Examining Relations Between Parent and Child Psychopathology in Children with ADHD: Do Parent Cognitions Matter?

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Abstract

Among children with ADHD, parental psychopathology has well-documented, adverse effects on children's externalizing behavior, yet the underlying predictors of this relation remain understudied. One promising yet untested explanation for the intergenerational transmission of psychopathology is parental cognitive errors (PCEs), which reflect overly negative, stable, and helpless beliefs that parents hold toward their child's behavior and their own parenting practices. The present investigation examines whether PCEs and parenting behaviors (inconsistent discipline, corporal punishment, and positive parenting) explain the relation between symptoms of parental psychopathology (parental ADHD and depression/anxiety) and child externalizing behaviors in families of children with ADHD ($N = 199$, ages 7–11). A similar pattern emerged regardless of the type of parental psychopathology examined. PCEs and inconsistent discipline/corporal punishment significantly and collectively accounted for the relation between parental psychopathology symptoms and child externalizing behaviors. No relations were found in the models that examined positive parenting practices. The current findings suggest that addressing parental psychopathology during behavioral parenting interventions, with a particular emphasis on targeting PCEs and their impact on inconsistent discipline and corporal punishment, may hold promise for optimizing treatment response for children with ADHD.

Attention-deficit/hyperactivity disorder (ADHD) is one of the most common childhood mental health disorders, affecting approximately 7% of children worldwide (Thomas et al., 2015). Children with ADHD demonstrate increased rates of externalizing behaviors, such as hyperactivity, aggression, and conduct problems relative to neurotypical peers (Holmberg & Hjern, 2008; Kuja-Halkola et al., 2015; Retz & Rösler, 2010), and an estimated 25–50% of children with ADHD also meet the criteria for conduct or oppositional defiant disorder (American Psychiatric Association, 2013; Cuffe et al., 2020). When present, externalizing symptoms exert a synergistic effect on impairments and exacerbate near-term (e.g., social, family, and academic problems;

Booster et al., 2012; Cuffe et al, 2020) and long-term (e.g., substance abuse, incarceration, antisocial personality disorder; Klein & Mannuzza, 2010; Mohr-Jensen et al., 2019; Sibley et al., 2014) adverse outcomes relative to children with ADHD alone. Given the compounding effects of externalizing behaviors and ADHD, understanding relations between symptom domains is crucial.

While the link between ADHD and externalizing behaviors has been studied extensively, few investigations have examined mechanisms to explain this relation. This work is critical, as elucidating predictors and mechanisms of externalizing problems in children with ADHD is a requisite first step towards identifying potentially novel intervention targets to reduce the negative outcomes associated with externalizing symptoms within this population. Among the few proposed factors, parental psychopathology appears promising: children of parents experiencing mental health challenges evince impaired social functioning (Eiden et al., 2009), reduced academic achievement (Mensah & Kiernan, 2010), and higher rates of psychopathology (Chronis et al., 2007; Pfiffner et al., 1999) relative to children of parents

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without mental health concerns. Child externalizing behaviors in particular show large magnitude relations to parental psychopathology (Cheung & Theule, 2019) that are consistent regardless of the nature of parental psychopathology (Hicks et al., 2004; Marmorstein et al., 2004) and predictive of adverse outcomes in several multi-year (up to eight years) longitudinal studies (Chronis et al., 2007; Mäntymaa et al., 2012; Murray et al., 1999). Among parents of children with ADHD, parental psychopathology is especially common. Roughly half of children with ADHD have at least one parent who also meets criteria for the disorder (Johnston et al., 2012), and parents of children with ADHD also demonstrate greater rates of mood and anxiety disorders compared to parents of neurotypical children (e.g., mood disorders odds ratio (OR) = 2.79; anxiety disorders OR = 2.06; Chronis et al., 2003). These rates increase further when the child evinces comorbid externalizing symptoms (e.g., mood disorders OR = 3.70, anxiety disorders OR = 3.76; Chronis et al., 2003). Thus, parental psychopathology is an especially important factor for understanding externalizing behaviors in children with ADHD.

Explanations as to why parental psychopathology may increase risk for externalizing behaviors have also been studied extensively. Negative parenting behaviors have been consistently associated with increased parent psychopathology and child externalizing behaviors both within ADHD samples (Breaux et al., 2017; Chronis-Tuscano et al., 2011; Pfiffner et al., 2005) and broader populations (Berg-Nielsen et al., 2002; Pinquart, 2017). One comprehensive review identified two primary dimensions of dysfunctional parenting displayed at high rates among families with increased parental psychopathology: lack of positive parenting (i.e., rewards, praise, physical affection) and increased inconsistent discipline practices (i.e., not following through with punishments, applying contingencies in a variable manner, lax parenting; Berg-Nielsen et al., 2002). A second review confirmed these findings and also identified greater rates of corporal punishment (i.e., using harsh or physical punishment methods such as slapping, spanking, hitting with hand/object) in parents with higher levels of ADHD symptoms (Park et al., 2017). All three of these parenting behaviors have well-documented negative effects on child externalizing behaviors (Berg-Nielsen et al., 2002; Caspi et al., 2004; Li & Lansford, 2018; Miner & Clarke-Stewart, 2008; Pinquart, 2017). Among parents of children with ADHD, these parenting behaviors are also important mediators of the relation between parent psychopathology and child externalizing behaviors (Breaux et al., 2017; Chronis-Tuscano et al., 2011; Tung et al., 2014). For example, several longitudinal studies have demonstrated that parental ADHD symptoms predict higher levels of corporal punishment, which in turn predict higher levels of child externalizing symptoms (Breaux et al., 2017; Tung et al., 2014).

While the link between parental psychopathology and parenting behaviors has been identified, less research has examined why this effect occurs. One possibility is through cognitive errors, also called cognitive distortions (Beck, 1963), which have well-documented effects on behavior. Beck (1963) initially described cognitive errors as biases in information processing associated with depression, but cognitive errors have since been associated with varied psychopathologies and demonstrate wide-ranging effects on behavior (Barriga et al., 2008; Helmond et al., 2015; Leung & Poon, 2001). Cognitive errors about parenting- and child-related behaviors specifically (i.e., Parental Cognitive Errors; PCEs) reflect overly negative, stable, and helpless beliefs that parents hold toward their child and parenting practices (Jiang et al., 2022). Importantly, PCEs show relations to both parental psychopathology and parenting behaviors. Higher levels of parental depressive and ADHD symptoms have been shown to predict greater levels of PCEs (Haack et al., 2017), and general cognitive errors are consistently correlated with higher levels of parental depression (Giallo et al., 2014) anxiety (Orchard et al., 2015), and ADHD (Strohmeier et al., 2016).

It is possible that symptoms of parental ADHD and anxiety/depression may differentially affect parenting behaviors and PCEs. Relative to other forms of parental psychopathology, parental ADHD shows stronger relations to corporal punishment (Breaux et al., 2017; Tung et al., 2014), while parental depression and anxiety are more highly associated with inconsistent discipline and lack of positive parenting (Chi & Hinshaw, 2002; Gerdes et al., 2007). In addition, parents may endorse different PCEs based upon the type of psychopathology experienced. For example, individuals with ADHD tend to endorse cognitive errors relating to perfectionism and emotional reasoning (e.g., a parent gets upset after their child displays negative behaviors and thinks "I am really bad at keeping my cool with my child"; Strohmeier et al., 2016) while individuals with depression endorse greater catastrophizing-related errors (e.g., a parent must give multiple reminders for their child to stay on task during homework and thinks "My child is *never* going to be able to do his/homework on his/her own"; Leung & Poon, 2001). General cognitive errors are also related to parenting behaviors, and accumulating evidence shows strong and potentially causal (Slep & O'Leary, 1998), relations to increased inconsistent discipline (Gerdes et al., 2007), corporal punishment (Johnston & Mash, 2001), and reduced positive parenting (Jiang et al., 2018).

There is conflicting evidence as to whether psychopathology causes and is upstream of cognitive errors (Cole et al., 1998; Oei et al., 2005), cognitive errors cause psychopathology (Hjemdal et al., 2013), or the relation is bidirectional (Pössel & Black, 2014). However, Beck's cognitive theory posits that negative life events or moods activate maladaptive self-schema and lead to depression and anxiety (Beck, 1967; Beck & Clark, 1988). Once activated, both dysfunctional schema and the experience of psychopathology lead to systematic distortions
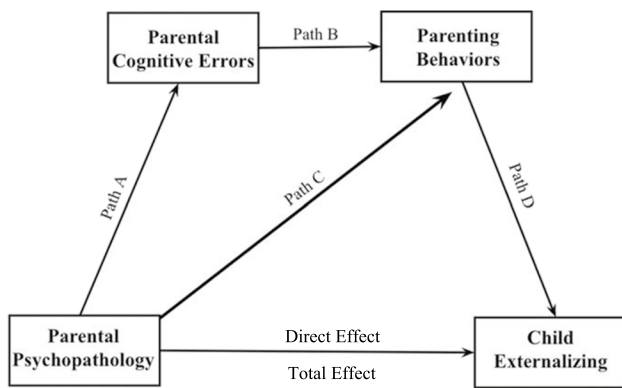
Fig. 1 Theoretical model with parental psychopathology predicting child externalizing behaviors via Parental Cognitive Errors (PCEs) and parenting behaviors

in information processing (i.e., cognitive errors; Beck & Clark, 1988). Thus, based on theoretical rationale, it is more likely that the presence of psychopathology has a causal influence on perceptions of child and parenting behaviors rather than PCEs inducing depression or anxiety. Similarly, for individuals with a neurodevelopmental disorder such as ADHD, PCEs likely have little causal effect on the development or maintenance of the disorder. Rather, it is much more likely that the presence of psychopathology alters perceptions of child and parent behaviors by increasing the accessibility of overly negative and biased interpretations. Therefore, in the present study, psychopathology and cognitive errors are modeled consistent with temporal considerations (see Fig. 1), as recommended (Kendall et al., 2017).

Understanding predictors of externalizing behaviors is especially important in families of children with ADHD, as treatments for ADHD are less effective when children evince comorbid externalizing problems (Groenman et al., 2022). Yet only a handful studies have examined the effect of parenting behaviors and PCEs on child externalizing behaviors in an ADHD population, and none have examined the collective influence of these factors (see Fig. 1). For example, Gerdes et al. (2007) identified general cognitive errors as a putative mechanism underlying the relation between parental depression and inconsistent discipline practices among parents of children with ADHD-Combined presentation; however, effects on child behaviors were not examined. To our knowledge, the only study to examine effects of PCEs on the behavior of children with ADHD-Inattentive presentation found that errors significantly mediated the relation between parental ADHD/depressive symptoms and child inattentive symptoms; however, child externalizing behaviors and potential parenting-related mechanisms of this relation were not examined (Haack et al., 2017).

The current study examines whether PCEs and parenting behaviors (i.e., inconsistent discipline, positive parenting, and corporal punishment) explain the relation between parent psychopathology (i.e., symptoms of anxiety/depression and ADHD) and child externalizing behaviors (see Fig. 1 for a conceptual model). Parental ADHD and anxiety/depression were modeled separately given potential differential effects on PCEs and parenting behaviors (Leung & Poon, 2001; Strohmeier et al., 2016). We hypothesize that parents with greater parental psychopathology will exhibit increased PCEs, reduced positive parenting, and greater inconsistent and corporal punishment. We also predict that the collective effect of PCEs and parenting behavior will affect child behavior, such that greater errors and poorer parenting practices will be associated with increased child externalizing behaviors. If supported, findings would suggest that parental psychopathology broadly, and cognitive distortions in particular, may be promising targets for optimizing existing parenting programs for children with ADHD and externalizing problems.

Methods

Participants

The present study is a secondary data analysis of 199 parents and their children who participated in a larger, randomized control trial of the Child Life and Attention Skills (CLAS) program, a behavioral intervention for children with ADHD-Inattentive Presentation (ADHD-I). Participants were recruited from one of two sites: the University of California, San Francisco ($n = 96$) and the University of California, Berkeley ($n = 103$). Only baseline data were examined in the present study. Families were recruited from schools, pediatricians, child psychiatrists and psychologists, online, and through word-of-mouth. Recruitment flyers were also posted in online parenting networks and professional organizations.

Children were required to meet the following criteria for study entry: (1) a primary diagnosis of ADHD-I, as confirmed by the Kiddie Schedule for Affective Disorders and Schizophrenia (KSADS-PL), (2) aged 7–11, (3) child IQ ≥ 80, (4) living with at least one parent for the past year, (5) attending school full time in a regular classroom, (6) availability to participate in treatment groups, (7) school proximity within 45 min of the study site, (8) teacher consent to participate in school-based treatment, and (9) no evidence of pervasive developmental disorders or other neurological illnesses. Families of children who were taking nonstimulant psychoactive medication were excluded because of the difficulty of withholding medication to confirm ADHD-I symptoms, as were any children planning to begin or change any psychoactive medication treatment over the course of the study. Non-psychiatric medications did not affect study inclusion or exclusion.

Demographic data for the families participating in the study are as follows: Mean child age was 8.6 years old (SD = 1.2), and 58% of the sample was boys. 54% were

White, 17% were Latinx, 8% were Asian American, 5% were African American, and 17% self-identified as more than one race. 83.5% of the parents were biological mothers, 6.5% were biological fathers, 1% were stepmothers, 5% were adoptive mothers, 1.5% were adoptive fathers, 0.5% were grandmothers, and 1.5% identified as an 'other' parental figure 80% of parents reported graduating from high school and 12.5% reported being single parents. Only 4% of children were taking medication for ADHD. For a detailed description of the sample and demographic breakdown, see Pfiffner et al., 2014.

Procedure

Detailed explanations of participant screening, flow, attrition, and diagnostic procedures are provided elsewhere (Pfiffner et al., 2014) . Briefly, initial screening began with parent and teacher telephone interviews. Those who met initial eligibility were sent parent and teacher rating packets containing the ADHD module of the Child Symptom Inventory (CSI-4; Gadow & Sprafkin, 1994) and the Impairment Rating Scale (IRS; Fabiano et al., 2006). On the CSI-4, a symptom was judged to be present if rated "often" or "very often" by either parent or teacher. Participants were invited for a diagnostic clinic visit if they met the following criteria: (1) at least five independent symptoms of inattention endorsed on the CSI-4 by parent or teacher, with at least two inattention symptoms endorsed by each informant; (2) five or fewer independent symptoms of hyperactivity and impulsivity endorsed on the CSI-4 by parent or teacher; and (3) evidence of impairment due to inattention as rated by both parents and teachers on the IRS (i.e., at least one area of functioning had to be rated ≥ 3 by each informant; Fabiano et al., 2006).

To confirm diagnostic status, parents were interviewed by a licensed clinical psychologist and were administered all modules from the *Kiddie Schedule for Affective Disorders and Schizophrenia for School-Age Children* (K-SADS-PL; Kaufman et al., 1997) which assesses ADHD, autism spectrum disorder, oppositional defiant disorder, conduct disorder, anxiety disorders, major mood disorders, and psychosis. The K-SADS has excellent psychometric properties, including test–retest reliability and strong relations with other semi-structured and structured clinical interviews (Kaufman et al., 1997). All cases met full DSM criteria for ADHD-I which consisted of six or more inattention symptoms and fewer than 6 hyperactive-impulsive symptoms endorsed on the K-SADS (inattention symptom count $M = 7.6$, $SD = 1.1$; hyperactivity-impulsivity symptoms count $M = 1.2$, $SD = 1.2$). Parents completed questionnaires that included measures of parenting behaviors and parental psychopathology. Children were also administered the WISC-IV and a battery of tests and questionnaires. All procedures were approved by the Committees on Human Research at the University of California, San Francisco and the University of California, Berkeley. Parents

provided informed written consent and children provided written assent for participation, respectively.

Measures

Parental ADHD Symptoms A composite score assessing parental self-rated ADHD symptoms was created using the average age and gender corrected T-scores from the ADHD DSM subscale of the Conners' Adult ADHD Rating Scale (CAARS; Conners et al., 1999) and the Attention Problems subscale of the Adult Self Report (ASR; Achenbach & Rescorla, 2003). The CAARS ADHD DSM subscale assesses symptoms on a 4-point scale ranging from "not at all, never" to "very much, very frequently," with higher scores indicating greater ADHD severity. The ASR Attention Problems subscale measures behaviors and impairment related to inattention on 3-point scale ranging from "not true" to "very true or often true." A composite score was used to reflect both symptoms (i.e., CAARS and ASR) and impairments (i.e., ASR) to better account for parental ADHD sequelae.[1] Both measures have good psychometric properties, including high predictive validity for ADHD diagnoses (CAARS: 87%; ASR: 87%), test–retest reliability (CAARS: 0.88–0.91; ASR: 0.84; Conners et al., 1999; Achenbach & Rescorla, 2003), concurrent validity with other ADHD symptom instruments ($r = .47$) and internal consistency (CAARS: $\alpha = .85$; ASR: $\alpha = .81$; de Vries et al., 2020; Erhardt et al., 1999).

Parental Depression and Anxiety Parental depression and anxiety symptoms were measured using age- and gender-corrected T-scores from the anxious/depressed syndrome subscale of the Adult Self Report (ASR; Achenbach & Rescorla, 2003). The ASR measures symptoms and impairments related to anxiety and depression on a 3-point scale from "not true" to "very true or often true." The subscale is associated with high test–retest reliability (.87), concurrent validity with other anxiety and depression instruments ($r = .69$ with Beck Anxiety Inventory; $r = .74$ with Beck Depression Inventory), predictive validity (71%) for anxiety and depressive disorder diagnoses, and internal consistency ($\alpha = .88$; Achenbach & Rescorla, 2003).

Parent Cognitive Errors PCEs were measured using the Parental Cognitive Error Questionnaire (PCEQ; Kaiser et al., 2010). The PCEQ is a 24-item parent-report questionnaire assessing cognitive errors related to attributions of negative child behavior and parenting (Jiang et al., 2022). This measure is based on two measures of general cognitive errors: the Cognitive Error Questionnaire (Lefebvre, 1981) and Child Negative Cognitive Error Questionnaire (Leitenberg et al., 1986). The test–retest validity of the Cognitive Error Questionnaire is .80 (Lefebvre,

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[1] Neither the pattern nor interpretation of our findings changed when measures were considered independently or as a composite.

1981) and the test–retest validity of the Child Negative Cognitive Error Questionnaire is .65 (Leitenberg et al., 1986). Items on the PCEQ consist of vignettes containing cognitive errors regarding parents' own parenting practices and their child's behavior. Each item is rated on a 5-point scale ranging from 1 = "Almost exactly like I would think" to 5 = "Not at all like I would think," with lower scores representing greater PCEs. A sample item is *"Your child has done well with completing his/her morning routine all week. On Friday morning, your child has a meltdown while getting ready for school and the whole family is late. You think to yourself, 'Wow, can't my child ever get ready on time?'"* The PCEQ has been utilized in extant literature, shows expected relations to parent psychopathology (Haack et al., 2017) and positive and negative parenting behaviors (Jiang et al., 2018), and has high internal consistency in the present sample ($\alpha = .90$).

Parenting Behaviors Parenting behaviors were assessed using the inconsistent discipline, corporal punishment, and positive parenting subscales of the Alabama Parenting Questionnaire (APQ; Shelton et al., 1996). Subscales were examined separately to examine differential relations to parent psychopathology and child externalizing behaviors. The APQ is a 42-item parent-report questionnaire assessing parenting practices. Each item is rated on a 5-point scale ranging from "never" to "always," with higher scores reflecting greater endorsements of the behavior. The inconsistent discipline and positive parenting subscales contain six items each and the corporal punishment subscale contains three items. The APQ is associated with excellent psychometric properties including test–retest reliability (Corporal Punishment: .69; Inconsistent Discipline: .85; Positive Parenting: .88), concurrent validity with the NIMH Diagnostic Interview Schedule for Children, parent-report (DISC-P) and ability to discriminate between parents of behavior-disordered children and parents of non–disordered children (Locke & Prinz, 2002; Shelton et al., 1996). The APQ is widely used and shows strong predictive relations to observed parenting behaviors (Hawes & Dadds, 2006), and good internal consistency ($\alpha = .69$) in the present sample.

Child Externalizing Behaviors Child externalizing behaviors were measured using age- and gender-corrected T-scores from the Externalizing Problems Composite Score from the Behavior Assessment System for Children-Second Edition Parent and Teacher Rating Scales (BASC-2 PRS and TRS; Reynolds & Kamphaus, 2004). The BASC-2 is a 160-item parent- and teacher-report measure that provides information on the child's problem and adaptive behaviors at home and in the community. The externalizing problems composite score assesses hyperactivity, aggression, and conduct problems in children. Informants rate how often behaviors occur for the child; each item is rated on a 4-point scale ranging from "Never" to "Almost Always." There is sufficient variability in externalizing behaviors to assess study questions, as 29% of the current sample exhibited externalizing behaviors greater than one standard deviation above the mean (T > 60). A composite score of parent and teacher scores was created and utilized in the study models to assess externalizing behaviors cross-situationally. Parent and teacher reports were significantly correlated ($p < .001$). The BASC Externalizing Problems subscale shows high test–retest reliability (teacher-report: .85, parent-report: .88), strong concurrent validity studies with several measures of child behavior (e.g., Impairment Rating Scale, $r = .49$), predictive validity for Oppositional Defiant and Conduct Disorder diagnoses (91%; Girio-Herrera et al., 2015), and strong internal consistency ($\alpha = .93$; Reynolds & Kamphaus, 2004).

Data Analysis

Serial mediation analyses using the PROCESS script for SPSS (Hayes, 2014) examined the extent to which PCEs and parenting behaviors account for the relations between parent psychopathology and child externalizing behaviors. Although all data were collected at the same time-point, the serial mediation models in the present study are based upon strong theoretical and empirical evidence documenting temporal relations between these variables (Breaux et al., 2017; Chronis et al., 2007; Cole et al., 1998; Mäntymaa et al., 2012; Murray et al., 1999; Oei et al., 2005; Tung et al., 2014), consistent with expert recommendations for mediation analyses on data collected cross-sectionally (Hayes, 2013). Nonetheless, cross-sectional mediation analyses may generate biased estimates (Maxwell & Cole, 2007) and the present results should be interpreted with caution. All analyses were completed using bias-corrected bootstrapping to minimize Type II error, as recommended (Shrout & Bolger, 2002). Bootstrapping was used to establish the statistical significance of all total, direct, and indirect effects, and 5,000 samples were derived from the original sample by a process of resampling with replacement (Shrout & Bolger, 2002). The completely standardized effects for all direct, indirect, and total effect paths are reported to provide an effect size estimate. The completely standardized effect expresses the direct and indirect effects in terms of the difference, expressed in standard deviation units of Y, between two cases that differ by one standard deviation in X (i.e., the completely standardized indirect effect is the multiplicative relation of standardized A and B paths; Hayes, 2013).[2]

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[2] This approach was chosen over other measures of effect size for several reasons. First, completely standardized effect sizes are not scale bound; in comparison, partially standardized effect sizes retain the original units of X and therefore complicate interpretation. Additionally, other effect size metrics, such as effect ratios, are unstable from sample to sample and may provide erroneous results when paths have differing signs (Hayes, 2013).

Separate serial mediation models were run for each combination of parental psychopathology and parenting behavior mediators to examine differential relations. PCEs were entered into the model first based on theoretical grounds that PCEs affect parenting behaviors (Johnston & Mash, 2001), rather than vice versa. The path from PCEs to child externalizing behaviors was omitted based on theoretical grounds that PCEs would not affect children's behavior directly, but only indirectly through parents' behaviors (Bornstein et al., 2018). Simple models without covariates were tested initially. The following covariates were then entered into study models: child medication status, child age, child race, child gender, biological/non-biological parent status, parent education, household income, parent race, cohort, treatment group. However, all identified covariates were either nonsignificant or did not change the pattern or interpretation of results. Therefore, simple models without covariates are presented.

In order to control for Type I error, simultaneous confidence intervals were generated using the Bonferroni method (Kyriakides & Heydt, 2006). Using this method, the simultaneous confidence interval was obtained by calculating the Bonferroni inequality, $CI = (1–0.05/C)$, where C is the number of models (in the present study, $C = 6$). This produced simultaneous confidence intervals of 99%, which we subsequently use to determine significance of our results.

Power Analysis

Medium to large magnitude effect sizes were predicted based on established relations between depression/anxiety and PCEs ($r = 0.61$; Lefebvre, 1981), parental ADHD and PCEs ($r = 0.25$; Haack et al., 2017); PCEs and parent-reported positive and negative parenting behaviors ($rs = 0.44$, -0.24; Jiang et al., 2018); and positive and negative parenting behaviors and child externalizing behaviors ($rs = -.25$, .26; Gryczkowski et al., 2010). Mediation analysis using bias-corrected bootstrapping requires 71 total participants to achieve .80 power (Fritz & MacKinnon, 2007), and 199 families participated in the current study.

Results

Preliminary Analyses

Very few data were missing (< 1%), so none were imputed. All outcome variables were screened for multivariate outliers using Mahalanobis distances ($p < 0.001$) and univariate outliers as reflected by scores exceeding 3.5 standard deviations above the mean in either direction (Tabachnick & Fidell, 2007). None were identified.

PCEs were significantly related to symptoms of parental ADHD and anxiety/depression ($rs = .29$ and .35, respectively) and inconsistent discipline and corporal punishment ($rs = .34$, .23, respectively). PCEs were not significantly related to positive parenting ($r = -.07$). Parental ADHD symptoms and PCEs were significantly related to child externalizing behaviors ($rs = .21$, .23, respectively); however, parental anxiety/depression symptoms were not significantly related to child externalizing behaviors ($r = .07$). All parenting behaviors were significantly related to child externalizing behavior ($rs = .28$ and .23), with the exception of positive parenting ($r = .10$). However, all variables were retained for mediation analyses as correlation is not a necessary condition for mediation (Bollen, 1989; Hayes, 2013). See Table 1 for zero-order intercorrelations.

Inconsistent Discipline The total effect of parental ADHD symptoms on child externalizing behaviors was significant, $β = .06$, 99% CI (.01, .14), see Table 2. Inspection of indirect effects indicated that inconsistent discipline alone was not a significant mediator of the parental ADHD symptoms to child externalizing behaviors relation, $β = .04$, 99% CI (-.01, .12). However, when modeled serially, the indirect effect assessing PCEs and inconsistent discipline jointly was significant, $β = .02$, 99% CI (.002 to .06).

Examination of parental anxiety/depression symptoms revealed that the total effect of anxiety/depression on externalizing behaviors was not significant, $β = .04$, 99% CI (-.01, .10). Inconsistent discipline alone was not a significant mediator of the relationship between symptoms of anxiety/depression and externalizing behaviors, $β = .01$, 99% CI (-.04, .07); however, the indirect effect through both PCEs and inconsistent discipline was significant, $β = .03$, 95% CI (.01, .07). Findings suggest that PCEs and inconsistent discipline collectively influence child externalizing behaviors regardless of the type of parental psychopathology observed.

Corporal Punishment The total effect of parental ADHD symptoms on child externalizing behaviors was not significant, $β = .004$, 99% CI (-.03, .05).[3] Corporal punishment alone was not a significant mediator of the parental ADHD symptoms to child externalizing behaviors relation, $β = −.01$, 99% CI (-.05, .03). However, the serial indirect effect of PCEs and corporal punishment on externalizing behaviors was significant, $β = .01$, 99% CI (.002 to .05).

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[3] There are several reasons why total effects may be nonsignificant while indirect effects remain significant, such as an unmeasured suppressor variable (Rucker et al., 2011) or opposing path signs (Zhao, Lynch, & Chen, 2010). Because mediation may be present without significant total or direct effects, the field has moved away from emphasizing these effects as a requirement for mediation (Hayes, 2009; MacKinnon et al., 2000; Shrout & Bolger, 2002; Zhao et al., 2010) and towards evaluating the magnitude of indirect effects instead (Rucker et al., 2011).

Table 1 Zero-order correlations, means, and standard deviations

		1	2	3	4	5	6	7
1	Parental ADHD Symptoms							
2	Parental Anxiety/Depression Symptoms	.60* (.50, .69)						
3	PCEQ	.29* (.16, .43)	.35* (.22, .47)					
4	Inconsistent Discipline	.27* (.11, .41)	.16* (.22, .47)	.34* (.21, .46)				
5	Corporal Punishment	.02 (-.10, .15)	-.03 (-.16, .09)	.23* (.07, .39)	.33* (.20, .46)			
6	Positive Parenting	-.03 (-.17, .1)	-.05 (-.20, .10)	-.07 (-.21, .07)	-.05 (-.19, .10)	.04 (-.11, .19)		
7	Child Externalizing Behaviors	.21* (.07, .34)	.07 (-.08, .21)	.23* (.09, .36)	.28* (.14, .41)	.21* (.07, .34)	.11 (-.04, .25)	
M (SD)		50.42 (10.06)	56.21 (7.23)	42.17 (12.29)	13.71 (3.33)	5.37 (1.49)	25.10 (3.02)	51.07 (6.54)
Min		38	50	24	6	3	15	39.5
Max		85	79	84	22	10	30	68
N		198	196	193	198	198	198	199

PCEQ Parent Cognitive Errors Questionnaire. Correlations reflect bias-corrected, bootstrapped Pearson's Correlation coefficients with 5000 samples derived from the original sample. 95% confidence intervals are presented in parentheses below the corresponding correlation coefficient. *Correlation is significant based on confidence intervals that do not include 0.0 (Shrout & Bolger, 2002)

Table 2 Standardized path coefficients and effects

	Path A (Parental Psychopathology → PCEs)	Path B (PCEs → Parenting Behavior)	Path C (Parental Psychopathology → Parenting Behavior	Path D (Parenting Behavior → Child Externalizing)	Indirect Effect 1	Indirect Effect 2	Direct Effect	Total Effect
Inconsistent Discipline								
ADHD	.36* (.09)	.08* (.02)	.06 (.02)	.47* (.14)	.04 (.02)	.02* (.01)	.10 (.05)	.06* (.03)
Anxiety/Depression	.59* (.12)	.10* (.02)	.02 (.03)	.58* (.14)	.01 (.02)	.03* (.01)	.02 (.06)	.04 (.02)
Positive Parenting								
ADHD	.36* (.09)	-.2 (.2)	-.002 (.02)	.24 (.15)	-.001 (.01)	-.002 (.003)	.14* (.05)	-.003 (.01)
Anxiety/Depression	.59* (.12)	-01 (.02)	-.01 (.03)	.24 (.16)	-.003 (.01)	-.002 (.004)	.06 (.07)	-.005 (.01)
Corporal Punishment								
ADHD	.36* (.09)	.03* (.01)	-.01 (.01)	.89* (.31)	-.01 (.01)	.1* (.01)	.13* (.05)	.004 (.01)
Anxiety/Depression	.59* (.12)	.03* (.01)	-.03 (.02)	.92* (.31)	-.03 (.02)	.02* (.01)	.07 (.06)	-.01 (.01)

*Path is significant based on simultaneous confidence intervals that do not contain 0.0 (Shrout & Bolger, 2002)

Standard errors are presented in parentheses next to the corresponding path coefficient

Direct Effect: Parent Psychopathology → Child Externalizing Behavior

Indirect Effect 1: Parent Psychopathology → Parenting Behavior → Child Externalizing Behavior

Indirect Effect 2: Parent Psychopathology → PCEs → Parenting Behavior → Child Externalizing Behavior

Similar results were observed for symptoms of parental anxiety/depression. The total effect, $\beta = -.01$, 99% CI (-.05 to .04), of anxiety/depression symptoms on child externalizing behavior, and simple indirect effect through corporal punishment, $\beta = -.03$, 99% CI (-.08 to .01), were not significant. However, the serial indirect effect reflecting PCEs and corporal punishment was significant, $\beta = .02$, 99% CI (.004 to .06). Results suggest that parental ADHD and mood/anxiety symptoms are associated with increased rates of PCEs and corporal punishment, which collectively serve as a significant mechanism for increased externalizing behaviors.

Positive Parenting The total effect of parental ADHD symptoms on child externalizing behaviors was not significant, $\beta = -.003$, 99% CI (-.04, .02). Positive parenting alone was not a significant mediator of the parental ADHD symptoms

to child externalizing behaviors relation, $\beta = -.001$, 99% CI (-.04, .03). The combined indirect effect of PCEs and positive parenting was also not significant, $\beta = -.002$, 99% CI (-.01 to .01). A similar pattern emerged for parental symptoms of anxiety/depression, such that the total, $\beta = -.005$, 99% CI (-.04, .02), and indirect effects were nonsignificant, $\beta = -.003$, 99% CI (-.04, .03) and $\beta = -.002$, 99% CI (-.01, .01). These findings indicate that positive parenting, either alone or in consideration with PCEs, does not account for the relation between parental psychopathology symptoms and externalizing behaviors.

Discussion

The present study is the first to examine parental cognitive errors (PCEs) and parenting behaviors to explicate the large-magnitude relations between symptoms of parental psychopathology and externalizing behaviors among children with ADHD-Inattentive Presentation (ADHD-I). Our findings were consistent regardless of the type of parental psychopathology (ADHD, anxiety/depression) and implicate PCEs and inconsistent/harsh parenting practices as contributors to externalizing problems among children with ADHD. Given that a large proportion of children with ADHD have parents who either experience ADHD (50%; Johnston et al., 2012) or depression/anxiety (23–36%; Chronis et al., 2003), these findings hold great public health significance for understanding ADHD-related sequelae and identifying novel intervention targets to improve treatments for childhood ADHD.

Consistent with prior literature (Cheung & Theule, 2019; Chronis et al., 2007; Hicks et al., 2004) and aligned with our initial hypotheses, parental ADHD and anxiety/depression symptoms were significantly related to child externalizing behaviors, such that children with parents who endorsed greater parental symptom severity evinced increased rates of child externalizing behaviors. Our findings suggest that this relation is, at least in part, the result of maladaptive parenting practices, as inconsistent discipline and corporal punishment were related to both parental psychopathology symptoms and child externalizing behaviors. Importantly, our findings extend the prior literature by examining PCEs as a potential mechanism linking symptoms of parental psychopathology to parenting and child behaviors. PCEs and inconsistent discipline/corporal punishment mediated the relation between parental psychopathology (i.e., symptoms of ADHD and anxiety/depression) and child externalizing behaviors. Consistent with Beck's seminal model on the effects of cognition on behavior, it is likely that parental psychopathology activates maladaptive schemas that increase rates of PCEs. PCEs, in turn, have a cascading effect on both parenting and child behaviors. This interpretation is aligned with decades of research on relations between behaviors and cognitions (Beck, 2005), as well as findings that link parenting cognitions and harsh/inconsistent parenting practices among children with externalizing disorders (Gerdes et al., 2007; Nix et al., 1999). Taken together, our findings implicate PCEs and downstream effects on parenting practices as predictors to explain intergenerational transmission of psychopathology among children with ADHD-I.

Contrary to our initial hypotheses and the extant literature (Chronis et al., 2007; Jiang et al., 2018; Park et al., 2017), positive parenting practices showed small magnitude, nonsignificant relations to parental psychopathology and child externalizing behaviors. Positive parenting was also unrelated to PCEs, and PCEs failed to explain the relation between positive parenting and child/parenting behaviors. However, the age of our participants may provide insight into these conflicting results. Meta-analytic evidence suggests that the link between positive parenting and maternal psychopathology is more robust for children younger than six, and relations among elementary school-aged children, as assessed in the present study, are relatively weak (Lovejoy et al., 2000). It is hypothesized that older children are better able to elicit praise, affection, and other positive behaviors from their parents relative to younger children who rely on parental initiation. Therefore, the effects of parental psychopathology on positive parenting among elementary school-aged children may be reduced given children's ability to evoke physical affection and compliments/praise rather than passively awaiting their expression. Similar mechanisms may account for the lack of relations between positive parenting and PCEs: children may elicit positive parenting behaviors regardless of the presence of distorted cognitions in their parents. It is also possible that social desirability effects biased parents' responses to positive parenting questions. While future research is needed to confirm these suppositions objectively during parent/child interactions, our findings suggest that positive parenting behaviors may be robust against the negative effects of parent psychopathology and PCEs.

Limitations and Future Directions

Despite multiple strengths (e.g., gold-standard, multi-method/multi-informant diagnostic evaluation, well-validated measures of parental psychopathology and parenting behaviors), several limitations warrant discussion. Future research is necessary to replicate our results in larger and more diverse samples (e.g., broader range of SES, race/ethnicity, and gender). The high level of parental education within the current sample (i.e., 76% report graduating college) may also limit generalizability. However, parental education was not a significant covariate in any models in the present study and its inclusion did not alter the pattern of results. It is therefore unlikely that parental education accounted for the robust findings observed within the present investigation.

Although the current study finds support for the mediational influence of PCEs on parenting behaviors and child externalizing problems, all ratings were collected at the same time-point. While some may argue that true mediation could not be established due to temporal uniformity, the present study examines theory-driven models supported by decades of empirical evidence documenting temporal relations (Breaux et al., 2017; Chronis et al., 2007; Cole et al., 1998; Mäntymaa et al., 2012; Murray et al., 1999; Oei et al., 2005; Tung et al., 2014), consistent with expert recommendations for mediation analyses on data collected cross-sectionally (Hayes, 2013). Nevertheless, future research should examine these findings longitudinally to determine whether the directional relations in the present study are correct, reversed, bidirectional, and/or cyclical.

It may also be argued that rater biases due to global, stable, depressogenic halo effects may influence parents' ratings of child behavior and parenting practices, such that parents with greater depressive symptoms may similarly endorse poorer parenting practices and greater child externalizing problems. Indeed, significant relations were observed between parents' depression/anxiety symptoms and parent-rated child externalizing behaviors, although these relations were of small magnitude ($r = .15$). However, our finding that parental ADHD symptoms also show relations to PCEs, parenting behaviors, and child externalizing problems sheds doubt on this possibility. In addition, the inclusion of teacher ratings in the composite score for externalizing behavior reduces the likelihood that mono-method bias, secondary to parental depressive symptoms or otherwise, accounts for the present findings.

It is also important to note that parental ADHD and anxiety/depression symptoms were measured continuously and did not represent diagnostic classifications. A strength of this approach is that the full continuum of symptom severity is considered. This approach is also consistent with increasing calls within the field to consider mental health conditions as a spectrum to avoid artificially dichotomizing human behavior and better characterize symptom expression (Allsopp et al., 2019; Heidbreder, 2015; Lobo & Agius, 2012; Timimi, 2014). However, it is also possible that PCEs may affect parenting behaviors and child externalizing problems differently among parents with diagnosable ADHD or anxiety/depression.[4] Indeed, several studies support the idea that parents with greater levels of psychopathology experience more PCEs (Haack et al., 2017) and display more negative parenting behaviors (Park et al., 2017) than those with

lower levels. It is therefore possible that relations between PCEs and parenting behaviors that failed to reach significance in the present study (e.g., positive parenting) may show significance when parents with rigorously diagnosed psychopathology are considered, and future studies should examine this possibility.

The present study exclusively examines the influence of PCEs among parents of children diagnosed with ADHD-Inattentive Presentation, and future research should explore whether these relations are consistent among families with differing presentations of youth ADHD. Although nearly one-third of our study sample (29%) exhibited externalizing behaviors greater than one standard deviation above the mean ($T > 60$), extant research demonstrates that externalizing problems are more prevalent and problematic among children with combined or hyperactive/impulsive presentations (Eiraldi et al., 1997; Hodgens et al., 2000). Rather than threatening our findings, this notion suggests that our work should be extended to populations where the effect may be more pronounced given the robust and consistent pattern observed.

Another limitation of the present study is that many of the child symptoms examined are non-pathognomonic and are present in many disorders of childhood. In particular, inattention is present in childhood ADHD, anxiety, and depression. However, we elected not to control for comorbid child conditions (e.g., anxiety/depression) due to considerable theoretical and statistical arguments against their use. That is, best practice recommendations (Miller & Chapman, 2001) state that the grouping variable (i.e., ADHD) should be unrelated to covariates due to concern about removing important, overlapping variance from the independent variable. For example, in the present study, removing anxiety (and the inattentive-related symptoms stemming from anxiety sequelae) from ADHD would result in a diagnosis with one of its primary symptoms removed (i.e., inattention). In addition, children's ADHD diagnosis was determined following a rigorous, multi-method, multi-informant approach that included a semi-structured interview (KSADS), and rates of anxiety and depression on the KSADSs were quite low (2.5% and 2.0%, respectively). Nevertheless, future research should examine the effects of PCEs on internalizing symptoms among children with and without ADHD to identify potential differences between groups.

Clinical Implications

Collectively, the present results indicate that PCEs and parenting practices are crucial mechanisms linking parental psychopathology to children's externalizing problems, and our findings have important implications for optimizing extant interventions for youth with ADHD. Current best-practice recommendations advise behavioral parenting interventions, either alone or in combination with medication, as a

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[4] 35% ($N = 67$) of parents had an average T score exceeding 1 SD above the mean ($T > 60$) on the CAARS/ASR Composite, while 27% ($N = 51$) exhibited T scores above 60 on the Depression/Anxiety subscale of the ASR. 21% ($N = 40$) of parents had an average T score exceeding the clinical cutoff ($T > 65$) on the CAARS/ASR Composite, while 18% ($N = 34$) exhibited T scores above 65 on the Depression/Anxiety subscale of the ASR.

front-line treatment for elementary school-aged children with ADHD (Wolraich et al., 2019). While improvements are consistently observed across domains (Evans et al., 2018; Friedman & Pfiffner, 2020), treatment-related improvements are significantly attenuated when parents also evince symptoms of ADHD and anxiety/depression themselves (Chronis-Tuscano et al., 2011; Friedman et al., 2020; Owens et al., 2003; Sonuga-Barke et al., 2002). It is likely that PCEs may similarly predict treatment-related improvements in parenting and child externalizing behaviors. Indeed, several studies have demonstrated that lower PCEs not only predict reduced negative parenting (Jiang et al., 2018), but also better child treatment outcomes such as improved ADHD symptoms, externalizing symptoms, homework behavior, and functional impairment (Hoza et al., 2000; Kaiser et al., 2010).

Although interventions that target PCEs are likely to optimize treatment outcomes, only two studies to date have examined the effect of targeting PCEs during parenting interventions for children with ADHD. Chacko et al. (2009) examined whether brief, pre-treatment motivational interviewing and correction of distorted cognitions improves outcomes for single mothers completing a behavioral parenting intervention for their child's ADHD. Relative to a parenting program without these enhancements, greater adherence (e.g., attendance and homework completion) and post-treatment improvements (e.g., decreased externalizing symptoms and parenting stress, improvements in parent–child relationship and parenting behavior) were observed. However, parental ADHD symptoms were neither assessed nor targeted. Given the effects of parental ADHD on parenting behaviors in the current study, targeting parental ADHD symptoms during treatment appears indicated. A second study examined the effect of a 12-week CBT protocol for maternal depressive symptoms after completing an intensive behavioral intervention program for their child's ADHD (Chronis et al., 2006). Greater maintenance of child ADHD treatment effects were observed for those who received adult-focused CBT immediately after child behavioral treatment; however, no study to date has examined whether CBT for parental ADHD has similar beneficial effects. Given that nearly half of all children with ADHD have at least one parent with ADHD, targeting PCEs and parental ADHD in the context of behavioral parenting interventions may hold promise for optimizing outcomes and should be the focus of future treatment development initiatives.

Declarations

Conflict of Interest Gabrielle Fabrikant-Abzug, Lauren M. Friedman and Linda J. Pfiffner declare that they have no conflict of interest.

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