CLARITY AMONG CHAOS: DISENTANGLING THE RELATIONSHIP BETWEEN CAREGIVER STRESS AND CHILD EXECUTIVE FUNCTION

by

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While parenting is often rewarding, there are some aspects of parenthood that are stressful. One potential source of stress for parents is child behavior, especially for parents of children with low executive function (EF), who may feel stress due to their child's difficulties with focus, task completion, and emotion regulation. This form of stress, which is directly related to the parent-child interaction, is called parenting stress. Stress experienced by parents may also be related to more general factors, such as chronic stress, trait worry, or perceived stress. This study aims to determine if child executive function is more strongly related to parenting stress than other forms of stress in order to gain insight as to what resources may best support stress reduction in parents of children with low EF. If child EF is strongly correlated with parenting stress, interventions that help parents better support their child's needs may be most effective in reducing their stress. However, if child EF is strongly correlated with other, more general forms of stress then interventions to target general stress management would be more effective in supporting parents of children with low EF. Results showed that EF was not related to parenting stress, nor was it related to parent chronic stress, trait

worry, or perceived stress. This suggests that targeting parenting stress is not specifically more favorable than other types of support for parents of children with low EF.

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Introduction

Along with parenthood comes the introduction of various new stressors. A common source of stress for parents is their child's behavior, which can impact parents' well-being and ability to manage the tasks of everyday life. Stress experienced by parents may also result from other stressors that are not explicitly related to interactions with their child, such as chronic stress, worry, and perceived stress. This study aims to disentangle the correlations between parenting stress and more general forms of stress with child executive function (EF). It is important to know if parenting stress is higher in parents of children with low EF because low EF may be associated with behaviors that increase stress related to the parent-child relationship (Hutchinson et al., 2016). Results from this research may inform future interventions for parents of children with low EF.

Executive function is a set of cognitive processes that undergo significant development during ages 3-5 and play a role in a child's ability to focus, complete tasks, and regulate emotions (Best & Miller, 2010). Three primary processes constitute EF: inhibitory control, attention shift, and working memory. Inhibitory control is the ability to control impulses or urges—particularly those that are not appropriate (Rueda et al., 2005). For example, a child may exhibit inhibitory control by resisting the urge to pour the milk out of their glass. Attention shift is the ability to switch between thinking about or focusing on different subjects and is necessary for carrying out desired actions (Rueda et al., 2005). An example of successful attention shifting is a child switching between focusing on playing to focusing on eating without becoming upset. Working memory is a type of short-term memory that involves the ability to temporarily store

information, especially in the face of interference (Calderon, 2020). An example of a child using working memory is if they are walking to wash their hands, but are interrupted by somebody talking to them, yet are still able to remember that they were going to wash their hands once the interaction is over.

Deficits in EF may affect a child's ability to initiate, analyze, prioritize, and/or finish a task in the appropriate time frame (Hosenbocus & Chahal, 2012). Children with executive function deficits may be regarded as "lazy," "unmotivated," or "forgetful" due to their difficulty completing goal-oriented tasks (Hosenbocus & Chahal, 2012). This creates frustration for the child, which may result in a display of oppositional defiant behavior, meltdowns, or anxiety (Hosenbocus & Chahal, 2012). Parents of children who display these behaviors may have increased stress due to difficulties interacting with their child (Hutchinson et al., 2016). They may spend excess time and energy regulating their child's behavior and supporting their child's needs in comparison to parents of children with average EF.

Parenting stress is stress that is directly related to the parent-child system (Abidin, 1995). The Parenting Stress Index indicates three subcategories of parenting stress—parental distress, dysfunctional interaction, and difficult child behavior (Abidin, 1995). Parents who are high in parenting stress may feel trapped by their responsibilities as a parent, that they are unable to do things they enjoy since having a child, or that their child rarely does things for them that makes them feel good (Abidin, 1995).

Previous literature indicates that parenting stress may be exacerbated in parents of children with low levels of executive function (Hutchinson et al., 2016; Joyner et al., 2009; McLuckie et al., 2021; Wagner et al., 2015). In several studies, researchers found

that parents of children with attention-deficit/hyperactivity disorder (ADHD), who experience significant EF deficits, reported greater parenting stress (Hutchinson et al., 2016; Joyner et al., 2009; McLuckie et al., 2021). This correlation has also been supported in a non-ADHD sample where researchers found that parents of children with poor EF, in the 3–5-year-old age range, reported higher parenting stress (Wagner et al., 2015). Collectively, there is compelling evidence suggesting that low child EF is related to increased parenting stress. However, parent well-being may be affected by other types of stress which are not specifically related to parent-child interactions. These include chronic stress, worry, and perceived stress.

Chronic stress is stress caused by common life conditions, such as financial issues, work life, and/or home life (Wheaton, 1994). For example, those with chronic stress may have long-term debt, find it difficult to pay their monthly bills, or have a job that leaves them feeling mentally and physically tired (Wheaton, 1994). There is evidence that increased stress in parents of children with low EF is related to these kinds of environmental stressors. Household chaos is a facet of chronic stress, as disorganization and instability within the home is an ongoing, everyday life stressor. In a meta-analysis, researchers investigated the relationship between household chaos and child executive function, finding that they were inversely correlated, meaning higher levels of chaos were associated with lower levels of child EF (Andrews et al., 2021). A systematic review investigating socioeconomic inequality and EF development found that socioeconomic disadvantage, which is considered a component of chronic stress, was associated with poor youth performance on EF tasks (Merz et al., 2018). These

studies suggest that there is a significant link between parent chronic stress and child executive function.

Another type of stress experienced by parents is *worry,* which is the tendency to have repetitive negative thoughts about a future event that can be difficult to remove from the mind (Ehring & Watkins, 2008). Worry is considered an individual trait, unrelated to the child or recent events in the parent's life. Parents who are high in worry may feel that they know they should not worry about things but can't help it, or that they always worry about projects until they are done (Meyer et al., 1990). Currently, no evidence was found supporting or opposing a link between parent trait worry and child EF.

Parents may also differ in how sensitive they are to *perceiving stress*. Parents with high perceived stress may feel that they are "unable to control important things in their life," or that they "cannot cope with all of the things they need to do" (Cohen & Williamson, 1988). Furthermore, parents who are high in perceived stress *and* have children with low EF may be disproportionately impacted by their child's behavioral challenges. However, one previous research study found that perceived stress in parents from a variety of different socioeconomic backgrounds was not related to their child's EF (Ursache at al., 2015). This evidence is not substantial but does suggest a potentially nonsignificant relationship between perceived stress and child EF.

Collectively, previous research indicates that parents may experience stress from multiple sources. Although a number of studies indicate a link between increased parent stress and lower child EF (Andrews et al., 2021; Hutchinson et al., 2016; Joyner et al., 2009; McLuckie et al., 2021; Merz et al., 2018; Wagner et al., 2015), it is unclear

whether the association is due to parenting stress or to stress in general (i.e., not related to parenting, per se). This study examined the correlations between different types of stress and child EF as an attempt to disentangle the effects of parenting stress, chronic stress, trait worry, and perceived stress. Based on previous research, it was hypothesized that parenting stress would be negatively associated with child executive function. That is, parents of children with low EF would have higher rates of parenting stress. Further, it was predicted that there would be a significant negative correlation between chronic stress and child EF, but to a lesser degree than parenting stress. Lastly, it was hypothesized that there would be little or no correlation between parent worry and child EF and little or no correlation between perceived stress and child EF.

If child EF is strongly related to parenting stress, parents of children with low EF would benefit more from a parenting program than from other resources with regards to stress reduction. By contrast, if chronic stress is correlated with child EF, parents may benefit more from services that would support them in their daily lives, such as low-cost daycare centers. If trait worry or perceived stress are correlated with child EF, or if there is a similar strength correlation between each form of stress and child EF, the stress may be attributed to parents' personality traits. In this case, it may be suggested that parents obtain support from a counselor or therapist who may help them develop greater coping skills. Disentangling the correlations between different types of parent stress and child executive function lends insight to what treatment plan will be most effective to support parents of children with low EF.

Methods

Participants

Between March 2019 and March 2020, a convenience sample of caregiver-child dyads were recruited from the Eugene/Springfield area using flyers, which were distributed on and off the University of Oregon campus. Free electronic message boards were also utilized to distribute flyers (e.g., Facebook and Craigslist). Caregivers were at least 18 years old with children who were between 36 and 84 months of age. This age group was chosen because there is strong evidence that caregiving plays a formative role in children's brain development during this period (Barker & Fisher, 2020). Caregivers were excluded if they reported themselves unable to be separated from their child for 45 minutes, reported that themselves, or their children had physical or medical conditions making it difficult or uncomfortable to complete the assessment protocol (medical history of epilepsy, head wounds, lice), or if they were not fluent in English.

Procedures

Caregivers expressed interest through email or phone contact. Interested families were contacted by a researcher who administered a screening questionnaire over the phone. If eligible and interested, families were scheduled a date and time to participate in a research session. During their visit to the lab, participants completed informed consent. After consenting, each participant received a research ID number that was used to de-identify all subsequent documentation.

During the research session, caregivers (n = 101, M age = 34.0, SD = 5.3 years) completed a series of questionnaires. Children (n = 101, M age = 4.9, SD = 1.1 years) completed a series of executive function tasks, which were administered via a touch-

screen laptop. Caregivers were compensated for their time in the form of a gift card. Children were compensated with small toys. All protocols were approved by the Institutional Review Board at the University of Oregon.

Child Executive Function

To measure child executive function, researchers used the Executive Functions (EF) Touch battery. Previously, the tasks in the EF Touch battery had been extensively conducted on paper and pencil but were later computerized to increase efficiency (Willoughby & Blair, 2011). The complete battery consists of 7 tasks, which take between 45 and 60 minutes to complete altogether. The EF touch tasks measure inhibitory control, attention shifting, and working memory. This study used three tasks that assess child working memory and attention shift, including Pick the Picture (Cragg & Nation, 2007; Petrides & Milner, 1982), Something's the Same (Jacques & Zelazo, 2001), and Houses (Kane & Engle, 2003). To administer the EF Touch tasks, a researcher read a standardized script of instructions to the child from the touch screen laptop. Then, the child used the touch screen to respond. Tasks were administered in a randomized order. Researchers received a rating of the impression of data quality after each task. They also received a score indicating percent completion of the task and percent items completed correctly. The score of percent items correct for each task was combined to yield one total executive function score. EF Touch has been shown to have higher test-retest reliability when tasks were measured together as a single battery, rather than individually (Willoughby et al., 2016). The battery was run on Windows OS and used one monitor to display a script to the interviewer and one touch screen monitor to record the child's responses.

Pick the Picture. This task assessed working memory (Cragg & Nation, 2007; Petrides & Milner, 1982; Willoughby et al., 2010). Children were shown a set of identical images, which were displayed on a series of consecutive pages. As each new page was presented, children were instructed to pick the image on the screen that had not been previously selected, so that each image "gets a turn." The arrangement of images was randomly changed across trials.

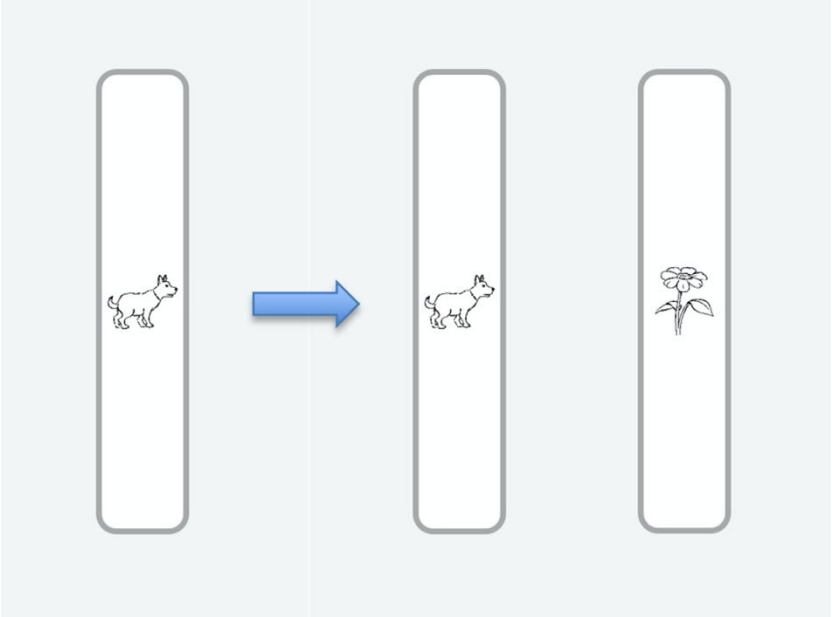

Figure 1: Pick the Picture Stimuli

In this example, children were shown a picture (e.g., the dog), then shown several more pictures and asked to pick which one was the same as the first (Willoughby et al., 2010).

Something's the Same. This task assessed attention shifting (Jacques & Zelazo, 2001; Willoughby et al., 2010). Children were shown two pictures that were the same on one dimension: content, color, or size. A researcher explicitly stated the dimension of similarity to the child. Then, the child was presented with a new page which contained the same two pictures as well as one new one. The new image was the same

as one of the first images along a dimension that was different than the similarity between the first two images. The child was asked to indicate which of the two original images was the same as the new one.

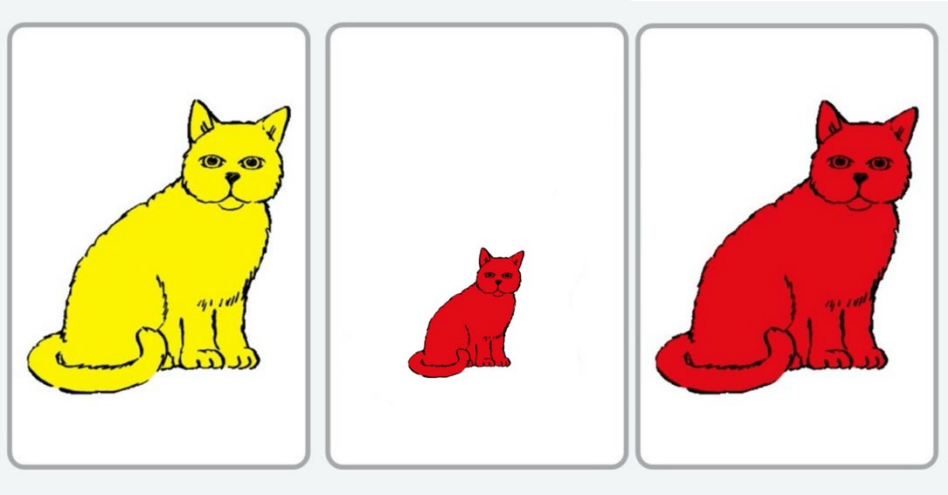

Figure 2: Something's the Same Stimuli

In this example, children were shown two pictures that contained the same content (e.g., both cats). Then, they were shown a picture with the same content as one of the first pictures, but in a different size. The child picked which of the original pictures was the same as the new one (Willoughby et al., 2010).

Houses (Working Memory Span). This task has 19 items and assessed working memory (Kane & Engle, 2003; Willoughby et al., 2010). Children were shown a line drawing image of an animal with a colored dot above it, both of which were located within the outline of a house. A researcher asked the child to name the animal and color of the dot. Then, the page was turned, and the child saw only the outline of the house from the previous page. The child was then asked to name what animal lived in the house.

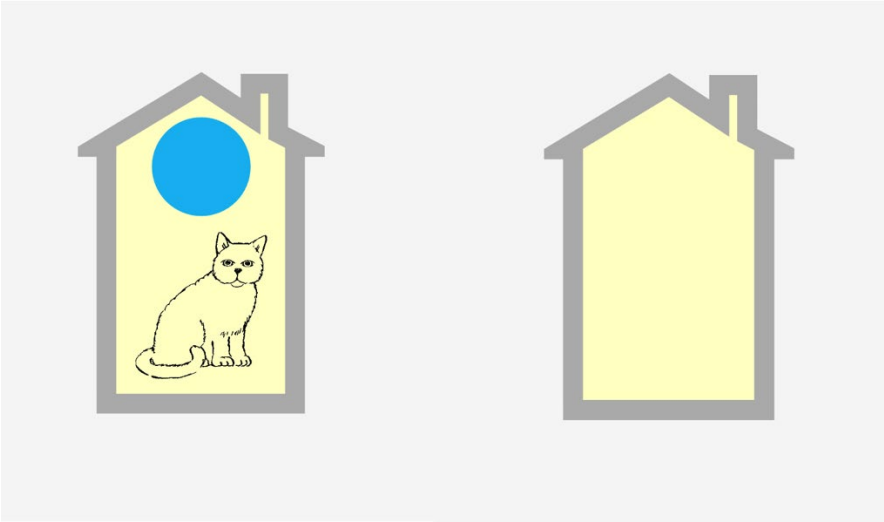

Figure 3: Houses (Working Memory Span) Stimuli

In this example, children were shown an animal and colored dot within the outline of a house (e.g., cat; blue dot), then shown an empty outline and asked to recall what animal lived in the house (Willoughby et al., 2010).

Parenting Stress Index

The Parenting Stress Index-Short Form (PSI-SF; Abidin, 1995) is a 36-item self-report questionnaire used to identify areas of parent-child dysfunction in children ages 1 month to 12 years. The short form of the PSI was directly derived from the original, 101-item PSI, both being composed of three subscales: Parental Distress, Parent-Child Dysfunctional Interaction, and Difficult Child. Items were rated on a 5-point Likert scale, responses ranging from "Strongly agree" to "Strongly disagree." A higher summed score (total or within the subscales) indicated higher levels of caregiver stress caused by the parent-child system. The correlation between the full form PSI and PSI-SF is 0.94 (Abidin, 1995). The PSI-SF takes 10 minutes to complete.

Wheaton Chronic Stress

Wheaton's Chronic Stress (WCS; Wheaton, 1994) is a 50-item self-report questionnaire asking about common life conditions and situations (e.g., financial issues, work, marriage, family) in order to measure one's exposure to chronic stressors. The items were rated on a 3-point Likert scale, responses ranging from "not true at all" to "extremely true." Items were summed to yield a total chronic stress exposure score—ranging from 0 to 102. Wheaton's Chronic Stress questionnaire takes 10-15 minutes to complete.

Penn State Worry Questionnaire

The Penn State Worry Questionnaire (PSWQ; Meyer et al., 1990) is a 16-item self-report questionnaire designed to measure the trait of worry in adults. Each item was rated on a 5-point Likert scale, responses ranging from "not at all typical of me" to "very typical of me." Eleven of the items targeted pathological worry—higher scores indicating more worry (e.g., 'Once I start worrying, I cannot stop'). The five other items were worded to indicate that the worry was not a problem, with higher numbers indicating less worry (e.g., 'I never worry about anything'). A total score was yielded by summing the first 11 items and the reverse-scores of the latter 5. The questionnaire takes about 3-5 minutes to complete.

Perceived Stress Scale

The Perceived Stress Scale (PSS; Cohen & Williamson, 1988) is a 10-item self-report questionnaire used to measure an individual's current perception of their own stress. Responses existed on a 5-point Likert scale, indicating the frequency with which

a feeling or thought occurred ("Never" to "Very Often"). Four of the items on the scale were worded positively (e.g., 'Confident about ability to handle personal problems?'). Final scores were determined by reversing the scores on the four positive items and summing them with the other six items. This questionnaire takes approximately 2-3 minutes to complete.

Analytic Plan

Data was analyzed using Jamovi version 2.3.18.0. Regressions were completed of each of the parent stress measures (PSI, WCS, PSWQ, PSS) on child executive function. Regression analysis was used to test the hypothesis that child executive function is more strongly correlated with parenting stress than worry, chronic stress, and perceived stress. In order to determine whether there was a significant correlation between different types of stress experienced by parents and child executive function, four linear regression models were run. Correction was made for multiple tests by using a significance value of $p < .012$ based on the planned use of four tests.

Results

When investigating demographics, it was found that self-reported household income ranged from $14,570 or less to $100,000+ (median: $42,620), which was notably lower than the U.S. national median ($67,521; Shrider et al., 2021) and county median ($59,016; US Census Bureau, 2022). Because this sample has a lower median income than the nation and county, it is reinforced that the data is relevant and applicable to the subject matter, as low-income households are often associated with higher stress (Wheaton, 1994). In this regard, it may be inferred that parents in the sample were experiencing the same or more stress than the average parent.

Education levels in this sample ranged from less than high school to doctorate or professional (median: bachelor's or higher, 38.1% of sample), which was not notably different from the national average (37.9% bachelor's or higher; US Census Bureau, 2022) or county average (30.5% bachelor's or higher; US Census Bureau, 2020). Because the sample matched county and national samples for education, it may be inferred that parent education level did not play a role in the results.

There was no statistically significant relationship found between any of the four caregiver stress measures and child executive function scores in this sample (all p-values > .20). The first hypothesis, that there would be a significant inverse relationship between child EF and parenting stress, was not supported. Results from the regression of parenting stress on child EF were non-significant, indicating that child EF did not predict parenting stress, $t(2) = 0.32$, $p = 0.75$. Similarly, the second hypothesis, that there would be a weaker, but still significant inverse relationship between child EF and chronic stress, was also not supported. The regression of chronic stress on child EF was

non-significant, indicating that child EF does not predict parent chronic stress, $t(2) = 1.07$, $p = 0.29$. The third hypothesis, that there would be no significant relationship between child EF and worry or perceived stress, was supported. The regression of trait worry on child EF was non-significant, indicating that child executive function did not predict parent trait worry, $t(2) = 0.99$, $p = 0.32$. Results from the regression of perceived stress on child EF were also non-significant, indicating that child executive function does not predict parent perceived stress, $t(2) = 0.43$, $p = 0.67$. Because the primary analysis showed no linear relationship between child EF and parent stress, moderation tests were not conducted (Fein et al., 2022).

Measure	R
PSI	0.03
WCS	0.11
PSWQ	0.1
PSS	0.04

Table 1: Correlation Between Stress Measures and Child Executive Function

Correlation coefficient results for regressions of parent stress measures on child executive function. (PSI: Parenting Stress Index; WCS: Wheaton's Chronic Stress; PSWQ: Penn State Worry Questionnaire; PSS: Perceived Stress Scale)

Discussion

This study examined whether child EF was predictive of different types of stress experienced by parents. It was hypothesized that parenting stress would be negatively correlated with child executive function and that the magnitude of this correlation would be greater than the correlation between child EF and chronic stress, trait worry, and perceived stress. The results did not support the hypothesis, as there was no statistically significant correlation between child EF and parenting stress.

There are some potential explanations for the non-significant results. One consideration is that there may be a genetic influence on child EF development (Friedman et al., 2008). Parents with children who have low EF may have low EF themselves, causing them to either not notice, or not be distressed by behaviors resulting from their child's low EF. Another possible explanation for the results is that there may not be as strong of a relationship between child EF and child behavior in this population, as was expected. If EF was not significantly impacting the behavior of the children in this sample, it is understandable that their parents were not experiencing particularly high parenting stress. This may inform future directions, as previous literature suggested that child EF and child challenging behavior are highly related (Hutchinson et al., 2016; Joyner et al., 2009; Wagner et al., 2015). Lastly, because this was not a specifically low or high EF sample, it is possible that a correlation was not found due to a lack of variability in the child EF scores. For example, a sample that included children with and without ADHD may have yielded a wider range of EF scores, allowing for more clear associations with parenting stress.

The results provide insight into the best ways to support parents of children with low EF. Knowing that parent stress may be unrelated to child EF may prevent researchers from unproductively targeting this variable when developing parenting programs and other resources for this population. Parents of children with low EF may benefit from other forms of parenting support; however, based on these results, stress reduction as the primary focus of intervention may not be warranted.

One limitation of the sample is that it lacked racial diversity. The United States census reports a 61.6% white population (Jones et al., 2021). 89% of the study participants were white, demonstrating that the sample contains disproportionately more white individuals than the United States. This lack of representation impacts the external validity of the study, making the results less relevant to diverse populations. Another limitation of this study is related to the EF Touch measure. Reliability of the measure was not particularly high (Cronbach's alpha = 0.57) and might have been improved if more tasks from the EF Touch battery were used. It was found that the battery is more reliable when composite scores were taken from children who completed all seven of the EF Touch tasks (Willoughby et al., 2016).

Future research may measure child *and* parent EF in order to investigate if the heritability of EF is impacting the results of the regressions. Future studies may collect more detailed data on child behavior as a separate measure in order to verify that it is related to child EF. In addition, future work may have children complete more, if not all seven of the possible EF Touch battery tasks. They may also recruit from a more racially diverse population.

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