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A Rapid Evidence Assessment of the Effectiveness of Educational Interventions to Support Children and Young People with Attention Deficit Hyperactivity Disorder

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A Rapid Evidence Assessment of the Effectiveness of
Educational Interventions to Support Children and Young
People with Attention Deficit Hyperactivity Disorder

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Views expressed in this report are those of the researcher and not
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Table of contents

Glossary.....	2
Acknowledgements.....	4
1. Executive Summary	5
2. Introduction	8
3. Methodology.....	16
4. Findings.....	21
5. Discussion.....	61
6. Conclusions.....	67
References	69
Annex A – Medline and Embase search strategy	72
Annex B – Definitions and use of components of school-based interventions identified by Richardson et al., 2015	74
Annex C – Critical appraisal of included studies	76

List of tables

Table 3.1: Scope of the rapid evidence assessment.....	18
Table 4.2: Key meta-analytical results from the included systematic reviews	59

Glossary

Key word	Definition
Antecedent-based intervention	An intervention that manipulates antecedent conditions (conditions which precede and potentially influence a response or behaviour from the person with attention deficit hyperactivity disorder [ADHD]), such as the environment, task or instruction.
Clinical recovery rate	Achievement of response (see definition below) plus reduction of ADHD symptoms to within normal range (considered to be below the 93 rd percentile on the Barkley Adult ADHD Rating Scale-IV or below the 96 th percentile on the Brown Attention Deficit Disorder Rating Scales).
Coaching	This method uses questioning to help students develop reflective thinking, goals, empathy and structure, aiming to improve their ability to achieve life goals.
Consequence-based intervention	An intervention that uses reinforcement and punishment to alter the frequency of target behaviour.
Curriculum achievement	Scholastic attainment on school-based curriculum tests and coursework.
Dialectical behavioural therapy	A type of talking treatment based on cognitive behavioural therapy adapted to help people who experience emotions very intensely.
Differential reinforcement	A contingency-management approach where only the appropriate behaviour is reinforced (rewarded), and any other behaviour is not reinforced (the reward is withheld).
Effect size	A standardised measure of the effect of an intervention, usually in comparison to a comparator group, but sometimes in comparison to baseline. There are different effect size measures, such as Cohen's d (also known as the standardised mean difference). An effect size of 0 means no effect of an intervention. Effect sizes are usually reported in such a way that a positive effect size reflects an improvement with an intervention, which a negative effect size reflects a worsening.
Executive function	Higher level cognitive skills which are used to control and coordinate other cognitive functions and behaviours.
Externalising symptoms	Emotional and behavioural symptoms that are under controlled and externalised, for example: fighting, bullying, or defiance.
Hyperactivity/impulsivity	An inability to manage activity levels appropriate to task and context. For example, fidgeting, interrupting others, being constantly in motion, inability to stay seated without excessive movement, restlessness, excessive talking, inability to engage in tasks quietly, impatience and inability to regulate emotions.
Inattention	An inability to focus and pay attention appropriate to task and context. For example, being easily distracted disorganised, procrastinating and being forgetful. The individual may move between tasks without completing any one activity, losing interest in one task and starting on another
Internalising symptoms	Emotional and behavioural symptoms that are over controlled and internalised. For example, shyness, anxiety, withdrawal from social situations

Key word	Definition
Reliable Change Index	A form of standardised score calculated by dividing the difference between the pre-treatment and post-treatment scores by the standard error of the difference. If the Reliable Change Index score is ≥ 1.96 a difference is considered clinically significant.
Response	Improvement in the outcome of equal to or greater than the Reliable Change Index.
School adjustment	A rater's perception of scholastic behaviours including adjustment to school. For example, scholastic achievement, motivation, productivity, and study skills (including time management and organisation)
Self-regulation intervention	An intervention aimed at the development of self-control and problem-solving skills to regulate cognition and behaviour
Social skills	Ability to communicate and interact effectively with others (including peers, siblings, teachers and parents) in a context-appropriate manner.
Standardised achievement	Achievement in scholastic tasks as assessed by standardised intelligence and achievement tests.

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1. Executive Summary

- 1.1 This rapid evidence assessment (REA) was commissioned to assess the extent to which interventions are effective in supporting children and young people with attention deficit hyperactivity disorder (ADHD) in educational settings. The purpose of the assessment is to facilitate the planning and delivery of timely and effective interventions to support children and young people with ADHD.
- 1.2 The REA identified studies assessing a variety of school-based interventions to support children and young people with ADHD. There have been few robust assessments of these interventions. The REA included 11 studies: seven systematic reviews and four additional randomised controlled trials (RCTs).
- 1.3 The most recent and robust study included in this REA was a systematic review from 2015 carried out as part of the UK Health Technology Assessment (HTA) programme (Richardson et al., 2015). It assessed the impact of school-based interventions as a group on ADHD core symptoms (hyperactivity, impulsivity and inattention), ADHD-related symptoms (internalising and externalising symptoms and social skills), and scholastic behaviours and outcomes (adjustment to the educational setting, curriculum or standardised achievement).
- 1.4 The HTA review included 39 RCTs and 15 other (non-randomised) controlled studies (1,751 participants), and pooled the result of all of the school-based interventions together. Most of the other six reviews included predominantly or exclusively non-RCT evidence and some pooled results by the type of intervention used. Most included studies were from the United States and provided support to children of primary school age. The individual studies in the reviews and the additional RCTs tended to be small. Most studies did not utilise blinding, meaning the outcome assessors were aware of which group a child was in (intervention or not), which could have affected how they rated the participants' outcomes.
- 1.5 Overall, the evidence reviewed suggested that non-pharmacological interventions delivered in educational settings may lead to improvement in ADHD and externalising symptoms, and some academic outcomes (such as standardised test achievement and teacher-rated adjustment to school). As yet, the evidence does not suggest benefit for internalising symptoms (such as depression or anxiety) or for social skills.

- 1.6 The evidence regarding the impact of specific interventions is less strong than the evidence for groups of interventions. The included studies assessed a variety of interventions made up of differing components. Even interventions using similar approaches (e.g. consequence-based approaches) often varied in the exact way these approaches were used and how they were combined with other approaches. This means that few studies assessed the same interventions, and the available reviews have pooled findings either for school-based interventions as a whole or grouped by type of intervention.
- 1.7 Interventions including the use of consequence-based (contingency management) interventions appear to be among the most commonly researched. Contingency management involves using reward and punishment to alter the frequency of target behaviour. These interventions appeared to offer benefits for problem behaviours, such as off-task or disruptive behaviour, and may also have a small effect on improving academic outcomes.
- 1.8 Perhaps unsurprisingly, academic/antecedent-based interventions, such as altering academic instruction or academic materials, potentially offer more benefit for academic outcomes, but less impact on problem behaviours than other intervention types. Self-regulation interventions, which aim to get the affected child to monitor and control their thinking and behaviour, also potentially have benefit for reducing off-task and disruptive behaviour.
- 1.9 The only interventions which showed relatively convincing evidence of having no beneficial effect were performing screening for ADHD in a primary school setting and/or simply providing primary school teachers with written advice about ADHD. These strategies were tested in a very large RCT in England and not found to improve academic outcomes or ADHD symptoms.
- 1.10 It should be noted that assessment of the effects of specific types of interventions largely came from reviews of less robust study designs (i.e. non-RCTs). Therefore, conclusions on the extent to which interventions are effective should be considered as tentative. According to the hierarchy of evidence initially developed in evidence-based medicine (Guyatt et al., 1995, Greenhalgh, 1997), RCTs are considered to be the most robust study design for assessing the impact of interventions. This is because randomisation creates intervention groups balanced for known and unknown confounders, which, along with the use of a control group, allows clear identification of the impact of the intervention itself, without the effects of confounders or the passage of time.

1.11 In summary, there are a range of strategies that could be considered by school staff to support children and young people with ADHD (see Annex B for a summary). As the evidence is not yet conclusive in terms of which interventions are the most effective, ideally schools should carry out objective evaluations of the impact of any support measures they introduce, to ensure they are effective.

2. Introduction

Background to the REA

- 2.1 This REA discusses the available evidence on the effectiveness of interventions delivered within educational settings to support children and young people with ADHD. The most robust evidence from existing evidence-based guidance, systematic reviews and RCTs has been summarised to provide an overview of the extent to which interventions delivered in educational settings are effective in realising positive outcomes for young people with ADHD such as educational attainment, attendance, inclusion, social and emotional development, ADHD symptoms and behaviour in the educational setting.

Legislative context

- 2.2 The Additional Learning Needs and Educational Tribunal (Wales) Bill was introduced into the National Assembly in Wales in December 2016. This Bill will enable the development of a new legislative framework for improving the planning and execution of additional learning provision. It replaces legislation surrounding special educational needs (SEN) and the assessment of children and young people with learning difficulties and/or disabilities (LDD) (Welsh Government, 2017). This was developed in response to parents' and teachers' views that the current system was too complex, bewildering and adversarial. The assessment process could be more efficient, less bureaucratic and costly, as well as being more child centred and user friendly. A motion to agree the general principles of the Bill was agreed in June 2017 (National Assembly for Wales, 2017).

The condition: ADHD

- 2.3 ADHD is a neurodevelopmental disorder where the affected individual displays symptoms such as hyperactivity, impulsivity and inattention, which are above the level that would be appropriate for their age group (National Institute for Health and Care Excellence, 2008).
- 2.4 Children with ADHD are often also diagnosed with other mental health disorders, particularly antisocial and oppositional behaviour, but also tic disorders, specific learning difficulties, autistic spectrum disorder, anxiety and depression (National Institute for Health and Care Excellence, 2008). One study from the USA found that two thirds (67%) of children with ADHD had at least one other disorder (Larson et al., 2011).

- 2.5 Symptoms of ADHD often begin early in life, typically before age seven, and persist into adolescence (National Collaborating Centre for Mental Health, 2009). The level of symptoms a child experiences may vary, as can their level of impairment. Symptoms are reported to decrease with age, but may persist into young adulthood.

Prevalence

- 2.6 Estimates of ADHD prevalence differ depending on the method of identifying affected individuals. A worldwide meta-analysis from 2015 gave a pooled prevalence of ADHD in children and adolescents of 7.2% (95% confidence interval [CI] 6.7% to 7.8%), based on 175 studies using Diagnostic and Statistical Manual of Mental Disorders (DSM) criteria (Thomas et al., 2015). In studies where affected individuals were identified using checklists of symptom only, prevalence estimates were on average 2% higher than if clinical interviews were used to make a formal diagnosis.
- 2.7 In the UK specifically, in 1999 in a large survey of children aged five to 15, the prevalence of ADHD using DSM-IV criteria was estimated as 3.6% in boys and 0.9% in girls (Ford et al., 2003). The prevalence of clinically diagnosed ADHD is much lower, with UK estimates of 0.19% of children aged six to 17 years having ADHD in 1998, rising to 0.55% in 2007 and then falling slightly to 0.51% by 2009 (estimates based on primary care records) (Holden, 2013).

Impact of ADHD on children and young people's education

- 2.8 Children and young people with ADHD can find educational settings particularly challenging due to the need for focus and attention. The core symptoms of ADHD (inattention and hyperactivity/impulsivity and also comorbid behavioural conditions) can lead to children displaying problem behaviour in class. For example, they may have difficulty in paying attention to instructions and focusing on tasks, instead speaking to other children or the teacher or leaving their seat at inappropriate times (Gaastra et al., 2016).
- 2.9 This can result in academic underachievement, need for special educational provision or for repeating a school year, reduced attendance, suspension or drop-out from school, or failure to progress to further education (Gaastra et al., 2016, Loe and Feldman, 2007).

- 2.10 As the symptoms of ADHD often begin early in life, the resulting academic difficulties can also start early, for example, affecting preschool age children's readiness for school (Loe and Feldman, 2007, Daley and Birchwood, 2010). While symptoms tend to become less severe with age, they can still remain to some extent into young adulthood and cause academic difficulties.
- 2.11 Affected children's behaviours can also impact on classmates, disrupting their learning and affecting classroom academic and social functioning. Teachers may struggle to manage these children without appropriate knowledge and strategies (Gaastra et al., 2016). Teachers report finding teaching children with ADHD more stressful and needing more support than children without the condition. The behaviours related to ADHD can, therefore, cause problems in educational settings for the affected pupil themselves, for teachers and other pupils (Richardson et al., 2015).

Financial implications of ADHD for the education system

- 2.12 ADHD in children and young people is associated with considerable financial costs for the educational system. The total annual cost to the NHS, social services and education system¹ of adolescents aged 12 to 18 with ADHD in the UK is estimated to be £670 million (Telford et al., 2013). Costs to the education system accounted for about 75% of these costs (approximately £507 million). The majority of these costs were for special schools, teachers and classroom support assistants in mainstream schools, and special needs statements.

The interventions: Non-pharmacological interventions in educational settings

- 2.13 Non-pharmacological interventions for those with ADHD, such as those assessed in this REA, aim to change the affected individual's behaviour directly or indirectly through cognitive and emotion-related (affective) processes. These interventions can target the affected child or young person, their parents and teachers, singly or in combination. Interventions delivered to teachers and parents usually involve training them to deliver interventions to the affected child or young person. While the child or young person's treatment takes place mainly outside of the educational setting, educational interventions also have an important role to play. For example,

¹ Educational costs included cost of special needs statements, classroom support assistants, teachers, special schools, special educational needs coordinators, meetings with school head/deputy/head of year/class, educational social worker/educational welfare officers, school counsellor, educational psychologists, and school nurses/doctors. NHS costs included GPs, community psychiatric nurses, health visitors/practice nurses, psychologists, family therapists, children and adolescent mental health services workers, and art/drama/music therapists, Average social services costs were estimated to be negligible.

even in those children who have been correctly diagnosed with and are being treated for ADHD, some level of symptoms and academic impairment may remain (Loe and Feldman, 2007). Children with undiagnosed ADHD or those who have been diagnosed but are not complying with their treatment may also require educational interventions.

2.14 A wide variety of interventions have been studied in children and young people with ADHD in educational settings (Gaastra et al., 2016, Richardson et al., 2015, DuPaul et al., 2012, McGoey et al., 2002, Cleveland and Crowe, 2013). The interventions often include a number of different components, and there is no single agreed framework among researchers for categorising these components or the resulting multicomponent interventions.

2.15 One example framework for describing components of interventions which have been studied in educational settings is shown in Annex B (Richardson et al., 2015). This framework groups intervention components into the five categories listed below.

- **Reward and punishment (contingency management):** this involves a systematic use of rewards and/or punishments to reinforce wanted behaviour(s) and/or create barriers to unwanted behaviour(s). It can be combined with the use of a daily report card, which creates a record of the student's behaviour to share with their parent or carer, to document progress towards mutually agreed goals.
- **Skills training and self-management:** in this framework this grouping is relatively broad. It includes approaches based on training the individual to be able to monitor and control their own behaviour, emotions, or thoughts, and adapt them to suit the demands of the situation (self-regulation). This can include training in academic and study skills, motivational beliefs, or use of biofeedback (using monitoring and feedback of heart rate or brain waves to help the individual improve their self-control).
- **Creative-based therapies:** such as music- and drama-based therapies.
- **Physical treatments:** such as physical activity programmes or massage.
- **Other approaches:** such as adapting the learning environment (e.g. teaching methods, tasks or classroom – such as changing seating, reducing distractions, using smaller class sizes or giving one-to-one support) (Loe and Feldman, 2007, Daley and Birchwood, 2010) to promote the wanted behaviour(s) and/or create

barriers to the unwanted behaviour(s), or simply providing information about ADHD-related topics.

- 2.16 Other evidence reviews have used different frameworks with fewer categories (DuPaul et al., 2012, Gaastra et al., 2016). These frameworks also included categories for approaches based on reward and punishment, and called these contingency management (DuPaul et al., 2012), or consequence-based approaches (Gaastra et al., 2016). They grouped self-management and reflective problem solving approaches as cognitive behavioural interventions (DuPaul et al., 2012) or self-regulation interventions (Gaastra et al., 2016), and categorised academic skills training together with adaptations to the learning environment as academic or antecedent-based interventions.

Intervention delivery

- 2.17 Different interventions are likely to require varying levels of training to deliver, and in some cases equipment. For example, biofeedback requires special equipment for monitoring e.g. brain waves, and is likely to require trained practitioners. This may limit its applicability in some educational settings where these resources are not available. On the other hand, some changes to the learning environment, such as seating students with ADHD nearer to the teacher or reading tests aloud, are likely to be more straightforward to implement and not require specific training.
- 2.18 Some approaches could potentially be delivered within the classroom setting, for example, contingency management approaches. Other approaches may require one-to-one or smaller groups outside the general classroom setting, for example, creative-based therapies or skills training and self-management sessions. Teachers or classroom assistants may be able to deliver some interventions without specialist training, for example, contingency management approaches or some adaptations to the learning environment. However, other approaches will require either training for the teachers or classroom assistants to deliver, or delivery by specialist professionals such as psychologists (for example, emotional skills training).
- 2.19 Certain intervention approaches may be more suited to certain age groups than others, or may require tailoring to different age groups. For example, use of contingency management approaches and daily report cards may be more appropriate for younger age groups than older age groups. Age-dependent adaptations to interventions could include, for example, delivering shorter training or therapy sessions for younger children (McGoey et al., 2002)

National recommendations on educational support for children and young people with ADHD

- 2.20 The National Institute for Health and Care Excellence (NICE) has produced a guideline on the diagnosis and management of ADHD which was last updated in 2016. The guideline is in the process of being updated and the revised version is expected to be published in February 2018².
- 2.21 The current guideline is based on a systematic review undertaken by the National Collaborating Centre for Mental Health (NCCMH) (National Collaborating Centre for Mental Health, 2009). This review is part of the evidence included in this REA, and is described in greater detail in the Findings Chapter. The NICE guideline touches on the role of teachers and educational interventions in ADHD management, and these aspects of the guideline are summarised below.
- 2.22 The NICE guideline highlights the importance of communication and coordination between parents and/or carers and professionals involved in the child's care.
- 2.23 The guideline recommends local multi-agency groups should be set up with multidisciplinary representatives from groups with significant local involvement in ADHD services, including education, social services and mental health and learning disability trusts among others. These groups should, among other things:
- oversee the implementation of the NICE guideline
 - start and coordinate local training initiatives, including the provision of training and information for teachers about the characteristics of ADHD and its basic behavioural management
 - oversee the development and organisation of parent-training/education programmes (National Institute for Health and Care Excellence, 2008).
- 2.24 The guideline recommends that following a diagnosis of ADHD in a child or young person, healthcare professionals should, with the parents' or carers' consent, contact their teachers to explain:
- the diagnosis and severity of symptoms and impairment
 - the care plan
 - any special educational needs (National Institute for Health and Care Excellence, 2008).

² Project information available at: <https://www.nice.org.uk/guidance/indevelopment/gid-cgwave0798> (last accessed 18 October 2017)

- 2.25 In addition, when parents or carers of a child or young person with ADHD and moderate impairment take part in parent training/education programmes, the guideline suggests the professional delivering the sessions should consider contacting the school and providing the child or young person's teacher with written information on the areas of behavioural management covered in these sessions, as long as the parents or carers consent.
- 2.26 No additional recommended actions on the part of nursery or preschool teachers are specified in the guideline. For school age children and young people with moderate or severe impairment, the guideline recommends teachers who have received training about ADHD and its management should provide suitable and appropriate behavioural interventions in the classroom.
- 2.27 Group treatment programmes (cognitive behavioural therapy [CBT] and/or social skills training) are also recommended for children or young people with ADHD. NICE suggest a range of topics and approaches should be targeted for improvement, including social skills with peers, problem solving, self-control, listening skills and dealing with and expressing feelings. Active learning strategies should be used and rewards given for achieving key elements of learning. While these recommended programmes are not specified for a school setting, these topics and principles could also be considered by teachers and schools in supporting children and young people with ADHD.
- 2.28 There has been research on the effect of diet on ADHD symptoms, for example, the effects of certain food additives and colourants, or certain fatty acids. As a result it may be an area of interest to parents and could potentially be an area which could be targeted by schools which provide school meals. However, the NICE guideline on ADHD states the following:
- elimination of artificial colouring and additives from the diet should not be advised as a generally applicable treatment for children and young people with ADHD
 - dietary fatty acid supplementation should not be offered or advised for treating ADHD in children and young people
 - family members or carers of children with ADHD should be advised there is no evidence about the long-term effectiveness or potential harms of a 'few food' diet for children with ADHD, and only limited evidence of short term benefits.

- 2.29 The guideline does note that a balanced diet and good nutrition is important for children and young people with ADHD, and that a child may see a dietician if a food diary supports a link between diet and behaviour. On this basis, schools offering school meals do not need to take any further action to support those with ADHD beyond the usual efforts to provide a balanced diet and good nutrition, except in cases where the child has specific recommendation for dietary intervention from their healthcare professionals.
- 2.30 The Scottish Intercollegiate Guidelines Network (SIGN) guideline on the management of attention deficit and hyperkinetic disorders (HKD) in children and young people recommends that children with ADHD/HKD require an individualised school intervention programme including behavioural and educational interventions (Scottish Intercollegiate Guidelines Network, 2009).
- 2.31 The systematic review carried out to inform the development of the SIGN guideline on ADHD also provides some potentially useful additional information on implementing interventions in schools. The review is not included in the main analysis in this REA as it is a relatively old review (searches conducted in 2009), including only three older studies (all published before 2000) and providing limited details of these studies.
- 2.32 One meta-analysis included in the SIGN review found that contingency management strategies and academic interventions were more effective for behaviour outcomes than cognitive behavioural strategies (DuPaul and Eckert, 1997). The first author of this meta-analysis also authored a more recent review on school-based interventions which has been included in the main analysis of this REA (DuPaul et al., 2012).
- 2.33 The SIGN review also suggests that behavioural interventions normally have a short term effect on the targeted behaviours in children, but that this will often end as soon as the intervention stops (Scottish Intercollegiate Guidelines Network, 2009). One study was cited by the SIGN review to suggest that smaller class size, use of resource rooms versus regular classrooms, direct versus indirect instruction, and whole class engagement have resulted in increased levels of concentration among students with ADHD (Abramowitz and O'Leary, 1991). This study was classified by SIGN as a well conducted case control or cohort study with a low risk of confounding or bias and a moderate probability that the relationship is causal. However, no further information was available about the design or results, on which to base an assessment of their robustness.

3. Methodology

Aim and purpose

- 3.1 The aim of the project is to provide an assessment of the extent to which interventions are effective in supporting children and young people with ADHD in educational settings.
- 3.2 The purpose of the assessment is to facilitate the planning and delivery of timely and effective interventions to support children and young people with ASD.

Objectives

- 3.3 The specific objectives to meet the aim involve:
- undertake an assessment to broaden the understanding of the support needs of learners with ADHD and identify interventions to support those children and young people
 - determine the extent to which the interventions are effective
 - identify the most effective interventions for children and young people with ADHD at various stages in their learning.

Design and approach of the REA

- 3.4 The key elements in the design and approach of this REA were as follows:
- agreement of scope
 - development of the search strategy
 - initial database searches for relevant studies
 - agreement of a shortlist of relevant studies
 - review of studies
 - synthesis of evidence.

Scope of the REA

- 3.5 A number of meetings were held with the Welsh Government project team to agree the full scope of this REA and to agree the search strategy and search terms for inclusion. It was agreed this REA would incorporate a search strategy that prioritised study designs which would provide the highest quality and most robust literature about the effectiveness of school-based interventions according to the hierarchy of evidence that was initially developed in the context of evidence-based

medicine, namely systematic reviews and randomised controlled trials (Guyatt et al., 1995, Greenhalgh, 1997). While an approach that looked for these types of literature might limit the number of results returned, it was agreed this approach was still likely to allow for coverage of a broad range of interventions, whilst staying within the REA timescale and focusing on the best available evidence.

- 3.6 Table 3.1 describes the agreed scope for the REA in terms of the population, interventions and outcomes of interest, together with included study designs. As a recent high quality systematic review was identified which covered a broad range of school-based interventions for ADHD (Richardson et al., 2015), it was agreed that the search for RCTs was to only include studies published after the search date of that study (2013).

Table 3.1: Scope of the rapid evidence assessment

Domain	Inclusions	Exclusions
Population	Children and young people aged between 0 and 25 with diagnosed or suspected ADHD in educational settings	Studies solely in adults aged above 25
Interventions	Any intervention delivered in an educational setting such as schools by teachers, teaching assistants or visiting health staff	Any intervention delivered in residential treatment programmes, laboratory, hospital or prison settings
Measures	Any outcome measures, such as: <ul style="list-style-type: none"> • behaviour (in the educational setting) • learning outcomes • educational attainment • scholastic behaviours (e.g. perception of scholastic adjustment) • attendance • wellbeing • ADHD symptoms (i.e. inattention, hyperactivity/impulsivity) • ADHD-related symptoms (i.e. externalising, internalising and social skills) and standardised achievement and curriculum achievement. 	Studies which did not quantitatively assess the impact of the interventions. Studies were not excluded on the basis of which outcomes they assessed.
Study types	To inform on the types of interventions in use (and to identify underlying reviews): <ul style="list-style-type: none"> • evidence-based policy documents • evidence-based guidelines. To assess evidence of effectiveness: <ul style="list-style-type: none"> • systematic reviews • randomised (including cluster randomised) and quasi-randomised controlled trials. 	Studies which were: <ul style="list-style-type: none"> • animal studies • case series • case reports • non-comparative studies • conference abstracts • editorials • letters • opinion pieces • ecological studies.

Systematic search and sift

3.7 It was agreed the searches of the electronic databases listed below would be limited to systematic reviews published between 2000 to April 2017 and RCTs published from 2013 to April 2017 using combinations of the agreed topic terms and text words.

- 3.8 Various search approaches (e.g. different combinations of search terms and use of filters) were tested to develop a strategy with the optimal balance of sensitivity and specificity, meaning sufficient depth and breadth in the context of a rapid evidence assessment. Welsh language terms for ADHD were tested in the database searches; however, as they did not identify additional studies, they were not included in the final search strategies, i.e. the only studies identified were in the English language.
- 3.9 The validated SIGN³ methodological study type filters for systematic reviews and RCTs were used.
- 3.10 Discussions were held about which databases were to be included and to ensure that a comprehensive range of topic areas were covered across a number of disciplines. The databases searched for this REA were as follows:
- Embase (Excerpta Medica Database)
 - MEDLINE
 - PsycINFO
 - Cochrane Library databases
 - Education Resources Information Centre (ERIC) database
 - Education Research Complete (ERC) database
 - NICE Evidence Search.
- 3.11 Supplementary search techniques were used including: forward and backwards citation chasing, website searching of known research institutes, key author tracking and targeted Google searches to fill gaps. In addition, websites focusing on teaching children with ADHD were searched for relevant studies.
- 3.12 The search focused on using terms around the educational setting rather than terms linked to individual interventions. This approach was taken to allow identification of any potentially relevant interventions conducted in this setting, rather than biasing the search towards identification of only known and named interventions. An initial sift of the search was carried out at the title and abstract level to remove any clearly non-relevant material. A second more detailed sift was carried out to identify the studies which appeared most relevant to the REA scope (based on the criteria in

³ SIGN methodological search filters are available at: <http://www.sign.ac.uk/search-filters.html> (last accessed 18th October 2017)

Table 3.1). These studies were then assessed at full text to identify the final inclusions. Each stage of study assessment was carried out by a single analyst, with any queries resolved by discussion with a senior analyst.

- 3.13 A decision was made to include a brief description of selected studies that did not fulfil the inclusion criteria, but described interventions that were of potential interest for use for young people with ADHD.

Data extraction, quality assessment and synthesis

- 3.14 All included studies were critically appraised and quality assessed using the validated quality check lists from the Critical Appraisal Skills Programme (CASP)⁴. We removed the question on whether benefits are worth the harms and costs as an assessment of cost effectiveness was beyond the scope of this REA. Data from the included studies was extracted into evidence tables. Studies were synthesised narratively. Where studies comparing two groups utilised effect sizes, these were interpreted using the following rules of thumb from Cohen: 0.2 to <0.5 small, 0.5 to <0.8 medium, ≥ 0.8 large (Cohen, 1992). This measure is effectively how many times bigger the size of the difference between groups is than the standard deviation (a measure of the spread) of measurements. It provides a standard measure which can be compared between studies and pooled across different outcome scales used in different studies.
- 3.15 There are no similar standardised guidelines for interpreting effect sizes for within subject and single subject study designs, or comparing these effect sizes with from between-group study designs (Richardson et al., 2015). The same rules of thumb as for Cohen's effect sizes (described above) are utilised to give a sense of magnitude of effect in these non-RCT studies this REA, but these should be interpreted cautiously.

⁴ Available at: <http://www.casp-uk.net/casp-tools-checklists> (last accessed 11 October 2017)

4. Findings

Description of the included evidence

- 4.1 Following the data extraction and quality assessment seven systematic reviews and four RCTs were included for the evidence synthesis stage.
- 4.2 A summary of included studies is in table 4.1 grouped according to the stage of education they covered (stages are classified according to the UK educational system stages).

Table 4.1: Summary of studies included

Authors (Year)	Study design (included studies and/or participants)	Intervention(s)	Country(ies) in which primary studies were conducted
Preschool			
McGoey et al., (2002)	Systematic review, search date 2000 (9 single subject or within subjects designs, n=24)	Behavioural interventions	Not reported
Charach et al., (2013)	Systematic review, search date 2011 (5 studies: 3 RCTs, 2 cohort studies, n=601)	Behavioural interventions	Not reported
Primary school			
Hoza et al., (2014)	RCT (n=202, including 94 at risk of ADHD)	Before school physical activity or sedentary (art in classroom) activity	USA
Primary and secondary school			
Richardson et al., (2015)	Systematic review, search date 2013 (54 studies: 39 RCTs, 15 non-randomised controlled trials, n=1,751)	Any school-based interventions, categorised into: <ul style="list-style-type: none"> • reward and punishment • skills training and self-management • creative-based therapy • physical treatment • other approaches. 	North America (44) Netherlands (1) Sweden (1) Italy (1) Spain (3) Asia (2) Africa (1) New Zealand (1)

Primary and secondary school (continued)			
DuPaul et al., (2012)	Systematic review, search date 2010 (60 studies: 4 between group design, 17 within subjects design, 39 single subject design, n=1,576)	Any school-based interventions, categorised into: <ul style="list-style-type: none"> • academic interventions (antecedent-based) • contingency management (reward and punishment) • cognitive behavioural (skills training and self-management). 	Not reported
Gaastra et al., (2016)	Systematic review, search date 2013 (100 studies: 24 within subjects design, 76 single subject design, n=627)	Classroom interventions, categorised into: <ul style="list-style-type: none"> • antecedent-based interventions • consequence-based interventions • self-regulation interventions. 	Not reported
National Collaborating Centre for Mental Health (2009)	Systematic review, search date 2006/2007 (6 RCTs, n=26,117)	Educational interventions, including: <ul style="list-style-type: none"> • screening for ADHD in educational settings • teacher advice • teacher-led interventions • teacher training on ADHD • multicomponent intervention including teacher training. 	England (1) USA (4) Canada (1)
Spiel et al., (2016)	RCT (n=36, including 16 with or at risk of ADHD)	Having tests read aloud	USA
Secondary school			
Evans et al., (2014)	RCT (n=24)	Multicomponent school-based intervention	USA
Post-secondary school			
Cleveland and Crowe (2013)	Systematic review, search date 2011 (11 studies, number of participants unclear*)	Cognitive and meta-cognitive interventions	Not reported
Fleming et al., (2015)	RCT (n=33)	Dialectical behaviour therapy	USA

*Information may be contained in the tables of this paper, which were not available to the REA authors.

- 4.3 Most of the included systematic reviews were of moderate to high quality. The most robust and comprehensive review was the recent review was the HTA by Richardson et al., (2015). One review was considered low quality as only very limited details of its methods and findings could be obtained by the authors of this REA despite efforts to procure additional information (Cleveland and Crowe, 2013, DuPaul et al., 2012).
- 4.4 The quality of the studies included in the reviews varied. The reviews by Richardson et al., (2015), the NCCMH (2009) and Charach et al., (2013) included only controlled studies (both those using randomisation and those not), and even for these studies the methodological quality was rated by the authors as mostly low to moderate. The other reviews included less robust evidence. They were generally smaller studies with mainly non-RCT designs, many of which were studies that did not include a control group or assessed outcomes only in single individuals (single subject design). In three of the reviews the quality of the included studies was not formally assessed (Cleveland and Crowe, 2013, McGoey et al., 2002, DuPaul et al., 2012).
- 4.5 Some of the reviews focused on specific age groups or settings such as preschoolers or those in post-secondary education (McGoey et al., 2002, Charach et al., 2013, Cleveland and Crowe, 2013). Others focused on a narrower subset of outcomes such as off-task and disruptive behaviour (Gaastra et al., 2016). However, there was overlap in the questions the reviews address, which meant that there was overlap in the studies they included.
- 4.6 The studies tested a wide variety of school-based interventions, which were often multifaceted in nature, and the reviews grouped them in differing ways (see Table 4.1). There was also little standardisation across the studies in terms of the measurement tools used to assess outcomes. This heterogeneity complicates interpretation and synthesis.
- 4.7 Duration of the interventions varied widely, ranging from a week to three years in the studies included in the UK HTA (Richardson et al., 2015). Most studies did not carry out follow up after the intervention completed to assess outcomes (for example, about three quarters of the studies included in the UK HTA and the additional RCTs included in this REA did not). The reviews did not tend to differentiate between results at the end of the intervention and those at follow-up, therefore the durability of any effects after the end of the interventions was unclear.

- 4.8 Outcomes assessed in the studies included mainly teacher and parent ratings of ADHD symptoms and related symptoms and behaviour, as well as some education-related outcomes such as test scores. None of the included studies assessed broader outcomes such as school or college attendance, or achieving employment.
- 4.9 One of the additional RCTs was rated as high quality, and the other three as moderate quality. However, they were quite small, with between 16 and 94 participants either with, or at risk of, ADHD. This small size is likely to have reduced the ability of these studies to detect differences between groups. Two of the RCTs were pilot RCTs, used to assess feasibility and acceptability and give an initial indication of effectiveness of the interventions (Fleming et al., 2015, Evans et al., 2014). Two of the RCTs (Hoza et al., 2015, Spiel et al., 2016) included some children who did not have ADHD for comparison with those who did. Only one of four RCTs (Fleming et al., 2015) used blinded study personnel (i.e. who did not know which intervention each participant had received) to administer outcome measure assessments, but as it was the participants themselves who responded to the measures in this study, this blinding is unlikely to have prevented biased responses.

Key findings from the systematic reviews

Richardson et al., (2015)

- 4.10 This high quality systematic review assessed the effectiveness of non-pharmacological interventions for ADHD in educational settings for children and young people aged between four and 18 years old (Richardson et al., 2015). This review was part of a wider HTA, which also included three complementary reviews summarising the findings of studies looking at the attitudes and experiences of pupils, parents and teachers towards ADHD and non-pharmacological interventions for ADHD in school settings. This REA focuses on the effectiveness review (review 1 of the four reviews) as this is most relevant for the questions being addressed.
- 4.11 The effectiveness review (review 1) included 54 relevant studies, of which 39 were RCTs (including 47 intervention groups) and 15 non-RCTs (including 17 intervention groups) (Richardson et al., 2015). School-based non-pharmacological interventions were compared with either: treatment as usual/waiting list (in 28 RCTs), a time/contact matched inactive control (in eight RCTs), or a partial intervention (in three RCTs). Interventions were delivered over a period of between about one week

and three years, and included between just under half an hour to 243 hours of actual delivery time.

- 4.12 The interventions being assessed by the included studies comprised between one and six different component approaches (defined in Annex B). Over half (58%) of interventions used more than one component approach. The most commonly used approach across the RCTs and non-RCTs was contingency management, which was used in 41% of the interventions. This was followed by cognitive behavioural self-regulation training and academic/study skills training, both of which were used in 27% of the interventions. The least commonly used approaches were play therapy, massage, structured physical activity, or provision of information only, which were each used in 2% of interventions. (See Annex B for frequencies of use of all of the intervention components.)
- 4.13 Most of the interventions (78%) were delivered in school only; the remainder included a home-based aspect. In 59% of the studies the person delivering the intervention was given training to do so; in the remainder of studies training was not mentioned. The intervention was delivered by teachers alone in 33% of cases, university students or researchers alone in 23%, school mental health providers alone in 9%, and other practitioners in 9% (not specified further). The remaining interventions were delivered by combinations of these individuals (11%), or the provider was not reported (14%).
- 4.14 Almost half (44%) of the interventions were reported to have been delivered at least partly in a classroom, for the remaining interventions the delivery setting was not described (36%), or they were delivered in other school rooms such as gyms or music rooms (20%). Just under half of the studies (48%) delivered at least part of the intervention(s) to the child individually, and/or as part of a group (44%), with about a quarter (26%) delivered at least in part to the whole class (some interventions were delivered in more than one of these formats).
- 4.15 The majority of the included studies were performed in the USA and sample sizes were small - averaging at about 45 participants (range six to 119). The majority of participants were male (mean 74%).
- 4.16 In 28 (52%) of the included studies, at least some of the participants (range 7% of 100% of participants where reported) were on medication for ADHD, while 11 studies (20%) included no participants on medication and 15 studies (28%) did not specify medication usage. Most of the studies (74%) solely included

elementary/primary school children but there were also studies of children and young people in preschool (2%), middle school (17%), and high school (4%) or a mixture of these settings (4%). None of the included studies were explicitly reported as being carried out in a setting such as a special school or pupil referral unit.

- 4.17 Richardson et al., (2015) appraised the quality of the included studies using pre-set criteria (addressing selection bias, detection bias, attrition bias, and use and length of follow-up), and concluded their quality was generally low. The authors noted their review included more controlled trials than previous reviews and meta-analyses, and therefore study quality had improved. However, there were still methodological weaknesses in the included studies. For example, only ten of the 39 RCTs (26%) adequately described their randomisation methods, and only one RCT (3%) made a good attempt at allocation concealment. Few studies adjusted results for baseline differences. Only about a fifth of studies (19%) used blinded assessment of at least one outcome measure. Only about a quarter (26%) assessed follow-up outcomes, which took place between two weeks and two years after the post-intervention assessment.
- 4.18 The review meta-analysed all of the interventions together rather than by intervention type, to also carried out a statistical analysis which aimed to attempt to identify any specific intervention features associated with improvement in outcomes. It grouped results into: core ADHD symptoms, ADHD related symptoms, and scholastic behaviours and outcomes. For each of these three areas, they pooled the results separately according to who provided the information – the child themselves (sometimes through neurocognitive assessment), parents, teachers, or independent (blinded) observers.
- 4.19 In terms of core ADHD symptoms, the meta-analysis of RCTs showed that school-based interventions provided a small to medium improvement in inattention as assessed in neurocognitive tests (effect size [Cohen's d with Hedges' correction, d^+] = 0.44, 95% CI 0.18 to 0.70; $p = 0.001$) and as rated by teachers ($d^+ = 0.60$, 95% CI 0.14 to 1.06; $p = 0.01$). There was no significant effect on inattention as rated by parents or independent observers.
- 4.20 School-based interventions provided a small improvement in hyperactivity/impulsivity as assessed in neurocognitive tests ($d^+ = 0.33$, 95% CI 0.13 to 0.53; $p = 0.001$), but there was no significant effect on this outcome when it

was assessed by parents or teachers. There was also no effect on combined measures of ADHD symptoms as assessed by parents or teachers.

- 4.21 In terms of ADHD-related symptoms, teachers (but not parents) reported a small benefit from school-based interventions for externalising symptoms ($d+ = 0.28$, 95% CI 0.04 to 0.53; $p = 0.03$), but. There was no significant impact on internalising symptoms or social skills as assessed by parents, teachers, or the affected child.
- 4.22 In terms of scholastic behaviours and outcomes, there was evidence of a small beneficial effect of the school-based interventions on teacher-rated perceptions of scholastic adjustment ($d+ = 0.26$, 95% CI 0.05 to 0.47; $p = 0.02$), but no significant impact on this outcome as rated by the parents or affected children.
- 4.23 In terms of objective outcomes, there was a very small benefit on standardised achievement tests ($d+ = 0.19$, 95% CI 0.04 to 0.35; $p = 0.02$), but no statistically significant impact on curriculum achievement.
- 4.24 Results from meta-analysis of the non-RCTs also found benefit for ‘inattention’ assessed by neurocognitive assessment of the affected children and also as rated by teachers, but otherwise there was no overlap in the findings of the meta-analysed RCTs and non-RCTs. However, there were too few meta-analysed non-RCTs to enable a reliable comparison.
- 4.25 Ten of the included studies (seven RCTs and three non-RCTs) could not be included in the meta-analysis, and in these studies most outcomes assessed showed no significant effect of the interventions. Even where there was significant improvement in an outcome in one study this was not consistent across studies.
- 4.26 The review carried out meta-regression to try and identify the “active ingredients” of the interventions, as well as the impact of other factors such as the length of the intervention. There was some weak indication that interventions not including social skills training ($p=0.06$), and shorter interventions ($p=0.04$) might be more effective for improving teacher-rated perception of school adjustment. However, these findings should be treated with caution given that these links were only found for one of the many outcomes assessed in the meta-regression, and that relatively few studies of mostly low quality were included in this analysis. In addition, the impact of such factors could be related to other contextual issues such as the age of the target population and the severity of their ADHD.

4.27 The following sections first describe the key findings from individual systematic reviews and RCTs, and then summarise their results by intervention type and outcome. Key meta-analytical findings from the included reviews are summarised in Table 4.2 at the end of this Chapter. A summary of the critical appraisal of study quality can be found in Annex C.

Gaastra et al., (2016)

4.28 This moderate quality systematic review assessed the literature on the effects of classroom interventions for off-task and disruptive classroom behaviour in children and young people (aged six to 18 years) with symptoms of ADHD (Gaastra et al., 2016). The review included 100 studies and the authors classified interventions into the four categories listed below.

- **Consequence-based interventions:** interventions that use reinforcement and punishment to alter the frequency of target behaviour (e.g., praise, reprimands, prizes, privileges). Equivalent to the contingency management approach described in the Richardson et al., (2015) review. Thirty three studies used this type of intervention.
- **Self-regulation interventions:** interventions aimed at the development of self-control and problem-solving skills to regulate cognition and behaviour (e.g., self-instruction, self-monitoring, self-reinforcement). This category is similar to the self-management category of interventions as described in the Richardson et al., (2015) review, particularly cognitive-behavioural self-regulation training. Thirty one studies used this type of intervention.
- **Antecedent-based interventions:** interventions that manipulate the conditions which precede and potentially influence a child's behaviour, such as the environment, task, or instruction (e.g., seating, music, tutoring, choice making, computer-assisted instruction). These types of interventions are similar to some of the packages defined in the Richardson et al., (2015) review, such as adaptations to the learning environment and music therapy. Twenty six studies used this type of intervention.
- **Combined interventions:** ten studies used interventions combining more than one of the approaches described above.

- 4.29 The studies included a total of 627 participants, 76 of studies were single subject design (SSD, n=156 participants)⁵ and 24 were within subjects design (WSD, n=471 participants)⁶ (Gaastra et al., 2016). Two thirds of the WSD studies (16 out of 24) did not have a control group; the remaining third (eight out of 24) had a control group of participants who did not receive the intervention. It was unclear whether groups were assigned at random in the controlled studies. In the SSD studies, participants act as their own controls during periods of no intervention. Overall, this evidence base is less robust than in the review by Richardson et al., (2015) as the included study designs are more prone to bias than RCTs as they are more subject to confounding. As a result, the findings should be considered with caution.
- 4.30 Sample sizes were fairly small, ranging from one to 65, and most of the participants were male (74 of the studies included at least 81% males). As in the Richardson et al., (2015) review, studies varied in the proportion of participants who were receiving medication for ADHD: in 40% of studies at least 20% of participants were receiving medication, in 33% of studies it was less than 20%, and medication use not specified in the remaining 27% of studies. Most studies were of primary school age children (six to 11 years, 84%) and 16% were of young people of secondary school age.
- 4.31 The review focused specifically on interventions which were delivered (or could be delivered) by teachers in the classroom, and excluded any which required parental involvement. The most commonly used interventions in the included studies were consequence-based (33%), followed by self-regulation interventions (31%), antecedent-based interventions (26%) and combined interventions (10%).
- 4.32 The review assessed the quality of the included studies and mainly rated the WSD studies as weak (83%; 8% rated strong and 8% adequate) and the SSD studies as adequate (54%; 3% rated strong and 43% weak). The lack of a control group in most of these studies limits ability to draw robust conclusions about the effectiveness of the interventions being assessed.

⁵ SSD involve comparing outcomes for each participant individually whilst receiving the intervention and whilst not receiving the intervention. Each SSD study usually only assesses a very small number of participants.

⁶ Within subjects designs involve more than one participant and assess their outcomes on at least two occasions, usually before and after the intervention. They may include a control group who are assessed at the same time points as the intervention group.

- 4.33 The review did not clearly report whether any of the WSD studies with control groups were RCTs. However, 8.3% were reported to show “evidence” of random assignment. For those WSD studies without a control group a “fictive” control group was imputed with a standardised mean change in outcome of zero. This approach effectively assumes the participants’ behaviour would not change from baseline if untreated, which may not be correct. A quarter of the WSD studies, and about 4% of SSDs were reported to have used blinded outcome raters.
- 4.34 The review pooled measures of off-task and disruptive behaviour in its meta-analyses, but meta-analysed the different study types separately. The WSD and SSD studies found a medium to large reduction in off-task and disruptive behaviour with classroom interventions (WSD studies: SMD 0.92, 95% CI 0.59 to 1.25; SSD studies: SMD 3.08).
- 4.35 In the WSD studies consequence-based interventions produced larger effects (SMD 1.82, 95% CI 1.39 to 2.24) than self-regulation (0.56, 95% CI 0.02 to 1.11), antecedent-based (0.31, 95% CI 0.06 to 0.55), or combined interventions (0.58, 95% CI 0.07 to 1.08). The order was slightly different for the SSD studies, with the largest effect sizes for self-regulation interventions (SMD 3.61) and smallest for consequence-based interventions (SMD 2.47). As the SSD studies’ effect sizes come from single individuals, they cannot provide an estimate of how effects vary across the population and whether the effects are statistically significant. This limits the conclusions which can be drawn from these studies.
- 4.36 For studies of the WSD the mean weighted effect of school-based interventions on off-task or disruptive behaviour appeared large. However, its calculation assumed that in the studies without a control group, if such a group had existed, the change in outcomes would have been zero. This assumption is not likely to be correct, as outcomes such as ADHD symptoms and behaviour may change over time for reasons unrelated to the intervention being tested. For example, due to changes in the affected students’ ADHD medication usage, events at home or school, or the student’s development with age.
- 4.37 There were larger effects for interventions implemented in general education classrooms (WSD studies: SMD 1.30, 95% CI 0.82 to 1.78; SSD studies: 3.58) than in other classroom settings (SMD for: WSD studies 0.64, 95% CI 0.26 to 1.02; SSD studies: 2.41). The exact other classroom settings used in the included studies were not reported, but the authors defined this category as including special education,

self-contained, resource, remedial, experimental, laboratory, or hospital classrooms. This may reflect that children are placed in these other classroom settings due to being more severely affected by ADHD, and therefore interventions may not be as effective. Therefore, these results should not be interpreted to mean that any intervention will be more effective if performed in a mainstream classroom setting.

- 4.38 There was no clear evidence that age, gender, medication use or outcome-rater influenced results, due to limited power in the included studies. This may have been due to the relatively small size of studies resulting in a lack of power.
- 4.39 Ten studies included in the review (four WSD, six SSD studies; n ranged from three to the entire class (not further defined)) looked at direct and indirect effects of the classroom interventions on classmates of the children with ADHD. Direct effects were where the entire class received the intervention (e.g. where music was played in the background), and indirect where classmates did not receive the intervention themselves.
- 4.40 These studies evaluated a range of intervention types: antecedent-based (e.g. having music in the background, classwide peer-tutoring, using a formal rather than informal classroom setting, using stability balls, or use of recess), self-regulation (e.g. self-management procedures – some classwide or with peer monitoring), consequence-based (teacher-administered classwide reinforcement), or combined interventions (skills training plus self-monitoring plus differential reinforcement).
- 4.41 The studies had mixed findings. Three of the WSD studies found no direct impact of various antecedent-based interventions on off-task behaviour, teacher-rated ADHD symptoms, or academic performance of the classmates. One WSD study found that a formal classroom setting significantly reduced hyperactive behaviour in classmates (SMD 1.97, 95% CI 0.60 to 3.34). Five of the SSDs found improvements (direct or indirect) in various outcomes among classmates: uncontrolled verbalisation (not further defined SMD 2.53), inappropriate behaviour (SMD 1.96), off-task or disruptive behaviour (34% to 52% reduction), on-task behaviour (SMD 1.46) and academic productivity (6% increase, not further defined). One of the SSDs found a small (2%) worsening in on-task behaviour among classmates.
- 4.42 However, there was no statistical assessment of these changes in the SSDs, and there were no control groups. This means it is not possible to be certain that the changes seen were due to the interventions themselves, rather than chance or the

children's development over time. In addition, it was unclear whether these outcomes were assessed by independent blinded observers.

DuPaul et al., (2012)

- 4.43 This moderate quality review aimed to assess the impact of school-based interventions for students with ADHD (from about age five to 18 years) in studies carried out between 1996 and 2010 (DuPaul et al., 2012). It grouped interventions into academic, contingency management and cognitive behavioural interventions. It defined academic interventions as focusing mainly on changing antecedent conditions such as method of instruction (e.g. using peer tutoring or computer aided instruction), or academic materials or approaches (e.g. organisational skills interventions). This overlaps with the antecedent-based category described by Gaastra et al., (2016) and also with the academic and study skills training approach described by Richardson et al., (2015).
- 4.44 Du Paul et al., (2012) defined cognitive behavioural interventions as those which focused on regulating behaviour through the development of self-control skills (e.g. using cognitive rehearsal, self-instruction), and reflective problem solving strategies (e.g. self-management, self-reinforcement). This overlaps with the self-management approaches described by Richardson et al, particularly cognitive-behavioural self-regulation training, and with the self-regulation category described by Gaastra et al., (2016).
- 4.45 The review included 60 studies, four of these were between group design (BGD, i.e. included a no intervention control group), 17 were WSD (some of which included a control group) and 39 were SSD (DuPaul et al., 2012). A quarter of the included studies (25%) were reported to use a control group (receiving no intervention), but most (75%) did not. A fifth of included studies (20%) were reported to use random allocation of participants and 8% non-random allocation, while randomisation was reported as not being applicable for 72% due to their study design.
- 4.46 A total of 1,576 participants were included in the studies and most were male (48% of studies included males only, 3% included females only, and 45% were mixed). Most studies (72%) were carried out in elementary school (typically ages four to 12 years), 20% in middle school (typically ages 12 to 15 years), none in high school alone (typically ages 15 to 18) and 8% in a mixture of these levels. In most of the studies (75%) at least some participants were receiving medication (where this information was provided), although the proportion varied. In 30% of studies

medication status changed during the study for some participants – which could impact on their outcomes. This could mean the results of these studies may reflect changes in medication and not of the intervention itself.

- 4.47 The most commonly used intervention approach in the studies was contingency management (43%), with the next most common being academic interventions (25%), then cognitive behavioural interventions (15%), and 17% used interventions which combined different approaches. Average intervention length was 10 weeks. The majority of studies (80%) did not conduct follow-up assessments after assessing outcome at the end of the intervention.
- 4.48 The review pooled measures of behavioural outcomes, which could include a variety of outcomes such as off-task behaviour, social behaviour, or rule breaking. There was no significant effect of school-based interventions overall in the three BGD studies which assessed behavioural outcomes. This may have been due to the small size of the studies (total n=57).
- 4.49 Overall, school-based interventions had a medium (approaching large) sized effect on behaviour in the WSDs (15 studies, effect size 0.72, 95% CI 0.13 to 1.30). When looking by intervention type, contingency management and academic interventions alone or combined each had medium to large effect sizes, but none reached statistical significance on its own, likely to be due to the reduction in sample size from separating the trials.
- 4.50 In terms of academic outcomes, again there was no significant effect of school-based interventions overall in the two small BSD studies (n=35). Overall, in WSD studies (10 studies) school-based interventions had a small (approaching medium sized) effect on academic outcomes (effect size 0.42, 95% CI 0.09 to 0.93). When looking by intervention type, academic interventions and academic plus contingency management interventions had larger effects (effect sizes 0.56 and 0.53 respectively, medium sized effects) than contingency management alone (effect size 0.24, small effect, $p < 0.001$ for difference between the groupings). However, only the result for contingency management alone was statistically significant (effect size 0.24, 95% CI 0.02 to 0.46), potentially due to the greater number of studies in this grouping leading to increased power in the analysis.
- 4.51 Published studies had a higher mean effect sizes than unpublished studies or dissertations/theses for both outcomes, suggesting possible publication bias (i.e. that there might be unpublished studies with smaller or no effect).

- 4.52 Similar results were found when pooling the studies looking at the impact of the interventions in single individuals (SSD studies), with large effects of educational interventions as a whole for behaviour (effect size 2.20, 95% CI 0.81 to 3.59) and academic outcomes (effect size 3.48, 95% CI 1.77 to 5.20). Their findings also suggested that academic interventions (alone or combined with contingency management) were associated with greater effects on academic outcomes, and cognitive behavioural interventions with greater effects on behaviour outcomes. However, given the nature of this study design (its small size and lack of a control group) these results should be interpreted with caution.
- 4.53 This review concluded that school-based interventions for students with ADHD have a “moderate to large” effect for behavioural and academic outcomes.
- National Collaborating Centre for Mental Health (NCCMH) (2009)*
- 4.54 This high quality systematic review assessed whether teacher-delivered educational interventions for children and young people aged three years or over with ADHD impacted on outcomes such as the affected individual’s behaviour in classroom, academic achievement and progress, attitude to school, self-esteem, employment or teachers’ quality of life (National Collaborating Centre for Mental Health, 2009). This systematic review (which also covered non-education-based interventions) was part of the supporting evidence used in the development of the NICE guideline on ADHD.
- 4.55 It included six RCTs involving 26,111 participants (the vast majority (25,482 children) included in one large RCT in England) (National Collaborating Centre for Mental Health, 2009). The interventions assessed in the RCTs were: screening for ADHD in educational settings (one RCT), teacher advice on ADHD (three RCTs), teacher-led interventions (one RCT), teacher training on ADHD and behavioural management (two RCTs), and multicomponent interventions including teacher training (three RCTs) versus either no intervention or another intervention. The included evidence was generally rated as being of moderate quality, except the multicomponent teacher training RCTs which were rated as low to moderate.
- 4.56 The RCTs all included participants of a primary school age (aged four years to about 10 years) and participants were predominantly male (78% in studies where this was reported). Interventions lasted from 10 weeks to five years. Medication usage in the RCTs was not reported. The outcomes assessed by the included

studies were ADHD core symptoms, ADHD related symptoms such as conduct problems, and academic outcomes.

- 4.57 One large RCT (n=25,482) carried out in England found that screening for ADHD in primary schools did not have a significant impact on teacher-rated ADHD core symptoms, or children's performance in mathematics or reading compared to no intervention. This RCT also found that providing a booklet of advice for teachers about classroom strategies for ADHD did not have a significant impact on teacher-rated ADHD core symptoms, or children's performance in mathematics or reading compared with no intervention. However, there were low levels of teachers reading the advice booklet provided in this RCT, which would have reduced any possible effects. Combining this advice booklet for teachers with screening for ADHD also had little or no effect on symptoms or academic outcomes versus no intervention.
- 4.58 One small RCT (n=30) found that adding written advice for teachers on ADHD and information about ongoing parent training had a large positive effect in reducing parent and teacher-rated ADHD core symptoms (SMD -1.15, 95% CI -2.03 to -0.28) but no effect on conduct problems compared with parent training alone.
- 4.59 Another small RCT (n=86) assessed a teacher-led contingency management approach to giving effective commands. When the child was given a command by the teacher, if they did not follow it they were warned of consequences, and if they still did not follow the command the consequences were carried out. This intervention had a large effect on reducing teacher-rated conduct problems (SMD -1.47, 95% CI -1.94 to -0.99) compared with no intervention.
- 4.60 The teacher-training interventions assessed in two RCTs (n=210) involved training in behavioural management methods (including contingency management approaches among others) and in one RCT also in collaborative problem solving, plus education to modify any dysfunctional opinions about pupils with ADHD. In one of the RCTs the teachers implemented these strategies in special treatment classes and in the other in mainstream classes. There was no significant effect of these interventions on teacher-rated conduct problems or on parent or teacher-rated ADHD core symptoms when compared with no intervention.
- 4.61 Multicomponent teacher training involved adding other components to teacher training, such as parent and child training. The three RCTs of this approach (n=519) found that multicomponent teacher training in mainstream classes or special treatment classes had no statistically significant impact on children's conduct

problems or core symptoms (parent or teacher-rated) compared with no intervention. It is unclear why these multicomponent interventions, which were relatively intensive, did not have a positive impact on the outcomes assessed in these RCTs.

- 4.62 While some results for teacher training or multicomponent teacher training showed a trend towards a small improvement in behaviour, none of them reached statistical significance. In one RCT of multicomponent training parents had poor attendance at their training and this may have reduced effectiveness.
- 4.63 Overall, the review concluded that there was some evidence that teacher-training and multicomponent teacher-training involving parent training and child interventions might have a small effect in improving the behaviour of children with ADHD, but that the lack of statistical significance meant that the findings were inconclusive.
- 4.64 There was also no statistically significant difference between the multicomponent interventions involving teacher training and teacher training alone in impact on children's conduct problems or core symptoms.

Cleveland and Crowe (2013)

- 4.65 This review assessed supportive strategies for young people with ADHD in post-secondary educational settings (Cleveland and Crowe, 2013). While the main text of this paper was available for assessment by this REA, the paper's tables were not available online and could not be obtained from the publisher. Only limited information was therefore available about the included studies, such as their designs, methods and results. This led to the review being judged as low quality based on the available information.
- 4.66 The review included any post-secondary educational setting, such as vocational or community colleges and universities. The included interventions could use cognitive and meta-cognitive strategies – essentially interventions about learning or thinking. The included studies appeared to assess a range of approaches including adaptations to the learning environment and coaching (Cleveland and Crowe, 2013). The review included 11 studies (study designs not clearly described). The number of participants, their gender or medication usage, or country in which the studies were performed was not reported in the main text of the paper. The review did not report assessing the quality of the included studies in the main text.

- 4.67 Successful strategies were reported to be personal and executive coaching, and faculty (staff) support. These methods included components such as colour coding information to convey teacher expectations, providing lecture outlines, class assignment calendars, using preferential seating, breaking up test information into smaller blocks and peer support. The authors did not state whether their research identified any unsuccessful strategies.
- 4.68 Three studies of coaching interventions were described in the main text of the review. One used a strategy instruction approach⁷, involving assessing the students' learning skills and using colour coding and other sensory methods to help them understand their teacher's expectations (no further details provided). This approach was reported to improve the academic performance of children with ADHD. This was the case for both students already achieving reasonably good grades already (who improved from a mean grade point average [GPA] of 2.43 to 2.72) and those achieving low grades (who improved from a mean GPA of 1.56 to 2.04).
- 4.69 The second found that in a junior college setting (one which provides two year courses), using executive coaching using an inquiry approach⁸ (not further defined), just over three quarters of the students (76%) went on to further study after graduating.
- 4.70 A third study was reported as finding that executive coaching helped students with independence, reducing confrontational attitudes, stress or feelings of social incompetence (no further detail provided).
- 4.71 Coaching was therefore considered a successful strategy by the review authors. They also considered staff and peer support for the students as successful strategies, but no details were provided in the main text of studies evaluating the impact of these.

⁷ Strategy instruction typically involves teaching the young person study skills, such as time management skills, taking notes accurately and using technology. See: <http://www.childrensresourcegroup.com/services/strategy-instruction-study-skills/> (last accessed 18 October 2017)

⁸ In teaching an inquiry approach is a student-centred and -led process typically involving active learning based on the student's own questions. It can involve a cycle of asking questions, investigating these, developing a solution or appropriate response as a result, followed by discussion, and reflection – leading to developing new questions and re-starting the cycle. See: http://oer.educ.cam.ac.uk/wiki/Teaching_Approaches/Inquiry (last accessed 18 October 2017)

4.72 The lack of information about the review's methods, or the designs, sizes, or other methods of the included studies mean that it is not possible to draw firm conclusion on the robustness of this review's findings. However, the evidence does not appear robust from the information provided. For example, none of the reported studies appeared to have a control group, therefore it is not possible to be certain that the changes seen related to the interventions themselves and not just normal development over time.

Charach et al., (2013)

4.73 This moderate quality review aimed to assess interventions for preschool children (aged less than six years old) at high risk of developing ADHD (Charach et al., 2013). Those defined as being at high risk included those with clinically significant disruptive behaviour who had been referred for treatment, and diagnosed with ADHD, oppositional defiant disorder (ODD) or conduct disorder. The review only included comparative studies. It assessed both pharmacological and non-pharmacological interventions, but only those studies including a preschool/daycare-based non-pharmacological intervention are described here.

4.74 The review included five studies (n=601) relevant for this REA – three RCTs and two prospective cohort studies. Three of the studies were considered to be of good quality and two of fair quality. The studies included participants with diagnosed ADHD (two studies), with or at risk of disruptive behaviour disorder (two studies), or at risk for ADHD or ODD (one study). The studies included between 57 and 158 participants, with average ages between four and five years old. The studies included between 40% and 79% males. Whether the participants were receiving medication for ADHD was not reported.

4.75 All of the studies assessed a preschool- or daycare-based intervention combined with parent behaviour training. Details of the intervention content were not reported, but the interventions were reported to vary widely. The interventions lasted between 10 weeks and one year, and three of the trials included post-intervention follow-up of between one and two years. Only very limited details of the results were reported, and they were not pooled due to the differences in the interventions.

4.76 The authors reported that only one RCT, carried out with low socioeconomic status participants, found that children's disruptive behaviour improved more (based on parent and teacher reports) when they received the ten week combined intervention compared to no intervention ($p < 0.001$, no further detail provided). This study did not

follow up participants after the intervention had ended. Two studies (one RCT and one cohort study) in more advantaged groups found that an intensive combined intervention did not improve outcomes compared with parent psychoeducation alone (not further defined). One of the other RCTs initially found improvements in attention and aggression at the end of the combined intervention (but no improvement in academic outcome) compared with parent training alone, but this improvement did not last at two year follow-up. The final cohort study was reported to find that the combined intervention reduced child disruptive behaviour in the classroom, but it was unclear whether this was a between group comparison, and whether it was statistically significant.

- 4.77 In some of the studies parent participation in parent training sessions was low, despite comprehensive efforts to facilitate attendance (e.g. providing transport and babysitting assistance). One study suggested that increased parental attendance was associated with greater improvements in the child's behaviour.
- 4.78 These conflicting results led to the authors concluding that there was too little evidence to draw conclusions about the effects of combined home and school-based interventions in preschool children at high risk of ADHD.

McGoey et al., (2002)

- 4.79 The objective of this moderate quality review was to evaluate efficacy of early interventions (pharmacological, parent training and behavioural) designed to manage the disruptive behaviour of preschool children (ages three to five) with, or at risk of, ADHD (McGoey et al., 2002). The behavioural interventions are the interventions of relevance to the current REA, as most were delivered in preschool classrooms. The review did not report on studies in detail or pool study results.
- 4.80 Nine studies (n=24) investigating behavioural management interventions for children aged three to five years with, or at risk of, ADHD were included. The included studies are now quite dated (most were from before the 1990s) so may not be as relevant in current educational environments.
- 4.81 The included studies were very small (one to five children). None of the studies appeared to include a comparator group. Their designs were not well described, but their sizes suggest single study designs or within subjects designs. Seven studies were based in the preschool classroom and two in a more controlled 'laboratory'

setting. The majority of participants were male. Whether any of the participants were receiving medication for ADHD was not reported.

- 4.82 Eight of the nine included studies showed some benefits of the behavioural interventions e.g. increasing on-task behaviour, attentiveness, self-control and sustained schoolwork, and reducing hyperactivity, non-compliance, activity changes, or disruptive behaviour (no data on the size of these effects or statistical significance was provided). However, at least one study found no impact of the intervention being tested (self-instruction training), and one found that while improvement was seen in accuracy on worksheets similar to the training materials, there was no impact on other accuracy on other worksheets. It was unclear whether the review was reporting all of the outcomes assessed by the studies, or solely those which showed an effect. The authors described the results of the studies as inconsistent.
- 4.83 Components of successful behavioural interventions for this group were reported to include rewarding appropriate behaviour (a contingency management approach), giving effective directions and requests (not further described), teaching self-control (a self-regulation approach) and using consistent methods of discipline. Two studies, each in a single child, found benefits from a daily report card system and self-monitoring of attention to schoolwork. Self-instruction training using cognitive behavioural methods (not further described) showed benefits in only two out of the three studies which evaluated this intervention.
- 4.84 Overall, due to the limitations in the studies identified, the authors concluded that while behavioural strategies in the preschool setting showed promise, the evidence available was not conclusive about their effects.

Key findings from the additional RCTs

Hoza et al., (2015)

- 4.85 The aim of this moderate quality RCT was to compare the effects of before school physical activity and sedentary classroom-based interventions on the symptoms, behaviour, moodiness and peer functioning of primary school aged students at risk of ADHD (n=94) and typically developing children (n=108) (Hoza et al., 2015).
- 4.86 The average age of participants was 6.83 years (range was four to eight years). Children at risk of ADHD were those identified as scoring at or above the 90th percentile on parent and teacher ratings of ADHD symptoms on an initial screen,

plus at least five hyperactivity/impulsivity symptoms on teacher report and a more detailed in person assessment with their parents, and impairment in at least two domains. Typically developing children were those scoring below the 90th percentile for parent- and teacher-rated ADHD symptom scores on the initial screen.

- 4.87 Participants were assigned to either moderate to vigorous physical activity or sedentary activity (art in a classroom) sessions lasting about half an hour, before school hours for a period of 12 weeks. Both interventions were run according to a structured manual by trained staff, and involved a mixture of small and large group activities. Contingency management was used for both groups, in the form of stickers and small monetary prizes earned as a reward for active participation, together with praise from the research staff members.
- 4.88 Overall, across all participants (both those at-risk of ADHD and those developing typically together), the only significant differences between the interventions were that the physical activity intervention significantly reduced parent-rated inattention symptoms ($p=0.01$) and moodiness (explosive and unpredictable behaviour such as temper outbursts, crying often and easily, and changing mood quickly and drastically; $p=0.03$) compared with the sedentary activity. There were no significant differences between groups in parent-rated hyperactivity/impulsivity, oppositional symptoms (for example, displays of argumentativeness, defiance, or uncooperativeness), behaviour towards peers, or reputation among peers, or in any of the outcomes as rated by teachers.
- 4.89 The study did not compare the effects of the interventions in the ADHD risk group separately, but did provide comparisons with baseline. The researchers had not anticipated that the sedentary intervention would have an effect on outcomes. However, with both interventions, children in the ADHD risk group showed significant reductions from baseline in parent- and teacher-rated hyperactivity/impulsivity and inattention as well as parent-rated oppositional symptoms and behaviour towards peers. The at-risk children in the physical activity group (but not the sedentary group) also improved significantly in parent-rated moodiness and reputation among their peers, and teacher-rated behaviour towards peers. Effect sizes for these outcomes ranged from small to medium (Cohen's d ranged from 0.31 to 0.69; p for all <0.05).

4.90 As this study did not have a no treatment control group, it is not possible to determine whether the interventions were similarly effective. This is potentially because they both used effective instruction giving and praise by the staff (the latter being a contingency management strategy) to manage behaviour and encourage participation - or whether the changes seen from baseline would have occurred over time without treatment. The lack of differences could also reflect the small sample size reducing ability to detect differences between the groups. Therefore, while results do not rule out a beneficial effect of either intervention, by themselves they are not conclusive evidence of such an effect.

Spiel et al., (2016)

4.91 This moderate quality crossover RCT assessed whether reading tests aloud improve test performance more in children aged between nine and 14 years old with ADHD symptoms than in their peers (Spiel et al., 2016). Sixteen children were enrolled who had or were at risk of ADHD, based on pre-existing clinical diagnosis (n=11) and/or parent-reported symptoms (n=5). The remaining 20 children enrolled did not have ADHD.

4.92 This intervention was carried out at a five day long summer camp which included a range of activities such as art, recreation and academic learning. Throughout the camp strict behavioural management approaches were used, where points were earned for positive behaviours and lost for negative behaviours. Points could be redeemed for prizes. This is an example of a contingency management approach.

4.93 Each day there was an interactive science-based lesson/discussion. Children were randomly allocated into two classrooms of 18 children for this lesson, and each classroom randomly allocated into two groups, who alternated on consecutive days between having test questions read aloud to them and taking the same test in silence.

4.94 At the end of the lesson children divided into their randomised groups to complete the short test (15 multiple choice and five short answer questions). In one group the tests were read aloud question by question by a teacher in small groups of four to five and the other where they sat silently in a classroom to complete the test in a slightly larger group (eight to 10 students).

- 4.95 The study found that reading the tests aloud improved the testing performance of the youths with, or at risk of, ADHD when compared to taking the test in silence (average score change +6.99%; Cohen's d 0.42; $p=0.001$). The test scores of the children without ADHD did not differ significantly between the reading aloud or silent test (average score change -1.2%, $p=0.56$).
- 4.96 The results obtained on the brief tests taken this summer school setting may not be representative of the impact of this intervention in a normal school setting where tests may be longer and more complex, and cover the material learned over a longer period of study.

Evans et al., (2014)

- 4.97 This moderate quality pilot RCT aimed to assess the efficacy of a multifaceted high-school-based programme in adolescents with ADHD (age range 13 to 17 years, average age 15.4 years) and whether receiving more of the intervention resulted in greater improvements for academic and social outcomes (dose-response).
- 4.98 The programme was an in-school version of the Challenging Horizons Programme (CHP, which is normally delivered after school), and included one-to-one coaching and interpersonal skills groups for the student over an entire academic year, plus training for their parents. This was compared with parents being provided with a list of community services and encouraged to pursue care (Evans et al., 2014).
- 4.99 The intervention involved one-on-one CHP coaching for the adolescents through the school year, plus weekly after-school interpersonal skills training group (ISG) sessions at the school over a 10 week period and simultaneous weekly training sessions for their parents to help them create behavioural contracts relating to homework or other behaviour issues with their adolescents. The intervention content largely appears to belong to the skills training and self-management grouping from the review by Richardson et al., (2015) - mainly cognitive-behavioural self-regulation training, academic and study skills training, and social skills training.
- 4.100 Individual CHP coaching was delivered by two specially trained former teachers working under the supervision of the school psychologist and with an intervention manual. The coaches met with participants during school hours for an average of 22 minutes per session. During the sessions provided the CHP academic interventions (on book bag and binder organisation, assignment tracking, study skills, and self-

monitoring), and helped the students to develop their own solutions. Participants varied in the number of sessions they attended (i.e. the dose of the intervention they received), largely due to logistical issues such as teachers releasing students for coaching sessions and student attendance. The student participants had an average of 26.8 coaching sessions over the school year (range three to 41 sessions).

4.101 The weekly ISG sessions for adolescents lasted 90 minutes. There were three phases of this intervention.

- Phase 1: teaching the CHP problem solving steps, ending with participants defining how they would like to be perceived by others.
- Phase 2: teaching the adolescents to show behaviour consistent with their goals in group social activities, and to attend to and accurately interpret the feedback of others on whether their behaviour was consistent with their goals.
- Phase 3: CHP coaches helped the adolescents extend their goals to a variety of actual social situations.

4.102 The parent sessions also lasted 90 minutes and were run by a doctoral level school psychologist and mainly aimed to help them create behaviour contracts at home. Parents were taught basic information about ADHD, communication and problem solving and introduced to the Homework Management Plan approach for monitoring homework.

4.103 The parents of control group participants were provided with a list of services within the community and were encouraged to seek help through these. This group were followed during the course of the year but were not given any specific interventions.

4.104 Overall, the analyses did not show much statistically significant benefit for the CHP intervention.

4.105 In terms of ADHD core symptoms, initial analyses of the interventions did not significantly affect parent-rated inattention compared to control, however, mother's education level was found to interact with these results. When this was controlled for, the intervention was found to improve inattention symptoms more than control ($p=0.042$). There was no difference between the intervention and control groups in parent-rated hyperactivity/impulsivity.

- 4.106 In terms of ADHD-related symptoms, the CHP intervention reduced parent-rated family impairment more than control ($p=0.043$), largely during the period when parents were attending training sessions. This effect was not seen in other areas of impairment (overall, peer relationships, parent-child relationship, or academic). There was no difference between the intervention and control groups in teacher-rated classroom behaviour (including academic and interpersonal aspects).
- 4.107 In terms of academic outcomes, there was little evidence of benefit from the intervention. It did not significantly impact academic performance in maths or science (i.e. grades achieved). The intervention group performed better in English language classes when maternal education level was controlled for ($p=0.046$), although differences were largely seen in the early and middle part of the year, with the groups performing similarly by the end of the year. There was a difference between the groups in social studies performance over time ($p=0.01$): the intervention group's performance remained relatively stable while the control group performed better in the middle of the year but then their performance dropped again.
- 4.108 However, given the large number of significance tests performed, the size of the effects seen (considered moderate), and the low number of significant effects found the authors concluded that they could not say with certainty that CHP was likely to be beneficial. Dose of the intervention did not seem to have a large impact on parent-rated ADHD symptoms, but the improvement parent-rated impairment (family and academic) increased with increasing doses of the intervention. For example, using regression modelling they estimated that 14.9% of students not having coaching would achieve reliable improvement (greater than the reliable change index) in family impairment over the year compared with 55.7% of those having 50 coaching sessions. They also estimated that none of the students would achieve reliable improvement in parent-rated academic impairment without coaching, compared to 55.7% of those having 50 coaching sessions. However, these figures should be interpreted with caution as they are only estimates, and are based on subjective assessments. Also, it is not clear how likely it would be that this high level of engagement could be achieved in practice.
- 4.109 Overall, the authors concluded that the school-based CHP intervention may offer some promise for adolescents, but that further development and evaluation were needed.

Fleming et al., (2015)

- 4.110 This high quality pilot RCT aimed to assess the efficacy of dialectical behaviour therapy (DBT) group skills training targeted at reducing the symptoms and impairment associated with ADHD in college students (Fleming et al., 2015).
- 4.111 It recruited 33 undergraduate college students (aged 18 to 24) with ADHD who were randomised to receive either DBT group skills training or self-guided skills training handouts over an eight week period. They were assessed before and after the intervention, and three months after the interventions finished by an assessor blinded to treatment allocation. This was the only additional RCT included in this REA which assessed outcomes not only at the end of the intervention, but also at a later follow-up.
- 4.112 DBT is an approach based on cognitive behavioural therapy and mindfulness/acceptance strategies, which aims to find a balance between accepting yourself as you are and making positive life changes. The DBT intervention included a 15 minute individual meeting focused on motivation enhancement, followed by eight weekly 90 minute group sessions focusing on gaining and strengthening skills that would help the students deal with the college environment (e.g. psychoeducation, mindfulness; daily planner use, chunking tasks and prioritisation; structuring the environment, using social support; managing sleep, eating and exercise; emotion regulation; troubleshooting and how to generalise skills). There were also seven weekly 10-15 minute individual coaching phone calls focusing on generalising the skills learned, plus a 90 minute booster group session at the start of the post-intervention follow-up focusing on maintaining use of skills. Sessions were delivered by specially trained advanced graduate students in clinical psychology in an on campus outpatient psychology clinic. Similarly to the intervention in the RCT by Evans et al., (2015) the DBT intervention content largely falls under the skills training and self-management grouping as described by Richardson et al., (2015) review, including training in cognitive behavioural self-regulation, motivational beliefs, academic and study skills, emotional skills, and possibly social skills.
- 4.113 The skills handouts used by the control group were 34 pages long, and contained publicly available self-help information on ADHD. The topics covered included psychoeducation about ADHD, organisation, time management, planning, structuring the environment, and stress management.

- 4.114 For the outcomes of total ADHD symptoms and executive function, DBT group skills training increased the proportion of participants achieving a clinically important response (ranges for these outcomes 53-65% versus 19-25%) and the proportion achieving clinical recovery (47-59% versus 6-13%; see glossary for definitions) compared with skills handouts. These differences were quite large, with these outcomes at least twice as common in the DBT group. This difference was statistically significant at both the end of the intervention and three month follow-up ($p \leq 0.05$ for all).
- 4.115 DBT showed a trend towards reducing ADHD inattentive symptoms more than those receiving skills handouts over the entire period of the trial ($p = 0.056$). This was not significant post-treatment (effect size 0.55; $p = 0.14$), however was significant at follow-up (effect size 0.84, $p = 0.02$). Similarly, DBT significantly increased the proportion of participants achieving a clinically important response (but not recovery) in terms of inattention at follow-up (65% with DBT versus 25.0 with skills handouts, $p < 0.05$) but not post-treatment.
- 4.116 Compared with the skills handouts DBT also improved executive function at the end of the intervention and follow-up (overall $p = 0.007$; post-treatment: effect size 0.94, $p < 0.01$; follow-up: effect size 0.81, $p < 0.01$), and quality of life at the end of the intervention but not at follow-up (overall $p = 0.038$, post-treatment: effect size 0.90, $p < 0.05$; follow-up: effect size 0.21, p value non-significant). The effect sizes for the significant outcomes ranged from medium to large.
- 4.117 There was no significant difference between the groups in comorbid symptoms of anxiety ($p = 0.213$) or depression ($p = 0.260$), or in academic performance (grade point average, $p = 0.765$).
- 4.118 The authors concluded that DBT group skills training may be useful for treating ADHD among college students.

Summary of results by outcome domain

- 4.119 For this summary, outcomes have been grouped into three domains as per the review by Richardson et al., (2015):
- core ADHD symptoms: including measures of inattention, hyperactivity/impulsivity, or both of these symptoms
 - ADHD-related symptoms: including measures of externalising symptoms, internalising symptoms, and social skills

- scholastic behaviours and outcomes: including perceptions of school adjustment, curriculum achievement, and standardised achievement (see glossary for definitions).

- 4.120 We utilise this framework below to discuss the findings of the included studies on the impact of the interventions on these outcomes. Not all studies assessed all three outcome domains. Hence, the body of evidence available for each outcome section varies. Also, as described in detail above, the included reviews tend to pool results either across all school-based interventions or by type of intervention (for example, academic interventions or consequence-based interventions). Therefore, for these reviews the results refer to groups of interventions rather than specific interventions.
- 4.121 Key meta-analytical findings from the reviews are summarised in Table 4.2 at the end of this Chapter.

ADHD core symptoms

Inattention

- 4.122 Some researchers have suggested that inattention may be the key to the academic impairments seen in children with ADHD (Daley and Birchwood, 2010, Wolraich et al., 2003); therefore interventions which improve inattention may also impact academic performance. Three reviews (Richardson et al., 2015, Charach et al., 2013, McGoey et al., 2002) and three of the additional RCTs assessed inattention (Hoza et al., 2015, Evans et al., 2014, Spiel et al., 2016).
- 4.123 Richardson et al. found that school-based interventions led to a significant small to medium sized improvement in inattention as reported by teachers and assessed by neurocognitive tests in the children; a similar benefit was seen in the meta-analysed non-randomised controlled studies. However, no benefit was seen for inattention assessed by parents or independent (i.e. blinded) observers. This may in part reflect that the effects of these school-based interventions have less of an impact outside of the school setting, or that relatively few studies used independent observers.
- 4.124 The other two reviews assessing inattention were in preschool children with, or at risk of, ADHD; they did not meta-analyse study results (McGoey et al., 2002, Charach et al., 2013). They both found inconsistent evidence of benefit for inattention or related outcomes (on-task behaviour, frequency of changing activities

and sustained attention to schoolwork). The studies in the review by McGoey et al., (2002) were very small (one to five participants) and dated (the most recent was from 2000). They may not, therefore, reliably reflect current intervention approaches, or the impact the interventions would have in a wider group of children. The studies in the review by Charach et al., (2013) assessed adding preschool/daycare-based behavioural interventions to parent training; they were more up to date and more robust in design (RCTs and cohort studies). One RCT in this review suggested that while attention was improved by the end of the intervention, this benefit was not maintained after the intervention finished. Overall these results are inconclusive about the effects of these interventions on inattention in this age group.

4.125 The findings from the three additional RCTs which assessed inattention suggested that a range of interventions may be able to reduce inattention across primary to post-secondary age groups. However, their small size, the lack of evidence of improvements in teacher-rated inattention specifically, and the fact that each intervention was only assessed in a single RCT does mean these results should be seen as tentative pending more research.

4.126 Hoza et al., (2015) found that a 12 week physical activity intervention improved parent-rated, but not teacher-rated inattention, more than a sedentary intervention in a group of 202 primary school children, about half of whom had, or were at risk of, ADHD. The small pilot RCT (n=24) by Evans et al., (2014) found that an intensive, year-long school-based intervention involving coaching and interpersonal skills groups for adolescents with ADHD and also training for their parents, improved parent-rated inattention, but did not assess teacher-rated inattention. Finally, the small pilot RCT (n=33) by Fleming et al., (2015) found that eight weeks of dialectical behaviour therapy reduced inattention among college students three months after the end of the intervention compared to being given written self-help materials only.

4.127 Overall the results suggest that inattention can be reduced by interventions carried out in educational settings. As yet, there is not strong evidence to suggest which intervention approaches are the most effective for inattention.

Hyperactivity/impulsivity

4.128 Two reviews (Richardson et al., 2015, McGoey et al., 2002) and one additional RCT assessed hyperactivity/impulsivity (Hoza et al., 2015).

- 4.129 The meta-analysis of RCTs carried out by Richardson et al., (2015) found school-based interventions resulted in small improvements in hyperactivity/impulsivity as measured by neurocognitive tests in the affected children. There was a trend towards improvement in this outcome as assessed by parents or teachers, but it did not reach significance. It is possible that this reflects either that the impact on the children's hyperactivity/impulsivity may not be sufficient to be noticeable to observers, or that the sample sizes in the non-significant analyses were too small to allow detection of a difference.
- 4.130 Only one of the nine studies included in the review by McGoey et al., (2002) was reported as assessing hyperactivity. This small uncontrolled study (n=5) found an intervention including a contingency management approach (positive reinforcement and timeouts) reduced hyperactivity with in preschool children with hyperactivity. This RCT was very old (published in 1976), and carried out in a laboratory setting rather than a real-life classroom, and its results are not robust enough to draw strong conclusions.
- 4.131 The RCT by Hoza et al., (2015) (n=202, of whom 98 had, or were at risk of, ADHD) did not find a significant difference in hyperactivity in primary school children between 12 weeks of either a physical activity intervention or a sedentary intervention. While it did find a reduction in hyperactivity from baseline with both interventions, without a no treatment group it is not possible to say whether this was caused by the interventions themselves.
- 4.132 Overall, while there is some evidence of the potential for a reduction in hyperactivity/ impulsivity with interventions in educational settings, the evidence is not as strong as for inattention, and the effect seems smaller.

Core symptoms combined

- 4.133 Three reviews (Charach et al., 2013, Richardson et al., 2015, National Collaborating Centre for Mental Health, 2009) and one additional RCT (Fleming et al., 2015) reported measures of the core symptoms of ADHD combined.
- 4.134 The RCTs meta-analysed by Richardson et al., (2015) did not find a significant impact of school-based interventions on combined measures of ADHD symptoms.
- 4.135 In the RCTs included by the NCCMH (2009) review, teacher plus parent training (multicomponent training), teacher training, and screening of primary school children for ADHD or providing their teachers with written advice on ADHD did not

have an impact on combined ADHD core symptoms (parent and/or teacher assessed). The RCT of screening and written advice for teachers was very large (n=25,482) and its results are likely to be relatively robust, suggesting these interventions are not likely to be effective. In part, this may have been due to limited engagement by teachers with the advice materials provided. The other RCTs were smaller, and therefore their findings cannot conclusively rule out an effect. Adding teacher advice to parent training did have a large effect on core ADHD symptoms in one small RCT in the review (n=30), but its small size suggests the results should be interpreted with caution.

- 4.136 The small pilot RCT (n=33) by Fleming et al., (2015) found that DBT produced large increases in the proportion of college students with ADHD who had improvements in overall ADHD symptoms large enough to meet criteria for clinical response or recovery (see glossary for definitions), compared with self-help materials alone. However, given the size of this RCT and the lack of blinding of participants these findings should be seen as tentative pending replication in other studies.
- 4.137 Overall, the evidence for an effect on combined ADHD core symptoms is generally less convincing than the evidence for inattention; again, this may reflect a more limited impact of interventions on hyperactivity/impulsivity or the fact that fewer studies have assessed this outcome.

ADHD-related symptoms

- 4.138 All of the included reviews and three of the additional RCTs (Hoza et al., 2015, Fleming et al., 2015, Evans et al., 2014) reported on some aspect of ADHD-related symptoms (externalising symptoms, internalising symptoms or social skills). In most cases, the studies were assessing outcomes relating to externalising symptoms and/or social skills.
- 4.139 The review by Richardson et al., (2015) found a small improvement in teacher reported externalising symptoms with the school-based interventions. However, there was no significant impact on parent, teacher, or child ratings of internalising symptoms or social skills (Richardson et al., 2015).
- 4.140 In the NCCMH (2009) review, teacher plus parent training (multicomponent training, two RCTs) and teacher training alone (two RCTs) were not found to improve parent and/or teacher-rated conduct problems in primary school children. However, one small RCT (n=86) in this review found that teachers using contingency management

to give effective commands did lead to a large benefit for teacher-rated conduct problems in primary school children with ADHD. The size of this RCT warrants some caution in extrapolating this result.

- 4.141 The review by Gaastra et al., (2016) pooled measures of off-task and disruptive behaviours, so results may reflect both inattention and externalising symptoms. Its findings supported the finding that school-based interventions can reduce teacher- or other observer-rated off-task and disruptive behaviours, based on within subject studies. When looking at different types of interventions, the review found that consequence-based (contingency management), self-regulation, antecedent-based, and combined interventions all improved these behaviours, with the largest effects seen for consequence-based interventions. Meta-analysis of single subject studies supported the potential for improvement in these behaviours with these interventions.
- 4.142 The review by DuPaul et al., (2012) pooled results for behaviours such as off-task or social behaviour, and rule breaking, so the result of this analysis is likely to relate to inattention, social skills, and externalising symptoms. There was a statistically significant, medium sized improvement in behaviour with school-based interventions when pooling within subjects studies. This finding was supported by the single subject studies. Analysis by intervention type suggested that contingency management and academic (antecedent-based) interventions alone or combined could have similar effect sizes to the overall effect seen, but these effects did not reach statistical significance. This, and the fact that the review did not find a benefit for behaviour in between group studies, is likely to be due to the smaller number of people in these analyses.
- 4.143 The review by Cleveland and Crowe (2013) included one study reporting that post-secondary students receiving coaching (not further described) felt that it helped reduce their confrontational attitudes, stress, and feelings of social incompetence. There was no detail provided on which to judge the robustness of this study, and as a single study its results may not be generaliseable to the wider student population.
- 4.144 The two reviews of preschool- or daycare-based interventions both found mixed results for measures of externalising behaviour (Charach et al., 2013, McGoey et al., 2002). Some, but not all, of the individual studies in these reviews found some reduction in disruptive behaviour or aggression (effect sizes not reported). The

findings are inconclusive, due to inconsistency in results, and the studies' small number, size, and lack of a control group in some cases.

- 4.145 The additional RCT by Hoza et al., (2015) assessed externalising symptoms and social-related outcomes. The participants were a mixed group of 202 primary school students, 98 of whom had or were at risk of ADHD. The researchers found that a before-school physical activity reduced parent-rated, but not teacher-rated, moodiness (such as temper outbursts and mood swings) compared to a sedentary activity. Physical activity before school did not reduce parent- or teacher-rated oppositional behaviour, behaviour towards peers or reputation among peers compared to the sedentary activity. While both interventions (active and sedentary) showed some improvement from baseline in some of these outcomes, without a no treatment group it is not possible to say whether this was caused by the interventions themselves.
- 4.146 The small pilot RCT (n=24) of an intensive multicomponent school-based intervention (including parent training) for adolescents by Evans et al., (2014) found a reduction in parent-reported family impairment, but no impact on their parent-child relationship or peer relationship impairment.
- 4.147 The small pilot RCT (n=33) by Fleming et al., (2015) found no impact of dialectical behaviour therapy on measures of anxiety or depression symptoms (internalising symptoms).
- 4.148 Overall, the results suggest that interventions in educational settings can have at least a small impact on externalising symptoms. The existing evidence does not currently suggest an impact on internalising symptoms or social skills but few studies have assessed these outcomes, so no firm conclusions can be drawn.

Academic outcomes

- 4.149 Most of the reviews and RCTs included some assessment of academic outcomes. In general, there was evidence of a very small to small improvement in some measures of academic outcome from interventions in educational settings.
- 4.150 The review by Richardson et al., (2015) found that school-based interventions led to a very small improvement in performance on standardised achievement tests; there was a non-significant trend towards a medium sized improvement on school-based tests and coursework (curriculum achievement). There was a small but significant improvement in teachers' perception of how well the children were adjusted to

school with the school-based interventions. Parental perceptions of this outcome were in the direction of benefit but not statistically significant; the perceptions of the children themselves showed little effect. The small numbers of individuals in some of these analyses may have limited their ability to detect differences in outcomes with the interventions.

- 4.151 The review by DuPaul et al., (2012) identified benefits for pooled academic outcomes (including homework completion, teacher ratings and performance on academic assignments) in within subject and single subject design studies, but not in the comparative (between subject) studies – potentially due to the limited number and size of the latter. When looking at individual types of interventions, academic interventions had the largest impact, but this effect did not reach statistical significance. While contingency management had a smaller impact on academic outcomes, this effect was statistically significant. This was potentially due to a larger sample size in this analysis.
- 4.152 A single very large RCT in England (n=25,482) included in the NCCMH (2009) review found no benefit from screening for ADHD or providing teachers with an advice booklet on ADHD (individually or combined), in maths and reading test performance in primary school children (National Collaborating Centre for Mental Health, 2009). Given the size of this study, this is relatively convincing evidence that these approaches are not likely to be effective. This may in part be due to low rates of the teachers reading the advice materials in this trial.
- 4.153 The Cleveland and Crowe (2013) review cited individual studies (study designs not reported) which suggested that some interventions for students in post-secondary education, such as coaching, can improve some academic outcomes such as grades and progression to further education. However, the results are not conclusive, as the robustness of these studies, and whether other studies had similar or conflicting findings, was unclear.
- 4.154 The two reviews of preschool- or daycare-based interventions both had mixed findings for academic outcomes, with some studies, but not others, reporting some benefit such as improved accuracy in worksheets or pre-academic skills (Charach et al., 2013, McGoey et al., 2002).
- 4.155 The RCT by Spiel et al., (2016) found that reading tests aloud to students aged nine to 14 years old did improve test performance. This study was carried out in a summer school setting, and the tests used in this study were very brief. The results

may not reflect how well the intervention would work for longer more complex tests in 'real world' educational settings, or in older age groups.

- 4.156 The small pilot RCT (n=24) by Evans et al., (2014) found that a multicomponent school-based intervention did not affect parents' ratings of their adolescent child's academic impairment, and there was no clear evidence of benefit in their grades. There was a suggestion that those who attended more coaching sessions during the intervention had better outcomes. The small pilot RCT (n=33) by Fleming et al., (2015) found no effect of dialectical behaviour therapy on grade point average among college students compared to just providing them with self-help materials.
- 4.157 None of the studies assessed outcomes such as school attendance or exclusion.

Other outcomes

- 4.158 The small pilot RCT (n=33) by Fleming et al., (2015) found that dialectical behaviour therapy improved quality of life of college students with ADHD at the end of the eight week intervention compared with self-help handouts alone, but this difference did not last once the intervention had ended. It found a large effect on executive function - the higher level cognitive skills used to control and coordinate other cognitive functions and behaviours - at the end of the intervention and three months later. While this RCT shows the feasibility of an impact on these outcomes, as a single small RCT its findings need confirmation in other studies.
- 4.159 The review by Gaastra et al., (2016) assessed whether classroom-based interventions might have direct or indirect effects on the classmates of the affected children. Most of the WSD studies (three out of four) did not find a significant direct effect of antecedent-based approaches on off-or on-task behaviour, ADHD symptoms, or academic performance among classmates, while one found a reduction in their hyperactivity. Five out of six SSD studies found some benefit (direct or indirect) for classmates, but the lack of control groups or statistical assessments in these studies means it is not possible to conclusively attribute these effects to the interventions themselves. Overall, the impact on classmates of school-based interventions for children with ADHD is not yet clear.

Impact of outcome assessors

- 4.160 Parent-rated measures in the review by Richardson et al., (2015) did not show significant effects. This could be due to these largely school-based interventions not having an impact outside of the school setting. The other reviews did not pool

results separately based on the outcome assessor. Some of the additional RCTs did find a few parent reported benefits (Hoza et al., 2015, Evans et al., 2014); in one case this may have been due to the inclusion of parent-training in the multicomponent intervention being assessed (Evans et al., 2014).

- 4.161 There was also a lack of impact on child perception-based outcomes in the Richardson et al. review (e.g. school adjustment), which they suggested might reflect the young age of the children included in the studies affecting their ability to assess their own behaviour.

Summary of results by intervention type

- 4.162 The evidence identified by this REA suggests that overall, non-pharmacological interventions delivered in educational settings lead to small to medium beneficial effects in reducing teacher-rated inattention and externalising symptoms, and very small or small improvements in some academic outcomes such as standardised achievement tests and teacher-rated perceptions of school adjustment. The evidence reviewed did not identify a significant impact on internalising behaviour, social skills, or curriculum-based tests or achievement.
- 4.163 The evidence regarding impact of the individual interventions is less strong than the evidence for interventions in educational settings as a whole. The Richardson et al., (2015) review noted that the interventions used are complex, often including multiple components and there were few studies evaluating interventions with similar groups of components, which makes identifying exactly which interventions or components are effective difficult (Richardson et al., 2015). The review authors used statistical analysis (meta-regression) to try and identify the “active ingredients” of the interventions, but they did not find evidence that the specific approaches the intervention used impacted their effectiveness. This may be due to the interventions all being similarly effective, or due to the analyses lacking power to detect differences in effect by intervention content.
- 4.164 As a result they suggest that the range of strategies used in the included studies could be considered by school staff. However, the tentative nature of the findings led them to recommend that the impact of any interventions on the outcomes being targeted should be evaluated carefully by the practitioners.

4.165 The reviews by Gaastra et al., (2016) and DuPaul et al., (2012) provide some indication of potential effects of interventions using different approaches, but this should be interpreted with caution as it is based on less robust study designs than the Richardson review. In addition, some of the meta-analyses of the individual intervention types, while finding a trend towards benefit, did not find that these effects were statistically significant. This may be due to these subgroup analyses including fewer participants than the overall analysis. In addition, effect sizes from these reviews should be treated with caution, as less robust study designs, such as single subject and within subject studies, generally find larger effect sizes than controlled studies (Fabiano et al., 2009, Pelham and Fabiano, 2008).

4.166 This evidence from the reviews suggests that there may be benefit from the following approaches.

- **Contingency management (consequence-based) interventions:** the meta-analyses by Gaastra et al., (2016) and DuPaul et al., (2012) both suggested that these interventions could have a large impact on behaviour, although this effect was not significant in DuPaul's analysis. These interventions were found to have a small but significant impact on academic outcomes in the meta-analysis by DuPaul et al.
- **Self-management (self-regulation) interventions:** Gaastra et al., (2016) found that these led to a medium sized reduction in off-task and disruptive behaviour. There were no meta-analyses looking at their impact on other outcomes.
- **Antecedent-based/academic interventions:** the interventions categorised by Gaastra et al. as being antecedent-based are likely to overlap with those categorised as academic interventions by DuPaul et al. DuPaul et al., (2012) defined academic interventions as ones that focus primarily on manipulating antecedent conditions, such as academic instruction or academic materials. Gaastra et al., (2016) found that antecedent-based interventions led to a small reduction in off-task and disruptive behaviour, and DuPaul et al., (2012) found a non-significant medium-sized improvement in behaviour with academic interventions. In both reviews, the impact on behaviour was smaller than that with consequence-based interventions. DuPaul et al., (2012) also found a non-significant medium-sized improvement in academic outcomes with academic interventions (either alone or combined with

contingency management) – the size of the effect was larger than for consequence-based interventions. The fact that it was non-significant means that we cannot rule out that this difference has occurred by chance.

4.167 Overall, contingency management approaches appeared to be the most commonly studied, and therefore there is the most evidence on these. These approaches can be used alongside other approaches, for example, as in the RCTs by Hoza et al., (2015) and Spiel et al., (2016) to help control behaviour. It is possible that antecedent-based/academic interventions may have a larger impact on academic outcomes than contingency management approaches, but as yet this evidence is not robust.

Table 4.2: Key meta-analytical results from the included systematic reviews

Review	Intervention	Outcome	Studies (participants) included	Effect size (95% CI)	Notes
ADHD core symptoms					
Richardson et al., 2015	School-based interventions overall	Inattention (teacher-rated)	12 RCTs (n=548)	0.60 (0.14 to 1.06)	No significant effect on inattention rated by parents (7 RCTs, n=384) or independent observers (4 RCTs, n=203); or on ADHD symptoms combined, rated by parents (3 RCTs, n=110) or teachers (6 RCTs, n=218)
		Inattention (child-assessment)	7 RCTs (n=292)	0.44 (0.18 to 0.70)	
		Hyperactivity/impulsivity (child-assessment)	8 RCTs (n=411)	0.33 (0.13 to 0.53)	
ADHD related symptoms					
Richardson et al., 2015	School-based interventions overall	Externalising symptoms (teacher-rated)	9 RCTs (n=548)	0.28 (0.04 to 0.53)	No significant effect on parent-rated externalising symptoms (4 RCTs, n=232), or on internalising symptoms (parent-rated: 3 RCTs, n=193; teacher-rated: 4 RCTs, n=252; child assessment: 3 RCTs, n=167), or social skills (parent-rated: 4 RCTs, n=260; teacher-rated: 6 RCTs, n=304; child assessment: 2 RCTs, n=59)
Gaastra et al., 2016	School-based interventions overall	Off-task and disruptive behaviour	24 WSDs (n=471)	0.92 (0.59 to 1.25)	Outcome is likely to capture aspects of inattention and externalising symptoms
	<i>Consequence-based interventions</i>		8 WSDs (n=NR)	1.82 (1.39 to 2.24)	
	<i>Self-regulation interventions</i>		4 WSDs (n=NR)	0.56 (0.02 to 1.11)	
	<i>Antecedent-based interventions</i>		9 WSDs (n=NR)	0.31 (0.06 to 0.55)	
	<i>Combined interventions</i>		3 WSDs (n=NR)	0.58 (0.07 to 1.08)	
DuPaul et al., 2012	School-based interventions overall	Behaviour	15 WSDs (n=NR)	0.72 (0.13 to 1.30)	No significant effect in comparative studies (2 BGDs, n=57). Behaviour
	<i>Contingency management</i>		8 WSDs (n=NR)	0.87 (-0.72 to 2.46)*	

Review	Intervention	Outcome	Studies (participants) included	Effect size (95% CI)	Notes
	<i>interventions</i>				included measures of e.g. off-task behaviour, social behaviour, or rule breaking. It is likely to capture aspects of inattention, social skills and externalising symptoms
	<i>Academic interventions</i>		3 WSDs (n=NR)	0.53 (-0.41 to 1.47)*	
	<i>Combined interventions</i>		4 WSDs (n=NR)	0.61 (-0.15 to 1.37)*	
Academic outcomes					
Richardson et al., 2015	School-based interventions overall	Perception of school adjustment (teacher-rated)	9 RCTs (n=497)	0.26 (0.05 to 0.47)	No significant effect on parent (3 RCTs, n=133), or child (5 RCTs, n=190) perceptions
		Standardised achievement	10 RCTs (n=502)	0.19 (0.04 to 0.35)	
		Curriculum achievement	5 RCTs (n=154)	0.50 (-0.06 to 1.05)*	
DuPaul et al., 2012	School-based interventions overall	Academic outcome	10 WSDs (n=NR)	0.42 (0.09 to 0.93)	No significant effect in comparative studies (3 BGDs, n=NR). Academic outcome included e.g. teacher ratings, academic grades, work completion
	<i>Contingency management interventions</i>		4 WSDs (n=NR)	0.24 (0.02 to 0.46)	
	<i>Academic interventions</i>		3 WSDs (n=NR)	0.56 (-0.12 to 1.24)*	
	<i>Combined interventions</i>		3 WSDs (n=NR)	0.53 (-0.63 to 1.69)*	

Italicised results are for sub-types of school-based interventions. * Not statistically significant. RCT randomised controlled trial, BGD between group design (i.e. study with a comparator group), WSD within subjects design, NR not reported

5. Discussion

- 5.1 This REA has assessed the available literature reporting on the effectiveness of interventions to support children and young people with ADHD within the educational system.
- 5.2 Relatively few robust assessments of these types of interventions were identified in the literature. Eleven studies met the inclusion criteria for this REA: seven systematic reviews published since 2000 and four additional RCTs published since 2013 (the search date of the most robust recent systematic review included in this REA).
- 5.3 From the evidence identified it does appear that interventions delivered in the educational setting, improve some outcomes such as inattention, teacher-rated (but not parent-rated) externalising symptoms in children and young people with ADHD, and performance on standardised test. There is a trend towards improvement with the interventions in some other areas, such as curriculum tests, but this was not statistically significant, so cannot be considered conclusive.
- 5.4 The included systematic reviews varied in quality, with several including largely non-RCT evidence with relatively few participants. The most robust and recent review was part of a UK HTA by Richardson et al. published in 2015. The additional RCTs identified by this REA were mostly of moderate quality and generally relatively small (all with fewer than 100 participants with ADHD), so any conclusions drawn from these RCTs should be made with caution.
- 5.5 RCTs are considered the most robust study design for assessing the effects of interventions according to the hierarchy of study designs that was developed initially in the field of evidence-based medicine (Guyatt et al., 1995, Greenhalgh, 1997). This is because randomisation creates intervention groups balanced for known and unknown confounders. This, and the use of a control group who receive no intervention (sometimes while being placed on waiting lists for the intervention)/standard care within the RCT, allows clear identification of the impact of the intervention itself, without the effects of confounders or the passage of time.
- 5.6 Most included studies were carried out with children of primary school age, with some in young people at secondary school, and few with preschool children or young people in post-secondary education. Only a few studies included in the reviews were reported as being carried out in non-mainstream school settings, such

as special schools (Gaastra et al., 2016, DuPaul et al., 2012). Therefore, the findings may be less applicable to older children, or those in the non-mainstream settings.

- 5.7 The majority of the studies identified were carried out in the United States (where this information was reported) and none were reported as being carried out in Wales. The research does provide a starting point for identifying interventions which could potentially be implemented and evaluated in Wales. However, differences in the education and health systems should be considered when applying the findings and interventions to the Welsh setting. There were also no studies that assessed how bilingualism in the student body, such as that found in the Welsh educational system, might impact on the outcomes of school-based interventions, or tested interventions specifically aimed at a bilingual population.
- 5.8 The included studies assessed the effectiveness of interventions in terms of a range of outcomes including reduction in ADHD symptoms, and improvements in problem behaviour and academic performance. Only one RCT was identified which assessed student quality of life (Fleming et al., 2015).
- 5.9 The nature of these educational interventions means it is unlikely to be feasible to blind the students, their parents or teachers to what intervention had been received in controlled studies. Studies could use independent observers blinded to the intervention received to assess outcomes and validate any findings from the assessors who are not blinded. The fact that the children or young people with ADHD, their teachers and parents (who assessed most outcomes) would have known which interventions were received may have consciously or subconsciously influenced their assessment of these outcomes.
- 5.10 In terms of further research, ideally large pragmatic RCTs would be carried out to assess interventions that are based on current research, with the interventions clearly described to allow replication. They would use validated outcome measurements, including measures of academic outcomes as well as other outcomes important to the affected individuals and their families, such as quality of life and wellbeing. These should utilise independent outcome assessors alongside unblinded assessors where possible. More research is also particularly needed in the age groups which have been less frequently studied – preschool children and young people in post-secondary education.

- 5.11 Few of the included studies investigated the same interventions so it is difficult to compare their findings to identify patterns of effectiveness for individual interventions. The Richardson review provided a comprehensive categorisation of the components of the interventions (described in Annex B). Their moderator analyses (using meta-regression) were not able to reliably identify which components were associated with effectiveness, potentially due to the limited amount of evidence available for each component.
- 5.12 In order to provide some indication of which interventions may be more (or less) promising, this REA also looked at the other included reviews, some of which analysed results by type of intervention. This interpretation is complicated by the fact that different reviews grouped the interventions in different ways, and that the reviews which carried out meta-analysis by intervention type included predominantly or exclusively less robust study designs. Therefore, conclusions about the effects of individual interventions should be treated as tentative only.
- 5.13 Interventions including the use of contingency management (consequence-based interventions) appear to be among the most commonly researched, either with or without the use of a daily report card (Richardson et al., 2015). This may reflect that this approach is one which is commonly used in educational settings. Contingency management involves using reward and punishment to alter the frequency of target behaviour. Based on the evidence identified in the reviews, these interventions appeared to offer benefits for problem behaviours, such as off-task or disruptive behaviour (National Collaborating Centre for Mental Health, 2009, Gaastra et al., 2016, DuPaul et al., 2012).
- 5.14 Perhaps unsurprisingly, academic interventions, such as altering academic instruction or academic materials, appeared to potentially offer more benefit for academic outcomes, but less so problem behaviours, than other intervention types (DuPaul et al., 2012). Self-regulation interventions and antecedent-based interventions also potentially have benefit for reducing off-task and disruptive behaviour (Gaastra et al., 2016).
- 5.15 In the post-secondary setting, coaching and dialectical behaviour therapy (an approach based on CBT) appeared to offer some promise, particularly for reducing inattention and executive function (Cleveland and Crowe, 2013, Fleming et al., 2015). However, there is very little robust evidence in this area, with the review in this older population offering little detail of the studies it included, and the RCT being a small pilot study.

- 5.16 In the preschool setting, the evidence is similarly sparse and inconclusive (Charach et al., 2013, McGoey et al., 2002). Strategies that have been used in this age group include contingency management approaches (e.g. positive reinforcement and attention as a result of appropriate behaviour, and time out for inappropriate behaviour), teaching self-control, self-monitoring of on-task behaviour, and daily report cards.
- 5.17 The only interventions which showed relatively convincing evidence of no beneficial effect were performing screening for ADHD in a primary school setting and/or simply providing primary teachers with written advice about ADHD. These strategies were tested in a very large RCT in England and not found to improve academic achievement or ADHD symptoms (National Collaborating Centre for Mental Health, 2009).
- 5.18 In summary, there are a range of strategies that could be considered by school staff to support children and young people with ADHD (see Annex B for a summary). Since the interventions tested have been diverse and the evidence is inconclusive in terms of which are most effective, ideally schools should carry out objective evaluations of the impact of any support measures they introduce, to ensure they are effective.
- 5.19 In terms of selecting and implementing interventions, the included reviews offer some potentially helpful suggestions. One review, in preschool children with or at risk of ADHD, highlighted the importance of interventions being age- and developmentally appropriate, for example, in terms of their length and intensity, and in other details such as the rewards offered in contingency management approaches (McGoey et al., 2002). These issues would also be of importance when considering other age groups. Another issue which is likely to need consideration is the severity of the students' ADHD, as this could affect which interventions are used or how they are implemented.
- 5.20 As well as looking at intervention effectiveness, the Richardson et al. HTA also reviewed studies looking at attitudes and experiences of those with ADHD and their teachers and parents (Richardson et al., 2015). This raised a number of findings that are relevant for designing and implementing interventions for children with or at risk of ADHD in the school setting (listed below).
- The specific context for a student with ADHD needs to be actively considered, including:

- the pupil – their knowledge and beliefs about ADHD
 - their classroom – such as the child’s fit in the class; teacher knowledge and beliefs about ADHD; teaching method; relationships between pupil, peers, teachers and parents; and stigma and marginalisation
 - their school – such as resources available (time, support, knowledge); school policies (such as behavioural policies, and collaboration between parents and teachers); and issues of stigma and marginalisation
 - socio-political issues – such as national educational policies and legislation; power imbalances between pupils/parents and others leading to the pupil/parents’ views not being taken into account; and medicalisation of ADHD (which may lead to favouring medication over behavioural approaches).
- Interventions may have the unintended consequence of increasing stigma and marginalisation.
 - Along with the interventions themselves, it may be useful to provide psychoeducation about ADHD to the students with ADHD and their peers as well as school staff.
 - Educators tend to have positive or neutral attitudes to most interventions, with the use of daily report cards being the only intervention consistently considered positively.
 - The concerns related to school-based interventions from students, teachers and parents included:
 - knowing how structured and tailored the interventions ought to be
 - the time available for the interventions
 - whether the interventions might work for the targeted skills and behaviours, but not improve academic achievement
 - whether skills and knowledge would be applied after the intervention finished.

5.21 For decision makers in educational institutions considering implementing interventions to support students with ADHD, it may be helpful to consider how these issues will be addressed. Finally, ensuring good communication and coordination between educators, teachers, parents and/or carers and other professionals involved in the child's care where possible is likely to be important (National Institute for Health and Care Excellence, 2008).

6. Conclusions

- 6.1 Children and young people with ADHD have age inappropriate and impairing levels of inattention, impulsivity and hyperactivity (National Institute for Health and Care Excellence, 2008, Richardson et al., 2015). Childhood ADHD can result in difficulties in learning, as children can find educational settings a challenge and the behaviours related to the condition can cause impairments and underachievement. There is potential for teachers to take a more active role in managing behaviour in children and young people with ADHD (National Institute for Health and Care Excellence, 2008).
- 6.2 Non-pharmacological interventions target behaviour directly or indirectly through cognitive and affective processes and typically target children, teachers and parents. Interventions that are provided for teachers and parents usually involve training for delivery of interventions that target the children.
- 6.3 This rapid evidence assessment identified limited robust evidence assessing the effectiveness of interventions carried out within educational settings to support children and young people with ADHD. The evidence identified mainly related to children of primary school age, and evidence in children in preschool and young people in post-secondary education was particularly sparse.
- 6.4 From the evidence that does exist, it appears that many of the interventions assessed had some degree of positive impact on outcomes such as ADHD symptoms, externalising symptoms, or academic outcomes. However, most of the studies had limitations, for example, the studies included in the systematic reviews often did not use robust study designs and were mostly small, as were the additional RCTs. The studies tended to be of short duration and not to carry out post-intervention follow-up, or utilise blinding of outcome assessors. These limitations mean that the findings should be interpreted with some caution.
- 6.5 Despite some positive findings, no single intervention has been consistently proven to have benefits across educational settings. The included studies varied in the types of interventions assessed, and even interventions of the same type (e.g. antecedent-based interventions) differed in their content. The reviews which assessed the effects of specific types of interventions largely included less robust study designs; therefore it is difficult to form firm recommendations for specific interventions.

- 6.6 The types of interventions described in existing research (see Annex B) provide options for educators to consider. Ideally, schools should carry out objective evaluations of the impact of any support measures they introduce, to ensure they are being effective [The contract manager will indicate whether recommendations are required at the inception meeting. Where recommendations are required there should be a clear link from findings to conclusions then from conclusions to recommendations.
- 6.7 Factors seen to influence whether or not recommendations are taken up include: characteristics of recommendations (are they easy to operationalize and implements - technical unspecific and ambiguous recommendations will be ignored); organisation factors; and external context.]

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Annex A – Medline and Embase search strategy

- #1 'attention deficit disorder'/de 47,457
- #2 (attenti* NEAR/3 deficit*):ab,ti 32,170
- #3 adhd:ab,ti 25,986
- #4 inattenti*:ab,ti OR impulsiv*:ab,ti OR disruptive*:ab,ti OR hyperactiv*:ab,ti OR 'hyper activ*':ab,ti 92,278
- #5 'hyperkinesia'/de 4,691
- #6 hyperkine*:ab,ti OR 'hyper kine*':ab,ti 5,908
- #7 ('brain dysfunction' NEAR/2 minimal):ab,ti 701
- #8 #1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 123,267
- #9 'special education'/exp 2,377
- #10 (special NEAR/3 education*):ab,ti 5,027
- #11 school*:ab,ti 281,847
- #12 'pre school':ab,ti OR preschool:ab,ti OR kindergarten*:ab,ti OR nurser*:ab,ti 42,219
- #13 universit*:ab,ti OR colleg*:ab,ti 678,292
- #14 class* 2,375,898
- #15 student*:ab,ti OR pupil*:ab,ti 302,132
- #16 learn*:ab,ti 363,843
- #17 teach*:ab,ti 196,206
- #18 instruct*:ab,ti 99,619
- #20 academic*:ab,ti OR schola*:ab,ti 186,987
- #21 tutor*:ab,ti 9,818
- #22 'multilingualism'/exp 1,300
- #23 bilingual* OR multilingual*:ab,ti 6,100
- #24 #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 4,280,298
- #25 'meta analysis (topic)'/de 23,354
- #26 'meta analysis'/exp 101,273
- #27 meta:ab,ti AND analy*:ab,ti 111,022
- #28 'meta-analysis':ab,ti OR 'meta-analyses':ab,ti OR 'meta-analytic':ab,ti 105,685
- #29 'metaanalysis':ab,ti 4,355

#30 (systematic NEAR/2 (review* OR overview*)):ab,ti 95,444

#31 'systematic review'/de 100,089

#32 'systematic review (topic)'/de 13,734

#33 cochrane:ab OR embase:ab OR psychlit:ab OR psychlit:ab OR psychinfo:ab OR
 psycinfo:ab OR cinahl:ab OR cinhal:ab OR bids:ab 76,808

#34 'science citation index':ab 2,495

#35 'reference list':ab OR bibliograph*:ab OR 'hand searching':ab OR 'hand search':ab
 OR 'relevant journals':ab OR (manual NEAR/1 search*):ab 23,118

#36 #25 OR #26 OR #27 OR #28 OR #29 OR #30 OR #31 OR #32 OR #33 OR #34 OR
 #35 271,242

#37 'selection criteria':ab OR 'data extraction':ab 35,837

#38 review:it 2,080,441

#39 #37 AND #38 17,362

#40 letter:it OR editorial:it 1,389,774

#41 'animal'/exp 21,013,295

#42 'human'/exp 16,447,832

#43 #41 NOT (#41 AND #42) 4,565,463

#44 #40 OR #43 5,924,325

#45 #36 OR #39 275,226

#46 #45 NOT #44 320,812

#47 #8 AND #24 AND #46 915

#48 #47 AND [2000-2017]/py 877

Annex B – Definitions and use of components of school-based interventions identified by Richardson et al., 2015

Intervention	Definition	Frequency of use of the component in included studies in Richardson et al., 2015:		
		RCTs	Non-RCTs	Overall
Reward and punishment				
1. Contingency management	Systematic use of rewards and/or punishments to change, alter or redirect the child's behaviour(s)	40%	41%	41%
2. Daily report card plus contingency management	Daily report cards involve monitoring the student's behaviour and recording it for the student to take home to share with their parent or carer. The method is used in collaboration with a child to set goal(s) and monitor progress towards them. Rewards and/or punishments are then used in response to the child's progress towards their goals in order to reinforce the wanted behaviour(s) or create barriers to the unwanted behaviour(s).	15%	12%	14%
Skills training and self-management				
3. Motivational beliefs	Encourage or facilitate the adoption of beliefs that facilitate self-motivation towards obtaining the focal behaviour(s) (e.g. the attribution of success at school to hard work and effort)	4%	0%	3%
4. Cognitive-behavioural self-regulation training	Establish methods for the child to self-monitor and record their behaviour(s). Includes analysing the factors that lead to problem behaviour(s) and identifying solutions to overcome them ('problem solving') and self-instruction on how to perform the behaviour(s)	21%	41%	27%
5. Cognitive retraining	Training and practice in the use of cognitive processes related to executive function (e.g. attention and working memory)	9%	18%	11%
6. Academic and study skills training	Training and practice in academic skills (e.g. reading and writing strategies) and general study strategies (e.g. note taking, test taking, organisation and time management)	26%	29%	27%
7. Social skills training	Training and practice in effective social interaction	13%	18%	14%
8. Emotional skills training	Training and practice in learning to recognise and control emotions (e.g. relaxation training and/or enhancing positive emotion)	23%	0%	17%

9. Biofeedback	Feedback about physiological or biochemical activity (e.g. heart rate and brain waves) using an external monitoring device to enhance self-control of wanted behaviour(s)	17%	6%	14%
Creative-based therapy				
10. Music therapy	Music used in a prescribed way to modify or alter thoughts emotions and behaviours	6%	0%	5%
11. Play therapy	Play used in a prescribed way to modify or alter thoughts, emotions and behaviours	2%	0%	2%
Physical treatment				
12. Massage	Applying pressure to parts of the body (e.g. rubbing or kneading) in a prescribed way to modify or alter thoughts, emotions and behaviours	2%	0%	2%
13. Structured physical activity	Planned physical activity with the aim of increasing energy expenditure and improved physical fitness and health	0%	6%	2%
Other packages				
14. Adaptations to learning environment	Alteration to the environment (physical and social) where learning takes place and/or learning materials in order to facilitate performance of the wanted behaviour or create barriers to the unwanted behaviour (e.g. adapt teaching methods, tasks and classroom)	6%	18%	5%
15. Information	Provide information about focal behaviour(s) (e.g. information about positive peer relationships, communication skills)	2%	0%	2%
Adapted from (Richardson et al., 2015)				

Annex C – Critical appraisal of included studies

Table C.1: Systematic reviews

	Gaastera et al., (2016)	Richardson et al., (2015)	Charach et al., (2013)	Cleveland and Crowe (2013)	DuPaul et al., (2012)	NCCMH (2009)	McGoey et al., (2002)
1. Did the review address a clearly focused question?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2. Did the authors look for the right type of papers?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3. Do you think all the important, relevant studies were included?	Unclear	Yes	Yes	Unclear	Unclear	Yes	Yes
4. Did the review's authors do enough to assess the quality of the included studies?	Yes	Yes	Yes	No	No	Yes	No
5. If the results of the review have been combined, was it reasonable to do so?	Yes	Yes	Not applicable (NA)	NA	Yes	Yes	NA
6. What are the overall results of the review?	SMD	Cohen's d	Mixed	Mixed	Effect sizes	SMD	Mixed
7. How precise are the results?	Moderately	Moderately	Unclear	Moderately	Moderately	Mixed	Unclear
8. Can the results be applied to the local population?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
9. Were all important outcomes considered?	No	Yes	Unclear	No	No	Yes	Unclear

Table C.2: Randomised controlled trials

	Spiel et al., (2016)	Fleming et al., (2015)	Hoza et al., (2015)	Evans et al., (2014)
1. Did the trial address a clearly focused issue?	Yes	Yes	Yes	Yes
2. Was the assignment of patients to treatments randomised?	Yes	Yes	Yes	Yes
3. Were all of the patients who entered the trial properly accounted for at its conclusion?	Unclear	Yes	Yes	Yes
4. Were patients, health workers and study personnel 'blind' to treatment?	No	Mixed	No	No
5. Were the groups similar at the start of the trial?	Yes	Yes	Yes	No
6. Aside from the experimental intervention, were the groups treated equally?	Yes	Yes	N (but did not appear to impact results)	No
7. How large was the treatment effect?	Small	Medium to large	Small to medium	Medium
8. How precise was the estimate of the treatment effect?	Not very precise	Unclear	Unclear	Unclear
9. Can the results be applied in your context?	Yes	Yes	Yes	Yes
10. Were all clinically important outcomes considered?	No	Yes	No	Yes