CHILDREN'S MENTAL HEALTH RESEARCH

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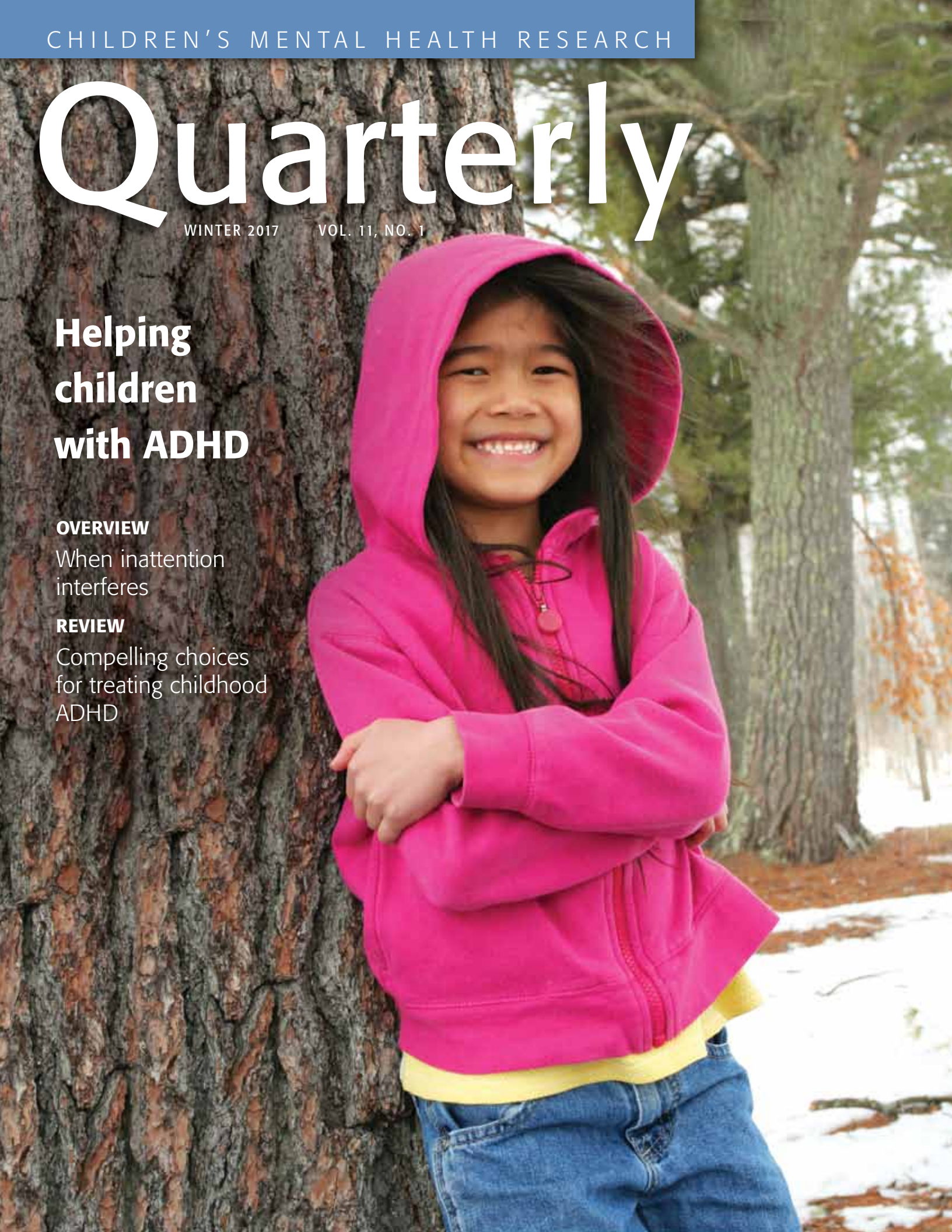

Helping children with ADHD

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VOL. 11, NO. 1 2017

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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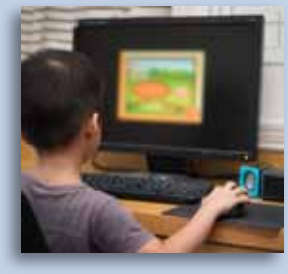
This Issue



NEXT ISSUE

Supporting LGBTQ youth

Many lesbian, gay, bisexual, transgender and queer youth experience higher rates of preventable adversities such as discrimination and bullying. We examine interventions and policies that can improve outcomes for LGBTQ youth.

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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Errata

In the Summer 2016 issue of the *Quarterly* (vol. 10, no. 3, page 7), Table 4 listed a combined treatment that included taking sertraline for 2 weeks. Correction as of November 2016 clarified that sertraline was taken for 12 weeks.

Some children experience challenges with inattention, hyperactivity and impulsivity – to a degree that interferes with their development and success at home, at school or in the community.

When inattention interferes

Most children develop the ability to regulate their behaviour without serious difficulties, for example, learning to pay attention, sit quietly and think before acting. Some children, however, experience challenges with inattention, hyperactivity and impulsivity — to a degree that interferes with their development and success at home, at school or in the community. In these cases, a diagnosis of attention-deficit/hyperactivity disorder (ADHD) may need to be considered.

Diagnostic decision-making

Prior to making a diagnosis, qualified practitioners should conduct a thorough assessment, preferably working in interdisciplinary teams. Such an assessment should include carefully interviewing children and caregivers to determine the history, frequency, severity and impact of the symptoms as well as potential causes.

A careful and comprehensive assessment is essential to ensure that children who are diagnosed with ADHD actually have the disorder.

In particular, inattention, hyperactivity or impulsivity must exceed what is expected given the child's developmental stage. As well, symptoms must interfere with the child's functioning in multiple settings (e.g., both at home and at school). It is important to also ascertain that symptoms are actually due to ADHD rather than to another mental disorder such as anxiety, or to learning difficulties, or to adverse circumstances such as child maltreatment. In addition to interviewing children and caregivers, many practitioners will ask caregivers and teachers to complete standardized questionnaires about the child's behaviours. As well, children may be asked to complete tests of attention.

A careful and comprehensive assessment is essential to ensure that children who are diagnosed with ADHD actually have the disorder. Considerable harm can result when inappropriate ADHD diagnoses lead to unnecessary treatment, and such diagnoses may also cause unnecessary distress for children and families. Harm can also result when other conditions are mistaken for ADHD, if these underlying conditions do not get addressed. Table 1 describes the criteria for diagnosing ADHD.

Table 1: Diagnostic Criteria for ADHD[1]

ADHD involves a persistent pattern of inattention and/or hyperactivity that interferes with functioning or development. For a diagnosis, six or more symptoms must persist over six or more months, symptoms must be present before age 12 years, and symptoms must be inconsistent with developmental level. Other contributing potential causes must also be ruled out, e.g., underlying anxiety disorders or child maltreatment.

Inattention	**Hyperactivity and Impulsivity**
• Difficulty sustaining attention	• Frequently fidgets or squirms
• Easily distracted	• Difficulty remaining seated
• Forgetful in daily activities	• Excessive running or climbing about
• Makes careless mistakes/poor attention to detail	• Challenges playing quietly
• Challenges listening	• Excessive talking
• Problems following instructions	• Blurts out answers
• Difficulties organizing tasks or activities	• Problems with taking turns
• Avoids tasks needing sustained mental effort	• Interrupts others
• Loses needed items	• Restlessness/difficulties being still

What causes ADHD?

A recent high-quality review has summarized the evidence on the possible causes of ADHD.[2] After carefully considering the available research, the authors identified a number of important risk factors for ADHD — both genetic and environmental. (For something to be deemed a *risk factor,* it must occur before the disorder is developed. To be deemed a *causal risk factor,* there must be evidence showing that modifying the risk factor actually changes whether the disorder develops.)[3]

Thinking about causation

Identifying what causes a disorder typically begins by determining which factors are associated or correlated with the disorder. The next step involves determining which of these factors precede the disorder. Beyond this a *causal risk factor* is defined even more rigorously – as a modifiable factor that changes the outcome, such as ADHD, when you manipulate it with interventions.[3, 6] Why do these distinctions matter? If we erroneously focus on factors that are not truly causal, we divert time and resources away from searching for and addressing factors that can really make a difference for children.[2] In addition, focusing on single factors, whether genetic or environmental, overlooks the now-overwhelming research evidence that genes and environment do not operate independently.[2] So, beyond seeking and addressing causal risk factors, researchers and practitioners must always consider the role of gene-environment interplay in causation, particularly when designing interventions for children.

The authors found strong evidence that ADHD runs in families, with individuals who have first-degree relatives with ADHD being two to eight times more likely to have the disorder.[2] Importantly, this increased risk due to family history can involve both genetic *and* environmental factors — as well as the interactions between them. For example, genetic vulnerability can alter an individual's sensitivity to environmental risk and protective factors.

The review also identified a number of gene and chromosomal variations implicated in ADHD.[2] Even so, the individual effects of identified genetic variations were very small.[2] As well, the identified chromosomal variants were not unique to individuals with ADHD. They were also found among some children without ADHD and were not always present among children with ADHD.[2] As a result, neither gene nor chromosomal risk factors have the level of evidence needed to identify them as causing ADHD.[2]

The authors also identified many environmental risk factors for ADHD. Prenatal factors included exposure to nicotine, alcohol and other substances as well as maternal stress.[2] Perinatal factors included low birth weight and prematurity.[2] Environmental toxins included exposure to lead, pesticides such as organophosphates and industrial products such as polychlorinated biphenyls.[2]

Although the review authors concluded that none of the identified risk factors had consistent and strong enough evidence to be identified as *causing* ADHD, they found one item that reached the threshold of a *likely causal risk factor:* early and severe deprivation in childhood.[2] For example, they described children raised in Romanian orphanages in the 1980s. There, deprivation was so severe that many children lacked absolute essentials such as adequate heating, water, nutrition and basic care.[4] This evidence was deemed stronger than the evidence for the other risk factors. The research included quasi-experimental data comparing long-term outcomes for children from the Romanian orphanages who were later adopted by British families to British children who were also adopted but who had not experienced a deprived institutional rearing. This "natural experiment" found that the Romanian adoptees had much higher rates of inattention and overactivity at age six than British adoptees.[5] At age 11, only the Romanian adoptees who had been adopted after age six months continued to show elevated levels of inattention and hyperactivity.[5]

Forty years of research have shown that many effective treatments exist for childhood ADHD.

Knowing about risks and building resiliency

The best available evidence suggests that many different risks can lead to the development of ADHD.[2] And the identification of these risk factors has important implications. This knowledge can inform new efforts to prevent ADHD as well as guide existing prevention interventions, such as those identified in our previous issue. Additionally, this information can help direct more general efforts to promote children's well-being, including supporting women to have pregnancies that are substance free and with minimal stress. Even with such efforts, however, some children will still develop ADHD and will require effective treatments. The Review article that follows identifies a range of interventions with proven success for children.

The best available evidence suggests that many different risks can lead to the development of ADHD.

REVIEW

Compelling choices for treating childhood ADHD

At any given time, approximately 2.5% of Canadian children — or nearly 17,000 in BC — meet diagnostic criteria for attention-deficit/hyperactivity disorder (ADHD).[7] For these children to reach their full potential, they need effective treatments. Our past reviews of the research have identified several options with strong evidence of success.

The evidence supporting child CBT and behavioural therapy is particularly strong, spanning many studies now, and evidence on neurofeedback is also starting to emerge.

In our Fall 2007 issue, we reviewed three medications commonly used to treat ADHD: methylphenidate, dextroamphetamine and atomoxetine. (Their brand names are listed in the sidebar.) The systematic review we featured found that all three medications effectively reduced ADHD symptoms and improved children's quality of life — despite all being associated with side effects, including decreased appetite, insomnia, headache and stomachache.[8]

In that issue and in our Spring 2013 issue, we also identified several effective psychosocial treatments, including behavioural and cognitive-behavioural therapy (CBT) for children, and behavioural training for parents.[8–9] Even so, children had better outcomes when these treatments were combined with medications.[8–9] Equally important, we also identified several treatments with no rigorous evidence supporting their use. These included dietary modifications, such as polyunsaturated fatty acids, as well as homeopathy, pet therapy and play therapy.[8–9]

A guide to ADHD medications

Medications used to treat childhood ADHD are sold in Canada under various names, which are summarized in the table below. The effects of "short-acting" versions typically last several hours, while effects of "long-acting" versions typically last twice as long (e.g., up to eight or 10 hours), meaning that medication benefits can be more stable.[10]

ADHD Medications[11–12]

Generic name	Brand name
Psychostimulants	
Methylphenidate	Biphentin Concerta Ritalin
Dextroamphetamine	Adderall Dexedrine Vyvanse
Non-psychostimulants	
Atomoxetine	Strattera
Guanfacine	Intuniv

Building on our knowledge base

To identify newer ADHD treatments, we conducted a targeted search and review of randomized controlled trials (RCTs). Given that we have already extensively analyzed the three most commonly used ADHD medications, we limited our medication search to guanfacine.[11] We did this because in 2013, Health Canada approved guanfacine as a treatment for ADHD in children aged six to 12 years — both on its own and as an adjunctive therapy for children with suboptimal responses to psychostimulant medications.[13] We also conducted a separate search for RCTs evaluating psychosocial treatments and dietary supplements published between

2011 and 2016. We limited our search to five years to ensure that we captured newer RCTs, updating our most recent previous review. Based on these two searches, we retrieved and assessed 88 RCTs, six of which met our inclusion criteria (detailed in the Methods). Two RCTs evaluated guanfacine and four evaluated psychosocial interventions.[14–21]

A newer use for an older medication

Guanfacine, a selective alpha-2 agnostic, is a medication that has long been used to reduce blood pressure in adults with hypertension.[13] While its precise mechanism of action for ADHD is unknown, it is thought to activate receptors for neurotransmitters such as noradrenaline.[14, 22] Because it has only recently been used to treat childhood ADHD, the long-term effects of this medication for young people are unknown.

For guanfacine, one RCT assessed the medication independently and one assessed it as an adjunctive therapy in six- to 17-year-olds.[14–16] The RCT assessing guanfacine as an adjunctive therapy focused on children who had experienced some improvement on extended-release forms of psychostimulants (methylphenidate or dextroamphetamine products) but who still had mild to moderate ADHD symptoms and at least some functional impairment.[15] All children in this study remained on their usual ADHD medication (i.e., methylphenidate or dextroamphetamine products) and in addition, were randomly assigned to also receive either guanfacine or a placebo.[15] Notably, the drug manufacturer was heavily involved in design, data collection, analyses and interpretations for both studies. As well, all study authors had financial ties to the drug manufacturer. Table 2 provides additional information about these two RCTs.

Table 2: Guanfacine Evaluations

Program (Country)	**Delivery** (Total time on medication)	**Sample size**	**Child ages**
Guanfacine alone[14] (US, Canada + 11 European countries)	Dose increased over 4 –7 weeks, then maintained for 6 weeks, followed by 2-week tapering off period (12 weeks for 6 –12 year olds; 15 weeks for 13–17 year olds)*	338	6 –17 years
Guanfacine adjunctive to a psychostimulant[15] (US)	Dose increased over 5 weeks, then maintained for 3 weeks, followed by 1- week tapering off period (9 weeks)*	461	6 –17 years

* Final side effect assessments occurred 7 days[14] or 7–9 days[15] after the final medication dose.

Other approaches for treating childhood ADHD

The four accepted psychosocial RCTs assessed five different interventions — three delivered to children and two focused on parents.[17–20] All three child programs worked to cultivate specific cognitive skills, such as attention and memory, using computer games.

The first child-focused RCT evaluated *Braingame Brian*, which aimed to increase executive functioning skills — including improving memory and cognitive flexibility and decreasing impulsive responding.[17] Children were randomized to participate in either the full version of *Braingame Brian* (where the difficulty of all tasks was automatically adjusted to the child's performance level), a "partial" version (where the difficulty of memory tasks, specifically, remained stable) or a placebo condition (where the difficulty of all tasks remained stable). All children completed 25 sessions, each lasting 35 to 50 minutes, using computers at home over a five-week period, supported by weekly phone calls to monitor progress.

The second child-focused RCT compared two different approaches — neurofeedback and cognitive training — to a waitlist control condition.[18] In the neurofeedback group, children were trained to increase their attention skills by altering two specific types of brain waves. Specifically, children learned to increase beta waves, which are associated with being alert and focused, and decrease theta waves, which are associated with

relaxation.[18] Children received immediate feedback from electroencephalogram (EEG) sensors embedded in a bicycle helmet. For example, when they succeeded in increasing their beta- to theta-wave ratio, they earned points in the computer game.[21]

In the cognitive training program, meanwhile, children completed 14 different computerized tasks targeting attention, working memory and impulsivity.[18] When children succeeded at a task, such as matching letter-number pairs, they earned virtual prizes. The tasks automatically became more challenging as children's skills progressed.

For both neurofeedback and cognitive training, children participated in 40 training sessions at their school lasting 45 minutes each.[18] A research assistant was available during all training sessions to provide minimal help, if needed. Children in both programs were also encouraged to continue with any other treatments they were already receiving, including medications.

Table 3 describes the three child-focused approaches and their evaluations. The table also describes the two parent-centred interventions, outlined in the two subsequent paragraphs.

Table 3: Psychosocial Treatment Evaluations

Program (Country)	**Delivery format** (Duration)	**Sample size**	**Child ages**
Child-Focused Treatments			
Braingame Brian [17] (Netherlands)	25 individual child sessions focused on improving memory + cognitive ability + stopping impulsive responding; using a computer game at home (5 weeks)	89	8–12 years
Neurofeedback [18] or ***Cognitive Training*** [18] (US)	40 individual child sessions focused on increasing attention; using a computer game with EEG sensors in schools (5 months)	104	7–11 years
	40 individual child sessions focused on increasing attention + memory through a variety of exercises; using a computer game in schools (5 months)		
Parent-Focused Treatments			
Psychoeducation (Spain)[19]	12 group educational family sessions focused on information about ADHD + behavioural strategies for managing symptoms + reducing defiant behaviour; delivered in a community clinic (3 months)	81	5–18 years
Strongest Families (Canada)[20]	12 self-directed parenting sessions focused on behavioural strategies; supported by 14 telephone coaching sessions; predominately self-delivered in homes (3 months)	72	8–12 years

Both of the parent-focused treatments concentrated on helping caregivers manage children's ADHD symptoms. In the psychoeducation program, groups of eight to 10 families participated in nine sessions, receiving information about ADHD.[19] These sessions were followed by three sessions addressing a variety of behavioural strategies for managing ADHD symptoms and reducing defiant behaviour.

Substantial research supports the effectiveness of parent training interventions for childhood ADHD.

The other parent-focused program, *Strongest Families*, differed in its focus and delivery. Parents were taught behavioural strategies including creating positive relationships with their children through noticing and consistently rewarding their positive behaviours.[20] Positive communication strategies — such as alerting children to upcoming transitions and working with schools — were also stressed. Parents worked through handbooks and videos at home over a 12-week period, supported by 14 telephone calls from program coaches.[20]

Determining what works

Most of the RCTs assessed a variety of outcomes beyond ADHD symptoms, such as oppositional behaviours, memory and executive functioning. Given the purpose of our review, however, we report only on child ADHD outcomes at final follow-up. As well, many of the outcome measures reported were behavioural rating scales that included an overall score (e.g., total ADHD symptoms) as well as subscale scores (e.g., hyperactivity/impulsivity and inattention). In such situations, we report findings from the total score only. For all reported findings, we also 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, or effect size, for a given intervention.

A new medication option?

The study that assessed guanfacine's effectiveness when used independently showed significant benefits.[14] Specifically, children on guanfacine had fewer clinically significant ADHD symptoms, as evidenced by a large effect size, compared to placebo.[14] ADHD symptom severity was also reduced for children on guanfacine compared to placebo. In addition, guanfacine led to more children having improved symptoms overall — 67.9% versus only 44.1% for children on placebo. Finally, children on guanfacine experienced less impairment in daily living, including functioning better at school and in social activities.

This guanfacine study also assessed side effects comprehensively, using laboratory tests, physical examinations and rating scales.[14] Overall, 77.2% of children on guanfacine reported side effects, compared to 65.8% of children who took placebo.[14] However, the authors did not assess whether these differences were statistically significant. Drowsiness (43.9%), headaches (26.3%) and fatigue (25.4%) were the most commonly reported symptoms for children taking guanfacine. Notably, nine of the 114 children assigned to guanfacine (or 8%) discontinued the medication because of side effects.

There are only two RCTs on guanfacine, and both involved significant ties to the drug manufacturer.

Does adding medication add benefits?

The study that assessed guanfacine when taken in addition to extended-release methylphenidate or dextroamphetamine also showed significant benefits.[15] Specifically, children receiving guanfacine adjunctively showed significant reductions in ADHD symptoms — with small-to-moderate effect sizes — compared to children taking a psychostimulant and a placebo (the comparison group). These children also had less severe ADHD symptoms, with 42.3% to 51.4% falling in the "normal to borderline range," compared to 32.9% in the comparison group.[15]

This guanfacine study also assessed side effects comprehensively, using laboratory tests and physical examinations.[15] Children on guanfacine as an adjunct to psychostimulants experienced more side effects than children who took only psychostimulants and a placebo — 76.3% to 77.3%, compared to 63.4% for psychostimulants plus placebo.[15] (The authors did not assess whether these differences were statistically significant.) Headaches (21.2%), drowsiness (13.6%) and upper respiratory tract infections (9.9%) were the most common side effects for guanfacine. Ten of the 302 children assigned to guanfacine (or 3%) discontinued the medication because of side effects.

Table 4 summarizes the findings for both guanfacine studies.

Table 4: Guanfacine Outcomes

Format	Follow-up	Positive child outcomes*	No significant difference
Guanfacine alone[14]	Post-test (children had been on medication for between 10 and 13 weeks)	↓ ADHD symptoms** ↓ ADHD symptom severity ↑ ADHD symptom improvement ↑ Functioning	None
Guanfacine adjunctive to a psychostimulant[15]	Post-test (children had been on medication for 8 weeks)	↓ ADHD symptoms** ↓ ADHD symptom severity ↑ ADHD symptom improvement	None

* 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.

Building children's skills

We found considerable variation in outcomes for the three child-focused programs. *Braingame Brian* resulted in no significant differences on measures of inattention or hyperactivity/impulsivity for intervention children compared to controls at three-month follow-up.[17]

For neurofeedback, however, significant positive results occurred at six-month follow-up.[21] Children receiving this intervention had fewer symptoms of inattention (by parent report, albeit with a small effect size).[21] They also had fewer symptoms of hyperactivity/impulsivity (by parent report, with a small effect size, and by researchers' classroom observations, where effect size was not reported). In contrast, the other program evaluated in this RCT — cognitive training — did not improve any child ADHD outcomes.[21]

Table 5 summarizes the findings for the three child-focused programs. It also summarizes findings for the parent-focused programs, which are described next.

Table 5: Psychosocial Treatment Outcomes

Program	Follow-up	Positive child outcomes*	No significant difference
		Child-Focused Treatments	
Braingame Brian[17]	3 months	None	Inattention Hyperactivity/Impulsivity
Neurofeedback[21]	6 months	↓ Inattention ↓ Hyperactivity/Impulsivity (2 measures)	None
Cognitive Training[21]		None	Inattention Hyperactivity/Impulsivity
Parent-Focused Treatments			
Psychoeducation[19]	12 months	↓ Inattention	ADHD symptoms** ADHD symptom severity ADHD symptom improvement Hyperactivity/Impulsivity
Strongest Families[20]	5 months	↓ ADHD diagnoses	None

* 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.

How can parents help?

Both parent-focused interventions produced benefits for children. One year after the psychoeducation program ended, children of participating families had significantly fewer symptoms of inattention, based on parent reports. The degree of clinical improvement for this outcome was moderate. However, when the study authors took the added step of conducting multiple statistical analyses, inattention was no longer significant. As well, the program did not produce substantial gains for any other ADHD-related outcomes, including overall symptoms, symptom severity or improvement, or hyperactivity/impulsivity-specific symptoms, by either parent or clinician report.[19]

The *Strongest Families* evaluation was the only RCT that assessed children's diagnostic status — the most robust outcome indictor when testing treatments. At five-month follow-up, children whose parents participated in the program were significantly less likely to meet ADHD diagnostic criteria compared to controls.[20] In fact, *Strongest Families* children had less than half the odds of receiving an ADHD diagnosis (see Table 5).

Recapping the results

Of the six treatments evaluated in our review, three showed particularly strong benefits. The medication guanfacine effectively reduced ADHD symptoms when used independently or when used adjunctively with psychostimulant medications. However, these findings need to be viewed with caution. The drug manufacturer was involved in study design, data collection, data analyses and interpretation in both studies. As well, all study authors had financial ties to the drug company. Additionally, guanfacine was associated with side effects, particularly headaches and drowsiness. Further evaluations are therefore warranted.

Beyond medications, of the three child-focused programs, only neurofeedback produced positive outcomes for ADHD symptoms. This program reduced inattention as well as hyperactivity/impulsivity. Although both parent-focused programs also produced some benefits, *Strongest Families* stood out. This Canadian program significantly reduced the number of children meeting diagnostic criteria for ADHD — a robust outcome indicator.

Who's *still* footing the bill?

In our Spring 2013 issue, we identified concerns with drug companies funding evaluations of medications that they produce and sell, including past attempts to stop the publication of unfavourable results.[9] While steps have been taken to address some conflicts of interest, including certain journals requiring conflict-of-interest declarations, challenges remain. The drug manufacturer's involvement in the guanfacine studies cited in this issue is a good example. We decided to retain these two studies, however, while identifying our concerns with them. Children are being prescribed these medications, so families and practitioners need to know about the findings and the issues. Still, we echo the calls that others have made for governments and non-commercial sponsors to increase their funding of independent drug evaluations, including requiring independent trials for drug approval from regulatory agencies — particularly for drugs prescribed for children.[23]

Implications for practice and policy

Combining our current review and our previous two *Quarterly* issues on ADHD treatments, we have now examined nearly 40 years of research. This large body of evidence suggests three recommendations for practice and policy.

- *Build on the power of parenting.* Substantial research supports the effectiveness of parent training interventions for childhood ADHD. These programs teach positive behavioural strategies, such as consistently noticing and rewarding children when their actions are constructive. Among these programs, *Strongest Families* stands out for its ability to reduce the number of Canadian children with ADHD diagnoses. Essential elements of this program are home delivery using parent handbooks and videos,

an excellent format for reaching traditionally underserved children and families such as those in rural or remote communities; telephone coaching to support parents; and its brief format, offering sessions over just three months. Communities and organizations may also want to consider implementing other effective behaviourally based parent training interventions, including those that offer in-person support. Adaptations may need to be considered to ensure that any programs implemented are culturally relevant.

- *Help children develop new skills.* A number of effective interventions can also be delivered directly to children. The evidence supporting child CBT and behavioural therapy is particularly strong, spanning many studies now, and evidence on neurofeedback is also starting to emerge. Unlike medications, these psychosocial treatments have the added advantage of continuing to show benefits months after the intervention ends. Another advantage for both CBT and behavioural therapy is that many practitioners are familiar with these interventions, making their implementation feasible. Child CBT and behavioural therapy are therefore highly recommended.
- *Use the right medications, and use them carefully.* Many children with ADHD require medication, even with psychosocial treatments in place. The medications methylphenidate, dextroamphetamine and atomoxetine all have strong evidence of success. As well, two recent preliminary evaluations showed that guanfacine is effective — on its own and adjunctively for children with suboptimal responses to psychostimulants. However, there are only two RCTs on guanfacine, and both involved significant ties to the drug manufacturer. So caution and further research are warranted for this medication. Practitioners who prescribe any ADHD medications need to carefully track children's responses, including evaluating efficacy as well as side effects on an ongoing basis.

Forty years of research have shown that many effective treatments exist for childhood ADHD. Practitioners can offer children and families a range of good options, such as parent training and child CBT and behavioural therapy, coupled with appropriate medications (and monitoring) when needed. Policy-makers can also support children — by ensuring that effective treatments are made widely available. This is good news for BC children with ADHD.

For more information on our research methods, please contact

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METHODS

We used systematic review methods adapted from the *Cochrane Collaboration* and *Evidence-Based Mental Health*. First, we conducted a search to identify high-quality research evidence on the effectiveness of interventions aimed at treating attention-deficit/hyperactivity disorder (ADHD) in children. We then built quality assessment into our inclusion criteria to ensure that we reported on the best available evidence. For example, we required that studies used randomized controlled trial (RCT) methods. To update our previous work, we limited our search to psychosocial treatments, with the exception of a separate search for guanfacine RCTs. Our search strategy is detailed in Table 6.

Table 6: Search Strategy

Sources	• CINAHL, ERIC, Medline and PsycINFO
Search Terms	• ADHD or attention-deficit/hyperactivity disorder or attention deficit or attention disorder or hyperkinesis *and* treatment or intervention or train*
Limits	• Peer-reviewed articles published in English between 2011 and 2016 (for psychosocial and dietary supplements) or before May 2016 (for guanfacine) that were either original RCTs or follow-up RCTs • Children aged 18 years or younger

* For our search for psychosocial interventions, we added the term "not pharmacological or medical"; for our guanfacine search we added "guanfacine."

Using these approaches, we identified 88 RCTs with potential relevance. Two team members then independently assessed each RCT, finding six that met all our inclusion criteria, detailed in Table 7.

Table 7: Inclusion Criteria for RCTs

- Clear descriptions were provided of participant characteristics, settings and interventions
- Interventions were evaluated in a high-income country* for comparability with Canadian policy and practice settings
- Interventions aimed to treat childhood ADHD
- At study outset, most study participants had an ADHD diagnosis
- Child 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

Psychosocial Treatment Studies

- Participants were randomly assigned to intervention and control groups at study outset
- Follow-up was three months or more (from the end of the intervention)
- Attrition rates were below 20% at follow-up and/or intention-to-treat analysis was used
- Child ADHD outcomes were assessed at follow-up using two or more informant sources
- At least one outcome rater was blinded to participants' group assignment

Medication and Dietary Studies

- Participants were randomly assigned to intervention and placebo groups at study outset
- Attrition rates were below 20% at post-test and/or intention-to-treat analysis was used
- Child ADHD outcomes were assessed at post-test using two or more informant sources
- Double-blinding procedures were used
- Side effects and adverse reactions were comprehensively assessed and reported

* According to World Bank standards.

Data from these RCTs were then extracted, summarized and verified by two or more team members. Throughout our process, any differences between team members were resolved by consensus.

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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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