TEACHER KNOWLEDGE OF BEHAVIOURAL INTERVENTIONS FOR STUDENTS WITH ADHD: A SCOPING REVIEW

by

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ABSTRACT

This study examined the existing literature of teacher and pre-service teachers' knowledge of behavioural interventions for students with ADHD. Five hundred ninety-seven peer-reviewed studies of teacher knowledge of behavioural interventions for ADHD conducted in the last 15 years were searched, with nine studies meeting inclusion criteria. Based on findings from included articles, three major themes emerged: (1) teachers have varying levels of baseline knowledge about ADHD and its treatment; (2) teachers are more likely to use less intensive behavioural management strategies (e.g., preferential seating) or passive instructional approaches (e.g., modifying language used for instruction) than more intensive strategies; and (3) teachers are more likely to use instructional strategies (e.g., extra time) rather than behavioural interventions (e.g., token economy) to manage the classroom behaviour of students with ADHD. Implications for implementation of behavioural interventions in the classroom are discussed along with implications for school psychology practice.

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CHAPTER ONE

Literature Review

Attention-Deficit/Hyperactivity Disorder

Attention-Deficit/Hyperactivity Disorder (ADHD) is one of the most common neurodevelopmental disorders of childhood (Coles et al., 2012; Debjani et al., 2012; American Academy of Pediatrics [AAP], 2019) with prevalence rates estimated to be 7.2% worldwide (Thomas et al., 2015), meaning that in a classroom of 25 to 30 children, between one and three students may have ADHD (DuPaul & Jimerson, 2014; DuPaul & Stoner, 2014). ADHD is characterized by developmentally inappropriate symptoms of inattention, hyperactivity, and impulsivity observed before the age of 12 and is diagnosed more often in boys than girls, with a ratio of approximately 2:1 (American Psychiatric Association, 2013). The most common behavioural problems of students with ADHD rated by teachers are distraction, short attention span, careless errors, excessive movement, and rushing through assignments (Harrison et al., 2012).

The AAP (2019) has developed a set of best practice guidelines for the evaluation, diagnosis, and treatment of ADHD in children and adolescents. It is recommended that clinicians use the *Diagnostic and Statistical Manual of Mental Disorders- Fifth Edition* (DSM-5; American Psychiatric Association, 2013) to assess the child's symptoms. Information must be collected across multiple settings (e.g., home, school, social, occupational) and from multiple informants (e.g., parents/guardians, teachers, other school personnel) and the clinician must rule out any alternative cause/disorder that may explain the child's symptoms (AAP, 2019; Visser et al., 2015). The diagnosis and treatment of ADHD relies heavily on the observations of both

parents/caregivers and teachers. Teachers are often the first to notice the symptoms and associated functional impairment of ADHD (AAP 2019; Coles et al., 2012).

ADHD is also frequently comorbid with other disorders such as Oppositional Defiant Disorder (ODD), Conduct Disorder (CD), Disruptive Mood Dysregulation Disorder and Specific Learning Disorder (APA, 2013; Barkley, 2013; Barkley, 2014; Gillberg et al., 2004; Jensen et al., 1997; Jensen et al., 2001; Reale et al., 2017; Spencer et al., 2007). Anxiety disorders (Jarrett & Ollendick, 2012), Major Depressive Disorder, Intermittent Explosive Disorder, and substance use disorders also occur in a minority of individuals with ADHD (American Psychiatric Association, 2013). Boys diagnosed with ADHD are more likely to exhibit externalizing disorders like ODD or CD whereas girls with ADHD are more likely to exhibit internalizing disorders like anxiety or depression (AAP, 2019). ADHD is a costly disorder (see Doshi et al., 2012), as children and adolescents with the disorder often require medication, psychological/behavioural treatment, and/or mental health or special education services in the school system (DuPaul & Stoner, 2014).

Diagnostic Criteria

The DSM-5 (American Psychiatric Association, 2013) defines three presentations of ADHD: (1) Predominantly inattentive presentation (ADHD-I), which is defined by six or more symptoms of inattention present for at least six months; (2) Predominantly hyperactive/impulsive presentation (ADHD-HI), which is defined by six or more symptoms of hyperactivity-impulsivity present for at least six months; and (3) Combined presentation (ADHD-C), which is defined by six or more symptoms of inattention and six or more symptoms of hyperactivity-impulsivity present for at least six months. In addition to meeting the criteria for these behavioural symptoms, the child must also meet the following criteria: (1) symptoms

inconsistent with developmental level prior to age 12; (2) symptoms in two or more settings (e.g., home and school); (3) symptoms must affect social, academic, or occupational functioning; and (4) the symptoms are not better explained by another mental disorder (American Psychiatric Association, 2013).

Behavioural Symptoms

Inattentive Symptoms. The inattentive symptoms of ADHD are characterized by impairment in sustained and focused attention. Inattention can cause distractibility and forgetfulness and can impair both working memory and organizational skills (Lundervold et al., 2017). Children with ADHD who struggle with attention typically have trouble with both paying attention and sustaining attention. These children are generally easily distracted and tend to avoid tasks that require sustained mental effort (American Psychiatric Association, 2013; Harrison et al., 2020), such as independent seatwork (DuPaul & Stoner, 2014). In the classroom setting, a child with ADHD might have trouble reading a passage while also answering written questions about the passage, due to difficulties with sustained mental effort (Harrison et al., 2020). Students with attentional difficulties may also have problems in the following areas: test performance, study skills, organization of materials and workspaces, and attending to classes/lectures or group discussions (DuPaul & Stoner, 2014). A meta-analysis conducted by Kolfer and colleagues (2008) found that students with ADHD exhibit on-task behaviour about 75% of the time while their peers exhibit on-task behaviour about 88% of the time (Hedges' g effect size = 1.40). This finding was echoed by Imeraj and colleagues (2013), who found that elementary students with ADHD spent less time on-task compared to their peers during whole-group instruction and individual seatwork (d = 0.61) but not during small-group work. The authors hypothesized that working in a small group provided more structure, active roles for

students, and opportunities for teacher feedback. In addition, on-task behaviour differences were observed during highly academic subjects (i.e., math, language arts) and during transitions.

Hyperactive/Impulsive Symptoms. The hyperactive symptoms of ADHD consist of excessive motor or vocal activity that is developmentally inappropriate when compared to typically developing same-aged peers (Alderson et al., 2012; Barkley, 2014; Hudec et al., 2015; Rapport et al., 2009). Hyperactive symptoms can also affect a child's working memory and executive functioning (Hudec et al., 2015); it has been hypothesized that this is the result of increased cortical arousal during tasks that place increased demands on working memory (Hudec et al., 2015; see Rapport et al., 2001). The impulsive symptoms of ADHD consist of difficulties with impulse control (Barkley, 2014), as well as difficulties with executive control, delayed gratification, effort, and compliance (Olson, Schilling, & Bates, 1999). People who are impulsive are quick to act in a situation without first waiting for instructions and may also act without consideration of consequences, which can be dangerous and/or destructive (Barkley, 2014). Children with ADHD who act impulsively in the classroom may frequently call out, talk to classmates at inappropriate times, become angry when confronted with reprimands, leave their seat without permission, play with objects inappropriately, repetitively tap their hands and feet, and fidget in their chairs. They may also be impulsive in their work, completing it carelessly (DuPaul & Stoner, 2014).

Course

It was previously believed that children with ADHD would "outgrow" their behaviour as they got older (DuPaul & Stoner, 2014). However, research has demonstrated that the presentation and nature of ADHD can change over time and across genders (Barkley, 2014). However, as children with ADHD progress into adolescence, the frequency and intensity of their

symptoms manifest differently (Barkley, 2014). For example, an 18-year old with ADHD might not be as active or forgetful as a 6-year old with ADHD, but they may be more disorganized, as they are no longer reliant on parents or teachers to organize their schedule and responsibilities. Regardless, the symptoms of inattention, hyperactivity, and impulsivity are more observable and impairing than in those without childhood ADHD, meaning that ADHD is a lifelong disorder (Barkley, 2014; Debjani et al., 2012; Fabiano et al., 2015).

ADHD progresses from childhood to adolescence and can affect many areas of functioning. ADHD in adolescence can impair friendships, relationships, academics, and work performance (Barkley, 2014). School difficulties follow children with ADHD into adolescence. For example, students with ADHD have poorer organizational skills, lower report card grades, and higher rates of truancy, suspension, grade retention, school dropout, antisocial behaviour, reckless behaviour (e.g., reckless driving, car accidents) and substance abuse (Barkley et al., 2006; Barkley et al., 2008; Biswas et al., 2011; DuPaul & Stoner, 2014; Kent et al., 2011; Molina et al., 2009; Robb et al., 2011) than their typically developing peers. Teenagers with ADHD often exhibit noncompliance and defiance of authority figures (Biederman et al., 1997), which is problematic in both the school and work setting. Teenage girls with ADHD have been found to be at increased risk of self-injury and suicide attempts (Hinshaw et al., 2012).

ADHD can also have a negative effect on adult functioning. A third of adults with ADHD will have dropped out of high school, with only 5% completing a university degree (Barkley, 2014), with severity of inattentive symptoms being a significant predictor of high school dropout (Pingault et al., 2011). Adults with ADHD are more likely to have substance abuse problems (Barkley, 2014; Charach et al., 2011; Debjani et al., 2012) and a higher risk of sexually transmitted infections, head injury, and emergency department admissions (Olazagasti et al.,

2013). ADHD and comorbid CD can result in a higher risk of substance abuse problems (Barkley, 2014). Adults with ADHD are also more likely to experience higher unemployment rates, fewer long-term friendships, and higher risk of divorce (Bellendiuk et al., 2012; Ebejer et al., 2012; Smith et al., 2010). Adults with ADHD who were diagnosed with ODD in their childhood are at a greater risk of developing bipolar disorder, anxiety disorders, and substance use disorders compared to those without a childhood diagnosis of ADHD and comorbid ODD (Harpold et al., 2007). Adults with ADHD are more likely to have comorbid diagnosis of ODD, CD, personality disorders, substance use disorders, anxiety disorders, mood disorders, and obsessive-compulsive disorders. Comorbid diagnoses can result in adults with ADHD experiencing psychological maladjustment (Barkley, 2014).

Biederman and colleagues (2012) hypothesized that children who had ADHD would develop greater impairments and dysfunction in adulthood when compared to non-ADHD controls. They found that as boys with ADHD grew up, they were at a higher risk for adverse psychosocial, educational, occupational, and cognitive outcomes, even after controlling for psychiatric disorder. This research suggests that it is important to identify and treat ADHD early. In addition, the impairments associated with ADHD in adulthood are due to ADHD itself and not to another psychiatric disorder (Biederman et al., 2012).

Diagnosing adult ADHD is based on the assumption that adult ADHD is the same disorder as childhood ADHD. However, Moffitt and colleagues (2015) note that whereas this is presented in the *DSM-5* criteria for diagnosis, there was not a prospective longitudinal study which examined the childhoods of adults later diagnosed with ADHD. To account for this, Moffitt and colleagues (2015) designed a prospective longitudinal study of a birth cohort. They analyzed ADHD diagnosed in childhood and ADHD diagnosed in adulthood using participants

from the Dunedin Multidisciplinary Health and Development Study. The purpose of their research was to determine if the correlates of adult ADHD are the same as the correlates of childhood ADHD. Participants were followed and assessed every two years between the ages of 3 and 38. Children from the Dunedin study were diagnosed with ADHD at ages 11, 13, and 15 (see Anderson et al., 1987; Anderson et al., 1989; Caspi et al., 2008; McGee et al., 1992; Mill et al., 2002; Mofitt, 1990). Children diagnosed with ADHD were predominantly boys. The childhood prevalence of ADHD was 6% and 3% at age 38 (Moffitt et al., 2015). The researchers also found that only three of the 61 children diagnosed with ADHD continued to meet diagnostic criteria at 38, suggesting very little overlap of individuals. Adults with ADHD self-reported life dissatisfaction, everyday cognitive problems, and money troubles. They also reported that they were disorganized, had not reached their potential, felt that they exhaust others, had accidents, and engaged in risky behaviour (e.g., tailgating, speeding). Half of these adults had substance use problems. There were no significant sex differences in adult ADHD (Moffitt et al., 2015).

Sex Differences

Research has found that boys are more often diagnosed with ADHD with a ratio ranging from 2:1 to 10:1 depending on the diagnostic criteria used as well as the sample used (Coles et al., 2012; Mowlem et al., 2019). Clinical samples report higher boys-to-girls ratio compared to population-based samples (American Psychiatric Association, 2013; Mowlem et al., 2019). It is likely that boys are more often diagnosed with ADHD because there has historically been a research focus on school-aged boys with ADHD (Barkley, 2014; Waschbusch et al., 2006), thereby limiting the understanding of girls with the disorder (Arnett et al., 2015; Barkley, 2014). Boys may also be diagnosed more often because ADHD symptoms often present differently in boys and girls. Boys are more likely to express hyperactive behaviours (e.g., inability to settle,

fidgety) and aggressive and antisocial behaviour (AAP, 2019; Barkley, 2014). Hyperactive behaviours are easily observable and disruptive, and these behaviours are observed more frequently in boys (AAP, 2019). These behaviours are more disruptive to the classroom environment and are therefore more likely to affect academic achievement and motivating parents and/or teachers to seek help and services (Barkley, 2014; Mowlem et al., 2019; Waschbusch et al., 2006). In contrast to their typically developing peers, girls with ADHD often present with inattentive symptoms, which are usually less disruptive to the classroom environment, thereby leading to less frequent identification and referral for services (American Psychiatric Association, 2013; Coles et al., 2012; Mowlem et al., 2019). When girls present with hyperactive behaviours, hyperverbal behaviours (e.g., excessive talking), and not hyperactive behaviours, are most frequently observed (Barkley, 2014). However, girls who exhibit hyperactive/impulsive symptoms are more often referred for services (Mowlem et al., 2019). This could be because these behaviours are not typically associated with girls (Waschbusch et al., 2006). Research conducted by Mowlem and colleagues (2019) found that girls were more likely to be prescribed medication if they exhibited the more externalizing behaviours of ADHD, whereas boys were more likely to be prescribed medication regardless of the symptom presentation.

The Effects of ADHD on Child and Family Functioning

Behavioural and Emotional Problems

Children with ADHD are often diagnosed with comorbid disorders such as Oppositional Defiant Disorder (ODD; 50-60% in children), Conduct Disorder (CD; 20-50% in children and 40-50% in adolescents), anxiety disorders (10-40% in children), depressive disorders (16-26% in children), bipolar disorders (11-75% in children), tic disorders (20% in children), obsessive

compulsive disorders (6-15% in children) and autism spectrum disorders (65-80%) (APA, 2013; Barkley, 2013; Barkley, 2014; Blederman & Faraone, 2005; Gillberg et al., 2004; Jarrett & Ollendick, 2008; Jensen et al., 1997; Jensen et al., 2001; Jensen & Steinhausen, 2015; Kadesjö & Gillberg, 1999; Reale et al., 2017; Spencer et al., 2007). ADHD and learning disabilities (LD) are also frequently comorbid (45% with an impairment in reading, math or spelling) (Barkley, 2014; DuPaul et al., 2013; Spencer et al., 2007). Comorbidity can affect diagnosis and intervention. When diagnosing ADHD, a clinician should also consider a range of other possible psychiatric conditions (Reale et al., 2017). For example, a practitioner may have to decide if ADHD, ODD, or a combination of the two are causing the current problems as well as try and decide on an intervention (DuPaul & Stoner, 2014).

If left untreated, ODD can develop into CD. This is problematic, as CD is associated with more severe behavioural problems (Anastopoulos et al., 2011). Children with ADHD and comorbid ODD/CD are more likely to divorce as adults (Barkley, 2014). Mothers of children with ADHD-HI and comorbid ODD report experiencing more parental distress, more negative relationships with their child, and rated their child as being more difficult than did mothers of children with ADHD-HI only (Goldstein et al., 2007). Children with ADHD and comorbid ODD/CD are more likely to experience antisocial behaviours as adults (Barkley, 2014).

Children with ADHD also often experience emotional problems, such as emotional dysregulation (i.e., difficulties inhibiting their emotions and emotional impulsivity; Barkley, 2014). Emotional impulsivity is the speed with which the individual responds to an (negative) emotional event. Because children with ADHD have trouble regulating their emotions, they are more likely to respond negatively to an event compared to others their age (Barkley, 2014). According to Gottman and Katz (1989), emotion regulation is the ability to "(a) inhibit

inappropriate behaviours related to strong negative or positive emotion, (b) self-soothe any physiological arousal that the strong affect has induced, (c) refocus attention, and (d) organize for coordinated action in the service of an external goal" (p. 373). There is a link between emotional regulation and ADHD symptoms. For example, various rating scales ask parents and teachers to rate their child's emotional self-regulation abilities (e.g., Behavior Rating Inventory of Executive Functioning (BRIEF), Gioia et al., 2000; Child Behavior Checklist (CBCL), Achenbach, 2001; Conner's Parent and Teacher Rating Scales, Conners, 2008). Parents, teachers, and clinicians often rate the child as having experienced higher emotional highs and lower emotional lows (Anastopoluos et al., 2011). Children with ADHD are often impulsive, impatient, irritable, and easily upset. They are more likely to have temper tantrums, act defiantly towards adult requests, and react more emotionally to everyday situations (Anastopoulos et al., 2011; Barkley, 2014). Emotional problems have also been linked with disrupted peer relationships (i.e., higher levels of peer conflict) (Anastopoulos et al., 2011; Barkley & Fischer, 2010; Melnick & Hinshaw, 2000; Sobanski et al., 2010).

Peer and Sibling Relationships

Children with ADHD are reported as being more demanding, defiant, and aggressive than their peers, meaning that their behaviour can affect their relationships (Barkley, 2013). It is estimated that between 50 to 80% of children with ADHD are rejected by their peers; once a child with ADHD is rejected by their peers, it is harder for their peers' opinion of them to be changed (Hoza, 2007). This rejection can occur even after a brief interaction and even when the child with ADHD is medicated (e.g., Pelham & Bender, 1982). Generally, children with ADHD have difficulty getting along with their siblings or their peers (Barkley, 2014) because they have a harder time cooperating, sharing, and interacting (Barkley 2013; 2014). They are also less

likely to have reciprocal friendships (Barkley, 2013; Barkley, 2014; Hoza et al., 2005; Mikami, 2010).

Children with ADHD exhibit impulsive and aggressive behaviour, making it harder for them to form relationships (Altszuler et al., 2017; Barkley, 2013) and they are often described as intrusive, argumentative, and inappropriate in social interactions when compared to their peers (McQuade & Hoza, 2008). For example, children with ADHD may make inappropriate attempts to join a game, exhibit poor conversational etiquette (e.g., frequent interruptions), and can be prone to losing their temper during conflict (DuPaul & Stoner, 2014). Research in an intensive summer treatment program found that once a child with ADHD is rejected by their peers, they were more likely to violate camp rules, fail to pay attention during activities, and complain (Mrug et al., 2007).

Some research suggests that there is a link between ADHD symptoms and social behaviour (McQuade & Hoza, 2008). Specifically, children with ADHD-C have been found to be more likely to experience peer rejection, whereas children with ADHD-I are more likely to be socially isolated (Hodgens et al., 2000; Hinshaw, 2002). Peers tend to rate children with ADHD-C as being more aggressive and more likely to start fights compared to children with ADHD-I, who are frequently rated by their peers as shy and passive (Hodgens et al., 2006; Hinshaw, 2002; Maedgen & Carlson, 2000). These studies suggest that social behaviour differs between the ADHD presentations such that inattentive symptoms of ADHD may result in difficulty participating in social interactions, whereas the hyperactive/impulsive symptoms may result in more aggressive and negative social behaviours (McQuade & Hoza, 2008).

In addition to the link between negative social behaviours and ADHD presentation, there may also be a link between negative social behaviours and gender. Research has shown that boys

with ADHD in a classroom were more likely to interrupt, leave their seats, exhibit aggression, and break the rules compared to girls with ADHD. However, girls with ADHD were more likely to be verbally aggressive towards their peers (Abikoff et al., 2002; McQuade & Hoza, 2008). Girls with ADHD are more likely to spread rumours or exclude others compared to typically developing peers (Zalecki & Hinshaw, 2004).

Childhood ADHD results in impairments of adolescent peer relationships (Bagwell et al., 2001). Bagwell and colleagues (2001) examined the relationship between childhood ADHD and adolescent peer relationships. They found impairments in parent reports of peer rejection, and that their child had fewer friends compared to parent reports of children without ADHD. They also found impairment in adolescents' reports of their friends' conventionality (i.e., involvement in conventional activities such as school activities and community activities). It was also found that adolescents with a childhood diagnosis of ADHD experienced peer rejection, regardless of if the symptoms of ADHD followed them into adolescence.

Having negative peer relationships is an impairment to a child with ADHD, but treatments for peer problems of children with ADHD are limited (McQuade & Hoza, 2008). McQuade and Hoza (2008) note that whereas medication can help reduce negative peer interactions, it does not appear to produce prosocial behaviour. Some researchers suggest that children with ADHD have peer problems due to specific cognitive deficits that lead to deficits in performance, rather than a deficit in their social knowledge (Abikoff, 2009; Barkley, 2014; de Boo & Prins, 2007; Tseng & Gau, 2013). Behaviour modification and social skills training (SST) can target social skills deficits, but it does not normalize the social status of children with ADHD (Hoza et al., 2005). SST is not a stand-alone intervention; therefore, it is difficult to determine whether it is a well-established treatment for children with ADHD (Willis et al., 2019). SST is

often used for children with ADHD to help with social impairment and improve peer functioning (Mrug et al., 2001). During SST, an adult teaches the child about a specific, target social skill and provides opportunities for the child to practice this skill (Mrug et al., 2001). Evans and colleagues (2014) rated SST as a level five treatment (not effective) and Evans and colleagues (2018) rated SST as a level five treatment (questionable efficacy).

Parent-Child Relationship

Parenting stress occurs when the demands placed on a parent outweigh their resources (Theule et al., 2013) and is especially common in parents of children with ADHD (Barkley, 2014; Theule et al., 2013). Parenting stress can affect the parent-child relationship, causing a parent to experience conflict with their child (Barkley, 2013; Barkley, 2014; Lench et al., 2013; Theule et al., 2013). There is both a behavioural and cognitive component to the parent-child relationship. The behavioural aspect of the relationships consists of the behavioural interactions between parent and child, whereas the cognitive component consists of the parents' thoughts about their child and their thoughts about themselves as parents (Barkley, 2014). The constant conflict between the parent and child results in a coercive parenting style (see Patterson, 1976). This coercive parenting style may begin when a parent attempts to manage their child's ADHD behaviours. The parents may become verbally aggressive towards their child after other strategies such as time out or loss of privileges have not resulted in compliance with parental request. This parental response can lead to the child receiving less praise, encouragement, approval, and warmth from their parents (Barkley, 2013). As a result of the negative reactions from their parent, the child then behaves negatively toward the parent (i.e., ADHD behaviours increase as a result of negative reinforcement), which then negatively reinforces the parent's perception that their child's behaviour is difficult to manage, starting the cycle once again

(Barkley, 2013; Patterson, 1976). This parenting style can lead to increased family conflict because parents find it difficult over time to parent their child (Eddy, Leve, & Fagot, 2001; Patterson, 1976).

Interventions for ADHD

Evidence-Based Practice

"Evidence-Based Practice (EBP) of psychological treatments involves the conscientious, explicit, and judicious use of the best available research evidence to inform each stage of clinical decision-making and service delivery. This requires that psychologists apply their knowledge of the best available research in the context of specific client characteristics, cultural backgrounds, and treatment preferences" (CPA Presidential Task Force on Evidence-Based Practice of Psychological Treatments, 2014, p. 155). EBPs are practices that are built on scientific research (Brendtro & Mitchell, 2012) and have been shown to have been effective in multiple trials (Kratochwill, 2007). Using EBPs ensures the best possible outcome for the individual and using EBP helps minimize the risk of harm (McGoey et al., 2014). Psychologists use EBPs in their everyday practice to reduce the risk of harm to their clients. Psychologists must stay up to date on the literature to ensure that they are using EBP that is in the research. EBPs for ADHD are designed to help increase target behaviours across both academic and social domains (DuPaul & Stoner, 2014).

Evidence-Based Interventions for ADHD

As noted by King and colleagues (2021), several large, multi-site studies have concluded that the most effective interventions for ADHD are (1) behavioural interventions (i.e., behavioural parent training, behavioural classroom management, behavioural peer training, and organization training); (2) pharmacological interventions such as psychostimulant medications

(e.g., methylphenidate); and (3) a combination of both (e.g., American Academic of Pediatrics, 2019; Canadian Pediatric Society, 2002; Evans et al., 2014; Evans et al., 2018; Jensen et al., 2001; MTA Cooperative Group, 1999, 2004; Pelham et al., 1998; Pelham & Fabiano, 2008). In their most recent clinical practice guidelines for ADHD, the AAP (2019) recommends the following approach: (1) behavioral treatment alone should be the first line of treatment for young children (i.e., 4-5 years); (2) medication and behavioural treatment, *preferably* both, should be used to treat elementary-age children (i.e., 6-11 years); and (3) medications combined with encouragement to engage in behavioural treatments or evidence-based training interventions (e.g., organizational training), *ideally* both, be used to treat adolescents (i.e., 12-18 years).

Pharmacological Interventions.

Psychostimulant Medication. Decades of research have demonstrated that psychostimulant medications are effective in the short-term management of ADHD by improving target behaviours and symptom ratings (Hawk et al., 2018). The two most researched stimulant medications are methylphenidate (MPH; i.e., Ritalin®) and amphetamine (AMP; i.e., Adderall®) (AACAP, 2007; Barkley, 2014; Maia et al., 2017), with MPH being the most commonly studied and prescribed (Barkley, 2014; Brault & Lacourse, 2012; Hodgkins et al., 2011; Maia et al., 2017; MTA 1999a, 1999b, 2004a, 2004b; Pelham et al., 2014; Pottegard et al., 2012; Rubia et al., 2014). Psychostimulants can either be immediate-release, meaning that the child must take the medication two to three times a day (AACAP, 2007) or long-acting, taken once a day (AACAP, 2007). When starting stimulant medication, it is recommended that the child receive a low dose, as response to the medication can be variable and unpredictable (AAP, 2019).

Stimulant medications are helpful in treating symptoms such as impulsivity and motor hyperactivity. Studies comparing MPH and placebo have found that MPH has a large effect (Cohen's *d*s = 0.8-1.0) on ADHD symptom reduction compared to placebo (Banaschewski et al., 2006; Faraone & Buitelaar, 2010). However, research conducted by Pelham and colleagues (2017) has shown that adolescents with ADHD taking MPH could not distinguish medication from placebo (on 40% of days), and they did not attribute their good or bad days to the medication.

Evidence suggests that psychostimulants can improve the core symptoms of ADHD in the short-term (AACAP, 2007; Fabiano et al., 2015; Hawk et al., 2018). For example, psychostimulants can help with seatwork completion, disruptive behaviour, and on-task behaviour in the classroom (Conners, 2002; Pelham et al., 2001). Some research suggests that stimulant medications can also improve cognitive abilities such as sustained attention to tasks and productivity (Barkley, 2014; Hawk et al., 2018). For example, Coghill and colleagues (2014) found that MPH was superior to placebo at improving functions such as executive and non-executive memory, reaction time, reaction time variability, and response inhibition.

Although some research suggests that stimulant medication can improve homework completion in children with ADHD (e.g., Lanberg et al., 2010), other research has not found a clear link between psychostimulant medication and long-term improvement in academic functioning. (Barnard-Brak & Brak, 2011; Langberg & Becker, 2012; Loe & Feldman, 2007; Molina et al., 2009; Raggi & Chronis, 2006). Importantly, Loe and Feldman (2007) note that children with ADHD often have comorbid learning problems, and stimulant medication alone does not result in long-term gains in academic achievement in these students.

There are possible short-term side effects to taking stimulant medication, such as sleep disturbance/insomnia, decreased appetite, weight loss, headache, and stomach-ache, as well as a small increase in heart rate and blood pressure (Barkley, 2014; Hennissen et al., 2017). Hallucinations and other psychotic symptoms are an uncommon but adverse side effect of stimulant use (AAP, 2019). The higher the dosage of medication, the more side effects are reported (Barkley, 2014). There are also long-term side effects to taking stimulant medication. Long-term stimulant use can cause weight and height deficits. (Barkley, 2014; Carucci et al., 2021). If a child is prescribed stimulant medication, then it is important for them to be monitored while taking the medication. They should be monitored at baseline, during any increases or decreases in dosage, as well as when receiving the full dosage (Barkley, 2014). Children also must be monitored while taking stimulant medications because stimulants have been linked to increases in heart rate and blood pressure (AAP, 2019). Although psychostimulants are considered the first line of defense for children ages 6 and up (with medication and behavioural interventions recommended for ages 6 to 12 years) (AAP, 2019), their mechanisms are poorly understood (Rubia et al., 2014), meaning that physicians must weigh the risks and benefits of that medication for each individual patient when prescribing a psychostimulant (i.e., the risk of adverse effects of a psychostimulant against the risk of untreated ADHD) (see Kraut et al., 2013).

***Nonstimulant Medication*.** Thirty percent of children may not respond to stimulant medications or may experience side effects. Stimulant medications are also a controlled substance, and some families express concern over this. Nonstimulant medications (e.g., atomoxetine; Strattera ®) can then be prescribed (AAP, 2019; Barkley, 2014). A meta-analysis and meta-regression conducted by Cheng and colleagues (2007) found that atomoxetine was

effective in reducing ADHD symptoms in children and adolescents and was especially effective at treating girls with ADHD, children without comorbid ODD, and children with ADHD-I (Cheng et al., 2007). Side effects of taking nonstimulant medications include drowsiness, gastrointestinal tract symptoms, decreased appetite, and, although less common, an increase in suicidal thoughts (AAP, 2019). Nonstimulant medications have not been approved for pre-school children but have been approved for elementary school-aged students (AAP, 2019). A systematic review and meta-analysis conducted by Prasad and colleagues (2013) found two studies that studied the effects of atomoxetine on academic achievement. Brown and colleagues (2006) found that teachers and parents reported an improvement in child behaviour, but not for teacher ratings of academic productivity. Wietecha and colleagues (2009) compared two different atomoxetine titration doses and two atomoxetine maintenance doses used to treat adolescents with ADHD. The results demonstrated that there were some improvements in academic performance (e.g., reading, written language scores, and math grades) in both groups and no significant differences between groups.

Psychosocial Interventions. Psychosocial interventions (i.e., behavioural interventions) are another evidence-based treatment approach for ADHD (Evans et al., 2014; Fabiano et al., 2015; Pelham & Fabiano, 2008) and are often used alone or in combination with stimulant medication (e.g., MTA Cooperative Group, 1999a, 1999b; Pelham et al., 2016). Research has shown that whereas stimulants have a larger effect on the 18 core symptoms of ADHD, parents were more satisfied with the effect of behavioural therapy, as the positive effects of therapy typically extend beyond treatment completion, in contrast to the positive effects of medication, which are not observed following treatment completion (AAP, 2019). Given that ADHD symptoms impair peer relationships, parent-child relationships, and academic/school functioning,

it is important to target these areas with psychosocial interventions (Pelham et al., 2017). Psychosocial interventions for ADHD are typically focused in two areas: (1) behaviour management (BM) (e.g., behavioural parent training, behavioural classroom management, and behavioural interventions) (Evans et al., 2018; Pelham & Fabiano, 2008) and (2) training interventions (e.g., organization training) (Evans et al., 2018).

Behavioural Parent Training. Behavioural parent training (BPT) is based on operant conditioning and social learning theories (Altszuler et al., 2017; Fabiano et al., 2015; Garland et al., 2008). Operant conditioning occurs when a behaviour is changed by its consequences (Martin & Pear, 2019). These consequences occur in the form of positive or negative reinforcement and/or positive or negative punishment. Positive reinforcement occurs when a behaviour is more likely to occur followed by a positive reinforcer. This increases the likelihood that the individual will do the same behaviour. (Martin & Pear, 2019). For example, a child who studies for a test and gets 100% is more likely to study for the next test. Negative reinforcement occurs when an aversive stimulus is removed, therefore resulting in the individual doing the same behaviour in a similar situation (Martin & Pear, 2019). For example, hitting the snooze button on the alarm clock. Positive punishment occurs when an individual is given an undesirable stimulus to decrease an undesired behaviour. For example, a spanking a child for crying. Negative punishment occurs when a desirable stimulus is removed to decrease an undesired behaviour. For example, a child might have their toys taken away for having a tantrum. Social learning is learning that occurs through interactions and observations. Children learn appropriate and inappropriate behaviours by observing others. For example, a child watches another child cry to get a cookie. The next time the child wants something then they may also cry as they observed that behaviour (Forehand & Long, 2010).

Programs such as the Community-Oriented Parenting Education Program (see Cunningham et al., 1993) and the Defiant Children Program (see Barkley, 1997) are two programs that have successfully trained parents to change their child's behaviour. BPT can be conducted in weekly group sessions that take place over 8 to 12 weeks (Chacko et al., 2009; Fabiano et al., 2009; Fabiano et al., 2012; van den Hoofdakker et al., 2007) or in individual sessions over 12 weeks (McGrath et al., 2011). BPT is most successful when provided to parents of pre-school to young school-age children because parents predominantly influence the child's environment at this age. At middle school age both parent and child have shared influence over their environment (Barkley, 2014).

A typical BPT program starts by providing caregivers with psychoeducation about ADHD, such as information about the disorder, general causes of behaviour (e.g., parenting styles, child temperament), followed by instruction on antecedents, behaviours, and consequences of behaviour (i.e., the ABC model). It is important that parents understand the ABC model because they will be trained to manipulate contingencies in the target environment (Barkley, 2014). They are trained to use strategies to manipulate the antecedents (i.e., what occurs before the behaviour) and consequences (i.e., what occurs after the behaviour) of their child's behaviour. Once the behaviour has been changed, then the behaviour can be generalized and maintained (Evans et al., 2018). For example, a parent may want to improve their child's compliance with requests. Parents would learn that a response cost system may help improve this behaviour versus a time-out (Barkley, 2014; Kazdin, 2005).

Behavioural Classroom Management. Behavioural classroom management (BCM) is a school-based intervention for ADHD implemented by teachers (Altszuler et al., 2017; DuPaul et al., 2012; Evans et al., 2014). These interventions were designed to help students with their on-

task behaviour (Altszuler et al., 2017). Examples of these interventions include developing classroom rules, implementing a point system, providing positive attention, implementing group contingencies, and implementing daily report cards (DRC) (Altszuler et al., 2017; Coles et al., 2012; Fabiano et al., 2007; McGoey et al., 2014; Pelham et al., 2014). These examples have been found to be effective interventions that reduce problem behaviour, increase on-task behaviour, and improve the academic performance of students with ADHD (Fabiano et al., 2007; Fabiano et al., 2015; McGoey et al., 2014; Pelham & Fabiano, 2008).

A meta-analysis conducted by Evans and colleagues (2014) found two well-established studies of BCM. Participants in both studies consisted of elementary school-aged children. Fabiano and colleagues (2010) examined the efficacy of DRC by having behavioural consultants develop a DRC with the teacher and parents based on the child's individualized education plan (IEP) goals and objectives. The teacher implemented the intervention while the parents were responsible for the rewards at home. The results indicated that use of the DRC resulted in improved classroom behaviour, teacher ratings of academic productivity, and meeting IEP goals and objectives.

Mikami and colleagues (2012) analyzed BCM in summer programs. Teachers in the summer programs had behavioural expectations for the children and the teachers implemented a system (e.g., contingency management system) where children could gain or lose points based on compliance and exhibiting appropriate behaviours. The researchers also evaluated two classroom management methods, Contingency Management Training (COMET) and Making Socially Accepting Inclusive Classrooms (MOSAIC). COMET is a behavioural management intervention used to improve socially appropriate behaviours in children with ADHD whereas MOSAIC was a novel intervention that used behavioural management for children with ADHD by training

peers to be socially inclusive. Results showed that the MOSAIC intervention resulted in children with ADHD being less rejected by their peers and having more reciprocal friendships compared to COMET (η^2_p= .34). However, this effect was larger for boys with ADHD than for girls with ADHD (η^2_p= .33).

Behavioural Peer Interventions. Behavioural peer interventions occur in recreational settings such as Summer Treatment Programs (STP) (e.g., Pelham & Hoza, 1996) and were created for students with ADHD to learn social skills and appropriate behaviour by watching modelling of appropriate behaviour by a counsellor (Altszuler et al., 2017; see Pelham et al., 2014). In an STP, children with ADHD can be directly observed while interacting with peers, which allows for teaching and modelling of appropriate behaviour, social skills, sports knowledge, teamwork, and appropriate sportsmanship. The STP allows children with ADHD to be provided with intervention, academic instruction, and provides parent with parent training (Pelham et al., 2017). In STP, a response-cost system is used such that children can earn points for exhibiting appropriate behaviours (e.g., following rules, good sportsmanship, paying attention) and lose points for inappropriate behaviour (e.g., teasing, noncompliance, aggression). Points can be traded in for prizes such as shopping at a point store, privileges, social honours, camp-based rewards, and parent-administered rewards (Pelham et al., 2017). Points are paired with praise to teach appropriate behaviours. DRCs are also sent home to parents so that behaviours can carry across settings. “Prudent punishment” may also be used in STP. For example, if a child with ADHD exhibits an inappropriate behaviour (e.g., intentional aggression, intentional destruction of property) then prudent punishment is enforced (e.g., loss of privileges, time-out) (Pelham et al., 2017).

Mikami and colleagues (2010) trained parents using Parent Friendship Coaching (PFC) instead in a recreation setting. PFC coaching is similar to the coaching in STP. Parents are trained to be social coaches to help their child with ADHD learn appropriate behaviour (Mikami et al., 2010). Parents were taught to manipulate contingencies when their child was in a social situation to help teach the child with ADHD the appropriate social behaviour. Parents completed eight weekly group sessions where they learned about topics such as the ABC model, using active listening, coaching social skills, teaching dyadic play skills, choosing the right peer, organizing playdates, inviting a peer for a playdate, preparing the playdate, and debriefing with the child after the playdate. Parent ratings of their child's social skills and their child's quality of play was improved after receiving PFC. Teachers' ratings of peer liking and acceptance was higher for children who had received PFC but no effect was found for teacher rating of social skills (Mikami et al., 2010).

Organization Training. Organization training is designed to train children and adolescents with ADHD to organize their school materials and their lives. Abikoff and colleagues (2013) and Langberg and colleagues (2012) both taught children with ADHD organization rules and the children's organization was routinely measured. Participants in Abikoff and colleagues' (2013) study consisted of elementary school aged children with ADHD who were randomly assigned to either Organization Skills Training (OST) intervention, Parents and Teachers Helping Kids Organize (PATHKO) intervention or to a waitlist control condition. In the OST intervention, children learned techniques to track their assignments and materials, manage time, and plan tasks. To learn these skills, they also learned new tools and routines (e.g., organize papers in binders, use a checklist). Children received prizes during the sessions for using their skills and tools. Teachers and parents were briefly trained to reward the child if they

used the above skills (Abikoff et al., 2013). The PATHKO intervention involved training teachers and parents to created individualized daily goals for the child. These sessions primarily involved parents, with their child joining at the end of each session. PATHKO consisted of DRC's targeting organization, time management, and planning behaviours, a token economy system, and homework rules and structures. PATHKO relied on the use of contingency management and response cost procedures, whereas OST focused on reinforcing the child's process and substeps for developing their skills. PATHKO focused on reinforcing end behaviours. The OST intervention resulted in higher parent and teacher ratings of academic functioning, organization, homework completing, and family conflict (Abikoff et al., 2013).

Participants in the Langberg and colleagues' (2012) study consisted of middle school aged children who were randomized to either the Homework, Organization, and Planning Skills (HOPS) intervention or to a waitlist group. In the HOPS group, the targeted skills included school materials organization, homework recording and management, and planning/time management. With respect to materials organization, students were taught to use a specific approach to organize their bookbag, binder, and locker. They were also taught how to transfer their homework materials from school to home and back (Langberg et al., 2012). For homework recording and management, students were taught how to record their homework, assignments, projects, and tests in their planner. For planning/time management, students were taught how to break tests and assignments into small pieces and how to plan the time out that it takes to complete each piece (Langberg et al., 2012). A point system was used, and students could receive points if they demonstrated the skills on the tracking checklist. Results indicated that parent ratings of organization, homework, and family conflict were significantly higher than teacher ratings of organization and homework.

Bul and colleagues (2016) created and examined a gaming intervention (Plan-it Commander). The purpose of the intervention was to teach and reinforce time management, planning, organization, and cooperation skills. Children with ADHD (ages 8-12) were assigned either to the gaming intervention or a treatment-as-usual (TAU) crossover group. Both groups took medication. The first group received the gaming intervention for 10 weeks, and then received TAU for 10 weeks. The second group received TAU for 10 weeks, and then crossed over to the gaming intervention and received the gaming intervention and TAU for 10 weeks. Parent reports indicated that children in the first group demonstrated improvement of their time management skills, social skill of responsibility, and working memory. Parents and teachers also reported that social skills improved within groups, but total social skills, planning and organization skills were nonsignificant between groups based on teacher ratings.

Organization training has also been studied with combined treatments (see Sprich et al., 2016; Vidal et al., 2015). For example, cognitive behavioural treatments (CBT) using strategies such as cognitive restructuring (Evans et al., 2018). Cognitive-behavioural therapies for ADHD have been studied in adults. For example, Solanto and colleagues (2008) assessed a new manualized CBT group, Meta-Cognitive Therapy (MCT). MCT used both the principles of cognitive behavioural therapy and the development of self-management skills. Adults with ADHD in the MCT group exhibited improvements in their inattention symptoms, and executive functioning skills (see also Solanto et al., 2010). Research conducted by Boyer and colleagues (2015) examined two CBT treatments for adolescents with ADHD and participants were assigned to one of two treatments, Plan my Life (PML) or a solution-focused treatment (SFT). In PML planning skills were discussed at every session. In both treatments, participants ADHD symptoms, planning, EF problems, comorbid symptoms, and general functioning improved from

pre-test to follow-up test. The researchers hypothesized that adolescents who received PML would improve more than those who received SFT, but no differences in improvement were demonstrated (Boyer et al., 2015).

Combined Treatment

The largest randomized clinical trial to date examining well-established treatments for ADHD is the Multimodal Treatment of Attention Deficit Hyperactivity Disorder (MTA) study (MTA Cooperative Group, 1999a, 1999b, 2004a, 2004b). Research conducted prior to the MTA study only examined the short-term effects of stimulant medication (i.e., > 3 months). The MTA study compared four types of treatment: medication management; behavioural treatment; combined treatment; and community care. Medication management consisted of a double-blind administration of MPH (placebo, 5mg, 10mg, 15mg or 20mg) (Greenhill et al., 1996). Behavioural treatment consisted of BPT (eight weekly sessions per family) (Barkley, 1987; Forehand & MacMahon, 1980), child-focused treatment (STP) (Pelham & Hoza, 1996), and a school-based intervention (Biederman et al., 1991; Swanson, 1992). All of these behavioural treatments were the maximum dosage of behavioural treatment a family could receive. Those in the community care group did not receive any treatments.

Findings of the MTA study suggest that that all children improved to some extent, regardless of condition. With respect to ADHD symptoms, participants in the medication management group and combined treatment groups improved significantly more than the other two groups. In addition, the combined treatment group improved significantly more than the behavioural treatment group and community care group on other factors such as internalizing symptoms, teacher-rated social skills, parent-child relations and reading achievement, whereas children in the medication management group did not (MTA Cooperative Group, 1999a, 1999b,

2004a, 2004b). The MTA study found that a combination treatment allowed for the use of lower stimulant dosage (AAP, 2019). The MTA study indicates that medication alone may not necessarily be the best treatment for every child with ADHD. In line with these findings on combination treatment, a meta-analysis conducted by Arnold and colleagues (2020) found that achievement test scores and academic performance outcomes of children with ADHD can improve with combined treatment.

Research conducted by Pelham and colleagues (2014) has found that combination treatment treats the symptoms of ADHD at the same rate of the highest dose of medication alone, but with lower side effects and higher parental satisfaction. This is in contrast to other research suggesting that the dosage of behaviour treatment does not matter as much as the medication dosage (see MTA Cooperative Group 1999a, 1999b). This difference could be due to the fact that the research conducted by Pelham and colleagues (2014) examined different treatment dose combinations whereas the MTA study only examined a high-intensity dose of each treatment. In another study examining combined treatment, Pelham and colleagues (2016) found that, contrary to MTA findings and current AAP guidelines, a low dose of behaviour modification seemed to be the best first line of treatment for students with ADHD. The researchers also found that it was best to begin treatment with behaviour modification, and then add medication if needed, as opposed to beginning with medication and adding a behavioural treatment. They also found that if a student with ADHD did not respond to behavioural treatment, then more behavioural treatment should be implemented before adding medication.

In a follow-up to the Pelham and colleagues (2016), Coles and colleagues (2020) note problems with the MTA studies, particularly dosing and sequencing (see Pelham, 1999). Specifically, the MTA study only examined a high-intensity dose of each treatment, meaning it is

unclear whether children could have been treated with a less intensive behavioural treatment or medication (Coles et al., 2020). Regarding sequencing, children in the study began the pharmacological and behavioural treatment at the same time. Cole and colleagues (2020) examined whether using behavioural treatment as a first-line treatment can delay, reduce, or eliminate the need for pharmacological intervention. Participants were randomly assigned to either high-intensity behavioural consultation (HBC), low-intensity behavioural consultation (LBC), or no behavioural consultation (NoBC) in both the home and school setting. All children were unmedicated. Parents and teachers completed weekly ratings to determine if the children would need pharmacological treatment. Receiving BC delayed the start of children with ADHD taking medication. It also reduced their dosage taken at school and the prevalence of medication use at home (Coles et al., 2020).

Emerging Psychosocial Interventions

Cognitive Training. According to the meta-analysis conducted by Evans and colleagues (2014) there were two studies of cognitive training (e.g., working memory training) that were found to be effective. Beck and colleagues (2010) used a waitlist control study to investigate whether WM training would improve WM and other executive functions in children with ADHD, based on parent and teacher ratings. The WM intervention consisted of a computer-based training program completed by children under the supervision of a parent. The program consisted of verbal WM tasks such as backwards digit span, and visuo-spatial WM tasks. These exercises varied in difficulty based on the child's performance. Sixty-one percent of the participants were taking stimulant medication. Results of the study by Beck and colleagues (2010) were mixed, with parents rating the success of the intervention higher than teachers immediately after treatment and at four-month follow-up. Cognitive training studied by van der

Oord and colleagues (2010) included an additional computer game feature. Results of this research was similar to results from the Beck and colleagues (2010) study as parents found improved behaviours on two of the five subscales. Teachers did not report any significant differences between the groups. Based on the results of these studies, cognitive training was rated as an experimental treatment for ADHD.

An updated meta-analysis conducted by Evans and colleagues (2018) found three additional studies which evaluated the efficacy of Cogmed Working Memory Training (CWMT). CWMT is a computerized training program for verbal and nonverbal working memory (see Chacko et al., 2014; Dongen-Boomsma et al., 2014; Steeger et al., 2016 for review). An additional two studies examined the efficacy of Braingame Brain, which is a computerized training program for working memory, inhibition, and cognitive flexibility (see Dovis et al., 2015; van der Oord et al., 2014 for review). Cognitive training continues to be an experimental treatment for children with ADHD ages 5 to 15 (Evans et al., 2018).

Neurofeedback Training. Neurofeedback training is an operant conditioning procedure through which participants can change their electroencephalogram (EEG) patterns (i.e., the recording of brain electrical activity) using self-control (Heinrich et al., 2007). Electrodes are placed on the scalp and EEGs are recorded as frequency bands, delta, theta, alpha, and beta. Participants can see their EEG patterns while they work on changing these patterns and are positively reinforced when they are able to self-control their EEG patterns (Gevensleben et al., 2009). Neurofeedback training is hypothesized to help a child with ADHD acquire self-control of specific brain activity parents to reduce their ADHD symptoms while improving their daily functioning. Gevensleben and colleagues (2009) studied neurofeedback training by randomizing participants into either a neurofeedback training (i.e., Self-regulation and Attention Management

(SAM) Program) or an attention skills training (Skillies program) group. Both groups completed attention-demanding computer tasks and were told to develop strategies for attention and to practice these strategies at home and in school. Parent and teacher ratings showed improvement in the overall symptoms of ADHD for participants who had the neurofeedback training. Based on Gevensleben and colleagues (2009), neurofeedback training resulted in symptom reductions but no significant gains in functioning, suggesting that neurofeedback training is a possibly efficacious treatment for children with ADHD (Evans et al., 2014).

ADHD in the Classroom

The greatest risk for children with ADHD is the risk of academic underachievement and dropping out of school in adolescence into adulthood (Barkley, 2014). Indeed, one-third of children with ADHD have been held back a grade (Barkley et al., 2008), they are more likely to be suspended or expelled from school compared to their typically developing peers (Barkley et al., 1990), and a student with ADHD is at 10% higher risk of dropping out of high school compared to their peers (Barkley et al., 2008). These difficulties can follow the student into adulthood, as only about 20% of adults with childhood ADHD continue with post-secondary education (Weiss & Hechtman, 1986, 1993).

Children with ADHD underachieve academically compared to their peers (Barkley, 2014; DuPaul & Stoner, 2014). Achievement test scores between students with ADHD and their typically developing peers differ by 0.71 standard deviations (Frazier, Youngstrom, Glutting, & Watkins, 2007) and they receive lower academic grades compared to their peers (DuPaul & Stoner, 2014). Children with ADHD also receive the lowest ratings by teachers on the Child Behaviour Checklist (CBCL; Achenbach & Rescorla, 2001) for academic competence.

There is debate in the literature as to whether the symptoms of ADHD (i.e., inattention, impulsivity, and hyperactivity) result in academic underachievement or if the academic difficulties exhibited by students with ADHD are the results of distinct LDs. Most research examining ADHD and LD is correlational in nature or focuses solely on ADHD without assessing or accounting for LDs (DuPaul & Stoner, 2014). Some research suggests that a LD occurs first and is then followed by a behavioural pattern of ADHD (Healey, 2010; Thapar et al., 2013), whereas other research suggests that LD occur in almost every child with ADHD because inattention and hyperactivity could encourage learning difficulties as a result of chronic inattention or lack of work engagement (Gagliano et al., 2007; Luoni et al., 2013; Rapport et al., 2001). DuPaul and colleagues (2013) reviewed 17 studies from 2001-2011 examining ADHD and LD comorbidity and found that between 8% and 76% (i.e., at least one out of every three or four children) of students with ADHD also had an LD. This variability in comorbid LD diagnosis is due to the method used to diagnose the LD (i.e., discrepancy model, response to intervention (RTI) model) and/or the category of LD diagnosis (e.g., reading disorder, math disorder, writing disorder) (DuPaul et al., 2013).

Part of ADHD and LD debate is the difficulty distinguishing between academic skill deficits (i.e., learning disorders) and academic performance deficits (DuPaul & Stoner, 2014). Academic skills deficits result from difficulty learning the specific subject matter, meaning that the student may not be able to learn the skills being taught, even in individual instruction (DuPaul & Stoner, 2014). Academic performance deficits occur when a student possesses the necessary skills to learn, but they do not demonstrate this knowledge consistently. For example, a child with ADHD may have adequate academic skills but lack the attention to perform well on a task. Additionally, inattention and behaviour difficulties could affect the student's ability to

engage in the current lesson, resulting in greater levels of academic underachievement (DuPaul & Stoner, 2014; Silver, 1990).

The symptoms of ADHD are incompatible with classroom expectations (Harrison et al., 2020) and can affect a child's learning and their future academic success (Barkley, 2014; Fabiano et al., 2007; Ohan et al., 2011). They exhibit lower rates of on-task behaviour (Imeraj et al., 2013; Kofler et al., 2008), independent work (Imeraj et al., 2013) and have fewer opportunities to complete and respond to academic material (Pfiffner, Barkley, & DuPaul, 2006). Children with ADHD may also have difficulty with the homework process. They must write down assignments, remember to bring their materials home (and back to school), sit down to complete the assignment, work in a distracting home environment, work until the assignment is complete, and remember to turn in the homework/assignment on the due date (Merrill et al., 2016). The child's behaviours can get in the way of their productivity. Teachers, therefore, are required to implement classroom behavioural interventions to support students with ADHD, to minimize the effect of behavioural difficulties on learning.

Classroom Support

There are two categories of school-based services that teachers may use to help a student with ADHD: (1) intervention and (2) accommodation. Interventions, such as a teacher implementing BM, can help support classroom management. Interventions can be used to help the student with ADHD meet age-appropriate academic and behavioural expectations (AAP, 2019). Interventions are used to help improve the student's behaviour (AAP, 2019).

Accommodations can be used to provide changes to the student's academic programming to facilitate academic task completion. They are used to change/alter the administration of instruction or assessments (Lovett & Harrison, 2021). Accommodations include (but are not

limited to) extended time to complete tests and assignments, reduced homework demands, and copies of the teacher's notes to the student. Teachers must be mindful of the fact that reliance on accommodations only can lead to reduced behavioural and academic expectations of the student in the long term (AAP, 2019), as the student will not have been provided with the opportunity to learn appropriate behaviours. Accommodations can also result in an unfair advantage for students (e.g., cheat sheets for tests) (Lovett & Harrison, 2021). Interventions increase student's skill levels whereas accommodations do not (Lovett & Harrison, 2021). It is therefore important to include formal interventions as part of a school-based approach to ADHD management. Accommodations may be used if the student has a disability-related deficit, if an intervention is ineffective, or if the accommodation does not compromise the student's instruction or assessment (Lovett & Harrison, 2021).

Given the disruption caused by ADHD in the classroom, it is important for teachers to be knowledgeable about ADHD interventions. Teacher knowledge of ADHD is an important component in early identification, the diagnostic process, and the intervention (Coles et al., 2012). With this in mind, the following chapter will address teachers' knowledge and perceptions of ADHD interventions.

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CHAPTER TWO

Teacher Knowledge of Behavioural Interventions for Students with ADHD: A Scoping Review

Attention Deficit Hyperactivity Disorder (ADHD) is the most common neurodevelopmental disorder of childhood, with prevalence rates estimated to be approximately 7.2% worldwide (Thomas et al., 2015). ADHD is characterized by developmentally inappropriate levels of inattention and/or hyperactivity/impulsivity, symptom onset before age 12, and impairment in at least two settings (e.g., home and school) (American Psychiatric Association, 2013). Children and adolescents with ADHD have been found to experience academic underachievement (Barkley, 2014; DuPaul & Stoner, 2016; Kent et al., 2011), poor friendships and relationships (Barkley, 2014; Mikami, 2010), antisocial behaviour (Barkley, 2014; DuPaul & Stoner, 2016), reckless behaviour (Barkley, 2014; DuPaul & Stoner, 2016), and higher risk of substance abuse (Barkley, 2014; DuPaul & Stoner, 2016). Given the potential for poor long-term outcomes in this population, it is essential to implement evidence-based interventions across settings to ensure the best possible outcomes for children and youth with ADHD (see King et al., 2021).

Research has consistently indicated that the most effective treatments for ADHD are (1) behavioural interventions (e.g., behavioural parent training, behavioural classroom management, behavioural peer training, and organization training for adolescents) (Barkley, 2014; Evans et al., 2014, 2018; Fabiano et al., 2015; King et al., 2021; Wolraich et al., 2019); (2) pharmacological interventions (e.g., psychostimulant medications such as methylphenidate) (Barkley, 2014; King et al., 2021; Wolraich et al., 2019); and (3) a combination of both (Barkley, 2014; King et al., 2021; Wolraich et al., 2019). Behavioural interventions for ADHD are based on foundational

behavioural principles such as reinforcement and punishment and typically focus on manipulating the antecedents and consequences of behaviour to increase desirable behaviours and decrease undesirable behaviours. Proper implementation of behavioural interventions have consistently been shown to result in positive behaviour change among children and youth with ADHD (see Blotnicky-Gallant et al., 2015; Evans et al., 2014, 2018; Strelow et al., 2020).

School-Based Behavioural Interventions for ADHD

The use of behavioural interventions for ADHD is especially important in the school setting, with multiple studies showing improvements in problem behaviours (e.g., Barkley, 2014; Evans et al., 2014; Fabiano et al., 2010; Martin & Pear, 2019), increased compliance with teacher requests (e.g., Barkley, 2014; Evans et al., 2014), increases in on-task behaviour (e.g., Barkley, 2014; Evans et al., 2014; Martin & Pear, 2019), improved academic performance (e.g., Barkley, 2014), and improved academic productivity following implementation (e.g., Barkley, 2014; Fabiano et al., 2010). Commonly implemented classroom-based behavioural strategies include developing classroom rules (Barkley, 2014; DuPaul & Stoner, 2016; Schultz et al., 2011), developing a point system (DuPaul & Stoner, 2016), providing positive attention (DuPaul & Stoner, 2016; Evans et al., 2014), implementing group contingencies (DuPaul & Jimerson, 2014; McGoey et al., 2014), implementing daily report cards (DRC) (DuPaul & Jimerson, 2014; DuPaul & Stoner, 2016; Evans et al., 2014; Fabiano et al., 2010; McGoey et al., 2014; Schultz et al., 2011), token economies (Barkley, 2014; DuPaul & Stoner, 2016; McGoey et al., 2014; Schultz et al., 2011), and response-cost systems (Barkley, 2014; DuPaul & Stoner, 2016; McGoey et al., 2014; Schultz et al., 2011).

Behavioural interventions for ADHD are corrective strategies that are used to support classroom management and improve and/or change student behaviour (Lee & Witruk, 2016;

Lovett & Harrison, 2021). For example, a DRC can be used in the classroom to increase desired behaviours by selecting target behaviours for the classroom, having teachers rate their occurrence, and rewarding them accordingly in the home (e.g., Fabiano et al., 2010; Girio-Herrera et al., 2021; Schultz et al., 2011). Token economy systems can also be used in the classroom to shape a target behaviour by rewarding that behaviour with a token that can be traded in for a prize (see Martin & Pear, 2019; Schultz et al., 2011). Finally, response-cost systems are often implemented along with a token economy and usually involve the removal of previously earned tokens for demonstrating undesirable behaviour (Schultz et al., 2011). Behavioural interventions such as these have been shown to result in improved classroom behaviour (e.g., Owens et al., 2008; Rosen et al., 1984; Wolraich et al., 1978).

In addition to the behavioural interventions noted above, teachers may also use instructional approaches, which are strategies that change the learning context with the goal of reducing a student's problem behaviour (Martinussen et al., 2011). Instructional approaches are proactive strategies consisting of teaching approaches and accommodations such as preferential seating or chunking tasks to better meet the needs of the student (Blotnicky-Gallant et al., 2015; Lee & Witruk, 2016; Lovett & Harrison, 2021). Accommodations are used to change or alter the student's programming to help with task completion (e.g., reading a test aloud to a child with a learning disability in reading) (Lovett & Harrison, 2021). Although accommodations are widely used in the school system, they do not directly increase students' skill levels (Lovett & Harrison, 2021), meaning that they might not reduce symptoms as effectively as one of the interventions described above.

Teacher Knowledge of Behavioural Interventions for ADHD

The implementation of school-based behavioural interventions for ADHD typically falls on classroom teachers; however, if these interventions are to be effective and result in the best possible outcomes for students, they must be feasible with respect to resource allocation, implemented consistently with integrity and fidelity (DuPaul et al., 2020), and acceptable to teachers (Korchmaros et al., 2021; McGoey et al., 2014; Poznanski et al., 2018). Ideally, teachers should be somewhat familiar with ADHD and with foundational behavioural principles to ensure they understand the intervention approach and how to effectively implement classroom-based behavioural interventions (Martinussen et al., 2011). However, research has shown that, although teachers and administrators report that they know how to implement behavioural interventions in the classroom (Fabiano & Pelham, 2003), many school-based interventions are not effective and do not result in observable behaviour change (Fabiano & Pelham, 2003). This could be due to several factors such as program intensity, teachers' discomfort with adjusting a behaviour plan, and/or their lack of knowledge of behavioural principles, as training in behavioural programming is rarely provided as part of teacher training programs (see Anderson et al., 2012; Barkley, 2014; Blotnicky-Gallant et al., 2015; Fabiano & Pelham, 2003).

Studies examining teacher knowledge of ADHD and its treatment show that teachers report moderate knowledge about ADHD symptoms and diagnosis, but understand little about its treatment (e.g., Anderson et al., 2012; Blotnicky-Gallant et al., 2015; Ohan et al., 2008), suggesting that there may be a research-to-practice gap with respect to the evidence for the effectiveness of behavioural interventions for ADHD and their implementation in the school system (Dort et al., 2020; DuPaul et al., 2020; McGoey et al., 2014; Strelow et al., 2020). When studying behavioural interventions, research has indicated that teachers prefer positive

interventions (e.g., rewarding) over reductive interventions (e.g., removal of privileges), as well as treatments that require less time and effort (Elliott et al., 1984; Witt et al., 1984). Teachers have different perceptions about ADHD treatment. Epstein and colleagues (1986) examined teacher ratings of intervention acceptability and found that teachers prefer psychosocial interventions (e.g., behaviour modification, counselling, special education programming, and affective education) to medication. Power and colleagues (1995) examined teacher acceptability of DRC, response-cost intervention, and stimulant medication and found that teachers rated the DRC as the most acceptable intervention, with DRC and stimulant medication rated as the most acceptable combined treatment. Likewise, Pisecco and colleagues (2001) and Curtis and colleagues (2006) examined teacher acceptability of DRC, response-cost intervention, classroom lottery, and stimulant medication and found that teachers rated the DRC as the most acceptable intervention. Other research has found that teachers prefer to use less intensive classroom management strategies (CMS) such as praise and reprimands more often than more intensive CMS such as the DRC (Chafouleas et al., 2006; Hart et al., 2017; Martinussen et al., 2011; Rosén et al., 1990; Zentall & Stormont-Spurgin, 1995).

Understanding teacher knowledge of behavioural interventions for ADHD is important, since they are often required to implement these approaches in the classroom, often with very little on-going consultation from school or clinical psychologists and varying levels of understanding of the disorder and the behavioural principles that form the basis of treatment (see McGoey et al., 2014). This is in contrast to Behavioural Parent Training (BPT), a manualized treatment that is usually implemented by a psychologist and includes introductory modules consisting of psychoeducation about ADHD and the foundational principles of behaviour to ensure that parents implement the intervention consistently and with fidelity (see Barkley, 2013;

Cunningham et al., 1993). If psychologists wish to work collaboratively with classroom teachers to ensure positive outcomes for students with ADHD, it is essential to understand their existing knowledge; by doing so, psychologists can "meet teachers where they are" and understand the type and intensity of support they require to implement the behavioural interventions that are often recommended (McGoey et al., 2014).

It would be helpful for school psychologists to know whether teachers prefer specific intervention or accommodation approaches over others or whether teachers know more about some interventions than others. By understanding teacher knowledge and preferences, school psychologists can work with teachers to provide needed psychoeducation and can recommend management strategies that will be more likely to be implemented. With this in mind, the purpose of the current study is to conduct a scoping review of the literature of teacher knowledge of ADHD intervention. Given that this was an exploratory study, no formal hypotheses were generated; however, based on previous findings (e.g., Anderson et al., 2012; Blotnicky-Gallant et al., 2015; Ohan et al., 2008), it was expected that teacher knowledge of ADHD and its treatment would be variable and possibly incomplete.

Method

Protocol and Registration

The PRISMA statement and checklist guided this review (Moher et al., 2009). The protocol was not registered but the first author can be contacted for further information. The research question sought to identify teacher and pre-service teacher knowledge of ADHD interventions/treatment.

Eligibility Criteria

JG performed an electronic search of the following databases from 2006 to 2021: (1) Academic Search Premier (2) APA PsycInfo, and (3) Education Research Complete. Databases were searched using the following search string "ADHD OR attention deficit hyperactivity disorder OR attention deficit-hyperactivity disorder AND teacher OR educator OR pre-service teacher AND knowledge OR understanding OR awareness AND interventions OR strategies OR best practices". Studies that were selected for inclusion during the abstract screening stage were based on the following inclusion criteria: (a) peer-reviewed research studies (e.g., observational, qualitative, quantitative, original research); (b) published within the last 15 years (i.e., 2006-2021); (c) published in English; (d) participants consisted of teachers or pre-service teachers; (e) teachers of students aged 5-18 with ADHD; and (f) studying behavioural/psychosocial treatment knowledge. Exclusion criteria consisted of the following: (a) ADHD with comorbid disorders/conditions; (b) adults with ADHD; and (c) teacher and parent knowledge/ratings that were not differentiated.

Study Selection

After the removal of duplicate articles, all remaining articles were uploaded into Covidence systematic review software (Veritas Health Innovation, Melbourne, Australia). The titles and abstracts were screened by one author (JG) according to the inclusion criteria. If the author had difficulty determining if the abstract met the inclusion criteria, then a second reviewer (SK) was consulted.

Data Extraction Process

Data extraction was performed by JG. Excel was used to create a table to classify included studies. Data gathered for each study included reference, country, study funding

sources, possible conflicts, methods (i.e., aim of study, study design, intervention/measures/outcomes), participants (i.e., population description, inclusion criteria, exclusion criteria, method of recruitment, total number of participants), results (i.e., demographics, intervention/measures/outcomes), discussion, notes, and any missing information (e.g., effect size not reported, descriptive statistics not reported).

Results

Study Selection and Characteristics

As of July 5th 2021, the search returned 597 articles, with nine studies identified as meeting full text inclusion criteria for this review (see Figure 1). Two studies were from the United States, one from Canada, one from Pakistan, one from Nigeria, one from Germany, and one from South Africa. Two studies compared teachers between countries (i.e., U.S. and New Zealand, South Korea and Germany). Studies included in the review consisted of a total of 3,383 participants with ages ranging from 20 to 70 years of age. Seven studies focused on practicing teachers (Blotnicky-Gallant et al., 2015; Curtis et al., 2006; Jones & Chronis-Tuscano, 2008; Khan et al., 2019; Lasisi et al., 2017; Lee & Witruk, 2016; Topkin et al., 2015) and two studies focused on pre-service teachers (Poznanski et al., 2018; Strelow et al., 2020).

Study Design

Three studies used an online survey (Blotnicky-Gallant et al., 2015; Poznanski et al., 2018; Strelow et al., 2020) and four studies used in-person survey/questionnaire (Curtis et al., 2006; Khan et al., 2019; Lee & Witruk, 2016; Topkin et al., 2015). Jones and Chronis-Tuscano (2008) used a randomized, controlled design, whereas Lasisi and colleagues (2017) used a randomized controlled trial with intervention and waitlist control group. We were only interested in data measuring teacher reporting of behavioural knowledge before receiving any type of

intervention or professional development, therefore only outcomes relating to the research question will be reported (see Table 1).

Outcome Measures

Studies examined teachers' and pre-service teachers' knowledge of behavioural treatments/interventions in a variety of ways. Blotnicky-Gallant and colleagues (2015) used the Instructional and Behavior Management Approaches Survey (IBMAS), a 36-item true/false questionnaire that measures teachers' use of both instructional and BM practices. Curtis and colleagues (2006) asked teachers to read a vignette describing a child with ADHD and then read a description of classroom interventions (i.e., DRC, response cost technique, stimulant medication [i.e., methylphenidate], and classroom lottery). Participants were then asked to rate these interventions using the Behavioral Intervention Rating Scale (BIRS). The BIRS, which consists of 24 items, examines perceived intervention acceptability, effectiveness, and timeliness of effect using a six-point rating scale format (Curtis et al., 2006). Jones and Chronis-Tuscano (2008) examined teacher use of classroom behaviour management strategies prior to receiving professional development using a Likert rating scale ranging from "this would not fit well with my teaching" to "I use regularly".

Khan and colleagues (2019) developed a questionnaire that examined ADHD interventions used by teachers. Lasisi and colleagues (2017) measured teacher knowledge pre-intervention using the Knowledge of Behavioural Interventions Questionnaire (KBIQ), which was created by the second author of their study. The purpose of the KBIQ is to examine teachers' knowledge of classroom strategies that can be used for students with ADHD. For example, the KBIQ included statements such as "The position where a child with ADHD sits in the classroom does not really affect their behaviour or learning as long as they feel comfortable" (Lasisi et al.,

2017). Lee and Witruk (2016) adapted Kos's (2004) questionnaire to examine Korean and German teachers' attitudes towards classroom management strategies (CMS) and teachers' perceived control of their own behaviour. They examined teacher use of corrective strategies (i.e., reinforcement, negative consequences, planned ignoring) and proactive strategies (i.e., environmental adaptive [organizing classroom] using a four-point Likert scale (Lee & Witruk, 2016).

Poznanski and colleagues (2018) examined pre-service teacher knowledge of CMS using a modified version of the Knowledge of Behavioral Principles Questionnaire (BPQ), which describes classroom scenarios to which teachers are required to respond to multiple-choice questions related to behaviour modification. Strelow and colleagues (2020) used sections of the ADHD School Expectation Questionnaire (ASE) to examine pre-service teachers' intentions to use CMS. They also used the behavioural component of the ASE, which examines CMS that can be used in the classroom. Participants were required to estimate how often they would use the intervention. They were provided with 15 effective interventions (e.g., use a reward system) and 12 ineffective interventions (e.g.., banish the student from the classroom with no comment) (Strelow et al., 2020). Topkin and colleagues (2015) added two additional sections to the Knowledge of Attention Deficit Disorders Scale (KADDS) to examine teacher knowledge regarding classroom interventions and their effectiveness for students with ADHD. The teachers had to respond to the items using a four-point Likert scale (Topkin et al., 2015).

As shown in Table 1, outcome measures varied widely across studies, making it difficult to complete statistical analyses. Therefore, a narrative analysis of studies and findings is presented below (see Grimshaw, 2010).

Findings and Synthesis of Results

Summary of Outcomes

Three broad themes emerged from this scoping review: (1) teachers have varying levels of baseline knowledge about ADHD and its treatment; (2) teachers are more likely to use less intensive behavioural management strategies (e.g., preferential seating) or passive instructional approaches (e.g., modifying language used for instruction) than more intensive strategies; and (3) teachers are more likely to use instructional strategies (e.g., extra time) rather than behavioural interventions (e.g., response-cost system) to manage the classroom behaviour of students with ADHD.

Baseline Knowledge of Behavioural Interventions. Results of four studies (i.e., Jones & Chronis-Tuscano, 2008; Lasisi et al., 2017; Poznanski et al., 2018; Strelow et al., 2020) suggested that teachers have varying levels of knowledge of behavioural interventions. Jones and Chronis-Tuscano (2008) and Lasisi and colleagues (2017) examined teacher knowledge of behavioural interventions prior to receiving professional development on the topic. As previously reported, Lasisi and colleagues (2017) used the KBIQ to assess teachers' knowledge of common classroom strategies for ADHD. On the KBIQ, higher scores indicate that the teacher has a better knowledge of behavioural interventions (range 0-12) (Lasisi et al., 2017). The intervention groups' (n=76) reported knowledge of behavioural intervention pre-intervention was a mean of 7.39 (SD=2.88) and the control groups' (n=71) reported knowledge was a mean of 6.54 (SD=2.69), which indicates that teacher knowledge of classroom strategies prior to receiving an intervention was found to be average. In Jones and Chronis-Tuscano's (2008) study, the immediate in-service groups' (n=74) reported use of classroom behaviour management techniques was a mean of 47.9 (SD=6.7) and the waitlist control groups' (n=68) reported use of

classroom behaviour techniques was a mean of 50.4, (*SD*=5.0). Neither of these studies provided information regarding the types of behaviour management strategies used by teachers (e.g., preferential seating, DRC).

Participants in Poznanski and colleagues (2018) responded to questions on the BPQ with 60.7% accuracy. Pre-service teachers responded to questions probing use of praise and their knowledge of behaviour plan design with 96% and 86% accuracy, respectively; however, they had more difficulty on items probing responses to disruptive behaviour based on function, suggesting limited knowledge of foundational behavioural principles. The researchers note that a gap exists in teacher knowledge of CMS. Strelow and colleagues (2020) examined pre-service teachers' (*n*=1086) intention to use effective and ineffective CMS. Knowledge, attitude towards CMS, attitude towards effective CMS, and intention to use CMS were positively correlated with intention to use effective CMS (*p*s = .316, .531, .720, .694, respectively) , while attitude towards ineffective CMS was negatively correlated with intention to use effective CMS (*p* = -.088).

Teacher Approach to Behaviour Management. Results of five studies (i.e., Blotnicky-Gallant et al., 2015; Curtis et al., 2006; Khan et al., 2019; Lee & Witruk, 2016; Topkin et al., 2015) suggested that teachers tend to prefer using less intensive behaviour management strategies to manage ADHD in the classroom. Blotnicky-Gallant and colleagues (2015) reported that teachers indicated a preference for less intensive behavioural management strategies such as providing positive teacher attention as opposed more intensive strategies, such as implementing a token economy. Similarly, participants in Khan and colleagues' (2019) study reported that teachers typically used less intensive behaviour management strategies such as physical arrangement (20%), home-based contingencies (12.5%), and teacher attention (16%) over more intensive strategies such as token economy (0.5%), response cost (3%), and time-out from

positive reinforcement (1.5%). A similar theme was observed in Curtis and colleagues' (2006) study. Teachers rated the DRC, where the student is rewarded for their behaviour at home, as a more acceptable intervention than response cost (*d*=-.68) and classroom lottery (*d*=-1.14), both of which require teacher reward in the classroom.

In contrast to the studies noted above, Lee and Witruk (2016) found that both German and South Korean teachers reported using corrective strategies such as reinforcement, negative consequences, and planned ignoring. However, this study did not evaluate teacher preferences for one type of behavioural intervention over another, making it difficult to determine whether they would be more likely to use a less intensive strategy if given a choice. Likewise, participants in Topkin and colleagues' (2015) study were asked to rate the acceptability of various classroom strategies. Results indicated that teachers rated both less intensive behavioural management strategies (e.g., seating in classroom [78.4%], setting of behavioural expectations [80.8%], learning expectations [84.3%], classroom rules [91.0%] and intensive behavioural strategies (e.g., token reinforcement [86.9%], communication as intervention [86.5%], and ignoring disruptive behaviour [66.7%]) as acceptable.

Teacher use of Instructional Strategies. Results of four studies (i.e., Blotnicky-Gallant et al., 2015; Khan et al. 2019; Lee and Witruk, 2016; Topkin et al., 2015) suggested that teachers tend to prefer using less intensive instructional strategies to manage ADHD in the classroom. Blotnicky-Gallant and colleagues (2015) reported that on the Instructional Approaches subscale of the IBMAS, teachers often used less intensive instructional approaches, such as modifying language used for instruction as opposed to more intensive instructional approaches, such as providing the student with guided notes for content. Similarly, participants in Khan and colleagues (2019) study reported using less intensive instructional approaches such as peer

tutoring (25%) over more intensive instructional approaches such as varied presentation of format and materials (13.5%) and transitory academic tasks interspersed with passive tasks (3.5%). Participants in Topkin and colleagues' (2015) study rated the following interventions as acceptable: educational interventions (97%), assistive technology (81.9%), learning expectations (84.3%), academic and social improvements (85%), time given for tests (58.4%), repetition of directions (82.8%), and class work broken into units (83.3%).

In contrast to the studies noted above, Lee and Witruk (2016) found that both German and South Korean teachers reported using proactive strategies. However, this study did not provide examples of proactive strategies or evaluate teacher preferences for one type of proactive strategy over another, making it difficult to determine whether they would be more likely to use a less intensive strategy if given a choice.

Discussion

The purpose of this study was to conduct a scoping review of the literature to examine teacher knowledge of behavioural interventions for ADHD. Based on previous findings, it was hypothesized that teachers would have limited knowledge of behavioural interventions for ADHD. There were only nine studies that met the inclusion criteria for this scoping review, demonstrating that there is limited research on teacher knowledge of ADHD intervention. The limited research on the topic of teacher knowledge of ADHD intervention indicated that: (1) teachers have varying levels of baseline knowledge about ADHD and its treatment; (2) teachers are more likely to use less intensive behavioural management strategies or passive instructional approaches; and (3) teachers are more likely to use instructional strategies rather than behavioural interventions to manage the classroom behaviour of students with ADHD.

Baseline Knowledge of Behavioural Interventions

Results of the current review indicated that teachers have varying levels of knowledge of behavioural interventions for ADHD (e.g., Jones & Chronis-Tuscano, 2008; Lasisi et al., 2017; Poznanski et al., 2018). Jones and Chronis-Tuscano (2008) and Lasisi and colleagues (2017) did not provide information regarding the types of behaviour management strategies used by teachers, making it difficult to evaluate the exact knowledge that teachers have about ADHD intervention. Participants in Poznanski and colleagues (2018) had difficulty responding to items questions about behaviour theory as it related to disruptive behaviour (e.g., "When a student who struggles with math makes obscene noises in class, the teacher sends him to sit in the office for severe disrespect. According to behaviour theory, what is the most likely to happen?") but were able to respond correctly to items probing their knowledge of anxiety management. These findings are consistent with those of other studies (e.g., Warner, 2014) suggesting that teachers feel more confident in managing anxiety compared to disruptive behaviour in the classroom. Perhaps the participants in Poznanski and colleagues (2018) felt more confident in dealing with anxious students, hence the higher percentage of correctly answering questions about anxiety on the BPQ. Teachers may feel more comfortable in dealing with anxious students because there is speculation that teachers view anxious behaviours as personality traits instead of a behavioural symptom. Perhaps teachers are more confident in managing personality traits as opposed to disruptive behaviours (Warner, 2014).

Results from Strelow and colleagues' (2020) study indicated that pre-service teachers typically intend to use effective CMS, as long as they believe that the strategies used will be effective. However, if teachers are expected to implement effective CMS, it is necessary for them to have good foundational knowledge about basic behavioural principles to ensure that they

evaluate CMS logically and implement the most effective strategy. This indicates that teachers need to be knowledgeable about ADHD interventions and buy into using them. Stormont and colleagues (2011) examined teachers' knowledge of evidence-based interventions for children with emotional and behavioural problems. The researchers found that teachers were not able to identify specific evidence-based interventions from a list because they had never heard of them (e.g., 91% of teachers had never heard of the Good Behavior Game) (Stormont et al., 2011). This demonstrates that teachers might not have learned about specific behavioural interventions at the pre-service or practicing teacher level. Teachers' baseline knowledge of behavioural interventions for ADHD may also vary due to their training. Education curricula vary, but most programs typically focus on teachable subjects, pedagogical approaches, educational issues, curriculum and assessment, and classroom practice (Whitley et al., 2013). It appears that teacher training programs are not providing teachers with appropriate training in ADHD interventions (Anderson et al., 2012; Blotnicky-Gallant et al., 2015; Ohan et al., 2008).

Teacher use of Behavioural Interventions and Instructional Strategies

Based on the findings of the current review, teachers showed a preference for using less intensive behavioural management strategies and instructional approaches over more intensive behavioural interventions when working with students with ADHD (e.g., Blotnicky-Gallant et al., 2015; Curtis et al., 2006; Khan et al., 2019; Topkin et al., 2015). The less intensive behavioural management strategies (e.g., positive teacher attention) and passive instructional strategies (e.g., accommodations) that teachers preferred are examples of effective classroom management strategies; however, these strategies do not necessarily result in long-term behaviour change (Harrison et al., 2020).

Accommodations are often used in the school system because they are perceived to be less effortful to implement when compared to interventions (Lovett & Harrison, 2021). However, although accommodations can be helpful for some students, they do not directly increase students' skill levels or result in improvements in symptomatology or student functioning (Harrison et al., 2020; Lovett & Harrison, 2021). Several authors caution that accommodations should not be used in place of interventions to improve academic and behavioural outcomes for students with ADHD (e.g., Pariseau et al., 2010; Shaw, 2021). These findings suggest that perhaps teachers are unaware of the distinction between instructional strategies/accommodations and interventions (Downing & Parker, 2006); providing professional development in this area could result in increased uptake of interventions by teachers working with students with ADHD.

Curtis and colleagues (2006) reported that teachers rated the DRC as the most acceptable intervention for ADHD in the classroom, which may indicate that teachers are willing to use intensive approaches, such as the DRC. Whereas the DRC is considered an intensive behavioural intervention, it may not be perceived by teachers as being as intensive as other interventions (e.g., response cost), as much of the work of reinforcement is completed by parents in the home. Similarly, Topkin and colleagues (2015) indicated that many teachers in their study rated token reinforcement as an acceptable intervention. Whereas teachers in this study rated it highly as an acceptable intervention, other studies demonstrated that teachers are not likely to use it in the classroom (e.g., Blotnicky-Gallant et al., 2015).

Teachers may prefer less intensive approaches for several reasons. In a survey conducted by the Canadian Teachers Federation (Froese-Germain & Riel, 2012), 91.9% of teachers reported ADHD as the most pressing concern in the classroom. If it is the most pressing concern, teachers may wish to manage it by using a strategy (i.e., accommodation) that they perceive to

require less effort (e.g., accommodation; Lovett & Harrison, 2021). Another reason teachers may prefer less intensive strategies could be related to their perceptions of students with ADHD. Specifically, Blotnicky-Gallant and colleagues (2015) reported that teachers' beliefs about ADHD were correlated with their use of intervention strategies, meaning that teachers who had negative beliefs about students with ADHD were less likely to use evidence-based behavioural management strategies. Teachers may require professional development about ADHD to better understand their students, which could, in turn, change their negative beliefs. Teachers may also prefer less intensive approaches as a result of their training; that is, they might not have been provided with adequate instruction in management of disruptive behaviours such as those exhibited by students with ADHD. As previously discussed, education curricula vary (Whitley et al., 2013), suggesting that teacher training programs may not be providing teachers with appropriate training in classroom behavioural interventions for ADHD (Anderson et al., 2012; Blotnicky-Gallant et al., 2015; Ohan et al., 2008). Teachers may also prefer less intensive approaches due to the demands of teaching. Institutional demands and resources (e.g., class size), classroom demands and resources (e.g., students' academic, behavioural, social, and emotional needs), and personal demands and resources (e.g., self-efficacy) are examples of factors that are related to both teacher stress and burnout (Bottiani et al., 2019). Behavioural problems have been shown to contribute to teacher stress (Martin et al., 2012). Teachers may experience stress while teaching students with ADHD and therefore might find it challenging to manage the demands of the classroom while also implementing an intensive intervention.

As previously stated, less intensive approaches (e.g., accommodations) are less labour-intensive to administer in the short term (Lovett & Harrison, 2021), and might be implemented without much consideration of whether this is the best approach, as teachers are using an

approach that is comfortable, requires few resources, is established, intuitive, and has become a part of their classroom (Prasad & Ioannidis, 2014). For example, Lovett and Leja (2015) examined extended test time in college students with ADHD and found that this group was less likely to use their extended time effectively, and Pariseau and colleagues (2010) found that when students with ADHD are given extra time, they slowed their work pace, suggesting that this frequently provided accommodation offers little extra benefit to the students receiving it. Although it may offer little extra benefit, Lewandowski and colleagues (2007) found that both students with and without ADHD benefited from extra time on speeded mathematics calculation test, indicating that teachers need to carefully consider the purpose of the accommodation before implementing it. Spiel and colleagues (2014) examined Individual Education Plans (IEP) for young adolescents with ADHD in the US and found that, although behaviour modification has been identified as the most effective intervention for ADHD based on decades of research, fewer than one third of IEPs included evidence-based behavioural interventions. Instead, there was a large focus on accommodations, such as extended time, test aids, breaks, and study supports (Spiel et al., 2014); highlighting the risks associated with incomplete teacher knowledge of ADHD and its treatment; that is, the use of less intensive strategies can mean that students with ADHD are not getting the intensive interventions that they need, possibly resulting in academic underachievement.

If interventions are to be effective, they must be feasible, implemented consistently with integrity and fidelity (DuPaul et al., 2020), and teachers must find the interventions acceptable (Korchmaros et al., 2021; McGoey et al., 2014; Poznanski et al., 2018). The DRC is an example of an intervention that is both effective with respect to meaningful behaviour change and symptom reduction (Fabiano et al., 2010; Owens et al., 2012; Pyle & Fabiano, 2017; Vannest et

al., 2010), feasible (Owens et al., 2008, 2012), and rated by teachers as an acceptable intervention (Curtis et al., 2006; Pisecco et al., 2001; Power et al., 1995). However, research has found that the DRC is not always implemented with integrity (Fabiano et al., 2010; Owens et al., 2012), which is especially important in ensuring effectiveness of an intervention (Girio-Herrera et al., 2021). It is possible that teachers prefer less intensive approaches because they lack knowledge about the components of interventions and why they are effective. Research has demonstrated that there is a relationship between a change in teacher behaviour (e.g., implementing intervention with integrity) and change in student behaviour (Coles et al., 2015; DiGennaro et al., 2007; Reinke et al., 2014; Sanetti et al., 2014). This research suggests that when teachers are appropriately taught about behavioural interventions, then they are likely to implement the interventions with integrity, which then makes the intervention effective for the student. More research is needed to better understand teacher knowledge of foundational behavioural principles, ADHD, and its treatment.

Limitations and Future Directions

There were several limitations of the current study. It is possible that due to human error articles were excluded that should have been included. Second, the nine studies all used different outcome measures and statistics, precluding a thorough statistical analysis of findings. Third, many of the studies used rating scales or true/false responses. Future studies should include open-ended responses for teachers to elaborate more on their knowledge of ADHD intervention/treatment. As previously stated, the nine studies used various outcome measures which tested teacher knowledge of behavioural interventions for ADHD. However, the studies did not probe whether teachers actually implement these practices in their classroom. Teachers

may have indicated a preference for a less intensive strategy, but it is important for researchers to examine what this practice looks like in the classroom.

Future reviews should include dissertations and the grey literature as part of the initial search. Due to time constraints and limitations on research caused by the Covid-19 global pandemic, it was not feasible to search dissertations and the grey literature as part of the current review process. However, it was noted that many dissertations examined teacher knowledge of ADHD intervention/treatment, and two papers included in this scoping review appeared to be published versions of dissertations (i.e., Curtis et al., 2006; Jones & Chronis-Tuscano, 2008). As previously discussed, being a reflective teacher is a part of education. Future reviews may also want to include teacher reflection of their behavioural interventions for ADHD (e.g., open ended questions). Future reviews may want to further differentiate between interventions and accommodations to determine whether teachers are knowledgeable about the difference between the two, and why interventions are more effective in the long-term. It would also be of benefit for future research to examine teacher knowledge of foundational behavioural principles, as ADHD interventions are based on the principles of behaviourism (Martin & Pear, 2019). In the nine studies included in this scoping review, behavioural interventions and instructional approaches were often just grouped as interventions. It is important to differentiate these terms for teachers in future research, especially if they are not knowledgeable about the differences between the two. Future research should also examine teacher's confidence in implementing behavioural interventions for ADHD.

Implications for School Psychologists

School psychologists bring a unique perspective to the education system. Whereas the fields of education and psychology have vast differences, the profession of school psychology

brings the two together. According to the National Association of School Psychologists (NASP) (2020) domains of practice, school psychologists have knowledge of research and statistics which helps them interpret and evaluate programs. This means that they are familiar with evidence-based practice.

The findings of this scoping review have important implications for both school psychologists and for those providing training to pre-service and practicing teachers. Behaviour plans are created for teachers to implement; however, teachers must have a thorough understanding of interventions that they are implementing, if they are to implement them consistently and with fidelity. The following recommendations for school psychologists are provided to assist when working with teachers to implement behavioural interventions in the classroom.

The current findings indicate that teachers might benefit from ongoing consultation, or a coaching model of professional learning, to assist them in incorporating behaviour management or behavioural interventions in the classroom to help students with ADHD. Results suggested that teachers prefer using less intensive strategies; however, school psychologists should work with teachers to ensure the implementation of the best evidence-based intervention for ADHD rather than the least labour-intensive. School psychologists may need to identify whether ineffective practices are being used in the classroom, as teachers may use practices that they are comfortable with, meaning that school psychologists need to debunk these interventions by demonstrating effective evidence-based interventions (see McGoey et al., 2014; Shaw, 2021). This could be accomplished through provision of professional development workshops, working one-on-one with teachers to create and implement behaviour plans, and following up with teachers regularly to evaluate progress and troubleshoot any problem areas.

School psychologists need to be aware of the limited research on the topic of teacher knowledge of ADHD interventions. School psychologists also need to be aware that teachers may perceive interventions and accommodations as the same practice and they may need to provide training to teachers on distinguishing between the two.

School psychologists can help close the research-to-practice gap that exists by providing teachers with ongoing support and practical examples (see Blotnicky-Gallant et al., 2015). It would also be beneficial for school psychologists to provide professional development on ADHD, with a focus on classroom-based interventions (Blotnicky-Gallant et al., 2015; McGoey et al., 2014) as well as training about foundational behavioural principles.

This scoping review provided information about teacher knowledge of behavioural interventions for students with ADHD. Nine studies met criteria for this review, indicating that there is limited research on this topic. There were three themes identified from the nine studies. First, it was identified that teachers have varying levels of knowledge of behavioural interventions. This may be due to factors such as lack of training or varying curricular taught at each university. Secondly, it was identified that teachers are more likely to use less intensive behavioural management strategies or passive instructional approaches. Lastly, teachers are more likely to use instructional strategies over behavioural interventions. Teachers' preference for less intensive behavioural management strategies, passive instructional approaches, and instructional strategies over behavioural interventions may be due to factors such as accommodations requiring less effort to implement, lack of training, negative beliefs about students with ADHD, and the comfort of using well-known accommodations. The current research contributes to the ADHD literature, as it has demonstrated that teachers would benefit from assistance when implementing classroom behavioural interventions. This research may provide a starting point

for school psychologists in supporting teachers, as school psychologists and teachers need to work more collaboratively (McGoey et al., 2014) when implementing behavioural interventions for students with ADHD to ensure the best possible outcomes for students and families challenged by ADHD.

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Table 1

Study Characteristics

Study authors (year)	Study design; *N*	Outcome measures	Main findings
Blotnicky-Gallant et al (2015)	Online survey; 113	Behaviour Management Approaches Survey (IBMAS).	• On the Instructional Approaches (*M*=3.41, *SD*=0.54) and Behaviour Management (*M*=3.44, *SD*=0.44) subscales of the IMBAS, teachers rated that they were using evidence-based classroom practices "occasionally" and "frequently". • Less intensive approaches, (*M*=4.12, *SD*=0.76). Seldom used more intensive approaches (*M*=2.62, *SD*=1.04). • Less intensive strategies, (*M*=4.41, *SD*=0.62) and did not often use more intensive strategies (*M*=2.54, *SD*=1.35).
Curtis et al (2006)	In-person survey/questionnaire; 159 from U.S. and 261 from N.Z.	Vignette describing a child with ADHD and then read a description of classroom interventions (i.e., DRC, response cost technique, stimulant medication (Ritalin), and classroom lottery). Participants then had to rate these interventions using the Behavioural Intervention Rating Scale (BIRS).	• DRC as a more acceptable intervention than response cost (*d*=-.68) and classroom lottery (*d*=-1.14) • Response cost more acceptable intervention than classroom lottery (*d*=-.40) • Teachers in the U.S. rated the response cost as a more acceptable intervention than teachers in N.Z. Teachers in N.Z. rated classroom lottery as a more acceptable, effective, and timely intervention for girls with ADHD.
Jones & Chronis-Tuscano (2008)	Randomized, controlled design; 142 teachers (74 in immediate in-service group, 68 in waitlist control).	Examined teacher use of classroom behaviour management strategies pre-intervention using a rating	The immediate in-service groups' (*n*=66) reported use of classroom behaviour management techniques pre-intervention (*n*=66) had a mean of 47.9 (*SD*=6.7) and the waitlist control group (*n*=66) had a mean of

Study authors (year)	Study design; *N*	Outcome measures	Main findings
	Teachers were randomly assigned at the school level to receive in-service training immediately or to a waitlist control group that received in-service training 1 month later. Data were collected at pre-in-service intervention and 1 month post-in-service intervention for all immediate in-service schools. Waitlist control schools received the in-service following their last data collection point.	scale from "this would not fit well with my teaching" to "I use regularly".	50.4 (*SD*=5.0).
Khan et al (2019)	In-person survey/questionnaire; 200	A questionnaire which examined ADHD interventions used by teachers developed by authors.	
Lasisi et al (2017)	Randomized controlled trial with intervention and waitlist control group; 84 intervention group. 75 control group. The intervention and control groups completed the outcome measures at baseline and 1 week after the first 3-h training for the intervention group.	Knowledge of Behavioural Interventions Questionnaire (KBIQ).	The intervention groups' (*n*=76) reported knowledge of behaviorual intervention pre-intervention was a mean of 7.39 (*SD*=2.88) and the control groups' (*n*=71) reported knowledge was a mean of 6.54 (*SD*=2.69).
Lee & Witruk (2016)	In-person survey/questionnaire; 639	Adapted Kos (2004) questionnaire.	• Did not report any significant results between Korean and German teachers use of

Study authors (year)	Study design; *N*	Outcome measures	Main findings
	teachers from Korea. 317 teachers from Germany.		corrective versus proactive strategies. • Korean teachers: reinforcement (*M*=6.80, *SD*=1.21), negative consequences (*M*=4.85, *SD*=1.62), and planned ignoring (*M*=5.24, *SD*=1.59). German teachers: reinforcement (*M*=6.93, *SD*=1.05), negative consequences (*M*=5.85, *SD*=16.88), and planned ignoring (*M*=5.74, *SD*=11.98). • For proactive strategies: Korean teachers (*M*=6.40, *SD*=1.24) and German teachers (*M*=6.35, *SD*=1.36).
Poznanski et al (2018)	Online survey; 107	Modified version of the Knowledge of Behavioral Principles Questionnaire (BPQ).	On the BPQ, pre-service teachers answered with 60.7% (*SD*=10.6) accuracy.
Strelow et al (2020)	Online survey; 1086	Sections of the ADHD School Expectation Questionnaire (ASE).	The following were positively correlated with pre-service teachers' attitude towards CMS: attitude towards effective CMS (*p*=.766), attitude towards ineffective CMS (*p*=.582), intention to use CMS (*p*=.573), intention to use effective CMS (*p*=.531), and intention to use ineffective CMS (*p*=.216). The following were positively correlated with pre-service teachers' attitude towards effective CMS: intention to use CMS (*p*=.437) and intention to use effective CMS (*p*=.720). Attitude towards ineffective CMS (*p*=-.076) and intention to use ineffective CMS (*p*=-.178) were negatively correlated. The following were positively correlated with pre-service teachers' attitude towards ineffective CMS: intention to use CMS (*p*=.336) and intention to use ineffective CMS

Study authors (year)	Study design; *N*	Outcome measures	Main findings
			(*p*=.560). Intention to use effective CMS (*p*=-.088) was negatively correlated. Intention to use effective CMS was negatively correlated with intention to use ineffective CMS (*p*=-.128).
Topkin et al (2015)	In-person survey/questionnaire; 200	Added two additional sections to the Knowledge of Attention Deficit Disorders Scale (KADDS) to examine teacher knowledge regarding classroom interventions and their effectiveness for students with ADHD.	

Figure 1

PRISMA Flow Diagram