al., 2012		
6	Ni et al., 2013	Strong	72%
7	Emilsson et al., 2011	Strong	71%
	Mitchell et al., 2013		
	Ni et al., 2016		
	Chronis-Tuscano et al., 2010		
	Solanto et al., 2018		
8	Agay et al., 2010	Strong	70%
9	Biederman et al., 2017	Strong	69%
	Morgensterns et al., 2016		
	Fleming et al., 2015		
	Lin et al., 2015		
	Allenby et al., 2018		
	Bettis et al., 2017		
10	Bueno et al., 2015	Strong	67%
	Groeneveld et al., 2019		
11	Fan et al., 2017	Strong	66%
	Adler et al., 2017		

Rank No.	Authors	Appraisal Category	Final Appraisal Score
13	Edel et al., 2017	Strong	64%
	Ramos-Quiroga et al., 2014		
	Arvidsson et al., 2019		
	Volkow et al., 2012		
	Arns et al., 2012		
14	Bachmann et al., 2018	Strong	62%
	Schranter et al., 2016		
	Franzen et al., 2013		
	Coppola et al., 2018		

### Methodological Standard of the Studies

Although 40 studies made it through to the summation phase based on meeting the threshold score of 61%, there were obvious differences in the way that authors contextualised the studies, identified and discussed the theoretical frame in which the interventions took place, operationalised the study by describing their methodological choices, reported on results and discussed the outcomes of the interventions.

All 40 studies neglected to report or describe the use of a theoretical orientation as the basis for the intervention used. The development of the intervention was reported by most (38) studies. Thus, these studies reported background information on how that particular intervention came about, reasons it was considered effective, and typically included mention of previous studies where that intervention was utilised. This may be as a result of this particular subsection taking on a vital role in providing an understanding and context to the intervention which is the focus of the study. Thirty-four studies described the elements making up the particular programme/intervention and reported on its implementation. In pharmacological studies, this meant that the type of drug, dosage, dosage schedule and time period of intervention was described. In non-pharmacological studies, it meant that an overview of what was covered in each treatment session, as well as the number of sessions

was described. Despite the lack of theoretical orientation reported, the care taken to include the development of the intervention and steps implemented could be seen as a by-product of publication bias, given that academic journals usually favour the inclusion of certain information in the articles they publish.

A large number of studies (30; 75%) identified using probability sampling, that is every person had an equal chance of being included in the study. This is likely due to the high amount of RCTs which subscribe to this type of randomised sampling method, and are popular in systematic reviews on interventions. Participants were allocated to groups through random assignment in 33 studies. The method used to determine the size of the study was not reported upon in 34 studies, although this does not necessarily mean that researchers failed to use a method to determine the correct sample size. We know from the literature that this is of extreme importance to a study, in terms of ensuring not to use a sample size which is too small and not able to contribute effectively to the advancement of knowledge, whereas a sample that is too big is likely to be expensive and run the risk of wasting resources. (Kang et al., 2008). It may also simply mean that the author of the study did not deem it necessary to describe it, but that it was generally accepted as part of the research process. The majority of articles utilised probability sampling which adds to the robustness of the research results. However, 34 articles (85%) did not include the method or parameters used to determine the optimal number of participants needed for the study to yield significant results.

All 40 articles were clear in their identification of instruments used to collect data. The most commonly used instrument was the Connor's Adult ADHD Rating Scale (CAARS) which was used in 15 studies. Almost half (19) of the studies reported on the psychometric properties whilst 34 did not report on the psychometric properties of the scale for the particular sample being mentioned. This speaks to the methodological soundness of the

article; it may be a requirement from the specific journal in which it was published rather than due to quality of writing or author (Wisdom et al., 2012).

Most studies (37) obtained ethics approval from an identifiable committee and 38 obtained informed consent from the participants in the study. It is of concern that two articles neither included ethics sections nor even mentioned an ethics clearance number. This is a fundamental process in research and all published research should undergo and report on their ethical clearance obtained. The decision to omit information about ethics has bearing on overall methodological quality of the articles and thus, the quality of reporting.

All studies identified the method of analysis and reason for it. Thirty-five studies did not report on the fidelity to the implementation of the programme, and thus the extent to which the interventions adhered to the protocol that was developed is mostly unknown. This is also important information with regard to the replicability of the study and thus speaks to adherence to the methodological rigor.

All 40 studies ensured a clear conclusion was drawn. All studies identified certain limitations and 37 studies made recommendations for future research.

In a research study, an author's role is ultimately to report on a combination of what is considered to be important by the journal publisher and what the author deems to be important. Notwithstanding, the author still has the final word on what will be included and excluded in the final product. The information which is included has an influence on the methodological standards of the study thereby influencing rigor and replicability.

### **Descriptive Meta-Synthesis**

A descriptive meta-synthesis was used to identify and discuss interventions and report on the outcomes of the interventions. The discussion for Review Question 2 (which intervention models, programmes or strategies are currently available to treat adult ADHD?) will follow below and provides an overview of the types of interventions used in the articles.



### *Types of interventions*

Two types of intervention categories were found within the review of articles, namely pharmacological and non-pharmacological interventions. These articles used either a pharmacological or non-pharmacological approach to adult ADHD except in the case of one study which was found to use a combination of both pharmacotherapy and psychosocial modalities to elicit an effective treatment outcome.

**Pharmacological Interventions.** Twenty-two articles were identified that utilised pharmacological approaches to intervention for Adult ADHD. Twenty of these studies implemented a single pharmacological approach, in other words one type of drug was used to treat ADHD. Table 3 provides a summary of the type of medication that was used as a pharmacological intervention in the treatment of adult ADHD in the respective studies.

**Table 3**

*Pharmacological Interventions*

<b>Modality/Treatment</b>	<b>Author/Year</b>
Methylphenidate	Agay et al., 2010 Arvidsson et al., 2019 Low et al., 2018 Nielson et al., 2017 Schrantee et al., 2016 Verster et al., 2010 Volkow et al., 2012
Osmotic-Release Methylphenidate	Biederman et al., 2012 Chronis-Tuscano et al., 2010
Atomoxetine	Coppola et al., 2018 Fan et al., 2017 Lin et al., 2015 Ramos-Quiroga., 2014
Methylphenidate/ Atomoxetine (Comparison)	Nie et al., 2013 Nie et al., 2016
Dextroamphetamine	Franzen et al., 2013

<b>Modality/Treatment</b>	<b>Author/Year</b>
Lisdexamphetamine	Adler et al., 2017 Brams et al., 2012
Memantine	Biederman et al., 2017
AZD3480 (Ispronidine)	Potter et al., 2014
AZD1446 (Donepezil)	Jucaite et al., 2014
ABT-089 (Pozanicline)	Apostol et al., 2012

The 22 pharmacological studies utilised nine types of pharmaceuticals for treating ADHD in adults. These included the use of both stimulants and non-stimulants as treatment. Stimulants discussed were MPH, LDX and dextroamphetamine whilst non-stimulants were ATX, memantine, donepezil, pozanicline and ispronidine.

The articles varied in their approach to treatment. While 22 articles focused on locating the best forms of treatment for adult ADHD, two articles focused on comparing identified interventions against one another to discover the most efficacious intervention. The reason for the varying approaches may be to be able to locate the most effective and suitable intervention for this particular adult population (Nie et al., 2013; Nie et al., 2016). These two approaches (single and comparative pharmaceutical studies) will be discussed in more detail below.

***Single Pharmaceutical Approach.*** Of the 20 studies using a single pharmaceutical approach, seven used the stimulant methylphenidate (MPH; Agay et al., 2010; Arvidsson et al., 2019; Low et al., 2018; Nielson et al., 2017; Schrantee et al., 2016; Verster et al., 2010; Volkow et al., 2012). Methylphenidate works by increasing central dopamine and norepinephrine activity which has been found to improve attention and executive functioning and thus is effective in assisting adults with ADHD (Faraone, 2018). Two of the studies used

osmotic release oral system (OROS)-methylphenidate which is an extended release version of the stimulant in which the onset is delayed but more consistent, and therefore more stable for the individual (Biederman et al., 2012; Chronis-Tuscano et al., 2010). The stimulant LDX was used to manage ADHD in two of the studies (Adler et al., 2017; Brams et al., 2012); whereas one study used dextroamphetamine, another type of amphetamine stimulant for treatment (Franzen et al., 2013).

A particular study used a cholinesterase inhibitor called memantine which is a non-competitive antagonist of N-methyl-D-aspartate (NMDA) receptors, to manage ADHD symptomatology (Biederman et al., 2017). In other words, the enzyme cholinesterase (which functions by breaking down acetylcholine) is blocked which means that acetylcholine is preserved and increased in the body thereby positively effecting memory, arousal, and learning. Research indicates that memantine has mild or tolerable side effects when compared to stimulants (Mohammadzadeh et al., 2019). Jucaite and colleagues (2014) used donepezil, a different cholinesterase inhibitor, to manage symptoms of ADHD.

Four of the 17 studies used the non-stimulant drug ATX as treatment for ADHD in adults (Coppola et al., 2018; Fan et al., 2017; Lin et al., 2015; Ramos-Quiroga., 2014). This non-stimulant is a selective norepinephrine reuptake blocker, generally well-tolerated, and used when individuals have side-effects to stimulants. Its mechanism of action is not fully understood, however research indicates that it may be involved in selective inhibition of the presynaptic norepinephrine reuptake in the prefrontal cortex (Garnock-Jones & Keating, 2009). Administration of the medication can take place in a single daily dose or two equal half doses.

The final two studies used the nicotinic agonists, ispronicline and pozanicline which imitate the action of acetylcholine, a known neurotransmitter responsible for motivation,

attention, learning and memory, and therefore suitable for individuals with ADHD (Apostol et al., 2012; Potter et al., 2014).

**Comparison of Pharmaceutical Drugs.** Two studies compared one drug with another to assess effectiveness in terms of treating ADHD (Nie et al., 2013; Nie et al., 2016). These studies aimed to identify which type of pharmaceutical would be more effective in managing symptoms in adults. The pharmaceuticals used were MPH and ATX, and both were found to be equally effective in terms of improving executive function, inhibitory control, and reaction time. However, ATX yielded more significant results with regards to spatial planning.

**Non-Pharmacological Interventions.** Eighteen of 40 articles were classified as using non-pharmacological interventions, 13 of which referred to psychosocial treatment modalities, and five to interventions with a focus on neuro-stimulation. Table 4 provides a summary of the type of psychotherapeutic modalities that were used as non-pharmacological interventions in the treatment of adult ADHD.

The 13 psychosocial interventions listed in Table 4 included nine sub-types of psychotherapeutic modalities. These articles varied in their therapeutic approach to treatment of ADHD in adults. A single therapeutic approach was used in nine of the studies; one modality was assessed for effectiveness in managing ADHD. Four of the studies utilised a comparative therapeutic approach to ADHD where more than one modality was tested and compared with another to ascertain the most effective modality for use in an adult population. Both the single, comparative therapeutic approaches and the combination of therapeutic and pharmaceutical approaches will be discussed in more detail below.

**Table 4***Psychosocial Interventions Used in the Treatment of Adult ADHD*

<b>Modality/Treatment</b>	<b>Author/Year</b>
MAP	Mitchell et al., 2013 Bueno et al., 2015
MAP/Psychoeducation	Bachmann et al., 2018 Hoxhaj et al., 2018
Mindfulness-based training/DBT	Edel et al., 2017
DBT	Fleming et al., 2015 Morgensterns et al., 2016
CBT	Solanto et al., 2018
MBCT	Gu et al., 2018 Hepark et al., 2015
Meta-cognitive therapy	Solanto et al., 2010
CCT	Stern et al., 2014
Coping skills/CCT	Bettis et al., 2017

**Single Therapeutic Approach.** Of the nine studies using this approach, Bueno and colleagues (2015) and Mitchell and colleagues (2013) used the mindful awareness practices (MAP) therapeutic approach to manage ADHD in adults. Another two studies used dialectical-behavioural therapy (DBT; Fleming et al., 2015; Morgensterns et al., 2016). Mindfulness-based cognitive therapy (MBCT) was used in two studies (Gu et al., 2018; Hepark et al., 2015). One study researched the effectiveness of cognitive-behavioural therapy (CBT) in relation to ADHD (Solanto et al., 2018). The remaining two studies out of the ten used meta-cognitive therapy (Solanto et al., 2010), and computerised cognitive training (Stern et al., 2014) as modalities to treat ADHD in adults. It is interesting to note that compared to other disorders, there is a limited focus on interventions which look at parenting skills, or

relational therapies. This might be due to the focus on changing thought patterns which is the focus in multiple psychosocial interventions including DBT, CBT and MBCT, and in so doing influence behaviour for enhanced functioning.

***Comparison of Therapeutic Approach.*** Four studies compared one intervention with another to assess the effectiveness in treating ADHD. Two of the four studies compared MAP with psychoeducation (Bachmann et al., 2018; Hoxhaj et al., 2018) in an attempt to understand which therapeutic approach is most effective in treating ADHD. One study contrasted MBT with DBT (Edel et al., 2017). Results indicated a similar reduction in ADHD symptoms by both interventions, an improved ability to be mindful as well as increased self-efficacy. However, Edel and colleagues (2017) report that MBT showed more significant overall improvement in the symptoms of ADHD in adults. The remaining study compared CCT with coping skills (Bettis et al., 2017), and reported that both interventions were effective in reducing social stress and improving executive functioning deficits. However, participants receiving CCT displayed significantly greater improvements in behaviour regulation which we know to be associated with ADHD.

**Interventions with a Focus on Neuro-Stimulation.** Studies that had a focus on neuro-stimulation used the following techniques in the treatment of adult ADHD. Table 5 below provides a summary of the type of techniques that were used in the treatment of ADHD in the respective studies.

Neuro-stimulation techniques included the use of neurofeedback and heart rate variability biofeedback, bright light therapy, transcranial direct current stimulation and QEEG-informed neurofeedback. These studies mostly used a single approach to treating ADHD with the exception of one study which will be discussed below.

**Table 5***Interventions with a Focus on Neuro-Stimulation*

<b>Modality/Treatment</b>	<b>Author/Year</b>
Z-Score Neurofeedback & heart rate variability biofeedback training	Groeneveld et al., 2019
Bright light therapy	Fargason et al., 2017
Transcranial direct current brain stimulation	Allenby et al., 2018
QEEG-informed neurofeedback	Arns et al., 2012

Bright light therapy has been indicated as a method which can advance circadian rhythms and decrease the symptoms of ADHD (Fargason et al., 2017). Individuals with ADHD often have dysfunctional circadian rhythms causing delayed sleep timing and daytime sleepiness which can have an impact on sleep quality and ability to sleep. This can subsequently lead to mood disturbances and occupational dysfunction. Fargason and colleagues (2017) found that bright light therapy was effective in improving symptoms of ADHD and sleep disturbance which is often not targeted by stimulants.

Transcranial direct current stimulation (tDCS) is a method which uses intentional modulation of the nervous system's activity using non-invasive methods (Camp et al., 2021). During this intervention, multiple electrodes are situated externally and direct electric currents are aimed at certain areas of the brain. Allenby and colleagues (2018) reported a decrease in impulsivity after six sessions of tDCS.

Neurofeedback is an operant conditioning procedure which teaches participants to self-regulate their behaviour. Audio or visual feedback of the brain activity that is taking place during a particular behaviour is then fed back to the individual (Rubia et al., 2021). One study looked at quantitative electroencephalogram (QEEG)-informed neurofeedback as a

personalised neurofeedback protocol which is based on an individual's electroencephalogram (EEG) pattern (Arns et al., 2012). Individuals are placed into certain sub-groups and paired with treatment that is more suited to their particular type of brain function according to an EEG. Arns and colleagues (2012) reported that QEEG-informed neurofeedback resulted in improved attention, reduced hyperactivity, and fewer symptoms of comorbid depression in adults with ADHD.

One study combined two approaches to manage symptoms of ADHD (Groenewald et al., 2019). Two separate approaches that were integrated and used in the treatment were Z-score neurofeedback and heart rate variability biofeedback. According to Thatcher and Lubar (2014, p.1), 'Z Score Neurofeedback is a new technique using a normative database to identify and target a specific individual's area of dysregulation allowing for faster and more effective treatment'. Heart rate variability biofeedback assists in the training of individuals to control respiratory sinus arrhythmia to increase variability of their heart rate. Research indicates that adults with ADHD may suffer with reduced heart rate and thus this intervention could prove to be useful. Additionally, participants in this study received psychoeducation on various topics such as exercise, diet, and deep breathing. After 30 sessions, results indicated significant improvement in ADHD symptoms for both approaches.

**Combination of Psychosocial and Pharmacological Interventions.** One study employed a combination or multimodal approach where two types of interventions were used on the same population to holistically treat adults with ADHD (Emilsson et al., 2011).

This study conducted a randomised controlled trial using 54 adult outpatients with ADHD with an average age of 34 years (Emilsson et al., 2011). An intention to treat analysis was used to confirm the effectiveness of a combined psychosocial and psychopharmacological approach to ADHD. This type of analysis describes when participants remain in the group to which they were originally assigned from randomisation



through to analysis, regardless of whether they received the treatment, withdrew or were non-compliant (Gupta, 2011). This is considered to be a more reliable estimate of treatment effectiveness due to replication of what happens in the real world, thus suggesting greater generalisability (Fergusson et al., 2002). Additionally, it prevents bias when incomplete data is related to outcome. The study also wanted to establish effectiveness on symptoms of comorbid disorders such as depression, anxiety, and antisocial behaviour. The study used a population already receiving pharmacological treatment and combined this with CBT. The pharmacological treatment used by study participants ranged from the stimulants, MPH and amphetamines to the non-stimulants, ATX and bupropion. The result of the study indicated that this multimodal approach to treating ADHD in adults was effective in reducing symptoms of ADHD, depression, anxiety and anti-social behaviour in these adults. It is interesting to note that while the multimodal approach has been considered to be effective treatment for adults with ADHD, only one article using this approach was found in this study. It may be that the particular search criteria prevented these types of studies from being located or it may be that due to the fact that interventions treating adult ADHD are still in their infancy, studies using a combined approach are still lacking. The following section will describe the results and discuss Review Question 3.

### ***Outcomes of Interventions***

This section's main focus is on reporting of the outcomes of pharmacological and non-pharmacological interventions as described in the preceding section.

**Pharmacological Interventions.** Table 6 provides a synopsis of the author, date, and the reported outcome of the identified pharmacological interventions.

**Table 6***Pharmacological Interventions*

<b>Modality/Treatment</b>	<b>Author/Year</b>	<b>Outcomes</b>
Methylphenidate	Agay et al., 2010 Arvidsson et al., 2019 Low et al., 2018 Nielson et al., 2017 Schrantee et al., 2016  Verster et al., 2010 Volkow et al., 2012	Enhanced specific aspects of cognitive performance and increased short-term memory. Improved processing times in adults with ADHD. Results indicated improved visual processing speed (alertness). Resulted in improved perceptual, cognitive & processing efficiency. Decreased cerebral blood flow in cortical areas. No mention is made of positive effects on ADHD symptoms. Improved declarative memory functioning in patients with ADHD. Resulted in a reduction in symptoms of inattention and significant decrease in ADHD symptoms.
Osmotic-Release Methylphenidate	Biederman et al., 2012 Chronis-Tuscano et al., 2010	Treatment yielded a significant reduction in ADHD symptoms. Resulted in significant effects on ADHD symptoms.
Atomoxetine	Coppola et al., 2018 Fan et al., 2017  Lin et al., 2015 Ramos-Quiroga, 2014	Results indicated a significant reduction in the levels of impulsivity Improved inhibitory control, enhanced visual processing and improved clinical symptoms. Improved all three core clinical symptoms of ADHD. Significant improvement in ADHD clinical symptoms.
Methylphenidate/ Atomoxetine (Comparison)	Nie et al., 2013  Nie et al., 2016	Both MPH and ATX were effective in improving executive function in adults. However, ATX was more effective in improving spatial planning when compared with MPH.  Both MPH and ATX Improved intra-individual variability in reaction time and improved inhibitory control.
Lisdexamphetamine	Adler et al., 2017 Brams et al., 2012	All three core ADHD symptoms significantly improved. Core symptom reduction in the majority of participants.
Dextroamphetamine	Franzen et al., 2013	Improvement in attentional deficits and symptoms.
Memantine	Biederman et al., 2017	Improvements in selective areas of executive functioning.
AZD3480 (Ispronicline)	Potter et al., 2014	Significant improvements in the core symptoms of ADHD.
AZD1446 (Donepezil)	Jucaite et al., 2014	Well tolerated, but did not significantly improve ADHD symptoms however there was found to be a significant improvement in executive functioning.
ABT-089 (Pozanicline)	Apostol et al., 2012	Efficacious and generally well tolerated and improved core symptoms of adult ADHD.

**Single Pharmaceutical Approach.** Ten of the 22 pharmacological studies using a single drug to treat ADHD reported improved overall core symptoms of ADHD. It was noted that out of the 10 studies indicating improved core symptoms, three used ATX, another three used MPH, two used LDX while the last two used nicotinic agonists as treatment for ADHD symptomatology. Nine of the 22 studies did not indicate improved core symptoms, but still identified other improvements such as increased visual processing speed, reduced impulsivity, better short-term memory, alertness, and executive functioning, which were found to improve the functioning of individuals in the home and work context. These nine pharmaceuticals included MPH (five studies), dextroamphetamine (one study), ATX (one study), donepezil (one study) and memantine (one study). This finding seems to emphasise that a variety of medications has proved to be effective in the treatment of ADHD symptoms in adults. Lastly, one study (Schrantee et al., 2016) used MPH in an intervention to identify the differences in effect in adults and children. This study did not report on effectiveness, but rather indicated that MPH was found to decrease cerebral blood flow in cortical areas. Fantini and colleagues (2016) explains that this can lead to an individual experiencing headaches, seizures, encephalopathy and stroke. It could be that the goal of this study was not to determine effectiveness but rather, compare adults and children in their reaction to MPH.

**Comparison of Pharmaceutical Drugs.** The remaining two studies (of the 22 studies using pharmacology) used a comparative approach in which they compared one pharmaceutical with another to determine effectiveness. (Nie et al., 2013; Nie et al., 2016). Both studies compared MPH with ATX in order to ascertain which would be more effective in managing ADHD in an adult population. According to Nie and colleagues (2013) the results of the study indicated improved executive functioning by both MPH and ATX, however participants taking ATX showed greater improvement in spatial planning. The second study (Nie et al., 2016) reported a similar improvement in reaction time and inhibitory

control for both pharmaceuticals. It is interesting to note that both studies compared ATX with MPH. This is likely due to the popularity of these drugs and recommendation as front line treatment thus, a comparison would likely identify the best treatment for ADHD.

**Non-Pharmacological Interventions.** Table 7 provides a synopsis of the author, date, and the reported outcome of the identified pharmacological interventions. The 13 psychosocial studies identified in Table 7 show favourable outcomes when exploring the effectiveness of interventions for adult ADHD.

**Single Therapeutic Approach.** A reduction of all of the core symptoms of ADHD namely, inattention, hyperactivity and impulsivity was found in seven of the nine studies using a single therapeutic approach to treat adult ADHD. The therapeutic modalities used were DBT (two studies), mindfulness and variations (two studies) and CBT variations (two studies). In contrast, the study by Bueno and colleagues (2015) which used MAP as an intervention, did not indicate decreased core symptoms, but still showed a reduction in inattention, which resulted in reported improvement of the individual's quality of life (Bueno et al., 2015). Additionally, a second study by Solanto and colleagues (2018) which used CBT as an intervention also failed to report improvement in the three core symptoms, yet still indicated improvements in attention, sleep and symptoms of depression. Thus, both of these studies were found to still be reporting useful interventions for treating adult ADHD. A useful point to remember is that adults with ADHD do not always present with all three core symptoms. They may be diagnosed with the predominantly inattentive or predominantly hyperactive/impulsive subtypes, and thus may not require an intervention that can treat all areas. The needs of the individual should be explored and a suitable intervention appropriate to the person should be identified.

**Table 7***Outcomes of Interventions with a Psychosocial Focus*

<b>Modality/Treatment</b>	<b>Author/Year</b>	<b>Outcomes</b>
MAP	Mitchell et al., 2013 Bueno et al., 2015	Improved ADHD and Executive functioning symptoms as well as emotion dysregulation. Improved inattention, mood and quality of life of patients and controls.
MAP/ psychoeducation	Bachmann et al., 2018	No significant difference between MAP and psychoeducation. Both yielded a significant decrease in ADHD core symptoms and improved task performance.
Mindfulness-based training/ DBT	Hoxhaj et al., 2018	Both interventions, mindfulness meditation and PE were efficacious in reducing symptom load. Increased self-concept, quality of life, overall mental state, depression and improved mindfulness.
	Edel et al., 2017	Both MBT and DBT resulted in a similar reduction in ADHD core symptoms, improvement in mindfulness and self-efficacy.
DBT	Fleming et al., 2015 Morgensterns et al., 2016	Improved ADHD symptoms, executive functioning and quality of life. DBT improved overall core ADHD symptoms , improved well-being, ability to be mindful, acceptance of emotions and quality of life.
CBT	Solanto et al., 2018	Improvement in inattentive symptoms, sleep and depressive symptoms were found.
MBCT	Gu et al., 2018	Improved ADHD core symptoms and assisted in lessening anxiety and depression, helped with greater levels of mindfulness and neuropsychological performance.
	Hepark et al., 2015	Resulted in significant reduction of ADHD symptoms. significant improvements in executive functioning and mindfulness skills.
Meta-cognitive therapy	Solanto et al., 2010	Improved overall core symptoms of ADHD.
CCT	Stern et al., 2014	Improved executive functions, ADHD symptomatology and occupational performance.
Coping skills/ CCT	Bettis et al., 2017	Both groups reported significant decrease in social stress, executive function difficulties, and anxiety symptoms post intervention. CT programme reported more improved ADHD symptoms compared with coping skills

Six studies reported other benefits that individuals experienced after the psychosocial interventions; namely improved executive functioning (Fleming et al., 2015; Hepark et al., 2015; Mitchell et al., 2013; Stern et al., 2014) and the ability to be mindful (Gu et al., 2018; Hepark et al., 2015; Morgensterns et al., 2018). Improved quality of life, well-being, mood and reduced depressive symptoms also featured in these studies. This might link to psychosocial interventions helping patients to self-regulate, which pharmacotherapies do not focus on.

***Comparison of Therapeutic Approaches.*** Four studies utilised a comparative approach in that one type of intervention was compared with another to be able to assess the most effective intervention for adults with ADHD. Two of these studies compared MAP with psychoeducation in their ability to treat symptoms (Bachmann et al., 2018; Hoxhaj et al., 2018). There was no significant difference found between the results from MAP and psychoeducation; results indicated that both were effective in reducing the core symptoms of ADHD. This is interesting to note as these two modalities are vastly different in their approaches to intervention, which seems to indicate that a wide variety of techniques can assist with ADHD symptom reduction. Additionally, improved task performance, self-concept, quality of life, overall mental state, and mindfulness also were consistent across both studies. One study (Edel et al., 2017) compared MBT and DBT and found no significant difference between them. Both were effective in reducing core symptoms of ADHD. Finally, one study compared CCT and coping skills in management of ADHD in adults (Bettis et al., 2017). Although both were found to be effective in decreasing social stress and difficulties in executive functioning and anxiety, CCT was found to be superior to coping skills in terms of ability to reduce symptoms of ADHD. It is possible that coping skills as an intervention strategy may be too simplistic in its ability to reduce ADHD symptoms and thereby lose sight of the complexities of this disorder.

**Neuro-Stimulation.** Table 8 provides a synopsis of the author, date and the reported outcome of the identified interventions with a focus on neuro-stimulation.

**Table 8**

*Outcomes of Interventions with a Focus on Neuro-Stimulation*

<b>Modality/Treatment</b>	<b>Author/Year</b>	<b>Outcomes</b>
Z-score neurofeedback and heart rate variability biofeedback training	Groeneveld et al., 2019	Both improved symptoms of ADHD as well as task performance.
Bright light therapy	Fargason et al., 2017	Resulted in a decrease in overall symptoms of ADHD.
Transcranial direct current brain stimulation	Allenby et al., 2018	Resulted in an improvement in impulsivity symptoms
QEEG-informed neurofeedback	Arns et al., 2012	There was significant improvement for inattention, hyperactivity/ impulsivity and comorbid depressive complaints

The outcome of the interventions with a focus on neuro-stimulation indicated improvement in overall core symptoms in three of the four studies (Arns et al., 2012; Fargason et al., 2017; Groenewald et al., 2019). The remaining study reported usefulness in terms of improved inhibition of impulsivity. (Allenby et al., 2018). This insight remains vague in that so few studies focusing on neuro-stimulation were identified in this review. This is likely due to effects of the particular search criteria used.

## **Conclusion**

All intervention methods described in this study were found to be efficacious in treating adult ADHD. Some were found to be successful in reducing all three core ADHD symptoms while others were identified as effective in reducing either one or two core symptoms, or others linking to comorbidities. Methylphenidate and ATX were considered to be first-line treatment in terms of pharmaceutical treatments for adults with ADHD. Due to the potential for misuse, contra-indications, adverse effects and possibility of ineffectiveness, non-pharmacological interventions have been identified as alternate options or as an adjunct to pharmacology.

Those deemed most effective were found to be DBT, CBT and variations on these, as well as interventions that focused on mindfulness techniques. Interventions focusing on neuro-stimulation were also recommended, however studies focusing on this area were minimal.





## CHAPTER FIVE: CONCLUSION

### Introduction

The main aim of this review was to identify high-quality articles through a vigorous filtration process and describe the interventions and programmes currently being used to treat ADHD in an adult population. Descriptive meta-synthesis was used to provide an overview of the main characteristics of the extracted studies, to identify the interventions that are described in these studies, and report on the relevant outcomes and effectiveness of these interventions. This chapter begins with an executive summary, then proceeds to explain certain identified limitations. The significance of the study is highlighted and the chapter concludes with the recommendations for future research.

### Executive Summary

This review confirmed the notion that although ADHD is classified as a neuro-developmental disorder with its aetiology embedded in early childhood, it is now considered as a disorder that is also prevalent in adults. ADHD is proved to have an impact on adult functioning in emotional, cognitive, physical, interpersonal, and occupational spheres of the affected individual's life.

The objective of this systematic review was to consolidate recent literature on the most effective treatment of adult ADHD through a vigorous filtration process to ensure that high quality articles were used to:

1. Describe the methodological standard of the studies related to the interventions/models or programmes
2. Identify and describe the interventions/models or programmes currently being used to treat adults with ADHD; and
3. Report on the outcomes or effectiveness of these studies.

The study used a systematic review methodology and considered peer-reviewed, full text studies that used both a qualitative and quantitative design, published from 2009–2019. The target population was adults (classified as 18 years and older) with a diagnosis of ADHD, inclusive of males and females. The study utilised an adapted version of the PRISMA and included four levels of review, namely identification, screening, eligibility, and summation. The method of data synthesis employed for this study was a descriptive meta-synthesis. Literature was retrieved from the UWC online Library Database using EBSCOhost. Databases that had a psychological and medical focus were identified and used to identify articles that fulfilled the inclusion criteria: Academic Search Complete, APA PsycArticles, MEDLINE and SocINDEX. The following search terms were used in this review: ADHD, Adult, intervention, programme, management, treatment, therapy, intervention models, intervention programmes, psychological interventions, psychological treatment, psychosocial strategies, modalities, psychotherapeutic approaches, and were combined into 12 Boolean phrases that were used during the identification process.

Fifty-two full-text journal articles were filtered by title and abstract and subjected to evaluation and appraised using the SFS critical appraisal tool. Forty articles satisfied the threshold score of 61% and were included in the final summation process. Two reviewers were independently involved in the title search, abstract search and critical appraisal process which assisted in ensuring a high degree of methodological rigour.

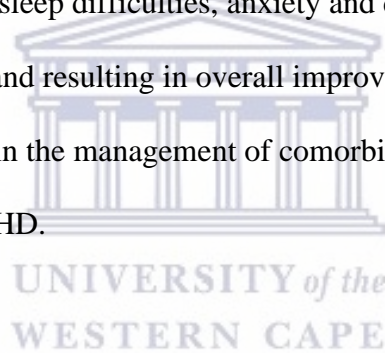
This review identified interventions in the following categories: pharmacological and non-pharmacological (which included interventions with a focus on neurostimulation techniques). In terms of pharmacological interventions, stimulants mentioned within the articles included MPH and amphetamines such as LDX and dextroamphetamine, which target the central nervous system. Some of the barriers to the use of stimulants that were identified included adverse effects such as insomnia, irritability, appetite suppression, weight loss,

gastrointestinal symptoms, headaches, heart palpitations and nervousness. Further barriers are a non-reduction in symptoms and/or the risk for addiction or abuse of the stimulants. In situations where stimulants were contra-indicated, non-stimulants were recommended. The review identified non-stimulants such as ATX, and memantine and donepezil (cholinesterase inhibitors), as well as nicotinic agonists which included ispronicline and pozanicline. Similar to the stimulants' side effects, the identified studies suggest that whilst the non-stimulants are not addictive in nature, they still present with adverse effects such as dry mouth, insomnia, nausea, decreased appetite, constipation, and decreased libido. Notwithstanding these adverse side effects, the non-stimulants are still seen as an effective treatment modality for adult ADHD. Although pharmacological treatment was the preferred modality of treatment the use of non-pharmacological interventions for adult ADHD were also emphasised as a vital modality in the effective treatment of adult ADHD. Non-pharmacological interventions have been identified and used in a significant number of studies in this review either as an alternative or as an adjunct to pharmacological treatment. The review identified various psychosocial interventions being used to assist in treatment of adult ADHD. The interventions were based on the following modalities: DBT, CBT, MBCT, MAP, CCT, meta-cognitive therapy, MBT, psychoeducation and coping skills. A second category of non-pharmacological intervention was classified as those with a focus on neuro-stimulation; the stimulation of particular parts of the brain considered as showing abnormal activity in adults with ADHD.

The authors of these studies were found to take on different approaches in their assessment of effectiveness. While some studies adopted a single-modality approach where one pharmaceutical or modality was tested alone, others chose a comparative method which looked at more than one pharmaceutical or modality to ascertain the most effective type of intervention. A third approach was identified which sought to combine techniques in a

multimodal approach. This typically involved both pharmacological and non-pharmacological techniques in a single intervention.

According to this review, the most effective interventions for use with adult ADHD were identified as the stimulant MPH, non-stimulant ATX as well as DBT, CBT and variations, mindfulness techniques and variations. In addition, neurofeedback and bright light therapy were identified as useful however, studies were minimal within this review. A combination of these was identified as increasing the effectiveness of the treatment of symptoms. These interventions were found to be effective in treating the core symptoms of ADHD which include inattention, hyperactivity and impulsivity. It was interesting to note that these interventions also benefitted the individual with regard to improvement in executive functioning, reducing sleep difficulties, anxiety and depression, and enhancing memory, emotional regulation, and resulting in overall improved quality of life. All of this was useful in terms of assisting in the management of comorbidities which we know to be present in many adults with ADHD.



### **Limitations**

Language bias limited the amount of data available for analysis as only English studies were included. Additionally, non-English studies with significant results were more likely to be reported in English language journals rather than those with non-significant results, thus results of the study may be biased.

According to Akers and colleagues (2009, p12), 'Publication bias occurs when the publication of a study is influenced by its results, hence inclusion of only published studies may overestimate the intervention effect'. Publication bias limited the sampling frame from which to retrieve articles pertaining to this topic, as this study used peer-reviewed journal articles only. However studies are not always published as articles in peer-reviewed journals

but may be presented as book chapters, theses, conference abstracts or alternatively, remain unpublished.

### **Significance of the Study**

This research study was planned and executed while following specific recommended best practice guidelines relevant for systematic review methodology. (Hennessy et al., 2019). This included the use of rigorous approaches to the synthesis of primary evidence, adherence to processes that are transparent and reproducible, and thorough reporting of these processes in the study. Reporting on potential bias and the use of methods that reduce the possibility of bias were also followed, thus enhancing coherence and methodological rigour of the study, and making it a suitable template for a good quality systematic review. A comprehensive critical appraisal tool was used for this study which meant a more vigorous operationalisation of methodological rigour and quality.

The primary contribution of this study is that it consolidated the literature and delivered information on the most recent and effective interventions available for use with adults with ADHD, which will add to the existing knowledge on this topic. The literature in this study further highlights the need for well-researched, effective interventions which can be used to assist in the management of adult ADHD symptoms. This allows for consideration of appropriate changes to take place in the relevant documentation pertaining to general policy on mental health, inclusive of workplace policies detailing management of adults living with ADHD. Additionally, this study could contribute towards the formation of jobs by providing areas for further research and intervention.

### **Recommendations for Future Study**

It is recommended for future research that the inclusion/exclusion criteria be revised with regards to including non-English language studies, and the study is replicated to be able

to gather more extensive and accurate literature in terms of the recent interventions available to adults with ADHD.

A second recommendation is for studies to be conducted using local samples, as a gap has been identified in the literature with regards to interventions available to adults with ADHD in the South African context.

It is recommended that extensive research be conducted on non-pharmacological interventions and potential alternative approaches to assist with the large number of adults requiring treatment, that do not involve the use of pharmaceuticals due to the adverse effects or addictive potential involved.

Lastly, it is recommended that research focusing on interventions with a more family-orientated approach be investigated due to the enormous impact of ADHD on the family context.



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## APPENDIX A: ETHICAL CLEARANCE



UNIVERSITY of the  
WESTERN CAPE



20 July 2020

Ms C Wakelin  
Psychology  
Faculty of Community and Health Sciences

**Ethics Reference Number:** HS20/5/6

**Project Title:** A systematic review of recent interventions in South Africa for adults with ADHD.

**Approval Period:** 26 June 2020 -26 June 2023

I hereby certify that the Humanities and Social Science Research Ethics Committee of the University of the Western Cape approved the methodology and ethics of the above mentioned research project.

Any amendments, extension or other modifications to the protocol must be submitted to the Ethics Committee for approval.

**Please remember to submit a progress report by 30 November each year for the duration of the project.**

*The permission to conduct the study must be submitted to HSSREC for record keeping purposes.*

The Committee must be informed of any serious adverse event and/or termination of the study.

*Ms Patricia Josias  
Research Ethics Committee Officer  
University of the Western Cape*

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University of the Western Cape  
Private Bag X 17  
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NHREC Registration Number: HSSREC-130416-049

FROM HOPE TO ACTION THROUGH KNOWLEDGE.



## APPENDIX B : TITLE SEARCH

	<b>Author</b>	<b>Date Published</b>	<b>Date obtained</b>	<b>Title and Source</b>	<b>Database</b>	<b>Location stored</b>
1	Dittner et al.	Sep-14	10 Dec 2020	Protocol for a proof of concept randomized controlled trial of cognitive-behavioural therapy for adult ADHD as a supplement to treatment as usual, compared with treatment as usual alone <i>BMC psychiatry</i>	Medline	DOI: 10.1186/s12888-014-0248-1
2	Onnink et al.	Mar-14	10 Dec 2020	Brain alterations in adult ADHD: effects of gender, treatment and comorbid depression. <i>European neuropsychopharmacology</i>	Medline	DOI: 10.1016/j.euroneuro.2013.11.011
3	Ramos-Quiroga et al	Sep-13	10 Dec 2020	Attention deficit hyperactivity disorder in the European adult population: prevalence, disease awareness, and treatment guidelines. <i>Current medical research and opinion</i>	Medline	DOI: 10.1185/03007995.2013.812961
4	Mao et al	Jul-11	10 Dec 2020	ADHD in adults: current treatment trends with consideration of abuse potential of medications. <i>Journal of psychiatric practice</i>	Medline	DOI: 10.1097/01.pra.0000400261.45290.bd
5	Philipsen	Oct-12	10 Dec 2020	Psychotherapy in adult attention deficit hyperactivity disorder: implications for treatment and research. <i>Expert review of neurotherapeutics</i>	Medline	DOI: 10.1586/ern.12.91
6	Brown et al	Jun-19	10 Dec 2020	The Patient Perspective: Unmet Treatment Needs in Adults With Attention-Deficit/Hyperactivity Disorder. <i>The primary care companion for CNS disorders</i>	Medline	DOI: 10.4088/PCC.18m02397
7	Jain et al	Sep-17	10 Dec 2020	Addressing Diagnosis and Treatment Gaps in Adults With Attention-Deficit/Hyperactivity Disorder. <i>The primary care companion for CNS disorders</i>	Medline	DOI: 10.4088/PCC.17nr02153
8	Biederman et al	Feb-17	10 Dec 2020	Memantine in the Treatment of Executive Function Deficits in Adults With ADHD. <i>Journal of attention disorders</i>	Medline	DOI: 10.1177/1087054714538656
9	Adler et al	Sep-19	10 Dec 2020	Healthcare provider perspectives on diagnosing and treating adults with attention-deficit/hyperactivity disorder. <i>Postgraduate medicine</i>	Medline	DOI: 10.1080/00325481.2019.1647080
10	Perugi et al	Aug-19	10 Dec 2020	Current and emerging pharmacotherapy for the treatment of adult attention deficit hyperactivity disorder (ADHD). <i>Expert opinion on pharmacotherapy</i>	Medline	DOI: 10.1080/14656566.2019.1618270
11	Jernelöv et al	Jul-19	10 Dec 2020	Effects and clinical feasibility of a behavioral treatment for sleep problems in adult attention deficit hyperactivity disorder (ADHD): a pragmatic within-group pilot evaluation. <i>BMC psychiatry</i>	Medline	DOI: 10.1186/s12888-019-2216-2

12	Janssen et al	Jan-19	10 Dec 2020	Mindfulness-based cognitive therapy v. treatment as usual in adults with ADHD: a multicentre, single-blind, randomised controlled trial. <i>Psychological medicine</i>	Medline	DOI: 10.1017/S0033291718000429
13	Lopez et al	Mar-18	10 Dec 2020	Cognitive-behavioural interventions for attention deficit hyperactivity disorder (ADHD) in adults <i>The Cochrane database of systematic reviews.</i>	Medline	DOI: 10.1002/14651858.CD010840.pub2
14	Dittner et al	Feb-18	10 Dec 2020	Cognitive-behavioural therapy for adult attention-deficit hyperactivity disorder: a proof of concept randomised controlled trial. <i>Acta psychiatrica Scandinavica</i>	Medline	DOI: 10.1111/acps.12836
15	McCarthy et al	Feb-13	10 Dec 2020	Management of adult attention deficit hyperactivity disorder in UK primary care: a survey of general practitioners. <i>Health and quality of life outcomes</i>	Medline	DOI: 10.1186/1477-7525-11-22
16	Lensing et al	Jan-13	10 Dec 2020	Four-year outcome in psychopharmacologically treated adults with attention-deficit/hyperactivity disorder: a questionnaire survey. <i>The Journal of clinical psychiatry</i>	Medline	DOI: 10.4088/JCP.12m07714
17	Schönenberg et al	Sep-17	10 Dec 2020	Neurofeedback, sham neurofeedback, and cognitive-behavioural group therapy in adults with attention-deficit hyperactivity disorder: a triple-blind, randomised, controlled trial. <i>The lancet. Psychiatry;</i>	Medline	DOI: 10.1016/S2215-0366(17)30291-2
18	Fleming et al	Dec-12	10 Dec 2020	Developmental context and treatment principles for ADHD among college students. <i>Clinical child and family psychology review</i>	Medline	DOI: 10.1007/s10567-012-0121-z
19	Fuermaier et al	May-17	10 Dec 2020	Effects of methylphenidate on memory functions of adults with ADHD. <i>Applied neuropsychology</i>	Medline	DOI: 10.1080/23279095.2015.1124108
20	Morgensterns et al	Jun-16	10 Dec 2020	Structured skills training for adults with ADHD in an outpatient psychiatric context: an open feasibility trial. <i>Attention deficit and hyperactivity disorders</i>	Medline	DOI: 10.1007/s12402-015-0182-1
21	Sobanski et al	Nov-15	10 Dec 2020	Patterns of long-term and short-term responses in adult patients with attention-deficit/hyperactivity disorder in a completer cohort of 12 weeks or more with atomoxetine. <i>European psychiatry : the journal of the Association of European Psychiatrists</i>	Medline	DOI: 10.1016/j.eurpsy.2015.09.005
22	Adler et al	Aug-14	10 Dec 2020	Executive function in adults with attention-deficit/hyperactivity disorder during treatment with atomoxetine in a randomized, placebo-controlled, withdrawal study. <i>Journal of clinical psychopharmacology</i>	Medline	DOI: 10.1097/JCP.0000000000000138
23	Potter et al	Feb-14	10 Dec 2020	AZD3480, a novel nicotinic receptor agonist, for the treatment of attention-deficit/hyperactivity disorder in adults. <i>Biological psychiatry</i>	Medline	DOI: 10.1016/j.biopsych.2013.06.002
24	Ni et al	Oct-13	10 Dec 2020	A head-to-head randomized clinical trial of methylphenidate and atomoxetine treatment for executive function in adults with attention-deficit hyperactivity disorder. <i>The international journal of neuropsychopharmacology</i>	Medline	DOI: 10.1017/S1461145713000357
25	Manos	Mar-13	10 Dec 2020	Psychosocial therapy in the treatment of adults with attention-deficit/hyperactivity disorder. <i>Postgraduate medicine</i>	Medline	DOI: 10.3810/pgm.2013.03.2641

26	Kooij et al	Jul-12	10 Dec 2020	Distinguishing comorbidity and successful management of adult ADHD. <i>Journal of attention disorders</i>	Medline	DOI: 10.1177/1087054711435361
27	Buitelaar et al	Feb-12	10 Dec 2020	Long-term efficacy and safety outcomes with OROS-MPH in adults with ADHD. <i>The international journal of neuropsychopharmacology</i>	Medline	DOI: 10.1017/S1461145711001131
28	Biederman et al	Jan-12	10 Dec 2020	Examining the association between stimulant treatment and cognitive outcomes across the life cycle of adults with attention-deficit/hyperactivity disorder: a controlled cross-sectional study. <i>The Journal of nervous and mental disease</i>	Medline	DOI: 10.1097/NMD.0b013e31823e55ef
29	Retz et al	Sep-11	10 Dec 2020	Pharmacological treatment of adult ADHD in Europe. <i>The world journal of biological psychiatry</i>	Medline	DOI: 10.3109/15622975.2011.603229
30	Emilsson et al	Jul-11	10 Dec 2020	Cognitive behaviour therapy in medication-treated adults with ADHD and persistent symptoms: a randomized controlled trial. <i>BMC psychiatry</i>	Medline	DOI: 10.1186/1471-244X-11-116
31	Liu et al	Apr-11	10 Dec 2020	Tea consumption maybe an effective active treatment for adult attention deficit hyperactivity disorder (ADHD) <i>Medical hypotheses</i>	Medline	DOI: 10.1016/j.mehy.2010.08.049
32	Hirvikoski et al	Mar-11	10 Dec 2020	Reduced ADHD symptoms in adults with ADHD after structured skills training group: results from a randomized controlled trial. <i>Behaviour research and therapy</i>	Medline	DOI: 10.1016/j.brat.2011.01.001
33	Adler et al	Feb-11	10 Dec 2020	Long-term safety of OROS methylphenidate in adults with attention-deficit/hyperactivity disorder: an open-label, dose-titration, 1-year study. <i>Journal of clinical psychopharmacology</i>	Medline	DOI: 10.1097/JCP.0b013e318203ea0a
34	Brown et al	Sep-10	10 Dec 2020	Open-label administration of lisdexamfetamine dimesylate improves executive function impairments and symptoms of attention-deficit/hyperactivity disorder in adults. <i>Postgraduate medicine</i>	Medline	DOI: 10.3810/pgm.2010.09.2196
35	Gerhard et al	May-10	10 Dec 2020	Pre-existing cardiovascular conditions and pharmacological treatment of adult ADHD. <i>Pharmacoeconomics and drug safety</i>	Medline	DOI: 10.1002/pds.1931
36	Gu et al	Feb-18	10 Dec 2020	A Randomized Controlled Trial of Mindfulness-Based Cognitive Therapy for College Students With ADHD. <i>Journal of attention disorders</i>	Medline	DOI: 10.1177/1087054716686183
37	Fleming et al	Mar-15	10 Dec 2020	Pilot randomized controlled trial of dialectical behavior therapy group skills training for ADHD among college students. <i>Journal of attention disorders</i>	Medline	DOI: 10.1177/1087054714535951
38	Goodman et al	Jan-17	10 Dec 2020	Randomized, 6-Week, Placebo-Controlled Study of Treatment for Adult Attention-Deficit/Hyperactivity Disorder: Individualized Dosing of Osmotic-Release Oral System (OROS) Methylphenidate With a Goal of Symptom Remission. <i>The Journal of clinical psychiatry</i>	Medline	DOI: 10.4088/JCP.15m10348
39	Adamou et al	Nov-16	10 Dec 2020	Advancing services for adult ADHD: the development of the ADHD Star as a framework for multidisciplinary interventions. <i>BMC health services research</i>	Medline	DOI: 10.1186/s12913-016-1894-4

40	Bachmann et al	May-18		Effects of mindfulness and psychoeducation on working memory in adult ADHD: A randomised, controlled fMRI study. <i>Behaviour research and therapy</i>	Medline	DOI: 10.1016/j.brat.2018.05.002
41	Bastiaens et al	Mar-2019	16 Dec 2020	Treatment of Adult ADHD without Stimulants: Effectiveness in A Dually Diagnosed Correctional Population. <i>Psychiatric Quarterly</i>	Academic Search Complete	DOI: 10.1007/s11126-018-9602-7
42	Hoxhaj et al	Jan-2018	10 Dec 2020	Mindfulness vs psychoeducation in adult ADHD: a randomized controlled trial. <i>European archives of psychiatry and clinical neuroscience</i>	Medline	DOI: 10.1007/s00406-018-0868-4
43	In de Braek et al	Dec-2012	10 Dec 2020	Goal Management Training in Adults With ADHD: An Intervention Study. <i>Journal of attention disorders</i>	Medline	DOI: 10.1177/1087054712468052
44	Solanto et al	Mar-2010	10 Dec 2020	Efficacy of meta-cognitive therapy for adult ADHD. <i>The American journal of psychiatry</i>	Medline	DOI: 10.1176/appi.ajp.2009.09081123
45	Newark et al	Apr-2010	10 Dec 2020	Therapy-relevant factors in adult ADHD from a cognitive behavioural perspective. <i>Attention deficit and hyperactivity disorders</i>	Medline	DOI: 10.1007/s12402-010-0023-1
46	Philipsen et al	Dec-2015	10 Dec 2020	Effects of Group Psychotherapy, Individual Counseling, Methylphenidate, and Placebo in the Treatment of Adult Attention-Deficit/Hyperactivity Disorder: A Randomized Clinical Trial. <i>JAMA psychiatry</i>	Medline	DOI: 10.1001/jamapsychiatry.2015.2146
47	Solanto et al	Feb- 2018	10 Dec 2020	The efficacy of cognitive-behavioral therapy for older adults with ADHD: a randomized controlled trial. <i>Attention deficit and hyperactivity disorders</i>	Medline	DOI: 10.1007/s12402-018-0253-1
48	Young et al	Nov-2016	10 Dec 2020	Adult Attention-Deficit/Hyperactivity Disorder Diagnosis, Management, and Treatment in the DSM-5 Era. <i>The primary care companion for CNS disorders</i>	Medline	DOI: 10.4088/PCC.16r02000
49	Mitchell et al	Dec-2013	10 Dec 2020	A Pilot Trial of Mindfulness Meditation Training for ADHD in Adulthood: Impact on Core Symptoms, Executive Functioning, and Emotion Dysregulation. <i>Journal of attention disorders</i>	Medline	DOI: 10.1177/1087054713513328
50	Verbeeck et al	Oct-2017	10 Dec 2020	Bupropion for attention deficit hyperactivity disorder (ADHD) in adults. <i>The Cochrane database of systematic reviews</i>	Medline	DOI: 10.1002/14651858.CD009504.pub2
51	Young et al	May-2015	10 Dec 2020	Cognitive-behavioural therapy in medication-treated adults with attention-deficit/hyperactivity disorder and co-morbid psychopathology: a randomized controlled trial using multi-level analysis. <i>Psychological medicine</i>	Medline	DOI: 10.1017/S0033291715000756
52	Bueno et al	Jun-2015	10 Dec 2020	Mindfulness Meditation Improves Mood, Quality of Life, and Attention in Adults with Attention Deficit Hyperactivity Disorder. <i>BioMed research international</i>	Medline	DOI: 10.1155/2015/962857
53	Philipsen et al	Aug-2012	10 Dec 2020	Psychotherapy in adult attention deficit hyperactivity disorder: implications for treatment and research. <i>Expert review of neurotherapeutics</i>	Medline	DOI: 10.1586/ern.12.91

54	Edel et al	Jul-2016	10 Dec 2020	A Comparison of Mindfulness-Based Group Training and Skills Group Training in Adults With ADHD. <i>Journal of attention disorders</i>	Medline	DOI: 10.1177/1087054714551635
55	Chandler	Mar-2013	10 Dec 2020	Psychotherapy for adult attention deficit/hyperactivity disorder: a comparison with cognitive behaviour therapy. <i>Journal of psychiatric and mental health nursing</i>	Medline	DOI: 10.1111/jpm.12023
56	Chronis-Tuscano et al	Sep-2012	10 Dec 2020	Pharmacotherapy for parents with attention-deficit hyperactivity disorder (ADHD): impact on maternal ADHD and parenting. <i>CNS drugs</i>	Medline	DOI: 10.2165/11633910-000000000-00000
57	Stern et al	Apr-2014	10 Dec 2020	The Efficacy of Computerized Cognitive Training in Adults With ADHD: A Randomized Controlled Trial. <i>Journal of attention disorders</i>	Medline	DOI: 10.1177/1087054714529815
58	Knouse et al	Sep-2010	10 Dec 2020	Current status of cognitive behavioral therapy for adult attention-deficit hyperactivity disorder. <i>The Psychiatric clinics of North America</i>	Medline	DOI: 10.1016/j.psc.2010.04.001
59	Low et al	Dec-2018	10 Dec 2020	Visual attention in adults with attention-deficit/hyperactivity disorder before and after stimulant treatment. <i>Psychological medicine</i>	Medline	DOI: 10.1017/S0033291718003628
60	Volkow et al	Jan-12	10 Dec 2020	Methylphenidate-elicited dopamine increases in ventral striatum are associated with long-term symptom improvement in adults with attention deficit hyperactivity disorder. <i>The Journal of neuroscience</i>	Medline	DOI: 10.1523/JNEUROSCI.4461-11.2012
61	Zhou et al	Jul-2018	10 Dec 2020	Treatment patterns among adults with ADHD receiving long-acting therapy. <i>The American journal of managed care</i>	Medline	<a href="https://pubmed.ncbi.nlm.nih.gov/30020748/">https://pubmed.ncbi.nlm.nih.gov/30020748/</a>
62	Vidal et al	Oct-2013	10 Dec 2020	Psychoeducation for adults with attention deficit hyperactivity disorder vs. cognitive behavioral group therapy: a randomized controlled pilot study. <i>The Journal of nervous and mental disease</i>	Medline	DOI: 10.1097/NMD.0b013e3182a5c2c5
63	Hepark et al	Nov-2015	10 Dec 2020	The Efficacy of Adapted MBCT on Core Symptoms and Executive Functioning in Adults With ADHD: A Preliminary Randomized Controlled Trial. <i>Journal of attention disorders</i>	Medline	DOI: 10.1177/1087054715613587
64	Huang et al	Apr-2015	10 Dec 2020	Cognitive behavioral therapy for adults with attention-deficit hyperactivity disorder: study protocol for a randomized controlled trial. <i>Trials</i>	Medline	DOI: 10.1186/s13063-015-0686-1
65	Philipsen et al	Nov-2010	10 Dec 2020	Evaluation of the efficacy and effectiveness of a structured disorder tailored psychotherapy in ADHD in adults: study protocol of a randomized controlled multicentre trial. <i>Attention deficit and hyperactivity disorders</i>	Medline	DOI: 10.1007/s12402-010-0046-7
66	Adler et al	Jul-2010	16 Dec 2020	Open Label Pilot Study of Atomoxetine in Adults With ADHD and Substance Use Disorder. <i>Journal of Dual Diagnosis</i>	SOCIndex	DOI: 10.1080/15504263.2010.537224
67	Takahashi et al	Feb-2011	16 Dec 2020	An open-label, dose-titration tolerability study of atomoxetine hydrochloride in Japanese adults with attention-deficit/hyperactivity disorder. <i>Psychiatry &amp; Clinical Neurosciences</i>	Academic Search Complete	DOI: 10.1111/j.1440-1819.2010.02159.x

68	Groeneveld et al	Dec-2019	16 Dec 2020	Z-Score Neurofeedback and Heart Rate Variability Training for Adults and Children with Symptoms of Attention-Deficit/Hyperactivity Disorder: A Retrospective Study. <i>Applied Psychophysiology &amp; Biofeedback</i>	Academic Search Complete	DOI: 10.1007/s10484-019-09439-x
69	Verster et al	Oct-2010	16 Dec 2020	Methylphenidate significantly improves declarative memory functioning of adults with ADHD. <i>Psychopharmacology</i>	Academic Search Complete	DOI: 10.1007/s00213-010-1952-2
70	Wentz et al	Nov-2012	16 Dec 2020	Development of an internet-based support and coaching model for adolescents and young adults with ADHD and autism spectrum disorders: a pilot study. <i>European Child &amp; Adolescent Psychiatry</i>	Academic Search Complete	DOI: 10.1007/s00787-012-0297-2
71	Tsai et al	Feb-2019	10 Dec 2020	Psychiatric Comorbid patterns in adults with attention- deficit hyperactivity disorder: Treatment effect and subtypes <i>PloS one</i>	Medline	DOI: 10.1371/journal.pone.0211873
72	Cassidy et al	Apr-15	10 Dec 2020	Nonmedical use of prescription ADHD stimulant medications among adults in a substance abuse treatment population: early findings from the NAVIPPRO surveillance system. <i>Journal of attention disorders</i>	Medline	DOI: 10.1177/1087054713493321
73	van de Glind et al	Jan-14	10 Dec 2020	Variability in the prevalence of adult ADHD in treatment seeking substance use disorder patients: results from an international multi-center study exploring DSM-IV and DSM-5 criteria. <i>Drug and alcohol dependence</i>	Medline	DOI: 10.1016/j.drugalcdep.2013.04.010
74	Unal et al	Sep-15	10 Dec 2020	Association of adult attention deficit hyperactivity disorder subtypes and response to methylphenidate HCL treatment: A magnetic resonance spectroscopy study. <i>Neuroscience letters</i>	Medline	DOI: 10.1016/j.neulet.2015.08.006
75	Wietecha et al	Jun-12	10 Dec 2020	Atomoxetine once daily for 24 weeks in adults with attention-deficit/hyperactivity disorder (ADHD): impact of treatment on family functioning. <i>Clinical neuropharmacology</i>	Medline	DOI: 10.1097/WNF.0b013e3182560315
76	Young et al	Nov-16	10 Dec 2020	Adult Attention-Deficit/Hyperactivity Disorder Diagnosis, Management, and Treatment in the DSM-5 Era. <i>The primary care companion for CNS disorders</i>	Medline	DOI: 10.4088/PCC.16r02000
77	Lin et al	Sep-15	10 Dec 2020	Atomoxetine Treatment Strengthens an Anti-Correlated Relationship between Functional Brain Networks in Medication-Naïve Adults with Attention-Deficit Hyperactivity Disorder: A Randomized Double-Blind Placebo-Controlled Clinical Trial. <i>The international journal of neuropsychopharmacology</i>	Medline	DOI: 10.1093/ijnp/pyv094
78	Leahy	Dec-18	10 Dec 2020	Diagnosis and treatment of ADHD in children vs adults: What nurses should know. <i>Archives of psychiatric nursing</i>	Medline	DOI: 10.1016/j.apnu.2018.06.013
79	Babcock et al	Dec-12	10 Dec 2020	Efficacy of lisdexamfetamine dimesylate in adults with attention-deficit/hyperactivity disorder previously treated with amphetamines: analyses from a randomized, double-blind, multicenter, placebo-controlled titration study. <i>BMC pharmacology &amp; toxicology</i>	Medline	DOI: 10.1186/2050-6511-13-18
80	Young et al	Feb-11	10 Dec 2020	The identification and management of ADHD offenders within the criminal justice system: a consensus statement from the UK Adult ADHD Network and criminal justice agencies. <i>BMC psychiatry</i>	Medline	DOI: 10.1186/1471-244X-11-32

81	Muit et al	Jan-20	10 Dec 2020	Pharmacotherapy of ADHD in Adults With Autism Spectrum Disorder: Effectiveness and Side Effects. <i>Journal of attention disorders</i>	Medline	DOI: 10.1177/1087054719866255
82	Asherson et al	Jun-15	10 Dec 2020	The effects of atomoxetine on emotional control in adults with ADHD: An integrated analysis of multicenter studies. <i>European psychiatry : the journal of the Association of European Psychiatrists</i>	Medline	DOI: 10.1016/j.eurpsy.2014.12.002
83	Torgersen et al	Dec-14	10 Dec 2020	Factors associated with a positive occupational outcome during long-term central stimulant treatment in adult ADHD. <i>Attention deficit and hyperactivity disorders</i>	Medline	DOI: 10.1007/s12402-014-0135-0
84	Retz et al	Nov-14	10 Dec 2020	Prediction of methylphenidate treatment outcome in adults with attention-deficit/hyperactivity disorder (ADHD). <i>European archives of psychiatry and clinical neuroscience</i>	Medline	DOI: 10.1007/s00406-014-0542-4
85	Torgersen et al	Oct-2012	10 Dec 2020	Predictive factors for more than 3 years' duration of central stimulant treatment in adult attention-deficit/hyperactivity disorder: a retrospective, naturalistic study. <i>Journal of clinical psychopharmacology</i>	Medline	DOI: 10.1097/JCP.0b013e3182664dbc
86	Adler et al	Jan-2017	10 Dec 2020	Effectiveness and Duration of Effect of Open-Label Lisdexamfetamine Dimesylate in Adults With ADHD. <i>Journal of attention disorders</i>	Medline	DOI: 10.1177/1087054713485421
87	Carpentier et al	Mar-2017	10 Dec 2020	Pharmacological Treatment of ADHD in Addicted Patients: What Does the Literature Tell Us? <i>Harvard review of psychiatry</i>	Medline	DOI: 10.1097/HRP.0000000000000122
88	Goodman et al	Sep-2011	10 Dec 2020	Managing ADHD across the lifespan in the primary care setting. <i>Postgraduate medicine</i>	Medline	DOI: 10.3810/pgm.2011.09.2456
89	Castells et al	Jun-2011	10 Dec 2020	Amphetamines for Attention Deficit Hyperactivity Disorder (ADHD) in adults. <i>The Cochrane database of systematic reviews</i>	Medline	DOI: 10.1002/14651858.CD007813.pub2
90	Newlove-Delgado et al	Dec-2019	16 Dec 2020	Resumption of attention-deficit hyperactivity disorder medication in early adulthood: findings from a UK primary care prescribing study. <i>European Child &amp; Adolescent Psychiatry</i>	Academic Search Complete	DOI: 10.1007/s00787-019-01325-5
91	Nielsen et al	May-2017	16 Dec 2020	Processing speed can monitor stimulant-medication effects in adults with attention deficit disorder with hyperactivity. <i>Nordic Journal of Psychiatry</i>	Academic Search Complete	DOI: 10.1080/08039488.2017.1280534
92	Apostol et al	Feb-2012	16 Dec 2020	Efficacy and safety of the novel $\alpha\beta$ neuronal nicotinic receptor partial agonist ABT-089 in adults with attention-deficit/hyperactivity disorder: a randomized, double-blind, placebo-controlled crossover study. <i>Psychopharmacology</i>	Academic Search Complete	DOI: 10.1007/s00213-011-2393-2
93	Zoëga et al	May-2011	16 Dec 2020	Use of ADHD drugs in the Nordic countries: a population-based comparison study. <i>Acta Psychiatrica Scandinavica</i>	Academic Search Complete	DOI: 10.1111/j.1600-0447.2010.01607.x
94	Agay et al	Jul-2010	16 Dec 2020	Non-specific effects of methylphenidate (Ritalin) on cognitive ability and decision-making of ADHD and healthy adults. <i>Psychopharmacology</i>	Academic Search Complete	DOI: 10.1007/s00213-010-1853-4

95	Schermann et al	Mar-2019	10 Dec 2020	Lower risk of stress fractures in young adults with ADHD under chronic treatment with methylphenidate <i>Bone</i>	Medline	DOI: 10.1016/j.bone.2018.09.023
96	Ramos-Quiroga et al	Apr-2014	16 Dec 2020	Changes in the serum levels of brain-derived neurotrophic factor in adults with attention deficit hyperactivity disorder after treatment with atomoxetine. <i>Psychopharmacology</i>	Academic Search Complete	DOI: 10.1007/s00213-013-3343-y
97	Pérez de Los Cobos et al	Jan-2011	10 Dec 2020	Features and prevalence of patients with probable adult attention deficit hyperactivity disorder who request treatment for cocaine use disorders. <i>Psychiatry research</i>	Medline	DOI: 10.1016/j.psychres.2009.03.019
98	Frodl et al	Feb-2012	16 Dec 2020	Meta-analysis of structural MRI studies in children and adults with attention deficit hyperactivity disorder indicates treatment effects. <i>Acta psychiatrica Scandinavica</i>	Medline	DOI: 10.1111/j.1600-0447.2011.01786.x
99	Rösler et al	May-2010	16 Dec 2020	Psychopathological rating scales as efficacy parameters in adult ADHD treatment investigations - benchmarking instruments for international multicentre trials. <i>Pharmacopsychiatry</i>	Medline	DOI: 10.1055/s-0029-1242819
100	Chung et al	Nov-2019	16 Dec 2020	Trends in the Prevalence and Incidence of Attention-Deficit/Hyperactivity Disorder Among Adults and Children of Different Racial and Ethnic Groups. <i>JAMA network open</i>	Medline	DOI: 10.1001/jamanetworkopen.2019.14344
101	Taylor	Nov-2019	16 Dec 2020	ADHD Medication in the Longer Term. <i>Zeitschrift für Kinder- und Jugendpsychiatrie und Psychotherapie</i>	Medline	DOI: 10.1024/1422-4917/a000664
102	Brandt et al	Oct-2019	16 Dec 2020	Adult ADHD Is Associated With Gambling Severity and Psychiatric Comorbidity Among Treatment-Seeking Problem Gamblers. <i>Journal of attention disorders</i>	Medline	DOI: 10.1177/1087054717690232
103	Arvidsson et al	Feb-2019	16 Dec 2020	Methylphenidate effects on processing speed in a clinical sample of adults with ADHD and substance use disorder: a pilot study. <i>Nordic Journal of Psychiatry</i>	Academic Search Complete	DOI: 10.1080/08039488.2019.1573922
104	Fuermaier et al	Feb-2014	10 Dec 2020	Good vibrations--effects of whole body vibration on attention in healthy individuals and individuals with ADHD. <i>PloS one</i>	Medline	DOI: 10.1371/journal.pone.0090747
105	Abel et al	2014	16 Dec 2020	Stimulant medication for ADHD in opioid maintenance treatment. <i>Journal of Dual Diagnosis</i>	SOCIndex	DOI: 10.1080/15504263.2013.867657
106	Oddo et al	Mar-2018	10 Dec 2020	Investigating Resilience to Depression in Adults With ADHD. <i>Journal of attention disorders</i>	Medline	DOI: 10.1177/1087054716636937
107	Spencer et al	Jan-2018	10 Dec 2020	Opiate Antagonists Do Not Interfere With the Clinical Benefits of Stimulants in ADHD: A Double-Blind, Placebo-Controlled Trial of the Mixed Opioid Receptor Antagonist Naltrexone. <i>The Journal of clinical psychiatry</i>	Medline	DOI: 10.4088/JCP.16m11012
108	Fan et al	Oct-2017	10 Dec 2020	Neural correlates of atomoxetine improving inhibitory control and visual processing in Drug-naïve adults with attention-deficit/hyperactivity disorder.	Medline	DOI: 10.1002/hbm.23683



				<i>Human brain mapping</i>		
109	Fargason et al	Aug-2017	10 Dec 2020	Correcting delayed circadian phase with bright light therapy predicts improvement in ADHD symptoms: A pilot study. <i>Journal of psychiatric research</i>	Medline	DOI: 10.1016/j.jpsychires.2017.03.004
110	Schranter et al	Nov-2016	10 Dec 2020	The age-dependent effects of a single-dose methylphenidate challenge on cerebral perfusion in patients with attention-deficit/hyperactivity disorder. <i>NeuroImage. Clinical</i>	Medline	DOI: 10.1016/j.nicl.2016.11.021
111	Rosenberg et al	Sep-2016	10 Dec 2020	Methylphenidate Modulates Functional Network Connectivity to Enhance Attention. <i>The Journal of neuroscience : the official journal of the Society for Neuroscience</i>	Medline	DOI: 10.1523/JNEUROSCI.1746-16.2016
112	Ni et al	May-2016	10 Dec 2020	Atomoxetine could improve intra-individual variability in drug-naïve adults with attention-deficit/hyperactivity disorder comparably with methylphenidate: A head-to-head randomized clinical trial. <i>Journal of psychopharmacology</i>	Medline	DOI: 10.1177/0269881116632377
113	Bushe et al	Apr-2016	10 Dec 2020	Post Hoc Analysis of Potential Predictors of Response to Atomoxetine for the Treatment of Adults with Attention-Deficit/Hyperactivity Disorder using an Integrated Database. <i>CNS drugs</i>	Medline	DOI: 10.1007/s40263-016-0323-x
114	Buitelaar et al	Oct-2015	10 Dec 2020	Differences in maintenance of response upon discontinuation across medication treatments in attention-deficit/hyperactivity disorder. <i>European neuropsychopharmacology : the journal of the European College of Neuropsychopharmacology</i>	Medline	DOI: 10.1016/j.euroneuro.2015.06.003
115	Rovaris et al	Jul-2014	10 Dec 2020	Should we keep on? Looking into pharmacogenomics of ADHD in adulthood from a different perspective. <i>Pharmacogenomics</i>	Medline	DOI: 10.2217/pgs.14.95
116	Victor et al	Apr-2014	10 Dec 2020	Severity but not comorbidities predicts response to methylphenidate in adults with attention-deficit/hyperactivity disorder: results from a naturalistic study. <i>Journal of clinical psychopharmacology</i>	Medline	DOI: 10.1097/JCP.0000000000000091
117	Matheson et al	May-2013	10 Dec 2020	Adult ADHD patient experiences of impairment, service provision and clinical management in England: a qualitative study. <i>BMC health services research</i>	Medline	DOI: 10.1186/1472-6963-13-184
118	Faraone et al	Aug-2019	10 Dec 2020	The Adult ADHD Quality Measures Initiative. <i>Journal of attention disorders</i>	Medline	DOI: 10.1177/1087054718804354
119	Brams et al	Jul-2012	10 Dec 2020	Maintenance of efficacy of lisdexamfetamine dimesylate in adults with attention-deficit/hyperactivity disorder: randomized withdrawal design. <i>The Journal of clinical psychiatry</i>	Medline	DOI: 10.4088/JCP.11m07430
120	Bain et al	Jun-2012	10 Dec 2020	A randomized pilot study of the efficacy and safety of ABT-089, a novel $\alpha 4\beta 2$ neuronal nicotinic receptor agonist, in adults with attention-deficit/hyperactivity disorder. <i>The Journal of clinical psychiatry</i>	Medline	DOI: 10.4088/JCP.10m06719

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122	Wilens et al	Dec-2011	10 Dec 2020	Correlates of alcohol use in adults with ADHD and comorbid alcohol use disorders: exploratory analysis of a placebo-controlled trial of atomoxetine. <i>Current medical research and opinion</i>	Medline	DOI: 10.1185/03007995.2011.628648
123	Mao et al	Sep-2011	10 Dec 2020	A physician's guide to helping patients with ADHD find success in the workplace. <i>Postgraduate medicine</i>	Medline	DOI: 10.3810/pgm.2011.09.2460
124	Konstenius et al	Apr-2010	10 Dec 2020	Sustained release methylphenidate for the treatment of ADHD in amphetamine abusers: a pilot study. <i>Drug and alcohol dependence</i>	Medline	DOI: 10.1016/j.drugalcdep.2009.11.006
125	Allenby et al	Sep-2018	10 Dec 2020	Transcranial direct current brain stimulation decreases impulsivity in ADHD. <i>Brain stimulation</i>	Medline	DOI: 10.1016/j.brs.2018.04.016
126	Ramsay	Dec-2014	10 Dec 2020	Health care systems issues and disparities in ADHD care for African American adults. <i>The Journal of clinical psychiatry</i>	Medline	DOI: 10.4088/JCP.13008tx2c
127	Katzman et al	Aug-2017	10 Dec 2020	Adult ADHD and comorbid disorders: clinical implications of a dimensional approach. <i>BMC psychiatry</i>	Medline	DOI: 10.1186/s12888-017-1463-3
128	Nicastro et al	Jun-2017	10 Dec 2020	Subjective Distress Associated with Adult ADHD: evaluation of a new self-report. <i>Attention deficit and hyperactivity disorders</i>	Medline	DOI: 10.1007/s12402-017-0234-9
129	Ford	Jan-2020	10 Dec 2020	Transitional care for young adults with ADHD: transforming potential upheaval into smooth progression. <i>Epidemiology and psychiatric sciences</i>	Medline	DOI: 10.1017/S2045796019000817
130	Winhusen et al	May-2010	10 Dec 2020	Impact of attention-deficit/hyperactivity disorder (ADHD) treatment on smoking cessation intervention in ADHD smokers: a randomized, double-blind, placebo-controlled trial. <i>The Journal of clinical psychiatry</i>	Medline	DOI: 10.4088/JCP.09m05089gry
131	Surman et al	Jan-2019	10 Dec 2020	Does L-Methylfolate Supplement Methylphenidate Pharmacotherapy in Attention-Deficit/Hyperactivity Disorder?: Evidence of Lack of Benefit From a Double-Blind, Placebo-Controlled, Randomized Clinical Trial. <i>Journal of clinical psychopharmacology</i>	Medline	DOI: 10.1097/JCP.0000000000000990
132	Lugoboni et al	Jan-2017	10 Dec 2020	Co-occurring Attention Deficit Hyperactivity Disorder symptoms in adults affected by heroin dependence: Patients characteristics and treatment needs. <i>Psychiatry research</i>	Medline	DOI: 10.1016/j.psychres.2017.01.052
133	Rapinesi et al	Sep-2018	10 Dec 2020	Depressive symptoms, temperament/character, and attention deficit/hyperactivity disorder traits in medical students seeking counseling. <i>Psychiatria Danubina</i>	Medline	DOI: 10.24869/psyd.2018.305
134	Corbisiero et al	Dec-2012	10 Dec 2020	Is emotional dysregulation part of the psychopathology of ADHD in adults? <i>Attention deficit and hyperactivity disorders</i>	Medline	DOI: 10.1007/s12402-012-0097-z
135	Hinshaw et al	May-2011	10 Dec 2020	International variation in treatment procedures for ADHD: social context and recent trends. <i>Psychiatric services</i>	Medline	DOI: 10.1176/ps.62.5.pss6205_0459

136	Usher et al	Apr-2013	10 Dec 2020	Attention deficit hyperactivity disorder in a Canadian prison population. <i>International journal of law and psychiatry</i>	Medline	DOI: 10.1016/j.ijlp.2013.04.005
137	Johnston et al	Feb-2012	10 Dec 2020	Parenting in adults with attention-deficit/hyperactivity disorder (ADHD). <i>Clinical psychology review</i>	Medline	DOI: 10.1016/j.cpr.2012.01.007
138	Antshel et al	Jun-2011	10 Dec 2020	Advances in understanding and treating ADHD. <i>BMC medicine</i>	Medline	DOI: 10.1186/1741-7015-9-72
139	Chronis-Tuscano et al	Jan-2010	10 Dec 2020	Effects of maternal stimulant medication on observed parenting in mother-child dyads with attention-deficit/hyperactivity disorder. <i>Journal of clinical child and adolescent psychology</i>	Medline	DOI: 10.1080/15374416.2010.486326
140	Mowinckel et al	Mar-2017	10 Dec 2020	Increased default-mode variability is related to reduced task-performance and is evident in adults with ADHD. <i>NeuroImage. Clinical</i>	Medline	DOI: 10.1016/j.nicl.2017.03.008
141	Banaschewski et al	Jun-2018	10 Dec 2020	Supplementation with polyunsaturated fatty acids (PUFAs) in the management of attention deficit hyperactivity disorder (ADHD). <i>Nutrition and health</i>	Medline	DOI: 10.1177/0260106018772170
142	Shen et al	Dec-2013	10 Dec 2020	The role of trait impulsivity in response inhibition: event-related potentials in a stop-signal task. <i>International journal of psychophysiology</i>	Medline	DOI: 10.1016/j.ijpsycho.2013.11.004
143	Puyjarinet et al	Sep-2017	10 Dec 2020	Children and adults with Attention-Deficit/Hyperactivity Disorder cannot move to the beat. <i>Scientific reports</i>	Medline	DOI: 10.1038/s41598-017-11295-w
144	Rogers et al	Dec-2016	10 Dec 2020	Fatigue in an adult attention deficit hyperactivity disorder population: A trans-diagnostic approach. <i>The British journal of clinical psychology</i>	Medline	DOI: 10.1111/bjc.12119
145	Biederman et al	Jul-2012	10 Dec 2020	Adult outcome of attention-deficit/hyperactivity disorder: a controlled 16-year follow-up study. <i>The Journal of clinical psychiatry</i>	Medline	DOI: 10.4088/JCP.11m07529
146	Newark et al	Oct-2012	10 Dec 2020	Self-Esteem, Self-Efficacy, and Resources in Adults With ADHD. <i>Journal of attention disorders</i>	Medline	DOI: 10.1177/1087054712459561
147	Kabul et al	Aug-2015	10 Dec 2020	Real-World Dosing Patterns of Atomoxetine in Adults with Attention-Deficit/Hyperactivity Disorder. <i>CNS neuroscience &amp; therapeutics</i>	Medline	DOI: 10.1111/cns.12442
148	Franzen et al	Sep-2013	10 Dec 2020	Atypical coupling between posterior regions of the default mode network in attention-deficit/hyperactivity disorder: a pharmaco-magnetoencephalography study <i>Journal of psychiatry &amp; neuroscience</i>	Medline	DOI: 10.1503/jpn.120054
149	Fogler et al	Nov-2017	10 Dec 2020	Topical Review: Transitional Services for Teens and Young Adults With Attention-Deficit Hyperactivity Disorder: A Process Map and Proposed Model to Overcoming Barriers to Care. <i>Journal of pediatric psychology</i>	Medline	DOI: 10.1093/jpepsy/jsx102
150	Hall et al	Jul-2013	10 Dec 2020	'Mind the gap'--mapping services for young people with ADHD transitioning from child to adult mental health services. <i>BMC psychiatry</i>	Medline	DOI: 10.1186/1471-244X-13-186
151	Culpepper et al	Jul-2013	10 Dec 2020	Attention-deficit/hyperactivity disorder in a chronic care paradigm. <i>Postgraduate medicine</i>	Medline	DOI: 10.3810/pgm.2013.07.2680

152	Emmerik-van Oortmerssen et al	Feb-2014	16 Dec 2020	Psychiatric comorbidity in treatment-seeking substance use disorder patients with and without attention deficit hyperactivity disorder: results of the IASP study <i>Addiction</i>	SOCIndex	DOI: 10.1111/add.12370
153	Brunette et al	Jul-2010	14 Dec 2020	ADHD in Dual Diagnosis Patients. <i>Journal of Dual Diagnosis</i>	SOCIndex	DOI: 10.1080/15504263.2010.540773
154	Pedersen	Jun-2015	16 Dec 2020	From badness to illness: Medical cannabis and self-diagnosed attention deficit hyperactivity disorder. <i>Addiction Research &amp; Theory</i>	Academic Search Complete	DOI: 10.3109/16066359.2014.954556
155	Bröer et al	Jan-2013	16 Dec 2020	Neurobiology in public and private discourse: the case of adults with ADHD. <i>Sociology of Health &amp; Illness</i>	SOCIndex	DOI: 10.1111/j.1467-9566.2012.01477.x
156	Yule et al	Jan-2019	16 Dec 2020	Integrating Treatment for Co-Occurring Mental Health Conditions. <i>Alcohol Research: Current Reviews</i>	Academic Search Complete	DOI: 10.35946/arc.v40.1.07
157	Häge et al	Aug-2018	16 Dec 2020	Does the efficacy of parent-child training depend on maternal symptom improvement? Results from a randomized controlled trial on children and mothers both affected by attention-deficit/hyperactivity disorder (ADHD). <i>European Child &amp; Adolescent Psychiatry</i>	Academic Search Complete	DOI: 10.1007/s00787-018-1109-0
158	Caballero-Puntiverio et al	Jun-2019	16 Dec 2020	Effect of ADHD medication in male C57BL/6J mice performing the rodent Continuous Performance Test. <i>Psychopharmacology</i>	Academic Search Complete	DOI: 10.1007/s00213-019-5167-x
159	Jucaite et al	Mar-2014	16 Dec 2020	A randomized, double-blind, placebo-controlled crossover study of $\alpha\beta^*$ nicotinic acetylcholine receptor agonist AZD1446 (TC-6683) in adults with attention-deficit/hyperactivity disorder. <i>Psychopharmacology</i>	Academic Search Complete	DOI: 10.1007/s00213-013-3116-7
160	Torres et al	Nov-2015	16 Dec 2020	Bipolar disorder with comorbid attention-deficit and hyperactivity disorder. Main clinical features and clues for an accurate diagnosis. <i>Acta Psychiatrica Scandinavica</i>	Academic Search Complete	DOI: 10.1111/acps.12426
161	Ayako et al	Aug-2018	16 Dec 2020	Deficient neural activity subserving decision-making during reward waiting time in intertemporal choice in adult attention-deficit hyperactivity disorder. <i>Psychiatry &amp; Clinical Neurosciences</i>	Academic Search Complete	DOI: 10.1111/pcn.12668
162	None stated	Apr-2016	16 Dec 2020	Pharmacotherapy of ADHD in Slovenia: realities and perspectives. <i>European Child &amp; Adolescent Psychiatry</i>	Academic Search Complete	DOI: 10.1007/s00787-015-0811-4
163	Coppola et al	Sep-2018	16 Dec 2020	Impulsivity in Alcohol-Dependent Patients with and without ADHD: The Role of Atomoxetine <i>Journal of Psychoactive Drugs</i>	Academic Search Complete	DOI: 10.1080/02791072.2018.1471247
164	Verlaet et al	Jul-2014	16 Dec 2020	Nutrition, immunological mechanisms and dietary immunomodulation in ADHD. <i>European Child &amp; Adolescent Psychiatry</i>	Academic Search Complete	DOI: 10.1007/s00787-014-0522-2
165	Arns et al	Sep-2012	16 Dec 2020	The Effects of QEEG-Informed Neurofeedback in ADHD: An Open-Label Pilot Study. <i>Applied psychophysiology and biofeedback</i>	Academic Search Complete	DOI: 10.1007/s10484-012-9191-4
166	Holton et al	Sep-2019	16 Dec 2020	Evaluation of dietary intake in children and college students with and without attention-deficit/hyperactivity disorder. <i>Nutritional Neuroscience</i>	Academic Search Complete	DOI: 10.1080/1028415X.2018.1427661

167	Simmonite et al	Jun-2019	16 Dec 2020	Independent Components of Neural Activation Associated with 100 Days of Cognitive Training. <i>Journal of Cognitive Neuroscience</i>	Academic Search Complete	DOI: 10.1162/jocn_a_01396
168	Stokkeland et al	Aug-2014	16 Dec 2020	Attention deficit hyperactivity disorder among inmates in Bergen Prison. <i>Scandinavian Journal of Psychology</i>	Academic Search Complete	DOI: 10.1111/sjop.12131
169	Dowson et al	Feb-2010	16 Dec 2020	Impulsive aggression in adults with attention-deficit/hyperactivity disorder. <i>Acta Psychiatrica Scandinavica</i>	Academic Search Complete	DOI: 10.1111/j.1600-0447.2009.01460.x
170	Stoy et al	Jun-2011	16 Dec 2020	Reward processing in male adults with childhood ADHD-a comparison between drug-naïve and methylphenidate-treated subjects. <i>Psychopharmacology</i>	Academic Search Complete	DOI: 10.1007/s00213-011-2166-y
171	Lookatch et al	Nov-2017	16 Dec 2020	Neuropsychological Effects of Placebo Stimulants in College Students. <i>Journal of Psychoactive Drugs</i>	Academic Search Complete	DOI: 10.1080/02791072.2017.1344897
172	Bettis et al	Jul-2017	16 Dec 2020	Comparison of two approaches to prevention of mental health problems in college students: Enhancing coping and executive function skills. <i>Journal of American College Health</i>	Academic Search Complete	DOI 10.1080/07448481.2017.1312411
173	Graham et al	Jan-2011	16 Dec 2020	European guidelines on managing adverse effects of medication for ADHD. <i>European Child &amp; Adolescent Psychiatry</i>	Academic Search Complete	DOI: 10.1007/s00787-010-0140-6
174	Lis et al	Oct-2010		Objective measurement of motor activity during cognitive performance in adults with attention-deficit/hyperactivity disorder. <i>Acta Psychiatrica Scandinavica</i>	Academic Search Complete	DOI: 10.1111/j.1600-0447.2010.01549.x
175	Meer et al	Dec-2014	16 Dec 2020	The serotonin transporter gene polymorphism 5- HTTLPR moderates the effects of stress on attention-deficit/hyperactivity disorder. <i>Journal of Child Psychology &amp; Psychiatry</i>	Academic Search Complete	DOI: 10.1111/jcpp.12240
176	Albrecht et al	Aug-2014	16 Dec 2020	Genetics of preparation and response control in ADHD: the role of DRD4 and DAT1. <i>Journal of Child Psychology &amp; Psychiatry</i>	Academic Search Complete	DOI: 10.1111/jcpp.12212
177	Söderström et al	Apr-2014	16 Dec 2020	Development of a Swedish Comprehensive International Classification of Functioning, Disability and Health (ICF) Core Set for adult patients with attention-deficit hyperactivity disorder (ADHD). <i>Nordic Journal of Psychiatry</i>	Academic Search Complete	DOI: 10.3109/08039488.2013.789072
178	Grabemann et al	Aug-2013	16 Dec 2020	No clear effects of acute tryptophan depletion on processing affective prosody in male adults with ADHD. <i>Acta Psychiatrica Scandinavica</i>	Academic Search Complete	DOI: 10.1111/acps.12130
179	Mette et al	Aug-2013	16 Dec 2020	The impact of acute tryptophan depletion on attentional performance in adult patients with ADHD <i>Acta Psychiatrica Scandinavica</i>	Academic Search Complete	DOI: 10.1111/acps.12090
180	Sable et al	Mar-2013	16 Dec 2020	Attention-deficit hyperactivity disorder reduces automatic attention in young adults. <i>Psychophysiology</i>	Academic Search Complete	DOI: 10.1111/psyp.12012
181	Hegvik et al	Feb-2014	16 Dec 2020	Autoantibodies targeting neurotransmitter biosynthetic enzymes in attention-deficit/hyperactivity disorder (ADHD). <i>European Child &amp; Adolescent Psychiatry</i>	Academic Search Complete	DOI:10.1007/s00787-013-0429-3

182	Simoni et al	Mar-2016	16 Dec 2020	Do social skills mediate the relationship between ADHD and depression? <i>Sociological Spectrum</i>	SocINDEX	DOI: 10.1080/02732173.2015.1095662
183	Fayyad et al	Aug-2010	16 Dec 2020	Dissemination of an evidence-based intervention to parents of children with behavioral problems in a developing country. <i>European Child &amp; Adolescent Psychiatry</i>	Academic Search Complete	DOI: 10.1007/s00787-010-0099-3
184	Pretus et al	Sep-2018	16 Dec 2020	Just-in-time response to reward as a function of ADHD symptom severity. <i>Psychiatry &amp; Clinical Neurosciences</i>	Academic Search Complete	DOI: 10.1111/pcn.12689

## APPENDIX C : ABSTRACT SEARCH

Item	Author & Date Published	Title	Type of intervention	Study Population	Methodology Data collection	Methodology Data analysis	Type of design	Outcome
1	<b>Biederman et al, 2017</b>	Memantine in the Treatment of Executive Function Deficits in Adults With ADHD.	Pharmacotherapy	26 Outpatient adults, aged 18-57y, male and female.	Behaviour rating inventory of executive functions. Cambridge Neuropsychological test automated battery Adult ADHD Investigator Symptom Rating Scale -self report Clinical Global Impressions-ADHD Social Adjustment Self-report Questionnaire Endicott Work Productivity Scale Quality of Life Enjoyment and Satisfaction Questionnaire Wechsler Abbreviated Scale of Intelligence Test of Word-Reading Efficiency WAIS-IV Delis-Kaplan Executive Function Scale Colour-word interference subtest Wide Range Achievement Test	Mixed- effects Models	12- week, double blind, randomized control trial	Improvements in selective areas of executive functioning in adults with ADHD.
2	<b>Morgenster ns et al, 2016</b>	Structured skills training for adults with ADHD in an outpatient psychiatric context: an open feasibility trial.	Non-Pharmacotherapy (DBT)	98 adults with ADHD, recruited from outpatient clinic	Barkley current ADHD symptom scale-IV Beck Depression inventory Beck Anxiety inventory Karolinska Sleep Questionnaire Perceived Stress Scale Sheehan Disability Scale Mindful Attention Awareness Scale Acceptance & Action Questionnaire Adult ADHD Quality of life Scale	Descriptive statistics Standard multiple regression analysis	Open feasibility trial Multicentre	ADHD symptoms & ADHD- related functional impairment in everyday life were reduced. Well-being, ability to be mindful, acceptance of emotions & quality of life were increased.
3	<b>Potter et al, 2014</b>	AZD3480, a novel nicotinic receptor agonist, for the treatment of attention-deficit/hyperactivity disorder in adults.	Pharmacotherapy	30 adults aged 18-65, recruited from advertisements, referrals, public lecture.	Stop Signal Task Stop Signal Reaction Time Conners Adult ADHD Rating Scale Clinical Global Impressions	Linear mixed Models	Within subject, randomized placebo-controlled, double blind trial Exploratory Study	Improved overall ADHD symptoms.
4	<b>Ni et al, 2013</b>	A head-to-head randomized clinical trial of methylphenidate and	Pharmacotherapy	63 Adults aged 18-50y at an outpatient clinic	Cambridge Neuropsychological Test Automated Battery	Linear multi-level model	8-10 week, open label, head-to-head	Improved executive functioning in both MPH

		atomoxetine treatment for executive function in adults with attention-deficit hyperactivity disorder.			Schedule for Affective Disorders and Schizophrenia Weschler Adult Intelligence Scale Adult ADHD Self-report Scale		randomized clinical trial	and ATX. Improved spatial planning in ATX.
5	<b>Emilsson et al, 2011</b>	Cognitive behaviour therapy in medication-treated adults with ADHD and persistent symptoms: a randomized controlled trial.	Pharmacotherapy & non-Pharmacotherapy (CBT)	54 adults with ADHD	The Kiddie-Schedule for Affective Disorders & Schizophrenia ADHD section	Intention to treat analysis	Randomized controlled trial	Multifaceted improvements. CBT was a useful adjunct to drugs in treating ADHD.
6	<b>Gu et al, 2018</b>	A Randomized Controlled Trial of Mindfulness-Based Cognitive Therapy for College Students With ADHD.	Non-Pharmacotherapy (MBCT)	54 undergraduates with ADHD aged 19-24 years	Conners Adult ADHD Self-Rating Scale Beck Depression inventory Beck Anxiety inventory Mindful Attention and Awareness Scale Attentional Network Test	General Linear Models	Randomized controlled trial	Improved ADHD symptoms, sustained attention, less anxiety and depression, greater levels of mindfulness, greater improvement on neuropsychological performance.
7	<b>Fleming et al, 2015</b>	Pilot randomized controlled trial of dialectical behavior therapy group skills training for ADHD among college students.	Non-Pharmacotherapy (DBT)	33 undergraduates with ADHD, aged 18-24.	Barkley Adult ADHD Rating Scale Brown ADD Rating Scales Adult ADHD Quality of life Scale Beck Depression inventory Beck Anxiety inventory Five Facet Mindfulness Questionnaire Connor's Continuous performance Test	Linear Regression	Randomized controlled trial	Improved ADHD symptoms, executive functioning & improved quality of life.
8	<b>Bachmann et al, 2018</b>	Effects of mindfulness and psychoeducation on working memory in adult ADHD: A randomised, controlled fMRI study.	Non-Pharmacotherapy (Mindfulness & Psychoeducation)	40 adults with ADHD, recruited from outpatient clinics and inpatient unit, aged 18-65 years.	Conners Adult ADHD Rating Scale	General Linear Modelling Exploratory Linear Regression	Randomized controlled clinical trial	Significant decrease in ADHD symptoms. Improvement in task performance. Decrease in inattention/memory problems.
9	<b>Solanto et al, 2010</b>	Efficacy of meta-cognitive therapy for adult ADHD.	Non-Pharmacotherapy (Meta-cog therapy)	88 clinically referred adults with ADHD, aged 18-65, recruited from clinics, self help groups and universities.	Connors Adult ADHD Diagnostic Interview for DSM-IV Conners Adult ADHD Rating Scale Childhood Symptom Scale Structured Clinical Interview for DSM-IV WAIS-III Adult ADHD Investigator Symptom Rating Scale Brown ADD Rating Scales Behaviour Rating Inventory of Executive Function- Adult Version Beck Depression inventory Rosenberg Self-esteem inventory	General Linear Modelling Logistic regression	Not specified	Improvement found in severity of ADHD symptoms specifically inattention.



					On-time Management, Organisation & planning Scale Hamilton Anxiety Rating Scale			
<b>10</b>	<b>Solanto et al, 2018</b>	The efficacy of cognitive-behavioral therapy for older adults with ADHD: a randomized controlled trial.	Non-Pharmacotherapy (CBT)	88 adults with ADHD aged 18-65 (55 & older compared with 50 & over), recruited from clinics, self help groups and universities.	Adult ADHD Investigator Symptom Rating Scale Conners Adult ADHD Rating Scale Connor's Adult ADHD Diagnostic Interview for DSM-IV Childhood Symptom Scale Structured Diagnostic Interview for DSM-IV Structured Clinical Interview for DSM-IV WAIS-III Brown ADD Rating Scales Behaviour Rating Inventory of Executive Function- Adult Version Beck Depression inventory Rosenberg Self-esteem inventory On-time Management, Organisation & planning Scale Structured Interview Guide for the Hamilton Anxiety Rating	General Linear Modelling	Randomized controlled trial	Improvement in inattentive symptoms, sleep and depressive symptoms.
<b>11</b>	<b>Mitchell et al, 2013</b>	A Pilot Trial of Mindfulness Meditation Training for ADHD in Adulthood: Impact on Core Symptoms, Executive Functioning, and Emotion Dysregulation.	Non-Pharmacotherapy (MBCT)	22 Adults with ADHD, ages 18-50y, recruited from community via clinics and advertisements, referrals from clinics.	Connor's Adult ADHD Rating Scale Connor's Adult ADHD Diagnostic Interview for DSM-IV Structured Clinical Interview for DSM-IV Barkley's Current ADHD Symptoms Scale Deficits in Executive Functioning Scale Behaviour Rating Inventory of Executive Functioning- Adult Version. Difficulties in Emotion Regulation Scale Behavioural Regulation Index Metacognitive Index Distress Tolerance Scale Attentional Network Test Conners Continuous Performance Test Kaufman Brief Intelligence Test Childhood ADHD Symptom Scale Trail Making Test	Repeated measures mixed design	Pilot Trial	Improvement in ADHD and EF symptoms, and emotion dysregulation.
<b>12</b>	<b>Bueno et al, 2015</b>	Mindfulness Meditation Improves Mood, Quality of Life, and Attention in Adults with Attention	Non-Pharmacotherapy (MBCT)	55 Adults with ADHD aged 18- 45 (patient group)	Attentional Network Test Conners Continuous Performance Test Adult ADHD Self-Report Scale (who) Beck Depression Inventory	General Linear Modelling	Quasiexperimental pretest-posttest design	Improved sustained attention, mood & Quality of life.

		Deficit Hyperactivity Disorder.		20 Adults aged 18- 45 without ADHD (control group)	State-Trait Anxiety Inventory Positive and Negative Affect Schedule Adult ADHD Quality of Life Questionnaire Structured Clinical Interview for DSM-IV			
<b>13</b>	<b>Edel et al, 2017</b>	A Comparison of Mindfulness-Based Group Training and Skills Group Training in Adults With ADHD.	Non-Pharmacotherapy (MBCT & DBT)	91 adults with ADHD recruited from an outpatient unit	Wender-Reimherr Interview Mindful Attention Awareness Scale Generalized Self-Efficacy Scale	General linear models	Pragmatic open Design	Similar reduction in ADHD symptoms, and improvement in mindfulness and self-efficacy.
<b>14</b>	<b>Stern et al, 2014</b>	The Efficacy of Computerized Cognitive Training in Adults With ADHD: A Randomized Controlled Trial.	Non-Pharmacotherapy (CCT)	160 adults, aged 18-60, with ADHD recruited through advertisement at a university research centre. 60 met inclusion criteria	ASRS Symptom Checklist IntegNeuro assessment Structured Clinical Interview for DSM-IV Behaviour Rating Inventory of Executive Functioning- Adult Version. Canadian Occupational Performance Measure Adult Attention Deficit Quality of Life Scale Wender Utah Rating Scale	Non-intent-to-treat approach	Randomized Controlled Trial	Significant positive changes in executive functions, ADHD symptomatology & occupational performance were found.
<b>15</b>	<b>Low et al, 2018</b>	Visual attention in adults with attention-deficit/hyperactivity disorder before and after stimulant treatment.	Pharmacotherapy	42 adults with ADHD, 42 controls, aged 18-45, from outpatient clinic.	Bundesen's theory of visual attention assessment Behaviour rating inventory of executive functions Clinical Global Impressions-ADHD Adult ADHD Investigator Symptom Rating Scale -self report Adult ADHD Self-report Scale Mini International Neuropsychiatric Interview	Two-way mixed analyses of variance	Non-randomized, non-blinded, controlled, 6 week follow up design	Improvements were seen specifically in visual processing speed which could represent an improvement in alertness.
<b>16</b>	<b>Hepark et al, 2015</b>	The Efficacy of Adapted MBCT on Core Symptoms and Executive Functioning in Adults With ADHD: A Preliminary Randomized Controlled Trial.	Non-Pharmacotherapy (MBCT)	Adults with ADHD, randomly allocated to MBCT (55) or waitlist (48). Aged 18-65. Recruited from specialized outpatient clinic for adults with developmental disorders	Diagnostic Interview for ADHD in Adults Connor's Adult ADHD Rating Scale Behaviour Rating Inventory of Executive Functioning- Adult Self-report Version. Beck Depression Inventory State-Trait Anxiety Inventory Outcome Questionnaire Kentucky Inventory of Mindfulness Skills	Intention to treat analyses Exploratory moderation analyses	Preliminary Randomized Controlled Trial	Significant reduction of ADHD symptoms. Significant improvements in executive functioning and mindfulness skills were found. No improvements were observed for depressive & anxiety symptoms.
<b>17</b>	<b>Groeneveld et al, 2019</b>	Z-Score Neurofeedback and Heart Rate Variability Training for Adults and Children with Symptoms of Attention-	Neurostimulation (neurofeedback & heart rate)	39 Adults and 100 children with ADHD. Aged 6-59, specialized outpatient clinic	Achenback System of Empirically Based Assessment (ASEBA) Integrated Visual and Auditory Continuous Performance Test (IVA) Child Behavioural Checklist	Parametric Statistical analyses Multiple Linear Regression	A Retrospective pre-post study design	ADHD symptoms improved .

		Deficit/Hyperactivity Disorder: A Retrospective Study.	variability biofeedback)		Adult Self-Report symptom checklist			
18	<b>Verster et al, 2010</b>	Methylphenidate significantly improves declarative memory functioning of adults with ADHD.	Pharmacotherapy	18 adults with ADHD, aged 21-55.	Connor's Adult ADHD Rating Scale Spielberger State Trait Anxiety inventory The word learning test (Dutch version) DSM-IV ADHD Rating Scale Centre for Epidemiological studies depression scale	ANOVA Pearson r correlation coefficient	Double blind, placebo-controlled, Randomized crossover trial	Improvement in declarative memory functioning in patients with ADHD.
19	<b>Lin et al, 2015</b>	Atomoxetine Treatment Strengthens an Anti-Correlated Relationship between Functional Brain Networks in Medication-Naïve Adults with Attention-Deficit Hyperactivity Disorder: A Randomized Double-Blind Placebo-Controlled Clinical Trial.	Pharmacotherapy	Adults aged 18-52, 24 adults with ADHD, 24 healthy controls	Cambridge Neuropsychological Test Automated Battery Adult ADHD Self-report Scale Connors Adult ADHD Diagnostic Interview Schedule for Affective Disorders and Schizophrenia	Functional Connectivity Analysis One-way ANOVA Mixed-effect ANOVA	Randomized double-blind placebo-controlled clinical trial	Reduction in inattentive, hyperactivity and impulsivity symptoms.
20	<b>Adler et al, 2017</b>	Effectiveness and Duration of Effect of Open-Label Lisdexamfetamine Dimesylate in Adults With ADHD.	Pharmacotherapy	40 Adults with ADHD, aged 18-55	ADHD Rating Scale ADHD Self-Report Scale ADHD Symptom Checklist Structured Clinical Interview of DSM-IV Adult ADHD Medication Smoothness of Effect Scale Time-Sensitive ADHD Symptom Scale Adult ADHD Medication Rebound Scale Wender-Reimherr Adult ADHD Scale	Generalized Estimating Equation regression models	12 week, open-label study	ADHD symptoms significantly improved. Improved inattentive, hyperactivity, impulsivity and mood dysregulation symptoms.
21	<b>Agay et al, 2010</b>	Non-specific effects of methylphenidate (Ritalin) on cognitive ability and decision-making of ADHD and healthy adults.	Pharmacotherapy	32 adults with ADHD, 26 healthy controls. Recruited from Shalvata Mental Health Centre outpatient clinic	ADHD Self-Report Scale Connor's Adult ADHD Rating Scale Wender-Utah Rating Scale SCID Ravens Progressive Matrices Test of Variables of attention Iowa Gambling Task	Multivariate Analysis of Variance Two-way ANOVA of TOVA Expectancy-valence model	Randomized, double-blind manner.	MPH is capable of enhancing specific aspects of cognitive performance and this enhancement is not specific to ADHD. Increased short-term memory.
22	<b>Ramos-Quiroga et al, 2014</b>	Changes in the serum levels of brain-derived neurotrophic factor in adults with attention deficit hyperactivity disorder after treatment with atomoxetine.	Pharmacotherapy	Clinical sample of 54 adults with ADHD recruited from a hospital.	Connor's Adult ADHD Rating Scale Structured Clinical Interview for DSM-IV Connor's adult ADHD Diagnostic Interview for DSM-IV Wender-Utah Rating Scale Hamilton Rating Scale for Depression Hamilton Anxiety Scale	Paired t-tests Wilcoxon's signed-rank test	Not specified.	Significant improvement in their clinical symptoms.

23	<b>Arvidsson et al, 2019</b>	Methylphenidate effects on processing speed in a clinical sample of adults with ADHD and substance use disorder: a pilot study.	Pharmacotherapy	28 adults with ADHD and SUD, 28-56y recruited from psychiatric outpatient clinics.	Clinical Global Impression-TDAH A Quick Test of Cognitive Speed Mini-international Neuropsychiatric Interview Brown's ADD Scale WAIS-IV D-KEFS Colour-word Interference Trail Making Test Test of Variables of Attention	One-way ANOVA Correlation coefficients pearson r	A pilot study	Improved processing times.
24	<b>Fan et al, 2017</b>	Neural correlates of atomoxetine improving inhibitory control and visual processing in Drug-naïve adults with attention-deficit/hyperactivity disorder.	Pharmacotherapy	24 drug naïve adults with ADHD, clinical population, recruited from a hospital.	Counting Stroop task with fMRI Cambridge Test Automated Battery WAIS Connor's adult ADHD Diagnostic Interview for DSM-IV Schedule for Affective Disorders for Schizophrenia CGI Adult ADHD Self-Report Scale	Two-sample t-tests Statistical Parametric Mapping General Linear Model Repeated measures ANOVA Post hoc paired t-test	8 week, placebo-controlled, double-blind, randomized clinical trial	Improved inhibitory control. Enhance visual processing Improved clinical symptoms.
25	<b>Fargason et al, 2017</b>	Correcting delayed circadian phase with bright light therapy predicts improvement in ADHD symptoms: A pilot study.	Neurostimulation (Bright Light Therapy)	28 adults screened, Recruited by internal referral, fliers & local campus media. 19 completed protocol.	Adult ADHD Self-Report Scale Brief Sleep Disorder Screening Questionnaire Mini International Neuropsychiatric Interview HAM-A HAM-D Pittsburgh sleep quality index	Pearson's product moment correlation	Pilot study	Decrease in ADHD-RS total scores & hyperactive-Impulsive sub-scores.
26	<b>Schranter et al, 2016</b>	The age-dependent effects of a single-dose methylphenidate challenge on cerebral perfusion in patients with attention-deficit/hyperactivity disorder.	Pharmacotherapy	98 stimulant treatment-naïve male children (aged 10-12) and adult patients (aged 23-40), with ADHD. Recruited from clinical programmes.	Diagnostic Interview Schedule for children Diagnostic Interview for ADHD for Adults Wechsler Intelligence Scale for children- Revised	Mixed model Independent t-test Paired samples t-test 2-way mixed affect ANOVA	16 week double blind, randomized, placebo-controlled trial	MPH decreased Cerebral Blood Flow in both children & adults in cortical areas, although to a greater extent in adults.  No effects reported on symptoms of ADHD.
27	<b>Ni et al, 2016</b>	Atomoxetine could improve intra-individual variability in drug-naïve adults with attention-deficit/hyperactivity disorder comparably with methylphenidate: A head-to-head randomized clinical trial.	Pharmacotherapy	52 drug-naïve adults with ADHD, aged 16-50 recruited from outpatient clinics	Connors' continuous performance test Adult ADHD Self-report Scale Schedule for Affective Disorders and Schizophrenia Wechsler Adult Intelligence Scale CGI	Linear multi-level model	8-10 week, open-label, head-to-head randomized clinical trial	Both improved intra-individual variability in reaction time Improved inhibitory control.
28	<b>Brams et al, 2012</b>	Maintenance of efficacy of lisdexamfetamine dimesylate in adults with attention-deficit/hyperactivity disorder	Pharmacotherapy	116 Adults with ADHD, aged 18-55.	ADHD-Rating Scale-IV Clinical Global Impressions-severity of illness Structured Clinical Interview for DSM-IV Disorders	Analysis of covariance model Least squares mean difference	6 week, double-blind, placebo controlled, Randomized	Majority using LDX experienced ADHD symptom reduction.

		er: randomized withdrawal design.			Columbia-Suicide Severity Rating Scale		withdrawal design	
29	<b>Biederman et al, 2012</b>	Is response to OROS-methylphenidate treatment moderated by treatment with antidepressants or psychiatric comorbidity? A secondary analysis from a large randomized double blind study	Pharmacotherapy	296 participants were screened. Outpatient adults with ADHD, aged 19-60 years.	Hamilton – Depression Scale Hamilton- Anxiety Scale Adult ADHD Investigator Symptom Report Scale Structured Clinical Interview for DSM-IV Kiddie SADS-E CGI	Intention-to-treat Mixed-effects models for repeated measures	Three phase, Large, placebo controlled, randomized, double-blind, parallel study design.	Significant reduction in ADHD symptoms
30	<b>Volkow et al, 2012</b>	Methylphenidate-elicited dopamine increases in ventral striatum are associated with long-term symptom improvement in adults with attention deficit hyperactivity disorder.	Pharmacotherapy	20 treatment-naïve designs with ADHD, recruited from clinic referrals.	Connors' adult ADHD Rating Scale Hamilton – Depression Scale Hamilton- Anxiety Scale Clinical Global Impressions improvement & severity scales.	Pearsons correlations	Prospective Design	Reduction in symptoms of inattention Significant decrease in ADHD symptoms
31	<b>Allenby et al, 2018</b>	Transcranial direct current brain stimulation decreases impulsivity in ADHD.	Neurostimulation	37 participants, aged 18-65 with ADHD, recruited through mass media/ university programme	Connors' Continuous Performance Task Stop Signal Task Stop Signal Reaction Time Transcranial Direct Current Stimulation effects questionnaire Structured Clinical Interview for DSM-V	Separate linear mixed effects model. Multiple regression models	Within- subject, double blind, cross-over design, counterbalanced	Improved impulsivity symptoms in ADHD.
32	<b>Chronis-Tuscano et al, 2010</b>	Effects of maternal stimulant medication on observed parenting in mother-child dyads with attention-deficit/hyperactivity disorder.	Pharmacotherapy	23 mothers with ADHD and their offspring with ADHD ,aged 6-12 Recruited from ADHD speciality programmes at universities.	Beck Depression Inventory- II Connors' Adult ADHD Rating Scale Clinical Global Impressions- severity of illness scale. SCID-IV Schedule for Affective Disorders for Schizophrenia Disruptive Behaviour Disorders symptom rating scale Alabama Parenting Questionnaire	Intent-to-treat Analyses General Linear Models	Pilot Study: 5 week, double-blind, open-label, stimulant titration.	Positive effects of medication on ADHD symptoms  However, the study did not identify maternal stimulant effects on observed parenting or child behaviour.
33	<b>Franzen et al, 2013</b>	Atypical coupling between posterior regions of the default mode network in attention-deficit/hyperactivity disorder: a pharmacomagnetoencephalography study	Pharmacotherapy	12 adults with ADHD, 13 without ADHD, average age 40.	Adult ADHD self-report scale	Mixed- model analyses of variance	Unspecified	Positive improvement in ADHD symptoms.
34	<b>Jucaite et al, 2014</b>	A randomized, double-blind, placebo-controlled crossover study of $\alpha\beta^*$ nicotinic acetylcholine receptor agonist AZD1446	Pharmacotherapy	135 adults enrolled. 79 adults with ADHD, aged 18-65, recruited from clinic referrals and mass media	Connors' Adult ADHD Rating Scale CogState computerized test battery Clinical Global Impressions for ADHD Severity International Shopping List Task	Mixed effects repeated measures model	Multicenter, Randomized, double-blind, placebo-	Did not significantly improve ADHD symptoms after 2 weeks of treatment.

		(TC-6683) in adults with attention-deficit/hyperactivity disorder.			One Back task Two Back task Groton Maze Learning Task Stop-Signal Task		controlled crossover trial.	Significant improvement in executive functioning.
35	<b>Coppola et al, 2018</b>	Impulsivity in Alcohol-Dependent Patients with and without ADHD: The Role of Atomoxetine	Pharmacotherapy	92 alcohol- dependent adults with ADHD, recruited from outpatient facilities. Aged 18 and above.	Barratt Impulsiveness Scale Alcohol use Disorder Identification Test MINI Diagnostic Interview for ADHD for Adults Structured Interview for DSM - Personality Disorders Antidepressant Side-Effects Checklist	Pearsons correlation coefficient Kendall's Tau-b bivariate ANOVA for repeated measures	Observational, 12 week, open-label uncontrolled study	Significant reduction in the levels of impulsivity.
36	<b>Arns et al, 2012</b>	The Effects of QEEG-Informed Neurofeedback in ADHD: An Open-Label Pilot Study.	Neurostimulation	21 patients with ADHD recruited from a clinic	BDI Adult ADHD self-report scale Mini International Neuropsychiatric Interview	Repeated measures ANOVA One-way ANOVAS	Open-label pilot study	There was significant improvement for both inattention, Hyperactivity/ Impulsivity and comorbid depressive complaints
37	<b>Bettis et al, 2017</b>	Comparison of two approaches to prevention of mental health problems in college students: Enhancing coping and executive function skills.	Non-pharmacotherapy (Coping skills & CCT)	62 Undergraduate students from two universities, aged 18-22	Perceived Stress Scale BRIEF-A Delis-Kaplan Executive Function Scales Patient Health Questionnaire Responses to Stress Questionnaire Adult ADHD Self-Report Scale	ANCOVA t-tests	6 week, randomized study, comparative design	Both groups reported significant decrease in social stress, executive function difficulties, and anxiety symptoms post intervention. CCT programme reported more improved ADHD symptoms compared with coping skills.
38	<b>Nielsen et al, 2017</b>	Processing speed can monitor stimulant-medication effects in adults with attention deficit disorder with hyperactivity.	Pharmacotherapy	40 adults with ADHD, aged 17- 55y.	Quick Test of Cognitive Speed Browns ADD Scales ADHD Self-Report Scale WAIS-IV D-KEFS Colour-Word Interference Trail Making Test Test of Variables of Attention	One-way ANOVA with post-hoc analysis	Controlled, multi-centre study	Perceptual, cognitive & processing efficiency increased measurably with high-dose medication.
39	<b>Apostol et al, 2012</b>	Efficacy and safety of the novel $\alpha\beta$ neuronal nicotinic receptor partial agonist ABT-089 in adults with attention-deficit/hyperactivity disorder: a randomized, double-blind, placebo-controlled crossover study.	Pharmacotherapy	221 adults enrolled, 171 met inclusion criteria, aged 18-60.	Connors' Adult ADHD Rating Scale- Investigator Rated CGI-ADHD Severity Adult ADHD Clinical Diagnostic Scale Adult ADHD Investigator Symptom Report Scale	Intent-to-treat dataset Covariance model Mixed model repeated measures analysis of change	Exploratory, dose-range finding, multicentre study with a randomized, double-blind, placebo-controlled crossover design	Improvement in ADHD core symptoms.
40	<b>Hoxhaj et al, 2018</b>	Mindfulness vs psychoeducation in adult	Non-Pharmacotherapy	81 medication- free adult ADHD patients	Connors' ADHD Rating Scales BDI	Exploratory post-hoc tests	Randomized controlled trial	Both interventions, were efficacious in reducing

		ADHD: a randomized controlled trial.	(Mindfulness & Psychoeducation)	recruited from outpatient clinic	Structured Clinical Interview for DSM-IV Brief Symptom Inventory Wender Utah Rating Scale SF-36 Multiple Choice Verbal Intelligence Test The Five Facet Mindfulness Questionnaire	Univariate repeated-measures analysis of variance		symptom load in adult ADHD. Increased self-concept, quality of life, overall mental state, depression and improved mindfulness.
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## APPENDIX D: SFS CRITICAL APPRAISAL TOOL

### CRITICAL APPRAISAL CHECKLIST FOR A SYSTEMATIC REVIEW

Bibliographic Details	Author	Title	Source	
Purpose			Yes (1)	No (0)
1. Is there evidence that literature has been consulted in providing context or background?			<input type="checkbox"/>	<input type="checkbox"/>
2. Is a clear problem statement?			<input type="checkbox"/>	<input type="checkbox"/>
3. Is a clear rationale provided for the study?			<input type="checkbox"/>	<input type="checkbox"/>
4. Are the aims of the study clearly stated?			<input type="checkbox"/>	<input type="checkbox"/>
5. Are the aims explicitly related to the problem statement?			<input type="checkbox"/>	<input type="checkbox"/>
<b>Total points for this section</b>				
Study			Yes (1)	No (0)
1. Is this an intervention study?			<input type="checkbox"/>	<input type="checkbox"/>
2. Is the theoretical orientation of the interventions reported and described?			<input type="checkbox"/>	<input type="checkbox"/>
3. Was the theoretical orientation described in detail?			<input type="checkbox"/>	<input type="checkbox"/>
4. Did the authors report on the development of the intervention?			<input type="checkbox"/>	<input type="checkbox"/>
5. Were the elements of the programme reported on?			<input type="checkbox"/>	<input type="checkbox"/>
6. Did the authors report on the implementation of the programme?			<input type="checkbox"/>	<input type="checkbox"/>
7. Is there a description of fidelity to the implementation of the programme?			<input type="checkbox"/>	<input type="checkbox"/>
8. What is the relationship of the study to the area of the topic reviewed?				
a. Minimal to no relevance (0)			<input type="checkbox"/>	
b. moderate relevance (1)			<input type="checkbox"/>	
c. Highly relevant (2)			<input type="checkbox"/>	
<b>Total points for this section</b>				



Sample	Yes (1)	No (0)
1. Was the source population clearly identified?	<input type="checkbox"/>	<input type="checkbox"/>
2. Were the inclusion/ exclusion criteria specified?	<input type="checkbox"/>	<input type="checkbox"/>
3. Did the authors make a distinction between probability and non-probability in sampling? Did every eligible person have an equal chance of being included in the study?	<input type="checkbox"/>	<input type="checkbox"/>
4. Was the sampling choice motivated?	<input type="checkbox"/>	<input type="checkbox"/>
5. Was the sampling frame identified?	<input type="checkbox"/>	<input type="checkbox"/>
6. Was the sampling method appropriate?	<input type="checkbox"/>	<input type="checkbox"/>
7. How were subjects allocated to the groups?		
a. Pre-existing (1)	<input type="checkbox"/>	
b. Random assignment (2)	<input type="checkbox"/>	
8. How was the size of the study sample determined?		
a. Not reported (0)	<input type="checkbox"/>	
b. Using threshold numbers (1)	<input type="checkbox"/>	
c. Formulas (2)	<input type="checkbox"/>	
d. Statistical requirements (3)	<input type="checkbox"/>	
9. What techniques were used to ensure optimal sample size?		
a. None (0)	<input type="checkbox"/>	
b. Mortality follow up (1)	<input type="checkbox"/>	
c. Incentivization (2)	<input type="checkbox"/>	
d. Oversampling (3)	<input type="checkbox"/>	
<b>Total points for this section</b>		
Ethics	Yes (1)	No (0)
1. Was ethics approval obtained from an identifiable committee?	<input type="checkbox"/>	<input type="checkbox"/>
2. Was informed consent obtained from the participants of the study?	<input type="checkbox"/>	<input type="checkbox"/>
3. Have ethical issues been reported on:		
a. Confidentiality?	<input type="checkbox"/>	<input type="checkbox"/>
b. Anonymity?	<input type="checkbox"/>	<input type="checkbox"/>
c. Withdrawal	<input type="checkbox"/>	<input type="checkbox"/>
d. Informed consent?	<input type="checkbox"/>	<input type="checkbox"/>
<b>Total points for this section</b>		

<b>Instruments</b>		Yes (1)	No (0)
1.	Were instruments clearly identified with full references?		
2.	Were specific outcomes identified?		
3.	Were instruments appropriate for the outcomes identified?		
4.	Which of the following psychometric properties were reported <u>on</u> : a. Did they report on the psychometric properties? b. Did they report on psychometric properties of the scale for this sample? c. Did the authors report on the type of data produced by the instruments? d. Did the instruments produce data that supported the proposed analysis?		
<i>Total points for this section</i>			

<b>Data Analysis</b>		Yes (1)	No (0)
1.	Was the method of analysis made explicit?		
2.	Was the method of analysis motivated?		
3.	Was the method of analysis appropriate relative to the research question?		
4.	Were the conclusions drawn appropriate and supported by the data?		
5.	Were the inferences drawn supported by the type of sampling?		
<i>Total points for this section</i>			

<b>Results</b>		Yes (1)	No (0)
1.	Were alpha levels reported?		
2.	Were results correctly interpreted?		
3.	Were the results clearly linked to the research questions?		
4.	Were the results presented in a tabular form?		
<i>Total points for this section</i>			

<b>Conclusion</b>				<b>Yes (1)</b>	<b>No (0)</b>
1.	Was a clear conclusion drawn?				
2.	Was the conclusion supported by the findings?				
3.	Were relevant recommendations made based on the findings?				
4.	Were limitations identified?				
<i>Total points for this section</i>					
<b>Total score/Score (%):</b>				<b>Score (55)</b>	<b>Score (%)</b>
<b>Weak (&lt;40%)</b>	<b>Moderate (41-60%)</b>	<b>Strong (61-80%)</b>	<b>Excellent (&gt;80)</b>		
<b>(Studies will be excluded from the systematic review if the quality of evidence was rated as weak (&lt;50%))</b>					
<b>Overall Appraisal:</b>		<b>Include</b>	<b>Exclude</b>	<b>Seek further info</b>	

**APPENDIX E: PERMISSION LETTER****UNIVERSITY *of the* WESTERN CAPE****DEPARTMENT OF PSYCHOLOGY**

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Dear Prof. Smith,

I hope this email finds you safe and well.

I am emailing to request permission to use your general SFS appraisal tool as my master's research thesis is considering studies with qualitative and quantitative methodologies. I am currently an MPsych student conducting a mini thesis on the following topic.

A systematic review of recent interventions in South Africa for adults with ADHD

Please could you attach the document for me.

I am very appreciative of your time and consideration.

Kind Regards,

Candice

## APPENDIX F: EDITOR'S LETTER



### CHRISTINE BUCHANAN

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26 February 2022

#### DECLARATION

I, Christine Buchanan, hereby declare that I edited the language and APA (7th ed.) formatting of the thesis of Candice Wakelin (student number 4000091) entitled: *A Systematic Review of Recent Interventions for Adults with ADHD*, submitted in partial fulfilment of the requirements for the degree of Masters in Psychology at the University of the Western Cape.

All corrected clauses, including the implementation and inclusion thereof, were left to the discretion of Ms Wakelin.

Yours sincerely,

CHRISTINE BUCHANAN  
*Registered Counsellor (PRC0010804)  
Neuropsychologist (PS 0150797)  
Copy Editor*

BA Psych (Hons) (UJ)  
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Copy Editing Short Course (UCT)

Member: South African Neurorehabilitation Association  
British Psychological Society

Associate member: South African Clinical Neuropsychological Association

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