

Dissecting Daily Distress in Mothers of Children With ADHD: An Electronic Diary Study

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It is well known that parents of children with attention-deficit/hyperactivity disorder (ADHD) experience elevated levels of caregiver stress, but little is known about the ebb and flow of parental distress as it happens, or the degree of synchrony between short-term oscillations in child behaviors and maternal distress. Electronic diaries (eDiaries) were used to dissect daily distress in natural settings. Across 7 days during nonschool hours, half-hourly eDiaries were completed independently by mothers and their 8- to 12-year-old children (51 receiving medication for ADHD and 58 comparison peers). Diary items tapped behaviors, moods, and contexts, with children reporting their own behaviors and mothers reporting on themselves and their children. Maternal distress and child ADHD-type behaviors exhibited moderate to strong associations “in the moment,” whether child behaviors were reported by mothers or children. This mother-child synchrony emerged for the comparison as well as the ADHD group, although the associations were stronger when the dyad included a child with ADHD. Because fixed-effects analyses were conducted, these patterns are not attributable to levels of psychopathology or other stable individual differences in mothers or children. Further moderation analyses revealed that the links between child behaviors and maternal distress were strengthened by maternal risk and attenuated by child behavioral self-esteem; these effects were modest but detectable. These findings can help guide not only interventions targeted on improving quality of life in families of children with ADHD, but also programs designed to help all parents identify and manage their own parenting stressors.

Keywords: parenting stress, maternal risk, ADHD, electronic diaries

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Parenting is replete with challenges, and these challenges proliferate when the child has serious and persistent problems such as those that characterize attention-deficit/hyperactivity disorder (ADHD). Thus, it is not surprising that parents of children with ADHD often experience elevated levels of parenting stress as well as strains in multiple domains of everyday life (Anastopoulos, Guevremont, Shelton, & DuPaul, 1992; Johnston & Mash, 2001; Whalen et

al., 2006). There are several reasons to be concerned about high levels of parenting stress. Maladaptive parenting practices and problematic parent-child relationships have been associated with parenting distress (Johnston & Mash, 2001), and parents who are highly stressed may be unlikely to follow treatment regimens for their children with ADHD (Reader, Stewart, & Johnson, 2009). There are also empirical indications that caregiving for family members with chronic disorders can be hazardous to the physical health of the caregiver (Vitaliano, Young, & Zhang, 2004).

Studies of ADHD caregiver stress have typically relied on global measures of both children’s problems (e.g., clinical diagnoses or rating scales) and parental distress (e.g., single-occasion questionnaires). The present study extends previous findings by taking a more fine-grained look, mapping concurrent associations between parental distress and child behavior problems as parent and child go about their daily lives. Using electronic diaries (eDiaries), we captured moment-to-moment fluctuations in the families of children with and without ADHD. In other words, we sought to dissect distress-in-motion in real-world settings, examining the ebb and flow of the child’s problematic behaviors and the parent’s mood states. Although elevated levels of dis-

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tress have been found in fathers as well as mothers of children with ADHD (Podolski & Nigg, 2001), the present study focused on mothers, who are usually the primary caregivers.

Most studies of maternal distress take a between-groups approach, comparing mothers of children with ADHD to mothers of nondiagnosed peers. By leveraging the power of fixed-effects regression models, we were able to examine the interplay between maternal moods and child behaviors over time *within each dyad* and estimate whether mom's distress increased (relative to her typical level of distress) during moments when her child was inattentive or disruptive. This approach is novel in that it provides a test of whether there is a dynamic interplay between the moods of the parent and the behaviors of the child in the moment, beyond any associations resulting from individual differences such as personality dispositions or familial factors such as shared liability for psychopathology (Allison, 2005). A second objective was to identify moderators of the associations between child behaviors and maternal distress that may amplify or attenuate links between what the child does and how the parent feels. Based on the empirical literature, we selected two candidate moderators: maternal risk and child self-esteem.

Maternal Risk

Popular wisdom and the bulk of the research evidence dictate that maternal parenting stress stems primarily from the child's difficulties (Anastopoulos et al., 1992). There is no doubt, however, that maternal predispositions also play a meaningful role. Individuals do not enter parenthood as blank slates. Rather, they assume this role with a set of traits, tendencies, and experiences that may make parenting more or less stressful. Among the maternal factors most frequently cited as increasing susceptibility to stress while parenting are psychosocial difficulties, including the parent's own ADHD characteristics and depressive dispositions, as well as cognitions about the causes and consequences of the child's behavior problems. For the present study, indicators of these three factors were combined into a tripartite index to test whether maternal risk amplified the synchrony between child behaviors and maternal distress in the moment. The body of research linking each of the three components of the maternal risk composite to parenting practices and responsivity is reviewed below. Given the high degree of overlap across these components, we focus primarily on whether the cumulative burden increases the synchrony between child behavior and maternal mood, but we also note the pattern of findings for each specific component of the maternal risk index.

Maternal ADHD and Depressive Symptoms

ADHD runs in families. Elevated rates of ADHD in mothers as well as fathers of children with ADHD have been documented repeatedly (Chronis et al. 2003). Not surprisingly, mothers who have high levels of ADHD characteristics, compared to other mothers, display poorer par-

enting skills (Chronis-Tuscano et al., 2008; Murray & Johnston, 2006). Family environments may also differ, with higher levels of conflict and lower levels of cohesion in the families of mothers with ADHD characteristics (Biederman, Faraone, & Monuteaux, 2002). Especially noteworthy are recent findings that high levels of maternal ADHD symptoms may limit the effectiveness of both parent training programs and pharmacotherapy for children with ADHD (Chronis-Tuscano et al., 2010; Jensen et al., 2007; Sonuga-Barke, Daley, & Thompson, 2002).

Similar conclusions have emerged from the extensive literature on maternal depression, the second component of maternal risk studied here. Elevated levels of depressive symptoms in mothers of children with ADHD and other externalizing disorders have been documented repeatedly (Chronis et al., 2003). As with maternal ADHD, maternal depression is associated with a host of detrimental processes and outcomes, including low maternal responsiveness, ineffective parenting, family discord, current and future child conduct problems, and poor treatment response for the child (Elgar, McGrath, Waschbusch, Stewart, & Curtis, 2004; Kim-Cohen, Moffitt, Taylor, Pawlby, & Caspi, 2005; Owens et al., 2003). Associations between maternal depression and child externalizing disorders appear quite robust, and the processes are almost certainly bidirectional, with maternal depression serving as both cause and consequence of problematic child behaviors (Elgar et al., 2004).

Maternal Perceptions of Child Impact

In addition to mothers' ADHD and depressive dispositions, maternal cognitions about a child's problems can also influence distress (Bugental & Johnston, 2000; Whalen & Henker, 1999). One mother may view her child's overactivity as energy and exuberance, his impulsivity as creativity, and his inattention as self-containment. Another mother may construe the same behaviors as dysregulation, disobedience, or disdain. Despite having to confront comparable challenges because of their children's severe behavior problems, these two mothers may react quite differently. Regardless of their veridicality, a mother's appraisals of her child's difficulties and their impact on her own and her family's daily lives can influence outcomes for both mother and child (Bugental & Johnston, 2000).

In summary, maternal risk is defined as the combination of ADHD and depressive characteristics with negative cognitions about the child's impact on the family. Our expectation is that maternal risk increases vulnerability to everyday challenges and thus will amplify the relationship between child behavior problems and maternal distress. Mothers of children with ADHD are expected to have an elevated parenting burden because of both shared vulnerabilities for the disorder and the stressors involved in parenting a child with ADHD. The question here is whether there is greater synchronicity between a mother's level of distress and her child's behavior *in the moment* in dyads where maternal risk is high.

Child Behavioral Self-Esteem

Although self-esteem has been dubbed “one of psychology’s most venerable constructs” (Swann, Chang-Schneider, & McClarty, 2008, p. 65), debate is simmering about the extent to which high self-esteem may be detrimental rather than facilitative, both to the individual and to society (Baumeister, Campbell, Krueger, & Vohs, 2003). This debate provides an apt context for interpreting the mixed results that are emanating from studies of self-perceptions in children with ADHD. Whereas some investigators have found evidence of inflated self-views or positive illusory biases in children with ADHD (Hoza et al., 2004; Whalen, Henker, Hinshaw, Heller, & Huber-Dressler, 1991), others have reported more negative self-percepts when compared with same-age peers (Slomkowski, Klein, & Mannuzza, 1995; Whalen et al., 2006). Parents use attitudinal cues when interpreting children’s problematic behaviors, being influenced not only by the actual behaviors but also by how the child perceives these behaviors. Inflated self-views may maintain and even justify child misbehavior (Menon, Tobin, Corby, Hodges, & Perry, 2007). Negative self-views may also have undesirable consequences by signaling that the child accepts her problematic behaviors and may be indifferent to their impact. Little is known, however, about how parents of children with ADHD react to their children’s views of their own behavior. The question addressed here is whether associations between children’s troublesome behaviors and maternal distress are amplified or attenuated by how the child perceives his own behavior.

Research Questions and Approach

The present study was designed to address four research questions. First, are child behavior problems associated with elevated maternal distress on an ongoing basis, while mothers and children are negotiating the travails and triumphs of everyday life? Second, are the momentary associations between child behavior problems and maternal distress stronger when the child has been diagnosed with ADHD than when s/he has no psychiatric diagnosis? Third, are links between child behavior problems and maternal distress amplified by mothers’ own risk burden, defined as a composite of maternal ADHD and depressive symptoms as well as negative views of the child’s impact on quality of family life? Fourth and finally, does child behavioral self-esteem moderate the associations between child behavior problems and maternal distress?

These questions were addressed in an eDiary study of a community sample of school-age children, some with ADHD and some with no known psychiatric diagnosis. eDiary approaches have several notable advantages, including the capability of collecting contemporaneous information in natural settings on numerous occasions while respondents go about their normal daily activities (Whalen et al., 2009, 2006).

Parenting stress or distress is a broad concept that may refer specifically to stress generated while parenting or more broadly to distress reported by adults who are parents.

Parents of children with ADHD have elevated rates of both global psychological distress and parenting role-specific distress. There is considerable overlap between these two constructs, and they are often difficult to disentangle. Following Podolski and Nigg (2001), we focus here on a type of role-specific distress that occurs in the context of parenting. More specifically, we define maternal distress as contemporary reports by the mother, while she is with her child, of four mood states: stress, general worry, worry about the child, and sadness.

One of the problems endemic to research on parental distress and child symptomatic behavior is the potential role of source factors or method variance. Mothers are not only the primary caregivers but also the primary sources of information about their children. Mothers who are distressed or depressed may be especially likely to view and report their child’s behaviors as problematic, perhaps because they are more attuned to problems or have lower thresholds for undesirable behavior (Chi & Hinshaw, 2002). Thus, it is difficult to know how much of the association between child behavior problems and maternal distress or depression is attributable to the fact that mothers are usually the sole information sources for both domains. In the present study, we attempted to surmount this methodological hurdle, in part, by buttressing maternal reports of child behaviors with self-assessments by the child.

Method

Participants

There were 51 mother-child dyads (37 boys, 14 girls; M_{age} 10.63, SD 1.23) in the ADHD group and 58 (35 boys, 23 girls; M_{age} 10.41, SD 1.32) in the comparison group. This was a middle-income, educated sample, with 76% of mothers having earned an A.A. or higher degree. There were no significant group differences in child or maternal age, child gender, family size, family income, maternal education level, or marital status. Additional information about sample characteristics appears in Whalen et al. (2009). Participants were recruited through e-mail announcements, newspaper advertisements, and flyers distributed to local schools and community physicians.

Children were eligible for the comparison group only if they had no history of serious behavioral or learning problems and were not taking any psychoactive medications, according to maternal report. Inclusionary criteria for the ADHD group were a diagnosis of ADHD and ongoing treatment for at least 2 months with long-acting medication, either a stimulant such as Adderall or Concerta ($n = 26$), or the nonstimulant atomoxetine (Strattera, $n = 25$). All of these children were on stable doses and were reported, by mothers, to be doing well on their medication. Exclusionary criteria included a diagnosis of schizophrenia, pervasive developmental disorder, bipolar disorder, or prenatal drug exposure, and use of any psychotropic medication other than stimulants or atomoxetine. ADHD diagnosis was confirmed by maternal interview using the ADHD section of the Schedule for Affective Disorders and Schizophrenia for

School-Age Children (K-SADS; Kaufman et al., 1997). All of the children in the ADHD group (and none in the comparison group) met *DSM-IV* criteria for ADHD, based on this interview. The breakdown by ADHD subtype was 34 (67%) ADHD-combined, 13 (25%) predominantly inattentive, and 4 (8%) predominantly hyperactive/impulsive.

eDiary Monitoring and Maternal Distress Index

To sample a sufficient range of weekday and weekend experiences, eDiary monitoring was scheduled across 7 consecutive days during nonschool hours. The custom diary programs were installed on high-resolution Palm Tungsten PDAs (Palm, Inc., Sunnyvale, CA). All other computer functions (e.g., calendar, games) were locked out. Random schedules were generated such that each participant was signaled by a beep to complete a diary every 30 ± 6 min during the monitoring intervals (e.g., before and after school). If there was no response to the initial auditory signal, up to three reminder signals were emitted at 1-min intervals; the diary then became inaccessible until the next scheduled occurrence.

To facilitate independent reporting, the schedules were programmed so that the child's diary preceded the mother's diary by 5 ± 2 min. We decided against counterbalancing mother-child order and instead used this fixed order for two reasons. First, we were concerned that the mother's diary signal could cue a child to change behavioral course, and we wanted to minimize this type of reactivity. Second, a fixed order facilitated the pairing of mother and child reports.

Mother and child were instructed to complete their diaries independently and privately, without consulting each other. Before starting, mothers were interviewed about the forthcoming week's activities. To minimize disruption, the PDAs were programmed according to each family's schedule, and time-out periods were inserted so that no signals were emitted during planned events such as soccer games.

Diary items were written to tap contexts, behaviors, and moods that are relevant to the daily lives of parents and school-age children, to capture the quality of their interactions, and to include ADHD-relevant dimensions. Each item began with the phrase "At the beep" to remind mother and child to rate their current moods. Mood items included both a word and a small picture or icon and were rated on 4-point scales (not at all, just a little, pretty much, very much). To assist the children in using the scales, progressive shading and sizing of the mood icons were used to depict increasing points on the scales, and the "not at all" endpoint included a red circle with a diagonal line through it, the universal symbol for "no." Mothers and children mastered the basics rapidly and were able to complete an eDiary in ~ 2 min.

Ongoing maternal distress was operationally defined as the sum of four self-reported mood states: stress, general worry, worry about the child, and sadness (coefficient $\alpha = .73$). Maternal ratings of their child's ADHD-related behaviors covered three dimensions. Concentration was captured by a single item, "My child concentrated well." Hyperactivity/impulsivity was a composite of three items: "talked too much," "impatient," and "restless" (coefficient

$\alpha = .71$). Similarly, oppositionality was indexed by combining the three items "angry," "argued," and "disobedient" (coefficient $\alpha = .66$). Given the age of the children, the child diary was shorter than the parent diary, and thus the four child eDiary dimensions were all single items: mad or angry, restless, impatient, and focused or concentrating.

Baseline Measures

Maternal risk index. The adult component of the Assessment of Hyperactivity and Attention Scale (AHA; Mehlinger et al., 2002) was used to measure maternal ADHD symptoms. The items tap *DSM-IV* criteria and yield a hyperactivity/impulsivity and an inattention score. This instrument, which was designed to assess subclinical symptomatology, has been validated against semi-structured diagnostic interviews (Mehlinger et al., 2002). For the present sample, coefficient α was .85 for each of the subscales.

The Brief Symptom Inventory (BSI; Derogatis & Savitz, 2000), a shortened form of the classic SCL-90-R, was used to assess psychiatric symptoms. The depression dimension on the BSI contains six items that cover dysphoric mood, hopelessness, and loss of interest. The BSI depression scale correlates .95 with the full SCL-90-R depression scale, and strong reliability and validity have been documented (Derogatis & Savitz, 2000). For the present study, we dropped the suicidal ideation item, resulting in a 5-item scale with a coefficient alpha of .87.

The Disruptive Behavior Stress Inventory (DBSI; Johnson & Reader, 2002; Reader et al., 2009) asks primary caregivers to indicate whether each of 40 child-related stressors has been experienced in the past 6 months. For each item endorsed, they rate intensity using a 4-point scale that ranges from "not at all stressful" to "very stressful." Thus, the DBSI yields two scores: total number and average intensity of stressors. Because this measure asks putatively objective questions and focuses on the child rather than the mother, it provides an unobtrusive glimpse of maternal cognitions surrounding the child's ADHD.

In summary, the maternal risk index was a composite of the standardized scores, equally weighted, for the five indicators: AHA hyperactivity/impulsivity, AHA inattention, BSI depression, and DBSI number and intensity of child-related stressors. Coefficient α for this composite was .73.

Child behavioral self-esteem. Children completed the 36-item Self-Perception Profile for Children (SPPC), a widely used measure containing a global self-worth and five domain-specific scales (Harter, 1985). Following the specificity matching principle (Swann et al., 2008), we used the 6-item behavioral conduct scale, which contains items focused on child (mis)behaviors (e.g., whether the child does the right thing, does what he is supposed to do). Coefficient α for the present sample was .79.

Child behavioral and attention problems. To further characterize the sample, mothers also completed measures of the child's externalizing behavior problems (Swanson, Nolan, and Pelham *DSM-IV* scale or *SNAP-IV*; Swanson et al., 2001) and general psychopathology (Child Behavior Checklist or CBCL; Achenbach & Rescorla, 2001).

Procedures

An initial telephone interview was conducted to ensure that prospective participants met the inclusionary and exclusionary criteria and to explain the eDiary procedures. There were three phases during the 8-day course of this study: orientation, midweek review, and endpoint wrap-up. In the 2-hr orientation, mother and child were seen separately to ensure voluntary participation, confidentiality, and sufficient opportunity for questions and answers. After all procedures were explained, consent was obtained from the mother and assent from the child. The mother was interviewed about the child's problems using the K-SADS, and mother and child then completed the baseline questionnaires. Next, the PDAs were demonstrated; the diary items were reviewed; and mother and child practiced completing the eDiary. An interactive training program, using brief clips from children's movies, was developed to teach children how to use the 4-point scales and to ensure that they understood the meaning of each item. The 1-week eDiary monitoring began the following morning. Each dyad had a coach who was available to answer questions or resolve technical problems during the monitoring week.

The midweek review served to assess progress, enhance motivation after the initial novelty of the PDAs had worn off, address any questions, and download the data obtained to date to ensure against loss. Mother and child were given feedback on their adherence rates, and the child was paid a bonus incentive of up to \$10, depending on how many diaries had been completed. During an endpoint wrap-up session, mothers returned the equipment and received compensation (\$100 each for mother and child). Additional procedural details can be found in Whalen et al. (2009). All procedures were approved by the Institutional Review Board of the University of California, Irvine.

Analytic Plan

Data were analyzed in three phases. First, differences between the ADHD and comparison groups on baseline and eDiary variables were tested using independent samples t-tests for the baseline questionnaires and random effects GLS regression models for the eDiary variables. By using random effects modeling to analyze the eDiary data, we were able to examine differences between groups while adjusting for the nested nature of the repeated observations (Allison, 2005). Next, to determine whether child behavior problems were associated with elevated maternal distress on an ongoing basis (Question 1), fixed effects regression models were run. As described by Allison (2005), fixed-effects regression models provide some of the advantages of randomized experiments because they control for unmeasured individual differences by using each individual as his or her own control. Conceptually, these models allowed us to compute an effect of child behavior on maternal distress *within each dyad* (by regressing the repeated assessments of maternal distress on child behavior within each parent-child pair). The strength of the association between child behavior and maternal distress was allowed to vary across dyads;

there were some mother-child pairs where synchrony between behavior and mood was relatively weak and others where the relationship was quite strong. This procedure parallels the Hierarchical Linear Modeling (HLM) approach where within-dyad associations, or regression coefficients capturing the relationship between two variables over time, are allowed to vary between dyads (referred to as 'random effects') and are captured as part of the Level 1 model. In the present study, the coefficients derived from the fixed effects models can be interpreted as the expected increase in the mother's distress on occasions when her child's behavioral symptom levels were elevated one unit (i.e., one *SD*) above his or her mean during that same week. Separate analyses were conducted using maternal reports of child behaviors and child self-reported behaviors to help ensure that findings did not reflect shared method variance because of the mother reporting on her own levels of distress as well as the child's behaviors.

Tests of interactions were used to address the remaining three research questions. Question 2 tested whether group status (ADHD vs. Comparison) moderated the association between child problematic behaviors and maternal distress. Analogously, the potential moderator role of maternal risk was tested in Question 3, and that of child behavioral self-esteem was tested in Question 4. The moderation analyses tested whether the varying strength of the associations in child behavior and maternal mood *across the dyads* could be explained by characteristics of the mother and or the child (similar to the procedure used in an HLM framework where the Level-1 slopes are modeled as a function of Level-2 covariates).

Results

Descriptive Analyses

Diary reports and adherence. There were 7,370 paired diary reports, 3,253 from the ADHD group, and 4,117 from the comparison group. Two-thirds of these reports were made on weekdays (ADHD = 68%; Comparison = 66%). Adherence rates were quite high. Mothers in the ADHD and comparison groups responded to 93 and 94% of diary signals, respectively, and the corresponding rates for the children were 91 and 94%.

Overall group differences on baseline and eDiary variables. As can be seen in Table 1, the ADHD and comparison groups differed significantly on the baseline measures as well as on the maternal eDiary ratings, which were averaged over the study week. On all of these measures, the ADHD group scored in the more problematic direction. For the child eDiary self-ratings, the ADHD group scored higher on anger and lower on concentration; there were no group differences for impatience or restlessness.

Question 1: Do Ongoing Child Behaviors and Maternal Distress Fluctuate Together?

Results from fixed-effects regression models testing the momentary associations between maternal distress and child

Table 1
Group Differences in Baseline Assessments and eDiary Ratings

	ADHD <i>M</i>	COMP <i>M</i>	95% CI
Baseline assessments			
Maternal risk ^a	2.33	-2.05***	[-5.44, -3.31]
Child behavioral self-esteem ^b	2.87	3.26***	[0.20, 0.60]
eDiary: Aggregate maternal ratings			
Maternal distress	1.05	0.61**	[0.16, 0.68]
Child hyperactivity	1.08	0.30***	[0.57, 1.05]
Child oppositionality	0.69	0.28***	[0.28, 0.57]
Child concentration	1.57	1.98***	[-0.62, -0.29]
eDiary: Aggregate child self-ratings			
Anger	0.16	0.10*	[0.01, 0.14]
Impatience	0.21	0.18	[-0.06, 0.16]
Restlessness	0.21	0.21	[-0.15, 0.11]
Concentration	0.86	1.31*	[-0.71, -0.08]

Note. ADHD = attention-deficit/hyperactivity disorder group ($n = 51$); COMP = comparison group ($n = 58$); 95% CI = confidence interval of the mean difference.

^a Composite of standardized maternal self-ratings of adult ADHD (Assessment of Hyperactivity and Attention Scale), depression (Brief Symptom Inventory), and Disruptive Behavior Stress Inventory.

^b High scores denote high behavioral self-esteem.

* $p < .05$. ** $p < .01$. *** $p < .001$.

behaviors are presented in Table 2 and illustrate two main findings. First, elevated levels of maternal distress (relative to average levels of distress across the week) were more likely to be reported on occasions where the mother perceived her child to be hyperactive, oppositional, or lacking in concentration. Second, the momentary associations between maternal distress and child behavior could not be attributed to shared method variance, as higher levels of *child-rated* anger, impatience, and restlessness also predicted higher levels of concurrent maternal distress. Self-rated concentration was the only child behavior that did not predict maternal distress.

Question 2: Is the Synchrony Between Child Behaviors and Maternal Distress Stronger When the Child Has ADHD?

As shown in Table 2, diagnostic status moderated the strength of the relationship between maternal reports of

distress and all three of the child outcomes: Stronger links between child behaviors and maternal distress emerged for the ADHD versus the comparison group, as illustrated by the significant interaction terms. Despite the stronger synchrony between maternal distress and child behavior within the ADHD group, within-group analyses also revealed significant associations between child behaviors and maternal distress within the comparison group. With the *child* eDiary self-ratings of behaviors, tests of moderation by diagnostic group revealed significant interactions for anger, impatience, and concentration. As with the maternal ratings, these interactions reflected stronger associations between *child* self-rated behaviors and maternal distress for the ADHD than the comparison group. Separate analyses by group revealed that children's self-ratings of anger and restlessness predicted maternal distress in both the ADHD and the comparison groups. In contrast, child self-ratings of impatience and concentration predicted maternal distress only in the ADHD group.

Table 2
Parent- and Child-Reported Behaviors Predicting Maternal Distress by Group

Variable	Overall	Interaction	ADHD	COMP
	<i>b</i> (SE)	<i>b</i> (SE)	<i>b</i> (SE)	<i>b</i> (SE)
Maternal rating (n obs = 7,370)				
Hyperactivity	0.235 (.01)***	0.087 (.03)**	0.254 (.02)***	0.167 (.02)***
Oppositionality	0.397 (.01)***	0.118 (.03)***	0.432 (.02)***	0.314 (.02)***
Concentration	-0.198 (.02)***	-0.304 (.04)***	-0.364 (.03)***	-0.060 (.02)**
Child rating (n obs = 6,796)				
Anger	0.378 (.03)***	0.251 (.07)***	0.485 (.05)***	0.235 (.04)***
Impatience	0.120 (.03)***	0.156 (.06)*	0.194 (.05)***	0.038 (.03)
Restlessness	0.110 (.03)***	0.083 (.06)	0.154 (.05)**	0.071 (.03)*
Concentration	-0.021 (.02)	-0.074 (.03)*	-0.064 (.03)*	0.010 (.02)

Note. ADHD = attention-deficit/hyperactivity disorder group ($n = 51$); COMP = comparison group ($n = 58$); There were no significant interactions with child gender.

* $p < .05$. ** $p < .01$. *** $p < .001$.

Question 3: Are Links Between Child Behavior Problems and Maternal Distress Amplified by Maternal Risk?

As illustrated in Table 3, the associations between child behaviors and maternal distress were significantly stronger within dyads characterized by elevated levels of maternal risk. Although these increases were detectable, they were also quite modest. Parallel analyses using *child* eDiary self-reports revealed a consistent pattern of findings, with significantly stronger associations between maternal distress and *child*-reported anger, impatience, and restlessness emerging in dyads characterized by high levels of maternal risk; maternal risk did not moderate the association between *child*-reported concentration and maternal distress.

Question 4: Does Behavioral Self-Esteem in Children Amplify or Attenuate Associations Between Child Behaviors and Maternal Distress?

Children's behavioral self-esteem also moderated the concurrent associations between ongoing child behaviors and maternal distress, attenuating rather than strengthening these links. As can be seen in Table 3, the associations between maternal distress and maternal ratings of child behavior problems were weaker for children with higher levels of self-regard than for those who endorsed more negative descriptions of their behavioral conduct. No moderation effects emerged from parallel analyses using *child* eDiary reports.

Discussion

These findings document a synchrony in the behavioral ebb and flow of mother and child: As child ADHD-related behaviors fluctuated over the course of the day, so too did maternal distress levels. Especially noteworthy is the fact

that these child-related increases and decreases in maternal distress within and across days occurred not only for dyads in the ADHD group but also for dyads in which the child had no known behavioral or emotional problems. Because fixed effects (within-dyad) analyses were conducted, where each person served as his or her own control, the associations that emerged from these eDiary reports are not attributable to stable characteristics of mother or child such as type or degree of psychopathology. These findings extend previous reports of elevated distress levels in mothers of children with ADHD (Anastopoulos et al., 1992; Podolski & Nigg, 2001; Whalen et al., 2006) by demonstrating that distress levels are not merely a static characteristic of mothers but rather vary within and across days in conjunction with changes in children's behaviors. The present findings also demonstrate that links between what the child does and how the mother feels during the day are not specific to clinical samples but rather appear to be an ongoing aspect of everyday family life. It was also the case, however, that associations between maternal distress and child behaviors were stronger when the child had ADHD, as indicated by significant diagnostic group \times behavior interactions. These patterns, which emerged whether the mother or the child provided the eDiary ratings of child behaviors, are reminiscent of the long-standing adage that "children with ADHD are just like other children—only more so."

Maternal risk also moderated these associations, in the sense that distress was more strongly associated with child behavior problems in mothers with higher versus lower levels of risk. There are several possible mechanisms that may underlie these effects. A maternal sensitivity hypothesis would suggest that mothers with higher levels of risk may be more sensitive, reactive, or vulnerable to variations in their child's behavior problem levels. A child sensitivity hypothesis would suggest that the children of mothers with higher risk are more likely to react with problematic behavior when their mothers are showing signs of distress. This hypothesis has questionable validity, however, because many children find maternal distress uncomfortable and take it as a signal that it is time to "shape up."

A third possibility, which might be called an overgeneralization or negative halo hypothesis, is that when mothers with higher risk experience negative mood states, the negativity spreads to their perceptions and reports of the child. A fourth possibility, called the maternal threshold hypothesis, is that mothers with greater risk have lower thresholds for revealing negative things about themselves as well as their children; they may be less concerned with impression management than other mothers or more likely to adopt a clinical, symptom-finding stance. These latter two hypotheses are weakened by the fact that not all of the analyses relied on maternal ratings. Because some of the children's behavioral self-ratings also predicted maternal distress, the findings cannot be attributed solely to maternal rater bias. Thus, enhanced maternal sensitivity appears to be the most viable explanation, motivated perhaps by a need to delimit the depletion of psychological resources in a context of personal and family challenges.

Table 3
Moderators of the Momentary Associations Between Child Behavior and Maternal Distress

Moderator	<i>b</i> (<i>SE</i>)	<i>p</i>
Maternal risk		
Hyperactivity	0.013 (.003)	<.001
Oppositionality	0.010 (.003)	.004
Concentration	-0.041 (.005)	<.001
Child behavioral self-esteem		
Hyperactivity	-0.050 (.023)	.03
Oppositionality	-0.107 (.024)	<.001
Concentration	0.164 (.032)	<.001

Note. $n = 109$. Analyses were also run for the individual components of the maternal risk index, and the results were comparable to those for the composite, with two exceptions. First, although high levels of maternal inattention characteristics significantly amplified the associations between child behaviors and maternal distress, maternal hyperactivity characteristics did not. Second, maternal depressive characteristics significantly moderated the child behavior-maternal distress associations for child hyperactivity and concentration, but this interaction was not significant for child oppositionality.

Whereas the links between child behaviors and maternal distress were robust, the moderation effect for maternal risk was small. Previous studies have also found that child behaviors are the major contributors to maternal caregiving stress, with maternal characteristics playing a detectable but more minor role (Johnston & Mash, 2001). The relatively small moderation effect for maternal risk may be attributable in part to the use of a sample of mothers with low levels of psychological problems. Maternal risk may exert stronger moderation effects in a more heterogeneous sample of mothers, especially if demographic factors such as low education level, economic deprivation, and single-parent status are included in the risk index. Of note is the fact that significant moderation effects emerged for two of the three child behavior dimensions (hyperactivity and oppositionality) when the interaction was tested within the comparison group alone, suggesting that maternal risk is not merely a proxy for child ADHD.

Children's behavioral self-esteem also moderated the links between maternal distress and child behaviors: Higher behavioral self-esteem appeared to attenuate these associations, whereas lower self-esteem accentuated them. Slomkowski et al. (1995) reported that the lower self-esteem of adolescents with current or past ADHD was related to both the severity of their current ADHD symptoms and their overall psychosocial adjustment. In the present study, children's behavioral self-esteem was inversely correlated with maternal ratings of externalizing problem severity on the CBCL ($r = -.36$; $p < .001$) as well as with ratings of inattention, hyperactivity, and oppositionality on the SNAP ($r_s = -.30, -.39, \text{ and } -.37$, respectively; all $p_s < .01$). Children attain lower behavioral self-esteem scores by endorsing problematic behaviors. Thus, they not only have more severe behavior problems than their counterparts but also know and readily acknowledge that their behavior is problematic. Their troublesome behaviors might be more willful than unwitting and, as such, more distressing for mothers and more difficult for them to contain or redirect.

Strengths and Limitations

One noteworthy strength of this study was that children as well as mothers provided eDiary reports and baseline measures. Often it is necessary to rely on a single source, most often the mother, for both the predictors and the outcomes. Such single-source methods are always limited because maternal distress may drive negative perceptions of the child's behavior somewhat independently of the child's actual behaviors. Although this possibility cannot be ruled out in the present study, the fact that the child's self-ratings were also linked to maternal distress suggests that the findings are not attributable primarily to maternal rater bias.

The findings also illustrate the value of a hybrid approach that compares diagnosed clinical samples to nonclinical samples using dimensional predictors and outcomes, making it possible to determine whether parent-child processes differ in kind (qualitatively) or only in extent (quantitatively). The findings indicate that even at subclinical levels, maternal ADHD and depressive characteristics, as well as

cognitions about the child's impact on family life, play a role in maternal reactivity to children's behavior problems.

eDiary assessments have a number of distinct advantages. They enable monitoring in natural settings without disrupting the flow of everyday activities. They also enable high-density recording of ongoing behaviors that captures multiple glimpses of life as it is lived. They minimize retrospective biases and, because they include date and time stamps as well as lock-out features, they prevent catch-up or last-minute "parking lot" reporting at other than designated times. They are portable, efficient, and confidential. With careful training and adequate incentives, children as well as adults can record their actions and affect using PDAs or smart phones. Indeed, observations of and comments by the child participants in our studies indicate that children tend to find these methods more palatable and engaging than traditional questionnaires or interviews. In the present study, these methods offered the unique advantage of allowing us to go beyond global assessments and begin to probe the dynamic interplay between parent moods and child behaviors.

It should be noted, however, that these methods also have a number of limitations. Numerous reports throughout the day can be burdensome, and these methods are ill-suited to individuals who are disorganized or living chaotic lives. There is also the possibility of reactivity, although studies to date indicate that the magnitude of such effects is generally small (Aaron et al., 2005). There are also questions about optimal observation intervals, given the dearth of theory and empirical findings to guide such decisions. For the present study, we chose a high-resolution (30-min) temporal window. In future eDiary studies, it would be useful to compare various temporal windows to identify the most sensitive intervals for specific research questions, controlling for associations that lag across moments, hours, or days, and to explicitly model the lead-lag associations to ensure, for example, that the observed concurrent relationships are not being driven by autoregressive properties of the data.

There are also limitations in the sample that should be considered when interpreting the results. These were middle-income, primarily White families, and our attempts to recruit fathers as well as mothers met with only limited success. Nor did sample sizes allow for a full consideration of child sex differences, an important topic for future research. All of the children in the ADHD group were receiving pharmacotherapy with long-acting stimulants or atomoxetine, which means that the results cannot be generalized to unmedicated children with ADHD. It is difficult to know, however, whether or how ongoing treatment may have influenced the results, especially given the report by Reader et al. (2009) that mothers of children with ADHD who were taking medication reported more child-related stress than did mothers of children with ADHD who were not receiving pharmacotherapy.

Clinical Implications

Clinical studies indicate that parental distress often remains elevated even when children with ADHD receive

treatment (Reader et al., 2009; Wells et al., 2000), and there is no question that such distress may have a negative impact on family relations and child outcomes (Johnston & Mash, 2001). Such findings underscore the need to evaluate and treat child behavior problems in the context of the family, attending especially to the psychological functioning of parents. Teaching parents to identify their personal triggers and analyze the “what,” “when,” and “where” of perturbations in their own distress levels may help them learn to cope with unpleasant affective changes in adaptive ways, thereby decreasing the cumulative emotional toll of raising a child with a chronic disorder.

Summary and Conclusion

High-density eDiary reports revealed momentary associations between maternal distress and child ADHD-type behaviors in everyday life, whether child behaviors were reported by mothers or children. This mother-child synchrony emerged for the comparison as well as the ADHD group, although the associations were stronger when the child had ADHD. Maternal risk also strengthened these associations, whereas effects were attenuated among children with positive views of their behavioral conduct. These results affirm the value of eDiary methods in illuminating the ebb and flow of mother-child moods and behaviors. Perhaps one of the most meaningful findings is that variations in child problematic behaviors were linked to fluctuations in maternal distress not only when the child had a clinical diagnosis but also when the child had no known problems. A fruitful research direction is within-dyad analyses of behavioral and contextual triggers as well as factors that buffer these effects. This type of information can help guide not only interventions targeted on improving quality of life in families of children with ADHD, but also programs to help all parents recognize and manage the daily stressors of child rearing.

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