

Quarterly



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Promoting self-regulation and preventing ADHD symptoms

OVERVIEW

How children
learn to manage
their behaviour

REVIEW

Helping parents,
helping children



Children's Health Policy Centre

About the Children's Health Policy Centre

We are an interdisciplinary research group in the Faculty of Health Sciences at Simon Fraser University. We focus on improving social and emotional well-being for all children, and on the public policies needed to reach these goals.

To learn more about our work, please see childhealthpolicy.ca.

About the Quarterly

We summarize the best available research evidence on a variety of children's mental health topics, using systematic review and synthesis methods adapted from the *Cochrane Collaboration* and *Evidence-Based Mental Health*. We aim to connect research and policy to improve children's mental health. The BC Ministry of Children and Family Development funds the *Quarterly*.

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How children learn to manage their behaviour

Modulating activity levels, inhibiting impulsivity and focusing attention are crucial self-regulation skills for children. We look at how these abilities develop and what parents and teachers can do to assist.



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Helping parents, helping children

Can we prevent children from developing the core symptoms of attention-deficit/hyperactivity disorder? To answer this question, we review four studies assessing interventions that show promise.



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NEXT ISSUE

Helping children with ADHD

What contributes to the development of ADHD and what can be done to assist children with this disorder? We answer these questions in our upcoming issue.



How to Cite the Quarterly

We encourage you to share the *Quarterly* with others and we welcome its use as a reference (for example, in preparing educational materials for parents or community groups). Please cite this issue as follows:

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How children learn to manage their behaviour

Among the numerous skills that children develop, self-regulation is particularly critical. This includes the ability to modulate activity levels, inhibit impulsivity and focus one's attention.¹ As well as being important in and of itself, self-regulation has been linked to a host of other capacities — including delaying gratification, following directions, being socially competent and empathetic, and being skilled at cognitive and academic tasks.² Self-regulation, in other words, plays a central role in children's social and emotional well-being.



Self-regulation plays a central role in children's social and emotional well-being.

Self-regulation from infancy to adolescence

Through numerous observational studies and experiments, researchers have been able to chart the typical development of self-regulation skills. Many of these capacities emerge in infancy. Babies are able to orient their attention within the first few months of life.³ At just three months, infants can also soothe themselves by purposefully directing their attention to a toy after being overstimulated.⁴ Beyond this, between the ages of nine and 12 months, babies make significant gains in their motor control. For example, they become able to engage in goal-directed behaviours, such as putting a pacifier in their mouth.¹

Developments in self-regulation continue during toddlerhood. Attention continues to improve, and young children also typically become more able to inhibit their responses — even when it means delaying desired outcomes.⁵ This skill was highlighted in an experiment where researchers presented young children with a large gift bag but asked them to delay opening it. Notably, more than 70% of two-year-olds were able to wait the required three minutes without peeking in the bag.⁶

Gains in self-regulation are further consolidated during the school-age years. By age six, children typically perform well on tasks that require them to inhibit their impulses and motor responses.⁷ Specifically, when asked to remain quiet and still with their eyes closed while an examiner tried to provoke a reaction, for example, by dropping a pencil on a table, most six-year-olds could perform as well as typical 12-year-olds.⁷ This suggests that some self-regulation skills, including motor inhibition, reach optimal development quite early in childhood.

Still, many other self-regulation skills continue to develop in middle childhood. For example, on a test of sustained attention, 10-year-olds had 50% fewer attention lapses than eight-year-olds.⁸ This finding supports other research showing a rapid development in children's accuracy and speed in visual and auditory attention tasks between the ages of eight and 10, followed by more gradual gains between ages 10 and 13.⁷

Although most self-regulation studies have focused on early and middle childhood, researchers have nevertheless found that adolescents continue to develop skills in some specific domains. For example, the ability to control one's impulses continues to mature well into late adolescence.⁹ These gains are thought to be due to brain maturation in the prefrontal cortex throughout adolescence.¹⁰

Environmental factors have a profound impact on self-regulation.

The nature-nurture interplay

Children's ability to manage their behaviour is influenced by both biology and the environment. Biological factors include individual differences in brain structure and function. For example, researchers have found that children with a larger right anterior cingulate brain region were quicker and more accurate on a task requiring attention, even after controlling for factors such as age, cognitive abilities and overall brain size.¹¹

Environmental factors also have a profound impact on self-regulation. In very early life, prenatal brain development is optimized when women are supported to have pregnancies that are substance free, with limited stress and good nutrition.¹ The influence of environmental factors continues after birth as well. For example, studies have shown that parenting has a particularly strong influence on self-regulation skills for boys with a specific genetic profile. For these boys, more active and supportive parenting was especially beneficial to the development of their self-regulation skills.¹² Conversely, when parents were less engaged, these boys were more vulnerable to self-regulation problems.¹² Of course, all children benefit from a nurturing and stable environment — and have a right to expect this.

Most importantly, positive and engaged caregiving — provided by anyone who is raising a child — helps children develop the self-regulation skills they need.

What can parents do?

The good news about the nature-nurture interplay is that there are many opportunities to promote healthy child development. Most importantly, positive and engaged caregiving — provided by anyone who is raising a child — helps children develop the self-regulation skills they need.^{1, 13} Examples of this kind of caregiving include being attuned and responsive to children's moods,¹⁴ providing positive feedback to encourage children during challenging tasks,¹⁵ and supporting adolescents to become more autonomous.¹⁶

Building resiliency when there is risk

What puts children at risk for ADHD? We address this important question in our upcoming issue on treating childhood ADHD.

Most children develop self-regulation without significant hurdles. This development includes learning to pay attention and learning motor and impulse control. However, some children struggle with these skills. In the [Review](#) article that follows, we highlight four parenting programs that can help to prevent problems with inattention, hyperactivity and impulsivity for these children. 🙌



Helping parents, helping children

We can promote childhood self-regulation, but can we prevent childhood inattention, hyperactivity and impulsivity problems? And in particular, can these problems be prevented before they reach the level of becoming attention-deficit/hyperactivity disorder (ADHD)? The idea that it may be possible to prevent ADHD is relatively new, so research on potential preventive interventions is just beginning to emerge.^{17–18} We turned to this literature to determine whether childhood ADHD symptoms could be prevented.

First, we conducted a systematic review to identify randomized controlled trials (RCTs) evaluating preventive interventions that assessed any ADHD outcomes, including diagnoses or symptoms — regardless of the main study goals. In other words, we sought RCTs that measured ADHD outcomes even if interventions were designed to prevent other problems, such as behaviour disorders. We took this approach to capture all potentially relevant interventions, given that this topic is relatively new. We searched for interventions that took a universal approach or that concentrated on children at risk. We also required that ADHD-related outcomes be assessed at least three months after the intervention ended, since gains can diminish over time.¹⁹ Based on these criteria, we identified nine RCTs. (For more information, please see our [Methods](#).)

We typically report on all evaluations that meet our inclusion criteria, regardless of whether they show evidence of success. We do this to provide information not only on what works but also on what does not — enabling practitioners, policy-makers and families to be certain that children are provided with effective interventions. This approach works well when interventions are designed to prevent or treat a specific condition. However, eight of the nine RCTs we identified in this emerging area were not designed to address ADHD symptoms. So here we report on only the four RCTs showing positive benefits regarding ADHD symptoms.

Supporting parents through groups

The four RCTs evaluated four interventions for parents of young, at-risk children: *Legacy for Children*,^{20–21} *Incredible Years*,²² *Incredible Years* with a child literacy component,^{23–24} and *SAFE Children*.^{25–26} All four interventions aimed to teach parents more skills to encourage positive child development through group sessions, augmented in most cases with individual supports, such as phone calls or home visits. More details on each intervention follow.

Legacy for Children provided groups for disadvantaged mothers, starting during pregnancy and continuing until children reached age three.²⁰ Sessions focused on supporting mothers to create nurturing environments, discussing and testing different parenting strategies, and improving mother-child interactions by practising developing skills with their children.²⁰

Incredible Years provided groups for parents of young children with hyperactivity and behaviour problems over a three-month period.²² Sessions focused on teaching parents to encourage positive behaviours through praise, rewards and limit setting, as well as teaching strategies for addressing challenging behaviours.²²



All four programs started when children were young, affecting development in the preschool and early school years, well before ADHD problems and their negative consequences could become entrenched.

Incredible Years with a child literacy component also provided groups for parents of young children with behaviour problems over a three-month period.²³ But in this version, *Incredible Years* was augmented with literacy training where parents learned strategies to encourage their child's reading skills — over 10 weeks.²³ Parents then participated in an additional six weeks of group sessions combining both parenting and literacy promotion.²⁴

SAFE Children, meanwhile, had two main components. First, disadvantaged families participated in groups lasting 20 weeks.²⁵ Sessions focused on teaching parenting skills, improving family relationships, increasing peer support among participants, engaging parents in their child's school, and managing the challenges associated with living in violent neighbourhoods.²⁵ Second, the children received individual reading tutoring for 22 weeks.²⁵ (*SAFE Children* was the only intervention that provided services directly to children.)

Table 1 provides more information about these four programs.

Program (Country)	Delivery format (Duration)	Sample size	Child ages at start
Legacy for Children ^{20–21} (US)	100 group parenting sessions for disadvantaged mothers (3¼ years)	315	Prenatal
Incredible Years ²² (UK)	12 group parenting sessions for parents of children with hyperactivity + behaviour problems (3 months)	79	3–4 years
Incredible Years + literacy support ^{23–24} (UK)	12 group parenting sessions for parents of children with behaviour problems; 10 parent literacy-promotion sessions; 6 combined parenting + literacy-promotion sessions (6½ months)	112	5–6 years
SAFE Children ^{25–26} (US)	20 group family sessions for disadvantaged parents + children; 44 reading-tutoring sessions for children (5 months)	424	6 years

Determining what works

Given the purpose of our review, we report on only child ADHD outcomes at final follow-up, even though all the RCTs assessed additional outcomes, such as behavioural symptoms. We classify outcomes as being “positive” when researchers found statistically significant differences favouring the intervention over the control condition. Where available, we also report the degree of clinical improvement for a given intervention, or effect size.

Parenting and ADHD outcomes

With *Legacy for Children*, intervention children had significantly reduced hyperactivity symptoms compared with controls two years after the program ended, based on maternal reports.²⁰ However, the degree of clinical improvement, or effect size, was small.²⁰

For young children who come from disadvantaged families or who show early behavioural difficulties, it is possible to prevent the onset of problematic inattention, hyperactivity and impulsivity by improving parenting skills.

With *Incredible Years*, intervention children had significantly reduced ADHD symptoms compared with controls three months after the program ended, based on parent reports using a scale assessing multiple ADHD symptoms.²² Intervention children also experienced a 31% reduction in risk regarding ADHD symptoms relative to controls — a relatively large effect size.²² As well, improvements in attention and activity levels were significant even after statistically controlling for behaviour issues, suggesting that *Incredible Years* had an independent beneficial effect on ADHD symptoms.²²

Incredible Years augmented by literacy support produced similar results. Specifically, this version of *Incredible Years* resulted in children experiencing significantly fewer ADHD symptoms compared with controls four months after the program ended, based on parent interviews assessing multiple ADHD symptoms. However, the degree of clinical improvement, or effect size, was small.²³

Finally, participants in *SAFE Children* developed significantly better attention skills relative to controls over the course of the four-year follow-up, based on parent ratings.²⁵ The authors did not report the effect size for this outcome. This study did, however, take the added step of obtaining teachers' ratings. But there was no significant difference between intervention and control children based on teachers' reports of children's attention, impulsivity or hyperactivity. As well, the program had no impact on parent-rated impulsivity or hyperactivity.²⁵

Table 2 summarizes outcomes for all four interventions.

Program	Follow-up	Positive child outcomes*	No significant difference
<i>Legacy for Children</i> ²⁰	2 years	↓ Hyperactivity	N/A
<i>Incredible Years</i> ²²	3 months	↓ ADHD symptoms**	N/A
<i>Incredible Years</i> + literacy support ²³	4 months	↓ ADHD symptoms**	N/A
<i>SAFE Children</i> ²⁵	4 ¹ / ₃ years	↑ Attention (parent but not teacher ratings)	Hyperactivity Impulsivity

* All listed outcomes were statistically significant for intervention children compared with controls.
** ADHD symptoms including inattention, hyperactivity and impulsivity were measured using a single scale or interview.

These findings suggest that parenting interventions for families with young, at-risk children can improve child ADHD symptoms. While reported effect sizes were mostly modest, improvements nevertheless endured for as long as two to four years — for *Legacy for Children* and *SAFE Children*, respectively. Notably, as well, all four programs started when children were young, affecting development in the preschool and early school years, well before ADHD problems and their negative consequences could become entrenched.

These positive outcomes are tempered by the fact that for all four programs, significant gains were found based solely on parent ratings. The one study that assessed ADHD-related outcomes using a source other than parents (i.e., teachers) found no significant effects for the intervention. (It is preferable to assess child outcomes using two or more informants, given that symptom reports often differ depending on whether children, parents, teachers or other sources, such as independent observers, are doing the reporting.) Even so, our findings suggest that preventing childhood ADHD symptoms is possible and is a useful focus for further research that could greatly benefit children.

Implications for practice and policy

Our review suggests several considerations for practitioners and policy-makers.

- **Intervene early.** We can likely prevent ADHD symptoms from developing. For young children who come from disadvantaged families or who show early behavioural difficulties, it is possible to prevent the onset of problematic inattention, hyperactivity and impulsivity by improving parenting skills. It is notable that these problems can be prevented early — in the preschool or early school years — thereby likely averting the many negative consequences for children if these symptoms had become entrenched.

- **Support parenting.** Parenting interventions can have unexpected benefits for children. The four interventions we reviewed were originally designed to prevent behaviour problems (*Incredible Years*, both versions, and *SAFE Children*) or improve child health and development (*Legacy for Children*). Yet each program prevented childhood ADHD symptoms. This suggests that parent training can have far-reaching and unexpected effects, leading to substantial improvements in child well-being.
- **Use the power of groups.** Effective prevention programs can be delivered efficiently. *Incredible Years* is a good example. Typically delivered in just 12 group sessions, it has strong evidence of success in preventing conduct disorder and now, emerging evidence of success in preventing ADHD.^{22–23, 27} In terms of preventing ADHD symptoms in particular, *Incredible Years* produced a 31% reduction in risk — an indicator of robust clinical improvements for children.²² Its group format means that more families can be served, and served more efficiently. It also enables parents to receive support from one another, possibly reducing the stigma that some parents feel in seeking support. The brevity of the program, furthermore, means fewer demands on parents' time, making it more efficient and appealing for them too. An added benefit is that programs such as *Incredible Years* can be delivered in the evenings and on weekends, further increasing family access.

Effective prevention programs can be delivered efficiently.

We found that ADHD symptom prevention is possible. Still, further research is needed, in particular to incorporate symptom reports from children, teachers and/or independent observers in addition to parents. As well, because the four studies only assessed symptom measures, we do not know whether prevention programs can reduce ADHD *diagnoses*, a more robust outcome indicator. Future studies should therefore also incorporate diagnostic measures. In the interim, we can still take steps to help children — by increasing their access to effective parenting programs such as *Incredible Years*, which has multiple proven benefits and which now holds promise for preventing ADHD. 🙌

For more information on our research methods, please contact

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METHODS

We use systematic review (SR) methods adapted from the *Cochrane Collaboration* and *Evidence-Based Mental Health*. We build quality assessment into our inclusion criteria to ensure that we report on the best available evidence, for example, by requiring that intervention studies use randomized controlled trial (RCT) methods.

For this review, we searched for SRs on preventing symptoms of attention-deficit/hyperactivity disorder (ADHD) in children and for RCTs evaluating outcomes related to preventing ADHD symptoms, regardless of the intervention's original purpose. We also hand-searched SR reference lists to identify additional RCTs. Table 3 outlines our database search strategy.

Table 3: Search Strategy	
Sources	<ul style="list-style-type: none">• Campbell, Cochrane, CINAHL, ERIC, Medline and PsycINFO
Search Terms	<ul style="list-style-type: none">• ADHD or attention-deficit/hyperactivity disorder or attention deficit or attention disorder or hyperactive or hyperkinetic or inattentive or impulsive <i>and</i> prevention, intervention or promotion
Limits	<ul style="list-style-type: none">• Peer-reviewed articles published in English on any dates prior to March 2016• Child participants aged 18 years or younger• Systematic review, meta-analysis, or RCT methods used

Using these approaches, we identified 90 RCTs with potential relevance. Two team members then independently assessed each RCT. We found nine that met all our inclusion criteria, which are detailed in Table 4.

Table 4: Inclusion Criteria for RCTs
<ul style="list-style-type: none">• Participants were randomly assigned to intervention and control groups (including no treatment control, waitlist control, or attention control) at study outset• Clear descriptions were provided of participant characteristics, settings and interventions• Interventions were evaluated in a high-income country (according to World Bank standards) for comparability with Canadian policy and practice settings• At study outset, most study participants did not have an ADHD diagnosis• Follow-up was three months or more (from the end of the intervention)• Attrition rates were below 20% at final follow-up and/or intention-to-treat analysis was used• Outcome indicators included diagnoses and/or symptoms of ADHD• Reliability and validity of all primary outcome measures or instruments was documented• Levels of statistical significance were reported for primary outcome measures

Our typical approach in reviewing interventions is to report on all RCTs that meet inclusion criteria, regardless of whether they show evidence of success. We do this to provide information not only on what works but also on what does not — so practitioners, policy-makers and families can respond accordingly. This approach works well when interventions are designed to prevent or treat a specific condition. However, eight of the nine the RCTs we identified were *not* designed to address ADHD. So in reporting our findings, we only focused on the four RCTs showing positive benefits pertaining to ADHD. For these RCTs, one team member extracted data and another team member independently verified the findings. 🙌

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BC government staff can access original articles from [BC's Health and Human Services Library](#).

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LINKS TO PAST ISSUES

The *Children's Mental Health Research Quarterly* [Subject Index](#) provides a detailed listing of specific topics covered in past issues, including links to information on specific programs.

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