Non-pharmaceutical Management Strategies for Primary School Aged Children with Attention Deficit Hyperactivity Disorder

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Attention-Deficit/Hyperactivity Disorder (ADHD) is the most prevalent childhood neurodevelopmental disorder. Arising from a complex interaction between genetic and environmental factors, along with epigenetic changes during foetal development, ADHD is a lifelong condition that impacts children's academic and social functioning in numerous adverse ways. The treatment of ADHD tends to involve pharmacological (e.g., stimulant medications) or non-pharmaceutical interventions (e.g., family or school-based management), or a combination of both, although many parents and schools are reticent to administer stimulant medications to students. This study examines the effectiveness and implications of non-pharmaceutical interventions for students with ADHD, with the primary aim of improving educators' understanding of non-pharmaceutical based interventions. A search of the relevant literature was conducted via medical and educational journals and research data bases to identify non-pharmaceutical management strategies. These were then examined to identify those with the potential to improving educators understanding and impacting outcomes for students with ADHD. Overall, the findings demonstrated a strong ground for the integration of evidence-based interventions into educational settings to promote academic and social outcomes for students with ADHD.

Introduction and Background

Attention-Deficit/Hyperactivity Disorder (ADHD) is a neurodevelopmental disorder typically diagnosed during childhood and is characterised by the core symptoms of inattention, hyperactivity, and impulsivity (Cecil & Nigg, 2022; Coghill et al., 2021). Children may

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exhibit hyperactive and impulsive behaviours such as fidgeting, excessive talking, interrupting others, and acting on impulse without considering the consequences. It is the most common neurodevelopmental disorder presenting to child and adolescent mental health, paediatric, and primary care services (Coghill et al., 2021). The causes of ADHD are believed to be a combination of genetic and environmental factors, with some evidence suggesting that epigenetic changes during foetal development may contribute to the development of the disorder (Cecil & Nigg, 2022). ADHD is a lifelong condition often persisting into adulthood with negative impacts on social and academic functioning. With appropriate interventions and support, however, many individuals with ADHD can manage their symptoms and achieve adaptive functioning and success in life.

ADHD can present within an individual in three distinctive ways or subtypes. These include; ADHD Predominantly Inattentive Presentation whereby the individual finds it difficult to follow instructions, forgets routines and is easily distracted; ADHD Predominantly Hyperactive-Impulsive presentation where the individual fidgets, cannot sit still, is impulsive; and ADHD Combined presentation where the individual demonstrates symptoms from both areas (Rowland et al., 2008). The Diagnostic and Statistical Manual of Mental Disorders (DSM-5) and the more recent DSM-5 TR provide diagnostic criteria for each of these presentations, and healthcare professionals need to assess the individual thoroughly to determine which presentation best describes their symptoms. The application of these symptom lists from the DSM is only part of the process of diagnosis.

Coghill et al. (2021) stated that ADHD affects 5.3% of children worldwide. However, in Australia, the estimated rate of children presenting with ADHD is between 6 and 10% (Rege, 2022). There appears to have been no significant increase in the prevalence of ADHD among children and adolescents in the last 30 years. For example, in 1998 the first national (Australian) survey of the mental health of children and adolescents was conducted, with the second being conducted in 2013-2014 (and published in 2015). The second survey reported a decrease in the prevalence of ADHD decreasing from 9.8% to 7.8% (Lawrence et

al., 2015). However, it must be noted that this was based on self-reporting from children and parents. Nevertheless, ADHD was the most common mental disorder presenting in children and adolescents across Australia. Of the three ADHD subtypes, predominantly inattentive was the most common presentation with 3.4%, 1.2% with predominantly hyperactive and 2.8% with a combined subtype (Lawrence et al., 2015). However, studies from the US and Sweden noted increases in diagnosis, which have contributed to changes in clinical treatments (Faraone, 2021).

There have been variances noted in the occurrence of the disorder in different genders, with ADHD being more common in males than females with a ratio of 2:1 (10.4% as opposed to 4.3%) and females being more likely to present as predominantly inattentive (American Psychiatric Association, 2022; Faraone, 2021). Further exploration noted that in females there were higher rates in children than in adolescents (12-17 years) with 5.4% of the females surveyed being between 4-11 years old (Lawrence et al., 2015). Males showed relatively no difference in prevalence in either age group. However, a recent meta-analysis found no significant difference between males and females in the presentation of core symptoms (Faraone, 2021).

Social and demographic characteristics include parental/ caregiver education, employment status/ type, household income, and family structure. Regarding education, data demonstrated a link between diagnosis rates of ADHD and household education levels, with the lowest rates of ADHD (5.4%) being found where parents/carers held a university degree (Lawrence et al., 2015). Conversely, in households where adults had completed year 10 or lower prevalence rates were higher (11.7%) (Lawrence et al., 2015).

For employment, Lawrence et al. (2015) noted that households where both parents were employed had the lowest rates (5.8%) of children with ADHD, compared to households where parents were unemployed. If both parents or carers were unemployed prevalence rates rose to 15.6% whereas in households where one parent or carer was employed prevalence was lower at 7% (Lawrence et al., 2015). Additionally in single parent homes with no employment prevalence rates increased to

15.3%, which is double the rate if the parent or carer was employed (7.7%) (Lawrence et al., 2015). With regards to income, the prevalence of ADHD was higher in children living in households with lower incomes, education, and employment. The data show a direct link to household income with 1 in 10 (11.7%) children from households with lower incomes presenting with ADHD, compared to middle (6.6%) and higher (5.2%) income brackets (Lawrence et al., 2015). The higher the household income the lower the prevalence rate of ADHD.

For family structure family functioning (i.e., unhealthy patterns of communication, interactions and behaviour and extending to lack of care and support including emotionally) had the strongest links with prevalence rates suggesting that strong family relationships are a positive contributor. There were higher prevalence rates (18.1%) in families with poor family functioning (Lawrence et al., 2015), with this being more noticeable in children than adolescents. Households with high family functioning were significantly lower with only 5.6% prevalence rates (Lawrence et al., 2015).

The lowest prevalence was found in children living with their original families. This is outlined by Lawrence et al. (2015) as families where the child is living with at least one of their natural, adoptive, or foster parents and includes stepchildren. The highest prevalence was in children that lived in single parent/ carer homes (11.1%) or blended families (13.4%) (Lawrence et al., 2015).

ADHD Diagnostic Criteria

The DSM–5 (APA, 2022) is a classification system used for diagnosing a range of mental health disorders, including ADHD. The DSM-5 (APA, 2022) outlines a set of criteria covering the core symptoms presented to assist with the diagnosis of ADHD. Additionally, the DSM-5 (APA, 2022) also helps clinicians to identify the severity of ADHD by determining the level of functional impairment, which can range from mild to severe.

To receive a diagnosis of ADHD (inattentive), children must have demonstrated six or more of the following symptoms over six months that have negatively impacted social and academic activities (APA, 2022, p. 59):

- Fails to give close attention to details or makes careless mistakes in various activities such as schoolwork
- Difficulty sustaining attention in tasks or play activities
- Often seems to not listen when spoken to directly
- Does not follow through on instructions and fails to finish tasks in the classroom
- Difficulty organising tasks and activities
- Avoids tasks that require sustained mental effort
- Loses necessary things for tasks or activities
- Easily distracted by extraneous stimuli
- Forgetful in daily activities
- Leaves seat in situations when remaining seated is expected
- Runs about or climbs in inappropriate situations (may be limited to feeling restless in adolescents or adults)
- Unable to play or engage in leisure activities quietly
- "On the go," acting as if "driven by a motor" and unable to be still for extended periods
- Overly talkative
- Blurts out an answer before a question has been completed
- Has difficulty waiting turn (e.g., while waiting in line)
- Interrupts or intrudes on others (e.g., butts into conversations, games, or activities

In addition to the above criteria, an individual must also exhibit symptoms prior to the age of 12 years and across various settings such as school, home, and leisure activities (i.e., pervasiveness), which negatively affect their social and academic functioning (APA, 2022, p. 60) p. 60). It is crucial to exclude the likelihood of schizophrenia or another psychotic disorder, as well as other mental illnesses such as mood, anxiety, dissociative, personality disorders, or substance-related disorders, as the underlying cause of these symptoms.

Concerning levels of severity for ADHD, the DSM 5 (APA, 2022) stipulates mild (i.e., the presence of only a few symptoms required for diagnosis with minimal social or academic impairments); moderate (i.e., symptoms or impairments falling between mild and severe); and severe (the presence of numerous symptoms beyond those required for diagnosis, significant impairment in social or occupational functioning, or particularly severe symptoms) (APA, 2022, p. 60) It is worth noting that there are cultural differences in attitudes and responses to ADHD behaviours. In the United States, for instance, diagnosis rates among Caucasians are higher than those of other cultures (APA, 2022, p. 62).

A comorbid condition means that the individual is presenting with an additional psychological condition (i.e., two or more conditions) and in ADHD, comorbidity is common. A large population-based study conducted by Mohammadi et al. (2021) into the prevalence of comorbidities in children with ADHD concluded that ADHD is generally present with a range of comorbid conditions. Comorbid disorders can complicate the management of ADHD, and if severe enough can hinder school and social functioning (Gordon Millichap & Springerlink,2011). The primary disorders that are likely to co-occur with ADHD include learning difficulties, oppositional defiance disorder, autism spectrum disorder (ASD), depression, anxiety disorders and conduct disorders (Coutinho et al., 2021; Mohammadi et al., 2021; Reale et al., 2017).

The Present Paper

This study aims to improve teachers' understanding of the effectiveness of non-pharmaceutical based behaviour management interventions for students with ADHD in primary school settings. The study strives to provide insights into the most effective strategies for supporting students with ADHD to regulate their behaviours, achieve academic outcomes and develop skills to support them throughout their schooling.

The significance of this study lies in its ability to inform practice and policy in education. The study's impact on the education of students with ADHD has the potential to be significant as it could contribute to the development of evidence-based practices for supporting students with

ADHD in the classroom. Furthermore, this study could decrease the stigma surrounding ADHD and increase the importance of providing support for these students. Through developing teachers' understanding of strategies for managing the core symptoms of ADHD in the classroom, this study has the potential to improve academic and social-emotional outcomes for these students. For this study, primary school aged students are those between 4 and 11 years of age with these being the formal years of schooling in Western Australia. Adolescents are 12-17 years of age.

There were four specific goals of the present study:
- To examine the effectiveness of both non pharmaceutical-based interventions for students with ADHD
- To identify gaps in the existing research on behaviour management strategies for students with ADHD and provide recommendations for future research
- To provide insights into the most effective strategies for developing behaviour management skills in students with ADHD

To achieve this study's goals research was conducted using medical and educational journals and primarily using research databases such as ERIC, The National Library of Medicine, Google Scholar, and Sage journals such as the Journal of Attention Disorders. The primary articles selected were published within a specified 5-year time frame from 2019-2023, with other studies from 2008-2023 being considered for long-term analysis. Older articles are essential in understanding the topic comprehensively and examining trends over time. This approach allowed the incorporation of a range of studies over time, providing insights into the evolution of ADHD management. Reference lists of selected articles were checked to identify relevant additional sources. Keywords used included, but were not limited to, 'prevalence rates of ADHD", "Australia", "impact on social and academic functions", "SEL-based behaviour management interventions for students with ADHD", "classroom management interventions and attention deficit hyperactivity disorder", "non-pharmaceutical management for ADHD", "comorbidities in ADHD", and "off-task behaviour in ADHD". Articles

that dealt with adults or late teens were discounted unless they enhanced or added to current information, such as demonstrating the need for early intervention. Articles over 15 years old were primarily discounted due to advances in clinical understanding of ADHD and the evolution of mental health in education knowledge. However, some older sources were taken into consideration based on the historical or foundational information they provided on the topic; they were the latest report, or the posited ideas have remained consistent over time with older articles providing comprehensive evidence of this. Whilst focusing on non-pharmaceutical-based interventions the researcher felt a thorough analysis of other interventions would enhance the study's findings.

Utilising multiple databases and data sets allowed the cross-checking, or data triangulation, of information across multiple data collections helping to corroborate findings adding credibility to the information. Data triangulation is the use of multiple forms of data to enhance validity and trustworthiness of the findings (Carter et al., 2014). Utilising a range of sources ensures a comprehensive understanding of the issue. An audit trail of all records, and any notes made by the researcher, was created to show the steps taken in data collection and analysis. An audit trail is described by Merriam (2014) as a log that describes in detail the steps a researcher takes, how data was collected, how categories were decided and how decisions were made throughout the inquiry process. This will assist in the recreation of the study or further research as needed.

Pharmacological Management of ADHD

Currently, the management of ADHD in children focuses on parent training, classroom management, peer interventions and, in some cases, the use of psychostimulant medications (Felt et al., 2014). The focus of treatment, irrespective of the approach taken, is to improve functional performance and limit behavioural issues (Felt et al., 2014). Management tends to be pharmacological or non-pharmacological.

There are two main types of medications available for the treatment of ADHD: psychostimulants such as methylphenidate (Ritalin) and amphetamines, and non-stimulants like Atomoxetine, guanfacine, and

clonidine (Felt et al., 2014; Mechler et al., 2021;). Psychostimulants are generally the first choice for treatment of ADHD, and they work through the improvement of brain function by increasing the effectiveness of chemicals in the brain, such as dopamine and norepinephrine, that control attention and executive function (Mechler et al., 2021).

Executive functions are brain functions that activate, organise, integrate, and manage other functions. According to Barkley (2012) executive functions include: nonverbal working memory; internalisation of speech (verbal working memory); self-regulation of affect/motivation/arousal; and reconstitution (planning and generativity). In this model, individuals with ADHD cannot delay responses, thereby acting impulsively and without adequate consideration of future consequences. Brown (2005), on the other hand, conceptualised executive functions as six different "clusters": organising, prioritising, and activating tasks; focusing, sustaining, and shifting attention to task; regulating alertness, sustaining effort and processing speed; managing frustration and modulating emotions; utilising working memory and accessing recall; and monitoring and self-regulating action. These clusters operate in an integrated way, and difficulties in these clusters result in attentional deficits in that individuals have difficulty organising tasks, getting started, remaining engaged, remaining alert, maintaining a level of emotional state, applying working memory and recall, and self-monitoring and regulating actions (Schreiber et al., 2013).

Psychostimulants, available in both short and extended release (4-to-13-hour release), are generally chosen in the first instance due to their effectiveness in reducing core symptoms and being safe (Coghill et al., 2021; Felt et al., 2014). Side effects of psychostimulants can include nausea, headaches, irritability, loss of appetite, blood pressure and sleep problems (Melcher et al., 2012). Research by Cascade et al. (2010) reported that of 325 patients using psychostimulants as a treatment, 48% reported having side effects, and of these, 21% considered the side effects difficult. Conversely, Coghill et al. (2021) clearly state that there is limited knowledge of long-term adverse effects of psychostimulants due to the lack of data over a prolonged period.

Non-stimulants are generally a second-line drug for the treatment of symptoms of ADHD. These usually include Atomoxetine, Clonidine and Guanfacine. Whilst they are generally considered effective, fewer studies have explored their efficacy (Felt et al., 2014). Parents having concerns about their children using psychostimulants are one of the primary reasons for choosing a second line drug. Other reasons include drug diversion and comorbid conditions where one drug treats all symptoms (Felt et al., 2014).

A frequently prescribed non-stimulant is Atomoxetine, which works by blocking the norepinephrine transporter, allowing noradrenaline, a chemical in the brain that improves focus for a more significant duration (Melcher et al., 2021). Clonidine and guanfacine are similar in the way they work. Both alpha-2 activate adrenergic receptors in the brain, which can help improve focus and attention (Melcher et al., 2021). The most common side effects reported include those similar to psychostimulants with the addition of nightmares for guanfacine (Melcher et al., 2021). Dry mouth, sedation, bradycardia, and syncope were added to the list of side effects of Clonidine (Melcher et al., 2021). The most concerning side effect has been reported in the use of Atomoxetine where 12 placebo studies conducted showed a higher risk of suicide ideation in children taking Atomoxetine for treatment (Melcher et al., 2021). Similar studies in adults did not generate the same results.

Non-pharmaceutical Management of ADHD

Not all patients diagnosed with ADHD desire to be medicated. According to Hahn-Markowitz et al. (2016), not everyone responds to the medication and that up to 50% of adult patients only experience a 30% decrease in core symptoms whilst on medication. Furthermore, studies on medication to treat the core symptoms of ADHD have focused on improvements or changes in the severity of the symptoms rather than improvements in other areas of the patient's life, such as the ability to function (Hahn-Markowitz et al., 2016). Research has shown that whilst medication can significantly improve daily functioning in adults with ADHD, medicated adults continue to suffer impairments in their daily lives, highlighting the need for additional interventions to improve daily

functioning (Hahn-Markowitz et al., 2016). Early primary school interventions can lead to improved academic and social outcomes and may reduce the need for medication later in life.

ADHD can impact children across multiple areas of their lives. These include school, social, family and self. Given the challenges experienced by students with ADHD, it is not surprising that they encounter difficulties within the classroom environment. The school environment was reported as having the second most significant impact on children in Australia (Lawrence et al., 2015). However, attendance rates were not impacted significantly, with students with ADHD missing on average, 4-5 days of school a year due to their symptoms (Lawrence et al., 2015). According to Caye et al. (2019), students with ADHD have a higher rate of school refusal and lower academic attainment than students without an ADHD diagnosis. Conversely, absentee rates more than double (Lawrence et al., 2015) once the child becomes an adolescent, enhancing the need for interventions in the primary years as they move through their schooling. Faraone et al.'s (2021) meta-analysis of multiple studies identified that students with ADHD exhibited lower reading scores, struggled with spelling, and had mild to moderate difficulties with problem solving, working memory, sustained attention, focus and verbal memory. Challenges within the school environment are not limited to the academic arena. For example, one study of 8,600 children from the US found that students with ADHD were more likely to have social, emotional, and behavioural issues (Faraone et al., 2021). They were also found to have less resilience and a lack of ability to control their behaviour in response to new or stressful events. All of these can cause disruptions to a classroom environment, highlighting the need for behavioural and social and emotional learning. The data on attendance rates, school refusal, social and emotional issues as well as academic challenges highlight the need for behaviour management interventions for students with ADHD in primary school. Sprich et al. (2015) noted that adolescents with ADHD showed significant levels of impairment and were at increased risk in participating in high-risk behaviours such as substance abuse, risky sexual encounters, and antisocial behaviour. This was attributed to the fact that as they move from primary to high school they transition from close supervision with one teacher to more

independence and less adult supervision. This highlights the need for early intervention in primary school settings to provide these children with the skills to manage their symptoms as they move into adolescence and later adulthood. This can be done by implementing school-based interventions in the primary school setting.

School based interventions

A meta-analysis conducted by DuPaul et al. (2012) on 60 outcome-based studies from 1996 to 2010 that looked at school-based interventions for students with ADHD found that these interventions contributed to moderate to significant effects in academic and behaviour performance. However, it should be noted that this varied depending on research design, intervention type and school setting. The study found that contingency management strategies, classroom management strategies including academic intervention, and cognitive-behavioural intervention strategies were associated with positive behaviour and academic outcomes (DuPaul et al., 2012). Executive functioning training can effectively improve cognitive processes such as working memory, attention, and planning. However, many cognitive-behavioural strategies are taught outside the classroom and school environments.

Contingency management

Contingency management strategies or behavioural reinforcements can include modifying teacher practices and behaviour management systems to support positive behaviours and negate problematic behaviours. Contingency management is an evidence-based behavioural intervention that focuses on changing behaviours by providing rewards or consequences for specific behaviours. Strategies are based on monitoring target behaviours, providing positive reinforcement for desired behaviours and consequences for negative behaviours (Petry et al., 2001). Programs are generally implemented in a whole school or a classroom-based program. Contingency management uses rewards such as token or points systems to reward the student for on-target behaviours. Barkley (2016) compares rewards or token systems to prosthetic devices for physically disabled individuals in that it provides support for students

with ADHD to function. Meta-analyses have demonstrated that contingency management programs have the most significant effect on academic outcomes for students with ADHD (DuPaul et al, 2012). One study of the use of 1-2-3 Magic in early childhood behavioural management showed decreased frequency and severity of unwanted behaviours (Porzig-Drummond et al., 2014). It should be noted that responses to behaviour for students with ADHD should be immediate and not delayed in line with their motivational deficits (Barkely, 2016). This highlights the need to implement strategies that address the unique needs of ADHD students. Rewards and reinforcers should also be changed more frequently to maintain the interest of students with ADHD (Barkley, 2016).

Classroom interventions

The DuPaul et al. (2012) meta-analysis found that classroom interventions lead to a significant behaviour change in students with ADHD in the classroom environment. Classroom interventions made more of a significant impact on behavioural outcomes than they did on academic outcomes (DuPaul et al., 2012). Barkley (2016) suggests that behavioural control needs to be established within the first few weeks of the school year to be effective. Classroom interventions for students with ADHD may include classroom management strategies such as modifications to the environment, such as flexible seating options, sensory toys, and quiet spaces; academic interventions, such as modifying lesson delivery; and individual education plans. However, it is noted that the first step to ensuring that classroom interventions are successful is to know the students' strengths and weaknesses (William & Mary School of Education, 2023). Children and Adults with Attention-Deficit/Hyperactivity Disorder (CHADD) (2019a) point out that classroom interventions are intended to ensure that students with ADHD can access the same learning as their peers.

Classroom management strategies

Evidence based classroom management strategies (CMS) have been known to reduce the impact of disruptive behaviours associated with ADHD (Strelow et al., 2021). CMS can provide opportunities for students to manage their core symptoms and promote learning within the classroom environment (Stockhaus, 2022). This can be done through creating a positive learning environment. CMS can lead to long-term changes in behaviour and academic achievement for students with ADHD. Therefore, CMS is an essential intervention as it can negate long-term effects associated with ADHD, such as lower long-term academic achievement (Strelow et al., 2021).

An important element of CMS is creating a positive environment; this can be done through the provision of immediate feedback in the event of unwanted behaviour, providing clear expectations, praise, and positive reinforcement for desirable behaviour, engaging students in learning, and establishing a supportive and inclusive environment. Creating a positive environment is one of the most important strategies a teacher can implement to promote learning and positive behaviours (Conroy et al., 2009). An essential factor in creating a positive environment is how a teacher responds to unwanted behaviour. If a teacher responds in a combative manner, it can increase unwanted behaviour (Conroy et al., 2009). However, if they respond positively to the wanted or desired behaviour with reinforcement and praise there is an increased likelihood of the desired behaviour being repeated. Effective praise and feedback can contribute to this. For praise to be effective, it needs to be behaviour-specific, teacher-initiated, focused on improvement, and sincere (Conroy et al., 2009). Furthermore, it does not create competition among students and is age appropriate. Praise, when done well, contributes to a child's intrinsic motivation to learn (Barkley, 2016; Conroy et al., 2009). Two types of feedback have shown to contribute to effective change in students' behaviours. These are instructive and error correction. Instructive generally follows a correct behaviour from a student, and error correction follows an incorrect behaviour (Conroy et al., 2009). Through the implementation of CMS, such as creating positive environments, providing immediate feedback, setting clear expectations,

and using effective praise and feedback, teachers can alleviate the impact of disruptive behaviours associated with ADHD (Strelow et al., 2021; Stockhaus, 2022; Conroy et al., 2009).

Modification of the physical environment

Studies such as the one by Hartanto et al. (2015) observed that the increase in movement, such as 'fidgety' behaviour, was related to cognitive control functioning. This is based on a functional working memory model where children with ADHD engage in excess movements to increase stimulation and improve cognitive performance (Graziano et al., 2018). In other words, engaging in physical activity aids in regulating behaviour and emotions. The use of sensory tools may provide this stimulation in a classroom environment.

Modification of the physical environment can provide opportunities for students to manage symptoms of ADHD. Providing alternative seating arrangements can cater to students' specific needs. Students with ADHD can often struggle with sensory-motor issues, have trouble sitting still and paying attention and have deficits in sensory modulation (Harrison et al., 2013). Providing alternative seating in the form of active seats can address these issues, such as wobbly stools, standing tables or stability balls (Jayne, 2022). These seating options allow students to engage core muscles and provide sensory stimulation. A study conducted into the use of stability balls as seats by Fedewa and Erwin (2011) found that all students involved in the study had improved attention and in-seat behaviour. Due to the constant need for micro adjustments, the stability balls can meet the student's need to move. Through offering seating choices, educators also promote an inclusive environment demonstrating that they cater for diverse needs.

Management of the physical environment can include the utilisation of sensory toys such as fidgets. Conversely, teachers have reported that sensory fidgets often become a distraction and a toy rather than an aid (Graziano et al., 2018). CHADD (2019b) notes the difference between a fidget toy and a fidget tool. A fidget toy such as a 'fidget spinner' engages the child's attention, thereby creating a distraction from the task

that needs to be focused on. However, fidget tools such as textured putty and squeeze balls can give a person with ADHD an outlet to distract their hands and allow them to perform better on tasks (CHADD, 2019b). According to Barkley (2016), using a squeeze ball in the non-dominant hand as the student is working on a task can be beneficial. However, Graziano et al. (2018) found that sensory toys such as fidgets had a negative impact on the targeted behaviour of inattention and focus. Harrison et al., (2023) confirmed this noting that using sensory items was not helpful and caused distractions. Barkley (2016) noted that instead of sensory tools, one way to meet the physical movement needs of students with ADHD is to give them frequent short physical activity breaks. These can be simply a few minutes to move and stretch before refocusing and are often referred to as a brain break (Morrin, 2023).

There are differing views on the most effective approach to the seating arrangements or desk layout for students diagnosed with ADHD. Barkley (2016) suggests that teachers maintain a traditional desk arrangement, such as all desks facing forward, as well as situating students with ADHD near the 'teaching area' as this allows the teacher to engage more with this student as needed. This allows for a more structured and focused learning environment. Morrin (2022) suggests avoiding group table seating as this can be distracting as group tables provide more opportunities for off task behaviour and distractions. Morrin (2022) also recommends seating students away from distractions such as doors and windows. However, it is important to note that the best seating arrangement varies based on individual needs and classroom dynamics.

Strelow et al. (2021) noted that these strategies are imperative to reducing the impact of ADHD symptoms on student's educational outcomes. However, they did point out that teacher's attitudes towards ADHD and perceived behavioural control were important variables that impacted the study (Strelow et al., 2021). A teacher's attitude and beliefs towards students with ADHD and behaviour management can impact students within these classrooms and how CMS is implemented.

Academic interventions

Regardless of the effect of behaviour modification and medication, Jitendra et al. (2008) noted that interventions that focus directly on academic skills are imperative. Academic interventions encompass a range of strategies aimed at improving academic outcomes. These strategies are included in a student's individual education plan (IEP), a personal plan written specifically to support individual students with their academic and personal needs (Department of Education, 2017). Students diagnosed with ADHD will receive an IEP that will include information about their current level of academic and functional performance, measurable goals and objectives, and accommodations and modifications that will assist the student in meeting their goals (Harrison et al., 2022). All staff working within the school will have access to and will use the plan, and parent/carer involvement is sought (Department of Education, 2017). This is a collaborative document created to ensure that the student receives the same educational opportunity as their peers.

Adapting classroom instruction

Adapting classroom instruction can be an effective strategy. When teachers adapt their classroom instruction, they can better meet the needs of diverse learners. One way to adapt classroom instruction is to shorten or decrease the task length for students with ADHD. The rationale behind this strategy is to increase engagement by providing shorter tasks to students who may find larger tasks overwhelming, and struggle to complete them (CHADD, 2019a; Harrison et al., 2013). Barkley (2016) suggests decreasing the student workload to the essential and not including too much busy work with one example of giving the student the first five questions and, when these are complete the following five. This can reduce behavioural issues as the shorter task requires students to focus for shorter periods decreasing the incidences of the student becoming frustrated. However, it is essential to consider the disadvantages of shortening tasks. Unfortunately, this can become an issue as shortening tasks can mean that students have less opportunity than their peers to practise academic skills, which can negatively impact their academic achievement (Harrison et al., 2013). One suggestion to

overcome issues when decreasing workloads or shortening tasks, is to look at what is needed for the students to demonstrate the outcome and focus on that (Barkley, 2016). Again, the individual needs of students should be considered when adapting instruction.

Choice making

In addition to adapting classroom instruction choice-making, is another valuable academic intervention that can be utilised in the classroom to support students with ADHD. Choice-making involves providing the student with a choice between academic tasks to achieve the same goal (Harrison et al., 2013). The aim is to minimise off-task behaviours by giving students control over their environment. Harrison et al. (2013) analysed multiple studies, noting that across all studies where choice was provided, there was an increase in work productivity, task engagement, and accuracy, whilst negative behaviours decreased. Hence, motivation and engagement are increased by offering students the ability to make choices about their learning. This can lead to improved academic performance and lower behavioural issues. However, implementing this within a classroom environment may be challenging (Jitendra et al., 2008). Creating multiple lesson instructions can be time-consuming, with teachers having multiple demands on their time. Some teachers may be resistant due to the demands of managing many student tasks.

Computer Assisted Instruction

Computer-assisted instruction (CAI) is a method that allows the students to access learning materials independently (Jitendra et al., 2008). It also enhances the presentation of instructional materials. CAI allows the students to access learning materials and engage at their instructional level (Mautone et al., 2005). This personalised approach allows a student to work at their own pace. The benefits of this approach also include providing tasks in small amounts and immediate feedback (Mautone et al., 2005). This is another way of shortening tasks and providing feedback. Mautone et al. (2005) point out that with a rise in computers in classrooms, CAI is an intervention that can be implemented quickly. Research has shown that students with ADHD are more attentive to

computer learning programs and learn more this way than practising skills through worksheets (Barkley, 2016).

Cognitive Behaviour Therapy

Cognitive Behaviour Therapy (CBT) is a psychosocial treatment that changes the way the person views their symptoms (Jones et al., 2018). It aims to alleviate any distress and change negative behaviours. In CBT, a therapist works with the patient to identify areas of need and develops strategies to support change in these areas. For a student with ADHD, this might include focusing on behaviours that are impeding their academic and social outcomes, such as impulsivity and hyperactivity (American Psychological Association, 2017). Strategies may include challenging negative thoughts, teaching relaxation techniques, and learning to manage tasks. CBT is provided over multiple sessions, and in children and adolescents parental involvement in the sessions is encouraged (Sprich et al., 2015).

Research by Cherkasova et al. (2020) investigated the effects of CBT alone and with medication on adults with ADHD. The study involved over 80 participants separated into three groups: CBT alone, medication alone, or a combination of CBT and medication. The findings revealed an increased improvement in all three groups in the minimisation of core symptoms. However, the biggest improvement was noted in the group utilising both medication and CBT (Cherkasova et al., 2020). Interestingly, the study also demonstrated that the participants in the CBT only group showed the highest rate of improvement in executive functioning and quality of life, whereas those in the medication-only group did not (Cherkasova et al., 2020). Furthermore, the meta-analysis by DuPaul et al. (2012) demonstrated that CBT had the highest impact on improving outcomes for students with ADHD. Further studies on ADHD found that CBT was effective in improving emotional symptoms (Guo et al., 2021). However, there are some limitations to this approach, with the meta-analysis noting that whilst CBT was effective for adults with ADHD, including improving comorbid conditions such as anxiety and depression, there was no significant improvement for children with ADHD (Guo et al., 2021). This could be attributed to differences in

cognitive ability and brain development. However, Guo et al. (2021) did note that there were limitations to the studies, such as a smaller number of studies for some interventions and possibilities of bias in assessment.

Cognitive-functional (Cog-Fun) occupational therapy

Cognitive-functional (Cog-Fun) occupational therapy aims to address the executive function deficit in ADHD. The Cog-Fun model is based on occupational therapy (OT) models that demonstrated effectiveness in addressing cognitive deficits and improving daily functioning within an occupational environment (Hahn-Markowitz et al., 2016; Kim et al., 2020). However, the previous models had not been applied to children with ADHD, and Cog-Fun was developed to fill this void and focused on cognitive, emotional, and environmental barriers to daily functioning (Hahn-Markowitz et al., 2011). According to Kim et al. (2020, p.2), "Cog-Fun interventions were designed based on the Person-Environment-Occupation Model (PEO Model) and the Model of Human Occupation (MOHO)". Cog-Fun teaches strategies that aid children in developing skills such as self-monitoring and self-evaluation and works to improve their ability to regulate their behaviour in different contexts (Hahn-Markowitz et al., 2011; Kim et al., 2020). A study conducted by Hahn-Markowitz et al., (2011) demonstrated the effectiveness of Cog-Fun as an intervention for children with ADHD and significant improvements in executive functioning was reported by teachers and parents. However, there was an inconsistency in parent and teacher information. Hahn-Markowitz et al. (2011) suggested that this could be because of a more structured environment within the classroom and medication during school hours. However, it is important to acknowledge the limitations of these studies due to the possibility of parent and teacher bias in reporting on the effectiveness of Cog-Fun. This highlights the need for further double-blind studies to mitigate the issue of bias in reporting.

A more recent study conducted by Hahn-Markowitz et al. (2016) showed that teachers reported no change in students who received medication to manage symptoms. However, students who were not using medication as part of their treatment showed a moderate improvement in core ADHD

symptoms within the classroom (Hahn-Markowitz et al., 2016). Further studies by Kim et al. (2020) demonstrated that after the Cog-Fun intervention all participants showed improvement in executive function and self-directed learning. Issues with working memory, planning, and organisation also showed significant improvement. This suggests there may be benefits in this approach as non-pharmaceutical management for ADHD. However, as with previous studies, potential bias in parental reporting and lack of objective measures for reporting may be present. Limitations of the approach can include generalisability, the effectiveness may vary across different contexts, and lack of long-term follow-up. Furthermore, there have not been any long-term studies with the model only recently being applied.

Social and emotional based interventions

Social and emotional based learning (SEL) is an educational approach that focuses on developing social and emotional skills. A meta-analysis of SEL programs conducted by Durlak et al. (2022) noted significant improvement in SEL skills, prosocial behaviours, academic achievement, and reduced conduct problems. This data came from a review of 523 unique SEL based intervention report. SEL programs involve explicit instruction, guided practice, and opportunities to apply social and emotional skills. SEL programs have been identified as valuable programs for students' social and emotional development (Durlak et al., 2022). Comparisons of SEL based programs to other school-based interventions showed that SEL had more favourable results. Conduct problems showed significant improvement, academic performance whilst only demonstrating a small improvement was still more favourable than other academic interventions (Durlak et al., 2022). However, it must be noted that there are some limitations to SEL based interventions. Durlak et al. (2022) found that although proven effective, SEL based interventions vary in their effectiveness, some interventions were more successful than others, as associated with the school context. With deficits in social and emotional skills, behavioural issues, and academic achievement SEL based programs can be effective in improving outcomes for students with ADHD.

Executive function training

Children with ADHD have several deficits in their executive function (Barkley, 2016). Executive functioning training (EFT) can aid students in developing these skills. EFT involves teaching students strategies to improve their organisation, planning and time management skills. A study conducted by Boyer et al. (2018) found that planning skill deficits are more pronounced in adolescents as they move to more independence and parental control diminishes, demonstrating the need for intervention in primary school aged children.

Externalisation of information is one of the most successful strategies that can be used to assist with developing executive function skills (Barkley, 2016). This can involve using visual aids, utilisation of a planner or calendar, creating 'to do' lists, and setting reminders or timers. Visual aids such as rules and instruction externalises the information and makes it accessible for students at the point of need (Barkley, 2016). This can be in the form of posters of rules and expectations or clear instructions displayed for the students to access during the lesson. Relying on the student's ability to recall rules and instructions and verbal instructions is ineffective (Barkley, 2016). Children with ADHD struggle with time and often cannot complete tasks within the allocated time frame. Externalising this using a timer or clock for shorter tasks, such as under an hour, will allow the student to track how much time is left (Barkley, 2016). Shortening of tasks as previously discussed will be more effective for longer time periods. Colour coding their workbooks can assist students in keeping their resources and work tasks organised (Barkley, 2016). Other organisational skills that assist are utilising a calendar or planner or creating checklists or 'to do' lists.

It should be mentioned that Moore et al. (2018) found that whilst organisational skills training is important, it is more effective when used in conjunction with other interventions and is not as effective as the main focus of the intervention. Similarly, Barkley (2016) stated that these skills need to be combined with behaviour interventions. Interestingly, executive functioning deficits predict social adjustment issues in adolescents especially in girls (Hannesdottir et al., 2016).

Social skills

In addition to creating academic and behavioural challenges, ADHD often affects social skills (CHADD, 2019a). Problems with peer acceptance and interactions are typical in students with ADHD (Hannesdottir et al., 2016). Children with ADHD can exhibit issues with managing their emotions in social situations, initiating and maintaining conversations, and interpreting nonverbal cues. Children with a comorbidity of aggression are even more prone to social issues than those who are not aggressive (Hannesdottir et al., 2016). A meta-analysis of SEL based interventions found that programs focused on social skills training (SST) had a more significant impact on emotional regulation for children with ADHD (Guo et al., 2021).

Combined interventions

Programs that include a combined approach and utilise both cognitive behavioural interventions and working memory have demonstrated promising results for students with ADHD (Hai & Climie, 2021; Hannesdottir et al., 2016). These approaches focus on social and emotional skills utilising cognitive-behavioural techniques and include executive functioning training and CAI for working memory skills (Hannesdottir et al., 2016).

One study investigated programs with these combined approaches noted an improvement in core symptoms, improved social skill and emotional regulation. However, Hannesdottir et al. (2016) outlined no improvement in working memory and no changes in attention and processing speed. However, to ensure optimum results, consideration of motivational factors and to ensure that positive reinforcement is implemented. Programs that combine these approaches are positive behaviour support programs.

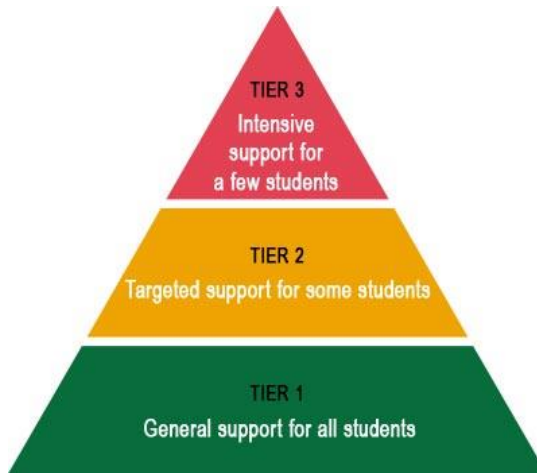### *Positive behaviour support program*

Positive behaviour support (PBS) programs are evidence-based and are implemented on a whole school level to promote positive behaviour within the community. This type of program contains many of the elements described as non-pharmaceutical management, such as behavioural, cognitive, social, developmental, and environmental psychology (Sailor, 2009). The PBS program supports an integrated approach and is endorsed by the Western Australian Department of Education to meet their Student Behaviour policy, procedures, and requirements (Subban et al., 2020).

PBS comprises several elements to support challenging behaviour. The first component is a functional behaviour analysis (FBA), observing when and how often the behaviour happens and focuses on looking at the meaning behind the behaviour (Sailor, 2009; LaVigna & Willis, 2012). Another component focuses on teaching of explicit skills, including social skills. These skills are taught in Tier 2 (Figure 1) and require teachers to be intentional in teaching social skills (Sailor, 2009). This provides instruction to students who are at risk of developing problem behaviours. The inclusion of ecological strategies, such as modifying the classroom environment, and providing a visual timetable are embedded within the PBS approach (Sailor, 2009). Further components include teaching executive functioning skills, self-regulation skills, and correct behaviours with reinforcements for positive behaviours (LaVigna & Willis, 2012).

Contingency management is one element of the PBS program, as is environmental modifications, explicit teaching of social and emotional skills, and providing positive reinforcement for positive behaviour. PBS works in a three-tier system of support. Tier 1 supports all students and targets most of the population (80%). Tier 2 focuses on supporting students who need more directed social support (12-15%), and Tier 3 targets those who need more targeted and individualised support (4-5%) as outlined in Figure 1 (Subban et al., 2020). Tier 3 intensive support suits students with the most challenging behaviour.

Figure 1.
Three-tier system of support

Note. From P. Subban, U. Sharma, E. Leif & S. Patnai. (2020). Five ways to use positive behaviour support strategies in your classroom. Monash Education.

Research has shown that PBS is a practical approach for the management of challenging behaviour in a classroom environment. It has been effective for severely challenging behaviours (LaVigna & Willis, 2012). The inclusion of many elements proven to be effective with students who have ADHD reinforces Barkley's (2016) opinion that the best interventions are those that use a comprehensive and integrated approach.

Implications

The study aimed to research non pharmaceutical interventions for students with ADHD. The aims of the study focused on identifying strengths and limitations of these interventions in the improvement of academic and social outcomes for these students. The following

discusses and compares the results to previous studies, acknowledges limitations and explores future implications for further research.

The findings outline the effectiveness of a range of non-pharmaceutical based interventions. A notable finding was the importance of individualised instruction, including computer assisted instruction (CAI). The study found that CAI was effective due to allowing students to engage at their own level, work with students' interests and subsequently improve outcomes (Jitendra et al., 2008; Mautone et al., 2005). These personalised approaches promoted a positive learning environment, which enhanced students' feelings of inclusion.

CBT was proven to be effective in addressing the core symptoms of ADHD and improving executive functioning (Cherkasova et al., 2020; DuPaul et al., 2012). CBT provides strategies for modifying problematic behaviour and enhancing social and academic outcomes. However, there is evidence that CBT may be more effective for adults than children. The difference is attributed to the fact that children do not often have the cognitive ability to engage in CBT at the same level as adults (Guo et al., 2021). However, Cherkasova et al. (2020) found that CBT is effective as a standalone treatment for ADHD and has a significant impact on executive functioning and quality of life. This is why age-appropriate adaptations have been taken in some of the studies incorporating parental involvement, classroom accommodations and stimulus medication are used as a multimodal treatment package (Hannesdottir et al., 2016).

Cog-Fun was a promising intervention that came to light through this study. Cog-Fun demonstrated its effectiveness through the teaching of self-monitoring and self-evaluation skills (Hahn-Markowitz et al., 2011; Kim et al., 2020). Through this approach, there was significant improvement in self-directed learning and executive functioning. Cog-Fun has shown high potential as a non-pharmaceutical management approach, with improvements being noted in working, memory, planning, and core ADHD symptoms positioning it as a viable non-pharmaceutical intervention (Kim et al., 2020). Conversely, there were some limitations to this approach. There was potential for parent and teacher bias in reporting, which affected the credibility of the

effectiveness of the intervention. Due to no long-term studies, further research is needed before definitive decisions on effectiveness can be made.

Additionally, programs that contained Social and Emotional Learning (SEL) demonstrated effectiveness in social skills, emotional regulation, prosocial behaviour, and academic achievement for students with ADHD (Durlak et al., 2022). Explicit instruction in social skills addressed deficits in peer acceptance, emotional management, and social interactions. In addition to the interventions mentioned above, classroom-based interventions such as PBS and contingency management have demonstrated success in improving academic and behavioural outcomes for students with ADHD. Classroom layout, reward systems and providing clear expectations and consequences were integral parts of these interventions (Pelham et al., 2014; Raggi et al., 2018).

The findings of this study have important implications for further research and classroom implementation of non-pharmaceutical management for students with ADHD. The successful outcomes noted in CBT, SEL programs, classroom accommodations and behavioural management techniques highlight the potential of non-pharmaceutical interventions as an alternative or complementary approach to pharmaceutical management. Many of these individually or combined interventions offer a personalised and holistic approach targeting individual needs and promoting academic and social outcomes for students with ADHD.

It is recommended that educators consider the integration of multiple interventions with a comprehensive management plan; this will maximise the benefits of non-pharmaceutical interventions. Combining different approaches, such as CAI, with SEL based programmes, or utilising a holistic program that already combines them all, such as PBS will enhance the effectiveness of the interventions and be better placed to address the multifaceted nature of ADHD. Additionally, future research should focus on longitudinal studies to examine the long-term

impact and practicality of implementing non-pharmaceutical interventions within the primary setting.

Conclusion

The findings of this present study reinforce previous research by highlighting the effectiveness of non-pharmaceutical interventions for students with ADHD. Positive outcomes observed in individualised instruction, CBT, occupational therapy interventions and SEL based programmes are consistent with prior studies that reported similar findings (e.g., Durlak et al., 2022; Jones et al., 2018; Hahn-Markowitz et al., 2011). However, context variations and individuality need to be accounted for. Each student's individual situation should be considered before implementation. These collective results provide a strong foundation for the integration of non-pharmaceutical interventions for students with ADHD, especially in schools.

Challenges in the implementation of behavioural interventions generally reside at the intervention level (Lawson et al., 2022). These can include compatibility, lack of resources, and time requirements. Other challenges can be forgetting to implement interventions and other tasks competing for time (Lawson et al., 2022). As Barkley (2008, p.9) states, "interventions only work if they are being implemented".

Teacher's attitudes, understanding of ADHD and negative beliefs about ADHD can lead to inefficient use of interventions (Lawson et al., 2022). Further education on ADHD and interventions can aid in challenging these teachers' beliefs. Strelow et al. (2021) point out that teachers are more likely to apply interventions they are invested in. Thus, while the integration of non-pharmaceutical interventions in schools can have positive effects on students with ADHD, practical resources such as factors and teachers' 'buy in' to the programs must be considered to ensure that such interventions are delivered with the fidelity required for this potential to be realised.

Brief Author Biography

Lorrena is a dedicated Level 3 Teacher with a passion for fostering holistic student development. Holding a Master's degree in education, specialising in Mental Health and Wellbeing from the University of Western Australia (UWA), she brings a wealth of knowledge to her educational endeavours. With a strong background in pedagogy and information and communication technology (ICT), Lorrena combines academic expertise with a commitment to nurturing the well-being of students. Her holistic approach is further complemented by her certification in exercise and sport nutrition, reflecting a dedication to promoting physical health alongside academic growth. Lorrena has actively engaged in leadership roles within the educational realm, notably serving as a Health and Wellbeing Coordinator. Through these experiences, she has witnessed firsthand the transformative impact of effective leadership in education.

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