

# CASER

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## ***Child Assessment Service Epidemiology and Research bulletin***

### **Child Assessment Service Epidemiological Report on Children with Disruptive Behaviour – 2011 to 2020**

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### **Profile of Children with Disruptive Behaviour at the Child Assessment Service**

Attention deficit hyperactivity disorder (ADHD) is one the most common neurodevelopmental disorders observed in childhood.<sup>1</sup> In a national parent survey in the United States, the estimated number of children diagnosed with ADHD is 6.1 million, that is, 9.4%, in children aged between 2 and 17 years old.<sup>2</sup> For treatment, the prevalence of ADHD medication use among children aged between 3 and 18 years old across 13 countries and in Hong Kong has also increased over time, with the absolute increase per year ranging from 0.02 to 0.26% between 2001 and 2015.<sup>3</sup>

To give a more comprehensive picture of ADHD diagnosed in Hong Kong, this epidemiological study reports on children who were diagnosed as having hyperactive and inattention disorders or problems by the Child Assessment Service (CAS) from 2011 to 2020. Four clinical subgroups were included. Two subgroups of children were diagnosed as having clinical disorders: attention deficit hyperactivity disorder with predominantly

hyperactivity, impulsivity or inattention symptoms (ADHD), and attention deficit hyperactivity disorder with predominantly inattention symptoms (ADD). The diagnoses were based on the ICD-10 classification system. Two other subgroups of children were diagnosed with subclinical problems, that is, hyperactive and impulsivity problems (HY) and inattention problems (IA). For these subclinical cases, the developmental difficulties found in these children affected their daily functioning with parental concern, but their problems have yet to reach impairment level.

### **Number of Cases and Rising Trend**

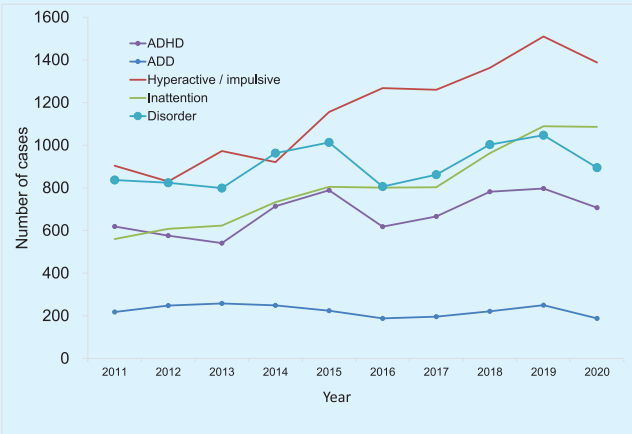
In our service, ADHD, ADD and related problems are the most common diagnoses for children presenting with disruptive behaviour. From 2011 to 2020, a total of 28,693 children were diagnosed. Among these children, 31.5% were diagnosed with ADHD or ADD, while 68.5% of children were diagnosed with hyperactive or inattention problems.

In 2020, there was a slight decrease in the total number of cases diagnosed, which may be related to the COVID-19 pandemic, as some parents chose to defer the assessment. In view of that, clinical data from 2011 to 2019 was used in the following trend analysis to give a better description of the clinical profile of these children.

As shown in Figure 1, a large rising trend is noted in the total number of cases diagnosed from 2011 to 2019. It rose from 2,301 to 3,646 cases, indicating a significant

increase of 58.4%. For ADHD and ADD, the number of cases rose from 837 to 1,047, indicating a moderate increase of 25%. For subclinical problems, the number of cases rose significantly from 1,464 to 2,599, indicating a huge increase of 77.5%.

Figure 1. Number of cases diagnosed from 2011 to 2020



For ADHD, the number of cases increased from 619 to 797, indicating a moderate increment of 28.8%. For ADD, the number of cases increased from 218 to 250, indicating a milder increment of 14.7%. The number of ADD cases is relatively steady throughout these years, with only mild fluctuations in between.

On the other hand, the number of children diagnosed with hyperactive and intention problems rose significantly throughout these years. For the hyperactive/impulsive group, the cases increased from 904 to 1,510, indicating a 67% increase. For the inattention problem group, the number of cases rose from 560 to 1,089, indicating a 94.5% increase. We postulate that it might be a result of increasing public awareness of developmental problems in children which led to more referrals and an increasing number of cases diagnosed over the years.

Among different clinical subgroups, the biggest increment is seen in the group of inattention problems. It is believed that with more public education on different developmental problems, more parents will become more alert to less obvious or disruptive problems such as inattention. Hence, more children will present with the problem and be diagnosed.

## Age at Diagnosis

For ADHD, since the symptoms are relatively more disruptive and noticeable in earlier years, the age of diagnosis in our cohort was generally younger when compared to ADD (Table 1). The average number of cases diagnosed rises from preschool years to peak at early primary school year (22.6% at age 5 to 27.9% at age 6).

For ADD, while most of the diagnoses were made after the children entered primary school, the average number rose from the first to the second primary school year (from 22.7% at age 6 to 25.9% at age 7). It is speculated that in primary school, as academic demands increased, ADD-related functional impairments became more obvious, which resulted in an increasing number of referrals and diagnoses.

Table 1. Percentage of ADHD and ADD cases diagnosed at different ages in 2011 and 2020

	Age	ADHD			ADD		
		2011	2020	Average	2011	2020	Average
Nursery	<3	0.3	0.0	0.1	0.0	0.0	0.1
Preschool age	3–4	10.7	1.7	1.4	0.0	0.0	0.1
	4–5	8.7	8.5	8.6	0.9	1.6	1.5
	5–6	14.1	26.2*	22.6*	2.8	6.4	8.0
School age	6–7	25.2*	28.9*	27.9*	15.6	27.1*	22.7*
	7–8	22.3*	17.1	20.0	19.3*	30.3*	25.9*
	8–9	13.7	10.5	10.3	26.6*	15.4	18.1
	9–10	7.6	3.5	4.7	17.0	9.6	11.4
	10–11	5.0	1.7	2.6	8.7	4.8	6.8
	11–12	2.1	0.9	1.3	6.4	2.7	3.6
	12–13	0.3	0.4	0.3	2.3	1.1	1.3
	Over 13	0.0	0.7	0.1	0.5	0.0	0.6

\*The first and second highest percentage of cases diagnosed in the year.

There was also a shift in the age of diagnosis of ADHD and ADD to earlier age throughout these years.

For ADHD, most of the cases were diagnosed earlier in preschool to the first primary school year in 2020 (26.2% and 28.9%, respectively, for ages 5 and 6) when compared to 2011, when most were diagnosed in the first and second primary school year (25.2% and 22.3%, respectively, for age 6 and 7). When looking at cases diagnosed in the preschool year of age 5, a larger

proportion of ADHD cases were diagnosed in 2020 when compared to 2011 (26.2% vs 14.1%).

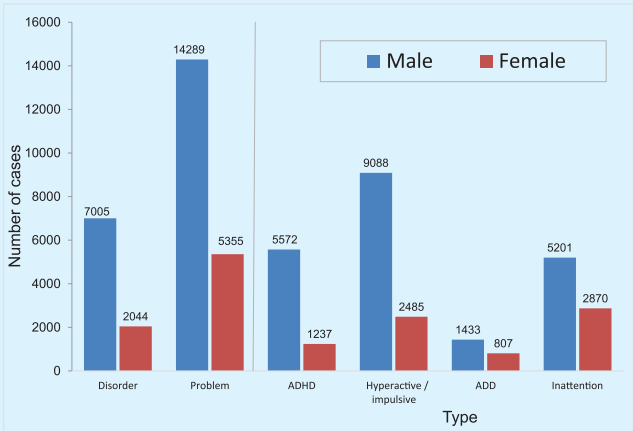
For ADD, although most of the cases were diagnosed in primary school years (ages 6 to 8), most of the cases were diagnosed earlier in 2020 with the peak of diagnosis at age 7 (30.3%) when compared to 2011, when the peak of diagnosis was at age 8 (26.6%).

### Gender Ratio

For ADHD and ADD, the overall gender ratio is 3.4:1. More boys than girls are diagnosed with the disorders in general (Figure 2). The ratio is higher in our cohort when compared to the ratio of 2:1 as cited in DSM-5. <sup>4</sup>

Further analysis in each subgroup revealed that more boys belonged to the hyperactive/impulsive and ADHD groups when compared to inattention problems and ADD. The boy-to-girl ratio for ADHD and hyperactive problems are 4.5:1 and 3.6:1, respectively. Both are higher when compared to the gender ratio of ADD and inattentive problems (both are 1.8:1).

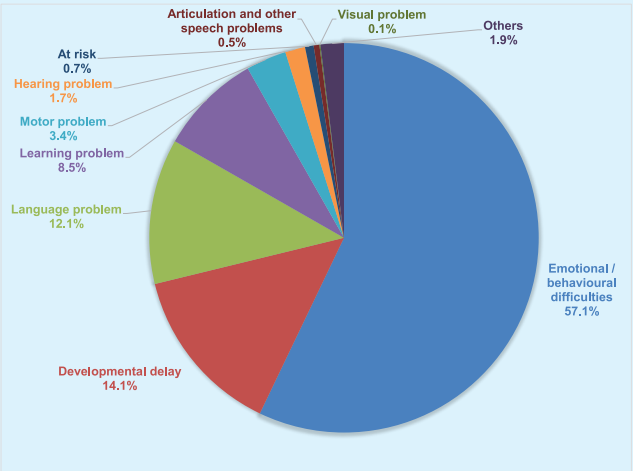
Figure 2. Average number of cases diagnosed between 2011 and 2020 by gender



### Reason for Referral

Most of the children were referred for behavioural and emotional problems, which accounted for 57.1%. Others were referred for suspected developmental delay (14.1%), language problems (12.1%) and learning problems (8.5%) (Figure 3).

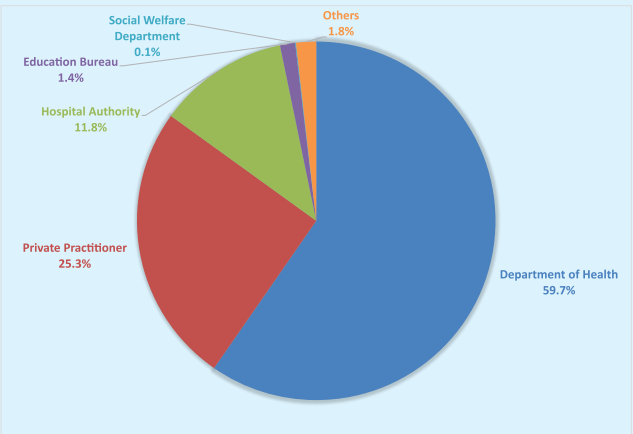
Figure 3. Referral reasons for the cases diagnosed from 2011 to 2020



### Source of Referral

The majority of cases were referred to us by the Department of Health (59.7%), including 57.3% by the Family Health Service and 1.2% by the Student Health Service. The other sources of referral were private practitioners (25.3%) and Hospital Authority (11.8%).

Figure 4. Different sources of referrals for the cases diagnosed from 2011 to 2020



### Comorbid Conditions

Dyslexia, autism spectrum disorder and specific language impairment were the three most common comorbid conditions. Emotional problems such as anxiety were the fourth most common comorbid conditions, despite the percentage being far smaller than the above three comorbidities. Dyslexia and emotional problems were more prominent in children diagnosed

with ADD or inattention problems. Hence, for children with inattention problems, it is very important to look for comorbid learning and emotional problems. The prevalence of oppositional defiant disorder (ODD) was far less than that reported in the literature, which is around 30 to 60%. It reflects that the conditions were significantly underdiagnosed in our service.

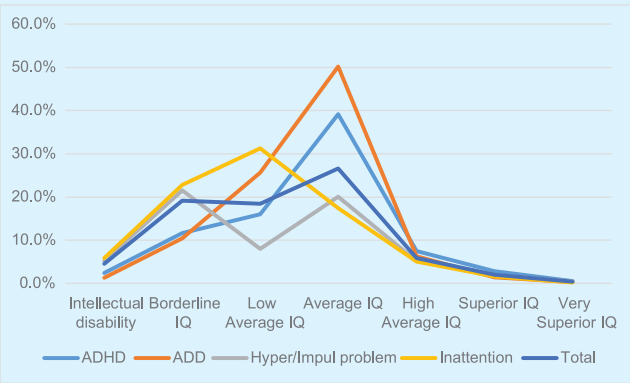
Table 2. Percentage of comorbid conditions in children diagnosed with ADHD, ADD and related problems from 2011 to 2020

Comorbid condition	Disorder level		Problem level	
	ADHD (n=6,809)	ADD (n=2,240)	Hyperactive /impulsive (n=11,573)	Inattention (n=8,071)
	%	%	%	%
Dyslexia	18.1	32.9	4.0	11.5
Autism spectrum disorder	17.3	11.4	23.8	21.9
Specific language impairment	18.3	18.4	29.4	28.0
Emotional problems	3.1	9.1	3.4	7.1
Oppositional defiant disorder/problem	1.4	0.1	0.1	0.0
Developmental coordination disorder	1.3	3.5	0.4	0.9
Tourette syndrome or tics	0.4	0.5	0.1	0.2

### Cognitive Profile

The intellectual profile of these children follows a normal distribution (Figure 5). A higher percentage of children diagnosed with hyperactive or inattention problems have been diagnosed as having a borderline developmental delay or borderline intellectual functioning in preschool years. Only 0.4% of the children were found to have a very superior IQ. It argues against the prevailing myth of these children being gifted.

Figure 5. Cognitive profile of children with ADHD, ADD, hyperactive/impulsive problems, and inattention problems from 2011 to 2020



### Management Plan

In our service, interim support services would be offered to the parents of these children. We organised an ADHD parent information day to give parents some information on clinical presentation, etiology, evidence-based interventions, school-based support services and community resources. Parenting groups for parents with school-age and preschool children were also offered.

The majority of children diagnosed with ADHD and ADD (90%) were referred to the Child and Adolescent Mental Health Services, signifying the importance of psychiatric interventions in supporting these children and their families in the long run. More than 70% of these children required referral to educational psychology services for better psychological and educational support in school. Around 50% of them also required referral to other school-based support services so that appropriate behavioural and classroom management could be provided.

Table 3. Management plan of children with ADHD and ADD from 2011 to 2020

Management plan	Disorder level		Problem level	
	ADHD (n=6,809)	ADD (n=2,240)	Hyperactive /impulsive (n=11,573)	Inattention (n=8,071)
	%	%	%	%
Child psychiatric service	91.4	90.8	68.6	46.4
Education psychology service	72.9	74.5	58.5	67.6
Intensive remedial service	48.7	56.4	34.6	49.7

### Conclusion

The present report shows that ADHD is one of the most common neurodevelopmental disorders diagnosed by CAS. The number of children diagnosed is on a rising trend and they are now more commonly diagnosed at an earlier age than in recent years. Comorbidities are common, which cause additional impacts on their functioning and outcomes. Resources for intervention and accommodation at home, school and community settings, with input and support from family, teachers and professionals, are of paramount importance.



## References

1. Scandurra V, Emberti Gialloreti L, Barbanera F, Scordo MR, Pierini A, Canitano R. Neurodevelopmental Disorders and Adaptive Functions: A Study of Children With Autism Spectrum Disorders (ASD) and/or Attention Deficit and Hyperactivity Disorder (ADHD). *Front Psychiatry*. 2019;10:673. Published 2019 Sep 4. doi:10.3389/fpsy.2019.00673.
2. Danielson ML, Bitsko RH, Ghandour RM, Holbrook JR, Kogan MD, Blumberg SJ. Prevalence of Parent-Reported ADHD Diagnosis and Associated Treatment Among U.S. Children and Adolescents, 2016. *J Clin Child Adolesc Psychol*. 2018;47(2):199-212. doi:10.1080/15374416.2017.1417860.
3. Raman SR, Man KKC, Bahmanyar S, et al. Trends in attention-deficit hyperactivity disorder medication use: a retrospective observational study using population-based databases. *Lancet Psychiatry*. 2018;5(10):824-35. doi:10.1016/S2215-0366(18)30293-1.
4. American Psychiatric Association, ed. *Diagnostic and Statistical Manual of Mental Disorders*. 5th ed. Washington, American Psychiatric Association; 2013.

## Incorporating Emotion Coaching into Behavioural Parent Training Programme (BPEC): A Training Group Programme for School-Age Children with Disruptive Behaviour – Development and Components

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Incorporating emotion coaching into behavioural parent training programme (BPEC)<sup>1</sup> was developed in the late 1990s by the Child Assessment Service. It is designed for parents who have difficulty in handling their children's disruptive behaviours. During the assessment of these children, we noticed an important need to develop a programme to empower these parents to enhance their children's compliance. BPEC targets parents of primary-school-age children who present with features of oppositional defiant disorder and other comorbid conditions, such as ADHD, specific learning disability, developmental language disorder and developmental

coordination disorder. Children with intellectual disability or autism spectrum disorder are excluded. The programme is suitable for parents with inadequate parenting skills when handling their children's behaviour.

BPEC consists of five three-hour sessions. Each group can serve up to 30 parents. Two clinical psychologists act as group leaders to deliver the group material and lead discussions, while clinical psychology trainees and nurses help as group facilitators during small group discussions. It incorporates emotion coaching into the behavioural parent training programme, covering major behavioural parenting skills, psychoeducation on children's emotions and emotion coaching steps. Major behavioural parenting skills are explained and rehearsed. Emotion coaching steps originally developed by Gottman and Declaire<sup>2</sup> are also modified and adopted.

## Outline of the Programme

**Session 1.** It starts with psychoeducation of the parents on the causes of their children's misbehaviours, and the impact of inborn characteristics and environmental influences on their children. It is hoped that the parents can understand their children more and develop reasonable expectations of them. The mechanism of learning and maintaining misbehaviour – based on the Antecedent, Behaviour and Consequence (ABC) model – is highlighted. Common conflictual scenarios are used to demonstrate the escalation trap. The ways of promoting positive parent-child relationship are also discussed.

**Session 2.** Emotion coaching is taught with demonstrations and behavioural rehearsals of typical scenarios. Emphasis is put on improving parent-child communication and relationship. Specific praise and non-verbal positive affirmations to improve children's behaviours are introduced.

**Session 3-4.** Core and evidence-based parenting skills in behavioural parenting training are taught, including

giving effective instructions and rule setting, the use of a behavioural contract to increase appropriate behaviour, and strategies like withdrawal of privilege and time out for inappropriate behaviour. The non-compliance routine is introduced and practiced. Parents are shown how to teach new skills to their children in order to replace inappropriate behaviour, such as problem-solving and time management skills.

**Session 5.** The parents are taught how to identify and prepare for high-risk situations. They are also guided to understand and manage their own emotions.

Throughout the five sessions, group discussions are led by facilitators and clinical psychologists. Videotapes and audiotapes are used to demonstrate parenting skills, which are further practiced by rehearsal and role play. Parents are then asked to practise the skills with their children at home after each session. Their experience and difficulties in practising the skills are discussed and addressed in the next session.

The effectiveness of BPEC has been examined throughout the years. It is found to be generally effective in reducing oppositional behaviours, and attention and hyperactive/impulsive problems in children. A randomized control trial was conducted in 2016 and 2017. The study was published in July 2022.<sup>3</sup>

## References

1. Chan CK, Cheung J, Sheh CS. Incorporating emotion coaching into behavioral parent training: A training manual, unpublished manuscript; 2016.
2. Gottman JM, DeClaire J. Raising an emotionally intelligent child: The heart of parenting. New York: Simon & Schuster; 1997.
3. Chan CKY, Fu K, Liu SKY. Incorporating emotion coaching into behavioral parent training program: evaluation of its effectiveness [published online ahead of print, 2022 Jul 15]. *Child Psychiatry Hum Dev*. 2022;10.1007/s10578-022-01402-y. doi:10.1007/s10578-022-01402-y.

## New Training Group for Parents of Preschool Children with Disruptive Behaviour

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Disruptive behaviours in preschool children commonly refer to their aggressive, oppositional, hyperactive or impulsive behaviours. Research evidence indicated that disruptive behaviours in early childhood are associated with negative mental health outcomes in the adolescent stage. These negative outcomes included aggressive, delinquent or risk-taking behaviours, peer rejection, academic failure, substance abuse and illegality.<sup>1</sup>

Multiple research studies converged to show that poor parenting is one of the most influential factors in the early onset of conduct problems.<sup>2</sup> Ineffective parenting is characterised by low levels of supervision and involvement or punitive and inconsistent discipline. Under ineffective parenting, the child's disruptive behaviours are positively reinforced through ineffectual parenting, while positive behaviours are reduced by not being attended to properly.

Behavioural parent training (BPT) is one of the most effective interventions in reducing childhood disruptive behaviours.<sup>3,4</sup> It is grounded by behavioural, cognitive and social-learning theory principles. BPT aims to reduce children's problematic behaviours, promoting children's positive social and compliant behaviours, as well as strengthening parents' mental health through the form of group-based training.<sup>3</sup>

Emotion-focused parenting is another important stream of intervention for children with disruptive behaviours.<sup>5,6</sup> Children with disruptive behaviour problems frequently presented with limited understanding of their own emotions and poor emotion regulation.<sup>7,8</sup> On the contrary, children who have positive emotion socialisation

experiences are more likely to have positive peer relationships, better academic achievement and more pro-social behaviour.<sup>9</sup> When parents have limited emotional awareness, their children are more likely to have poor emotion socialisation.<sup>10</sup> Hence, intervention programmes adopting emotion coaching can teach parents how to emotionally coach their children while regulating their own emotions.

In order to incorporate more evidence-based intervention strategies, a new parent training group for preschool children with disruptive behaviour is under development in our service. The group comprises six sessions, lasting two hours each. It is run by clinical psychologists and nurses during the development phase, and in the future, the aim is for this to be run by nurses. It covers the core evidence-based treatment components, including core behavioural parenting skills, emotional communication and emotion coaching. The main goals of the programme are to improve positive aspects of the parent-child relationship, increase compliance and reduce oppositional behaviour of the child and reduce parent-child conflict.

The target population of this group is parents of children aged 3 to 6 years old with oppositional behaviours. Children with significant developmental delay or intellectual disability, those with a suspected or confirmed diagnosis of autism spectrum disorder, parents who cannot read Chinese or those with significant mental illnesses would be excluded.

Below are the core themes and contents of the group:

Themes	Core Contents
Understanding a child's behaviours	<ul style="list-style-type: none"> <li>● Goal-setting</li> <li>● Causes of behavioural problem</li> <li>● Road map to positive parenting</li> </ul>
Play	<ul style="list-style-type: none"> <li>● Importance of play</li> <li>● Creating a fun family</li> <li>● Effective play skills</li> <li>● Barriers to play and problem-solving</li> </ul>
Emotion coaching	<ul style="list-style-type: none"> <li>● Psychoeducation on emotion</li> <li>● Five steps of emotion coaching</li> <li>● Common challenges</li> </ul>
Preventing inappropriate behaviours and encouraging appropriate behaviours	<ul style="list-style-type: none"> <li>● Environmental control</li> <li>● Clear and effective instruction</li> <li>● Praise, positive attention and physical affection</li> <li>● Behavioural contract</li> <li>● Natural and logical consequences</li> <li>● Summary of behaviour management strategies</li> </ul>
Application, reflection and booster	<ul style="list-style-type: none"> <li>● Application in public and other settings</li> <li>● Review changes</li> <li>● Recap key learning points in the past sessions</li> </ul>

The first pilot group was conducted from November to December 2021, and seven parents completed the pre- and post-measures. A paired samples t-test was conducted to determine the effectiveness of the pilot group. After the six sessions of the pilot group, preliminary results indicated a significant improvement in parental sense of competence ( $t(6) = -3.114, p = .021$ ), significant reduction of parental stress ( $t(6) = 3.507, p = .013$ ) and child's conduct problem ( $t(6) = 3.333, p = .016$ ). Further study will be conducted to investigate the effectiveness of this programme. It is hoped that more parents and children can benefit from this newly developed parenting programme and the long-term prognosis of these children can be improved.

## References

1. Broidy LM, Nagin DS, Tremblay RE, et al. Developmental trajectories of childhood disruptive behaviors and adolescent delinquency: a six-site, cross-national study. *Dev Psychol.* 2003;39(2):222-45. doi:10.1037/0012-1649.39.2.222.
2. Farrington DP. Childhood risk factors and risk-focused prevention. In: Farrington BC, editor. *The Oxford handbook of criminology*; 2007. p.602-640.
3. Hutchings J, Gardner F, Bywater T, et al. Parenting intervention in Sure Start services for children at risk of developing conduct disorder: pragmatic randomised controlled trial. *BMJ.* 2007;334(7595):678. doi:10.1136/bmj.39126.620799.55.
4. Sanders MR, McFarland M. Treatment of depressed mothers with disruptive children: A controlled evaluation of cognitive behavioral family intervention. *Behavior Therapy.* 2000;31(1):89-112.
5. Duncombe ME, Havighurst SS, Kehoe CE, Holland KA, Frankling EJ, Stargatt R. Comparing an Emotion- and a Behavior-Focused Parenting Program as Part of a Multisystemic Intervention for Child Conduct Problems. *J Clin Child Adolesc Psychol.* 2016;45(3):320-34. doi:10.1080/15374416.2014.963855.
6. Havighurst SS, Wilson KR, Harley AE, Prior MR, Kehoe C. Tuning in to Kids: improving emotion socialization practices in parents of preschool children--findings from a community trial. *J Child Psychol Psychiatry.* 2010;51(12):1342-50. doi:10.1111/j.1469-7610.2010.02303.x.
7. Morris AS, Silk JS, Steinberg L, Terranova AM, Kithakye M. Concurrent and longitudinal links between children's externalizing behavior in school and observed anger regulation in the mother-child dyad. *Journal of Psychopathology Behavioral Assessment.* 2010;32(1):48-56.

8. Trentacosta CJ, Shaw DS. Emotional Self-Regulation, Peer Rejection, and Antisocial Behavior: Developmental Associations from Early Childhood to Early Adolescence. *J Appl Dev Psychol*. 2009 May 1;30(3):356-65. doi: 10.1016/j.appdev.2008.12.016. PMID: 20161105; PMCID: PMC2739306.
9. Gottman JM, Katz L, Hooven CJ. *Meta-emotions: How families communicate emotionally*. Malwah; 1997.
10. Katz LF, Windecker-Nelson B. Parental meta-emotion philosophy in families with conduct-problem children: links with peer relations. *J Abnorm Child Psychol*. 2004;32(4):385-98. doi:10.1023/b:jacp.0000030292.36168.30.

## Update on Medical and Other Non-behavioural Treatment for ADHD

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### Medical Treatment for ADHD

According to the latest clinical practical guideline from the American Academy of Pediatrics on the diagnosis, evaluation and treatment of children and adolescents with attention deficit hyperactivity disorder (ADHD) in 2019, the following important key points should be of note:

Firstly, there is insufficient evidence to recommend diagnosis or treatment for children younger than 4 years old.<sup>1</sup> Parenting training in behavioural management (PTBM), which does not require a diagnosis to be applied, can be considered. Secondly, for preschool children aged 4–6 years with ADHD, PTBM and or behavioural classroom interventions should be the first line of treatment. Thirdly, methylphenidate (MPH) may be considered if these behavioural interventions do not provide significant improvement and there is moderate-to-severe persistent functional impairment. The clinician needs to weigh the risks of starting medication before 6 years old against the harm of delaying treatment. Preschool children may experience

increased mood lability and dysphoria with stimulant medications.<sup>2</sup> None of the non-stimulants have Food and Drug Administration (FDA) approval for use in preschool children. Fourthly, for school-age children aged 6 to 18 years, there is strong evidence to support the use of stimulant medication. For non-stimulants such as atomoxetine (available in Hong Kong) and extended-release guanfacine and extended-release clonidine (unavailable in Hong Kong), there is inadequate evidence to support their use as first-line management for ADHD. The effect sizes for stimulants and non-stimulants are 1.0 and 0.7, respectively.<sup>3</sup>

For drug titration, we have to understand that an individual's response to stimulants is variable and unpredictable. The response to methylphenidate or amphetamine is idiosyncratic, with approximately 40% responding to both and 40% responding to only one.<sup>4</sup> About 20% of treated patients do not tolerate current stimulants or experience inadequate efficacy. Calculating the dose based on body weight has not usually been helpful because variations in dose have not been found to be related to height or weight.<sup>5</sup> When stimulant therapy is not fully effective or limited by side effects, adjunctive medication may be considered. Only extended-release guanfacine and extended-release clonidine have FDA approval to support their use as adjunctive to stimulants.<sup>1</sup> Other medications have been used in combination on an off-label basis, such as a combination of atomoxetine with stimulant medication.

Due to the large variability in patients' response to ADHD medication, there is great interest in pharmacogenetic tools that can predict the best medication and dose for each child and adolescent. However, the available scientific literature does not provide sufficient evidence to support their clinical utility given that the genetic variants assayed by these tools have generally not been fully studied with respect to medication effects on ADHD-related symptoms and impairment. Study findings are inconsistent, or effect sizes are not of sufficient size to ensure clinical utility. For these reasons,



pharmacogenetics tools are currently not recommended.<sup>1,6</sup>

In the past decade, numerous new ADHD medication formulations have appeared on the market. Much of the new drug development centers on the use of microparticles, increasingly more sophisticated “coats” on these microparticles and the development of pH-dependent, transdermal and prodrug technologies. The advancement of clinicians’ knowledge of individual variability with regard to response and metabolism has allowed a more tailored approach to treatment.<sup>6</sup>

All formulations involve changes to the pharmaceutical delivery systems of the two existing compounds, MPH and amphetamine. In Hong Kong, MPH is the active ingredient in most of the commercially available stimulant medications. The available MPH preparations include mainly oral preparations: the immediate-release drug (Ritalin) and longer-acting drugs (Ritalin LA and Concerta). MPH blocks presynaptic dopamine and norepinephrine transporters, thereby increasing catecholamine transmission.

Although not yet available in Hong Kong, longer acting MPH preparations rely on different drug-release technology in order to obtain a lasting drug effect. Notably, the transdermal MPH patch (Daytrana) allows better adherence to medication, easier administration to younger children (especially those who cannot swallow medication) and is reported to induce fewer gastrointestinal side effects.<sup>6</sup> The total dose delivered is dependent upon the size of the patch and the wear time. Randomised controlled trials have demonstrated that children exhibited significant improvement on transdermal MPH patch treatment when compared to placebo treatment and improvement when compared with the extended-release oral drug Concerta treatment. Localised contact with dermatitis is a frequently reported side effect.

Newer MPH preparations in Western countries can achieve early onset of action while maintaining prolonged drug activity throughout the day, with one daily dose, by utilising unique multilayer bead technology. An example is Aptensio SR which contains 37% of uncoated

beads as immediate-release MPH and the rest are coated for extended release. The drug results in an onset of action within 1 hour of administration and a duration of up to 12 hours.<sup>6</sup> Older, long-acting MPH preparation often has a lag time between the administration of the drug and the onset of optimal drug action. This may lead to early morning functional impairment, warranting an additional dose of immediate releasing MPH preparation in the morning. Innovative drug delivery systems, such as that for Jornay PM, enable nighttime administration of medication with an onset of action targeted for the following morning. It eliminates the morning lag. Its delivery system uses microbead technology, with each microbead comprising a drug core surrounded by two layers of functional film coatings. The outer layer delays the release of the drug core and the inner layer regulates the release of the drug to achieve a delayed yet extended dispersal pattern. Instead of interfering with sleep onset, Jornay PM can result in early morning awakening. This can usually be addressed by adjusting the timing of the evening dose.

Amphetamine preparations were not available in Hong Kong previously. Recently, a new drug called Vyvanse is released. It contains lisdexamfetamine dimesylate, a prodrug of dextroamphetamine which is a non-catecholamine sympathomimetic amines which induces central nervous system (CNS) stimulant activity and is to be taken orally once a day. It was developed to create a longer-lasting version of dextroamphetamine that is less prone to abuse. The requirement of conversion into dextroamphetamine via enzymes in the red blood cells delays its onset of action. Its efficacy in the treatment of ADHD in children and adolescents has been established in several short- and long-term trials. To reduce the abuse of CNS stimulants, it is important to assess the risk of abuse prior to prescribing, and careful monitoring is needed afterward.<sup>7,8</sup>

Apart from MPH and amphetamine, new compounds are being explored as non-stimulant treatment options for ADHD. Trials investigating monoamine reuptake inhibitors (for example, viloxazine) or NMDA receptor antagonists (for example, amantadine) have offered promising results so far. Viloxazine was previously

marketed as an antidepressant for the treatment of major depressive disorder. It has since been repurposed as a treatment for ADHD and launched in the United States in April 2021.<sup>9</sup> Viloxazine extended release was reported to rapidly reduce symptoms in school-age children with a tolerable safety profile as shown in the results of the Phase III trial.<sup>10</sup> It is an oral drug that acts as a selective norepinephrine reuptake inhibitor. Its action as a potent antagonist of 5-HT<sub>2B</sub> receptors and potent agonist of 5-HT<sub>2C</sub> receptors may be involved in its efficacy for ADHD.<sup>9</sup> On the other hand, amantadine is a noncompetitive antagonist of NMDA receptors. It increases dopamine release and inhibits dopamine reuptake. It has been used as an antiviral and for Parkinson's dementia. Amantadine was studied in a double-blind randomised controlled trial in children.<sup>11</sup> The results suggested that amantadine may be promising as an add-on treatment to ADHD management in children.

### Non-pharmacological Approaches in Treatment of ADHD (Excluding Behavioural Therapy)<sup>12</sup>

Many non-pharmacological approaches are suggested to be useful in the management of ADHD. Commonly mentioned approaches and the updated scientific understanding so far are as follows: (i) neurofeedback has shown promise in single arm or uncontrolled studies, but the effects do not separate from placebo with rigorous placebo control and masked raters;<sup>13</sup> (ii) attentional and executive functioning training with interactive computer games (for example, Cogmed Working Memory Training) produces robust performance improvements on the training tasks;<sup>14</sup> however, the translation of these effects to improvements in ADHD symptoms has not been replicated,<sup>14,15</sup> despite promising findings from initial studies;<sup>16</sup> (iii) dietary treatments, such as the exclusion of additives or supplements with free fatty acids, have been shown to have modest effects in some placebo-controlled trials, although the effects are larger for exclusions when food intolerance is present;<sup>17,18</sup> (iv) physical exercise and meditation might have complementary benefits, but evidence for short-term or long-term control of symptoms is lacking.<sup>18,19</sup>

## References

1. Wolraich ML, Hagan JF Jr, Allan C, et al. Clinical Practice Guideline for the Diagnosis, Evaluation, and Treatment of Attention-Deficit/Hyperactivity Disorder in Children and Adolescents [published correction appears in Pediatrics. 2020 Mar;145(3)]. Pediatrics. 2019;144(4):e20192528. doi:10.1542/peds.2019-2528.
2. Greenhill L, Kollins S, Abikoff H, et al. Efficacy and safety of immediate-release methylphenidate treatment for preschoolers with ADHD [published correction appears in J Am Acad Child Adolesc Psychiatry. 2007 Jan;46(1):141]. J Am Acad Child Adolesc Psychiatry. 2006;45(11):1284-93. doi:10.1097/01.chi.0000235077.32661.61.
3. Southammakosane C, Schmitz K. Pediatric Psychopharmacology for Treatment of ADHD, Depression, and Anxiety. Pediatrics. 2015;136(2):351-9. doi:10.1542/peds.2014-1581.
4. Ching C, Eslick GD, Poulton AS. Evaluation of Methylphenidate Safety and Maximum-Dose Titration Rationale in Attention-Deficit/Hyperactivity Disorder: A Meta-analysis. JAMA Pediatr. 2019;173(7):630-39. doi:10.1001/jamapediatrics.2019.0905.
5. Coghill D, Banaschewski T, Zuddas A, Pelaz A, Gagliano A, Doepfner M. Long-acting methylphenidate formulations in the treatment of attention-deficit/hyperactivity disorder: a systematic review of head-to-head studies [published correction appears in BMC Psychiatry. 2015;15:202]. BMC Psychiatry. 2013;13:237. Published 2013 Sep 27. doi:10.1186/1471-244X-13-237.
6. Steingard R, Taskiran S, Connor DF, Markowitz JS, Stein MA. New Formulations of Stimulants: An Update for Clinicians [published correction appears in J Child Adolesc Psychopharmacol. 2020 Apr;30(3):202]. 2019;29(5):324-39. doi:10.1089/cap.2019.0043.
7. Newcorn JH, Nagy P, Childress AC, Frick G, Yan B, Pliszka S. Randomized, Double-Blind, Placebo-Controlled Acute Comparator Trials of Lisdexamfetamine and Extended-Release Methylphenidate in Adolescents With Attention-Deficit/Hyperactivity Disorder. CNS Drugs. 2017;31(11):999-1014. doi:10.1007/s40263-017-0468-2.
8. Coghill DR, Banaschewski T, Lecendreux M, et al. Efficacy of lisdexamfetamine dimesylate throughout the day in children and adolescents with attention-deficit/hyperactivity disorder: results from a randomized, controlled trial. Eur Child Adolesc Psychiatry. 2014;23(2):61-8. doi:10.1007/s00787-013-0421-y.
9. Johnson JK, Liranso T, Saylor K, et al. A Phase II Double-Blind, Placebo-Controlled, Efficacy and Safety Study of SPN-812 (Extended-Release Viloxazine) in Children With ADHD. J Atten Disord. 2020;24(2):348-58. doi:10.1177/1087054719836159.

10. Nasser A, Liranso T, Adewole T, et al. A Phase III, Randomized, Placebo-controlled Trial to Assess the Efficacy and Safety of Once-daily SPN-812 (Viloxazine Extended-release) in the Treatment of Attention-deficit/Hyperactivity Disorder in School-age Children. *Clin Ther*. 2020;42(8):1452-66. doi:10.1016/j.clinthera.2020.05.021.
11. Mohammadi MR, Kazemi MR, Zia E, Rezazadeh SA, Tabrizi M, Akhondzadeh S. Amantadine versus methylphenidate in children and adolescents with attention deficit/hyperactivity disorder: a randomized, double-blind trial. *Hum Psychopharmacol*. 2010;25(7-8):560-65. doi:10.1002/hup.1154.
12. Posner J, Polanczyk GV, Sonuga-Barke E. Attention-deficit hyperactivity disorder. *Lancet*. 2020;395(10222):450-62. doi:10.1016/S0140-6736(19)33004-1.
13. Cortese S, Ferrin M, Brandeis D, et al. Neurofeedback for Attention-Deficit/Hyperactivity Disorder: Meta-Analysis of Clinical and Neuropsychological Outcomes From Randomized Controlled Trials. *J Am Acad Child Adolesc Psychiatry*. 2016;55(6):444-55. doi:10.1016/j.jaac.2016.03.007.
14. Cortese S, Ferrin M, Brandeis D, et al. Cognitive training for attention-deficit/hyperactivity disorder: meta-analysis of clinical and neuropsychological outcomes from randomized controlled trials [published correction appears in *J Am Acad Child Adolesc Psychiatry*. 2015 May;54(5):433]. *J Am Acad Child Adolesc Psychiatry*. 2015;54(3):164-74. doi:10.1016/j.jaac.2014.12.010.
15. Chacko A, Feirsen N, Bedard AC, Marks D, Uderman JZ, Chimiklis A. Cogmed Working Memory Training for youth with ADHD: a closer examination of efficacy utilizing evidence-based criteria. *J Clin Child Adolesc Psychol*. 2013;42(6):769-83. doi:10.1080/15374416.2013.787622.
16. Klingberg T, Fernell E, Olesen PJ, et al. Computerized training of working memory in children with ADHD—a randomized, controlled trial. *J Am Acad Child Adolesc Psychiatry*. 2005;44(2):177-86. doi:10.1097/00004583-200502000-00010.
17. Stevenson J, Buitelaar J, Cortese S, et al. Research review: the role of diet in the treatment of attention-deficit/hyperactivity disorder—an appraisal of the evidence on efficacy and recommendations on the design of future studies. *J Child Psychol Psychiatry*. 2014;55(5):416-27. doi:10.1111/jcpp.12215.
18. Sonuga-Barke EJ, Brandeis D, Cortese S, et al. Nonpharmacological interventions for ADHD: systematic review and meta-analyses of randomized controlled trials of dietary and psychological treatments. *Am J Psychiatry*. 2013;170(3):275-89. doi:10.1176/appi.ajp.2012.12070991.
19. Krisanaprakornkit T, Ngamjaras C, Witoonchart C, Piyavhatkul N. Meditation therapies for attention-deficit/hyperactivity disorder (ADHD). *Cochrane Database Syst Rev*. 2010;2010(6):CD006507. Published 2010 Jun 16. doi:10.1002/14651858.CD006507.pub2.

## Recent Publications and Scientific Presentations

### Publications

Chan CKY, Fu K, Liu SKY. Incorporating emotion coaching into behavioral parent training program: evaluation of its effectiveness [published online ahead of print, 2022 Jul 15]. *Child Psychiatry Hum Dev*. 2022;10.1007/s10578-022-01402-y. doi:10.1007/s10578-022-01402-y

Ngai SPC, Wong LY, Poon VWK, Poon CYC, Yiu BPH, Wong TPS, Chow CP. Translation and validation of Cerebral Palsy Quality of Life Questionnaire-Teen in Hong Kong Chinese population [CP QoL-Teen (HK)]. *Eur J Pediatr*. 2023 Apr;182(4):1719-1730. doi:10.1007/s00431-023-04845-0. Epub 2023 Feb 9. PMID: 36757493; PMCID: PMC10167170.

### Scientific Presentations

**Local data of children with visual impairment (VI) at Child Assessment Service, Department of Health** on 26 November 2022 at Joint Annual Scientific Meeting 2022 Organized by The Hong Kong Paediatric Society, Hong Kong College of Paediatricians, Hong Kong Paediatric Nurses Association, Hong Kong College of Paediatric Nursing by Dr TONG Suet-wai.

**Supporting Children with Complex Communication Needs (CCN) in hospitals: basic training in Augmentative & Alternative Communication (AAC)** on 16 November 2022 at Hong Kong Children's Hospital by Dr CHOW Chin-pang, Jasper, TSANG Yee-ha, Lucia, LAM-ling, Lorinda, LEUNG Pui-ling, Joyce, CHAN Shuk-yan, Carol, YUEN Tsan-wing, Janice, POON Yuen-ching, Candice.

**WISC-IV(HK) & WIPPSI-IV (HK) – case conceptualization & report writing** on 15 November

2022 at Dept of Psychology, The Chinese University of Hong Kong by LAU Wai-yee.

**Diploma in Special Education (Special Learning Needs Education Course in Autism/Asperger's Syndrome)** on 10 November 2022 at HKU SPACE by LAM Ling, Lorinda.

**Special Education Needs (SEN) children and their assessment** on 10 November 2022 at Hong Kong International Optometric Symposium (HKIOS) by Dr LEE Mun-yau, Florence.

**Online certification workshop of Copying Speed Test for Hong Kong Secondary Students** on 4 November 2022 at Hong Kong Occupational Therapy Association by TAM Ka-yan.

**Clinical assessment using WPPSI-IV(HK)** on 28 October 2022 at M. Soc Sc. Programme, Department of Psychology, HKU by CHEN Yuk-ki, Theresa.

**General approach to clinical assessment of children: assessment of behavioral, social and emotional aspects** on 12 October 2022 at Department of Psychology, The University of Hong Kong by TSANG Yee-ha, Lucia.

**Assessment and diagnosis on children with Special Educational Needs (SEN) / 有特殊教育需要兒童的診斷及評估** on 7 October 2022 at Centre for Special Educational Needs and Inclusive Education, The Education University of Hong Kong by LEUNG Wing-in, Windy.

**Diagnostic terminology for child language disorders in Hong Kong** on 23 August 2022 at Hospital Authority by NG Kwok-hang, Ashley.

**Children with dual diagnosis of Autism Spectrum Disorder (ASD) and Attention Deficit Hyperactivity**

**Disorder (ADHD)** on 22 June 2022 at The Hong Kong Society of Child Neurology and Developmental Paediatrics – Neuro-Developmental Conference by Dr TONG Suet-wai.

**Cantonese phonology and speech sound problems** on 26 May 2022 at Thematic Course for Teacher Professional Development on Catering for Students with Speech and Language Impairment (SLI), The Education University of Hong Kong by WONG Kei-yan, Gillian.

**Understanding the aim, scope, and procedures on screening and assessment of oral language functions in pre-school and school-age children. How can teachers identify children with oral language difficulties in schools?** on 17 May 2022; **How to enhance the oral language skills of school-age children with language impairment** on 18 May 2022 at Thematic Course for Teacher Professional Development on Catering for Students with Speech and Language Impairment (SLI), The Education University of Hong Kong by CHAN Wai-ki, Amy and TONG Mei-yan.

**Bimonthly meeting of Hong Kong Society of Children's Palliative Care Supporting children with Complex Communication Needs (CCN) in the hospital** on 22 March 2022 at Hong Kong Society of Children's Palliative Care by Dr CHOW Chin-pang and SIU Kit-ling, Elaine.

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