# The Effectiveness of Applied Behavioral Analysis on Individuals with Attention–Deficit/Hyperactivity Disorder

by

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**Abstract**

Applied behavior analysis (ABA) applies principles of learning to problems of social significance. As a therapy, ABA is a treatment of choice for autism spectrum disorders (ASD), with several decades of research demonstrating ABA's effectiveness. However, the effectiveness of ABA for another common neurodevelopmental disorder, attention-deficit/hyperactivity disorder (ADHD), is less well known. Understanding the effectiveness of ABA for ADHD would be important for practitioners, especially for those working with individuals who have a comorbid diagnosis of ASD and ADHD. Thus, the purpose of this paper is to examine the effectiveness of ABA to treat symptoms of ADHD for individuals who are 6-17 years of age using a structured literature review. Using specific keywords, several public databases were searched for articles describing the use of ABA interventions to treat symptoms of ADHD. In total, fourteen articles were found that described the use of ABA to treat symptoms of ADHD. In general, 12 of 14 articles found indicated ABA was effective for treating symptoms of ADHD in children who are 6-17 years of age. Results are discussed for practitioners and consumers looking to make treatment decisions.

*Keywords*: applied behavior analysis, attention-deficit/hyperactivity disorder (ADHD), behavior therapy, neurodevelopmental disorders, behavioral interventions

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# The Effectiveness of Applied Behavioral Analysis on Individuals with Attention–Deficit/Hyperactivity Disorder

Since its inception as a therapy, applied behavior analysis (ABA) has focused on analyzing data and developing treatment interventions to address a variety of behaviors across different populations and settings. As a therapy, ABA is used to teach socially significant behaviors such as academic, social, communication, and daily living skills. Essentially, any skill that will enhance the individual's independence and quality of life (R. Carr et al., 2023). Cooper et al. (2019) defined ABA as "a science in which tactics derived from the principles of behavior are applied systematically to improve socially significant behavior and experimentation is used to identify the variables responsible for behavior change" (p. 19). Within this definition, ABA, as a therapy, is a scientific discipline that is rooted in the principles and techniques of behaviorism, particularly operant conditioning and the use of rewards and consequences to change behavior. These techniques for modifying behavior are meticulously outlined and executed methodically and technologically by specifically encompassing strategies drawn from the fundamental principles of behavior and emphasizing behavior that holds significance in situations of social importance. Furthermore, outlining the dual objectives of ABA: improvement and understanding. With these objectives in mind, ABA aims to achieve meaningful improvements in socially significant behaviors and identify the underlying factors contributing to those improvements.

## Seven Dimensions of ABA

Following these principles, as a therapy, ABA offers society an approach toward solving problems that is accountable, public, doable, empowering, and optimistic. This

furthermore increases the importance and valuableness of ABA as a source of knowledge for achieving improved outcomes for individuals of all ages (Cooper et al., 2019). Bear, Wolf, and Risley (1968) defined ABA as "the process of systematically applying interventions based upon the principles of learning theory to improve socially significant behaviors to a meaningful degree, and to demonstrate that the interventions employed are responsible for the improvement of behavior" (p. 91). In addition to these goals, Bear and colleagues first defined the seven core dimensions in the field of ABA in 1968, these core dimensions included generality, effectiveness, technological, applied, conceptually systematic, analytical, and behavioral. (Bear et al., 1968).

For an ABA intervention to display all seven core dimensions, it must first be generalizable, essentially meaning that it must be effective enough to have the ability to last over time and appear in environments other than the one in which the intervention that was originally produced, and has the ability or potential to be effective for other behaviors not directly targeted by the intervention (Bear et al., 1987; Cooper et al., 2019). This criterion aims to ensure that skills are learned, and that behavior can be adapted and demonstrated across various settings, people, and behaviors. The plan is not considered effective until generalization is achieved (R. Carr et al., 2023). Secondly, it must be effective by producing socially significant behaviors. The procedures in the plan show that they are working effectively, and this change is evident to the naked eye. No statistical analysis is needed to "see" it works (2023). Thirdly, it must be technological, meaning that it must describe interventions efficiently by providing a sufficient amount of detail, preciseness, and clarity to ensure replication. Procedures and strategies should be well-written, understandable, and clearly explained. Ask yourself, "Can I replicate this procedure based on how it is written?" (2023). The fourth core dimension is that ABA

interventions must be applied, in short, applied focuses on socially significant behaviors (Bear et al., 1987; Cooper et al., 2019). The goals chosen should be significant to the client. This is one of the biggest differences between experimental analysis of behavior and ABA, the difference between research for research's sake (i.e., experimental analysis of behavior) and research for socially significant reasons such as with ABA (2023).

The fifth core dimension of ABA is that interventions must be conceptually systematic. For an intervention to be conceptually systematic, the justifications of the techniques used as well as their effectiveness must be directly linked to the fundamental principles that ABA was built upon (Bear et al., 1987; Cooper et al., 2019). The procedures should be research-based and consistent with the principles of ABA. If you have trouble finding the interventions in behavior analytic journals, this is a time to consider if you propose evidence-based interventions. Another way to think about it is if you can provide citations for the methods proposed (2023). The sixth core dimension is that an ABA intervention must be analytic. For an intervention to be analytic, it must demonstrate a functional relationship between the intervention and the target behavior, as well as a reliable change in some measurable dimension of the targeted behavior. Overall, the experimenter must be able to control the occurrence and nonoccurrence of the behavior (Bear et al., 1987; Cooper et al., 2019; R. Carr et al., 2023). The seventh and final core dimension of ABA is that it must be behavioral. For an intervention to be considered behavioral based on Bear and colleagues (1968), it must be objective, measurable, and socially significant, and the behavior chosen must need improvement (Cooper et al., 2019). ABA focuses on what the child needs to do. Intervention plans, for example, should focus on teaching/increasing skills in addition to reducing challenging behaviors (2023). These seven dimensions ensure that interventions are data-driven and

supported by research. The result is that the goals are socially significant, interventions are evidence-based, and progress is constantly monitored. These dimensions have guided clinicians for decades in their use of behavior principles to impact behavior and produce change that can be observed across settings.

**Effectiveness of ABA as a Therapy**

Several studies within the field of ABA have continuously demonstrated and proven its effectiveness in improving socially significant behaviors and prioritizing meaningful outcomes with a variety of evidence-based strategies and interventions. For example, antecedent interventions (behavioral momentum, schedules, errorless learning, priming, visual supports, environmental modifications, Primack principle, etc.), skill development interventions (prompting, functional communication training, task analysis/chaining, shaping, compliance training, social stories, etc.), and consequence interventions (contingent reinforcement, token economy, redirection, differential reinforcement of other behavior, differential reinforcement of alternative behavior, differential reinforcement of incompatible behavior, differential reinforcement of low rates of behavior, differential reinforcement of high rates of behavior, etc.) are all utilized to modify behavior of interest. Interventions based on the principles of ABA have been demonstrated to be effective in changing important behaviors in organizational contexts, schools, homes, and other settings (Slocum et al., 2014).

**Misconceptions of ABA Therapy**

Despite a litany of evidence indicating ABA's effectiveness as a therapy, ABA is commonly misconceived as a treatment in therapy circles and mainstream psychology (Leaf et al., 2021). These misconceptions persist despite several decades of research demonstrating the effectiveness of the systematic application of ABA to build skills with

individuals with autism spectrum disorder (ASD) and other disabilities (Cooper et al., 2019, p.19). These misconceptions have been related to the intensive nature of ABA ("turning their children into robots"), its potential for creating over-reliance on external rewards for behavioral regulation ("using bribes"), stating that ABA can only be used for ASD, and its focus on modifying observable behavior and not fully addressing the "cognitive and emotional aspects" of neurodevelopmental disorders (2023). Other critics have characterized ABA as overly controlling and intrusive and hold that ABA is not beneficial to improving socially significant behaviors in the short or long term (Leaf et al., 2021).

### *ABA as a Treatment for ASD*

As stated above, ABA is a well-known and effective treatment for the symptoms of ASD. While ABA, as a therapy, has been extensively researched and shown to be an effective therapy for individuals with ASD it is based on the principles of behaviorism. This means that it focuses on changing behavior by reinforcing positive behaviors and reducing maladaptive behaviors to help individuals with autism and other developmental disabilities (i.e., down syndrome, ADHD, obsessive-compulsive disorder, post-traumatic stress disorder, borderline personality disorder, and intellectual disabilities) develop social, communication, and behavior skills (Behavior Analyst Certification Board, 2023).

### *Addressing Misconceptions*

Multiple articles have addressed misconceptions of ABA as well. Hoffman et al. (2016) stated that "behavior-analytic interventions have been demonstrated to be effective at enacting socially significant behavior change with a wide variety of individuals and diagnoses" (p.14). Other articles have sought to demonstrate that training parents in ABA can also be effective for teaching new skills. For example, Ragain and colleagues (2022)

surveyed the literature and found that “ten interventions showed positive effects in reducing children's challenging behaviors and negative parenting behaviors…the interventions within this article were based on the principle of operant and social learning theories and drew on strategies from the field of ABA” (p. 8). Overall, regardless of whether someone has developmental disabilities, social and behavioral deficits, autism diagnoses, ADHD, or obsessive-compulsive disorders. ABA can teach learners in all areas of life, such as learning social skills, communication skills, play skills, independent living skills, community safety skills, behavior, and academic readiness skills (Anderson & Carr, 2021; Cooper et al., 2019; Makrygianni et al., 2018).

**Attention-Deficit/Hyperactivity Disorder**

Another neurodevelopmental disorder that causes impact to developing children is attention-deficit/hyperactivity disorder (ADHD). ADHD is a chronic neurodevelopmental condition that is characterized by a frequent, ongoing pattern of pervasive and impairing symptoms of inattention and hyperactivity-impulsivity that affects and interferes with a child’s ability to function or develop in socially significant situations (Leffa et al., 2022; National Institute of Mental Health, 2023). As of 2019, almost 6 million children 6 to 17 years of age have been diagnosed with ADHD, making up 9.8% of the US population (CDC, 2023). A total of 2.4 million (10%) of those diagnosed were ages 6 to 11 years of age, and 3.3 million (13%) were 12 to 17 years of age (CDC, 2023). With almost 6 million children already diagnosed with ADHD, prevalence rates have been continuously increasing steadily over the past 40 years (Orantes et al., 2023). With no cure, ADHD has become a significant part of daily life for countless individuals, clients, stakeholders, families, schools, and service providers. Often arising in childhood, ADHD can be

chronic and frequently continues through adolescence and beyond at least causing some level of impairment (American Psychiatric Association, 2022).

Symptoms of ADHD can impact individuals in many domains, including physical health, academic, social, and occupational functioning, and overall well-being (Posner et al., 2020). The most common symptoms include deficits in attention, lack of concentration, disorganization, difficulty completing tasks, being forgetful, losing things, and disabilities in decision-making and emotional regulation (American Psychiatric Association, 2023). Other symptoms may include difficulties with social interactions, becoming easily frustrated, and becoming impulsive. Due to the inability to manage these symptoms, individuals with ADHD can have difficulties in school, work, and social situations, especially if symptoms go untreated. Untreated ADHD can lead to substance abuse, involvement with the criminal justice system, increased risks of accidents (driving, dental injuries, etc.), decreased social interactions leading to social deficits, increased risky behaviors, loss of jobs, and difficulty achieving in school due to difficulties paying attention and poor organizational skills which can lead to underperformance and academic failure (American Psychiatric Association, 2022; Bokor and Anderson, 2014; National Institute of Mental Health, 2023).

### *ADHD Over the Lifespan*

Over time, as the disorder progresses into adolescence and adulthood, core symptoms may manifest and give rise to further issues, including procrastination, mood stability, and diminished self-worth. Individuals may exhibit a greater susceptibility towards impulsivity or inattention, as the symptoms of hyperactivity can be more effectively managed. Furthermore, there are three presentations of ADHD defined by the DSM-5-TR, which include predominantly inattentive, predominantly hyperactive, or a combined type (American Psychiatric Association, 2022; Bokor & Anderson, 2014).

## *DSM-5 Criteria for ADHD*

Individuals diagnosed with ADHD present with six or more symptoms that are part of an ongoing pattern of behavior across multiple different environments. These symptoms include inattention, meaning a person may have difficulty staying on task, sustaining focus, and staying organized, and these problems are not due to defiance or lack of comprehension (National Institute of Mental Health, 2023). Hyperactivity: a person may seem to move about constantly, including in situations when it is not appropriate or excessively fidgets, taps, or talks. In adults, hyperactivity may mean extreme relentlessness or talking too much (National Institute of Mental Health, 2023). Impulsivity includes symptoms whereby a person may act without thinking or have difficulty with self-control. Impulsivity could also include a desire for immediate rewards or the inability to delay gratification. An impulsive person may interrupt others or make important decisions without considering long-term consequences (National Institute of Mental Health, 2023).

ADHD is one of the most prevalent neurodevelopmental disorders that is usually first diagnosed in childhood (Wolraich et al., 2019). In the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV), which was published in 1994, there were two different classifications of ADHD. They were attention deficit disorder (ADD) and attention deficit hyperactivity disorder (ADHD). In DSM-5 and DSM-5-TR, ADHD was combined into one disorder with three different presentations that were formally considered subtypes: predominantly inattentive, predominantly hyperactive, or a combined presentation (American Psychiatric Association, 2022; Bokor and Anderson, 2014). ADHD combined presentation is a presentation where the individual has six or more symptoms of hyperactivity and six or more symptoms of inattention. ADHD predominantly inattentive presentation, where the individual has six or more symptoms of

inattention. ADHD with a predominant hyperactive/impulsive presentation refers to when the individual has six or more symptoms of hyperactivity (Bokor and Anderson, 2014) but does not meet the criteria for inattention.

Unmanaged ADHD causes and the frequent ongoing pattern of pervasive and impairing symptoms of inattention and/or hyperactivity-impulsivity that affects and interferes with a child's ability to function or develop in socially significant situations (Leffa et al., 2022; National Institute of Mental Health, 2023). Due to the impact of unmanaged ADHD, early diagnosis and treatment of the disorder are crucial to prevent the persistence of symptoms into adulthood and the development of additional comorbid conditions. The primary treatment for ADHD mostly involves the prescription and use of stimulant medications and the implementation of psychotherapeutic interventions.

***Treatment/ Management of ADHD***

Early diagnosis and sufficient treatment and/or therapy have the capability to decrease the likelihood of adverse effects connected to ADHD in mental and physical well-being. The available treatment options include non-pharmacological interventions, pharmacological interventions, or a combination of both. The first involves psychosocial, cognitive, and behavior modification techniques that target particular neuropsychological areas linked to ADHD, such as cognitive and executive skills. The second, nonpharmacological treatment is often suggested as an initial or additional treatment for young children (aged 6 years or younger) and less severe cases. Pharmacological drugs typically consist of both stimulants and non-stimulants. Studies indicate that stimulants, including amphetamines like methylphenidate, generally demonstrate greater effectiveness than other drugs across all age groups (da Silva et al., 2023). This treatment has been proven effective in reducing the main symptoms of ADHD. There is also

evidence suggesting that it can improve other outcomes related to ADHD, such as quality of life, academic performance, social aspects, and comorbid neuropsychiatric conditions. Additionally, this treatment may reduce the risk of other functional impairments, including criminal behavior, self-harm, suicidal thoughts, and dangerous behaviors. Nevertheless, both amphetamines and methylphenidate have the same pattern of undesirable effects, typically characterized as mild and temporary. The most prevalent side effects include reduced hunger, dry mouth, irritability, sleep disruptions, tachycardia, and headache. Nevertheless, amphetamines are linked to a higher incidence of adverse effects, such as weight loss and insomnia.

Although there have been decades of studies on the subject, results for patients with ADHD remain uncertain, despite concerns about stimulant use. Medication nonadherence is prevalent, and it is challenging to provide follow-up care due to the high number of patients opting for alternative therapies. A significant number of parents lack confidence in pharmaceutical medications and frequently pursue alternative forms of treatment due to their concerns (da Silva et al., 2023). These concerns may lead to untreated ADHD, which may result in long-lasting dysfunction and severe consequences such as increased substance use, prolonged incapacity to work, and heightened risk of automobile collisions. (Bokor and Anderson, 2014)

**Statement of the Problem**

ABA is a widely recognized discipline that uses data and evidence-based treatment interventions to address a variety of behaviors across different populations and settings. The field focuses on shaping socially significant behaviors, such as academic, social, communication, and daily living skills. ABA is perhaps best known as an effective treatment for the symptoms of ASD. Despite the results of studies such as Hoffman et al.,

(2016) and Ragni et al., (2022) that have shown that behavior-analytic interventions are effective in producing socially significant behavior in a diverse range of individuals and diagnoses (i.e., obsessive-compulsive disorders, and developmental disabilities, social and behavioral deficits, autism diagnoses, or ADHD). ABA continues to be less well known as an effective treatment methodology for individuals diagnosed with ADHD. Lack of information on the effectiveness of ABA for ADHD has the potential to negatively impact children with ADHD because they potentially could miss being exposed to a treatment that has the potential to be effective. This along with the increasing need for effective treatments makes finding effective alternative treatments for individuals (such as ABA) even more important.

Therefore, the purpose of this current study is to review and examine the existing literature on ABA interventions for ADHD, outline/characterize the effectiveness of ABA interventions for ADHD, identify which symptoms of ADHD that ABA interventions are commonly applied to, and identify recommendations and most effective approaches for those managing ADHD with ABA interventions to help clinicians and clients who are seeking treatment options.

## Method

### Search and Inclusion Criteria

The literature review was encompassed by computer-based searches to identify relevant literature articles. These searches were conducted using the Springer Link, APA PsycINFO, PubMed, Sage Pub Journals, EBSCOhost, psychology and behavioral science databases using the following keywords: applied behavior analysis (ABA), attention-deficit/hyperactivity disorder (ADHD), minimal brain dysfunction, hyperkinetic reaction of childhood, neurodevelopmental disorders, behavior therapy, psychosocial

interventions, and behavioral intervention. The keywords attention-deficit/hyperactivity disorder or ADHD were to be included solely in the title while behavior therapy, behavior intervention, neurodevelopmental disorders, and applied behavior analysis were included anywhere within the original article that was chosen. To be included in the current review, the articles must have been published between 2014 and 2024, written in English, and featured in peer-reviewed journals. The articles must have described the use of interventions based on ABA strategies and participants in the articles were required to have a diagnosis of ADHD. The journals that were examined in the current review can be found in Table 1.

### *ABA Interventions in the Current Review*

For the purpose of the current review, articles must have included behavior modification or interventions that involve ABA strategies and discuss the effectiveness of these strategies when used on individuals with ADHD. The articles must have described how such interventions are compared to other ABA strategies and other modalities of treatment (medication). ABA strategies within this review included low-intensity interventions, social skills training (SST), individualized interventions, self-management, behavioral parent training (BPT), behavioral class management (BCM), behavioral peer interventions (BPI), function-based and nonfunction-based treatments, behavioral modification (Positive reinforcement, response cost, token economies, continuous reinforcement, shaping technique, modeling, turn-taking, rewards, task-analysis, direct instructions, and combined parent-child behavioral therapy), visual daily schedules, and essential living skills.

**Data Collection**

The author created a set of questions for collecting information from each source (see Table 2). The author thoroughly reviewed each article and carefully chose the relevant information pertaining to the question(s) of interest. The author read each article chosen and recorded the original author's specified description of the interventions' effectiveness to determine the effectiveness of such interventions in each study. For example, to answer the question, "Is Applied Behavior Analysis an effective treatment for individuals with ADHD?", the author would read the article and record the description of the interventions' effectiveness from the original author and then provide an answer that directly addresses the question about the article. (Was the intervention effective – Yes/No, overall – Yes/No). This method was iterated for every article, addressing each issue that may be answered with a binary response of either Yes or No. The author will systematically document all outcomes on a data collection sheet.

Other data collected included the number of articles published on the benefits of implementing ABA treatment for individuals with ADHD (short-term and long-term). These articles were compared and recorded based on answering the relevant question and the author provided an answer that directly addresses the question about the article. For questions that involve comparisons ("What interventions have caused the most improvements in children with ADHD?"). The author read each article, summarized relevant information from each treatment modality, recorded the data from all relevant graphs from each intervention or treatment used, and provided an answer that directly addressed the question about the article. The questions used in the current review are listed in Table 2.

# Results

## Behavior Change Interventions

The first question in the current research analyzed the literature to determine whether and which behavior change interventions were employed. Four out of the 14 (29%) articles implemented an intervention within the following ABA interventions and/or strategies: behavioral parent training, behavioral classroom management, and behavioral peer interventions. Additionally, 9 out of the 14 (64%) articles implemented an intervention within the following ABA interventions and/or strategies: social skills training (SST), self-management, function-based (motivating operations, extinction, differential reinforcement), nonfunction-based (delivery of arbitrary stimuli), and combined treatments, behavior modification (positive reinforcement, response cost, token economies, combined parent-child behavioral therapy, shaping technique, modeling, turn taking, task analysis, time-out, partial and continuous reinforcement, and direct instructions), instrumental reinforcement learning, daily living skills, daily schedules, and intensive individualized behavioral therapy. Table 3 provides additional details and locations within each article.

The second question examined and addressed what ABA interventions caused the most improvement for children diagnosed with ADHD. Five out of the 14 (36%) articles utilized found the most improvements for interventions that included behavior modification interventions and strategies (positive reinforcement, response cost, token economies, continuous reinforcement, shaping technique, modeling, turn-taking, rewards, task-analysis, direct instructions, and combined parent-child behavioral therapy). Four out of the 14 articles (29%) utilized found most improvements for interventions that included behavior management interventions (behavioral parent training, behavioral classroom

management, behavioral peer interventions, and combined behavioral treatment). These two ABA interventions were found to result in the most improvement among all articles reviewed. Overall, 12 out of the 14 articles utilized (86%) found that there were improvements in symptoms for children with ADHD. Refer to Tables 4 and 5 for additional details related to the second question and the location in each article.

**Effectiveness**

The third question in the current literature review identified whether the article found ABA interventions effective for ADHD. 12 out of the 14 (86%) identified for the review reported ABA to be effective. Several articles found that the effectiveness of ABA is significantly dependent on the factor that each child with ADHD comes with their own skills and behaviors across a wide continuum of impairments, and intervention strategies must be individualized based on the function of behaviors, age level of the child and structural constraints of an environment (Dorji, 2021, Rad et al., 2019, Wilder et al., 2019, Wiener & Daniels, 2016). Dorji and colleague's research was mainly focused on the behavior management of a child with ADHD in a classroom, with in this study they found that three main strategies worked well to manage the behavior of a child with ADHD. These techniques included applying ABA techniques (modeling, turn-taking, rewards, reinforcements, task analysis, time-out, and direct instructions), teaching daily living skills, and using a visual daily schedule. In addition, it was found that when using ABA for children with ADHD, it was best to ensure that direct instruction was short and clear (Dorji, 2021). De Meyer and colleagues investigated reinforcement contingency learning in children with ADHD specifically to examine the acquisition and extinction of operant responding under partial reinforcement and continuous reinforcement (2019). The results

from this study concluded that children with ADHD showed faster acquisition under continuous reinforcement than under partial reinforcement (De Meyer et al., 2019).

Evans and colleagues (2013) extended the conceptualization of treatment research by differentiating training interventions from behavior management. By reviewing the growing literature on training interventions and behavior management, they concluded that behavioral parent training (BPT), behavioral classroom management (BCM), and behavioral peer interventions (BPI) were well-established and effective treatments for children with ADHD (Evans et al., 2013). Martin and Hoza reiterate these results and state that based on many decades of empirical research, behavioral management therapies such as BPT, BCM, and BPI are generally shown to reduce core ADHD symptoms and improve key domains of functional impairment (i.e., behavioral, academic, social; Martin and Hoza, 2020). Irianjani and Rohmah examined applying a token economy system to improve the attention of a child with ADHD (2020). Observations and interviews were used to collect Data regarding attention difficulty in the learning process and doing a task. The results of this study showed that this behavior modification technique proved effective in increasing the concentration of children with ADHD. The subjects within the study showed improvement in attention duration and were able to give their attention to the given task for a longer duration (more than 5 minutes) (Irianjani and Rohmah, 2020). In another study, the original authors used qualitative methodology to characterize potential long-term effects (therapeutic and iatrogenic) of behavior therapy for adolescents with ADHD. Sibley and colleagues conducted forty-two in-depth interviews with adolescents with ADHD and parents, 4 years post-treatment to determine the long term benefits of ABA therapy (2022). Results found that a majority of the participants had long-term benefits that included: the development of organizational skills, enhanced

motivation, improved self-awareness, improved parental knowledge of ADHD, increased parent autonomy granting, enhanced parental engagement with the youth, and improved parent-teen relationships (Sibley et al., 2022).

Additional articles also examined aspects that could hinder the effectiveness of ABA for children with ADHD. Some of these factors are parents' tendency for inconsistency in monitoring their child's behavior, child motivation or participation, and parent-child collaboration (Irianjani and Rohmah, 2020; Sibley et al., 2022). One article examined the application of a shaping technique to increase on-task behavior duration in children with ADHD. Nasa and colleagues' research results showed that the shaping technique can increase the duration of on-task behavior in children with ADHD from 1 minute during baseline up to 10 minutes during the post-test (Nasa et al., 2018). Another article examined the use of social skills training (SST) to target social impairment and improve the social skills and functioning of youth with ADHD. Willis and colleagues found that a majority (88%) of the 16 SST interventions that they reviewed were found to improve various aspects of social functioning in children and adolescents with ADHD. Results stated that findings were inconsistent and were not maintained at follow-up assessments when SST was used as a stand-alone intervention. However, there were promising and significant results when SST was used as a supplemental treatment to behavioral classroom management programs (Willis et al., 2019).

As mentioned, 12 out of the 14 (86%) found ABA to be effective. Within these 12 articles, however, there were various interventions and strategies that were utilized by each author. This shows that each child with ADHD comes with their own skills and behaviors across a wide continuum of impairments, and intervention strategies must be

individualized based on the function of behaviors, age level of the child, needs based on the severity of symptoms, and structural constraints of an environment.

Although most of the articles in the current study found ABA to be effective and stated that behavior modification is a widely used and effective treatment for individuals with ADHD, two articles did not. The first article in the present study examined the effectiveness of fidget cubes on classroom behavior among students with ADHD. Croley and colleagues examined the use of sensory-based interventions by using fidget toys to improve attention. The results from this study indicated that noncontingent access to fidget toys during independent seatwork does not improve study outcomes or attentiveness, therefore making it ineffective for children with ADHD. However, it was found that it was effective in decreasing out-of-seat behavior and hyperactivity (Croley et al., 2022). In the second study, Bussing and colleagues aimed to address the willingness to use ADHD self-management by focusing on the perceptions of adolescents and parents. The results found that using self-management is ineffective for individuals with ADHD. Furthermore, the findings show that self-management interventions may be more acceptable to adults (parents) but they are resisted by adolescents (Bussing et al., 2015). Refer to Table 6 for additional details related to the third question and the location in each article.

**Long-term Benefits**

The fourth question and last question identified what the long-term benefits were for those with ADHD when using ABA interventions. 12 of the 14 articles (86%) utilized within this article found long-term benefits to the use of ABA therapy for those with ADHD. These benefits included: reductions of ADHD symptoms, promotion of self-advocacy, improvement of various aspects of social functioning, self-regulation, increase

in attention levels, significant improvements with homework completion, improvements in rule-following, classroom behavior, academic productivity, social skills, and quality of play, development of organization skills, enhanced motivation, improved, self-awareness, improved parental knowledge of ADHD, increased parent autonomy granting, enhanced parental engagement with the youth, and improved parent-teen relationships, reductions in problem behavior, management of ADHD symptoms, improvements in inattention, hyperactivity, and decrease in inappropriate classroom behaviors, reduction of core ADHD symptoms and improvement of key domains of functional impairment (i.e., behavioral, academic, social). Refer to Table 7 for additional details related to the fourth question and the location in each article.

## Discussion

The purpose of the current review was to examine the literature on existing ABA interventions/strategies and examine their effectiveness when applied to ADHD. Identification of their effectiveness was based on the principles of ABA, this review focused on determining their evidence base concerning managing ADHD and identifying suggestions and best practices for those managing ADHD. A related goal of this research was to provide information on how well ABA works for specific symptoms of ADHD in children 6 to 17 years of age. The results of this review indicated that most of the articles indicated that ABA was an effective therapy for individuals with ADHD. However, multiple articles indicated specific factors that seem necessary to ensure ABA's effectiveness. These factors included individualized interventions based on the function of behaviors, age level of the child, needs based on the severity of symptoms, and structural constraints of an environment. Other important factors are consistency and willingness to monitor their child’s behavior, child motivation or participation, and

parent-child collaboration. Furthermore, most improvements for interventions included behavior modification interventions (positive reinforcement, response cost, token economies, continuous reinforcement, shaping technique, modeling, turn-taking, rewards, task-analysis, direct instructions, and combined parent-child behavioral therapy) and behavior management interventions (behavioral parent training, behavioral classroom management, behavioral peer interventions, and combined behavioral treatment).

**Advice for Clinicians**

This article aims to inform clinicians of the importance of using ABA therapy and how they should use it to work with children with ADHD. Based on the results, ABA therapy has been proven to be effective, with behavior modification interventions and behavior management interventions showing the most improvement in children with ADHD. For clinicians, behavior modification interventions can include positive reinforcement, response cost, token economies, continuous reinforcement, shaping technique, modeling, turn-taking, rewards, task analysis, direct instructions, and combined parent-child behavioral therapy. Behavior management interventions can include behavioral parent training, behavioral classroom management, behavioral peer interventions, and combined behavioral treatment. These interventions are best suited for any child within the DSM-5-TR criteria for ADHD. Although, the specific type of intervention being used depends on many factors, such as the severity of the symptoms, age, environmental constraints, etc. These factors should be considered before choosing the intervention that is best suited for the individual.

The American Psychiatric Association (2022) stated that ABA principles are used as the first line of treatment for younger children, but when it comes to older children it is only used as a supplementary treatment. Clinicians need to continue using ABA therapy

as a treatment for ADHD throughout a child's development due to its effectiveness and due to how problematic untreated ADHD can be, as well as just using the medication as a treatment. Using behavior modification interventions and behavior management interventions, ABA therapy has the benefit of reducing ADHD symptoms, promoting self-advocacy, improving various aspects of social functioning, and self-regulation, and increasing attention levels even before an individual begins medication treatment. Having ABA therapy as a first-line treatment or even a supplementary treatment gives the individual the potential to learn to manage ADHD symptoms throughout their development.

**Limitations and Future Research**

The current review had multiple limitations. Firstly, there were limited articles that were found on the current topic that were both based on evidence-based ABA principles and that were researched within the past 10 years. Based on the current review, this could also be examined for future research. Secondly, multiple articles stated that ABA principles are used as the first line of treatment for younger children but when it comes to older children it is used as a supplementary treatment to medication. This study does not focus solely on medication or other treatments besides ABA therapy. Comparing these treatments to ABA therapy can be investigated for future research to determine best practices compared to other treatments.

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**Table 1**

*Location of Articles in the Current Review*

| Journal | Frequency | Percentage |
|---|---|---|
| Journal of Applied Behavior Analysis | 2 | 9% |
| Behavior Analysis in Practice | 1 | 5% |
| European Journal of Medicine and Veterinary Sciences-Novus | 1 | 5% |
| Journal of Clinical Child and Adolescent Psychology | 2 | 9% |
| Journal of Early Childhood Care and Education | 1 | 5% |
| Journal of Behavioral Education | 1 | 5% |
| Journal of Evidence-Based Therapies for Children and Adolescents | 1 | 5% |
| Journal of Abnormal Child Psychology | 1 | 5% |
| Journal of Child and Family Studies | 2 | 9% |
| Child Psychiatry & Human Development | 1 | 5% |
| Canadian Journal of School Psychology | 1 | 5% |
| Journal of Learning Disabilities | 1 | 5% |
| The Behavior Analyst | 1 | 5% |
| Journal of Evidence-Based Psychotherapies | 1 | 5% |
| Clinical Case Studies | 1 | 5% |
| Behavioral Neuroscience of ADHD | 1 | 5% |
| Autism and Child Psychopathology | 1 | 5% |
| Pediatrics | 1 | 5% |
| Journal of Pharmacy Practice | 1 | 5% |

**Table 2**
*Research Questions*

| Item | Question |
|---|---|
| 1 | What evidence-based interventions were used in each article? |
| 2 | What interventions have caused the most improvements in children with ADHD? |
| 3 | Is Applied Behavior Analysis an effective treatment for individuals with ADHD? |
| 4 | Are there effects of using ABA therapy for those with ADHD? Long term? Short term? |

**Table 3**

*Question 1 Results: Were evidence-based interventions used in each article?*

| Citation | Yes/No | Intervention | Location in Article |
|---|---|---|---|
| Wiener and Daniels, 2016 | Yes | Low intensity interventions (Preferential seating, and positive reinforcement) | p. 577, p. 578 |
| Rad et al., 2019 | Yes | Intensive behavioural therapy | p. 116, 117 |
| Willis et al., 2019 | Yes | Social Skills Training (SST), Alternative approaches to SST | p. 349 -350, p. 362 |
| Bussing et al., 2015 | Yes | Self-Management | p. 563 |
| Newcorn et al., 2015 | Yes | Behavior management interventions (behavioral parent training, behavioral classroom management, and behavioral peer interventions) | p. 15 |
| Evans et al., 2013 | Yes | Behavior management interventions (behavioral parent training, behavioral classroom management, and behavioral peer interventions) | p. 8 – 12 |
| Sibley et al., 2022 | Yes | Engagement-focused Behavior therapy | p. 995 |

**Table 3 (continued)**

| Citation | Yes/No | Intervention | Location in Article |
|---|---|---|---|
| Croley et al., 2022 | Yes | Noncontingent Reinforcement - Fidget Toys | p. 547 |
| Wilder et al., 2019 | Yes | Function-based (motivating operations, extinction, differential reinforcement), Nonfunction-Based (delivery of arbitrary stimuli), and Combined Treatments | p. 469 |
| Mannem et al., 2021 | Yes | Behavior modification (Positive reinforcement, response cost, token economies, and combined parent-child behavioral therapy) | p. 179 - 180 |
| De Meyer et al., 2019 | Yes | Instrumental reinforcement learning (acquisition) and extinction under conditions of partial and continuous reinforcement | p. 1897 |
| Nasa et al., 2018 | Yes | Behavior modification (shaping technique) | p. 152 |
| Irianjani and Rohmah, 2020 | Yes | Behavior modification (Token Economy) | p. 3 |

**Table 3 (continued)**

| Citation | Yes/No | Intervention | Location in Article |
|---|---|---|---|
| Dorji et al., 2021 | Yes | Daily schedules, ABA (modeling, turn-taking, rewards, reinforcement, task analysis, time-out, and direct instructions), Daily living skills | p. 45 |
| Martin and Hoza, 2020 | Yes | Behavior management interventions (behavioral parent training, behavioral classroom management, and behavioral peer interventions) | p.157 - 160 |

**Table 4**

*Question 2 Results: What interventions caused the most improvements in ADHD?*

| Citation | Intervention | Location in Article |
|---|---|---|
| Wiener and Daniels, 2016 | Low-intensity interventions (preferential seating, and positive reinforcement) | |
| Willis et al., 2019 | SST Interventions + Alternative Approaches to SST | p. 358, p. 362 - 363 |
| Rad et al., 2019 | Intensive behavioral therapy Individualized Interventions | p. 117 |
| Bussing et al., 2015 | Self-Management | p. 563 |
| Newcorn et al., 2015 | Behavior Management Interventions (Behavioral parent training, behavioral classroom management, and behavioral peer interventions) | p. 15 |
| Evans et al., 2013 | Combined Behavioral Treatment | p. 12 |
| Sibley et al., 2022 | Behavior Therapy - STAND | p. 993, 994 |
| Wilder et al., 2019 | Nonfunction-based treatment, Preferred treatment - Combined Treatment | p. 474 - 475(Figure 2, Table 1), 476 |
| Mannem et al., 2021 | Behavior modification (Positive reinforcement, response cost, token economies, and combined parent-child behavioral therapy) + Medication = Combined Therapy | p. 179 - 180 |

**Table 4 (continued)**

| Article | Intervention | Location |
|---|---|---|
| De Meyer et al., 2019 | Continuous reinforcement<br>Behavioral Parent Training (BPT) | p. 1897<br>p. 1890 |
| Nasa et al., 2018 | Behavior modification (shaping technique, positive reinforcement, and token economies) | p. 152, figure 1-3, 159 |
| Irianjani and Rohmah, 2020 | Behavior modification (Token economy) | p. 8, Table 3.1-3.3, 11 |
| Dorji et al., 2021 | Daily schedules, ABA (modeling, turn-taking, rewards, reinforcement, task analysis, time-out, and direct instructions), Daily living skills, FBA, and BIP | p. 46 |
| Martin and Hoza, 2020 | Behavior Management Interventions (Behavioral parent training, behavioral classroom management, and behavioral peer interventions) = Combined Behavioral Treatment | p.157 - 160 |
| Croley et al., 2022 | N/A | p. 555 |

**Table 5**

*Question 2: Occurrence of interventions between articles*

| Intervention | Occurrence in chosen Articles | Percentage |
|---|---|---|
| Low-intensity interventions (preferential seating, and positive reinforcement) | 1 | 6% |
| SST Interventions + Alternative Approaches to SST | 2 | 13% |
| Individualized Interventions | 1 | 6% |
| Self-Management | 1 | 6% |
| Behavior Management Interventions (Behavioral parent training, behavioral classroom management, behavioral peer interventions, and combined behavioral treatment) | 4 | 25% |
| Behavior Therapy – STAND | 1 | 6% |
| Nonfunction-based treatment, Preferred treatment – Combined Treatment | 1 | 6% |
| Behavior modification (Positive reinforcement, response cost, token economies, continuous reinforcement, shaping technique, modeling, turn-taking, rewards, task – - analysis, direct instructions, and combined parent-child behavioral therapy) | 5 | 31% |

**Table 5 (continued)**

| Intervention | **Occurrence in chosen Articles** | **Percentage** |
|---|---|---|
| Daily schedules, Daily living skills, FBA, and BIP | 1 | 6% |
| Behavior modification + Medication = Combined Therapy | 1 | 6% |
| N/A | 1 | 6% |

**Table 6**

*Question 3 Results: Is ABA an effective treatment for individuals with ADHD?*

| Citation | Yes/No | Location in Article |
|---|---|---|
| Willis et al., 2019 | Yes | p. 358 |
| Bussing et al., 2015 | No | p. 571, 572 |
| Newcorn et al., 2015 | Yes | p. 15 |
| Evans et al., 2013 | Yes | p. 8 - 12 |
| Sibley et al., 2022 | Yes | p. 993 - 994 |
| Croley et al., 2022 | No | p. 554, 555 |
| Wilder et al., 2019 | Yes | p. 476 |
| Mannem et al., 2021 | Yes | p. 179 - 180 |
| De Meyer et al., 2019 | Yes | p. 1897 |
| Nasa et al., 2018 | Yes | p. 152, figure 1-3, 159 |
| Irianjani and Rohmah, 2020 | Yes | p. 8, Table 3.1-3.3, 11 |
| Dorji et al., 2021 | Yes | p. 46 |
| Martin and Hoza, 2020 | Yes | p. 163 |
| Wiener and Daniels, 2016 | Yes | p.578 |

**Table 7**

*Question 4 Results: Are there effects of using ABA therapy for individuals with ADHD? Long Term?*

| Citation | Yes/No | Benefits | Location in Article |
|---|---|---|---|
| Wiener and Daniels, 2016 | Yes | Reducing ADHD symptoms, and promotion of self-advocacy | p. 577, p. 578 |
| Willis et al., 2019 | Yes | Improvement of various aspects of social functioning | p. 358 |
| Bussing et al., 2015 | Yes | Self-regulation, and increase in attention levels | p. 563 |
| Newcorn, et al., 2015 | No | - | - |
| Evans et al., 2013 | Yes | Reducing ADHD symptoms, self-advocacy, significant improvements with homework completion, improvements in rule-following, classroom behavior, academic productivity, social skills, and quality of play | p. 8 - 12 |
| Sibley et al., 2022 | Yes | Development of organization skills, enhanced motivation, improved, self-awareness, improved parental knowledge of ADHD, increased parent autonomy granting, enhanced parental engagement with the youth, and improved parent-teen relationships. | p. 993 |

**Table 7 (continued)**

| Citation | Yes/No | Benefits | Location in Article |
|---|---|---|---|
| Mannem et al., 2021 | Yes | Improvement of behavioral problems like aggression and improved parent-child relationships | p. 180 |
| Croley et al., 2022 | No | - | - |
| Wilder et al., 2019 | Yes | Reductions in problem behavior | p. 476 |
| De Meyer et al., 2019 | Yes | Management of ADHD symptoms | p. 1890 |
| Nasa et al., 2018 | Yes | Reduced and increased management of ADHD symptoms | p. 152 |
| Irianjani and Rohmah, 2020 | Yes | Increased motivation, discipline, and effective communication patterns between child and parent | p. 11 |
| Dorji et al., 2021 | Yes | Improvements in inattention, hyperactivity, and decrease in inappropriate classroom behaviors. | p. 46 |
| Martin and Hoza, 2020 | Yes | Reduction of core ADHD symptoms and improvement of key domains of functional impairment (i.e., behavioral, academic, social) | p. 163 |