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ISSN 1577-7057
© 2026 Asociación de Análisis del Comportamiento, Madrid, España
Printed in Spain

Volume 26, number 3 October 2026
Volumen 26, número 3 Octubre 2026

ISSN: 1577-7057

IJP&PT

International Journal of Psychology & Psychological Therapy

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International Journal of Psychology & Psychological Therapy, 2026, 26, 3, 397-414
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Combining Working Memory Training and Parental Interventions in Children and Adolescents with Attention-Deficit/Hyperactivity Disorder: A Narrative Review

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Abstract

This narrative review aims to synthesize current evidence on the therapeutic value of combining working memory training with parental interventions for children and adolescents with Attention-Deficit/Hyperactivity Disorder (ADHD). The review included peer-reviewed studies published in English or French between 2000 and 2025 that investigated parental, cognitive, or combined interventions and reported cognitive, behavioral, or functional outcomes in pediatric populations with ADHD. Studies focusing exclusively on pharmacological treatments, adult populations, or interventions not specifically targeting ADHD were excluded. The findings suggest that combining these approaches may provide complementary benefits for attention, behavioral regulation, and the transfer of acquired skills to everyday functioning. These benefits appear to be more pronounced in younger children and in those with more severe symptoms, particularly when interventions are introduced early, tailored to individual needs, and supported by active parental involvement. The integration of metacognitive components may further enhance cognitive outcomes. However, considerable methodological heterogeneity across the available studies limits the strength of the conclusions. Large-scale, well-controlled, multicenter randomized trials are needed to validate standardized combined intervention protocols and strengthen the evidence supporting their implementation in clinical practice.

Keywords: attention-deficit/hyperactivity disorder, parent skills training, computerized cognitive training, combined intervention, working memory training.

How to cite this paper: Haddioui L & Nabil A (2026). Combining Working Memory Training and Parental Interventions in Children and Adolescents with Attention-Deficit/Hyperactivity Disorder: A Narrative Review. *International Journal of Psychology & Psychological Therapy, 26,* 3, 397-414.

Novelty and Significance

What is already known about the topic?

- Attention-Deficit/Hyperactivity Disorder in children is typically addressed through combined behavioral interventions, parental support, and cognitive training.
- While cognitive training enhances specific executive functions, its generalization to daily real-world functioning remains variable.
- Active family involvement is crucial for maintaining long-term therapeutic benefits.

What this paper adds?

- This narrative review conceptualizes the combined impact of integrating cognitive training with structured parental interventions.
- It establishes the critical role of early, individualized, and metacognitive approaches to optimize outcomes.
- The study delivers a critical synthesis of current evidence while mapping precise directions for future clinical research.

Attention-deficit/hyperactivity disorder (ADHD) is a well-recognized disorder affecting approximately 5% of children worldwide (Haute Autorité de Santé, 2024). It is characterised by persistent difficulties in sustaining attention, regulating impulses, and controlling motor activity (Barkley, 2006), as outlined in major clinical guidelines (Wolraich *et alii*, 2019; American Psychiatric Association, 2013; Canadian ADHD Resource Alliance -CADDRA-, 2020). Among these symptoms, inattention and impaired inhibitory control represent core features of ADHD, affecting children's ability to maintain goals, resist distractions, regulate responses, and adapt their behavior to environmental

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demands. These difficulties are closely linked to executive function impairments, which are considered important contributors to the cognitive and behavioral manifestations of the disorder (Willcutt, Doyle, Nigg, Faraone, & Pennington, 2005). Beyond the classroom, these core symptoms disrupt peer interactions, social functioning, and family dynamics, often contributing to elevated parental stress and broader functional impairments, including academic difficulties (Fay-Stammbach, Hawes, & Meredith, 2014; Moen, Hedelin, & Hall Lord, 2016; Daley *et alii*, 2014; Coates, Taylor, & Sayal, 2014). Furthermore, ADHD symptoms are expressed within a developmental and relational context, in which family processes may influence symptom severity, functional outcomes, and treatment response. High parental stress, difficulties in parent-child interactions, and challenges in maintaining consistent behavioral strategies may contribute to the persistence of impairments, whereas supportive family environments may facilitate treatment engagement and skill generalization.

Pharmacological treatment, particularly psychostimulants, is the first-line intervention for children with ADHD and effectively reduces core symptoms (Barkley, 2006; Daley *et alii*, 2014). For preschoolers (4-5 years), medication is typically considered only if behavioral interventions are insufficient or safety concerns are present, in line with AAP and other major guidelines. Nevertheless, medication alone rarely addresses the full spectrum of functional deficits, such as social skills, emotional regulation, and real-world academic performance. Side effects and parental reluctance can further limit their use (CADDRA, 2020). These limitations have prompted growing interest in empirically supported psychosocial interventions, particularly behavioral parent training programs (PMT), such as those developed by Barkley (2013), McMahon and Forehand (2003), Eyberg, Nelson, and Boggs (2008), provide caregivers with practical, structured strategies based on reinforcement and consistent consequences. These programs improve child behavior and strengthen parent-child relationships (Chronis-Tuscano *et alii*, 2011; Daley *et alii*, 2014), yet they do not fully address cognitive or attentional deficits, underscoring the need for complementary child-centered interventions.

Indeed, research in cognitive psychology has highlighted the critical role of executive functions in ADHD, particularly working memory. Working memory, the ability to temporarily hold and manipulate information, is essential for goal-directed behavior, planning, and emotional regulation (Baddeley, 2012). For example, children with ADHD often struggle to remember and follow multi-step instructions in the classroom or to mentally manipulate information when solving arithmetic problems, reflecting working memory deficits that contribute to attentional lapses and academic difficulties (Martinussen, Hayden, Hogg-Johnson, & Tannock, 2005; Rapport *et alii*, 2008; Kasper, Alderson, & Hudec, 2012). Computerized working memory training programs have shown promising short-term improvements in specific cognitive outcomes, particularly working memory capacity and task performance on standardized neuropsychological measures, yet benefits are often transient and demonstrate limited generalization to everyday functioning (Holmes, Gathercole, & Dunning, 2009; Melby-Lervåg & Hulme, 2013; Klingberg, 2010; Green et alii, 2012; Spencer-Smith & Klingberg, 2015).

Given the limitations of pharmacological -which effectively reduce core ADHD symptoms but often fail to address broader cognitive and functional deficits (Al-Saad, Al-Jabri, & Almarzouki, 2021)- and single-modality non-pharmacological approaches that typically target either cognitive or behavioral domains in isolation, combined interventions integrating parent training and cognitive training have received increasing attention (Steeger, Gondoli, Gibson, & Morrissey, 2016; Capodieci, Re, Fracca, Borella, &

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Carretti, 2019; Paiva et alii, 2024). Preliminary evidence suggests that combining parent training with child-centered cognitive interventions can not only extend the durability of treatment effects but also promote improvements across cognitive, behavioral, and social domains (Dovis, Van der Oord, Wiers, & Prins, 2012). So far, research has explored various integrated approaches -typically pairing behavioral parent programs with working memory or executive function training -and reported gains in both child behavior and cognitive performance. Yet, these studies remain limited by small sample sizes, short follow-up periods, and variability in designs and outcome measures, making it difficult to draw firm conclusions. Taken together, these observations highlight the importance of this narrative review, which aims to synthesize current evidence on integrated approaches combining working memory training and parental interventions in school-age children with ADHD. By examining the conditions under which these combined strategies may be most effective, the cognitive, behavioral, and social outcomes reported across studies, and their potential implications for clinical practice. This narrative review seeks to clarify underlying mechanisms, identify current knowledge gaps, and outline future directions for research aimed at optimizing multimodal interventions for children with ADHD.

Method

Literature Search Strategy

This narrative review examined studies on combined parent-focused and cognitive interventions for children with ADHD, with particular attention to approaches targeting cognitive skills both at home and, when available, in school settings. We conducted a systematic search of *PubMed, PsycINFO, Scopus, Web of Science*, and *Google Scholar* using keywords such as ADHD, parent training, behavioral parent intervention, cognitive training, working memory training, and combined or multimodal intervention. These search terms were selected based on prior reviews and foundational studies in the field. Reference lists of key reviews and primary studies were also screened to identify additional relevant articles. We included studies published between 2000 and 2025 to capture contemporary intervention strategies and outcomes within the context of current clinical practice.

Selection criteria

Inclusion criteria were: (1) children or adolescents with ADHD; (2) evaluation of parental, cognitive, or combined interventions; (3) reporting cognitive, behavioral, or functional outcomes; (4) when available, comparisons between combined and single-modality interventions; and (5) narrative reviews, systematic reviews, and meta-analyses providing evidence on the effectiveness, theoretical basis, or implementation of ADHD interventions. Studies were excluded if they focused exclusively on pharmacological treatments, adult populations, or interventions not specifically targeting ADHD. Only studies published in English or French were considered.

The included studies are shown in Table 1 grouped according to the type of intervention: parent-focused interventions, cognitive interventions, and combined approaches. A total of 26 studies met the inclusion criteria. For each study, the table presents the type of intervention, sample characteristics, and main findings. This selection aims to highlight the main trends and clinically relevant evidence in the literature, without claiming to be exhaustive.

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Table 1. Characteristics and main findings of the included studies.

Type of Intervention	Study/Type	Age range (years)	*N*/*NS*	Population	Intervention	Main Outcomes
Parental	Hauth-Charlier & Clément (2014)/ Clinical	Mean≈ 10,6	*N*= 25	ChADHD	BPT	Significant reduction DB; behaviour approached control-group levels.
	Eyberg *et alii* (2008)/ Nr	Ch+Ado	*NS*= 16	ChADHD/DB	Psychosocial	PT as an evidence-based treatment for DB.
	Chronis-Tuscano *et alii* (2011)/ Clinical	6-10	*N*= 70	ChADHD	BPT	Maternal ADHD symptoms reduced BPT effectiveness; decreased negative parenting mediated child improvement.
	Coates *et alii* (2015/ SR/Meta)	2.75-12	603/11	ChADHD/BD	Parent-focused	Reduced ADHD symptoms, conduct problems, and improved parenting self-esteem.
	Menting *et alii* (2013/ Meta	Ch	*NS*= 50	ChADHD/DB	BPT	Reduced DB; increased prosocial behaviour; greater effects in severe cases.
	Rimestad *et alii* (2019)/ SR/Meta)	2.5-6	*NS*= 16	ChADHD	PT	Reduced ADHD symptoms, conduct problems, and negative parenting; maintained F-U.
	Paiva *et alii* (2024)/ RCIT	Ch	*N*= 57	ChADHD	Parent-based	Reduced ADHD symptoms; improved quality of life; online PT as effective as face-to-face.
	Sanders *et alii* (2000)/ RCT	Preschool Ch	*N*= 305	At-risk Ch	Triple P	Reduced DB; improved parenting practices and parental competence; enhanced and standard Triple P most effective.
	Sanders *et alii* (2008)/ Review	Ch+Ado	NR	FChBD	Triple P	Improved parenting skills and confidence; reduced behavioural and emotional problems.
Cognitive	Klingberg (2005/ Clinical)	7-12	*N*= 53	ChADHD	CWMT	Improvement in WM and attention; limited generalization
	Holmes *et alii* (2009/ RCT	8-11	*N*= 42	ChlowWM	WMT	Sustained improvement WM and mathematics performance at 6-month follow-up.
	Green *et alii* (2012)/ RCT)	7-14	*N*= 26	ChADHD	CCT	Improved WM and classroom task behavior, no significant improvement in parent-rated ADHD symptoms.
	Chacko *et alii* (2014)/ RCT	7-11	*N*= 85	ChADHD	WMT / EFT	Improved WM performance, no significant transfer effects ADHD symptoms, behavioral measures, academic outcomes.
	Bigorra *et alii* (2016)/ RCT	7-12	*N*= 66	ChADHD	CR/WMT	Improved EF, ADHD symptoms, and functional outcomes, sustained 6-m F-U.
	Capodieci et *et alii* (2019)/ Clinical	Ch	*N*= 27	ChADHD	WMT	Improved EF and ADHD-related behaviours; effects maintained F-U.
	Al-Saad *et alii* (2021)/ Nr	NR	NR	ChADHD	CT	Improvement in cognitive functioning
	Cortese *et alii* (2015)/ Meta	Ch	759/16	ChADHD	CT	Small-to-moderate cognitive improvements; limited evidence symptom improvement
	Martinussen *et alii* (2005)/ Meta	Ch	*NS*= 26	ChADHD	WMD / EFT	Demonstrated significant WM impairments associated with ADHD
	Melby-Lervåg et Hulme (2013)/ Meta	Ch+Adu	*NS*= 23	ChCD	WMT	Improvement in trained tasks but limited far-transfer effects
	Molazamani *et alii* (2023)/ RCT	8-12	*N*= 30	ChADHD	CCTR	Improved sustained and divided attention; no significant effect on impulsivity.
	Spencer-Smith & Klingberg (2015)/ Meta	Ch+Adu	*NS*= 12	Ch/AduADHD	WMT	Positive effects on WM, limited generalization
	Landínez-Martínez *et alii* (2022)/ SR	Ch	*NS*= 24	ChADHD	WMT	Improvement in trained WM tasks; limited evidence for transfer to ADHD symptoms.
Combined (Parental + Cognitive)	Chacko *et alii* (2014)/ RCT	7-11	*N*= 85	ChADHD	PT + CT	Improved WM; no significant effects ADHD symptoms or functional outcomes.
	Maleki *et alii* (2014)/ RCT	6-12	*N*= 36	ChADHD	CT + FI	Combined intervention outperformed PT and WM training reducing ADHD symptoms.
	Steeger *et alii* (2016)7 RCT	11-15	*N*= 91	ChADHD	Combined BPT+CT	Improved WM; no superior effect of combined treatment.
	Asgari *et alii* (2024)/ RCT	7-10	*N*= 30	ChADHD	Child-based WMT&P-ChIA	Improvement in parent-child interaction following WM training

Notes: Ado= Adolecents; ADHD= Attention-Deficit/Hyperactivity Disorder; Adu= Adults; BPT= Behavioral Parent Training; CCT= Computerized cognitive training; CCTR= Combined cognitive + Ritalin; Ch= Children; ChADHD= Children with ADHD; Ch/AduADHD= Children and adults with ADHD; ChADHD/BD= Children with ADHD or behavioral disorders; ChCD= Children with cognitive difficulties; ChADHD/DB= Children with ADHD or disruptive behaviors; ChlowWM= Children with low working memory capacity; CR/WMT= Cognitive remediation/ WMT; CT= Cognitive training; CWMT= Computerized working memory training; DB= disruptive behaviours; EF= Executive Functions; F-U= Follow-Up; Meta= Meta-analysis; FChBD= Families of children with behavioral difficulties; FI= Family Intervention; *N*= number of participants; *NS*= number of studies included in systematic reviews/meta-analyses; Nr= Narrative review; NR= Not Reported; P-ChIA= parent–child interaction assessment; PT= Parent training; RCIT= Randomized Clinical Trial; RCT= Randomized Controlled Trial; SR= Systematic review; Triple P (Positive Parenting Program); WM= Working Memory; WMD= Working Memory Deficits; WMT= Working Memory Training.

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Cognitive Training in ADHD

Working memory impairments are among the most consistently documented cognitive difficulties in children with ADHD and are widely considered a central feature of their executive functioning profile. These difficulties affect the ability to maintain, update, and manipulate information in the service of goal-directed behavior, which can manifest in everyday challenges such as following instructions, completing multi-step tasks, or organizing actions over time (Martinussen *et alii*, 2005; Kasper *et alii*, 2012).

From a neurocognitive standpoint, these impairments are generally understood as reflecting disruptions in attentional control and in the coordination of information processing systems. Rather than representing an isolated deficit, working memory difficulties appear to contribute to a broader pattern of executive dysfunction in ADHD. Within this framework, working memory has been increasingly viewed as a meaningful and theoretically grounded target for cognitive intervention (Cortese *et alii*, 2015).

Type of Cognitive training interventions

A broad range of cognitive training interventions has been developed to target working memory and related executive processes. While these approaches vary in format, degree of structure, and delivery context, they generally share a common principle: the repeated engagement of children in cognitively demanding tasks designed to mobilize and challenge executive functioning.

Computerized interventions are among the most extensively studied approaches targeting working memory in children with ADHD. They typically rely on adaptive, repetitive tasks in which the level of difficulty is continuously adjusted to the child's performance, thereby maintaining an appropriate and progressively increasing cognitive demand.

Although *Cogmed* (Klingberg *et alii*, 2005) remains the most frequently cited program in the literature, it should be viewed as one example within a broader and more diverse set of interventions. Its prominence has also been accompanied by ongoing discussion regarding its limitations, particularly with respect to the consistency and durability of observed effects, an issue that appears especially salient in younger children.

Alongside *Cogmed*, other programs such as *Jungle Memory* (Nelwan & Kroesbergen, 2016) and *Captain's Log* (Slate, Meyer, Burns, & Montgomery, 1998), as well as a range of research-based protocols, adopt comparable principles of adaptive training targeting both verbal and visuospatial aspects of working memory. At the same time, these interventions differ substantially in their design, intensity, and modes of supervision, contributing to a level of heterogeneity that complicates direct comparisons across studies.

More generally, computerized training approaches are grounded in the assumption that repeated engagement of cognitive processes can lead to functional improvements -an idea often framed in terms of a "training" effect. Similar assumptions underpin other intervention modalities, such as neurofeedback, whose clinical value continues to be debated despite an extensive body of research (Cortese *et alii*, 2015). From this perspective, computerized programs are perhaps best understood within a broader conceptual and methodological context that takes into account both their widespread adoption and the ongoing debates surrounding their underlying mechanisms and long-term impact.

Structured and adaptive cognitive exercises constitute another important approach, using task-based cognitive training protocols implemented in clinical, school, or research settings. These approaches typically draw on well-established working memory paradigms

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-such as digit span, backward recall, complex span tasks, or updating exercises- to systematically engage core executive processes (Dovis *et alii*, 2012; Holmes *et alii*, 2009; Chacko *et alii*, 2014; Capodieci *et alii*, 2019).

In contrast to fully computerized formats, these interventions are usually delivered within a more interactive framework involving direct guidance from a clinician or trained facilitator. This allows for ongoing adjustment of task demands, pacing, and feedback in response to the child's performance and level of engagement. Such flexibility is particularly relevant for children with ADHD, who often present with heterogeneous cognitive profiles and fluctuating attentional capacities.

A central feature of these approaches lies in their explicit focus on strategy use and metacognitive support. Rather than relying solely on repeated task exposure, children are encouraged to actively engage with the material by developing and applying strategies such as verbal rehearsal, chunking, attentional focusing, and stepwise problem decomposition. This orientation reflects a shift from a purely practice-based model toward a more guided and reflective learning process.

In some intervention models, these structured exercises are embedded within broader cognitive remediation or educational frameworks, facilitating connections with academic learning and the development of self-regulation skills. This may, in certain cases, involve coordination with teachers or parents in order to support continuity between training sessions and everyday functioning.

Taken together, these structured and adaptive approaches complement computerized training by combining systematic cognitive practice with guided interaction and explicit strategy development, ultimately allowing for a more individualized and context-sensitive mode of intervention.

Critical Analysis of the Cognitive Training Interventions

Research conducted over the past decade suggests that cognitive interventions can lead to measurable improvements in working memory functioning in children with ADHD. The most robust findings concern improvements observed in tasks that are very similar to those used during training, a phenomenon commonly referred to as near-transfer effects (Melby-Lervåg & Hulme, 2013). Several studies have particularly highlighted encouraging effects on visuospatial working memory, with children demonstrating greater accuracy, faster processing speed, and increased cognitive efficiency following repeated training sessions (Chacko *et alii*, 2014; Molazamani, Bavi, & Jayervand, 2023). These findings suggest that targeted and structured cognitive stimulation may contribute to strengthening certain executive processes that are often impaired in ADHD.

Despite these highly promising findings, research results become more heterogeneous when broader domains such as attentional regulation, behavioral functioning, or academic performance are examined. Some studies report modest improvements in attentional capacities and everyday functioning, particularly according to parent and teacher observations (Green *et alii*, 2012; Bigorra, Garolera, Guijarro, & Hervás, 2016). However, other studies do not demonstrate significant reductions in core behavioral symptoms, especially impulsivity and hyperactivity (Cortese *et alii*, 2015). Similarly, the benefits observed in academic performance often remain limited and are not always maintained over time.

These discrepancies may be explained by important methodological differences across studies, particularly regarding intervention duration, intensity, participant characteristics,

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and assessment methods. They also highlight the complexity of translating cognitive gains into concrete improvements in the child's everyday functioning.

One of the limitations most frequently emphasized in the literature concerns the difficulty of generalizing training effects beyond the specific tasks practiced during the intervention. Although children often become more proficient in the trained exercises, these improvements do not systematically transfer to everyday situations such as school learning, organization at home, or social interactions.

Adherence to intervention programs also represents a major challenge. Many interventions rely on repetitive exercises that may gradually reduce motivation, particularly among older children and adolescents. The still limited integration of emotional, motivational, or interactive dimensions may further decrease engagement and long-term participation (Spencer-Smith & Klingberg, 2015).

Finally, current cognitive remediation approaches often fail to sufficiently consider the child's broader environment. Yet the effective use of cognitive skills in daily life generally depends on support from parents, teachers, and the routines established within the child's environment. Without this ecological integration, the practical and long-term benefits of cognitive interventions are likely to remain relatively modest.

Although cognitive remediation interventions differ in their methods and structure, most are based on the assumption that repeated practice of working memory tasks can strengthen cognitive functioning through a "training effect." This theoretical principle has guided the development and design of many interventions for children with ADHD. In particular, computerized working memory training programs have been developed to target executive function deficits associated with ADHD, with the aim of improving cognitive processes involved in attention regulation and goal-directed behavior.

However, the effectiveness and long-term impact of these approaches remain debated in the literature. Although improvements in trained cognitive tasks are frequently reported, the extent to which these gains generalize to academic performance, daily functioning, and behavioral regulation remains uncertain (Green *et alii*, 2012; Bigorra *et alii*, 2016; Cortese *et alii*, 2015). Similar assumptions are also found in other interventions, such as neurofeedback, whose results remain mixed despite extensive research (Barkley, 2006).

In this context, cognitive remediation should not be considered a uniform approach. Interventions differ both in their theoretical foundations and in the mechanisms of change they propose. These considerations highlight the importance of integrating cognitive remediation within broader multimodal treatment frameworks that also include behavioral, educational, and environmental components. Such an integrative perspective provides a rationale for combining working memory training with parental interventions, with the aim of addressing both cognitive difficulties and the functional challenges experienced by children with ADHD.

Parental Interventions in the Management of ADHD

Behind every child with ADHD, there is a family trying to navigate between understanding, exhaustion, and sometimes discouragement. Parental stress is real and intense: Managing a child's inattention, impulses, and emotional instability can quickly become overwhelming (DuPaul, McGoey, Eckert, & VanBrakle, 2001). Relationships within the household can become strained, especially if education oscillates between permissiveness or, on the contrary, a tendency towards repressive authority (Chronis-Tuscano *et alii*, 2011). It also happens that parents themselves have issues (ADHD,

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anxiety, depression), making coherent support even more complex (Moen *et alii*, 2016). Understanding the child is therefore not enough: It is also necessary to support their parents and equip them with educational techniques.

In response to the behavioral challenges commonly associated with ADHD, several parent management training (PMT) programs have been developed to provide structured support to families. These interventions aim to strengthen parenting skills while increasing parents' confidence and perceived effectiveness.

Despite differences in format, most PMT approaches are grounded in shared behavioral principles, including the consistent use of positive reinforcement to encourage appropriate behaviors, the application of clear and predictable consequences when needed, the strategic use of differential attention (reinforcing desired behaviors while minimizing attention to disruptive ones), and the use of simple, direct instructions to facilitate child compliance.

Type of Parenting skills programs

Among the most well-known programs are Russel Barkley's Parent Management Training (PMT; Barkley, 2006), the Positive Parenting Program (Sanders, 1999), and the Incredible Years program (Webster-Stratton, 1981). The PMT program was developed by Russell Barkley, supports parents in establishing a structured and consistent educational environment based on clear rules, predictable routines, and systematic reinforcement. A central component is the role of adults in creating regular opportunities for the child to apply adaptive behaviors in everyday situations, while reinforcing these behaviors in a consistent manner. This active parental involvement not only helps reduce oppositional and disruptive behaviors but also promotes the generalization of cognitive and self-regulation skills beyond the training context.

The Triple P (Positive Parenting Program) was developed by Matthew R. Sanders as a modular, stepwise intervention that provides parents with progressively tailored support -from everyday management strategies to more intensive levels of intervention. It emphasizes the development of positive parenting, parents' emotional regulation, and the use of positive reinforcement (Nowak & Heinrichs, 2008; Sanders, 1999, 2008).

And the Incredible Years program was developed by Carolyn Webster-Stratton based on group sessions and the use of video materials; this program primarily aims to improve the quality of parent-child interactions. It promotes active listening, encourages prosocial behaviors, and reduces reliance on coercive parenting practices (Menting, Orobio de Castro, & Matthys, 2013; Webster-Stratton & Reid, 2018).

Although these programs do not cover all existing approaches, they illustrate the key principles underlying effective interventions for parents of children with behavioral disorders.

Critical Analysis of Parenting Interventions

Findings from meta-analyses are clear: parenting guidance programs such as those developed by PMT, Triple P, or Incredible Years often are associated with significant reductions in child oppositional behaviors, including defiance, noncompliance, and disruptive conduct as reported in home and school settings. The effects observed at the end of the intervention are generally moderate to strong in magnitude, making these approaches well-established and effective for supporting families facing these difficulties (Coates *et alii*, 2014; Daley *et alii*, 2014).

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Beyond reducing problematic behaviors, structured parenting interventions play a key role in enhancing the quality of the parent-child relationship. Several studies show that they foster more positive interactions, better family communication, and greater consistency in parenting practices (Sanders, Markie-Dadds, Tully, & Bor, 2000). These relational adjustments not only contribute to better regulation of the child's behavior but also help parents regain a stronger sense of parental competence. In fact, many participants report, after completing such programs, reduced parental stress (Moen *et alii*, 2016; Heubeck, Richardson, & Lauth, 2024) and an increased ability to manage everyday challenges (Chronis-Tuscano *et alii*, 2011; Eyberg *et alii*, 2008). Strengthening parents' sense of self-efficacy is a key factor in ensuring the durability of these positive outcomes.

Several recent longitudinal studies suggest that the benefits of structured parenting interventions are not limited to the intervention period itself, but continue beyond it, sometimes for several months. These prolonged effects are particularly evident in a lasting reduction in symptoms of inattention in children, a continuous improvement in the quality of the parent-child relationship, and a reinforcement of positive educational practices observed at home (Doffer *et alii*, 2023; Rimestad, Lambek, Zacher Christiansen, & Hougaard, 2019).

However, the magnitude and sustainability of these benefits appear to depend on several moderating factors, among which the family environment and parental psychological characteristics play a particularly important role. Several studies have shown that the effects of programs are often less pronounced when parents themselves have psychological vulnerabilities, such as depression, anxiety, or symptoms of ADHD (Chronis-Tuscano *et alii*, 2011; Johnston, Mash, Miller, & Ninowski, 2012). Similarly, unfavourable socioeconomic conditions -including financial insecurity, social isolation, or residential instability- can limit regular participation in the program and hinder the implementation of learned parenting strategies (Moen *et alii*, 2016). These contextual factors must therefore be considered when adapting and supporting families to reduce inequalities in access and effectiveness.

Recent research has also highlighted that individual face-to-face parenting training programs may outperform group formats for certain indicators. Indeed, a meta-regression conducted by Hornstra *et alii* (2023) shows that individual training generates greater gains in symptoms of inattention and hyperactivity-impulsivity than group training, possibly due to better adaptation to the specific needs of each family. These results corroborate a controlled study conducted in Germany (Heubeck *et alii*, 2024), which shows that after six months, participation rates were higher and the effects on inattention were more robust in the individual format compared to the group or usual care formats. This superiority of individualized face-to-face intervention highlights the importance of personalizing educational interventions to maximize their effectiveness.

In addition to tailoring interventions to the individual needs of families, active parental involvement has consistently been identified as a key determinant of treatment success of educational interventions. Empirical data show that the benefits of parenting programs tend to diminish when the strategies learned are not applied regularly, or when there is no support system in place to consolidate what has been learned over time (Nowak & Heinrichs, 2008; Doffer *et alii*, 2023). In other words, without sustained parental involvement, the effects observed after the intervention are likely to be temporary or diluted by the demands of everyday family life.

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In summary, parenting skills training programs are a cornerstone of the psychosocial approach to ADHD. Although their effectiveness is now well supported by the literature, their impact depends on several key variables, including the level of parental involvement, the family context, and the format of the intervention. These findings highlight the value of a complementary component such as cognitive reinforcement in order to offer truly comprehensive care.

COMBINED APPROACH

Given the complexity of ADHD, no single approach, however robust, can meet the multidimensional needs of the child on its own. Cognitive training, particularly working memory training, improves certain specific executive functions, but its effects are difficult to generalize outside the structured framework of the exercises. Conversely, parental interventions have a broader impact on everyday behaviors, but do not directly target deficient cognitive mechanisms.

From an integrative perspective, it is becoming increasingly clear that combining cognitive training with parental intervention is a promising approach for optimizing therapeutic outcomes in children with ADHD. On the one hand, cognitive training programs -particularly those targeting working memory and other executive functions- can lead to significant behavioral improvements, especially when supported by positive and consistent parenting practices. In turn, these same educational practices, by structuring the child's environment and reinforcing self-regulated behaviors, can also promote the development of cognitive abilities when combined with formal cognitive intervention. Thus, the two types of intervention act synergistically: the effects of cognitive reinforcement are more likely to transfer to everyday situations when they are recognized and supported by parents, while the benefits of parenting practices on the child's emotional and behavioral regulation are amplified by the cognitive gains from training (Steeger *et alii*, 2016; Maleki, Mashhadi, Soltanifar, Moharreri, & Ghamanabad, 2014). This integrative logic thus provides a relevant theoretical and empirical framework for designing multidimensional interventions that are better adapted to the functional and developmental reality of these children.

Combined Research and Protocols

A few pioneering studies have explored this promising avenue. Maleki *et alii* (2014) conducted a randomized controlled trial involving 36 children aged 6 to 12, divided into three groups: computerized working memory training, Barkley's parenting program, and a combination of the two. The results speak for themselves: only the combined intervention led to a significant reduction in symptoms of inattention and hyperactivity, as reported by parents using standardized scales (SNAP-IV and CBCL). This finding supports a joint approach targeting both the cognitive and contextual dimensions of the disorder.

For their part, Steeger *et alii* (2016) extended this logic to an adolescent population, testing a combination of the Cogmed program with a parental behavioral intervention in 91 participants. Although the overall effects of the combination did not significantly exceed those of the interventions taken separately, the authors emphasize a crucial point: the effectiveness of an integrated approach depends heavily on its adaptation to the developmental characteristics of the adolescent, family dynamics, and the severity of the disorders. These results underscore the need for finely calibrated interventions, rather than simply adding protocols together.

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More recently, Capodieci *et alii* (2019) demonstrated that an intervention combining visuospatial working memory training and group metacognitive activities improved executive functions and behaviors in children with ADHD. By integrating targeted cognitive training with an educational component promoting self-regulation, this approach generated specific and transferable effects, as confirmed by parental and teacher assessments. These results highlight the value of a structured combination of cognitive stimulation and educational support in producing lasting and generalizable effects.

Critical Analysis of Combined Approach

Research on these integrated approaches is beginning to converge toward a coherent vision, suggesting complementary mechanisms of action and increased potential for effectiveness when strategically combined.

The study conducted by Maleki *et alii* (2014) showed a significant reduction in the main symptoms of ADHD in the group that received the combined intervention. The effects observed appeared to be maintained, and even strengthened, at the three-month follow-up. Children in the experimental group showed better organization, reduced impulsivity, and improved performance on tasks requiring sustained cognitive control.

Interventions combining cognitive training and parental training are becoming increasingly popular for treating ADHD in children. Steeger *et alii* (2016) showed that while working memory training improves executive functions, parental training reduces parent-child conflicts, although no synergistic effect was objectively observed.

However, Chacko, Kofler, and Jarrett (2014) propose a theoretical framework according to which the combination of targeted neurocognitive approaches and interventions focused on behavioral and family skills could produce complementary effects. This combination would act on both cognitive regulation abilities and the family context, creating conditions conducive to greater child autonomy, increased school engagement, and improved family interactions.

Several variables significantly influence the effects of protocols combining cognitive training and parental training. First, intervention outcomes appear to be influenced by the child's age. Younger children (6-10 years old) generally benefit more than adolescents, which can be explained by greater neurocognitive plasticity at these early stages of development, as well as greater dependence on the family educational environment (Chronis-Tuscano *et alii*, 2011). Furthermore, it has been shown that parenting practices significantly influence the development of executive functions during early childhood, reinforcing the importance of early intervention that targets both the child's cognitive skills and parental interactions (Fay-Stammbach, Hawes, & Meredith, 2014). In addition, the effectiveness of combined interventions appears to be positively moderated by the initial level of deficit or symptom severity. (Holmes *et alii* 2009) demonstrated that children with the lowest working memory performance benefited most from adaptive cognitive training, with generalized lasting effects on untrained tasks observed up to 12 months after the intervention. More recently, Paiva *et alii* (2024) particularly emphasized that children with more severe symptoms benefit even more from combined interventions. These results suggest that the most clinically affected profiles benefit more from integrated approaches, probably due to a greater margin for improvement and a better adjustment of the therapeutic framework to their needs. Lastly and perhaps most importantly, the active involvement of parents -whether through their continued presence at sessions or the systematic application of strategies at home- is crucial to maximizing the effects of

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interventions, both on the child's behavioral regulation and on the family environment (Pfiffner, Villodas, Kaiser, Rooney, & McBurnett, 2014). For example, Clarke *et alii* (2015) demonstrated that adherence to parental "homework" was a better predictor of gains in children -particularly in terms of inattention and productivity- than simply attending sessions. Similarly, a more recent study showed that parental engagement, as carefully assessed by therapists (understanding, role-playing, planning, and use at home), accurately predicted a reduction in disruptive behaviors, regardless of pharmacological treatment (Joseph *et alii*, 2019).

Despite promising findings, several methodological limitations should be highlighted. First, most intervention studies are based on relatively small sample sizes, which limits statistical power and reduces the generalizability of the results. For example, the studies conducted by Chacko *et alii* (2014; *N*= 85, 7-11 years), Maleki *et alii* (2014; *N*= 36, 6-12 years), Steeger *et alii* (2016; *N*= 91, 11-15 years), and Asgari *et alii* (2024; *N*= 30, 7-10 years), all included fewer than 100 participants, a limitation frequently reported in clinical research (Kazdin, 2003).

Second, the heterogeneity of intervention approaches -ranging from cognitive training programs such as Cogmed (Klingberg, 2010) to metacognitive interventions and parent-guidance programs- makes direct comparisons between studies difficult. Methodological differences are also evident in the experimental protocols: several studies employed non-blind or single-blind designs, which may increase expectancy effects and observational biases, particularly when parents or clinicians are aware of the intervention condition. In contrast, blinded assessments generally provide more reliable estimates of treatment effects.

Finally, the diversity of outcome measures complicates the overall interpretation of the findings. Some studies rely primarily on subjective measures, such as parent- or teacher-reported questionnaires, which may overestimate improvements due to expectancy or reporting biases. Others use more objective indicators, including standardized neuropsychological tests or structured clinical observations, which often yield more conservative results. The coexistence of subjective and objective measures, combined with methodological variability across studies, reflects the relatively early stage of development of this field and highlights the need for more standardized and rigorous research protocols to strengthen the robustness and comparability of conclusions.

The combined approach, combining cognitive training and parental support, although still emerging, appears to be a solid and meaningful avenue to explore. It considers the child not as an isolated case, but as a developing being, deeply rooted in their relationships and educational environment. By strengthening both the child's skills and the active role of parents, this approach goes beyond the often-limited effects of compartmentalized interventions. It embodies a promising convergence between neuroscience and educational relationships, in the service of a more comprehensive approach to ADHD.

Discussion and Conclusion

Analysis of clinical data highlights the value of an integrated approach combining working memory training and parental interventions. Long treated separately, these two dimensions reveal real potential for synergy when coordinated in a coherent manner. Cognitive training aims to strengthen the child's executive functions, while parental support helps to anchor these skills in a stable and predictable family environment,

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conducive to their everyday use (Maleki *et alii*, 2014; Steeger *et alii*, 2016). This integrated perspective is further supported by recent evidence indicating that combining child-focused cognitive interventions with parental involvement may improve not only cognitive performance but also parent-child interactions, thereby enhancing the ecological relevance of treatment (Asgari *et alii*, 2024).

In school-aged children, this complementarity results in improved attention, reduced disruptive behaviors, and better generalization of skills in everyday life. The family environment thus becomes an essential lever, supporting the child's cognitive and behavioral development (Moen *et alii*, 2016; Johnston *et alii*, 2012). These findings support contemporary models of ADHD, which consider symptoms as emerging from dynamic interactions between neurodevelopmental vulnerabilities, executive dysfunctions, and environmental influences. This approach reflects a more nuanced understanding of ADHD, integrating both its neurodevelopmental and relational dimensions. Moreover, the overall evidence synthesized in recent systematic reviews suggests that although working memory training consistently improves performance on trained cognitive tasks, its greatest clinical value may be achieved when it is integrated into broader multimodal interventions that promote the transfer of acquired skills to everyday functioning (Landínez-Martínez *et alii*, 2022).

Research indicates that younger children and those with severe symptoms may particularly benefit from approaches that combine cognitive training and parental support (Chronis-Tuscano *et alii*, 2011; Holmes *et alii*, 2009; Paiva *et alii*, 2024; Rimestad *et alii*, 2019). These findings suggest that early intervention and appropriate treatment intensity are important determinants of therapeutic effectiveness.

In addition, the integration of metacognitive elements, such as learning self-regulation strategies, significantly reinforces the effects by facilitating the generalization of learning (Capodieci *et alii*, 2019). Therefore, intervention strategies should be individualized according to developmental stage, symptom severity, cognitive profile, and family context rather than applied uniformly across all children with ADHD.

The success of these interventions largely depends on the active involvement of parents, both in monitoring training and in applying educational techniques (Pfiffner *et alii*, 2014; Clarke *et alii*, 2015; Joseph *et alii*, 2019; Hauth-Charlier & Clément, 2014; Heubeck *et alii*, 2025). Systemic support, which fully integrates the family environment, is an essential lever for sustaining the child's progress. This collaborative approach promotes parental adherence and contributes to long-term treatment sustainability.

Beyond facilitating treatment adherence, parents play a key role in promoting the ecological transfer of cognitive and behavioral gains by helping children apply newly acquired strategies in everyday situations (Steeger *et alii*, 2016). This point is particularly relevant because improvements observed in neuropsychological assessments do not always translate into equivalent changes in real-world functioning.

One of the priorities for the coming years is the design of integrated intervention protocols based on a structured combination of cognitive training, parental guidance, and metacognitive components. Such multimodal interventions may provide broader clinical benefits by simultaneously targeting executive dysfunctions and environmental factors influencing ADHD symptom expression (Hornstra *et alii*, 2023).

These programs should be designed to facilitate the transfer of acquired skills into ecologically valid contexts, particularly school and family environments, where ADHD-related difficulties are most evident. The goal is to offer flexible, yet scientifically supported, approaches that can respond to a variety of contexts and clinical profiles.

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Future research should therefore move beyond laboratory-based outcomes and place greater emphasis on functional measures, including academic performance, daily executive functioning, social adaptation, and quality of life. Such outcomes are essential for determining the real-world clinical relevance of combined interventions.

Current advances remain limited by several methodological constraints, including small sample sizes, heterogeneous intervention protocols, variability in assessment methods, and relatively short follow-up periods. Multicenter, controlled, and extended studies (12-24 months) are needed to better understand the effectiveness of integrated approaches, identify the most receptive subgroups, and refine evaluation indicators.

A major limitation of the current literature is the scarcity of randomized controlled trials directly comparing combined interventions with isolated cognitive training or parental interventions. Most available studies examine individual components separately, making it difficult to determine the specific contribution of each component and whether their combination provides additional clinical value or true synergistic effects.

Furthermore, the considerable heterogeneity of protocols -in terms of duration, format, content, and evaluation criteria- as well as differences in participants' age, symptom severity, and clinical characteristics, limits direct comparisons between studies and reduces the generalizability of findings. The diversity of assessment tools, including parental reports, school-based measures, and cognitive assessments, also prevents the establishment of a unified framework for evaluating treatment outcomes.

These methodological limitations highlight the need for greater standardization, adequately powered multicenter randomized controlled trials, harmonized outcome measures, and longer follow-up periods to determine the durability and ecological validity of treatment effects (Kazdin, 2003).

This review highlights the growing interest in combined approaches integrating working memory training and parental interventions for children with ADHD. Rather than representing a simple addition of two independent interventions, this model proposes a complementary framework in which cognitive mechanisms and environmental adaptations interact to support functional improvement.

This integrated model does not merely target the child's executive functions; it also seeks to strengthen the continuity between therapeutic learning and its application in daily life through active involvement of the child's environment. Such a perspective reflects a shift from compartmentalized interventions toward a more ecological and collaborative approach centered on the child-family system.

From a theoretical standpoint, these findings support an integrative conceptualization of ADHD intervention, in which cognitive processes and environmental adaptations are considered complementary therapeutic targets rather than independent domains. From a clinical perspective, they encourage the development of evidence-based models combining cognitive, behavioral, educational, and family interventions according to each child's specific needs. Given the complexity of ADHD, individualized and contextualized care appears essential. Intervention programs should be flexible enough to accommodate differences in developmental stage, cognitive profile, symptom severity, and family characteristics, while ensuring that acquired skills are transferred across home, school, and social environments.

With this in mind, research and clinical practice should prioritize the development of integrated protocols combining cognitive, educational, and family components. These approaches should be evaluated through controlled, multicenter, and long-term trials in order to determine their effectiveness, sustainability, and potential for generalization.

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Future studies should also determine which combinations of therapeutic components are most effective, for which subgroups of children, and under which clinical conditions they produce the greatest benefits. Particular attention should be given to predictors of treatment response in order to move toward more personalized intervention strategies.

Ultimately, a structured research effort combining rigorous methodology, ecological outcome measures, and individualized intervention models will be necessary to establish the role of integrated approaches as a sustainable component of ADHD management in children and to contribute to the development of personalized, evidence-based models of care for children with ADHD and their families.

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Received, May 20, 2026
Acceptance, July 26, 2026

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