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The Relation Between Maternal ADHD Symptoms & Improvement in Child Behavior Following Brief Behavioral Parent Training is Mediated by Change in Negative Parenting

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Abstract

This study examined the extent to which maternal attention-deficit/hyperactivity disorder (ADHD) symptoms predict improvement in child behavior following brief behavioral parent training. Change in parenting was examined as a potential mediator of the negative relationship between maternal ADHD symptoms and improvement in child behavior. Seventy mothers of 6–10 year old children with ADHD underwent a comprehensive assessment of adult ADHD prior to participating in an abbreviated parent training program. Before and after treatment, parenting was assessed via maternal reports and observations and child disruptive behavior was measured via maternal report. Controlling for pre-treatment levels, maternal ADHD symptomatology predicted post-treatment child disruptive behavior problems. The relation between maternal ADHD symptomatology and improvement in child behavior was mediated by change in observed maternal negative parenting. This study replicated findings linking maternal ADHD symptoms with attenuated child improvement following parent training, and is the first to demonstrate that negative parenting at least partially explains this relationship. Innovative approaches combining

evidence-based treatment for adult ADHD with parent training may therefore be necessary for families in which both the mother and child have ADHD. Larger-scale studies using a full evidence-based parent training program are needed to replicate these findings.

Keywords

Attention-deficit/hyperactivity disorder; Parent training; Parenting; Parent-child interactions; Adult ADHD

Evidence-based behavioral and pharmacological treatments for childhood attention-deficit/hyperactivity disorder (ADHD) rely on parents to obtain and consistently administer treatment (Pelham et al. 1998). In particular, behavioral parent training requires parents to modify environmental antecedents and consequences in order to manage child behavior. Although the empirical evidence supports classification of behavioral parent training as an evidence-based treatment for children with ADHD (Pelham and Fabiano 2008), not all families benefit equally from these programs. Efforts to understand factors which predict parent training response have identified parental psychopathology as a robust predictor of outcomes (for reviews, see Chronis et al. 2004; Miller and Prinz 1990), presumably because parental psychopathology interferes with effective implementation of behavior management skills.

ADHD has a strong genetic component, with most heritability estimates exceeding .80 (Faraone et al. 2005). In particular, mothers of offspring with ADHD are at 24 times increased risk for ADHD compared to mothers of non-disordered children, with approximately 17% of mothers of children with ADHD meeting criteria for ADHD themselves during childhood (Chronis et al. 2003). Several studies have now documented impaired parenting and family functioning associated with adult ADHD (Biederman et al. 2002; Chronis-Tuscano et al. 2008; Murray and Johnston 2006). These studies suggest that mothers with either diagnosed ADHD or elevated ADHD symptoms, compared to mothers with lower levels of ADHD symptoms, tend to be more permissive and overreactive; less positive, involved, and consistent; and poorer at planning, monitoring, and problem solving. Moreover, studies which have attempted to improve parenting deficits by treating mothers with ADHD with stimulants have found that, despite reductions in adult ADHD symptoms, parenting remains unchanged (Chronis-Tuscano et al. 2010). Given that both parental psychopathology and parenting behavior have been identified as important environmental risk or protective factors in developmental outcomes for children with ADHD (Chronis et al. 2007; Johnston and Mash 2001), behavioral parenting interventions may be particularly important for mothers with ADHD.

At the same time, effective implementation of behavior management skills requires planning, forethought, persistence, and consistency as well as the inhibition of negative emotional reactions on the part of parents—all of which are impaired in adults with ADHD. In the single empirical study to examine the relation between parental ADHD symptoms and child outcomes following behavioral parent training, it was reported that mothers who had the highest self-reported ADHD symptoms (i.e., those in the highest third of the sample on an adult ADHD measure) reported no child symptom reduction following a parent training program for their preschool-aged children with ADHD (Sonuga-Barke et al. 2002). Thus, the evidence from this one study suggests that maternal ADHD symptoms may be associated with attenuated parent training outcomes for children with ADHD.

Data from the Multimodal Treatment Study for ADHD (MTA) demonstrate that the success of ADHD treatments is mediated by reductions in negative/ineffective discipline (Hinshaw

et al. 2000). One would hypothesize that adult ADHD symptoms may impede a mother's ability to make the necessary changes in her parenting, which would ultimately result in a diminished impact of behavioral parent training on child behavior. In particular, parents with elevated ADHD symptomatology likely have more difficulty inhibiting negative reactions to child behavior in favor of the behavioral skills taught in parent training programs. However, Sonuga-Barke et al. (2002) did not examine the extent to which maternal ADHD symptoms were associated with treatment-related improvements in parenting—the more proximal outcome in behavioral parenting programs. Moreover, all constructs were measured via maternal report in their study, raising the possibility that shared method variance could explain these results.

The present study extends the literature by adding measures of parenting as well as child outcomes, and by including both observational and maternal report measures. We used a multi-method approach to examine the relationship between maternal ADHD symptoms and child outcome following a brief group behavioral parent training program for mothers of children with ADHD. We took an analogue approach, using a brief training program, given the preliminary state of the evidence in this area. We hypothesized that: (1) maternal ADHD symptoms would be associated with attenuated improvements in child behavior following parent training, and (2) that the link between maternal ADHD symptoms and a failure to show expected improvements in parenting would at least partially explain the relationship between maternal ADHD symptoms and limited improvements in child disruptive behavior following behavioral parent training.

Method

Participants

Participants included 70 mother-child dyads recruited via mailings and presentations to local schools and health professionals (including pediatricians, family practice physicians, child psychologists and child psychiatrists) in the Washington, DC metropolitan area. For inclusion in the study, children: (1) met full Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (American Psychiatric Association [*DSM-IV-TR*], 2000) criteria for ADHD according to well-validated parent and teacher report instruments and parent diagnostic interviews; (2) had an estimated IQ above 70; (3) were between the ages of 6 and 10; and (4) resided with their biological mothers. Children taking stimulant medications were included, but were rated by parents and teachers while off medication for 1–2 days. In order to increase variability in observed child behavior, parent–child interactions were conducted while children were unmedicated. Medicated children also were required to remain on a stable dose of medication throughout their participation in the study, unless clinically contraindicated.

Mothers were not selected on the basis of an ADHD diagnosis, but were expected to display a broader range of ADHD symptoms than would be present in the general population given the strong heritability of ADHD (Faraone et al. 2005). In order to isolate relationships between maternal ADHD symptomatology and parenting, mothers who met current DSM-IV criteria for any Axis I disorder other than ADHD were excluded from participation. Efforts to screen out mothers on the basis of current psychopathology were made prior to the laboratory assessment. Mothers taking stimulant medication were also excluded, as stimulant medication has the potential to minimize or mask ADHD-related deficits in parenting.

Eighty-one mothers met screening criteria and were assessed. Eleven were deemed ineligible: 5 were excluded because the child did not meet full DSM-IV criteria for ADHD; 3 were excluded because the child had an estimated IQ below 70; and 3 were excluded on

the basis of the mother's current Axis I disorder that was identified during the laboratory assessment. Participant characteristics are presented in Table 1. As depicted in Table 1, the sample was racially and socioeconomically diverse; total family income ranged from \$32,500 to \$385,000 and approximately 64% of the sample was non-white.

Procedure

Mothers expressing interest in the study completed a brief telephone interview in which the family's appropriateness for the study was assessed according to the criteria described above. When families appeared appropriate based on the telephone screen, parent and teacher measures were mailed to the home, and mothers were instructed to return the completed measures prior to the assessment session. Mothers and children attended a 2.5-hour pre-treatment assessment session, during which diagnostic interviews were administered and a parent-child observation was conducted. Upon arrival at the assessment session, mothers were provided with a detailed explanation of the procedures and provided written informed consent. Mothers and children were paid \$40 for this visit.

Mothers who were deemed eligible based on this laboratory assessment were invited to attend an abbreviated 5-session behavioral parent training program, which included the following topics: Psychoeducation regarding ADHD, special time, differential attention (i.e., attending to/rewarding prosocial behaviors and planned ignoring of minor/irritating behaviors), effective commands, and time out. Groups were comprised of 6–8 mothers and were facilitated by a single group leader. Therapists included a Ph.D.-level psychologist and an advanced doctoral student in clinical psychology, both of whom had extensive experience in the delivery of evidence-based behavioral parenting interventions for ADHD. The advanced doctoral student was very closely supervised by the principal investigator, who watched all of the tapes and provided extensive feedback on a weekly basis. Session content was derived from the parent training manual used in the Multimodal Treatment Study for ADHD (Abikoff et al. 1994), which was based on evidence-based parent training programs for children with ADHD and disruptive behavior disorders (Barkley 1997; McMahon and Forehand 2003; Patterson 1974). To encourage attendance, reminder calls were made prior to each session, childcare was provided for the target child and his/her siblings, and mothers who attended all 5 sessions were paid \$25 as an extra incentive.

Following the completion of the 5-session parenting program, mothers completed questionnaires assessing their parenting and children's symptoms of ADHD and the disruptive behavior disorders and associated impairment, as well as a second parent-child interaction. Families who completed this post-treatment assessment were paid \$25.

These study procedures were approved by the University Institutional Review Board.

Assessment of Maternal ADHD Symptoms

Consistent with best practice guidelines for the assessment of adult ADHD (McGough and Barkley 2004), mothers were assessed using multiple instruments (diagnostic, dimensional) with available normative data, multiple informants (e.g., self, parent, spouse), and tools for differential diagnosis. They were administered the Structured Clinical Interview for the DSM-IV, Non-Patient Edition (SCID; First et al. 1996) to assess other psychiatric disorders that may co-occur with or better account for their ADHD symptoms.

The SCID was supplemented with modified modules from the Schedule for Affective Disorders for School-Aged Children (K-SADS) assessing mothers' past and current symptoms of ADHD, oppositional defiant disorder (ODD), and conduct disorder (CD) in adults (Biederman et al. 2002; Faraone et al. 1995, 2000). Interviewers were trained to reliability on the SCID and modified K-SADS by the first author and carefully supervised

throughout the study. Interviews were videotaped and 20% of the interviews were coded by an independent rater. Kappas were 1.00 for ADHD, 1.00 for anxiety disorders, 1.00 for mood disorders, and 1.00 for all other disorders.

Given concerns about individuals' ability to accurately report their own ADHD symptoms, our assessment of adult ADHD utilized information about past and current symptoms gathered from collateral informants in addition to mothers' own reports (McGough and Barkley 2004). Thus, whenever possible, past and current collateral reports of ADHD symptoms were obtained from individuals who lived with or were in close contact with the mothers during the period in question and felt confident about their ability to accurately rate the mothers' ADHD symptoms. Fifty-one collateral informants were contacted and provided reports: 36 were spouses/significant others, 10 were close friends, 3 were siblings, 1 was a co-worker, and 1 was of unknown relationship to the participating mother. Research assistants interviewed mothers' collateral informants via telephone using the modified K-SADS. Detailed analysis of collateral data is presented elsewhere (cite omitted to maintain anonymity). Consistent with the recommendations of McGough and Barkley (2004) and with procedures used in our prior studies (cites omitted), DSM-IV symptoms of ADHD were considered present if they were endorsed by *either* the participant *or* the collateral informant (i.e., the "or rule") as present to a clinically significant degree on the modified K-SADS. Maternal KSADS ADHD symptoms in this sample ranged from 0 to 17 (inattention: 0–9; hyperactivity/impulsivity: 0–8). Mean ADHD symptoms reported on the KSADS for the sample based on the "or rule" were: 2.83 ($SD=2.79$) for inattentive symptoms, 2.81 ($SD=2.22$) for hyperactive/impulsive symptoms, and 5.64 ($SD=4.45$) for Total ADHD symptoms.

Although the main analyses use a dimensional composite score (described below), diagnoses were made for descriptive purposes only. Diagnoses were made based on = 6 past symptoms and = 4 current symptoms reported on the KSADS using maternal and collateral report (McGough and Barkley 2004); however, since an adult ADHD impairment measure was not utilized, these "diagnoses" were based on symptom criteria only. Fourteen percent ($n=10$) of mothers met symptom criteria for ADHD according to these procedures. Nine of these participants met symptom criteria for ADHD based on self-report alone and five met criteria based on collateral report alone.

Mothers also completed the Conners Adult ADHD Rating Scale (CAARS; Conners et al. 1999; Erhardt et al. 1999), a dimensional measure of current ADHD symptoms in a form suitable for adults. The CAARS is a 93-item, reliable and valid measure of ADHD symptoms that assesses the core features of ADHD as seen in children and adolescents, while adding content unique to the adult expression of ADHD. The individual completing the form must indicate if he or she experiences the ADHD symptom on a scale ranging from *Not at all, never to Very much, very frequently*. The CAARS has excellent psychometric properties and provides essential normative data. The Total ADHD Symptom (CAARS-ADHD) subscale was used in the current study (Cronbach's $\alpha=.92$).

Assessment of Child ADHD

The diagnosis of child ADHD was made using the K-SADS parent interview (Ambrosini 2000; Orvaschel and Puig-Antich 1995) and parent and teacher forms of the Disruptive Behavior Disorders (DBD) symptom checklist (Pelham et al. 1992). Twenty percent of the K-SADS parent interviews were coded by an independent rater. Kappas were .86 for ADHD, 1.00 for ODD, and 1.00 for CD. The DBD symptom checklist is a 45-item parent and teacher report measure of the DSM-IV symptoms of ADHD, ODD, and CD. Symptoms are rated on a 4-point scale as describing the child not at all to very much (not at all=0 to very much=3). A total disruptive behavior score is calculated by summing all responses

rated as *pretty much* or *very much*. In this study, Cronbach's alpha for the pre-treatment parent-reported DBD symptom checklist total was .92; the post-treatment alpha was .94. Symptoms for the child ADHD diagnosis were considered present if they were endorsed by *either* the parent *or* teacher as occurring to a clinically significant degree on any of these measures (Piacentini et al. 1992).

Cross-situational impairment necessary for a DSM-IV diagnosis of ADHD was evaluated using parent and teacher forms of the Children's Impairment Rating Scale (CIRS; Fabiano et al. 2006). On the CIRS, raters assess impairment and need for treatment across multiple domains on a 7-point scale, with scores above the midpoint indicating clinically significant impairment (Fabiano et al. 2006). Alphas at pre- and post- treatment (respectively) in this sample were: 0.86 and 0.84.

The Vocabulary and Block Design subtests of the Weschler Intelligence Scale for Children, Third Edition (Wechsler 1991), were administered to exclude children with an estimated IQ below 70. This estimated IQ has been used in several studies (e.g., Seguin et al. 2004; Todd et al. 2002), and is correlated 0.92 with full scale IQ (Campbell 1998).

Approximately 30% of children ($n=23$) had received a diagnosis of ADHD by a medical or mental health professional prior to enrollment in the study, per parent report during the telephone screen. Parents reported that approximately 66% ($n=42$) of children were treated with medication and 17% ($n=12$) of children had received prior psychosocial (i.e., non-medication) treatment for mental health problems.

Child Behavior Outcomes

The DBD symptom checklist (Pelham et al. 1992) and the CIRS were administered to mothers before and after the abbreviated parent training program to evaluate treatment effects on child DBD symptoms and associated impairment.

Parenting

The Alabama Parenting Questionnaire (APQ; Shelton et al. 1996) is a 42-item measure on which parents indicate the frequency with which they implement the following parenting practices: Involvement, Positive Parenting, Poor Monitoring/Supervision, Inconsistent Discipline, and Corporal Punishment. Items are rated on a 5-point scale, ranging from 1 (*never*) to 5 (*always*). Internal consistency for all scales is moderate to high (Shelton et al. 1996), and test-retest reliability across a 3-year interval averages 0.65 (McMahon et al. 1997). The current study focused on treatment-related change in the Involvement, Inconsistent Discipline, and Positive Parenting subscales, as these subscales were hypothesized to be most likely impacted by maternal ADHD and were indeed associated with maternal ADHD symptoms in this sample (cite omitted to maintain anonymity). Alphas for these subscales at pre- and post- treatment (respectively) in this sample were: 0.79 and 0.79 for Involvement; 0.86 and 0.85 for Positive Parenting; and 0.76 and 0.78 for Inconsistent Discipline.

The present study also utilized observed parent-child interaction tasks commonly employed in the ADHD literature (Danforth et al. 1991): (1) a 5-minute free play; and (2) a 10-minute homework task in which the child completed a math worksheet while the mother was instructed to provide assistance "as you see fit." Mother-child interactions during these tasks were coded using a revised version of the Dyadic Parent-child Interaction Coding System (DPICS; University of Washington Parenting Clinic 2000). The DPICS was developed by Eyberg and colleagues (Robinson and Eyberg 1981; most recent edition is Eyberg et al. 2009). The validity of the DPICS has been documented in studies examining treatment outcome (Eyberg and Matarazzo 1981) and comparisons between non-disordered children

and those referred for oppositional/aggressive behaviors (Aragona and Eyberg 1981; Robinson and Eyberg 1981).

Discrete parenting behaviors were coded continuously with a resulting total frequency for each behavior. We utilized the following composite categories that are commonly reported in the literature: Positive Parenting (DPICS-PP; includes praise, positive affect, and physical positive); and Negative Parenting (DPICS-NP; includes negative command, critical statements, and physical negative; Eyberg et al. 2001; Webster-Stratton 1998; Webster-Stratton and Spitzer 1992). In addition, we included the “No Opportunity for Child to Comply” category (DPICS-NOCC), which is counted each time the mother gives a command, but reissues another command before 5 s have elapsed, regardless of whether the child has begun complying or not. These categories were selected on the basis of their hypothesized relationship to maternal ADHD symptoms (Chronis-Tuscano et al. 2008).

A team of two undergraduate coders was trained by a doctoral student in the use of the DPICS until 80% agreement was attained. After studying the coding manual, coders participated in six full days of training to review and discuss coding procedures and to practice coding videotapes of the mother-child interactions. Throughout the course of the study, coders participated in weekly face-to-face meetings to identify areas of disagreement, recode difficult tapes together, and discuss behaviors within each category to improve reliability for future coding. Reliability checks were conducted throughout the study in order to maintain an acceptable level of agreement. The primary coder coded all of the tapes and approximately 30% of these tapes were coded by a second coder to assess inter-rater reliability. Both coders had no knowledge of mother and child assessment information or time of assessment (i.e., pre- or post-treatment). Consistent with prior studies using the DPICS, overall reliability was computed by calculating percent agreement (Agreements/Agreements+Disagreements; Eyberg et al. 2009; University of Washington Parenting Clinic 2000). Inter-observer agreement coefficients for DPICS parenting categories at pre- and post-treatment (respectively) across situations were 0.89 and 0.69 for Positive Parenting; 0.83 and 0.85 for Negative Parenting; and 0.86 and 0.82 for No Opportunity to Comply.

Results

Preliminary Analyses

Maternal ADHD Symptoms—Given that CAARS-ADHD and KSADS-ADHD scores were highly correlated ($r=0.67$, $p<0.001$), a composite maternal ADHD variable was created for treatment outcome analyses. Use of a composite maternal ADHD variable served to reduce the overall number of analyses and thus the possibility of a Type I error. This composite was created using the total number of symptoms reported by the mother herself or the collateral informant on the modified KSADS interview and on the CAARS self-report. Standardized values (z-scores) for CAARS-ADHD and KSADS-ADHD were averaged to compute the maternal ADHD composite variable. Thus, this maternal ADHD composite variable combined self- and collateral-report data.

Treatment Attendance—The mean number of sessions attended was 3.58 of 5 ($SD=1.72$). Approximately 17% of mothers ($n=12$) attended no sessions and more than 75% of mothers attended at least 4 of the 5 sessions. Mothers who attended at least one session did not differ from non-attenders on the maternal ADHD composite variable, $t(68)=0.35$, $p=0.72$, or child DBD total score, $t(67)=1.70$, $p=0.10$. The maternal ADHD symptom composite was not significantly related to attendance, $r(68)=-0.001$, $p=0.992$.

Missing Data—Of the 58 families who attended at least one session, complete observational data at pre- and post- treatment were available for 32 families due to a range

of technical difficulties with the digital recording. For the total sample, self-report measures of child behavior and parenting were missing for 6 families pre-treatment (8.6%) and 18 families post-treatment (25.7%). There were no differences in pre-treatment DBD, $t(67)=1.012$, $p=0.21$, or maternal KSADS Total scores, $t(67)=-1.345$, $p=.16$ for those who were and were not missing post-treatment data. However, Little's MCAR was significant, MCAR test, $\chi^2 [145]=179.880$, $p=0.03$, which indicates that data were not missing completely at random (MCAR). Given that data were not MCAR, neither listwise nor pairwise deletion was appropriate. Thus, we used maximum likelihood estimation and all available data to impute missing data for parenting and child behavior measures. This approach allowed us to test our hypotheses with improved power over listwise deletion and less biased parameter estimates than other techniques including listwise deletion, mean substitution, and multiple regression estimation (Graham 2009).

Prediction of Child Behavior Treatment Outcome

Child DBD total symptom scores improved significantly from pre- ($M: 15.43$, $SD: 6.39$) to post-treatment ($M: 10.98$, $SD: 6.36$) for the sample, $t(69)=6.47$, $p<0.001$. Child CIRS total scores also improved significantly from pre- ($M: 23.58$, $SD: 8.61$) to post-treatment ($M: 20.69$, $SD: 9.32$) for the sample, $t(51)=2.80$, $p=0.007$. Regression analyses were conducted to examine whether the maternal ADHD symptom composite predicted DBD and CIRS total scores at post-treatment, controlling for pre-treatment scores. Maternal ADHD significantly and negatively predicted post-treatment DBD scores, controlling for pre-treatment DBD scores (see Table 2). Thus, mothers with higher ADHD symptoms reported attenuated effects of parent training on their children's DBD symptoms. However, maternal ADHD did not significantly predict post-treatment CIRS total scores.

Prediction of Parenting

Given that both the APQ and DPICS included scales measuring the Positive Parenting construct, we examined correlations between the APQ-PP scale and DPICS-PP during play and homework. At pre-treatment, APQ-PP and DPICS-PP during play were significantly positively correlated, $r(68)=0.40$, $p=0.004$, but not during homework, $r(68)=0.20$, $p=0.144$. No significant correlations were found at post-treatment, thus we did not control for shared variance between measures in our outcome analyses.

Regression analyses were conducted to examine whether the maternal ADHD symptom composite predicted changes in parenting behavior at post-treatment, controlling for pre-treatment scores. As presented in Table 2, maternal ADHD predicted APQ Inconsistent Discipline and Involvement subscale scores at post-treatment, indicating that mothers with higher ADHD symptoms reported less improvement in Inconsistent Discipline and Involvement after the brief parent training program. Maternal ADHD symptoms did not significantly predict change in the APQ Positive Parenting subscale.

Maternal ADHD predicted DPICS-Negative Parenting during both the free play and homework segments at post-treatment after controlling for pre-treatment frequencies, also indicating that mothers with higher ADHD symptoms demonstrated less improvement in observed negative parenting across situations. Maternal ADHD did not significantly predict DPICS-Positive Parenting at post-treatment for the play or homework segments.

Maternal ADHD predicted maternal repetition of commands before 5 s had elapsed, regardless of whether the child had begun complying or not (DPICS-NOCC) during both the play and homework segments at post-treatment after controlling for pre-treatment scores. This finding suggests that mothers with higher ADHD symptoms displayed less

improvement in reducing repeated commands without allowing the child an opportunity to comply.

Mediation—Given that maternal ADHD predicted change in six of nine parenting measures at post-treatment and change in maternal-reported child disruptive behavior at post-treatment, the potential mediating role of parenting in the association between maternal ADHD and child outcomes was examined. Analyses were conducted in accordance with the model for mediation proposed by Baron and Kenny (1986) and reviewed by Kenny (2009). Conditions 1 and 2 as outlined by Baron and Kenny’s model were already demonstrated in the analyses presented above: (1) the predictor variable (maternal ADHD composite) is significantly associated with the outcome variable of “change in child behavior” (i.e., maternal-report child disruptive behavior at post-treatment controlling for pre-treatment score) and (2) the predictor variable (maternal ADHD composite) is significantly associated with the mediator of “change in parenting” (i.e., parenting measures at post-treatment controlling for pre-treatment scores). Thus, linear regressions were conducted to examine conditions 3 and 4 of mediation: (3) that the mediators (change in parenting) are significantly associated with the outcome variable (change in child behavior), and (4) that the association between maternal ADHD symptoms and child outcome was reduced when the parenting variables were entered into the models.

Conditions 3 and 4 of mediation were supported for 3 of 6 parenting mediators, specifically maternal-reported Inconsistent Discipline and DPICS-NP during play and homework. Both maternal ADHD and APQ-ID were significant when entered together, suggesting partial mediation. However, maternal ADHD was no longer significant when entered with DPICS-NP during play and homework, suggesting full mediation. See Table 3 for standardized regression coefficients for hierarchical regressions examining mediation.

Sobel tests were then performed to evaluate the statistical significance of the mediation effects, condition 4 of Baron and Kenny’s model (MacKinnon et al. 2002; Sobel 1982). Sobel test results indicated that observed negative parenting during play and homework were significant mediators ($z=2.03$, $p=0.04$ and $z=2.00$, $p=0.045$, respectively) of the relationship between maternal ADHD symptoms and change in child behavior following brief parent training. That is, the previously significant relationship between maternal ADHD symptoms and change in child behavior was reduced significantly when the effects of observed negative parenting was controlled. The Sobel test was not significant for APQ Inconsistent Discipline as a mediator, however ($z=1.52$, $p=.13$).

Discussion

This study replicated prior findings suggesting that mothers with higher levels of ADHD symptoms report less improvement in child disruptive behavior following behavioral parent training, and is the first to demonstrate that the relationship between maternal ADHD and child behavior outcomes is mediated by reductions in observed negative parenting. That is, the relationship between maternal ADHD symptoms and attenuated response to parent training can be explained by the failure of mothers with elevated ADHD symptoms to reduce their use of negative parenting behaviors.

Consistent with the one published study on this topic (Sonuga-Barke et al. 2002), maternal ADHD symptomatology predicted change in child DBD scores following brief parent training, suggesting that mothers perceive less change in their children’s disruptive behavior when they themselves have higher levels of ADHD symptoms. Moreover, this study was the first to show that maternal ADHD symptoms were associated with the degree of change in self-reported and observed parenting, the most proximal outcome in behavioral parenting

interventions. We found that mothers' ADHD symptomatology predicted change in observed negative parenting, observed repeated commands without providing the child an opportunity to comply, and maternal reports of inconsistent discipline following behavioral parent training. These parental behaviors seem to characterize the adult with ADHD, who tends to be emotionally reactive and to have difficulty inhibiting her responses.

Perhaps most notably, we found that reductions in observed negative parenting mediated improvement in mother-reported child disruptive behavior. This finding is consistent with MTA results suggesting that success resulting from evidence-based ADHD treatments is related to the degree of change in negative/ineffective discipline (Hinshaw et al. 2000). The results of the present study support the notion that mothers with significant ADHD symptoms may have more difficulty inhibiting negative reactions to child behavior in favor of behavioral skills taught in parent training programs, and that this failure to inhibit negative parenting behaviors may explain the attenuated reduction in child behavior problems following treatment. Given that we utilized not only self-report data, but also observational data in an effort to avoid shared method variance and any potential biases in mothers' perceptions of their own or their children's behavior, we have more confidence that the lack of change in observed parenting indeed resulted in less change in child symptoms.

Prior research has both found that mothers with ADHD (or elevated ADHD symptoms) engage in more negative parenting practices toward their offspring with ADHD than mothers without ADHD symptoms (Biederman et al. 2002; Chronis-Tuscano et al. 2008; Murray and Johnston 2006) and that parenting is an important predictor of negative long-term outcomes for children with ADHD (Chronis et al. 2007; Johnston and Mash 2001). Therefore, findings suggesting that behavioral parent training is less effective at changing negative and inconsistent parenting when mothers experience elevated ADHD symptoms themselves have potentially serious implications. In particular, these findings suggest that offspring of mothers with higher levels of ADHD symptoms may be at increased risk for negative developmental outcomes, both as a result of maladaptive parenting and poor behavioral treatment response. However, this awaits empirical examination using larger samples and prospective longitudinal designs.

Contrary to our hypotheses, maternal ADHD symptoms were not significantly associated with the degree of change in positive parenting following intervention. This may reflect the fact that adults with ADHD, perhaps due to their own exuberance or their enhanced understanding of their children's symptoms (Psychogiou et al. 2007, 2008), have less difficulty displaying positive parenting. It may be the case that their ADHD symptoms interfere to a greater extent with their ability to inhibit negative reactions to child misbehavior.

Several limitations of this study must be considered. Mothers who participated in this study were not diagnosed with ADHD or clinically referred for adult ADHD; rather, we examined the extent to which continuously-distributed levels of maternal ADHD symptoms were related to treatment participation and outcomes. Unfortunately, an adult ADHD impairment measure was not available at the time this study was initiated. Future studies should utilize an impairment measure relevant to adults with ADHD so that diagnostic status of mothers can be obtained. Also, a clinically-referred sample of mothers with ADHD would likely have high levels of comorbidity with depression and other disorders, which could certainly impact the findings. Future studies will therefore need to examine whether the same results are found with a clinical sample of mothers with ADHD. It is very likely that the effects would be even stronger for mothers who are more impaired.

This study included a 5-week behavioral parent training program which was abbreviated from the typical 8-12 week programs which have established efficacy (Weisz 2004). Although ideally this question would be examined using a full-scale parent training program, we felt that a more analogue approach, using a brief training program was appropriate given the preliminary state of the evidence in this area. Our use of a brief parenting program was also consistent with recent evidence indicating that such programs may be effective (Axelrad et al. 2009; Nixon et al. 2003). It is certainly possible that results might be different had a typical 8-12 week program been implemented. In particular, mothers with ADHD symptomatology may require more repetition or a larger “dose” of treatment before meaningful change can be documented. Whether the results of the present report hold for a full evidence-based parent training program awaits further research. Next, we considered exclusively *maternal* ADHD symptoms, rather than symptoms in both mothers and fathers. We made this design decision because it remains the case that mothers are most often responsible for the organizational aspects of parenting (Furstenberg 1988; McBride and Mills 1993; Parke 1995). The majority of the parent training literature focuses on mothers, as mothers most often present to treatment for their children’s attention and behavior problems (Fabiano 2007). Nevertheless, fathers of children with ADHD also are at increased risk of having ADHD (Chronis et al. 2003) and many do take an active role in their children’s treatment. For these reasons, future studies should also consider the impact that paternal ADHD may have on behavioral treatment outcomes.

Finally, the sample size was limited, particularly for observational outcomes, and a fair amount of data were missing. The fact that we found significant mediation effects despite the small sample is quite promising, however. Still, the limited sample size prevented us from considering potentially important variables, such as child medication status. Thus, replication is required with a larger sample using standard (rather than abbreviated) evidence-based behavioral parenting programs, and considering ADHD symptoms in both mothers and fathers. Future studies should also carefully measure treatment participation, including implementation of behavior management skills outside of the session (e.g., at home) so that we can further understand the mechanisms related to attenuated treatment outcomes for this population.

Despite these limitations, this study replicated results from the single study suggesting that maternal ADHD symptomatology is associated with attenuated response to parent training, and is the very first to show that degree of improvement in negative parenting mediates change in child behavior. Given that negative and inconsistent parenting predict poor long-term child outcomes, these findings suggest that maternal ADHD symptomatology may negatively impact both the developmental and treatment outcomes of children with ADHD. Assessment and treatment of maternal ADHD, when present, may therefore be recommended to increase the likelihood that children with ADHD will derive maximum benefit from evidence-based behavioral treatment. In particular, treating maternal ADHD (either with stimulant medication or evidence-based psychosocial treatment) prior to her participation in behavioral parenting interventions may impact maternal behavior in treatment and subsequent child behavior gains.

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Table 1

Participant characteristics

Child characteristics		
Variable	Mean (SD)	%
Age (years)	8.06 (1.2)	
Sex (Male) (<i>n</i> =66)		71
WISC-III verbal (Scaled score)	11.20 (3.9)	
WISC-III performance (Scaled score)	9.61 (3.8)	
Race/Ethnicity		
Caucasian		36.2
African-American		40.6
Hispanic		4.3
Native American		1.4
Mixed		7.2
Other		1.4
Refused		8.7
ADHD diagnosis		
Combined type		78.9
Inattentive type		15.5
Hyperactive/Impulsive type		5.6
Comorbidity		
Oppositional defiant disorder		47.9
Conduct disorder		19.7
Medication status		
On medication		65.7
Mother characteristics		
Age	38.6 (6.1)	
Marital status (<i>n</i> =66)		
Married		71
Divorced/Separated/Other		29
Education level (<i>n</i> =66)		
High school		24.2
Some college/Associate's degree		10.6
Bachelor's or graduate degree		65.2
Family income (<i>n</i> =59)		
0–40,000		16.9
40,001–70,000		23.7
70,001–100,000		27.1
>100,000		32.2
Race/Ethnicity		
Caucasian		45.6
African American		45.6

Child characteristics		
Variable	Mean (SD)	%
Hispanic		7.4
Other		1.5

$n=70$ unless indicated. *WISC-III* Weschler intelligence scale for children, Third Edition; *ADHD* Attention-deficit/hyperactivity disorder; *ODD* Oppositional defiant disorder; *CD* Conduct disorder

Table 2

Results of regression analyses predicting child behavior and parenting at post-treatment from maternal ADHD symptom composite

Maternal-reported child behavior and impairment									
DBD			CIRS						
	<i>df</i>	<i>F</i>	<i>r</i> ² Δ	β	<i>df</i>	<i>F</i>	<i>r</i> ² Δ	β	
Step 1	1, 68	36.79	0.35		1, 50	38.61	0.44		
Pre				0.593**				0.660**	
Step 2	1, 67	27.21	0.10		1, 49	19.73	0.01		
Pre				0.500**				0.635**	
M-ADHD				0.325**				0.105	
Dyadic Parent Child Interaction Coding System (DPICS) parenting									
Play negative parenting			Play positive parenting			Play-no opp to comply			
	<i>df</i>	<i>F</i>	<i>r</i> ² Δ	β	<i>df</i>	<i>F</i>	<i>r</i> ² Δ	β	
Step 1	1, 68	0.407	0.00		1, 68	0.306	0.00		1, 68 1.14 0.02
Pre				0.077				-0.067	-0.128
Step 2	1, 67	14.77	0.30		1, 67	1.61	0.04		1, 67 6.83 0.15
Pre				-0.043				-0.050	-0.074
M-ADHD				0.561**				-0.204	0.395**
Homework negative parenting			Homework positive parenting			Homework-no opp to comply			
	<i>df</i>	<i>F</i>	<i>r</i> ² Δ		<i>df</i>	<i>F</i>	<i>r</i> ² Δ		
Step 1	1, 68	0.134	0.00		1, 68	0.001	0.00		1, 68 11.04 0.14
Pre				0.044				0.004	0.431*
Step 2	1, 67	13.78	0.29		1, 67	1.34	0.04		1, 67 16.47 0.19
Pre				-0.039				-0.032	0.326*
M-ADHD				0.544**				-0.200	0.332**
Alabama Parenting Questionnaire (APQ)									
Inconsistent discipline			Positive parenting			Involvement			
	<i>df</i>	<i>F</i>	<i>r</i> ² Δ		<i>df</i>	<i>F</i>	<i>r</i> ² Δ		
Step 1	1, 68	44.11	0.39		1, 68	38.42	0.36		1, 68 37.17 0.35
Pre				0.627**				0.601**	0.594**
Step 2	1, 6	26.03	0.04		1, 67	1.69	0.01		1, 67 22.26 0.05
Pre				0.540**				0.634**	0.654**

M-ADHD	0.227*	0.101	0.222*
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n=70. M-ADHD Maternal attention-deficit/hyperactivity disorder composite variable. *DBD* Disruptive behavior disorder rating scale. *CIRS* Child impairment rating scale. *No Opp to Comply* Command with no opportunity for child to comply

*** *p*<0.01

* *p*<0.05

Table 3

Summary of standardized regression coefficients from hierarchical regression analyses testing change in parenting as mediator of the relationship between maternal ADHD symptoms and change in child disruptive behavior

Parenting measure	Predictor-Mediator	Mediator-Outcome	Predictor-Outcome	Mediator-Outcome (Controlling for predictor)
NP-Play	0.561 **	0.343 **	0.325 **	0.231 *
NP-Homework	0.544 **	0.322 **	0.325 **	0.231 *
APQ-ID	0.227 *	0.338 **	0.325 **	0.247 *

Parenting and child behavior measure pre-treatment scores are controlled in all analyses. *NPDPICS* observed negative parenting. *APQ-ID* Alabama parenting questionnaire-inconsistent discipline

**
 $p < 0.01$

*
 $p < 0.05$