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Maternal Executive Function, Harsh Parenting, and Child Conduct Problems

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Abstract

Background—Maternal executive function and household regulation both are critical aspects of optimal childrearing, but their interplay is not understood. We tested the hypotheses that 1) the link between challenging child conduct problems and harsh parenting would be strongest for mothers with poorer executive function and weakest among those with better executive function, and 2) this mechanism would be further moderated by the degree of household chaos.

Methods—The socioeconomically diverse sample included 147 mothers of 3-to-7 year old children. Mothers completed questionnaires and a laboratory assessment of executive function.

Results—Consistent with hypotheses, harsh parenting was linked with child conduct problems only among mothers with poorer executive function. This effect was particularly strong in calm, predictable environments, but was not evident in chaotic environments.

Conclusion—Maternal executive function is critical to minimizing harsh parenting in the context of challenging child behavior, but this self-regulation process may not operate well in chaotic environments.

Keywords

parenting; executive function; emotion regulation; conduct problems

Angry, hostile parenting behavior and child conduct problems (e.g., anger, opposition, aggression) covary, and are more prevalent in stressful circumstances (Belsky & Barends, 2002; Chang, Schwartz, Dodge, & McBride-Chang, 2003; Goodnow, 2002; Patterson, 1997). There is a need for research that addresses contextual influences on parents' regulation of harsh parenting, in order to advance understanding of the processes underlying harsh parenting that put families and children at risk for a host of poor outcomes. Our goal in the current study was to examine the interplay of maternal executive function (i.e., regulation of attention, inhibitory control, and working memory) and household chaos involved in the connection between harsh parenting and child conduct problems.

Executive Function and Harsh Parenting

Child behavior that is angry and oppositional is challenging to manage. When faced with these behaviors, a parent must evaluate situations and potential responses in order to regulate her or his own thoughts and emotions in an effort to respond effectively and reduce the child's problematic behavior (Lorber, O'Leary, & Kendziora, 2003). If high levels of negative affect (e.g., anger, hostility) become part of a stable pattern of harsh parenting, it increases the risk of child maltreatment and the likelihood that child conduct problems will

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escalate (Deater-Deckard, 2004; Dodge, Bates, & Pettit, 1990; Patterson, 1997). Maternal executive function (i.e., regulation of attention, inhibitory control and working memory; Friedman et al., 2008) may be the key to avoiding harsh parenting. Executive attention and memory processes could support management of frustration and anger in the parent-child relationship, particularly when faced by challenging child behavior (Barrett & Fleming, 2011; Wahler & Dumas, 1989). This is because executive function promotes regulation of thoughts and emotions through reflection and consideration of potential responses to a challenging situation, as opposed to merely reacting in anger (Baddeley, 1998; Barrett, Tugade, & Engel, 2004; Ochsner & Gross, 2008).

Accordingly, executive function could be a critical aspect of emotion and behavior regulation for parents, within the context of child behavior that is oppositional and emotionally aversive to the parent. When child behavior is challenging, the parent must regulate feelings of frustration and anger to prevent reacting in anger to the child’s behavior. Recent research has shown that mothers with poorer working memory are more emotionally reactive to child conduct or behavioral problems (Deater-Deckard, Sewell, Petrill, & Thompson, 2010). The current study extends this line of research by examining maternal executive function using a comprehensive battery of executive function tasks spanning attention, inhibitory control and working memory in a socioeconomically diverse sample of families. Our first hypothesis was that there would be a stronger link between child conduct problems and harsh parenting among mothers with poorer executive function.

Regulation in Chaos

Regulation of harsh parenting also depends in part on aspects of the broader family context. The degree of household “chaos” (i.e., noise, crowding, lack of routines) may be particularly important, because it probably taxes parents’ capacities for regulating their emotions in challenging situations. The wide variation in chaos between households is stable over time, and is related to a host of parental, family and child factors ranging from poverty to harsh parenting to child IQ and behavioral disorders (Deater-Deckard et al., 2009; Evans & Wachs, 2009; Pike, Iervolino, Eley, Price, & Plomin, 2006). Household chaos exerts its influence on children’s developmental outcomes in part through its impact on parenting behaviors and parent-child interactions (Coldwell, Pike, & Dunn, 2006; Evans, Lepore, Shejwal, & Palsane, 1998). Furthermore, chronic chaos impairs cognitive capacities and contributes to chronic stress at emotional, behavioral, and physiological levels (Erickson, Drevets, & Schulkin, 2003; Evans, Hygge, & Bullinger, 1995), interferes with executive regulation of emotion and behavior (Blair et al., 2007), and has been associated with problems in parental regulation of attention (Mokrova, O’Brien, Calkins, & Keane, 2010).

To our knowledge, there is no prior research regarding whether and how chaos constrains executive function’s potential role in the regulation of harsh parenting. Therefore, our second hypothesis was that the regulatory role of maternal executive function identified in hypothesis 1 would itself depend on (i.e., statistically interact with) the level of chaos in the home in predicting variance in harsh parenting. However, this anticipated statistical interaction could reflect one of two competing processes. Executive function may support regulation of harshness only in *more* chaotic homes. Accordingly, the potential benefits of strong executive function when caring for a child with challenging conduct problems might be particularly important when the broader family context lacks structure and predictability. In contrast, executive function may support regulation of harshness only in *calmer* homes. Accordingly, the regulatory effects of executive function on harsh parenting in the face of challenging child behavior may be overridden by the prevailing chaos of the household environment. We explored which of these two competing predicted effects best fit the data.

Method

Participants

The sample included 147 mother-child pairs. Mothers were 32.80 years old on average (*SD* = 6.17). Half of the children were female, and they were 57.29 months old on average (*SD* = 15.54). Two-thirds of the mothers participated by attending a laboratory visit at a downtown office in a small urban area, and the other third attended a laboratory visit on a nearby rural university campus. The rural laboratory site included mothers that tended to be higher in SES, and these mothers also had the youngest children in the study. Site was coded 1 = urban, 2 = rural university, and was included as a covariate in the analyses along with SES and child age. The study was conducted in compliance with regulations from the Institutional Review Board. Each participant completed an informed consent procedure and signed a consent form.

The families were socioeconomically diverse. Sixty-nine percent of the mothers were cohabiting or married and living with the child's biological father, 6% were separated or divorced, and the remaining 25% were single mothers. For educational attainment for mothers/fathers: 22/31% high school diploma/GED or less; 28/29% some college or an Associate's degree; 30/19% 4-year degree; and 20/20% post-graduate degree. This distribution was similar to that found for the region's population (based on the 2005–2007 American Community Survey data, located at the US Census Bureau website, http://www.census.gov/acs). Fourteen percent lived in an apartment, 12% in a duplex, townhouse or mobile home (scored 0 = multiple family/high density dwelling), and 74% resided in a detached single family home (scored 1 = single family home). To derive a socioeconomic composite z-score for analyses, we standardized and averaged both parents' education levels and the binary housing score. The first principal component explained 61% variance, with loadings from .64 to .86.

Mother reported race for themselves and the child's biological father (mother/father): 74/68% Caucasian, 12/18% African American, 1/2% Asian, 8/7% multiple races, 1/1% other, and 4/4% not specified. This distribution approximated that found in the population in the region (based on the 2005–2007 American Community Survey data, located at the US Census Bureau website, http://www.census.gov/acs). Only a small number of parents (4% mothers, 2% fathers) were reported to be Hispanic.

Measures

Maternal Harsh Parenting/Negativity—Maternal self-reported harsh parenting was measured using the negativity scale (α = .90, *M* = 2.48, *SD* = .88, *range* = 1 to 4.38 on a 5-point Likert scale) from the Parent Feelings Questionnaire (Deater-Deckard, 2000). Sample items include, "My child and I fight or argue more than I would like to" and "Sometimes my child's behavior makes me so angry I can barely stand it" and "Sometimes I raise my voice with my child, especially after I've had a bad day". In addition, mothers reported their negativity using the three item harsh verbal scale (α = .73, *M* = 3.23, *SD* = 1.08, *range* = 1 to 5 on a 5-point Likert scale) and the two item verbal shaming scale (inter-item *r* = .50, *M* = 2.14, *SD* = .88, *range* = 1 to 5 on a 5-point Likert scale) from a brief discipline questionnaire developed by Lansford et al. (2010). Sample items include "raise your voice, yell, or scold your child?" and "tell your child s/he should be ashamed". For these variables, distributions were normal and spanned the entire potential range. The first principal component of these three variables explained 70% of the variance, with loadings from .79 to .89. Each scale was standardized, they were averaged, and the resulting composite standardized again to yield a z-score representing maternal harsh negativity toward the child.

Child Conduct Problems—Each mother also rated her child's challenging conduct problems. Relevant scales from the Strengths and Difficulties Scale (SDQ; Goodman, 1997) and the Child Behavior Questionnaire Short Form (CBQ-SF; Putnam & Rothbart, 2006) were used to compute composite scores. We used conduct problems (α = .63, *M* = 1.55, *SD* = .80, *range* = 1 to 5 on a 5-point scale) from the SDQ, and activity level (α = .71, *M* = 5.08, *SD* = .90, *range* = 2.86 to 7 on a 7-point scale), impulsivity (α = .72, *M* = 4.54, *SD* = 1.00, *range* = 2.33 to 7 on a 7-point scale), and frustration/anger (α = .80, *M* = 4.40, *SD* = 1.21, *range* = 1.67 to 7 on a 7-point scale) from the CBQ-SF. The distribution for SDQ conduct problems approximated norms for 4–7 year olds in the United States, though with some range restriction. The CBQ-SF scales were widely distributed and typical for community samples. The first principal component of these four variables explained 53% of the variance, with loadings from .65 to. 80. The scores were standardized, averaged, and standardized again to compute a composite z-score representing child conduct problems.

Household Chaos—Mothers completed the abbreviated Chaos, Hubbub and Order Scale (Matheny, Wachs, Ludwig, & Phillips, 1995) that has been used in several studies in the UK (Coldwell et al., 2006, α = .56; Pike et al., 2006, α = .63) and the US (Deater-Deckard et al., 2009, inter-rater and test-retest reliabilities in .6 to .8 range). It includes six items scored using a 5-point Likert-type scale (e.g., "You can't hear yourself think in our home", "It's a real zoo in our home", and "The atmosphere in our house is calm" [reverse scored]). Reliability (α = .65) was consistent with prior studies. The distribution was somewhat skewed toward the "calmer" end of the distribution, with a mean (2.26) below scale midpoint of 3 on the 5-point scale. However, scores spanned most of the potential range of the scale (*SD* = 0.66, *range* = 1 to 4).

Maternal Executive Function—There is a single executive function construct that is represented by attention shifting, inhibitory control, and working memory (Friedman et al., 2008). We used counterbalanced tasks to measure executive attention, inhibition, and memory (Engle & Kane, 2004; Davis & Keller, 1998; Heaton & PAR Staff, 2003). Descriptive statistics for each task score indicated performance distributions that were typical for young-to-middle-age adults. To increase measurement reliability we computed a composite z-score. Mothers also completed the PPVT-4 (Dunn & Dunn, 2007) as a measure of verbal ability; the scores approximated a population distribution, *M* = 102.46, *SD* = 14.64.

The Stroop color-word task was administered on a computer (Stroop, 1935). Participants named the color of the ink of color words in which the actual color of the letters and the color being named are congruent (e.g., "red" written in red ink) or incongruent (e.g., "red" written in yellow ink), following an initial reading trial in which the participant simply read the color of the ink of a series of Xs. We used a set of 20 words with mixed incongruent and congruent stimuli (which minimizes practice effects), and mothers' scores on the task were calculated as the average reaction time for correct responses, *M* = 1,667.27 ms, *SD* = 781.17 ms.

A computerized version of the Wisconsin Card Sorting Test (WCST) involved presentation of four stimulus cards with different colors, quantities, and shapes (Heaton & PAR Staff, 2003). Mothers attempted to match a stack of 64 (at the rural university lab) or 128 (at the urban lab) cards to the original stimulus cards according to a rule which they had to ascertain (i.e., either by color, quantity or shape). The matching rule changed several times and the participant had to infer the new rule based on feedback from the computer regarding correct vs. incorrect responses. We used the number of perseveration errors per 64 trials which represents mistakes made by continuously using the same incorrect matching rule (i.e., difficulty inhibiting the dominant practiced response) even after receiving feedback indicating that the rule was no longer correct, $M = 6.67$ errors, $SD = 5.01$ errors.

A computerized version of the Tower of Hanoi was used to measure mothers' problem solving abilities involving executive function and prefrontal activation (Davis & Keller, 1998). The task involved moving three disks of different sizes to a target peg in the same order, using two rules: only one disk can be moved each turn, and larger disks cannot be placed on smaller disks. Time to completion (up to 60 secs) was used as the score for the task, $M = 38.48$ secs, $SD = 16.57$ secs; those who did not finish received a score of 60 secs.

In addition, an experimenter administered a backward digit span task. The experimenter read a seemingly random series of single-digit numbers (0–9) and the participant attempted to reproduce the sequence in reverse. Following a practice trial with two sets of two digits, the task began with a four digit sequence and then added one more digit in each subsequent trial. Mothers had two chances to correctly reproduce the new digit sequence in reverse. The task ended when the mother provided incorrect responses on both chances. The last correct trial was used as the mother's backward digit span score, $M = 5.09$ digits, $SD = 2.17$ digits.

To estimate the overall executive function construct, we computed and analyzed a composite score representing attention, inhibition, and working memory (Friedman et al., 2008). The first principal component among the four task scores (with Stroop, Wisconsin Card Sorting Test, and Tower of Hanoi scores reversed so that higher scores represented better performance) explained 41% of the variance ($\lambda = .57$ to .75). All four scores were standardized and averaged for every mother who had at least one task score. The average score was standardized again to yield a composite z-score that was widely and normally distributed.

Results

As noted in the Method section, distributions for variables were wide ranging and typical of community samples of adults and children. Table 1 includes descriptive statistics and correlations for the composite scores and individual variables used for data analysis. Mothers at the rural university lab site had higher SES and PPVT scores. Also, as noted in Methods, all of the mothers of the youngest children were assessed at this site, resulting in site and child age being substantially negatively correlated. Higher SES and PPVT scores were associated with being older, less household chaos, better executive function, and fewer child conduct problems. Higher chaos, more maternal harsh negativity, and more child conduct problems covaried.

To test the hypothesis regarding maternal executive function and to explore the moderating effect of chaos, we used hierarchical linear regression (step 1: covariates including site, SES, PPVT, mother age, child age); step 2: main effects; step 3: two-way interactions; step 4: three-way interaction) to predict maternal harsh negativity (predictors centered). Test statistics and standardized regression coefficients are shown in Table 2. The second and fourth steps of the equation were significant and the first and third steps were marginally significant. The overall model was significant, $F(12, 134) = 6.13$, $p < .001$, accounting for 30% of the variance (*adjusted* R^2) in maternal harsh negativity.

Consistent with the first hypothesis, the two-way interaction between maternal executive function and child challenging behavior was significant.[1] We used analysis of simple slopes at one standard deviation above and below the mean for maternal executive function (e.g., Holmbeck, 2002), representing the statistical prediction of maternal harshness by child conduct problems. These results are shown in Table 3. For the composite score, the results supported the hypothesis that the link between child conduct problems and maternal harsh negativity would be evident among mothers with poorer executive function (β = .55) but more modest among mothers with strong executive function (β = .17). We also estimated simple slopes for each of the four individual tasks, also shown in Table 3. Results for the card sorting and tower tasks closely resembled the results for the composite; results for digit span and Stroop did not.

As anticipated, the three-way statistical interaction between child behavior, maternal executive function, and household chaos also was significant. To interpret this more complex interaction pattern, we computed bivariate correlations between child behavior and maternal harsh negativity above and below the sample means for executive function and household chaos. These are shown in Table 4. For the composite score, in lower chaos households, the two-way interaction between executive function and child behavior was present; child behavior and maternal harshness were moderately associated only among mothers with poorer executive function (Fisher difference test in correlations, z = 2.17, p < .05). In contrast, in higher chaos households, there was a moderate correlation between child behavior and maternal harsh negativity regardless of maternal executive function (Fisher z = 1.13, p < .27). Also as shown in Table 4, the same overall pattern was found in the correlations for the individual tasks, with the exception of Stroop performance. To rule out the alternative explanation that SES (rather than chaos) was the essential moderator, we tested the same hierarchical regression model but swapped household chaos and SES in the equation. The three-way interaction between SES, maternal executive function, and child conduct problems was negligible and nonsignificant, β = .07, p < .40. Chaos, not SES, interacted with executive function in accounting for the link between child conduct problems and maternal harsh parenting.

Finally, to test for replication, we reexamined data from Deater-Deckard et al. (2010) in which maternal working memory moderated the association between sibling differences in observed challenging behaviors and differential observed harsh maternal negativity. Chaos was measured in that study using the same instrument as the current study, but its moderating effect was not reported previously. Participants included 216 mother-twin triads. The mothers were older and more educated and affluent, and the twins slightly younger, than those in the current study. We found the same pattern. The correlation between sibling behavior problems differences and differential maternal negativity was moderated by maternal working memory in calm but not chaotic households (mean split). In non-chaotic homes, r(47) =.62, p < .001 for those with poorer working memory, but r(44) = .00, n.s., for those with stronger working memory. In contrast, in chaotic homes, r(55) = .46, p < .001 for those with poorer working memory and r(44) = .59, p < .001 for those with stronger working memory.

Discussion

Maternal executive function appears to be a key component in the self-regulation of negative emotions arising from parenting in the face of challenging child behavior. Executive attention, response inhibition and memory represent a general factor (Friedman et al., 2008), and variance in this factor is important because of its role in the cognitive processes involved in the parent's self-regulation of emotion and behavior (Barrett & Fleming, 2011; Ochsner & Gross, 2008; Wahler & Dumas, 1989). Our first hypothesis was that child conduct problems (i.e., noncompliance, anger, impulsivity) would be linked with higher

[1]Note that the interaction was tested along with two other two-way interactions that were not hypothesized, but that were required for testing the three-way interaction. The set of three two-way interactions was marginally significant as a third step in the equation. The hypothesized two-way interaction was itself significant whether it was entered in its own step in the equation, or entered with the other two interaction terms as reported in Table 2.

levels of maternal harsh negativity but only among mothers with poorer executive function. This hypothesis was confirmed. For mothers with poorer executive function, child conduct problems statistically explained 30% of the variance (β = .55) in maternal harsh negativity based on analysis of simple slopes. In contrast, for mothers with better executive function, child behavior was not significantly associated with maternal harsh negativity (β = .17). This pattern was seen for the composite executive function score, and for two of the four specific executive function task scores. The results were very similar to Deater-Deckard et al. (2010), even though the current study utilized different methods that assessed a broader range of cognitive functions, and had a more diverse sample. Indirectly, the finding also aligns with Lee et al. (2010), who reported harsher parenting among mothers with a version of dopamine transporter gene that has been linked with poorer executive function (Lee et al., 2010).

However, the role of executive function in modulating harsh parenting may depend on contextual factors—in particular, the degree of uncertainty and stress in the environment that can impair cognitive processes that otherwise operate more automatically when no stressors are present (Macrae & Bodenhausen, 2000). Household chaos is a prime suspect in the etiology of harsh parenting, given theory and empirical evidence that it plays a key role in the etiology of poor parenting and environmental uncertainty and inconsistency, even after controlling for parental IQ and SES (Coldwell et al., 2006; Evans & Wachs, 2009; Pike et al., 2006). We anticipated that household chaos would further moderate the effect of maternal executive function, and we explored two competing processes—one in which the moderating effect of maternal executive function was strongest in chaotic households, versus one in which the effect was weakest in chaotic households. Results were consistent with the latter process. The moderating effect of maternal executive function (Table 3) was found only in calmer households. In contrast, maternal executive function did not modulate maternal harshness in chaotic homes; this effect was replicated in reexamination of the data from Deater-Deckard et al. (2010). Thus, executive function's role in regulating harsh parenting may not function well in chaotic environments. This mirrors a prior study (Mokrova et al., 2010), in which there was a positive association between ineffective parenting and father ADHD symptoms only in non-chaotic households. Future research must address whether it is the stress, fatigue and uncertainty of chaotic environments that interferes with the self-regulating effects of executive function (Erickson et al., 2003) for parents of young children with challenging behaviors.

Conclusions and Implications

There are several limitations to consider. First, the design relied heavily on mothers' reports, which introduces potential method and informant variance. Second, chaos was assessed using a brief questionnaire that does not fully capture the variance in household disarray. In future, more thorough measurement with interview and observation is warranted. Third, the cross-sectional correlational design did not permit inferences of causality. We focused on statistical prediction of maternal harshness, but there is ample evidence that harsher parenting predicts growth in child behavior problems (Patterson, 1997). However, it does not seem plausible that harsh parenting would influence child behavior problems in non-chaotic households only for mothers with poorer working memory. We know of no theory or empirical findings regarding household chaos or maternal self-regulation that would lead to such a prediction. Nevertheless, quasi-experiments and experiments are needed before strong causal inferences can be made. Fourth, we did not have multiple measures of each sub-component of executive function (e.g., attention shifting, inhibition, working memory), and individual task scores have limited predictive validity compared to the composite score. As a result, caution is warranted when interpreting results for individual tasks in isolation.

These limitations aside, the findings lead to several conclusions. First, there are temporally stable differences between households in stressors and uncertainty that have serious consequences for parent-child relationship processes and children's developmental outcomes (Evans & Wachs, 2009). The current study showed that in chaotic households, there is no mitigating effect of maternal executive function on the link between challenging child behavior and harsh parenting. Second, a simple "trait" explanation for the role of maternal executive function in harsh parenting is not plausible. The correlations between maternal executive function, harsh negativity, and chaos were modest (see Table 1). Instead, the results require a process explanation involving transactions between person traits and states and contextual factors, as shown in research on adult social cognition and self-regulation (Higgins, 1999; Mischel, 2004; Wilkowski & Robinson, 2008).

Third, although adult self-regulation processes may seem immutable, they are amenable to change through regular training (Baumeister, Gaillot, DeWall, & Oaten, 2006). Because all caregiving situations are unpredictable at times, parental executive function may be a powerful mechanism for enhancing parenting interventions. It remains to be seen whether the training of attention and working memory can increase the use of reappraisal or improve regulation of negative emotional reactions to challenging child conduct problems. Nevertheless, there is cause for optimism. Some aspects of executive function can respond well to training, with effects on neural activation and connectivity (Olesen, Westerberg, & Klingberg, 2003; Takeuchi et al., 2010) that may generalize to other areas of cognitive function (Jaeggi, Buschkuehl, Jonides, & Perrig, 2008).

In sum, because self-monitoring is critical to effective self-regulation of emotions, thoughts and behaviors (Karoly, 1993), executive function may be a useful target for parenting prevention and intervention efforts because it is something that is relatively easy for parents to understand and experience. It also may provide a platform for helping parents learn to identify signs of the impairing effects of stress, fatigue, and other factors on their self-regulation, particularly when operating under conditions of stress or uncertainty. Nevertheless, even the strongest executive function capacity may not be effective at supporting self-regulation in the face of challenging child behavior if the broader family context is one of chronic uncertainty and chaos. Regulation does not solely operate at the level of the individual, but encompasses interpersonal relationship processes and person-environment processes (Diamond & Aspinwall, 2003; Evans & Wachs, 2009). Targeting household regulation is as important as targeting self-regulation when intervening to strengthen parenting skills and improve children's developmental outcomes.

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Key Points

- Maternal self-regulation and household regulation both are known to contribute to children's maladaptive development
- The current study is the first to examine the interplay between maternal executive function and household chaos
- Results show that stronger maternal executive function (attention, working memory) dampened the link between challenging child behavior and harsh parenting, but this process was not evident in highly chaotic households
- Prevention and intervention efforts to improve caregiving for high-risk children may maximize effects by targeting maternal self-regulation and household regulation

Table 1

Descriptive Statistics and Bivariate Correlations

	1	2	3	4	5	6	7	8	9
1. Site (1 = urban, 2 = rural)	1								
2. SES (z)	.28**	1							
3. PPVT	.31***	.57***	1						
4. Mother age (years)	.02	.52***	.30***	1					
5. Child age (months)	−.78***	−.15	−.16*	.14	1				
6. Chaos	−.04	−.23**	−.20*	−.06	.09	1			
7. Executive Function (z)	−.03	.35***	.39***	.03	.08	.10	1		
8. Child Conduct Prob (z)	.02	−.16*	−.16*	−.11	−.06	.31***	−.05	1	
9. Mother Harsh Neg (z)	−.03	.01	.17*	.14	.05	.31***	.08	.37***	1
Means	1.30	0.05	102.37	32.80	57.29	2.26	0.08	−0.01	−0.02
Standard Deviations	0.46	0.93	14.57	6.17	15.54	0.66	0.93	1.03	0.98

* $p < .05$,

** $p < .01$,

*** $p < .001$ (two-tailed).

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Table 2

Hierarchical Regression Results for the Prediction of Maternal Harsh Negativity

	Step 1: Covariates	Step 2: Main effect	Step 3: Two-way	Step 4: Three-way
Δ*F* (*df*)	**(5, 141) = 2.20^{+}**	**(3, 138) = 13.12*****	**(3, 135) = 2.25^{+}**	**(1, 134) = 9.04****
Δ *Adj R*^{2}	**.04**	**.20**	**.02**	**.04**
Standardized regression weights:	*β*	*β*	*β*	*β*
Step 1: Site	−.02	−.08	−.05	−.09
SES	−.26*	−.16	−.14	−.14
PPVT	.26*	.34***	.32**	.34***
Mother age	.17	.15	.13	.18
Child age	.04	.02	.05	.02
Step 2: Exec Function (EF)	---	−.03	.00	−.10
Conduct Probs (CP)	---	.35***	.32**	.29**
Household Chaos	---	.23**	.21*	.25*
Step 3:EF x CP	---	---	−.18*	−.19*
EF x Chaos	---	---	.02	−.08
CP x Chaos	---	---	.09	.13
Step 4: Chaos x EF x CP	---	---	---	.27**

* $p < .05$,

** $p < .01$,

*** $p < .001$ (two-tailed).

Table 3

Simple Slopes for Child Behavior Predicting Maternal Negativity as Function of Maternal Executive Function (Composite and Sub-Tasks)

	Executive Function Performance (±1 SD from Mean)	
	−1 SD	+1 SD
Composite	.55***	.17
Card Sort	.54***	.18
Tower	.53***	.16
Digit Span	.39***	.31**
Stroop	.40***	.31**

** $p < .01$,

*** $p < .001$ (two-tailed)

Table 4

Correlations (df) between Maternal Harsh Negativity and Child Challenging Behavior as Function of Maternal Executive Function (Composite and Sub-Tasks) and Chaos

	Executive Function Performance	
Composite:	**Below Average**	**Above Average**
Low chaos	.47** (39)	−.10 (31)
High chaos	.53** (29)	.40** (40)
Card Sort:		
Below average	.50** (31)	.06 (40)
Above average	.53** (29)	.31+ (37)
Tower:		
Below average	.37* (40)	.01 (25)
Above average	.59** (27)	.35* (36)
Digit Span:		
Below average	.36* (40)	.10 (30)
Above average	.43** (34)	.41* (32)
Stroop:		
Below average	.23 (40)	.33 (31)
Above average	.50** (28)	.41** (39)

+ $p < .06$,

* $p < .05$,

** $p < .01$,

*** $p < .001$ (two-tailed).