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# Review: Which components of behavioral parent and teacher training work for children with ADHD? – a metaregression analysis on child behavioral outcomes

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**Background:** This metaregression analysis examined which behavioral techniques that are commonly used in behavioral parent and teacher training programs for children with attention-deficit/hyperactivity disorder (ADHD) were related to program effectiveness on children's behavioral outcomes. **Methods:** We included 32 randomized controlled trials ( $N = 2594$  children) investigating behavioral parent training, teacher training, or a combination, in children with ADHD under 18 years. Outcomes were symptom counts of total ADHD, inattention, and hyperactivity-impulsivity and behavioral problems. The dosage of techniques was extracted from the intervention manuals. Metaregression was used to assess which techniques and intervention characteristics (setting, delivery method, duration, and home-school collaboration) were associated with intervention effectiveness. **Results:** Higher dosage of psycho-education for parents was associated with smaller effects on behavioral problems and, only in case of parent training, also with smaller effects on ADHD symptoms. Higher dosage of teaching parents/teachers to use negative consequences was associated with larger effects on behavioral problems. Individual training compared with group training was associated with larger effects on ADHD and hyperactivity-impulsivity symptoms. **Conclusions:** This study provides first insights into the specific techniques that are essential in behavioral parent and teacher training programs for children with ADHD. This knowledge can eventually be used to improve and tailor interventions.

## Key Practitioner Message

- Research on the effects of specific behavioral techniques that are commonly being taught to parents or teachers in behavioral parent or teacher training is scarce, especially in children with ADHD.
- This study incorporated a novel approach to examine whether dosage of specific behavioral techniques was related to the effectiveness of behavioral parent and teacher training programs on child behavioral outcomes.
- A higher dosage of negative consequences, such as correction and planned ignoring, was related to larger treatment effects on behavioral problems.
- A higher dosage of psycho-education for parents was related to smaller treatment effects on behavioral problems and ADHD symptoms, but reasons for this remain unclear.

**Keywords:** ADHD; parent training; teachers; behaviour therapy; meta-analysis

## Introduction

Behavioral parent and teacher training programs are evidence-based interventions for children and adolescents with attention-deficit/hyperactivity disorder

(ADHD) and associated behavioral problems (Evans et al., 2018). However, meta-analyses show that these programs have modest effect sizes at best (Coates, Taylor, & Sayal, 2015; Daley et al., 2014; Lee, Niew, Yang, Chen, & Lin, 2012; Mulqueen, Bartley, & Bloch, 2015),

which indicates room for improvement. Most of the available programs consist of a package of different techniques that are taught to parents or teachers (e.g., provide social rewards, planned ignoring, and time-out), and the majority of interventions have been examined as a whole, whereas research on the effects of specific techniques is scarce, especially for children and adolescents with ADHD (Chorpita & Daleiden, 2009; Daley et al., 2018; Schatz et al., 2020). Therefore, an important avenue to improve interventions is to gain more insight into which techniques increase or reduce treatment effectiveness (DuPaul, Evans, Mautone, Owens, & Power, 2020).

The various available behavioral parent and teacher training programs for children with ADHD are mostly based on social learning theory (Antshel & Barkley, 2008). The general aim of these programs is to teach parents and teachers behavioral techniques to prevent and manage their children's problem behaviors (Evans, Owens, & Bunford, 2014). There is substantial overlap in content between the different programs. For instance, most parent and teacher training programs for children with disruptive behavior problems include some forms of positive reinforcement, principles of effective limit-setting, or punishment techniques (Garland, Hawley, Brookman-Frazer, & Hurlburt, 2008). Nevertheless, programs differ in their focus and dosage of techniques. For example, some programs focus more on disciplinary communication (e.g., *Helping the Noncompliant Child*; Abikoff et al., 2015) or on management of antecedents of problem behavior (e.g., *First Step to Success Intervention*; Seeley et al., 2009), while others particularly pay attention to psycho-education (e.g., *The Sunshine Program for ADHD*; Ferrin et al., 2014, 2016).

To date, no meta-analysis investigated the relation between the dosage of different behavioral techniques that are being taught to parents or teachers in behavioral training programs and program effectiveness in children with ADHD. Two meta-analyses investigated the effectiveness of components of parent training programs for children with disruptive behaviors (i.e., not exclusively aimed at children with ADHD). Parent training programs that include positive reinforcement, praise, providing natural/logical consequences (Leijten et al., 2019), and the promotion of positive parent-child interactions, emotional communication skills, time-out, parental consistency, and practicing with parents and children during the sessions (Kaminski, Valle, Filene, & Boyle, 2008) had larger treatment effects than programs without these techniques. Inclusion in the programs of training of parents to use problem-solving strategies, of promoting of children's cognitive, academic, or social skills, and/or of additional techniques, such as anger or stress management, were associated with smaller effects (Kaminski et al., 2008). Although these meta-analyses provide important insights into effective techniques for treating disruptive behaviors, they were limited for a number of reasons. First, only the presence or absence of certain techniques was investigated, while the dosage of techniques may provide more accurate information in relation to program effectiveness. For example, an intervention with a focus on social rewards in all sessions was coded the same as an intervention that teaches parents to use social rewards in only one session. Second, in the previous meta-analyses (Kaminski et al., 2008;

Leijten et al., 2019), the techniques were not extracted from the manuals of the interventions but derived from the description of the intervention in the papers and from secondary sources that were cited in the papers, thereby possibly missing important information about the included techniques. Third, only behavioral parent training programs were included. Although parent and teacher training differ regarding the recipient of the program, the behavioral techniques that are being taught to the recipients are largely the same. Finally, the two meta-analyses were conducted with studies on the effectiveness of parent training programs for a broad range of children with disruptive behaviors. Previous findings cannot directly be translated to children with ADHD, as the symptom presentation (Groenman et al., 2021), and proposed underlying deficits and causes of ADHD may have implications for the effectiveness of the specific techniques that are being used in programs (Antshel & Barkley, 2008; Rapport, Chung, Shore, & Isaacs, 2001; Van der Oord & Tripp, 2020). For example, differences in motivational processes between children with ADHD and children with ODD and/or CD (e.g., Fairchild et al., 2019; Luman, Sergeant, Knol, & Oosterlaan, 2010; Luman, Tripp, & Scheres, 2010), such as altered reward and punishment sensitivity, may result in differences in the effectiveness of specific behavioral parent training techniques (Van der Oord & Tripp, 2020).

To improve interventions and as a step towards tailoring treatments for children with ADHD, we investigated the relation between the dosage of techniques (extracted from the manuals of the interventions) and effectiveness of parent and teacher training programs specifically for children with ADHD, using a metaregression analysis. To accurately measure the dosage of techniques in the programs, we scored manuals of the interventions with a taxonomy consisting of 39 different techniques, divided into 8 categories (see Appendix S1). We quantified the dosage of each technique with both the frequency and percentage of sessions in which the specific technique occurred.

As a secondary objective, we explored whether other intervention characteristics, such as method of delivery or duration of the program may influence program effectiveness. Previous meta-analyses regarding children with behavioral problems indicated that individually delivered parent training may be more effective than group programs (Lundahl, Risser, & Lovejoy, 2006) and that brief behavioral classroom interventions may have better treatment outcomes than long interventions (Veenman, Luman, & Oosterlaan, 2018). However, in meta-analyses regarding behavioral interventions for children with ADHD, these effects of duration of programs (Fabiano et al., 2009; Mulqueen et al., 2015; Van der Oord et al., 2008) and method of delivery (Lee et al., 2012; Rimestad et al., 2019) were not found. Although not yet studied in meta-analyses, it could be that the setting in which the intervention is delivered, or the inclusion of home-school collaboration (i.e., active encouragement of families and schools to work together to support the child), influences treatment success. Evidence from individual studies points towards the importance of these characteristics (e.g., Sonuga-Barke et al., 2018; Sonuga-Barke, Thompson, Daley, & Laver-Bradbury, 2004).

## Methods

### Protocol and registration

We registered the current meta-analysis at PROSPERO (registration number: CRD42018096768),<sup>1</sup> available from: [http://www.crd.york.ac.uk/PROSPERO/display\\_record.php?ID=CRD42018096768](http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42018096768). Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were followed.

### In- and exclusion criteria

We included randomized controlled trials that examined the effectiveness of behavioral parent or teacher training for children and adolescents with ADHD under the age of 18 years. Inclusion criteria were: (a) studies that compared parent or teacher training with a control condition, or studies that compared a multimodal intervention (i.e., a combination of parent, teacher, and/or child training) with a control condition, whether most of the training time was spent on either the parent and/or the teacher; (b) the study population concerned individuals meeting clinical cut-offs on ADHD questionnaires or meeting DSM-III (American Psychiatric Association, 1980), DSM-IV (American Psychiatric Association, 1994), DSM-IV-TR (American Psychiatric Association, 2000), or DSM-5 (American Psychiatric Association, 2013) criteria for ADHD on a (semi) structured interview; (c) studies used a control condition that was either (i) an active control treatment (i.e., a treatment arm that controls for nonspecific effects of the intervention); (ii) a treatment as usual; (iii) a no treatment/waitlist control. If trials had two control conditions, the condition with the highest quality (defined above i > ii > iii) was selected as the comparison. Studies that used medication as a control condition or intervention arms in which medication was (part of) the treatment were excluded. Studies including adults (over 18) and studies primarily aimed at samples with comorbid ADHD were excluded. If studies had more than one intervention arm, we included all eligible intervention arms in our meta-analysis.

### Interventions

We defined behavioral parent and teacher training as interventions that primarily teach parents and/or teachers techniques to manipulate the antecedents of child behavior (stimulus control techniques) and/or techniques to manipulate behavioral contingencies in the target setting (contingency management techniques), such that children are likely to increase the rate, frequency, or intensity of desired behaviors and conversely decrease unwanted behaviors (this definition was modeled after the definition of Evans, Owens, & Bunford, 2014).

### Outcomes

Our outcomes were total ADHD symptoms, separate symptoms of inattention and hyperactivity/impulsivity, and behavioral problems (symptoms of oppositional defiant disorder [ODD], or conduct disorder [CD]). If we had no total ADHD symptom score available, we pooled the separate inattention and hyperactivity-impulsivity symptoms scores and used this aggregate as measure of total ADHD symptoms. If a study had multiple measurement points, we selected the outcomes closest to the end date of the intervention. If there were multiple informants, we selected the parent-rated outcomes in case of parent training and the teacher-rated outcomes in case of teacher training. In case of multimodal interventions, we selected the informant with whom most training time was spent. When parent-rated outcomes were reported by both parents, we selected the mother-reported outcomes to increase the comparability across studies. In case of multiple outcome measurements of the same construct, we chose the measurement most commonly used in the included studies.

### Information sources, search, study selection

We used the following electronic databases to search for relevant publications: MEDLINE, CINAHL, PsycINFO, EMBASE+EMBASE CLASSIC, ERIC, Web of Science [Science Citation

Index Expanded] using a combination of the following search terms and their synonyms, and hierarchical family forms (e.g., MeSH terms): treatment-specific terms (i.e., behavioral treatment, psychosocial treatment, parent and/or teacher training), ADHD, hyperkinetic disorder, child and adolescent (the search terms per database can be found in Appendix S2), up to 13 May 2020. We included English, Dutch, and German language publications published in peer-reviewed journals. Selection and screening of studies was performed by two authors (out of three: RH, APG, TJD), using Rayyan; a web and mobile app for systematic reviews (Ouzzani, Hammady, Fedorowicz, & Elmagarmid, 2016). Disagreement was resolved by consensus and consultation with members of the research group (BJvdH, SvdO). The PRISMA flow diagram is presented in Figure 1.

### Data collection process

Data extraction was performed independently by two out of four persons (RH, APG, TJD, research assistant), and results were compared (see Appendix S3 for the extraction form). Disagreement was resolved by consensus and, if necessary, by consulting a third person (SvdO, BJvdH). To score the dosage of techniques, available manuals of the included interventions of eligible trials were double scored with a taxonomy (Appendix S1) by RH, TJD, or a research assistant. The taxonomy was constructed by combining information from a number of leading reviews (Chorpita & Daleiden, 2009; Kaminski et al., 2008; Lee et al., 2014; Michie et al., 2013) on behavioral treatment techniques. After consultation and tailoring of the taxonomy by the other authors (SvdO, BJvdH), the taxonomy was tested and cross-checked by RH and LvdV (registered clinical psychologist and cognitive behavior therapist). Finally, this resulted in a taxonomy with eight categories (i.e., 'Shaping knowledge', 'Observation and monitoring', 'Manipulating antecedents', 'Positive consequences', 'Negative consequences', 'Combined techniques', 'Generalization and maintenance', 'Relationship building and communication skills'), together covering 39 techniques (e.g., the category 'Negative consequences' consisted of the following techniques: 'planned ignoring', 'use of natural/logical consequences', 'punishment', 'response cost', and 'correction'). Using the taxonomy, we scored the number and percentage of sessions in which the technique was included. If the treatment manuals were not publicly available, we contacted the corresponding authors. If after several weeks we had no response, a reminder was sent to the corresponding author, and other authors were contacted. If the manual was not available (e.g., not sent or not available in English, Dutch, or German), we could not score the presence of techniques.

### Risk of bias

Quality assessment of the included studies was performed independently by two authors (RH and APG) using Grading of Recommendations Assessment, Development and Evaluation (GRADE). Any disagreement was resolved by consensus. Assessed domains included random sequence generation, allocation concealment, blinding of outcome assessment, incomplete outcome data, vested interest, and selective outcome reporting, rated on a 3-point scale (no risk of bias, unknown, or risk of bias).

### Analyses

Publication bias was assessed using the funnel plots and Egger's test, as recommended by the Cochrane Handbook for Systematic Reviews of Interventions (Higgins & Green, 2011). Trim-and-fill analyses were completed to estimate the number of studies needed to counteract potential funnel plot asymmetry (Duval & Tweedie, 2000). We calculated *p*-curves to estimate evidential value and to rule out potential flexibility in data analysis (Simonsohn, Nelson, & Simmons, 2014). Comprehensive Meta-Analysis software (CMA; Borenstein et al., 2006) was used to compute effect sizes in terms of standardized mean differences (SMD). Some effect sizes were recoded to ensure that positive effect sizes indicated positive effects of the intervention relative to the control condition. We determined heterogeneity with the Cochrane's *Q* tests and computed the *I*<sup>2</sup> statistic.

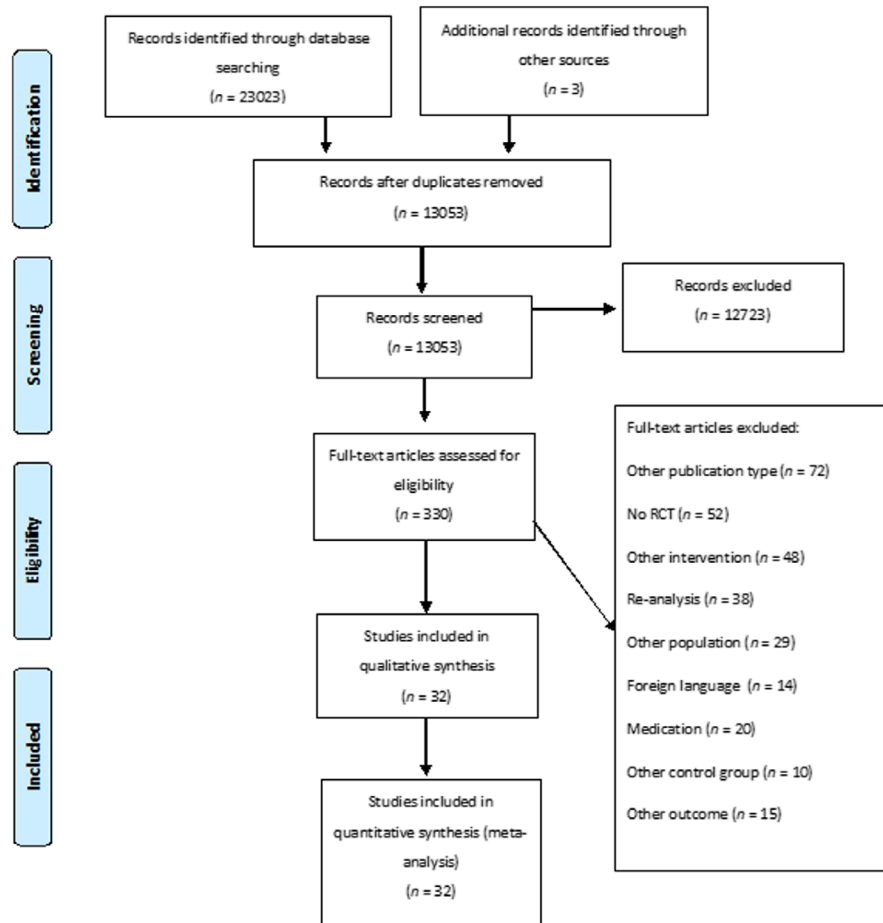


Figure 1. PRISMA flow diagram

Analyses were performed using the ‘metafor’ package (Viechtbauer, 2010) in R, version 4.0.2. We used random-effects meta-analyses to assess the main effect of parent and teacher training on our outcomes. For our primary aim, we used metaregression analyses to assess the associations between the dosage of the techniques (i.e., number and percentage of sessions) and treatment effectiveness. To restrict the number of comparisons, we first analyzed associations between the broader categories and outcomes, by examining the influence of (a) the number of sessions in which at least one of the techniques from a category occurred, and (b) the percentage of sessions in which at least one technique from a category occurred. We only conducted follow-up analyses on the specific techniques if a category (percentage or number of sessions) was significantly ( $p < .05$ ) or trend significantly ( $p < .10$ ) associated with effectiveness. We performed sensitivity analyses to check whether studies examining only behavioral parent training (as opposed to teacher training or multimodal programs) yielded different results. We report the  $\beta$ -coefficient for all metaregression analyses, where  $\beta_1$  indicates the change in standardized mean difference when the technique increases with one unit (i.e., one session or one percent) (Dekkers, Popma, van Rentergem, Bexkens, & Hui-zenga, 2016). For our secondary aim, metaregression was used to assess which intervention characteristics influenced treatment effectiveness. We assessed treatment duration as continuous characteristic, and setting (home, school, clinic, or mixed [a combination of two or more settings]), delivery method (individual, group, or combined), and the presence of home-school collaboration (yes/no) as categorical characteristics. Since all analyses were aimed at generating hypotheses, correction for multiple comparisons was not applied (Bender & Lange, 2001; Streiner & Norman, 2011). We only analyzed techniques or intervention characteristics with at least four interventions that deviated from the other interventions (categorical variables), or from zero (continuous variables) (Fu et al., 2008).

## Results

### Study selection

The final selection included 32 eligible studies (see Figure 1 for the PRISMA Flow Diagram), with a total  $N$  of 2594 children:  $n = 1596$  in the intervention group, and  $n = 998$  in the control group. A summary of the study characteristics is presented in Appendix S4. In the 32 included studies, 37 interventions were studied. We extracted outcomes on ADHD symptoms (29 interventions), inattention symptoms (20 interventions), hyperactivity-impulsivity symptoms (18 interventions), and behavioral problems (23 interventions). For 32 of the 37 interventions, the manuals were retrieved from the authors, and scored (see Appendix S5.1 and S5.2. for the scores per intervention). Of the other five manuals, one could not be used, as it was only available in Spanish (Miranda, Presentación, Siegenthaler, & Jara, 2013), and three manuals were not available anymore (Chacko et al., 2009; Pisterman et al., 1989, 1992 [only the traditional behavioral parent training-arm]). For one trial the manual was unavailable for the purpose of this meta-analysis (Corkum, Elik, Blotnicky-Gallant, McGonnell, & McGrath, 2015).

### Main effects

Behavioral parent and teacher training had significant medium-sized effects (ranging from .48 to .64, with  $p < .001$ ) on ADHD symptoms, behavioral problems, symptoms of inattention, and hyperactivity-impulsivity

symptoms (Table 1). The forest plot of the main effects can be found in Figure 2.

### Risk of bias and publication bias

The risk of bias graph and summary (interrater reliability;  $\kappa = .96$ ) are presented in Figures S1.1 and S1.2. Almost all studies scored high risk of bias on blinding of outcome assessment, due to the fact that our included outcomes were reported by parents or teachers who were also subject of the treatment. Most studies reported complete outcome data. For random sequence generation, allocation concealment, vested interest, and selective outcome reporting the information in the manuscripts were not sufficient to determine risk of bias. Publication bias was assessed using funnel plots (Figures S2.1–S2.4). The Egger's test for funnel plot asymmetry was significant for total ADHD symptoms ( $t = 2.27$ ,  $p = .032$ ), and behavioral problems ( $t = 3.57$ ,  $p = .002$ ), indicating possible publication bias. The Egger's test was not significant for inattention symptoms ( $t = .45$ ,  $p = .658$ ) and for hyperactivity-impulsivity symptoms ( $t = 1.58$ ,  $p = .135$ ). Trim-and-fill analyses (Duval & Tweedie, 2000) indicated that, on the left side of the funnel plot, seven studies were missing for total ADHD symptoms, nine studies for behavioral problems, and three studies for inattention symptoms and hyperactivity-impulsivity symptoms (Figure S2). After adding these missing studies, the effect size of the main effects somewhat decreased but remained significant for all outcome domains (see Table 1). All  $p$ -curves were right-skewed and indicated evidential value (see Figures S3.1–S3.4), thereby not indicating any signs of flexibility in data analysis. Taken together, although the Egger's test indicated potential publication bias for total ADHD symptoms and behavioral problems, our main effects were robust.

### Primary analyses: associations between dosage of techniques and treatment effectiveness

Significant associations between dosage of categories/specific techniques and treatment effects can be found in Table 2, and results of all analyses are available in Table S1. A higher dosage of the category 'Shaping knowledge' was associated with smaller treatment effects on behavioral problems. Further analysis of the techniques within that category showed that a higher dosage (both measured by the number and the

percentage of sessions) of psycho-education for parents was significantly related to smaller treatment effects on behavioral problems. A higher dosage (measured by the percentage of sessions) of the category 'Negative consequences' was significantly associated with better treatment effects on behavioral problems. Further analyses on which specific techniques of that category were related to effectiveness revealed no significant results. Other categories were not associated with treatment effectiveness.

### Sensitivity analyses

We reran the analyses without two specific studies primarily focusing on psycho-education (Ferrin et al., 2014, 2016), and a study without psycho-education that had the highest effect size on behavioral problems (Matos et al., 2009) and found similar results (Tables S2.1. and S2.2). Sensitivity analyses on the parent training interventions only (full results available in Tables S3.1. and S3.2) revealed results roughly similar to the full dataset. The only difference was that the category 'Shaping knowledge', and the specific technique psycho-education for parents (number of sessions) were not only significantly associated with smaller effects on behavioral problems, but also with smaller effects on total ADHD symptoms.

### Secondary analyses: associations between intervention characteristics and treatment effectiveness

We explored the associations between intervention characteristics and treatment effectiveness, and found that individual programs were associated with larger effects on total ADHD symptoms and hyperactivity-impulsivity symptoms than group programs. Too few interventions used a combination of individual and group sessions (i.e., combined), and therefore, effects of this delivery mode could not be assessed. Details of these secondary analyses can be found in Table S4.

## Discussion

Understanding which techniques contribute to or reduce treatment effectiveness is of importance to guide the development of future interventions and to tailor existing interventions (DuPaul et al., 2020). The primary aim of the present meta-analysis was to gain insight into

**Table 1.** Main effects without and with trim-fill correction per outcome domain

	$k$ ( $n_{es}$ )	SMD	95%CI	$Q$ ( $df$ )	$I^2$ (%)
ADHD symptoms	25 (29)	.48***	.35; .61	53.67 (28)**	48.70
After trim-fill correction	32 (36)	.35***	.19; .51	91.99 (35)***	62.00
Inattention symptoms	18 (20)	.52***	.34; .70	41.76 (19)**	55.51
After trim-fill correction	21 (23)	.42***	.22; .63	59.81 (22)***	63.20
Hyperactivity-impulsivity symptoms	16 (18)	.64***	.39; .89	56.55 (17)***	70.36
After trim-fill correction	19 (21)	.51**	.22; .79	76.93 (20)***	74.10
Behavioral problems	20 (23)	.48***	.35; .61	31.82 (22)**	32.36
After trim-fill correction	29 (32)	.32***	.16; .48	68.52 (31)***	54.80

$k$  represents the number of studies, with the number of effect sizes in parentheses. SMD, standardized mean difference; CI, confidence interval;  $I^2$  = proportion of variation in study estimates that can be accounted for by heterogeneity;  $Q$  = the probability value for heterogeneity of studies. The trim-fill correction calculates the effect size after correcting for funnel plot asymmetry. \*\* $p < .01$ , \*\*\* $p < .001$ .

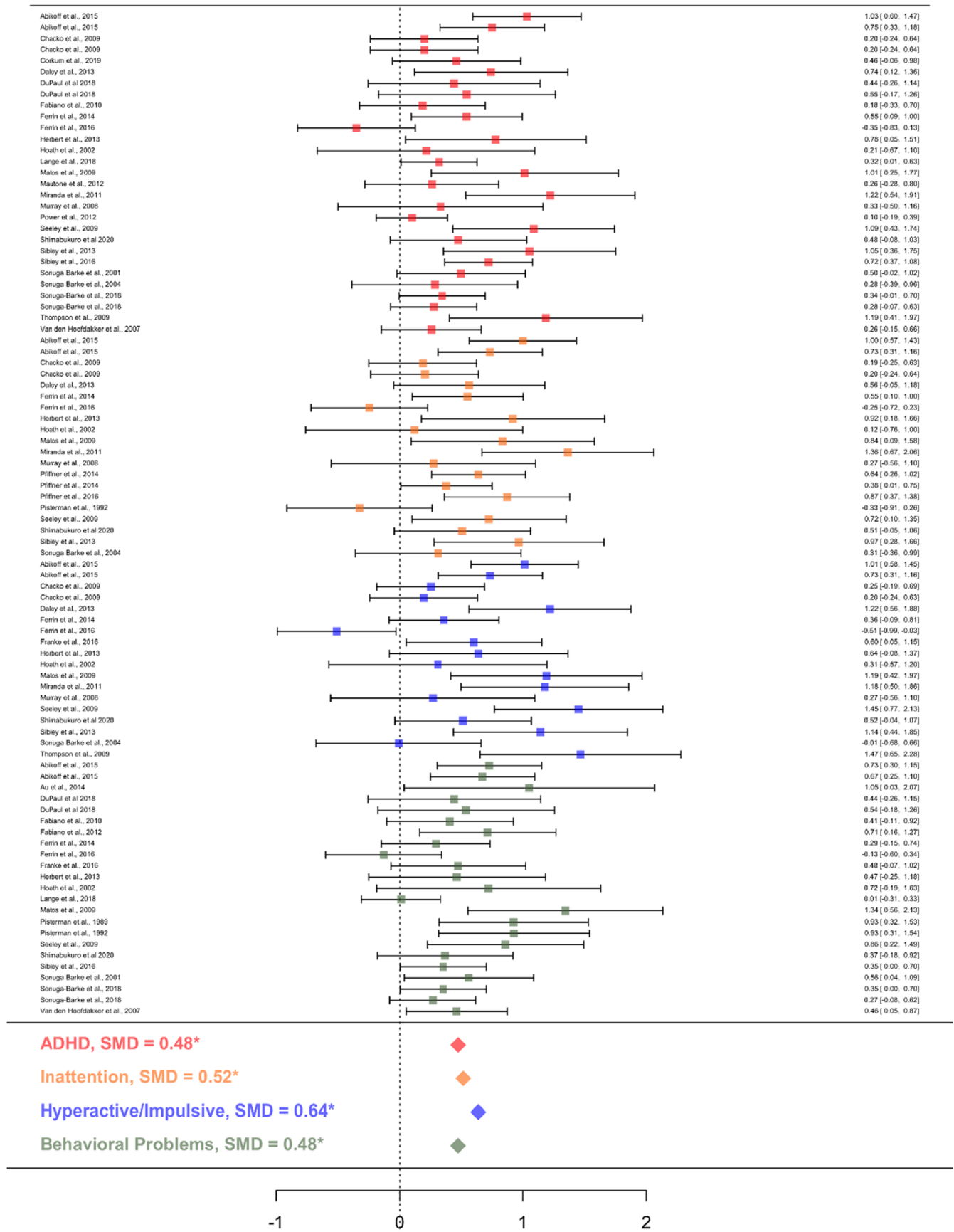


Figure 2. Forest plot with all effect sizes, color-sorted per outcome domain. The x-axis depicts the effect size in terms of standardized mean differences (SMD)

**Table 2.** Significant associations between dosage of categories/specific techniques and treatment effects

	Outcome domain	<i>k</i>	$\beta_1$	<i>I</i> <sup>2</sup> (%)
Shaping knowledge (sessions)	Behavioral problems	21	-.04 (-.07; -.01)**	10.52
Psycho-education parents (sessions)	Behavioral problems	21	-.04 (-.07; -.01)**	10.52
Shaping knowledge (%)	Behavioral problems	21	-.01 (-.01; -.00)**	7.75
Psycho-education parents (%)	Behavioral problems	21	-.01 (-.01; -.00)**	7.75
Negative consequences (%)	Behavioral problems	21	.01 (.00; .01)*	17.82

\**p* < .05, \*\**p* < .01.  $\beta_1$  denotes the change in SMD when the moderator increases with one unit (i.e., one session/one percentage point).

which techniques that are commonly being taught to parents and teachers in behavioral training programs for children with ADHD are associated with treatment effectiveness. Our secondary aim was to examine which other intervention characteristics were associated with treatment effectiveness. Our metaregression showed that (a) a higher dosage of psycho-education was related to smaller effects on behavioral problems, (b) a higher dosage of negative consequences, such as correction and planned ignoring, was related to larger effects on behavioral problems, and (c) individual training resulted in larger effects on children's inattention and hyperactivity-impulsivity symptoms than group training.

Although a recent review (Dahl et al., 2019) suggested positive effects of stand-alone psycho-educational interventions for ADHD, our results indicated smaller mean differences between interventions with a higher dosage of psycho-education and the control condition at posttest. On top of that, the analyses with parent training programs only showed that a higher dosage of psycho-education was associated with lower effects on total ADHD symptoms as well. The analyses without the studies that primarily focused on psycho-education or did not include any psycho-education yielded the same results, indicating that the inclusion of these studies did not explain our findings. Similar results were found in our meta-analysis on parental outcomes (Dekkers et al., 2021), in which we found a higher dosage of psycho-education to be related to lower effects on positive parenting and the quality of the parent-child relationship. Psycho-education may be less relevant to the specific outcomes targeted in these meta-analyses, as its primary aim is to give up-to-date information about ADHD and its treatment, thereby promoting knowledge and management of the disorder (Ferrin et al., 2014). Instead of directly targeting child behavioral outcomes, psycho-education is mainly expected to increase willingness to participate and adhere to interventions. We propose three possible explanations for the smaller effects of interventions with a high dosage of psycho-education. First, behavioral parent and teacher training programs are generally restricted in time, so one hypothesis is that when much time is spent on psycho-education, there is less opportunity to teach and practice with the other techniques. A second explanation may be that the psycho-education made parents and teachers more aware of the child's ADHD and behavioral symptoms that subsequently led to more severe estimations of the child's behaviors after treatment. Further research with more objective measures, such as blinded observations of behavior, should be conducted to verify this explanation. Third, the content of psycho-education, which was not assessed in the current meta-analysis, could also be

a factor influencing attitudes of parents and teachers. Information about the biological and genetic explanations of disorders can have negative effects on attitudes about children with the disorder (Read & Harré, 2001) and may lead to an underestimation of perceived influence on children's behavior (Maccoby, 2000). This potentially discourages parents and teachers to change their behavior and thus results in lower program effectiveness. Future studies should examine which amount and content of psycho-education in training programs are necessary to gain optimal treatment results.

Further, we found that a higher dosage of training parents and teachers to adequately use negative consequences for undesired behaviors was associated with better treatment effects on behavioral problems. This is in accordance with a meta-analysis into effective techniques in parenting programs for children with disruptive behavior (Leijten et al., 2019), which found that the use of natural/logical consequences was associated with a decrease in disruptive behavior. Our results highlight the importance of these techniques to reduce behavioral problems of children with ADHD in particular (instead of the core symptoms of ADHD). However, it should be noted that with our methods, we cannot draw conclusions about the effectiveness of these techniques in isolation. The investigated negative consequences were provided in programs in which a variety of positive behavioral techniques, such as praise, positive attention, and relationship enhancing strategies, were also part of the curriculum. It is likely that negative consequences are only effective when used in combination with a high dosage of those positive consequences (Caldarella, Larsen, Williams, Wills, & Wehby, 2019). Also, it is important to note that the negative consequences coded in the manuals did not include physical punishment. Furthermore, as we only assessed short-term treatment effects, possible negative effects of negative consequences in the long run cannot be ruled out (Van der Oord & Tripp, 2020). For example, experimental evidence demonstrated that after extensive exposure to punishment (i.e., removal of tokens and appearance of a sad-faced character), children with ADHD made more errors and showed reduced task persistence compared with typically developing children (Furukawa, Alsop, Sowerby, Jensen, & Tripp, 2017). Therefore, it seems important to always provide negative consequences in the context of positive consequences and other relationship-enhancing strategies (Caldarella et al., 2019).

The secondary aim of this study was to explore whether other intervention characteristics were associated with treatment effectiveness. Our results indicated that individual training of parents or teachers resulted



in better treatment effects on children's inattention and hyperactivity-impulsivity symptoms than training in a group. To date, there is little knowledge about which delivery method actually works better for which parents and teachers. Group parent training is advantageous because of the opportunity to learn from other parents and the social support from each other (Daley et al., 2018). Individually delivered training, however, may be better to tailor treatments to the individual needs of the child, and to adjust the therapy to the individual parent or teacher, thereby improving effectiveness. Additionally, in an individual training a one-on-one relationship with the therapist can be beneficial for the therapeutic alliance, which may reduce treatment drop-out, while group training often follows a fixed schedule and pace, which can cause difficulties in engagement for some families or teachers. Moreover, in a study in which parents of children with ADHD symptoms were asked which format they preferred, most parents preferred individual parent training above group training (Wymbs et al., 2016).

### *Strengths and limitations*

Our meta-analysis has several strengths. First, we used an extensive taxonomy consisting of 39 different behavioral techniques to disentangle the different treatment components. Second, in contrast to other meta-analyses (Kaminski et al., 2008; Leijten et al., 2019), we used the manuals of the interventions to score the behavioral techniques, giving us the opportunity to extract the dosage of the techniques. Third, whereas other studies focused on a broader range of behavioral problems (Kaminski et al., 2008; Leijten et al., 2019), we limited our meta-analysis to programs focusing on children with ADHD. This enabled us to draw conclusions on the dosage of effective techniques in behavioral parent and teacher training programs specifically for children with ADHD. Nevertheless, several limitations should also be considered when interpreting the results. First, we cannot draw conclusions about the effectiveness of single techniques, the sequencing of techniques, or the combination of techniques. Techniques not necessarily stand alone, rather, the effects are possibly contingent upon other techniques and intervention components (Chacko et al., 2015). In the current meta-analysis, we analyzed associations between the dosage of behavioral techniques and intervention effectiveness. Hence, it could be that other components of these interventions that are confounded with these techniques caused the lower or higher effect sizes of some interventions compared with others. To truly unravel the effectiveness and optimal dosage of specific techniques, experimental research in which different components are tested separately is needed. An ideal way to do this could be in microtrials; a randomized experimental trial in which certain components of an intervention are tested on a proximal specific outcome (Leijten et al., 2015; Sloboda, Petras, Robertson, & Hingson, 2019). For example, in two recent microtrials concerning stimulus control and contingency management techniques, both components proved to be effective in decreasing ADHD symptoms and oppositional behavior of children with ADHD (Hornstra et al., 2021; Staff et al., 2020). Second, an important consideration is that, even if a technique was described in the manual, we did not know whether it was

actually provided in the intervention. Nonetheless, because in all of our included studies the therapists were participating in a randomized controlled trial, it can be expected that there was more emphasis on treatment fidelity (Daley et al., 2018), and almost all studies included in the present meta-analysis conducted an integrity check. Third, the analyses in this metaregression analysis were hypothesis generating rather than hypothesis testing, and some analyses were based on a small number of studies, possibly causing a lack of power to detect significant factors. Individual participant data meta-analysis, in which raw data from individual participants of studies is used, might be a more optimal method to examine possible moderating effects. Finally, it could be that we did not find potential effective techniques due to a lack of variability in the intervention programs. For example, almost all programs included social rewards, albeit in different dosages, and few studies included behavior substitution.

### **Conclusion**

To optimize treatment results of behavioral parent and teacher training programs for children with ADHD, it seems important to teach parents or teachers how to adequately provide negative consequences to target comorbid behavioral problems. We do not advise to skip psycho-education altogether; however, it may be that offering parents psycho-education prior to an intervention is preferred over a high dosage of psycho-education within a training program. Moreover, individual training formats may be preferred over group programs. Our findings can strengthen existing interventions, or guide the development of new behavioral parent and teacher training programs for children with ADHD.

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standard groups. The remaining authors have declared that they have no competing or potential conflicts of interest.

## Ethical information

No ethical approval was required for this article.

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## Note

1 The PROSPERO registration also covers parental outcomes, which are described in a separate article by the same research group (Dekkers et al., 2021). For this reason, some of the wording in the method sections of these articles may overlap.

## Supporting information

Additional Supporting Information may be found in the online version of this article:

- Appendix S1.** Taxonomy.
- Appendix S2.** Search terms per database.
- Appendix S3.** Search form data extraction.
- Appendix S4.** Summary of study characteristics.
- Appendix S5.1.** Number of sessions including specific techniques.
- Appendix S5.2.** Percentage of sessions including specific techniques.
- Figure S1.1.** Risk of bias graph.
- Figure S1.2.** Risk of bias summary.
- Figure S2.1.** Funnel plot ADHD symptoms.
- Figure S2.2.** Funnel plot behavioral problems.
- Figure S2.3.** Funnel plot inattention symptoms.
- Figure S2.4.** Funnel plot hyperactivity-impulsivity symptoms.
- Figure S3.1.** *p*-curve for total ADHD symptoms.
- Figure S3.2.** *p*-curve for inattention symptoms.
- Figure S3.3.** *p*-curve for hyperactivity-impulsivity symptoms.
- Figure S3.4.** *p*-curve for behavioral problems.
- Table S1.** Results of metaregression analyses with dosage of categories of techniques.
- Table S2.1.** Results of metaregression analyses (without Ferrin et al., 2014, 2016) with dosage of categories of techniques.
- Table S2.2.** Results of metaregression analyses (without Matos, Bauermeister, & Bernal, 2009) with dosage of categories of techniques.
- Table S3.1.** Results of metaregression analyses (without teacher training) with dosage of categories of techniques.
- Table S3.2.** Results of metaregression analyses (without teacher training) with delivery mode and setting as moderators.
- Table S4.** Results of metaregression analyses with intervention characteristics.

## References

- American Psychiatric Association (2013). *Diagnostic and statistical manual of mental disorders* (5th edn). Washington, DC: Author.
- American Psychiatric Association (2000). *Diagnostic and statistical manual of mental disorders* (4th edn, text rev.). Washington, DC: Author.
- American Psychiatric Association (1994). *Diagnostic and statistical manual of mental disorders* (4th edn). Washington, DC: Author.
- American Psychiatric Association. (1980). *Diagnostic and statistical manual of mental disorders* (3rd edn). Washington, DC: Author.
- Abikoff, H.B., Thompson, M., Laver-Bradbury, C., Long, N., Brotman, L.M., Klein, R.G., ... & Sonuga-Barke, E. (2015). Parent training for preschool ADHD: A randomized controlled trial of specialized and generic programs. *Journal of Child Psychology and Psychiatry*, 56, 618–631.
- Antshel, K.M., & Barkley, R.A. (2008). Psychosocial interventions in attention-deficit/hyperactivity disorder. *Child and Adolescent Psychiatric Clinics of North America*, 17, 421–437.
- Bender, R., & Lange, S. (2001). Adjusting for multiple testing – When and how? *Journal of Clinical Epidemiology*, 54, 343–349.
- Borenstein, M., Hedges, L.V., Higgins, J.P.T., & Rothstein, H.R. (2006). *Comprehensive meta-analysis* (Version 2.2.027). Englewood, NJ: Biostat. Available from: <https://www.meta-analysis.com/> [last accessed 11 November 2020].
- Caldarella, P., Larsen, R.A.A., Williams, L., Wills, H.P., & Wehby, J.H. (2019). Teacher praise-to-reprimand ratios: Behavioral response of students at risk for ebd compared with typically developing peers. *Education and Treatment of Children*, 42, 447–468.
- Chacko, A., Allan, C.C., Uderman, J., Cornwell, M., Anderson, L., & Chimiklis, A. (2015). Training parents of youth with ADHD. In R.A. Barkley (Ed.), *Attention-deficit hyperactivity disorder: A handbook for diagnosis and treatment* (pp. 513–536). New York: The Guilford Press.
- Chacko, A., Wymbs, B.T., Wymbs, F.A., Pelham, W.E., Swanger-Gagne, M.S., Girio, E., ... & O'Connor, B. (2009). Enhancing traditional behavioral parent training for single mothers of children with ADHD. *Journal of Clinical Child and Adolescent Psychology*, 38, 206–218.
- Chorpita, B.F., & Daleiden, E.L. (2009). Mapping evidence-based treatments for children and adolescents: Application of the distillation and matching model to 615 treatments from 322 randomized trials. *Journal of Consulting and Clinical Psychology*, 77, 566–579.
- Coates, J., Taylor, J.A., & Sayal, K. (2015). Parenting interventions for ADHD: A systematic literature review and meta-analysis. *Journal of Attention Disorders*, 19, 831–843.
- Corkum, P., Elik, N., Blotnicky-Gallant, P.A.C., McGonnell, M., & McGrath, P. (2015). Web-based intervention for teachers of elementary students with ADHD: Randomized controlled trial. *Journal of Attention Disorders*, 23, 257–269.
- Dahl, V., Ramakrishnan, A., Spears, A.P., Jorge, A., Lu, J., Bigio, N.A., & Chacko, A. (2019). Psychoeducation interventions for parents and teachers of children and adolescents with ADHD: A systematic review of the literature. *Journal of Developmental and Physical Disabilities*, 32, 257–292.
- Daley, D., Van Der Oord, S., Ferrin, M., Danckaerts, M., Doepfner, M., Cortese, S., & Sonuga-Barke, E.J.S. (2014). Behavioral interventions in attention-deficit/hyperactivity disorder: A meta-analysis of randomized controlled trials across multiple outcome domains. *Journal of the American Academy of Child and Adolescent Psychiatry*, 53, 835–847.
- Daley, D., Van Der Oord, S., Ferrin, M., Cortese, S., Danckaerts, M., Doepfner, M., ... & Sonuga-Barke, E.J. (2018). Practitioner review: Current best practice in the use of parent training and other behavioural interventions in the treatment of children and adolescents with attention deficit hyperactivity disorder. *Journal of Child Psychology and Psychiatry*, 59, 932–947.
- Dekkers, T.J., Popma, A., van Rentergem, J.A.A., Bexkens, A., & Huizenga, H.M. (2016). Risky decision making in attention-deficit/hyperactivity disorder: A meta-regression analysis. *Clinical Psychology Review*, 45, 1–16.
- Dekkers, T.J., Hornstra, R., van der Oord, S., Luman, M., Hoekstra, P.J., Groenman, A.P., & van den Hoofdakker, B.J. (2021). Meta-analysis: Which components of parent training work for children with attention-deficit/hyperactivity disorder? *Journal of the American Academy of Child & Adolescent Psychiatry*, 61, 478–494.
- DuPaul, G.J., Evans, S.W., Mautone, J.A., Owens, J.S., & Power, T.J. (2020). Future directions for psychosocial

- interventions for children and adolescents with ADHD. *Journal of Clinical Child and Adolescent Psychology*, 49, 134–145.
- Duval, S., & Tweedie, R. (2000). A Nonparametric “Trim and Fill” method of accounting for publication bias in meta-analysis. *Journal of the American Statistical Association*, 95, 89–98.
- Evans, S.W., Owens, J.S., & Bunford, N. (2014). Evidence-based psychosocial treatments for children and adolescents with attention-deficit/hyperactivity disorder. *Journal of Clinical Child and Adolescent Psychology*, 43, 527–551.
- Evans, S.W., Owens, J.S., Wymbs, B.T., Ray, A.R., Evans, S.W., Owens, J.S., ... & Ray, A.R. (2018). Evidence-based psychosocial treatments for children and adolescents with attention deficit/hyperactivity disorder. *Journal of Clinical Child and Adolescent Psychology*, 47, 157–198.
- Fabiano, G.A., Pelham, W.E., Coles, E.K., Gnagy, E.M., Chronis-Tuscano, A., & O'Connor, B.C. (2009). A meta-analysis of behavioral treatments for attention-deficit/hyperactivity disorder. *Clinical Psychology Review*, 29, 129–140.
- Fairchild, G., Hawes, D.J., Frick, P.J., Copeland, W.E., Odgers, C.L., Franke, B., ... & De Brito, S. (2019). Conduct disorder. *Nature Reviews Disease Primers*, 5, 1–25.
- Ferrin, M., Moreno-Granados, J.M., Salcedo-Marin, M.D., Ruiz-Veguilla, M., Perez-Ayala, V., & Taylor, E. (2014). Evaluation of a psychoeducation programme for parents of children and adolescents with ADHD: Immediate and long-term effects using a blind randomized controlled trial. *European Child and Adolescent Psychiatry*, 23, 637–647.
- Ferrin, M., Perez-Ayala, V., El-Abd, S., Lax-Pericall, T., Jacobs, B., Bilbow, A., & Taylor, E. (2016). A randomized controlled trial evaluating the efficacy of a psychoeducation program for families of children and adolescents with ADHD in the United Kingdom. *Journal of Attention Disorders*, 24, 768–779.
- Fu, R., Gartlehner, G., Grant, M., Shamliyan, T., Sedrakyan, A., Wilt, T.J., ... & Trikalinos, T.A. (2008). Conducting quantitative synthesis when comparing medical interventions: AHRQ and the effective health care program. *Journal of Clinical Epidemiology*, 64, 1187–1197.
- Furukawa, E., Alsop, B., Sowerby, P., Jensen, S., & Tripp, G. (2017). Evidence for increased behavioral control by punishment in children with attention-deficit hyperactivity disorder. *Journal of Child Psychology and Psychiatry*, 58, 248–257.
- Garland, A.F., Hawley, K.M., Brookman-Frazee, L., & Hurlburt, M.S. (2008). Identifying common elements of evidence-based psychosocial treatments for children’s disruptive behavior problems. *Journal of the American Academy of Child and Adolescent Psychiatry*, 47, 505–514.
- Groenman, A.P., Hornstra, R., Hoekstra, P.J., Steenhuis, L., Aghebati, A., Boyer, B.E., ... & Daley, D. (2021). An individual participant data meta-analysis: Behavioral treatments for children and adolescents with attention-deficit/hyperactivity disorder. *Journal of the American Academy of Child & Adolescent Psychiatry*, 61, 144–158.
- Higgins, J.P.T., & Green, S. (2011). *Cochrane handbook for systematic reviews of interventions. Version 5.1.0*. The Cochrane Collaboration.
- Hornstra, R., van der Oord, S., Staff, A.I., Hoekstra, P.J., Oosterlaan, J., van der Veen-Mulders, L., ... & van den Hoofdakker, B.J. (2021). Which techniques work in behavioral parent training for children with ADHD? A randomized controlled microtrial. *Journal of Clinical Child and Adolescent Psychology*, 50, 888–903.
- Kaminski, J., Valle, L.A., Filene, J.H., & Boyle, C.L. (2008). A meta-analytic review of components associated with parent training program effectiveness. *Journal of Abnormal Child Psychology*, 36, 567–589.
- Lee, B.R., Ebesutani, C., Koliowski, K.M., Becker, K.D., Lindsey, M.A., Brandt, N.E., ... & Barth, R.P. (2014). Program and practice elements for placement prevention: A review of interventions and their effectiveness in promoting home-based care. *American Journal of Orthopsychiatry*, 84, 244–256.
- Lee, P.C., Niew, W.I., Yang, H.J., Chen, V.C.H., & Lin, K.C. (2012). A meta-analysis of behavioral parent training for children with attention deficit hyperactivity disorder. *Research in Developmental Disabilities*, 33, 2040–2049.
- Leijten, P., Dishion, T.J., Thomaes, S., Raaijmakers, M.A.J., Orobio de Castro, B., & Matthys, W. (2015). Bringing parenting interventions back to the future: How randomized micro-trials may benefit parenting intervention efficacy. *Clinical Psychology: Science and Practice*, 22, 47–57.
- Leijten, P., Gardner, F., Melendez-Torres, G.J., van Aar, J., Hutchings, J., Schulz, S., ... & Overbeek, G. (2019). Meta-analyses: Key parenting program components for disruptive child behavior. *Journal of the American Academy of Child and Adolescent Psychiatry*, 58, 180–190.
- Luman, M., Sergeant, J.A., Knol, D.L., & Oosterlaan, J. (2010). Impaired decision making in oppositional defiant disorder related to altered psychophysiological responses to reinforcement. *Biological Psychiatry*, 68, 337–344.
- Luman, M., Tripp, G., & Scheres, A. (2010). Identifying the neurobiology of altered reinforcement sensitivity in ADHD: A review and research agenda. *Neuroscience and Biobehavioral Reviews*, 34, 744–754.
- Lundahl, B., Risser, H.J., & Lovejoy, M.C. (2006). A meta-analysis of parent training: Moderators and follow-up effects. *Clinical Psychology Review*, 26, 86–104.
- Maccoby, E.E. (2000). Parenting and its effects on children: On reading and misreading behavior genetics. *Annual Review of Psychology*, 51, 1–27.
- Matos, M., Bauermeister, J.J., & Bernal, G. (2009). Parent-child interaction therapy for Puerto Rican preschool children with ADHD and behavior problems: A pilot efficacy study. *Family Process*, 48, 232–252.
- Michie, S., Richardson, M., Johnston, M., Abraham, C., Francis, J., Hardeman, W., ... & Wood, C.E. (2013). The behavior change technique taxonomy (v1) of 93 hierarchically clustered techniques: Building an international consensus for the reporting of behavior change interventions. *Annals of Behavioral Medicine*, 46, 81–95.
- Miranda, A., Presentación, M.J., Siegenthaler, R., & Jara, P. (2013). Effects of a psychosocial intervention on the executive functioning in children with ADHD. *Journal of Learning Disabilities*, 46, 363–376.
- Mulqueen, J.M., Bartley, C.A., & Bloch, M.H. (2015). Meta-analysis: Parental interventions for preschool ADHD. *Journal of Attention Disorders*, 19, 118–124.
- Ouzzani, M., Hammady, H., Fedorowicz, Z., & Elmagarmid, A. (2016). Rayyan—a web and mobile app for systematic reviews. *Systematic Reviews*, 5, 1–10.
- Pisterman, S., Firestone, P., McGrath, P., Goodman, J.T., Webster, I., Mallory, R., & Coffin, B. (1992). The effects of parent training on parenting stress and sense of competence. *Canadian Journal of Behavioural Science/Revue Canadienne des Sciences Du Comportement*, 24, 41–58.
- Pisterman, S., McGrath, P., Firestone, P., Goodman, J.T., Webster, I., & Mallory, R. (1989). Outcome of parent-mediated treatment of preschoolers with attention deficit disorder with hyperactivity. *Journal of Consulting and Clinical Psychology*, 57, 628–635.
- Rapport, M.D., Chung, K., Shore, G., & Isaacs, P. (2001). A conceptual model of child psychopathology: Implications for understanding attention deficit hyperactivity disorder and treatment efficacy. *Journal of Clinical Child & Adolescent Psychology*, 30, 48–58.
- Read, J., & Harré, N. (2001). The role of biological and genetic causal beliefs in the stigmatisation of “mental patients”. *Journal of Mental Health*, 10, 223–235.
- Rimestad, M.L., Lambek, R., Christiansen, H.Z., Hougaard, E., Rimestad, M.L., Lambek, R., ... & Hougaard, E. (2019). Short- and Long-term effects of parent training for preschool children with or at risk of ADHD: A systematic review and meta-analysis. *Journal of Attention Disorders*, 23, 423–434.
- Schatz, N.K., Aloe, A.M., Fabiano, G.A., Pelham, W.E., Smyth, A., Zhao, X., ... & Altszuler, A.R. (2020). Psychosocial interventions for ADHD: Systematic review with evidence and gap map. *Journal of Development and Behavioral Pediatrics*, 41, 1–11.

- Seeley, J.R., Small, J.W., Walker, H.M., Feil, E.G., Severson, H.H., Golly, A.M., & Forness, S.R. (2009). Efficacy of the first step to success intervention for students with attention-deficit/hyperactivity disorder. *School Mental Health, 1*, 37–48.
- Simonsohn, U., Nelson, L.D., & Simmons, J.P. (2014). P-curve: A key to the file-drawer. *Journal of Experimental Psychology: General, 143*, 534–547.
- Staff, A.I., Van den Hoofdakker, B.J., Van der Oord, S., Hornstra, R., Hoekstra, P.J., Twisk, J.W.R., ... & Luman, M. (2020). Effectiveness of specific techniques in behavioral teacher training for childhood ADHD: A randomized controlled microtrial. *Journal of Clinical Child and Adolescent Psychology, 50*, 763–779.
- Sloboda, Z., Petras, H., Robertson, E., & Hingson, R. (2019). In Z. Sloboda, H. Petras, E. Robertson, & R. Hingson (Eds.), *Prevention of substance use. Part I 4 Genetics and epigenetics of substance use*. Ottawa, ON: Springer Nature.
- Sonuga-Barke, E.J.S., Barton, J., Daley, D., Hutchings, J., Maishman, T., Raftery, J., ... & Thompson, M.J.J. (2018). A comparison of the clinical effectiveness and cost of specialised individually delivered parent training for preschool attention-deficit/hyperactivity disorder and a generic, group-based programme: A multi-Centre, randomised controlled trial of the new F. *European Child & Adolescent Psychiatry, 27*, 797–809.
- Sonuga-Barke, E.J.S., Thompson, M., Daley, D., & Laver-Bradbury, C. (2004). Parent training for attention deficit/hyperactivity disorder: Is it as effective when delivered as routine rather than as specialist care? *British Journal of Clinical Psychology, 43*, 449–457.
- Streiner, D.L., & Norman, G.R. (2011). Correction for multiple testing: Is there a resolution? *Chest, 140*, 16–18.
- Van der Oord, S., & Tripp, G. (2020). How to improve behavioral parent and teacher training for children with ADHD: Integrating empirical research on learning and motivation into treatment. *Clinical Child and Family Psychology Review, 23*, 577–604.
- Van der Oord, S., Prins, P.J.M., Oosterlaan, J., & Emmelkamp, P.M.G. (2008). Efficacy of methylphenidate, psychosocial treatments and their combination in school-aged children with ADHD: A meta-analysis. *Clinical Psychology Review, 28*, 783–800.
- Veenman, B., Luman, M., & Oosterlaan, J. (2018). Efficacy of behavioral classroom programs in primary school. A meta-analysis focusing on randomized controlled trials. *PLoS One, 13*, 1–23.
- Viechtbauer, W. (2010). Conducting meta-analyses in R with the metafor package. *Journal of Statistical Software, 36*, 1–48.
- Wymbs, F.A., Cunningham, C., Chen, Y., Rimas, H.M., Deal, K., Waschbusch, D.A., & Pelham, W.E.J. (2016). Examining parents preferences for group and individual parent training for children with ADHD symptoms. *Physiology & Behavior, 176*, 139–148.

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