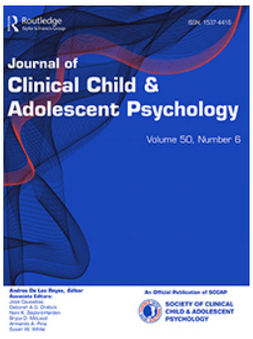

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Treatment Response among Preschoolers with Disruptive Behavior Disorders: The Role of Temperament and Parenting

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ABSTRACT

Objective: This study examined associations between temperament (negative affect, effortful control, and surgency) and symptoms of attention-deficit/hyperactivity disorder (ADHD) and oppositional defiant disorder (ODD) within a diverse preschool sample. Interactions between temperament and parenting in the prediction of ADHD/ODD symptoms *before* and *after* an 8-week early intervention program (i.e., Summer Treatment Program for Pre-kindergartners; STP-PreK) were also examined.

Method: The sample included 215 children (M_{age} = 5.0, 80.9% male, 84.7% Latinx) with a diagnosis of ADHD and/or ODD who completed the STP-PreK. Temperament was measured via parent report while ADHD/ODD symptoms were assessed via combination of parent and teacher report. Positive and negative parenting were assessed via rating scales and a standardized parent-child interaction observation.

Results: Higher surgency was associated with greater symptom severity of ADHD/ODD pre- and post-treatment. Higher negative affect was associated with greater symptom severity of ODD pre- and post-treatment, while higher effortful control was only associated with lower symptom severity of inattention pre-treatment. Positive parenting predicted lower symptom severity of ADHD/ODD post-treatment. Moderation analyses indicated that the benefits of low levels of negative parenting *only* occurred when paired with low temperament risk for symptoms of hyperactivity and ODD. Additionally, only the combination of high surgency and high observed negative parenting resulted in greater symptom severity of ODD. Finally, decreases in inconsistent discipline predicted decreases across all symptom domains post-treatment.

Conclusions: Our findings add to the temperament-based model of ADHD/ODD by highlighting temperament's unique prediction of treatment response as well as important interactions with the caregiving environment.

Attention-Deficit/Hyperactivity Disorder (ADHD) is one of the most common and impairing neurodevelopmental disorders (Danielson et al., 2018). In addition to having a highly stable and persistent course (Sibley et al., 2017) early-onset ADHD symptoms, including inattention, hyperactivity, and impulsivity are associated with a developmental trajectory of psychosocial impairment, including increased risk for later antisocial behavior, substance use disorders, peer rejection, and school dropout (Barkley & Mash, 2003; Loe & Feldman, 2007). Given the negative trajectories of early ADHD symptoms, as well as its high public health cost (Doshi et al., 2012; Robb et al., 2011), it is not surprising that a significant body of work has been devoted toward understanding the etiology of ADHD and co-occurring oppositional defiant disorder (ODD). A temperament based multi pathway conception of ADHD has been suggested to examine distinct etiological determinants of symptoms of ADHD (i.e., inattention versus hyperactivity/impulsivity) and co-occurring ODD (Martel et al., 2009). The current study examines the extent to which such a temperament-based model can be applied to identifying early symptoms of ADHD and ODD during the preschool period. Additionally, given the recommendations for preschoolers with ADHD/ODD to receive behavioral parent training as a first line of treatment (Wolraich et al., 2019), the current study examines how temperament interacts with parenting in the prediction of ADHD/ODD symptomology before and after an evidence-based intervention.

Temperament and ADHD/ODD

While there is still no consensus on the number of temperament dimensions nor their emphasis (i.e., behavior vs. emotion), researchers do agree that differences

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in temperament style represent biological or physiological differences (Calkins, 1997; Goldsmith et al., 2000; Kagan et al., 1987). Individual differences in emotional reactivity and regulation represent the broadest aspects of temperament (Rothbart, 1981; Rothbart et al., 2000) that are captured by three higher order dimensions: negative affect, effortful control, and surgency. Negative affect is a reactive dimension that refers to an individual's tendency to respond with negative emotion (e.g., anger, sadness) in an intense manner. Surgency is an approach dimension associated with high activity level, preference for situations characterized by high-intensity stimuli/pleasure seeking, and low levels of shyness (Rothbart et al., 2000). Finally, effortful control is a regulatory dimension involved in attentional control and necessary for planning and goal-directed behaviors (Eisenberg et al., 1996; Rothbart, 2011).

One of the strongest prospective longitudinal studies to examine the link between temperament and later ADHD symptoms found that individual differences in regulation and reactivity when children were 6–36 months contributed to the prediction of subsequent ADHD symptoms in first grade (Willoughby et al., 2017). When examining the higher order dimensions of temperament and building on Nigg et al. (2004)'s theoretical multiple pathway model, Martel and Nigg (2006) found that poor effortful control was specifically related to symptoms of inattention. Worse reactive control was related to hyperactivity and impulsivity, while more negative affect/emotionality was related to more symptoms of ODD. These findings were replicated within a preschool age sample, with the addition of surgency being associated with hyperactivity and impulsivity (Martel et al., 2012). The additional examination of surgency is noteworthy given the dual pathway model of ADHD focuses on altered reward processes (Sonuga-Barke, 2003). Finally, physiological, neurological, and clinical correlates have validated distinct temperament-based types of ADHD: mild (intact regulation), irritable (high negative affect), and surgent (high levels of positive approach) (Karalunas et al., 2019). While these studies are promising, it should be noted that the samples were community based and mostly Caucasian. Although research has shown that these temperament dimensions are reliably identified across cultures, the literature is scarce in examining if cultural differences emerge within children of Latinx ethnicity. One of the few studies examining these differences found Latina mothers rated their infants as more fearful and less predictable than non-Latina mothers (Lahey et al., 2008). Thus, an important next step is to confirm whether such differential associations between temperament dimensions and early onset ADHD/ODD symptoms are similar within a diverse sample. Additionally, parenting factors are often unexamined in these studies, which are important given parents' strong bidirectional influence on children's temperament (Slagt et al., 2016) and their role in treatment (Wolraich et al., 2019).

Temperament and Parenting

There is strong support for interactive associations between parenting and temperament. Some of this literature has focused on a diathesis-stress model (Monroe & Simons, 1991), which posits that vulnerabilities disproportionately affect individuals to exhibit worse outcomes in adverse environments. For example, children with difficult temperament only had marginally high incidences of adjustment problems relative to healthy controls, however, when combined with a poor parent-child relationship, the risk for adjustment problems increased significantly (Sanson et al., 1991). Another model that has emerged is differential susceptibility, which builds on the previous model and theorizes that vulnerable individuals are more sensitive to environmental influences, both in a positive and negative manner (Belsky, 2005). For example, infants high in negative emotion exhibited more externalizing behaviors, worse self-regulation, and more noncompliance when parenting quality was low, but less behavior problems and better adjustment when parenting quality was high (Blair, 2002; Feldman et al., 1999).

In support of the differential susceptibility model, a recent meta-analysis found that children higher on negative emotionality were more susceptible to negative parenting, but also benefitted more from positive parenting (Slagt et al., 2016). On the other hand, there was no clear model fit on how parenting interacts with surgency or effortful control in predicting child outcomes. It is important to note that the outcomes examined in this meta-analysis focused only on broad levels of internalizing and externalizing problems. Thus, it is less clear how temperament and parenting interact as it relates to more specific ADHD symptoms, with most studies focused in infancy (Miller et al., 2019). Additionally, little work has examined the link between temperament and parenting as it relates to ODD symptoms. One of the only studies, to our knowledge, to examine this link found that the path from temperament (negative affect and effortful control) to ODD was mediated by negative parenting (Ezpeleta et al., 2019). However, this study did not examine ADHD symptoms. In addition, the interaction of temperament and parenting is under-evaluated in treatment research. While some work has begun to show temperament predicting

treatment response in other psychological disorders (Burleson & Kaminer, 2008; Gurpegui et al., 2019), there is extremely limited research within ADHD/ODD (Lavigne et al., 2008; Purper-Ouakil et al., 2010) and even less examining parenting as a potential moderator. Understanding how individual's unique characteristics (i.e., temperament style) and environmental sensitivity (i.e., parenting behaviors) impact disease vulnerability and treatment response is critical in optimizing the most effective intervention plan.

The Current Study

In summary, there is an considerable research documenting how early temperament traits relate to ADHD/ODD symptoms (Martel & Nigg, 2006; Willoughby et al., 2017). Additionally, while the bi-directional links between parenting and temperament are well established (Slagt et al., 2016), less is known about how such interactions relates to specific ADHD/ODD symptomology. Finally, given that parenting interventions are the first line of treatment suggested for preschool children with ADHD/ODD (Wolraich et al., 2019), it is particularly important to examine how parenting may interact with temperament to predict treatment response. The currently study filled these gaps by examining the extent to which higher order dimensions of temperament (negative affect, effortful control, and surgency) relate to ADHD and ODD symptoms in preschoolers. Additionally, the current study examined potential interactions between temperament and parenting in the prediction of specific ADHD symptoms and ODD comorbidity *before* and *after* a multimodal behavioral intervention (i.e., Summer Treatment Program for Pre-kindergartners; STP-PreK) that has been shown to successfully reduce disruptive behavior problems among preschoolers (Graziano & Hart, 2016).

In line with previous findings, we hypothesize that (1) higher surgency will predict greater symptom severity of hyperactivity pre- and post-treatment (2) lower effortful control will predict greater symptom severity of inattention pre- and post-treatment (3) higher levels of negative affect will predict greater symptom severity of ODD pre- and post-treatment. In regard to parenting, measured by self-report and observation, we hypothesize that (1) negative parenting will predict greater symptom severity of inattention, hyperactivity and ODD pre-treatment while positive parenting will predict greater improvements across all symptom domains post-treatment. Finally, we expected positive parenting to attenuate, while negative parenting would exacerbate, the negative impact of the temperament risk factors (i.e., high surgency/negative affect, low effortful control) on ADHD/ODD symptoms at pre- and post-treatment. Given the highly genetic nature of ADHD (Greven et al., 2011; Martin et al., 2015), we expected the parenting by temperament interactions to be stronger as it relates to ODD symptoms.

Method

Participants and Recruitment

The study was conducted at a large urban university in the Southeastern United States with a large Latinx population. Families were recruited from local preschools and mental health agencies through brochures, radio ads, and open houses/parent workshops to participate in the STP-PreK (Graziano & Hart, 2016; Graziano et al., 2014). Eligibility to participate in the current study was determined by a) a diagnosis of ADHD (all subtypes were included) or ODD, b) enrollment in preschool the previous school-year, c) an estimated IQ of 70 or higher on the Wechsler Preschool and Primary Scale of Intelligence 4th edition (Wechsler, 2012), d) no history of autism spectrum disorder, and e) the ability to attend the 8 week STP-PreK. Twenty-nine children were excluded from the current study due to fact that they did not meet full DSM-5 diagnostic criteria for ADHD or ODD. The final sample consisted of 215 children (M_{age} = 5.0, *SD* = .50, 80.9% male, 84.7% Latinx) and their primary caregiver (M_{age} = 34.84, *SD* = 7.29) who provided informed consent to participate in this study. Study questionnaires were completed primarily by biological mothers (81.7%) with an average Hollingshead SES score in the low- to middle-class range (*M* = 43.52, *SD* = 12.53). Based on parent report at intake, only 10 children were on any psychotropic medication. Medication status was not associated with any predictors or outcomes.

Diagnoses of ADHD and ODD were obtained through a combination of parent structured interview (Diagnostic Interview Schedule for Children Version IV, C-DISC) (Shaffer et al., 2000), and parent and teacher ratings of symptom severity (Disruptive Behavior Disorders Rating Scale) (Pelham et al., 1992), and impairment (Impairment Rating Scale; IRS) (Fabiano et al., 2006) based on standard practice recommendations (Pelham et al., 2005). Dual Ph.D. level clinician review was used to determine diagnosis and eligibility. In the current sample, 30.7% met criteria for ADHD, 54.4% of children in the sample met criteria for ADHD and ODD, and 14.9% met criteria for ODD. Of note, between 95–97% of children diagnosed with ODD (either with or without co-occurring ADHD) had significant impairment at home, as rated by parents on the

IRS. There were no significant differences in our results when excluding the children diagnosed with ODD who did not have impairment at home (but rather at school) and thus we kept them in our results.

Measures

Temperament

To assess children's temperament, parents completed the Child Behavior Questionnaire-Very Short Form (CBQ-VSF) (Putnam & Rothbart, 2006) pre-treatment. The CBQ-VSF is a 36-item parent-report questionnaire that assesses temperament of children ages 3–8. Parents are asked to rate their child based on how they feel that their child's reaction is likely to be in a variety of situations. Responses are given on a 7-point scale ranging from 1 (*extremely untrue of my child*) to 7 (*extremely true of my child*). The CBQ-VSF has demonstrated good criterion validity, internal consistency, and longitudinal stability in young children (De la Osa et al., 2014; Kochanska et al., 1994; Putnam & Rothbart, 2006). The current study focused on the three higher order dimensions of temperament: surgency, negative affect, and effortful control, (α's = .70–.80).

ADHD and ODD

To asses ADHD and ODD symptom severity, parents and teachers completed the DBD Rating Scale pre- and post-treatment, adjusted for DSM-5 terminology. The DBD scale asks the respondent to rate the degree to which children display symptoms of ADHD, ODD, and CD, using a 4-point scale ranging from 0 (*not at all)* to 3 (*very much)*. Reliability and validity are well-established on these scales (Pillow et al., 1998), with this measure also showing sensitivity to behavioral treatment across multiple studies (Pelham et al., 2005). For the purposes of this study the mean ratings for hyperactivity/impulsivity, inattention, and ODD were examined (α's = .83–.96 across parent and teacher reports). Consistent with prior work (Hartman et al., 2007), the highest report between parent and teacher report were used.

Parenting

The Alabama Parenting Questionnaire (APQ) (Shelton et al., 1996) was used to assess parents' perception of their parenting ability as relevant to child disruptive behavior problems pre- and post-treatment. The APQ contains 42 questions, that are rated on a 5-point Likert scale of how often the parent feels that these things occur. For the purposes of this study we used the positive parenting subscale (α = .73), which describes the parents use of positive discipline techniques, with higher scores indicating more positive parenting techniques. To measure negative parenting, we used the inconsistent discipline subscale (α = .70), which describes the consistency in the use of such discipline, with higher scores indicating more inconsistent discipline practices. Both subscales used have been found to be psychometrically valid for assessing parenting practices and across cultures (Escribano et al., 2013; Essau et al., 2006). Further, research has consistently found the association between parenting problems, as documented by scales on the APQ, and conduct problems in children (Blader, 2004). Lastly, these subscales have demonstrated sensitivity to intervention effects in treating externalizing behavior problems in young children (August et al., 2003).

Observed Parenting

The Dyadic Parent-Child Interaction Coding System (DPICS) (Eyberg, 2013) is a behavioral coding system that measures the quality of parent-child interactions. Parents were observed and coded during a 5-minute child directed play (CDI) situation at pre- and post-treatment. Consistent with prior Parent-Child Interaction Therapy (PCIT) research (Bagner & Eyberg, 2007), two composite categories were created: positive parenting ("do" skills) and negative parenting ("don't" skills). "Do" skills include praises, behavioral descriptions, and reflections divided by the total number of verbalizations, while "don't" skills include questions, commands, and negative talk also divided by the total number of verbalizations. Undergraduate and graduate student coders, who were masked to diagnostic status and time point, were trained to 80% agreement with a criterion tape and coded 20% of the observations a second time to assess reliability. Reliability for the "do" and "don't" skills were good (*r*'s range from .73 to .95, *M* = .83). Previous studies have demonstrated good reliability, discriminant validity (Eyberg, 2013; Webster-Stratton & Lindsay, 1999), concurrent validity with parent reports of child behavior (Robinson & Eyberg, 1981), and sensitivity to parent training interventions (Webster-Stratton, 1998).

Intervention

All children participated in the STP-PreK, which is an 8-week multimodal intervention to improve behavioral, social-emotional, and academic readiness for children prior to the kindergarten transition (Graziano et al., 2014). The behavior modification program included the use of a daily report card, a time-out system, social reinforcement, and daily and weekly rewards. The social-emotional curriculum consisted of social skills and emotional awareness training via in-vivo training, the use of

puppets, and reinforcement of the skills throughout the day. Parents also attended 2-hour weekly group parenting sessions based on the School Readiness Parenting Program (SRPP) (Graziano et al., 2018). The first half of each session consisted of traditional behavior management strategies implemented within a group parent-child interaction therapy framework. The second portion of each session focused on group discussions on school readiness. The feasibility and initial efficacy of STP-PreK in improving school readiness and children's externalizing behavior problems are reported elsewhere (Graziano & Hart, 2016; Graziano et al., 2014).

Procedure

This study was approved by the university's Institutional Review Board. All families completed a pre-treatment assessment where parents were asked to complete questionnaires about their parenting practices, as well as child's temperament and behavior functioning. At the pre-treatment assessment children underwent IQ testing, academic achievement testing, and a standardized social-emotional/executive functioning battery; families were compensated at the completion of all tasks. All families also participated in a post-treatment assessment one week following the completion of the intervention where all study measures were re-administered, with the exception of IQ, and were compensated again. Teachers were also contacted to complete questionnaires about the child's behavior and social-emotional functioning pre- and post-treatment; teachers were compensated for each time point.

Data Analytic Plan

Missing data patterns were assessed using Little's Missing Completely at Random (MCAR) test in SPSS 26. Results revealed that the data was missing at random, χ^2 (16) = 45.59, $p > .05$. There were no significant differences between children with complete versus partial data on demographic variables or any outcomes examined. Nevertheless, models were estimated using full information maximum likelihood (FIML) in R. All further analyses were conducted in R using the Lavaan package (Rosseel, 2012) using robust maximum-likelihood analysis strategy. Preliminary analyses were conducted to examine the associations between demographic variables and outcome variables. Preliminary analyses were also conducted to examine if ADHD/ODD symptomology and parenting skills improved pre- to post-treatment.

A series of regression analyses were conducted to determine the extent to which temperament and parenting factors were uniquely related to children's ADHD and ODD symptoms pre- and post-treatment. These regressions were conducted separately for temperament and parenting. For models 1 and 4, all temperament variables were simultaneously entered together into the same regression. For models 2 and 5, all parenting variables were simultaneously entered together into the same regression. Models 3 and 6 included only significant main effects from the previous models. Additionally, in models 3 and 6 interaction terms were created from significant main effects of the previous models and included. To account for how changes in parenting may predict children's post-treatment symptomology in models 5 and 6, a second step in the regression was added, which included the post parenting variables. For these models, change in R^2 was used to examine if post-treatment parenting (step 2) significantly added unique variance toward the prediction of symptoms. All variables were standardized prior to entering the regression and significant interactions were probed accordingly (Aiken & West, 1991). When examining the effect of temperament and parenting on treatment response, all models controlled for pre-treatment inattention, hyperactivity, and ODD symptom severity.

Results

Preliminary Analyses

While child IQ was correlated with effortful control and parents' don't skills, cognitive deficits, such as those contributing to an IQ score, are considered inherent to ADHD and do not represent systematic error (Miller & Chapman, 2001). Therefore, we did not include IQ as a covariate. It is important to note that significant findings did not change when IQ was included as a covariate. No other demographic variables were associated with our variables of interest. In terms of ADHD/ODD symptoms, inattention, hyperactivity, and ODD symptom severity improved from pre- to post-treatment, p's<.05, Cohen's d = .89–1.02. Additionally, all four parenting variables improved from pre- to post-treatment, p's<.05, Cohen's d = .54–2.00.

Regression Analyses: Pre-Treatment Associations between Temperament, Parenting, and ADHD/ODD Symptoms

Model 1: Temperament Only

Surgency was significantly associated with pre-treatment symptoms of inattention (β = .27, $p < .001$),

hyperactivity (β = .51, p < .001), and ODD (β = .16, p = .016). Effortful control was significantly associated with pre-treatment symptoms of inattention (β = −.23, p < .001), but not with hyperactivity (β = −.03 p = .581) or ODD (β = .04, p = .444). Negative affect was only significantly associated with pre-treatment symptoms of ODD (β = .37, p < .001), with no significant association with inattention (β = .04, p = .530) or hyperactivity (β = .07, p = .276).

Model 2: Parenting Only

Inconsistent discipline was significantly associated with pre-treatment symptoms of inattention (β = .14, p = .046), hyperactivity (β = .15, p = .040), and ODD (β = .19, p = .004). Negative parenting, as measured by the "don't" skills, was significantly associated with symptoms of ODD (β =.218, p = .027), but was not significantly associated with inattention (β = .10, p = .354) or hyperactivity (β = .05, p = .644). Positive parenting, as measured by the "do" skills, was not significant across any symptom domains (β = −.05 to .11, p >.05). Additionally, positive parenting, as measured by the APQ, was not significantly associated with any symptom domains (β = −.02 to .09, p >.05).

Model 3: Temperament and Parenting Combined

The final regression model included all significant main effects from the previous models and tested for potential interactions, see Supplementary Table 1. Building on the previous models, all significant main effects for temperament remained. There were no longer main effects for inconsistent discipline or "don't" skills. However, a significant interaction between inconsistent discipline and effortful control in its association with hyperactivity emerged (β = .10, p <.05). As seen in Figure 1, probing of this interaction revealed that the buffering or protective impact of high effortful control on lower symptom severity of hyperactivity pre-treatment only occurred when combined with low levels of inconsistent discipline (β = −.12, p = .048). For symptoms of ODD, significant interactions emerged between surgency and inconsistent discipline (β = −.12, p <.05) as well as between surgency and "don't" skills (β = .14, p <.05). As seen in Figure 2, probing of these interactions revealed that the buffering or protective impact of low surgency on lower symptom severity of ODD pre-treatment only occurred when combined with low levels of inconsistent discipline (β = .27, p = .001). High surgency only related to greater symptom severity of ODD pre-treatment when combined with high levels of negative parenting, as measured by the "don't" skills (β = .29, p = .001).

Regression Analyses: Temperament and Parenting Pre-treatment Predicting ADHD/ODD Symptoms Post-Treatment

Model 4: Temperament Only

Surgency predicted treatment response across all symptoms, with higher surgency pre-treatment predicting greater symptom severity of inattention, hyperactivity, and ODD post-treatment, see Table 2. Additionally, higher negative affect pre-treatment significantly predicted greater symptom severity of ODD post-treatment.

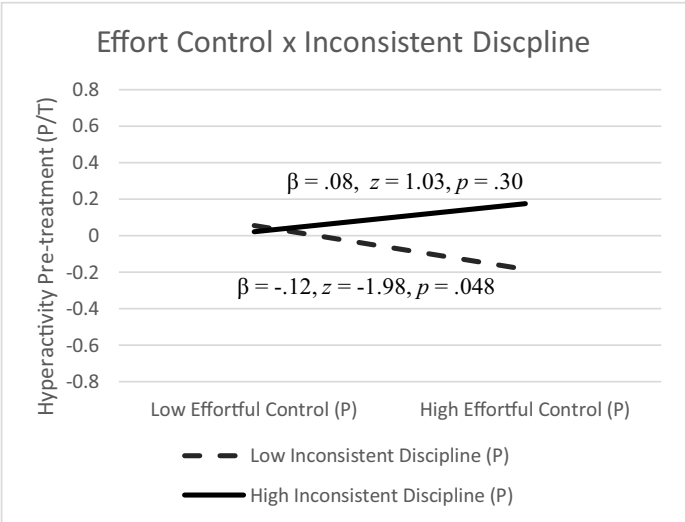

Figure 1. The interaction of effortful control and inconsistent discipline for hyperactivity pre-treatment. P/T = highest parent and teacher report, P = parent report. Interaction controlled for pre-treatment surgency, negative affect, inattention, and oppositional defiant disorder.

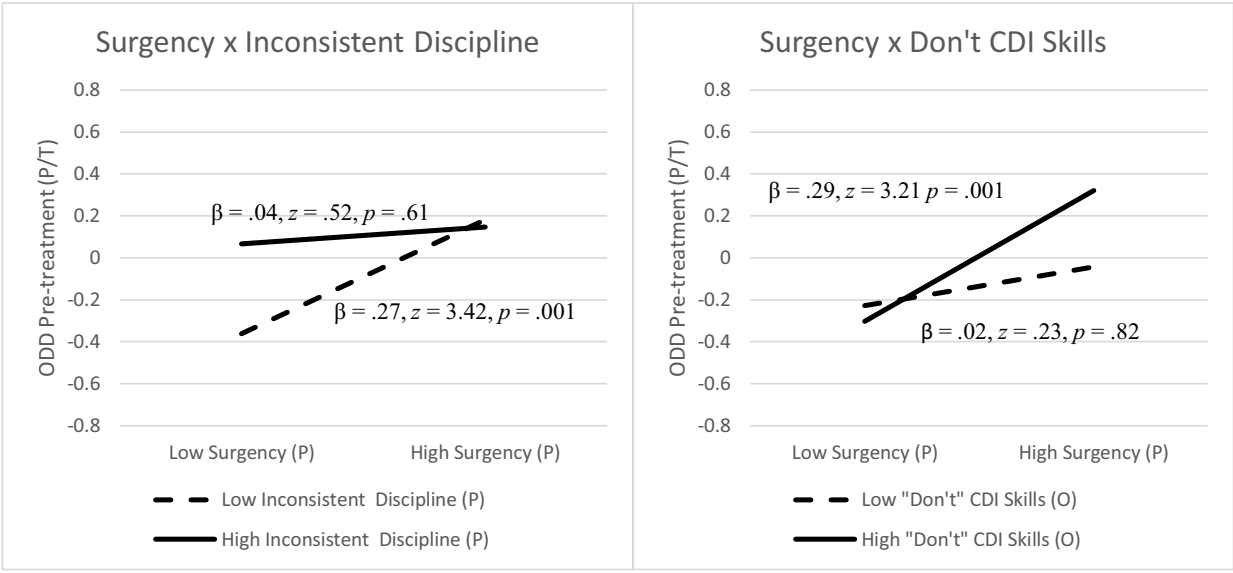

Figure 2. The interactions of surgency and parenting for ODD pre-treatment. ODD = oppositional defiant disorder, P/T = highest parent and teacher report, *P* = parent report, O = observation. Interactions controlled for pre-treatment effortful control, negative affect, inattention, and hyperactivity.

Model 5: Parenting Only

Positive parenting, as measured by the APQ, significantly predicted treatment response, with higher levels of self-reported positive parenting pre-treatment predicting lower symptom severity of inattention, hyperactivity, and ODD post-treatment, see Table 3. The improvement in positive parenting, as measured by the APQ, also predicted decreases in symptoms severity of ODD post-treatment. Decreases in inconsistent discipline pre- to post-treatment predicted decreases in symptom severity of inattention, hyperactivity, and ODD post-treatment.

Model 6: Temperament and Parenting Combined

The final regression model included all significant main effects and tested for potential interactions, see Table 4. Building on the previous models, higher surgency pre-treatment still uniquely predicted greater symptom severity of inattention, hyperactivity, and ODD post-treatment. Higher negative affect pre-treatment was also still significantly related to greater symptom severity of ODD post-treatment. Positive parenting pre-treatment significantly predicted lower symptom severity for hyperactivity and ODD post-treatment. The increase in positive parenting also predicted lower symptom severity of ODD post-treatment. The decrease in inconsistent discipline significantly predicted lower symptom severity of inattention, hyperactivity, and ODD post-treatment. No interactions were significant toward the prediction of post-treatment symptom domains.

Discussion

The current study examined how temperament and parenting interact pre-treatment in the prediction of ADHD/ODD symptom severity before and after an established multimodal treatment. Our results show that higher surgency pre-treatment was associated with greater symptom severity of inattention, hyperactivity, and ODD pre- and post-treatment. Higher negative affect was associated with greater symptom severity of ODD pre- and post-treatment, while greater effortful control was only associated with lower symptom severity of inattention pre-treatment. Negative parenting pre-treatment was associated with more severe symptoms of inattention, hyperactivity, and ODD at pre-treatment but did not predict treatment response. However, the change in negative parenting, as measured by inconsistent discipline, did predict treatment response across all symptom domains. Positive parenting pre-treatment predicted lower symptom severity of ADHD/ODD post-treatment, while the increase in positive parenting from pre- to post-treatment predicted lower symptom severity of ODD post-treatment. Additionally, several interactions emerged at pre-treatment between parenting and temperament as it relates to ADHD/ODD symptomology.

Pre-Treatment Functioning

In line with previous work (Martel et al., 2014; Martel & Nigg, 2006; Zastrow et al., 2018) greater effortful

Table 1. Correlations, means, and standard deviations.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. Surgency Pre (P)																	
2. Negative Affect Pre (P)	.08																
3. Effortful Control Pre (P)	.19**	.05															
4. Do Skills CDI Pre (O)	.00	.03	−.01														
5. Don't Skills CDI Pre (O)	−.03	−.02	−.07	−.68***													
6. Positive Parenting Pre (P)	.01	−.06	.35***	.06	−.06												
7. Inconsistent Discipline Pre (P)	.10	.21**	−.01	−.17*	.07	−.09											
8. Do Skills CDI Post (O)	.07	.15*	.07	.22***	−.12	.07	−.04										
9. Don't Skills CDI Post (O)	.00	−.06	−.03	−.23**	.14*	−.00	.04	−.69***									
10. Positive Parenting Post (P)	.07	.06	.13	.13	−.02	.30***	.00	.11	.00								
11. Inconsistent Discipline Post (P)	.06	.01	−.04	−.03	.02	−.10	.27***	−.16*	.14	−.30***							
12. Inattention Pre (P/T)	.22***	.05	−.17*	.03	.02	−.02	.10	.04	−.09	.07	.14						
13. Hyperactivity Pre (P/T)	.50***	.10	.08	.06	−.10	.00	.12	.03	.00	.13	.16*	.48***					
14. ODD Pre (P/T)	.24***	.38***	.09	.06	−.19**	−.09	.16*	.05	−.09	.32**	−.09	.08	.38**				
15. Inattention Post (P/T)	.18**	.06	.00	.03	.09	−.13	.04	−.03	.05	−.15	.32***	.35***	.16**	−.10			
16. Hyperactivity Post (P/T)	.30***	.06	.04	.02	.03	−.12	.02	.01	.02	−.19*	.34***	.30***	.30***	−.03	.85**		
17. ODD Post (P/T)	.20**	.27***	−.02	.09	−.08	−.17*	.04	.07	.05	−.19*	.21**	.01	.12	.26***	.59***	.69***	
Mean	5.16	4.56	5.02	.08	.52	68.57	13.10	.34	.23	72.05	9.86	1.89	2.16	1.47	1.25	1.43	.80
Standard Deviation	.82	.89	.71	.10	.15	7.03	3.98	.16	.14	5.90	3.23	.62	.59	.68	.81	.80	.65

***p <.001; **p <.01; * p <.05. Note. O = observed/standardized assessment, P = parent report, P/T = highest parent and teacher report. CDI = child directed interaction, ODD = oppositional defiant disorder.

Table 2. Model 4: temperament pre-treatment predicting ADHD and ODD post-treatment.

	β	SE	95%	Model R^2	z-test
Inattention Post (P/T)					
Inattention Pre (P/T)	.357***	.078	.203,.511	.171	4.554
Hyperactivity Pre (P/T)	−.051	.092	−.232,.129		−.558
ODD Pre (P/T)	−.182**	.067	−.314, −.050		−2.704
Surgency Pre (P)	.146*	.067	.014,.277		2.165
Negative Affect Pre (P)	.112	.065	−.016,.239		1.72
Effort Control Pre (P)	.046	.067	−.085,.177		.686
Hyperactivity Post (P/T)					
Inattention Pre (P/T)	.188*	.078	.034,.341	.175	2.398
Hyperactivity Pre (P/T)	.138	.084	.027,.304		1.641
ODD Pre (P/T)	−.170*	.069	−.305, −.035		−2.468
Surgency Pre (P)	.220***	.067	.089,.351		3.288
Negative Affect Pre (P)	.083	.064	−.043,.208		1.287
Effort Control Pre (P)	.023	.067	−.109,.154		.336
ODD Post (P/T)					
Inattention Pre (P/T)	−.043	.073	−.186,.099	.148	−.594
Hyperactivity Pre (P/T)	−.058	.085	−.225,.110		−.673
ODD Pre (P/T)	.227**	.081	.067,.387		2.784
Surgency Pre (P)	.196**	.068	.063,.328		2.897
Negative Affect Pre (P)	.177**	.063	.053,.302		2.803
Effort Control Pre (P)	−.098	.067	−.228,.033		−1.463

***p <.001; **p <.01; * p <.05. Note. P/T = highest parent and teacher report, P = parent report, ODD = oppositional defiant disorder.

control was associated with lower symptom severity of inattention, higher negative affect was associated with greater symptom severity of ODD, and higher surgency was associated with worse ADHD/ODD symptom severity all at pre-treatment. Given the importance of independent reproducibility, these findings replicate previous work in ADHD/ODD and temperament (Kerner Auch Koerner et al., 2018; Martel & Nigg, 2006), while expanding to a more diverse population. Our results show support for both Sonuga-Barke's (2005) and Nigg et al. (2004) dual pathway models: executive functioning deficits (effortful control) lead to inattentive symptoms, reward–response deficits (surgency) lead to the inattentive and hyperactive symptom clusters, and negative emotionality (negative affect) is related to ODD comorbidity in ADHD. Our findings further contribute to this literature by documenting that these temperament and ADHD/ODD associations are maintained even when considering pre-treatment parenting factors.

Table 3. Model 5: parenting predicting ADHD and ODD post-treatment.

	β	SE	95%	Model R^2	z-test
Inattention Post (P/T)					
Step 1: Inattention Pre (P/T)	.321***	.073	.179,.464	.170	4.422
Hyperactivity Pre (P/T)	.043	.088	−.129,.215		.492
ODD Pre (P/T)	−.140*	.068	−.274, −.006		−2.047
CDI Prop Do Pre (O)	.147	.082	−.014,.308		1.793
CDI Prop Don't Pre (O)	.126	.088	−.047,.299		1.426
Positive Parenting Pre (P)	−.150*	.068	−.283, −.016		−2.197
Inconsistent Discipline Pre (P)	.006	.075	−.142,.154		.076
Step 2: CDI Prop Do Post (O)	.052	.099	−.141,.245	.238	.528
CDI Prop Don't Post (O)	.095	.093	−.089,.278		1.012
Positive Parenting Post (P)	−.071	.087	−.241,.098		−.823
Inconsistent Discipline Post (P)	.239***	.074	.093,.384		3.221
Hyperactivity Post (P/T)					
Step 1: Inattention Pre (P/T)	.165*	.073	.021,.309	.157	2.242
Hyperactivity Pre (P/T)	.274***	.077	.123,.424		3.564
ODD Pre (P/T)	−.147*	.070	−.285, −.009		−2.085
CDI Prop Do Pre (O)	.052	.092	−.129,.233		.565
CDI Prop Don't Pre (O)	.038	.085	−.129,.206		.451
Positive Parenting Pre (P)	−.155*	.068	−.287, −.022		−2.281
Inconsistent Discipline Pre (P)	−.042	.072	−.182,.098		−.589
Step 2: CDI Prop Do Post (O)	.091	.096	−.097,.280	.239	.950
CDI Prop Don't Post (O)	.074	.087	−.096,.244		.856
Positive Parenting Post (P)	−.146	.091	−.324,.033		−1.599
Inconsistent Discipline Post (P)	.233**	.077	.083,.383		3.042
ODD Post (P/T)					
Step 1: Inattention Pre (P/T)	−.030	.070	−.166,.107	.115	−.424
Hyperactivity Pre (P/T)	.043	.073	−.099,.186		.595
ODD Pre (P/T)	.251***	.076	.101,.401		3.285
CDI Prop Do Pre (O)	.035	.099	−.158,.228		.359
CDI Prop Don't Pre (O)	.082	.104	−.121,.285		.788
Positive Parenting Pre (P)	−.177**	.073	−.320, −.035		−2.440
Inconsistent Discipline Pre (P)	−.038	.075	−.185,.109		−.505
Step 2: CDI Prop Do Post (O)	.137	.096	−.050,.325	.212	1.438
CDI Prop Don't Post (O)	.067	.087	−.104,.237		.766
Positive Parenting Post (P)	−.259**	.094	−.444, −.074		−2.740
Inconsistent Discipline Post (P)	.166*	.079	.010,.322		2.089

***p <.001; **p <.01; * p <.05. For each outcome, step two significantly contributed to the overall variance, p <.05. Note. P/T = highest parent and teacher report, O = observed/standardized assessment, P = parent report, ODD = oppositional defiant disorder.

Table 4. Model 6: temperament and parenting predicting ADHD and ODD post-treatment.

	β	SE	95%	Model R^2	z-test
Inattention Post (P/T)					
Step 1: Inattention Pre (P/T)	.336***	.072	.196,.477	.200	4.689
Hyperactivity Pre (P/T)	−.026	.090	−.203,.151		−.289
ODD Pre (P/T)	−.179*	.071	−.318, −.040		−2.526
Surgency Pre (P)	.156*	.066	.027,.286		2.370
Negative Affect Pre (P)	.127	.066	−.002,.256		1.928
Positive Parenting Pre (P)	−.120	.073	−.264,.023		−1.640
Sur (P) x Positive Parenting Pre (P)	−.020	.070	−.158,.118		−.284
NA (P) x Positive Parenting Pre (P)	−.104	.080	−.261,.054		−1.292
Inconsistent Discipline (P)	−.034	.073	−.177,.109		−.467
Sur (P) x Inconsistent Discipline (P)	.034	.060	−.084,.152		.571
NA (P) x Inconsistent Discipline (P)	−.072	.078	−.226,.081		−.927
Step 2: Positive Parenting Post (P)	−.005	.086	−.181,.160	.284	−.056
Inconsistent Discipline Post (P)	.266***	.071	.127,.402		3.741
Hyperactivity Post (P/T)					
Step 1: Inattention Pre (P/T)	.170*	.070	.036,.209	.240	2.482
Hyperactivity Pre (P/T)	.173*	.081	.013,.329		2.116
ODD Pre (P/T)	−.179*	.070	−.317, −.042		−2.553
Surgency Pre (P)	.240***	.062	.118,.362		3.869
Negative Affect Pre (P)	.083	.063	−.040,.207		1.328
Positive Parenting Pre (P)	−.144*	.070	−.282, −.007		−2.057
Sur (P) x Positive Parenting Pre (P)	−.077	.067	−.208,.054		−1.147
NA (P) x Positive Parenting Pre (P)	−.032	.075	−.179,.115		−.429
Inconsistent Discipline (P)	−.061	.068	−.193,.072		−.894
Sur (P) x Inconsistent Discipline (P)	.003	.056	−.107,.114		.061
NA (P) x Inconsistent Discipline (P)	−.140	.070	−.278,.003		−1.897
Step 2: Positive Parenting Post (P)	−.106	.085	−.282,.052	.324	−1.243
Inconsistent Discipline Post (P)	.261***	.073	.118,.269		3.579
ODD Post (P/T)					
Step 1: Inattention Pre (P/T)	−.017	.066	−.146,.113	.185	−.256
Hyperactivity Pre (P/T)	−.026	.080	−.182,.130		−.324
ODD Pre (P/T)	.184*	.077	.033,.336		2.390
Surgency Pre (P)	.179**	.066	.049,.308		2.702
Negative Affect Pre (P)	.238***	.063	.115,.361		3.791
Positive Parenting Pre (P)	−.141*	.073	−.284, −.002		−1.934
Sur (P) x Positive Parenting Pre (P)	−.025	.074	−.170,.120		−.338
NA (P) x Positive Parenting Pre (P)	−.110	.085	−.277,.056		−1.297
Inconsistent Discipline (P)	−.085	.072	−.226,.057		−1.173
Sur (P) x Inconsistent Discipline (P)	−.005	.059	−.121,.111		−.085
NA (P) x Inconsistent Discipline (P)	−.073	.070	−.210,.064		−1.046
Step 2: Positive Parenting Post (P)	−.207*	.085	−.379, −.044	.284	−2.430
Inconsistent Discipline Post (P)	.186*	.075	.038,.328		2.462

***p <.001, **p <.01, * p <.05. For each outcome, step two significantly contributed to the overall variance, p <.05.
Note. P/T = highest parent or teacher, P = parent report, Sur = surgency, NA = negative affect, ODD = oppositional defiant disorder.

As it relates to the caregiving environment, two out of three pre-treatment interactions are consistent with the vantage sensitivity model (Pluess & Belsky, 2013), which posits that individuals disproportionately benefit from positive features in the environment. Specifically, we found that the benefits of low inconsistent discipline *only* occurred when paired with low temperament risk (i.e., high effortful control and low surgency) for symptoms of hyperactivity and ODD, respectively. On the other hand, we found no impact of observed negative parenting (i.e., "don't skills") on symptoms of ODD at low levels of surgency. Only the combination of high surgency and high "don't" skills resulted in the greatest symptom severity of ODD, fitting more with the diathesis-stress model. It may by the case that parents find children high in surgency and low in effortful control behaviorally and emotionally demanding, thus making it difficult for them to consistently implement discipline strategies (Rodriguez & Wittig, 2019; Wilson et al., 2018). On the other hand, it is easier to parent consistently when children have an easier temperament (Van Zeijl et al., 2007). Parents of children with difficult temperaments (i.e., high surgency, low effortful control) may need additional support and tools to manage their own stress and emotions during treatment. Also consistent with prior work (Slagt et al., 2016), a child's temperamental susceptibility to parent behaviors may vary as a function of how such parenting is measured (i.e., self-report vs. observation). Future work examining how parenting impacts the association between temperament and

child outcomes should take into account how different assessment measures and modalities impact susceptibility interpretations.

Predicting Treatment Response

Surgency predicted response to intervention across all externalizing domains, with higher surgency pre-treatment predicting greater inattention, hyperactivity, and ODD symptom severity post-treatment. Negative affect also impacted treatment response, with higher negative affect pre-treatment predicting greater symptom severity of ODD post-treatment. This extends previous findings, highlighting how surgency and negative affect not only impact the development of ADHD and ODD (Martel & Nigg, 2006), but also predict treatment response. As it relates to parenting, parent self-report of positive parenting emerged as a significant predictor of treatment response such that higher self-reported positive parenting pre-treatment predicted lower inattention, hyperactivity, and ODD symptom severity post-treatment. This indicates that while a more negative parenting style might lead to the development and maintenance of ADHD/ODD, positive parenting is a powerful mechanism for change. This is in line with previous research showing that positive parenting is a critical component of behavior parent training (Sanders, 1999), which is also a core component of the current study's parenting intervention (Graziano et al., 2018). The impact of positive parenting decreased when entered along with the temperament dimensions in the final model. This is also in line with previous research indicating biologically driven traits (i.e., temperament) can have a stronger impact on child behavior compared to environment (i.e., parenting) (Earls & Jung, 1987; Saudino, 2005). Interestingly, our objective measure of positive parenting did not significantly predict treatment response. It is important to note that our objective measure of positive parenting ("do skills") did not correlate with parents' own self-report. Hence, while observational measures of parenting may serve as important indicators of treatment progress, parents' perception of their skills may be a more powerful predictor of children's treatment gains. It is also important to note that treatment gains were measured by parent and teacher report. It may be the case that rater-biases impacted the significant association between parent self-report of their parenting skills and child improvement.

When examining change in parenting skills, the increase in self-reported positive parenting only significantly predicted decreases in ODD symptom severity post-treatment. Change in inconsistent discipline predicted change across all symptom domains, with decreases in inconsistent discipline leading to decreases in symptom severity of inattention, hyperactivity, and ODD post-treatment. Additionally, while the benefits of low inconsistent discipline only occurred when paired with low temperament risk (i.e., low surgency) at pre-treatment, no such interactions were found at post-treatment. Consistent with traditional targets in behavioral parent training (Kaminski et al., 2008), our findings highlight the importance of parents improving their consistency as it relates to discipline, regardless of their children's temperamental risk. While improvements in inconsistent discipline appear to be important across symptom domains, our findings underscore to the importance of increasing positive parenting skills as it relates to ODD symptoms. The link between positive parenting skills and improvements in ODD symptom severity is consistent with emerging cognitive neuroscience work highlighting children with ODD's differential neural response to rewards versus punishment (Matthys et al., 2012). As children with ODD may be more sensitive to reward than punishment, treatments should focus on positive parenting versus only a reduction in negative parenting skills (Matthys et al., 2004).

Limitations

When interpreting our results, there were some limitations that need to be considered. It is important to acknowledge that associations between temperament and ADHD/ODD could be impacted by item-content overlap, otherwise referred to as measurement confounding. For example, effortful control defined as being involved in attentional control, necessary for planning, and goal directed behaviors is similar to deficits in inattention experienced by children with ADHD. However, prior research has found that the association between temperament and disruptive behaviors remain unchanged even after accounting for measurement confounding (Lemery et al., 2002). Nigg et al. (2004) elaborate on the distinction between temperament and ADHD and state that while the concepts appear to be related, they are not identical. For example, the authors state that "certain cognitive, language, and motor deficits associated with ADHD are generally not associated with temperament" (Nigg et al., 2004). Further, the correlations between temperament and ADHD/ODD symptoms in this study were only mild to moderate,

ranging from .08 to .50. Thus, while related conceptually and empirically, temperament and ADHD/ODD can be examined as separate constructs.

In addition, there was no objective measurement of temperament. Future research should utilize objective measures of temperament (e.g., temperament coding) to validate these findings. As our findings suggest a surgency and reward dysfunction pathway to ADHD/ODD, future research should also include an objective measure of reward sensitivity in preschoolers. It is also important to consider the stability of ADHD/ODD diagnoses in preschool, which can range from 59%-79% (Bunte et al., 2014; Riddle et al., 2013). While some studies show that nearly all young children with ADHD still meet criteria 3 years later (Lahey et al., 2004), other studies have found lower rates of stability over time, which can impact external validity (Bunte et al., 2014). The aforementioned studies point to the importance of examining ADHD/ODD symptoms across time in a more dimensional manner (like the current study), rather than change in meeting diagnostic criteria. Lastly, the cultural homogeneity of the current sample (85% Latinx) limits the generalizability of our conclusions to more heterogeneous groups. Yet, this may also serve as a strength as it validates previous findings, which are in mostly non-minority samples (Martel & Nigg, 2006), in a large Latinx population. This is important as Latinx families can have different viewpoints and interpretations of parenting and child behaviors (Calzada et al., 2010; Halgunseth et al., 2006), making it important to understand if different cultural backgrounds impact results. Our findings indicate that previous temperament and parenting models are applicable with a Latinx sample. Additionally, our findings show the importance of consistent parenting for improving ADHD/ODD symptoms within a Latinx sample.

Conclusion

Consistent with the reward dysfunction pathway (Sonuga-Barke, 2005), surgency emerged as the most consistent risk dimension, predicting ADHD/ODD symptom severity pre- and post-treatment. Furthermore, in line with previous models of ODD (Martel & Nigg, 2006; Stringaris & Goodman, 2009) we found that high negative affect was associated with greater symptom severity of ODD pre- and post-treatment. Our study adds to these previous theoretical models by documenting that within a large Latinx sample these associations between temperament and ADHD/ODD are independent of parenting dimensions. Perhaps the most clinically impactful findings from our study is that these temperament dimensions are predictive of children's treatment response. Demonstrating that temperament predicts treatment response further validates the utility of temperament as an early risk factor/precursor for ADHD/ODD. Given that temperament can be reliably measured from early infancy (Gartstein & Rothbart, 2003), it may be a useful construct in identifying children who may benefit from early prevention efforts.

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No potential conflict of interest was reported by the authors.

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References

Aiken, L. S., & West, S. (1991). *Multiple regression: Testing and interpreting interactions*. Sage.

August, G. J., Lee, S. S., Bloomquist, M. L., Realmuto, G. M., & Hektner, J. M. (2003). Dissemination of an evidence-based prevention innovation for aggressive children living in culturally diverse, urban neighborhoods: The early risers effectiveness study. *Prevention Science*, *4*(4), 271–286. https://doi.org/10.1023/A:1026072316380

Bagner, D. M., & Eyberg, S. M. (2007). Parent–child interaction therapy for disruptive behavior in children with mental retardation: A randomized controlled trial. *Journal of Clinical Child and Adolescent Psychology*, *36*(3), 418–429. https://doi.org/10.1080/15374410701448448

Barkley, R. A., & Mash, E. J. (2003). *Child psychopathology*. Guilford Press.

Belsky, J. (2005). Differential susceptibility to rearing influence. In Ellis B. J. & Bjorklund D. F. (Eds.), *Origins of the Social Mind: Evolutionary Psychology and Child Development* (pp. 139–163). New York, NY: Guilford.

Blader, J. C. (2004). Symptom, family, and service predictors of children's psychiatric rehospitalization within one year of discharge. *Journal of the American Academy of Child and Adolescent Psychiatry*, *43*(4), 440–451. https://doi.org/10.1097/00004583-200404000-00010

Blair, C. (2002). Early intervention for low birth weight, preterm infants: The role of negative emotionality in the specification of effects. *Development and Psychopathology*, *14* (2), 311–332. https://doi.org/10.1017/S0954579402002079

Bunte, T. L., Schoemaker, K., Hessen, D. J., Van der Heijden, P. G., & Matthys, W. (2014). Stability and change of ODD, CD and ADHD diagnosis in referred preschool children. *Journal of Abnormal Child Psychology*, *42*(7), 1213–1224. https://doi.org/10.1007/s10802-014-9869-6

Burleson, J. A., & Kaminer, Y. (2008). Does temperament moderate treatment response in adolescent substance use disorders? *Substance Abuse*, *29*(2), 89–95. https://doi.org/10.1080/08897070802093387

Calkins, S. D. (1997). Cardiac vagal tone indices of temperamental reactivity and behavioral regulation in young children. *Developmental Psychobiology: The Journal of the International Society for Developmental Psychobiology*, *31* (2), 125–135. https://doi.org/10.1002/(SICI)1098-2302(199709)31:2<125::AID-DEV5>3.CO;2-M

Calzada, E. J., Fernandez, Y., & Cortes, D. E. (2010). Incorporating the cultural value of respeto into a framework of Latino parenting. *Cultural Diversity & Ethnic Minority Psychology*, *16*(1), 77. https://doi.org/10.1037/a0016071

Danielson, M. L., Bitsko, R. H., Ghandour, R. M., Holbrook, J. R., Kogan, M. D., & Blumberg, S. J. (2018). Prevalence of parent-reported ADHD diagnosis and associated treatment among US children and adolescents, 2016. *Journal of Clinical Child & Adolescent Psychology*, *47*(2), 199–212. https://doi.org/10.1080/15374416.2017.1417860

De la Osa, N., Granero, R., Penelo, E., Domènech, J. M., & Ezpeleta, L. (2014). The short and very short forms of the Children's Behavior Questionnaire in a community sample of preschoolers. *Assessment*, *21*(4), 463–476. https://doi.org/10.1177/1073191113508809

Doshi, J. A., Hodgkins, P., Kahle, J., Sikirica, V., Cangelosi, M. J., Setyawan, J., … Neumann, P. J. (2012). Economic impact of childhood and adult attention-deficit/hyperactivity disorder in the United States. *Journal of the American Academy of Child and Adolescent Psychiatry*, *51*(10), 990–1002. e1002. https://doi.org/10.1016/j.jaac.2012.07.008

Earls, F., & Jung, K. G. (1987). Temperament and home environment characteristics as causal factors in the early development of childhood psychopathology. *Journal of the American Academy of Child and Adolescent Psychiatry*, *26*(4), 491–498. https://doi.org/10.1097/00004583-198707000-00005

Eisenberg, N., Fabes, R. A., Guthrie, I. K., Murphy, B. C., Maszk, P., Holmgren, R., & Suh, K. (1996). The relations of regulation and emotionality to problem behavior in elementary school children. *Development and Psychopathology*, *8*(1), 141–162. https://doi.org/10.1017/S095457940000701X

Escribano, S., Aniorte, J., & Orgilés, M. (2013). Factor structure and psychometric properties of the Spanish version of the Alabama Parenting Questionnaire (APQ) for children. *Psicothema*, *25*(3), 324–329. https://doi.org/10.7334/psicothema2012.315

Essau, C. A., Sasagawa, S., & Frick, P. J. (2006). Psychometric properties of the Alabama parenting questionnaire. *Journal of Child and Family Studies*, *15*(5), 595–614. https://doi.org/10.1007/s10826-006-9036-y

Eyberg, S. M. (2013). *Dyadic parent-child interaction coding system (DPICS): Comprehensive manual for research and training*. PCIT International, Incorporated.

Ezpeleta, L., Penelo, E., De la Osa, N., Navarro, J. B., & Trepat, E. (2019). Irritability and parenting practices as mediational variables between temperament and affective, anxiety, and oppositional defiant problems. *Aggressive Behavior*, *45*(5), 550–560. https://doi.org/10.1002/ab.21850

Fabiano, G. A., Pelham, J., William, E., Waschbusch, D. A., Gnagy, E. M., Lahey, B. B., Chronis, A. M., & Burrows-MacLean, L. (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. *Journal of Clinical Child and Adolescent Psychology*, *35*(3), 369–385. https://doi.org/10.1207/s15374424jccp3503_3

Feldman, R., Greenbaum, C. W., & Yirmiya, N. (1999). Mother–infant affect synchrony as an antecedent of the emergence of self-control. *Developmental Psychology*, *35* (1), 223. https://doi.org/10.1037/0012-1649.35.1.223

Gartstein, M. A., & Rothbart, M. K. (2003). Studying infant temperament via the revised infant behavior questionnaire. *Infant Behavior & Development*, *26*(1), 64–86. https://doi.org/10.1016/S0163-6383(02)00169-8

Goldsmith, H. H., Lemery, K. S., Aksan, N., & Buss, K. A. (2000). Temperamental substrates of personality development. In V. J. Molfese & D. L. Molfese (Eds.), *Temperament and Personality Development across the Life Span* (pp. 1–32). New Jersey: Erlbaum.

Graziano, P. A., & Hart, K. (2016, October). Beyond behavior modification: Benefits of social–emotional/self-regulation training for preschoolers with behavior problems. *Journal of School Psychology*, *58*, 91–111. https://doi.org/10.1016/j.jsp.2016.07.004

Graziano, P. A., Ros, R., Hart, K. C., & Slavec, J. (2018). Summer treatment program for preschoolers with externalizing behavior problems: A preliminary examination of parenting outcomes. *Journal of Abnormal Child Psychology*, *46*(6), 1253–1265. https://doi.org/10.1007/s10802-017-0358-6

Graziano, P. A., Slavec, J., Hart, K., Garcia, A., & Pelham, W. E. (2014). Improving school readiness in preschoolers with behavior problems: Results from a summer treatment program. *Journal of Psychopathology and Behavioral Assessment*, *36*(4), 555–569. https://doi.org/10.1007/s10862-014-9418-1

Greven, C. U., Rijsdijk, F. V., & Plomin, R. (2011). A twin study of ADHD symptoms in early adolescence: Hyperactivity-impulsivity and inattentiveness show substantial genetic overlap but also genetic specificity. *Journal of Abnormal Child Psychology*, *39*(2), 265–275. https://doi.org/10.1007/s10802-010-9451-9

Gurpegui, D., Ortuño, F., & Gurpegui, M. (2019). Temperament traits and remission of depression: A naturalistic six-month longitudinal study. *Journal of Affective Disorders*, *243*, 494–502. https://doi.org/10.1016/j.jad.2018.09.041

Halgunseth, L. C., Ispa, J. M., & Rudy, D. (2006). Parental control in Latino families: An integrated review of the

literature. *Child Development*, *77*(5), 1282–1297. https://doi.org/10.1111/j.1467-8624.2006.00934.x

Hartman, C. A., Rhee, S. H., Willcutt, E. G., & Pennington, B. F. (2007). Modeling rater disagreement for ADHD: Are parents or teachers biased? *Journal of Abnormal Child Psychology*, *35*(4), 536–542. https://doi.org/10.1007/s10802-007-9110-y

Kagan, J., Reznick, J. S., & Snidman, N. (1987). The physiology and psychology of behavioral inhibition in children. *Child Development*, *58*(6), 1459–1473. https://doi.org/10.2307/1130685

Kaminski, J. W., 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*(4), 567–589. https://doi.org/10.1007/s10802-007-9201-9

Karalunas, S. L., Gustafsson, H. C., Fair, D., Musser, E. D., & Nigg, J. T. (2019). Do we need an irritable subtype of ADHD? Replication and extension of a promising temperament profile approach to ADHD subtyping. *Psychological Assessment*, *31*(2), 236. https://doi.org/10.1037/pas0000664

Kerner Auch Koerner, J., Gust, N., & Petermann, F. (2018). Developing ADHD in preschool: Testing the dual pathway model of temperament. *Applied Neuropsychology. Child*, *7*(4), 366–373. https://doi.org/10.1080/21622965.2017.1347509

Kochanska, G., DeVet, K., Goldman, M., Murray, K., & Putnam, S. P. (1994). Maternal reports of conscience development and temperament in young children. *Child Development*, *65*(3), 852–868. https://doi.org/10.2307/1131423

Lahey, B. B., Pelham, W. E., Loney, J., Kipp, H., Ehrhardt, A., Lee, S. S., … Massetti, G. (2004). Three-year predictive validity of DSM-IV attention deficit hyperactivity disorder in children diagnosed at 4–6 years of age. *American Journal of Psychiatry*, *161*(11), 2014–2020. https://doi.org/10.1176/appi.ajp.161.11.2014

Lahey, B. B., Van Hulle, C. A., Keenan, K., Rathouz, P. J., D'Onofrio, B. M., Rodgers, J. L., & Waldman, I. D. (2008). Temperament and parenting during the first year of life predict future child conduct problems. *Journal of Abnormal Child Psychology*, *36*(8), 1139. https://doi.org/10.1007/s10802-008-9247-3

Lavigne, J. V., LeBailly, S. A., Gouze, K. R., Cicchetti, C., Jessup, B. W., Arend, R., … Binns, H. J. (2008). Predictor and moderator effects in the treatment of oppositional defiant disorder in pediatric primary care. *Journal of Pediatric Psychology*, *33*(5), 462–472. https://doi.org/10.1093/jpepsy/jsm075

Lemery, K. S., Essex, M. J., & Smider, N. A. (2002). Revealing the relation between temperament and behavior problem symptoms by eliminating measurement confounding: Expert ratings and factor analyses. *Child Development*, *73*(3), 867–882. https://doi.org/10.1111/1467-8624.00444

Loe, I. M., & Feldman, H. M. (2007). Academic and educational outcomes of children with ADHD. *Journal of Pediatric Psychology*, *32*(6), 643–654. https://doi.org/10.1093/jpepsy/jsl054

Martel, M. M., Gremillion, M. L., & Roberts, B. (2012). Temperament and common disruptive behavior problems in preschool. *Personality and Individual Differences*, *53*(7), 874–879. https://doi.org/10.1016/j.paid.2012.07.011

Martel, M. M., Gremillion, M. L., Roberts, B. A., Zastrow, B. L., & Tackett, J. L. (2014, July). Longitudinal prediction of the one-year course of preschool ADHD symptoms: Implications for models of temperament–ADHD associations. *Personality and Individual Differences*, *64*, 58–61. https://doi.org/10.1016/j.paid.2014.02.018

Martel, M. M., & Nigg, J. T. (2006). Child ADHD and personality/temperament traits of reactive and effortful control, resiliency, and emotionality. *Journal of Child Psychology and Psychiatry*, *47*(11), 1175–1183. https://doi.org/10.1111/j.1469-7610.2006.01629.x

Martel, M. M., Nigg, J. T., & Von Eye, A. (2009). How do trait dimensions map onto ADHD symptom domains? *Journal of Abnormal Child Psychology*, *37*(3), 337. https://doi.org/10.1007/s10802-008-9255-3

Martin, J., O'Donovan, M. C., Thapar, A., Langley, K., & Williams, N. (2015). The relative contribution of common and rare genetic variants to ADHD. *Translational Psychiatry*, *5*(2), e506–e506. https://doi.org/10.1038/tp.2015.5

Matthys, W., Van Goozen, S. H., Snoek, H., & Van Engeland, H. (2004). Response perseveration and sensitivity to reward and punishment in boys with oppositional defiant disorder. *European Child & Adolescent Psychiatry*, *13*(6), 362–364. https://doi.org/10.1007/s00787-004-0395-x

Matthys, W., Vanderschuren, L. J., Schutter, D. J., & Lochman, J. E. (2012). Impaired neurocognitive functions affect social learning processes in oppositional defiant disorder and conduct disorder: Implications for interventions. *Clinical Child and Family Psychology Review*, *15*(3), 234–246. https://doi.org/10.1007/s10567-012-0118-7

Miller, G. A., & Chapman, J. P. (2001). Misunderstanding analysis of covariance. *Journal of Abnormal Psychology*, *110*(1), 40. https://doi.org/10.1037/0021-843X.110.1.40

Miller, N. V., Degnan, K. A., Hane, A. A., Fox, N. A., & Chronis-Tuscano, A. (2019). Infant temperament reactivity and early maternal caregiving: Independent and interactive links to later childhood attention-deficit/hyperactivity disorder symptoms. *Journal of Child Psychology and Psychiatry*, *60*(1), 43–53. https://doi.org/10.1111/jcpp.12934

Monroe, S. M., & Simons, A. D. (1991). Diathesis-stress theories in the context of life stress research: Implications for the depressive disorders. *Psychological Bulletin*, *110*(3), 406. https://doi.org/10.1037/0033-2909.110.3.406

Nigg, J. T., Goldsmith, H. H., & Sachek, J. (2004). Temperament and attention deficit hyperactivity disorder: The development of a multiple pathway model. *Journal of Clinical Child and Adolescent Psychology*, *33*(1), 42–53. https://doi.org/10.1207/S15374424JCCP3301_5

Pelham, J., William, E., Fabiano, G. A., & Massetti, G. M. (2005). Evidence-based assessment of attention deficit hyperactivity disorder in children and adolescents. *Journal of Clinical Child and Adolescent Psychology*, *34*(3), 449–476. https://doi.org/10.1207/s15374424jccp3403_5

Pelham, W. E., Jr, Gnagy, E. M., Greenslade, K. E., & Milich, R. (1992). Teacher ratings of DSM-III-R symptoms for the disruptive behavior disorders. *Journal of the American Academy of Child and Adolescent Psychiatry*, *31*(2), 210–218. https://doi.org/10.1097/00004583-199203000-00006

Pillow, D. R., Pelham, W. E., Hoza, B., Molina, B. S., & Stultz, C. H. (1998). Confirmatory factor analyses examining attention deficit hyperactivity disorder symptoms and other childhood disruptive behaviors. *Journal of Abnormal Child Psychology*, *26*(4), 293–309. https://doi.org/10.1023/A:1022658618368

Pluess, M., & Belsky, J. (2013). Vantage sensitivity: Individual differences in response to positive experiences. *Psychological Bulletin*, *139*(4), 901. https://doi.org/10.1037/a0030196

Purper-Ouakil, D., Cortese, S., Wohl, M., Aubron, V., Orejarena, S., Michel, G., … Gorwood, P. (2010). Temperament and character dimensions associated with clinical characteristics and treatment outcome in attention-deficit/hyperactivity disorder boys. *Comprehensive Psychiatry*, *51*(3), 286–292. https://doi.org/10.1016/j.comppsych.2009.08.004

Putnam, S. P., & Rothbart, M. K. (2006). Development of short and very short forms of the Children's Behavior Questionnaire. *Journal of Personality Assessment*, *87*(1), 102–112. https://doi.org/10.1207/s15327752jpa8701_09

Riddle, M. A., Yershova, K., Lazzaretto, D., Paykina, N., Yenokyan, G., Greenhill, L., … McCracken, J. T. (2013). The preschool attention-deficit/hyperactivity disorder treatment study (PATS) 6-year follow-up. *Journal of the American Academy of Child and Adolescent Psychiatry*, *52*(3), 264–278. e262. https://doi.org/10.1016/j.jaac.2012.12.007

Robb, J. A., Sibley, M. H., Pelham, W. E., Foster, E. M., Molina, B. S., Gnagy, E. M., & Kuriyan, A. B. (2011). The estimated annual cost of ADHD to the US education system. *School Mental Health*, *3*(3), 169–177. https://doi.org/10.1007/s12310-011-9057-6

Robinson, E. A., & Eyberg, S. M. (1981). The dyadic parent–child interaction coding system: Standardization and validation. *Journal of Consulting and Clinical Psychology*, *49*(2), 245. https://doi.org/10.1037/0022-006X.49.2.245

Rodriguez, C. M., & Wittig, S. M. (2019, January–February). Predicting child problem behavior and maternal/paternal parent-child aggression: Identifying early prevention targets. *Journal of Applied Developmental Psychology*, *60*, 76–86. https://doi.org/10.1016/j.appdev.2018.11.001

Rosseel, Y. (2012). Lavaan: An R package for structural equation modeling and more. Version 0.5–12 (BETA). *Journal of Statistical Software*, *48*(2), 1–36. https://doi.org/10.18637/jss.v048.i02

Rothbart, M. K. (1981). Measurement of temperament in infancy. *Child Development*, *52*(2), 569–578. https://doi.org/10.2307/1129176

Rothbart, M. K. (2011). *Becoming who we are: Temperament and personality in development*. Guilford Press.

Rothbart, M. K., Ahadi, S. A., & Evans, D. E. (2000). Temperament and personality: Origins and outcomes. *Journal of Personality and Social Psychology*, *78*(1), 122. https://doi.org/10.1037/0022-3514.78.1.122

Sanders, M. R. (1999). Triple P-Positive Parenting Program: Towards an empirically validated multilevel parenting and family support strategy for the prevention of behavior and emotional problems in children. *Clinical Child and Family Psychology Review*, *2*(2), 71–90. https://doi.org/10.1023/A:1021843613840

Sanson, A., Oberklaid, F., Pedlow, R., & Prior, M. (1991). Risk indicators: Assessment of infancy predictors of pre-school behavioural maladjustment. *Journal of Child Psychology and Psychiatry*, *32*(4), 609–626. https://doi.org/10.1111/j.1469-7610.1991.tb00338.x

Saudino, K. J. (2005). Behavioral genetics and child temperament. *Journal of Developmental and Behavioral Pediatrics: JDBP*, *26*(3), 214. https://doi.org/10.1097/00004703-200506000-00010

Shaffer, D., Fisher, P., Lucas, C. P., Dulcan, M. K., & Schwab-Stone, M. E. (2000). NIMH diagnostic interview schedule for children version IV (NIMH DISC-IV): Description, differences from previous versions, and reliability of some common diagnoses. *Journal of the American Academy of Child and Adolescent Psychiatry*, *39*(1), 28–38. https://doi.org/10.1097/00004583-200001000-00014

Shelton, K. K., Frick, P. J., & Wootton, J. (1996). Assessment of parenting practices in families of elementary school-age children. *Journal of Clinical Child Psychology*, *25*(3), 317–329. https://doi.org/10.1207/s15374424jccp2503_8

Sibley, M. H., Swanson, J. M., Arnold, L. E., Hechtman, L. T., Owens, E. B., Stehli, A., … Mitchell, J. T. (2017). Defining ADHD symptom persistence in adulthood: Optimizing sensitivity and specificity. *Journal of Child Psychology and Psychiatry*, *58*(6), 655–662. https://doi.org/10.1111/jcpp.12620

Slagt, M., Dubas, J. S., Deković, M., & van Aken, M. A. (2016). Differences in sensitivity to parenting depending on child temperament: A meta-analysis. *Psychological Bulletin*, *142*(10), 1068.

Sonuga-Barke, E. J. (2003). The dual pathway model of AD/HD: An elaboration of neuro-developmental characteristics. *Neuroscience and Biobehavioral Reviews*, *27*(7), 593–604. https://doi.org/10.1016/j.neubiorev.2003.08.005

Sonuga-Barke, E. J. (2005). Causal models of attention-deficit/hyperactivity disorder: From common simple deficits to multiple developmental pathways. *Biological Psychiatry*, *57*(11), 1231–1238. https://doi.org/10.1016/j.biopsych.2004.09.008

Stringaris, A., & Goodman, R. (2009). Three dimensions of oppositionality in youth. *Journal of Child Psychology and Psychiatry*, *50*(3), 216–223. https://doi.org/10.1111/j.1469-7610.2008.01989.x

Van Zeijl, J., Mesman, J., Stolk, M. N., Alink, L. R., Van IJzendoorn, M. H., Bakermans-Kranenburg, M. J., … Koot, H. M. (2007). Differential susceptibility to discipline: The moderating effect of child temperament on the association between maternal discipline and early childhood externalizing problems. *Journal of Family Psychology*, *21*(4), 626. https://doi.org/10.1037/0893-3200.21.4.626

Webster-Stratton, C. (1998). Preventing conduct problems in head start children: Strengthening parenting competencies. *Journal of Consulting and Clinical Psychology*, *66*(5), 715. https://doi.org/10.1037/0022-006X.66.5.715

Webster-Stratton, C., & Lindsay, D. W. (1999). Social competence and conduct problems in young children: Issues in assessment. *Journal of Clinical Child Psychology*, *28*(1), 25–43. https://doi.org/10.1207/s15374424jccp2801_3

Wechsler, D. (2012). *Wechsler preschool and primary scale of intelligence—fourth edition*. The Psychological Corporation.

Willoughby, M. T., Gottfredson, N. C., Stifter, C. A., & Investigators, F. L. P. (2017). Observed temperament from

ages 6 to 36 months predicts parent-and teacher-reported attention-deficit/hyperactivity disorder symptoms in first grade. *Development and Psychopathology*, *29*(1), 107–120. https://doi.org/10.1017/S0954579415001236

Wilson, L. M., Lorber, M. F., & Fritz, P. A. T. (2018). A dynamic approach to risk factors for maternal corporal punishment in early to middle childhood. *Journal of Child and Family Studies*, *27*(3), 953–965.

Wolraich, M. L., Hagan, J. F., Allan, C., Chan, E., Davison, D., Earls, M., … Frost, J. (2019). Clinical practice guideline for the diagnosis, evaluation, and treatment of attention-deficit/hyperactivity disorder in children and adolescents. *Pediatrics*, *144*(4), e20192528. https://doi.org/10.1542/peds.2019-2528

Zastrow, B. L., Martel, M. M., & Widiger, T. A. (2018). Preschool oppositional defiant disorder: A disorder of negative affect, surgency, and disagreeableness. *Journal of Clinical Child & Adolescent Psychology*, *47*(6), 967–977. https://doi.org/10.1080/15374416.2016.1225504