Child Psychiatry & Human Development (2018) 49:853–864
https://doi.org/10.1007/s10578-018-0800-1

ORIGINAL ARTICLE

Effect of Comorbid Psychopathology and Conduct Problem Severity on Response to a Multi-component Intervention for Childhood Disruptive Behavior

Madison Aitken[1] · **Jordana A. Waxman**[2] · **Katie MacDonald**[1] · **Brendan F. Andrade**[1,3]

Published online: 29 March 2018
© Springer Science+Business Media, LLC, part of Springer Nature 2018

Abstract
This study examined the effects of comorbid ADHD symptoms, internalizing psychopathology, Callous–Unemotional (CU) Traits, and conduct problem severity on children's response to an evidence-based psychosocial intervention. Clinic-referred children with DBD ages 8–12 years ($N=76$) participated in a 15-week multi-component intervention. Parents provided weekly ratings of children's oppositionality-defiance, peer problems, and impairment. Oppositionality-defiance, peer problems, and impairment decreased significantly over the course of the intervention; however, there was considerable variability in weekly ratings. Baseline ADHD symptoms, internalizing psychopathology, CU traits, and conduct problem severity were unrelated to rate of change across treatment. However, ADHD symptoms uniquely predicted more oppositionality-defiance, peer problems, and impairment averaged across the 15 weeks of treatment. Follow-up analyses suggested this was driven by hyperactivity-impulsivity rather than inattention. Children with DBD and comorbid symptoms appear to benefit from a multi-component intervention, but those with ADHD symptoms may require additional support to address social and behavioral challenges.

Keywords Conduct disorders · Treatment · Internalizing disorders · ADHD

Introduction

Introduction

Disruptive behavior disorders (DBD), including oppositional defiant disorder and conduct disorder, are prevalent and impairing childhood mental health concerns [1]. A number of psychosocial treatment programs have demonstrated efficacy in reducing disruptive behavior [2]. In particular, multi-component group interventions that involve child and parent treatment are effective in reducing aggressive and disruptive behaviors [3, 4]. However, effect sizes for DBD interventions are generally small to medium [5] and many children with DBD do not show sufficient symptom reduction with evidence-based interventions, with some studies finding rates of treatment non-response as high as one-third to one-half [4, 6]. Determining factors that limit treatment benefits is necessary to improve outcomes.

Children with DBD are heterogeneous and differ in the types of problems they display, their prognosis, and the causes of their problem behaviors [7, 8]. A logical assumption is that children with more severe presentations, including those with comorbid symptoms, will benefit less from treatment than other children [9]. Alternatively, it is possible that children with more severe symptoms may benefit most from treatment given that they have the greatest room for improvement. Few studies have investigated whether individual-level complexity in psychopathology or key domains of functioning are related to treatment response [10]. Although it has been suggested that evidence-based treatments may be less effective for children with comorbid disorders, the majority of studies have not supported

✉ Brendan F. Andrade
brendan.andrade@camh.ca

[1] Centre for Addiction and Mental Health, 80 Workman Way, Toronto, ON M6J 1H4, Canada

[2] Department of Psychology, York University, Behavioural Science Building, Room 297, 4700 Keele Street, Toronto, ON M3J 1P3, Canada

[3] Department of Psychiatry, University of Toronto, 250 College Street, 8th floor, Toronto, ON M5T 1R8, Canada

this hypothesis [11]. Better understanding the impact of comorbidity on treatment outcome is important for children with DBD given that the majority present to clinics with co-occurring attention-deficit/hyperactivity disorder (ADHD) or internalizing disorders (i.e., anxiety, depression [1]), or demonstrate limited emotionality, caring, and apparent empathy (i.e., callous-unemotional, CU, traits [12]).

ADHD Symptoms

As many as 80% of children with DBD also meet diagnostic criteria for ADHD [1]. There is limited evidence that ADHD or ADHD symptoms reduce the effectiveness of treatment for DBD [13]. There is some evidence that children with comorbid ADHD exhibit more DBD symptoms and higher levels of impairment than children without comorbid ADHD following treatment [14, 15]. However, previous studies of group interventions, including parent and/or child group components, have reported that ADHD symptoms are not associated with differences in behavior change from pre- to post-treatment and, in some cases, ADHD symptoms have been associated with a greater reduction in DBD symptoms [10, 15, 16]. These results provide some insight into treatment response of children with DBD and comorbid ADHD symptoms; however, little is known about *rates of improvement* in symptoms or behavior across treatment in children with DBD and comorbid ADHD symptoms. In particular, cognitive and behavioral characteristics associated with ADHD symptoms, such as difficulties with higher-order language comprehension, or difficulty problem solving and generalizing strategies to new situations [17, 18] may contribute to slower or less consistent gains during treatment.

Internalizing Psychopathology

One-third to one-half of children with DBD meet diagnostic criteria for a mood or anxiety disorder [1]; however, evidence is mixed regarding the effects of comorbid internalizing psychopathology on the functioning of children with DBD [19]. A dual pathway model has been proposed in which anxiety either buffers against or exacerbates DBD symptoms [20]. The results of some intervention studies support this buffering effect, with higher levels of internalizing psychopathology predicting better treatment response [10, 15, 21]. However, other studies have found that internalizing psychopathology is unrelated to treatment response or associated with treatment non-response [6, 22]. Additional research on the effects of internalizing psychopathology may help to clarify the extent to which it affects treatment response in children with DBD.

Callous–Unemotional Traits

CU traits include low levels of guilt, remorse, concern for others, or concern about performance in important activities [23]. Children with CU traits show a temperament characterized by fearlessness or low levels of behavioral inhibition and a severe, aggressive and persistent pattern of disruptive and antisocial behavior [23]. CU traits are generally associated with limited response to treatment for DBD [24] and may even be associated with a worsening of DBD symptoms following evidence-based intervention [25]. The unique temperamental characteristics associated with CU traits may influence the effectiveness of various intervention components. For example, children with CU traits are less sensitive to punishment and may therefore be less responsive to standard components of parent interventions, such as the use of time out [24]. There is some evidence that CU traits are associated with poorer treatment response after symptom severity has been accounted for [25]; however, it remains unclear how CU traits, comorbid ADHD symptoms, and internalizing psychopathology are associated with differences in treatment response above and beyond conduct problem severity. Examining the influence of these variables together could help to develop a more precise understanding of individual-level factors and their relationship to treatment response in children with DBD.

Severity of Conduct Problems

Children with DBD vary considerably in the severity of their conduct problems [26, 27]. Some studies have found that children with more severe DBD have a poorer treatment response, perhaps because more severe symptoms are associated with an earlier onset of DBD and, therefore, a more entrenched and chronic pattern of behavior [6, 14]. Conduct problem severity may also affect treatment response through its interaction with parenting. For example, parents of children with more severe conduct problems show less improvement in parenting following intervention [10]. In contrast, at least one study reported that severity of conduct problems is not related to treatment outcomes [28]. Further research is therefore necessary to clarify the effect of conduct problem severity on treatment outcomes. Moreover, symptom severity may be in part an artefact of comorbidity. For example, children with comorbid ADHD symptoms display more DBD symptoms than children with DBD only [29] and, contrary to the buffering hypothesis, some studies have reported that children with comorbid internalizing psychopathology exhibit more severe conduct problems than their peers [22].

Evidence-Based Intervention for Childhood Disruptive Behavior

Research evidence and clinical best practice guidelines support the use of group-based parent training programs for parents of children with disruptive behavior, as well as group-based social cognitive problem solving interventions for school-age children with disruptive behavior [2, 30]. Thus, manualized multi-component interventions that include both parent and child components may be particularly useful for this population as the content of the parent and child groups complement one another. One such program that has demonstrated effectiveness for middle school children with disruptive behavior is the Coping Power program [31, 32]. Coping Power is a multi-component parent and child social-cognitive group intervention shown to reduce disruptive behavior in middle school children [33, 34]. In randomized controlled trials, Coping Power has reduced substance use, proactive aggression, covert delinquent behavior, and teacher-rated behavior problems, and increased social competence in children with disruptive behavior [35, 36]. The Coping Power program was developed for use with middle school, pre-adolescent children, with the goal of interrupting negative trajectories before adolescence [35, 36]. The effectiveness of the Coping Power program in reducing disruptive behavior has been demonstrated in a variety of cultures and contexts, with moderate effect sizes generally reported [37]. Understanding the extent to which children with commonly occurring comorbidities and different levels of symptom severity benefit from an evidence-based intervention such as Coping Power is an important step in understanding the effectiveness of treatments for disruptive behavior.

The Present Study

This study examines the association between pre-treatment ADHD symptoms, internalizing psychopathology, CU traits, and conduct problem severity and rate of improvement in symptoms and behavior in clinic-referred pre-adolescent children across 15-weeks of the Coping Power Program [31, 32]. We hypothesized that higher pre-treatment levels of ADHD symptoms, internalizing psychopathology, CU traits, and conduct problem severity would be associated with lower rates of improvement during treatment.

Table 1 Percentage of Children Falling within Abnormal Range on the Strengths and Difficulties Questionnaire

Score	Percentage
Emotional problems (internalizing)	34.2
Conduct problems	67.1
Hyperactivity-Inattention	68.5
Peer problems	49.3
Prosocial behavior	15.1

Score classifications are based on scoring guidelines for the SDQ

Method

Participants

Participants were 76 children ages 8 to 12 years ($M = 10.09$, $SD = 0.98$, 87% boys) who were referred to a service specializing in the assessment and treatment of disruptive behavior within an urban mental health hospital in Canada. Participants were part of a randomized controlled trial comparing an outpatient clinic-modified version of Coping Power to individual treatment as usual. The present study uses data from participants who were randomly assigned to the Coping Power intervention. An additional 27 children were excluded from the present study because they did not meet study inclusion criteria, their parents were not interested in participating, or their parents declined to participate after they were randomized to the Coping Power intervention. Study inclusion criteria were as follows: (1) Parents provided informed consent and children provided assent to participate; (2) Children met diagnostic criteria for Oppositional Defiant Disorder or Conduct Disorder on the Diagnostic Interview Schedule for Children—DSM-IV [38], or parent and/or teacher ratings were within the borderline range or higher on the Externalizing Behavior scale on the Behavior Assessment System for Children—2nd edition (BASC-2) [39]; (3) Parents or teachers reported scores in the clinical range on the Impairment Rating Scale [40]; (4) No evidence of Autism Spectrum Disorder or Asperger's Disorder; and (5) Children obtained a standard score of 80 or more on the verbal and nonverbal scale of the Kauffman Brief Intelligence Task—2nd Edition [41].

The majority of parents identified their ethnicity as White (65%) and 75% of parents had completed post-secondary education. Forty-seven percent of children were taking psychotropic medication at the time of the initial assessment (primarily stimulant medication for ADHD). As can be seen in Table 1, and typical of a clinical sample, rates of clinical-level difficulties were high across commonly measured domains of psychopathology and functioning based on parent ratings on the Strengths and Difficulties Questionnaires (SDQ) [42].

Procedure

A brief telephone screen was completed with parents of potential child participants to ensure that disruptive behavior was the child's primary presenting concern. Parents and children then attended a pre-treatment assessment, during which parents completed a structured diagnostic interview and questionnaires and children completed a battery of measures. Questionnaires were also mailed to teachers of participating children which, for the purposes of the present study, were only used to determine whether children met study inclusion criteria. Parents provided weekly ratings of children's behavior during the intervention. Families were provided with a $20 honorarium for completing the pre- and post-treatment assessments and children each received a small toy. The hospital's research ethics board approved all study procedures.

Intervention

Children and parents participated in a 15-session clinic-modified multi-component intervention following the Coping Power Program manual [31, 32]. The intervention consisted of concurrent parent and child group sessions. The parent program teaches behavioral parenting skills, cognitive strategies to manage stress, and skills to facilitate family communication and problem-solving [31]. The child program teaches skills to cope with emotional upset, problem solving, and strategies to re-evaluate unhelpful cognitions and attributions [32]. Child groups were facilitated by two trained child and youth workers and a senior doctoral trainee in clinical psychology. Parent groups were facilitated by a social worker or child and youth worker and a senior doctoral trainee in clinical psychology. Sessions were once weekly for 2 h. Fidelity to the manualized program was high (95.6% for parent group, 90.2% for child group) based on clinician ratings and independent observation by trained research personnel.

Measures

Internalizing and Conduct Problem Severity

Baseline internalizing psychopathology and conduct problem severity were measured using parent ratings on two 5-item subscales of the SDQ [42]: Emotional Symptoms (i.e., internalizing) and Conduct Problems. Each item is rated on a 3-point Likert scale of 0 (*not true*), 1 (*somewhat true*), or 2 (*certainly true*). Parent ratings on the Emotional Symptoms and Conduct Problems subscales demonstrate acceptable internal consistency, test–retest reliability, and parent-teacher inter-rater agreement [43]. Similarly, factor analyses support the construct validity of the Emotional Symptoms and Conduct Problems subscales [43, 44], and the scales have demonstrated concurrent validity through correlation with established measures of internalizing or disruptive behavior, such as the Child Behavior Checklist [43, 45]. The internal consistency for the Emotional Symptoms and Conduct Problems subscales in the present study were $\alpha = 0.61$ and $\alpha = 0.64$, respectively.

ADHD Symptoms

Hyperactivity and inattention were measured using parent ratings on the Hyperactivity and Attention Problems subscales of the BASC-2 [39]. Each item was rated on a 4-point scale ranging from 0 (*never*) to 3 (*always*). The BASC-2 is a widely used measure of children's social-emotional and behavioral functioning. It has demonstrated acceptable internal consistency, test–retest reliability, inter-rater reliability, construct validity, and concurrent validity [46, 47] Hyperactivity and Attention Problems scores were highly correlated in the present study ($r = .67$) and were summed to create a total Hyperactivity-Inattention score that was used in the primary analyses.

Callous–Unemotional Traits

CU traits were measured using the sum of parent ratings on three items from the Nova Scotia Modified IOWA Conners rating scale [7]. Each item was rated on a 4-point Likert scale (*not at all, just a little, pretty much, very much*). Items include: (1) appears to lack remorse; (2) seems to enjoy being mean; and (3) is cold or uncaring [7]. In a previous study, this brief measure of CU traits demonstrated high internal consistency, acceptable parent-teacher inter-rater reliability, and acceptable criterion validity based on its correlation with the Antisocial Process Screening Device, a well-established measure of CU traits [48, 49]. Moreover, the items used in the present study reflect the highest-loading items identified through a confirmatory factor analysis of the Inventory of Callous–Unemotional Traits [50] a commonly used measure of CU traits [51]. Therefore, although brief, these items appear to provide meaningful information on CU traits. The internal consistency of the CU items in the present study was $\alpha = 0.75$.

Treatment Response

Parents completed weekly ratings of children's behavior, peer problems, and behavioral impairment at the end of each group session using an abbreviated version the Pittsburg Modified Conners Parent Rating Scale [52], including the Oppositional-Defiant scale (e.g., "quarrelsome," "acts 'smart'") and the Swanson, Nolan and Pelham (SNAP) peer interaction scale (e.g., "frequently interrupts other children's

activities," "teases or calls other children names"). Each item was rated on a 4-point Likert scale, ranging from 0 (*not at all*) to 3 (*very much*). Parents also completed a single item rating children's behavioral impairment as *none, mild, moderate* or *severe*. When more than one parent provided ratings for a given week, the highest rating was used. Internal consistency values were acceptable for the Oppositional-Defiant ($\alpha = 0.80$ for mothers, $\alpha = 0.78$ for fathers during Week 1) and Peer Interaction ($\alpha = 0.65$ for mothers, $\alpha = 0.73$ for fathers during Week 1) subscales.

Analyses

Following an examination of missing data and descriptive statistics, paired samples *t*-tests or Wilcoxon signed rank tests were used to determine whether participants' scores changed from beginning to end of treatment. The reliable change index (RCI) was calculated for oppositionality-defiance and peer interaction problems.[1] The RCI can be used to determine whether improvement in a participant's score from pre- to post-test represents real change, above and beyond measurement error (i.e., test–retest reliability) [53]. A RCI less than or equal to -1.96 was considered to indicate reliable change [53] and the percentage of participants exhibiting reliable change based on this cut-off was calculated. Mean scores and individual trajectories across the 15 weeks of treatment were plotted and examined for each dependent variable. Intraclass correlation coefficients (ICCs) for each dependent variable were computed as a measure of variability across the 15 weeks. Correlations among independent variables were examined. Next, separate linear mixed models were examined for each dependent variable. Each independent variable was first included alongside control variables (medication status, sex). Independent variables that were significant predictors were then included together in a linear mixed model predicting the outcome variable of interest. In each analysis, main effects of the independent variables on scores across all 15 weeks of treatment were examined, as well as interactions between each independent variable and week, which test for differences in the rate of change (i.e., slope) associated with the independent variables. In keeping with previous studies on treatment response among children with disruptive behavior, we controlled for sex in all linear mixed models [10]. In addition, we controlled for medication status in all linear mixed models given that medication can be considered an intervention component and 47% of children in the sample were prescribed psychotropic medication (most for ADHD). The linear mixed models used intent-to-treat analyses and missing data were handled using maximum likelihood estimation.

[1] Published test–retest reliability values were not available for the single item measuring behavioral impairment and it was not possible to calculate internal consistency reliability given that only a single item is being used. Therefore, it was not possible to calculate the RCI for behavioral impairment.

Results

Descriptive Analyses

Seventy-five percent of the 76 children attended, and had weekly ratings available for, 10 or more of the 15 weeks of treatment, and were considered treatment completers. Of these treatment completers, 8 had ratings for all 15 weeks, 10 had ratings for 14 of the weeks, 15 had ratings for 13 of the weeks, 10 had ratings for 12 of the weeks, 5 had ratings for 11 of the weeks, and 9 had ratings for 10 of the weeks. Children who completed less than 10 sessions were considered to have dropped out of treatment but were nevertheless included in the linear mixed models analysis, in accordance with intent-to-treat procedures. Of these children, 10 were missing ratings for between 6 and 10 of the weeks, 5 were missing ratings for between 11 and 14 of the weeks, and 4 did not have ratings available for any of the 15 weeks. Rates of missing data were highest in the last 2 weeks of the intervention (over two-thirds), most likely due to participant drop-out and clinicians not administering the measures in some groups because of administrative demands in the final sessions. Children who completed treatment (i.e., attended 10 or more sessions) were compared with children who dropped out of treatment (i.e., attended 9 or fewer sessions). There were no significant differences between children who completed treatment and children who dropped out in terms of sex, $\chi^2(1, N = 76) = 0.15$, $p = .69$, medication status, $\chi^2(1, N = 71) = 0.06$, $p = .80$, age, $U = 409.00$, $Z = -1.59$, $p = .11$, parent education, $U = 360.00$, $Z = 0.00$, $p = 1.0$, conduct problem severity, $U = 457.00$, $Z = -0.49$, $p = .62$, hyperactivity-inattention, $U = 449.50$, $Z = -0.13$, $p = .90$, CU traits, $U = 386.50$, $Z = -0.33$, $p = .74$, or internalizing psychopathology, $U = 412.00$, $Z = -1.07$, $p = .28$. There were 63 participants with available data for the linear mixed models examining oppositionality-defiance and peer interaction (62 for the models examining impairment). Descriptive statistics are reported in Table 2.

Treatment Response

Participants' scores at weeks 1 and 12 were compared to determine whether they differed significantly (week 12 was chosen to maximize data available for analysis, but similar results were found using week 15 data). Oppositionality-defiance scores decreased significantly from week 1 ($M = 9.40$, $SD = 3.00$) to week 12 ($M = 5.42$, $SD = 2.82$), $t(44) = 8.00$,

Table 2 Descriptive statistics and correlations

Variable	Descriptive Statistics			Correlations		
	Mean	SD	Range	CU	Internalizing	Conduct problem severity
ADHD symptoms	28.8	7.63	10–47	0.19	0.19	0.39*
CU	1.54	1.93	0–8	–	0.11	0.33*
Internalizing[a]	3.74	2.35	0–8		–	0.36*
Conduct problem severity[a]	4.55	2.01	1–9			–

CU callous-unemotional

*$p < .01$

[a]Based on scoring criteria for the SDQ, internalizing scores ≥ 5 and conduct problem scores ≥ 4 fall within the abnormal range. Cut-offs are not available for ADHD symptoms or CU traits

$p < .001$. Based on RCI values, 53% of participating children exhibited a reliable decrease in oppositionality-defiance from week 1 to week 12. Peer interaction problems also decreased significantly from week 1 ($M = 8.02$, SD = 3.33) to week 12 ($M = 5.13$, SD = 3.40), $t(44) = 5.39$, $p < .001$. RCI values indicated that 27% of participating children showed a reliable decrease in peer interaction problems from week 1 to week 12. Behavioral impairment ratings also decreased significantly from week 1 ($M = 2.14$, SD = 0.61) to week 12 ($M = 1.57$, SD = 0.74), $Z = -3.28$, $p = .001$. Therefore, participating in Coping Power was associated with significant improvements in parent-rated oppositionality-defiance, peer interaction, and impairment.

Figures 1, 2 and 3 show the mean smoothing line and trajectories for each participant for each dependent variable. Trajectories of treatment response showed a great deal of variability, as indicated in Figs. 1, 2 and 3. The individual trajectory lines indicate large variability in response across treatment, as do the relatively low ICC values (oppositionality-defiance = 0.53; peer interaction = 0.58; impairment = 0.44).

Linear Mixed Model Results

Oppositionality-Defiance

ADHD symptoms ($B = 0.13$, SE = 0.04, 95% CI [0.05, 0.22], $p = .003$), CU traits ($B = 0.39$, SE = 0.18, 95% CI [0.02, 0.75], $p = .037$), and conduct problem severity ($B = 0.38$, SE = 0.18, 95% CI [0.03, 0.74], $p = .036$) each had a significant, positive main effect on oppositionality-defiance when entered individually with the control variables of sex and medication status. Internalizing psychopathology ($B = 0.16$, SE = 0.16, 95% CI [−0.15, 0.47], $p = .322$) was not a significant predictor. There were no significant interactions between week and any of the independent variables. In the final model that included all significant individual predictors, ADHD symptoms were the only significant, *unique* predictor of oppositionality-defiance (main effect), and no interaction effects with week were significant (see Table 3). Therefore, ADHD symptoms are associated with

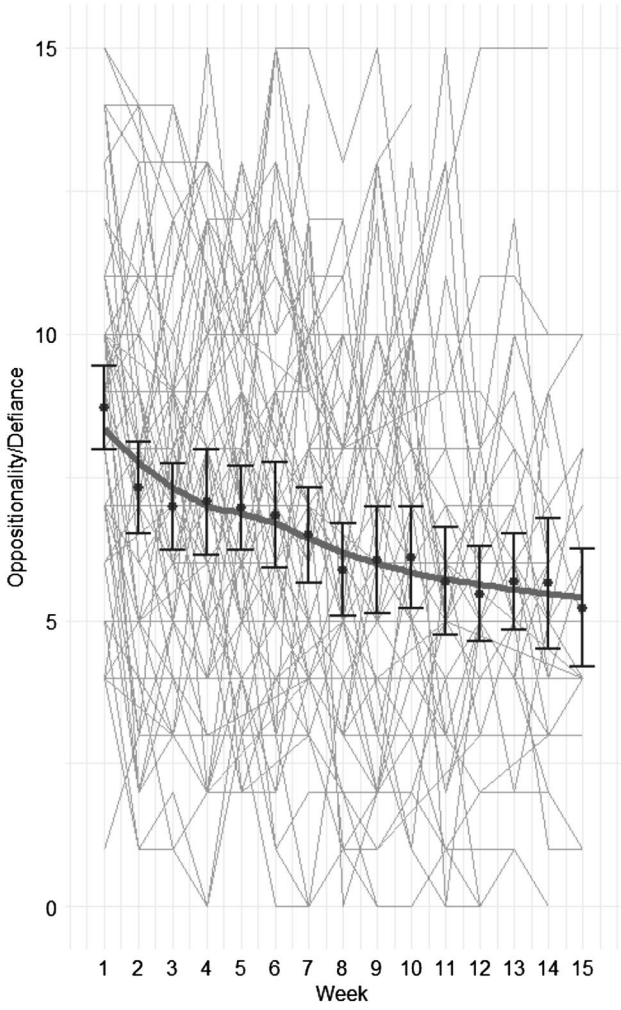

Fig. 1 Mean and individual oppositionality-defiance ratings across 15 weeks of treatment

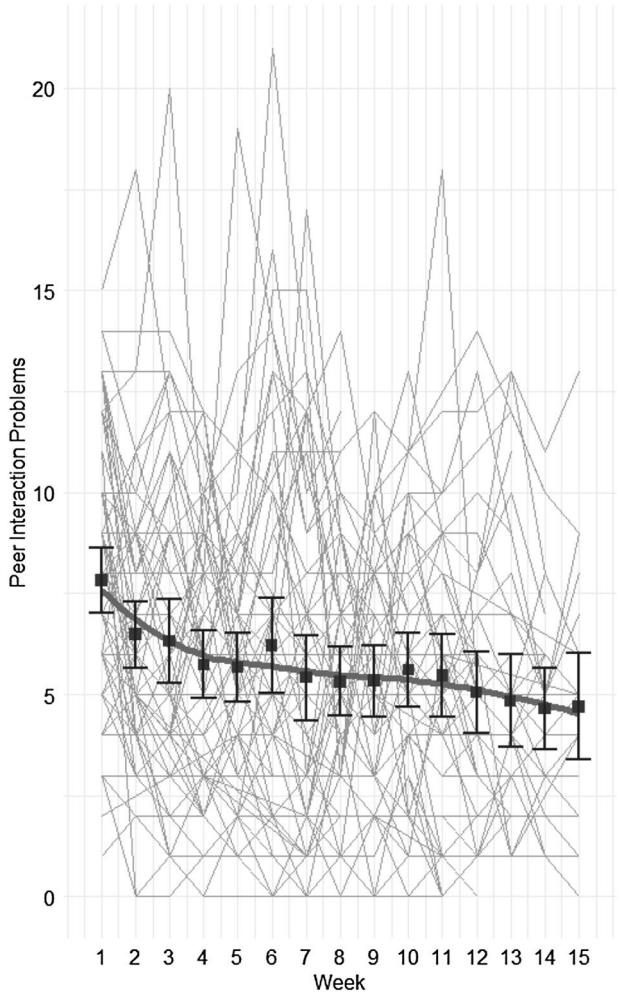

Fig. 2 Mean and individual peer interaction problem ratings across 15 weeks of treatment

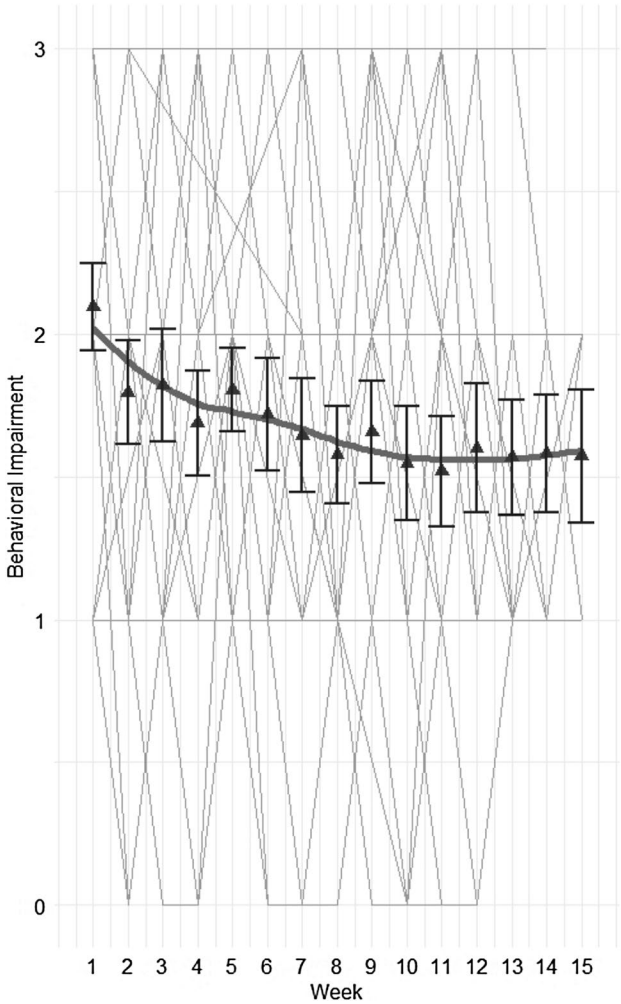

Fig. 3 Mean and individual behavioral impairment ratings across 15 weeks of treatment

higher ratings of overall oppositionality-defiance across all 15 weeks of treatment, but none of the variables measured were related to the rate at which participants' oppositionality-defiance scores changed during treatment.

Peer Interaction Problems

ADHD symptoms ($B = 0.18$, SE = 0.05, 95% CI [0.09, 0.28], $p < .001$), CU traits ($B = 0.61$, SE = 0.20, 95% CI [0.22, 1.00], $p = .003$), internalizing psychopathology ($B = 0.39$, SE = 0.17, 95% CI [0.05, 0.73], $p = .024$), and conduct problem severity ($B = 0.71$, SE = 0.19, 95% CI [0.33, 1.09], $p < .001$) each had significant, positive main effects on peer interaction problems when entered individually with the control variables of sex and medication status. There were no interaction effects with week for any of the independent variables. In the final model, ADHD symptoms were the only significant, unique predictor of peer interaction problems (main effect), and no interaction effects with week were significant (see Table 3). Therefore, ADHD symptoms are associated with greater peer interaction problems across all 15 weeks of treatment. However, none of the variables measured were related to the rate at which participants' peer interaction problem scores changed across treatment.

Behavioral Impairment

ADHD symptoms ($B = 0.04$, SE = 0.01, 95% CI [0.02, 0.05], $p < .001$), internalizing psychopathology ($B = 0.06$, SE = 0.03, 95% CI [0.001, 0.13], $p = .046$), and conduct problem severity ($B = 0.12$, SE = 0.04, 95% CI [0.05, 0.19], $p = .001$) each had significant, positive main effects on behavioral impairment when examined individually with the control variables of sex and medication status. CU traits were not a significant predictor of behavioral impairment ($B = 0.06$, SE = 0.04, 95% CI [−0.02, 0.13], $p = .13$). There

Table 3 Linear mixed model estimates

Variable	Dependent variable								
	Oppositionality-defiance			Peer interaction problems			Behavioral impairment		
	B	*SE*	95% CI	*B*	*SE*	95% CI	*B*	*SE*	95% CI
Intercept	5.17	1.71	1.75, 8.59	2.49	1.79	−1.08, 6.06	1.02	0.34	0.34, 1.70
Week	−0.14	0.13	−0.39, 0.11	0.01	0.13	−0.25, 0.26	0.02	0.03	−0.04, 0.08
Sex (male)	−0.70	0.93	−2.56, 1.16	−0.84	0.94	−2.73, 1.04	−0.18	0.19	−0.55, 0.20
Medication	−0.62	0.69	−2.00, 0.76	−1.17	0.68	−2.54, 0.19	−0.16	0.13	−0.42, 0.10
ADHD symptoms	**0.10**	**0.05**	**0.01, 0.20**	**0.12**	**0.05**	**0.02, 0.22**	**0.03**	**0.01**	**0.01, 0.05**
CU	0.24	0.19	−0.14, 0.62	0.37	0.20	−0.03, 0.76	–	–	–
Internalizing	–	–	–	0.16	0.17	−0.18, 0.50	0.02	0.03	−0.04, 0.08
Conduct problem severity	0.12	0.20	−0.28, 0.52	0.29	0.23	−0.16, 0.74	0.06	0.04	−0.02, 0.14
ADHD symptoms × week	−0.01	0.004	−0.01, 0.003	−0.01	0.005	−0.02, 0.001	−0.001	0.001	−0.004, 0.001
CU × week	0.002	0.02	−0.03, 0.04	−0.003	0.02	−0.04, 0.03	–	–	–
Internalizing × week	–	–	–	−0.01	0.02	−0.05, 0.02	−0.003	0.004	−0.01, 0.004
Conduct problem severity × week	0.01	0.02	−0.02, 0.05	0.02	0.02	−0.03, 0.06	−0.0003	0.005	−0.01, 0.01

CU callous-unemotional. Values in bold are significant at $p < .05$

were no interaction effects with week for any of the independent variables. In the final model, ADHD symptoms were the only significant, unique predictor of impairment, and no interaction effects with week were significant (see Table 3). Therefore, ADHD symptoms are associated with more overall behavioral impairment across all 15 weeks of treatment. However, none of the variables measured were related to the rate at which participants' impairment scores changed during treatment.

Supplemental Analysis

Follow-up linear mixed model analyses were run to tease apart the effects of hyperactivity-impulsivity and inattention on treatment response. Hyperactivity-impulsivity and inattention were entered as predictors of the three dependent variables, along with the control variables of sex and medication, and interactions between hyperactivity-impulsivity and week and inattention and week. Hyperactivity-impulsivity emerged as the only significant predictor of oppositionality-defiance ($B = 0.27$, SE = 0.09, 95% CI [0.09, 0.45], $p = .004$), peer interaction ($B = 0.31$, SE = 0.10, 95% CI [0.11, 0.51], $p = .003$), and impairment ($B = 0.06$, SE = 0.02, 95% CI [0.02, 0.09], $p = .002$), and no interactions with week were significant.

Discussion

This study examined the association between comorbidity and conduct problem severity and the rate of children's response to a multi-component intervention for disruptive behavior. Participating in the group treatment was associated with significant decreases in parent-rated oppositionality-defiance, peer interaction problems, and behavioral impairment in children; however, there was considerable variability in the trajectories of participants' scores across the 15 weeks of treatment. Pre-treatment ADHD symptoms, internalizing psychopathology, CU traits, and conduct problem severity each had significant positive associations with two or more outcome variables when examined individually. However, ADHD symptoms emerged as the only unique predictor of oppositionality-defiance, peer interaction, and impairment scores. Supplemental analyses indicated that hyperactivity-impulsivity, and not inattention, was the best predictor of all three scores across treatment.

Baseline levels of ADHD symptoms, internalizing psychopathology, CU traits, and conduct problem severity were each related to one or more dependent variables across treatment (main effects). These findings are consistent with those of previous studies that have found that higher levels of internalizing psychopathology, ADHD symptoms, or CU traits are associated with more externalizing symptoms pre- and/or post-treatment [14, 22, 25]. The present study provides novel information by demonstrating that ADHD symptoms are the only significant, unique predictor of overall oppositionality-defiance, peer interaction problems, and behavioral impairment across 15 weeks of treatment. Consistent with previous evidence [14], the association between ADHD symptoms and social and behavioral functioning was best accounted for by the presence of hyperactivity-impulsivity and not inattention. Therefore, children who present with higher levels of ADHD symptoms, internalizing psychopathology, CU traits, and conduct problems are

likely to experience more behavior problems and impairment over the course of treatment; however, ADHD symptoms, and specifically hyperactivity-impulsivity, are the strongest predictor of elevated behavior problems and impairment. These findings are consistent with the multiple problems hypothesis with regards to ADHD, whereby comorbidity exacerbates DBD symptoms [20]. Children who are hyperactive and impulsive may exhibit more behavior problems because they are more reactive and have difficulty regulating their behavior [54]. For example, children who are hyperactive and impulsive display disruptive behavior in response to lower levels of provocation than children with DBD without hyperactivity-impulsivity [29].

The present study also examined the effect of key pre-treatment child characteristics on rates of change during a multi-component intervention. Contrary to our hypotheses, none of the pre-treatment variables were associated with children's rate of symptom or behavioral change across the 15 treatment sessions. The lack of significant interactions between week of treatment and individual variables suggests that comorbid ADHD symptoms, internalizing psychopathology, CU traits and conduct problem severity may not influence the rate at which children with DBD improve over the course of the Coping Power program. A small number of studies have reported that ADHD symptoms are not associated with treatment response among children with disruptive behavior [10, 15, 16]. Regarding conduct problem severity, results have been mixed in terms of its effect on treatment response [10, 28]. However, CU traits have been more consistently associated with poorer treatment response [6, 24, 55] and, therefore, the present findings were unexpected (although see Kolko and Pardini [14] who found that CU traits were not related to treatment outcomes after controlling for other variables). Given the relatively small sample size in the present study, further research is necessary to confirm the effects of pre-treatment ADHD symptoms, internalizing psychopathology, CU traits, and conduct problem severity on rates of change during treatment and response to treatment for children with DBD.

The effect of comorbid internalizing symptoms on treatment response was of particular interest given that internalizing symptoms may either exacerbate (multiple problems hypothesis) or attenuate (buffer hypothesis) disruptive behavior [20]. The results of the present study do not support the hypothesis that internalizing psychopathology provides a buffering effect by enhancing response to treatment in children with DBD. Instead, our results are consistent with previous studies that have found no association between comorbid internalizing psychopathology and treatment gains among children with DBD [10, 22, 56]. The Coping Power program includes both parent and child interventions and targets emotional, cognitive, and behavioral aspects of children's functioning. It is possible that the multi-component format of the program supported children with a range of characteristics in making gains over the course of treatment; however, further research with larger samples and other measurement approaches is necessary to further explore treatment benefits for children with DBD with elevated internalizing psychopathology.

It is also important to note that there was considerable variability in children's oppositionality-defiance, social interaction problems, and behavioral impairment across the 15 weeks of treatment. In particular, individual participants' behavioral and impairment trajectories varied considerably. Moreover, 47% of children did not exhibit reliable improvements in oppositionality-defiance and 73% did not exhibit reliable improvements in peer interaction problems. These findings are an important reminder that the results of variable-oriented analyses at the sample level may not always generalize to individual children. That is, while psychosocial interventions such as the Coping Power program have demonstrated effectiveness in reducing disruptive behavior, actual change over the course of treatment may vary greatly from individual to individual, and a simple linear decrease in symptom severity is unlikely for an individual child. Further research including larger samples and incorporating person-oriented analytic approaches, such as growth mixture modeling [57], would help to identify specific patterns of treatment response among children that may or may not be associated with pre-treatment comorbidity and symptom severity.

The way treatment response is defined can influence the interpretation of findings. Whereas a number of pre-treatment variables were associated with overall behavior and impairment ratings across all 15 weeks of treatment, none were associated with rates of change during treatment. Previous studies of DBD differ in how they define treatment response. Some have used categorical classifications of response versus non-response [6, 56]. Others have examined the effect of baseline variables on post-treatment DBD, controlling for pre-treatment DBD scores [55] or used repeated measures analyses [22]. Still others have used growth curve analysis or linear mixed models to examine the effects of pre-treatment variables on change over time [10, 16, 25]. Some studies have also examined how baseline variables are related to both rates of change and overall outcomes following treatment for DBD [9, 22, 25]. Given that both rates of change and post-treatment symptom and impairment levels are important for understanding a child's treatment needs, continuing to use methods that allow for the examination of both main effects and slope effects may provide clinically relevant information that can inform service delivery.

Limitations and Future Directions

Interpretation of the present findings should take into account the study's limitations. First, the present study relied on parent report for independent and dependent variables. It is possible that parents had expectations in terms of improvement, which could have influenced their ratings. Moreover, the use of parent informants only may have inflated the association between independent and dependent variables. Second, a substantial proportion of weekly ratings were missing, primarily during the last 2 weeks of treatment. However, children who dropped out of treatment and children who completed treatment did not differ in terms of demographics or symptom ratings. Third, the present study focused on the effects of a specific, group-based multicomponent intervention (Coping Power) and, therefore, the results may not generalize to other psychosocial interventions for DBD. For example, it is possible that different results may be obtained in individual interventions, or interventions based on other theoretical models. Fourth, CU traits have been consistently associated with poorer treatment response among children with DBD [24, 25]. It is possible that the use of a relatively brief measure of CU traits in the present study limited the variability in CU traits we were able to detect, which may have contributed to the present nonsignificant association between CU traits and treatment response. Finally, the present study used a relatively small sample of children, which may have affected our ability to detect small effects of independent variables, and limited our ability to study specific treatment response trajectories. Future studies using larger samples and incorporating data from multiple informants (e.g., parent, teacher, child) would therefore be useful. Future studies examining other pre-treatment variables, such as parent-related factors, and other child factors may also further our understanding of differences in treatment response in children with DBD. In addition, further investigating various symptom profiles and their association with treatment response and treatment outcomes may help to increase our understanding of treatment non-response in children with DBD.

Clinical Implications

The Coping Power program is an evidence-based intervention for disruptive behavior that is in use in a number of clinic and community settings and that is consistent with best practice guidelines for psychosocial treatments of disruptive behavior [30, 35, 37]. Our results suggest that children with DBD who vary in terms of their level of ADHD symptoms, internalizing psychopathology, CU traits, and conduct problem severity show behavioral benefits from this evidence-based multi-component intervention. Therefore, children with DBD who present with a range of co-occurring symptoms and conduct problem severities can be included in multi-component interventions such as the Coping Power program. Nevertheless, children may continue to present with clinically elevated symptoms following treatment, particularly if they have high levels of hyperactivity-impulsivity. These children may benefit from additional intervention in order to further reduce behavior problems and impairment. Moreover, the present study did not measure changes in ADHD symptoms, internalizing, or CU traits, and it is likely that additional intervention would be needed to address comorbid psychopathology, if present. Finally, given that there was considerable variability in children's behavior, social interaction, and impairment across the 15 weeks of treatment, clinicians may consider normalizing this variability when setting treatment expectations with parents of children with DBD.

Summary

Children with DBD often fail to make desired gains following evidence-based intervention. The present study suggests that although children's behavior, social functioning, and impairment improved with treatment on average, many children did not show reliable changes in functioning. In the present study, individual pre-treatment characteristics had a non-significant effect on the rate of change during treatment but were significantly related to overall behavior problems and impairment. Specifically, hyperactivity-impulsivity was an important pre-treatment characteristic that influenced behavior across treatment. Further research is necessary to identify various treatment response trajectories and variables that may predict differences in treatment response.

Acknowledgements Dr. Andrade's research has been funded by the Ontario Mental Health Foundation, the Canadian Child Health Clinician-Scientist Program, and Canadian Institutes of Health Research. Dr. Aitken's research is supported by the CAMH Foundation. We thank Marcos Sanches for his guidance regarding the analyses.

Compliance with Ethical Standards

Conflict of interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

References

1. Greene RW et al (2002) Psychiatric comorbidity, family dysfunction, and social impairment in referred youth with oppositional defiant disorder. Am J Psychiatry 159:1214–1224
2. Eyberg SM, Nelson MM, Boggs SR (2008) Evidence-based psychosocial treatments for children and adolescents with disruptive behavior. J Clin Child Adolesc Psychol 37:215–237
3. The Conduct Problems Prevention Research Group (2002) Using the fast track randomized prevention trial to test the

early-starter model of the development of serious conduct problems. Dev Psychopathol 14:925–943
4. Webster-Stratton C, Hammond M (1997) Treating children with early-onset conduct problems: a comparison of child and parent training interventions. J Consult Clin Psychol 65:93–109
5. Bakker MJ, Greven CU, Buitelaar JK, Glennon JC (2017) Practitioner review: psychological treatments for children and adolescents with conduct disorder problems—a systematic review and meta-analysis. J Child Psychol Psychiatry 58:4–18
6. Masi G et al (2013) Response to treatments in youth with disruptive behavior disorders. Compr Psychiatry 54:1009–1015
7. Waschbusch DA et al (2004) Investigation of the heterogeneity of disruptive behaviour in elementary-age children. Can J Behav Sci 36:97–112
8. Andrade BF, Wade M (2016) Latent profiles of externalizing psychopathology and their relation to children's aggression and social behavior. J Dev Behav Pediatr 37:442–450
9. Kazdin AE, Whitley MK (2006) Comorbidity, case complexity, and effects of evidence-based treatment for children referred for disruptive behavior. J Consult Clin Psychol 74:455–467
10. Beauchaine TP, Webster-Stratton C, Reid MJ (2005) Mediators, moderators, and predictors of 1-year outcomes among children treated for early-onset conduct problems: a latent growth curve analysis. J Consult Clin Psychol 73:371–388
11. Ollendick TH, Jarrett MA, Grills-Taquechel AE, Hovey LD, Wolff JC (2008) Comorbidity as a predictor and moderator of treatment outcome in youth with anxiety, affective, attention deficit/hyperactivity disorder, and oppositional/conduct disorders. Clin Psychol Rev 28:1447–1471
12. Frick PJ, Ray JV, Thornton LC, Kahn RE (2014) Annual research review: a developmental psychopathology approach to understanding callous-unemotional traits in children and adolescents with serious conduct problems. J Child Psychol Psychiatry 55:532–548
13. Kutcher S et al (2004) International consensus statement on attention-deficit/hyperactivity disorder (ADHD) and disruptive behaviour disorders (DBDs): clinical implications and treatment practice suggestions. Eur Neuropsychopharmacol 14:11–28
14. Kolko DJ, Pardini DA (2010) ODD dimensions, ADHD, and callous–unemotional traits as predictors of treatment response in children with disruptive behavior disorders. J Abnorm Psychol 119:713–725
15. Costin JAN, Chambers SM (2007) Parent management training as a treatment for children with oppositional defiant disorder referred to a mental health clinic. Clin Child Psychol Psychiatry 12:511–524
16. Hartman RR, Stage SA, Webster-Stratton C (2003) A growth curve analysis of parent training outcomes: examining the influence of child risk factors (inattention, impulsivity, and hyperactivity problems), parental and family risk factors. J Child Psychol Psychiatry 44:388–398
17. McInnes A, Humphries T, Hogg-Johnson S, Tannock R (2003) Listening comprehension and working memory are impaired in attention-deficit hyperactivity disorder irrespective of language impairment. J Abnorm Child Psychol 31:427–443
18. Kurtz BE, Borkowski JG (1987) Development of strategic skills in impulsive and reflective children: a longitudinal study of metacognition. J Exp Child Psychol 43:129–148
19. Angold A, Costello EJ, Erkanli A (1999) Comorbidity. J child Psychol psychiatry 40:57–87
20. Drabick DAG, Ollendick TH, Bubier JL (2010) Co-occurrence of ODD and anxiety: shared risk processes and evidence for a dual-pathway model. Clin Psychol 17:307–318
21. Beauchaine TP, Gartner J, Hagen B (2000) Comorbid depression and heart rate variability as predictors of aggressive and hyperactive symptom responsiveness during inpatient treatment of conduct-disordered, ADHD boys. Aggress Behav 26:425–441
22. Chase RM, Eyberg SM (2008) Clinical presentation and treatment outcome for children with comorbid externalizing and internalizing symptoms. J Anxiety Disord 22:273–282
23. Frick PJ, Ray JV, Thornton LC, Kahn RE (2013) Can callous-unemotional traits enhance the understanding, diagnosis, and treatment of serious conduct problems in children and adolescents? A comprehensive review. Psychol Bull 140:1–57
24. Hawes DJ, Price MJ, Dadds MR (2014) Callous-unemotional traits and the treatment of conduct problems in childhood and adolescence: a comprehensive review. Clin Child Fam Psychol Rev 17:248–267
25. Dadds MR, Cauchi AJ, Wimalaweera S, Hawes DJ, Brennan J (2012) Outcomes, moderators, and mediators of empathic-emotion recognition training for complex conduct problems in childhood. Psychiatry Res 199:201–207
26. Frick PJ, Cornell AH, Barry CT, Bodin SD, Dane HE (2003) Callous-unemotional traits and conduct problems in the prediction of conduct problem severity, aggression, and self-report of delinquency. J Abnorm Child Psychol 31:457–470
27. Andrade BF, Sorge GB, Na JJ, Wharton-Shukster E (2014) Clinical profiles of children with disruptive behaviors based on the severity of their conduct problems, callous-unemotional traits and emotional difficulties. Child Psychiatry Hum Dev 46:567–576
28. Fleischman MJ (1981) A replication of Patterson's intervention for boys with conduct problems. J Consult Clin Psychol 49:342–351
29. Waschbusch DA (2002) A meta-analytic examination of comorbid hyperactive-impulsive-attention problems and conduct problems. Psychol Bull 128:118–150
30. National Collaborating Centre for Mental Health. Antisocial behaviour and conduct disorders in children and young people. (2013). http://www.nice.org.uk/guidance/cg158/chapter/2-research-recommendations#parent-training-programmes-for-children-aged-12-years-and-over-with-a-conduct-disorder
31. Wells KC, Lochman JE, Lenhart LA (2008) Coping Power Parent Group Program. Oxford University Press, Oxford
32. Lochman JE, Wells KC, Lenhart LA (2008) Coping Power Child Group Program. Oxford University Press, Oxford
33. Muratori P et al (2017) Evaluation of improvement in externalizing behaviors and callous-unemotional traits in children with disruptive behavior disorder: a 1-year follow up clinic-based study. Adm Policy Ment Heal Ment Heal Serv Res 44:452–462
34. Lochman JE, Wells KC, Qu L, Chen L (2013) Three year follow-up of coping power intervention effects: evidence of neighborhood moderation? Prev Sci 14:364–376
35. Lochman JE, Wells KC (2002) The Coping Power Program at the middle school transition: universal and indicated prevention effects. Psychol Addict Behav 16:S40–S54
36. Lochman JE, Wells KC (2004) The Coping Power Program for preadolescent aggressive boys and their parents: outcome effects at the 1-Year follow-up. J Consult Clin Psychol 72:571–578
37. Powell N, Lochman JE, Boxmeyer CL, Barry TD, Pardini DA (2017) The Coping Power program for aggressive behavior in children. In: Weisz JR, Kazdin AE (eds) Evidence-based psychotherapies for children and adolescents. Guilford, New York, pp 159–176
38. NIMH-DISC Editorial Board (2000) The National Institute of Mental Health Diagnostic Interview Schedule for Children (Version 14)
39. Reynolds CR, Kamphaus RW (2004) Behavior Assessment System for Children (BASC-2). Pearson, London
40. Fabiano GA et al (2006) A practical measure of impairment: Psychometric properties of the impairment rating scale in samples of children with attention deficit hyperactivity disorder and two school-based samples. J Clin Child Adolesc Psychol 35:369–385

41. Kaufman AS, Kaufman NL (2004) Kaufman brief intelligence test. Pearson, London
42. Goodman R (1997) The Strengths and Difficulties Questionnaire: a research note. J Child Psychol psychiatry 38:581–586
43. Stone LL, Otten R, Engels RC, Vermulst A, Janssens JM (2010) Psychometric properties of the parent and teacher versions of the Strengths and Difficulties Questionnaire for 4- to 12-Year-olds: a review. Clin Child Fam Psychol Rev 13:254–274
44. Aitken M, Martinussen R, Wolfe RG, Tannock R (2015) Factor structure of the strengths and difficulties Questionnaire in a Canadian elementary school sample. Assess Eff Interv 40:155–165
45. Achenbach TM, Rescorla LA (2001) Manual for the ASEBA school-age forms and profiles. University of Vermont, Research Center for Children, Youth, & Families, Burlington
46. Stein S, Watson T, Wickstrom K (2007) Behavior assessment system for children, 2nd edn. In: Geisinger KF, Spies RF, Carlson JF, Plake BS (eds) The seventeenth mental measurements yearbook. Buros Centre for Testing, Lincoln
47. Reynolds CR, Kamphaus RW, Vannest KJ (2011) Encyclopedia of clinical neuropsychology. Springer, New York, pp 366–371. https://doi.org/10.1007/978-0-387-79948-3_1524
48. Waschbusch DA, Graziano PA, Willoughby MT, Pelham WE (2015) Classroom rule violations in elementary school students with callous-unemotional traits. J Emot Behav Disord 23:180–192
49. Frick PJ, Hare RD (2001) Antisocial processes screening device. Multi-Health Systems, North Tonawanda
50. Hawes SW et al (2014) Refining the parent-reported Inventory of Callous-Unemotional Traits in boys with conduct problems. Psychol Assess 26:256–266
51. Frick PJ (2004) Inventory of Callous-Unemotional Traits. University of New Orleans, New Orleans
52. Atkins MS, Pelham WE, Licht MH (1988) The development and validation of objective classroom measures of conduct and attention deficit disorders. In: Prinz RJ (ed) Advances in behavioral assessment of children and families. JAI Press, Greenwich, pp 3–31
53. Jacobson NS, Truax P (1991) Clinical significance: a statistical approach to defining meaningful change in psychotherapy research. J Consult Clin Psychol 59:12–19
54. Barkley R (1997) Behavioral inhibition, sustained attention, and executive functions: constructing a unifying theory of ADHD. Psychol Bull 121:65–94
55. Bjørnebekk G, Kjøbli J (2017) Observed callousness as a predictor of treatment outcomes in parent management training. Clin Child Psychol Psychiatry 22:59–73
56. Stadler C et al (2008) Heart rate and treatment effect in children with disruptive behavior disorders. Child Psychiatry Hum Dev 39:299–309
57. Muthén BO, Muthén LK (2000) Integrating person-centered and variable-centered analyses: growth mixture modeling with latent trajectory classes. Alcohol Clin Exp Res 24:882–891