Video-Coded Maternal Behaviours and Stress Reactivity in Preschoolers of Mothers with Depression

by

Shaelyn Stienwandt

A Thesis submitted to the Faculty of Graduate Studies of

The University of Manitoba

In partial fulfillment of the requirements of the degree of

MASTER OF ARTS

Department of Psychology

University of Manitoba

Abstract

Parents play an important role in supporting their children's social-emotional development and well-being. Social buffering theory suggests that positive parent-child relationships are associated to children's ability to cope with acute stress. One method utilized to measure parent-child relationships is through observed video-coded interactions, but in the context of acute stress, there is an identified gap in standardized video coding systems. We created a video coding scheme to capture maternal behaviours associated with children's stress reactivity and recovery in a sample of mothers with clinical depression and their preschool aged children (N = 40). Mother-child dyads participated in a baseline assessment of a larger clinical trial study via online videoconferencing platform. Children partook in an acute stressor task alongside salivary cortisol and heart rate measurements. Video recordings of maternal behaviours were collected both during and after the acute stressor task. Transcriptions of maternal behaviours were recorded to inform the microanalytic coding scheme development. These transcriptions were consolidated into codes based on established systems and clinical theory. Partial construct validity of the video coding scheme was found when comparing the observed maternal behaviours with a standardized questionnaire of parenting behaviour. Results indicate that observed global maternal involvement *during* the online stressor task produced a blunting effect on children's stress reactivity. However, no associations between mothers' parenting behaviours *after* the stressor and children's stress physiology were found. Results may inform parenting interventions aimed at supporting children's well-being.

Keywords: Maternal behaviour, video coding, parenting, cortisol, heart rate, acute stressor task

Acknowledgements

I have been the fortunate recipient of much support over the past three years, without which, this master's thesis would not have come to fruition. I'm grateful for the opportunity to acknowledge this support here.

First, I would like to thank the families who participated in this research. Each family opened their homes, virtually, to our research team and without whom this work would not have been possible. The weekend mornings that I spent completing assessments with moms and their preschoolers were full of sweet and memorable moments that I will not forget.

I would like to express my gratitude to my advisor, Dr. Leslie Roos, who has provided consistent mentorship leading to my growth as a researcher. I would also like to extend my appreciation to my committee members, Dr. Ryan Giuliano and Dr. Laurence Katz. Your feedback, advice, and unique perspectives allowed this project to materialize, despite many setbacks, including a global pandemic.

This project required an amazing team of volunteers to come to fruition. Thank you to the BRIDGE Assessment Team and the BRIDGE Video Coding Team from the Hearts and Minds Lab who assisted in the completion of this work.

This research received financial support throughout my master's degree at the University of Manitoba. I would like to thank the Canadian Institutes of Health Research and the Department of Psychology for their financial assistance and prioritization of this work.

I began graduate school with the intention to receive a master's degree. What I didn't expect was to be introduced to others in my research lab who would become lifelong friends. Thank you to Marlee, Kathryn, and Lara for the infinite support during this process. The countless work sessions and outdoor adventures kept me both on track and rejuvenated. I'll forever be grateful that we met during this process.

Last, but certainly not least, I want to extend my gratitude to my family and my friends who are family. To my parents and sister, you may tease me about being in school forever, but you have never faltered when it comes to supporting me throughout this process. It is hard to express how much your love, support, and belief in me means. To my partner, Steven, thank you for your patience, encouragement, and for the fun you have brought to the past few years. I am thankful to have had you by my side through the ups and downs. To my friends who are family, Krista, Sydney, Ainslee, and Mikayla, I am so fortunate to have each of you in my life. Thank you for hearing me out when times were hard and for celebrating all the victories with me.

Table of Contents

List of Tables

List of Figures

Video-Coded Maternal Behaviours and Stress Reactivity in Preschoolers of Mothers with Depression

Children's early life experiences are critically important for healthy development (Kalmakis & Chandler, 2015; Petruccelli et al., 2019). Parents, at the heart of children's lives, are in a position of influence to nurture children's social-emotional development and well-being. Supportive parent-child interactions promote later adaptive characteristics such as emotion regulation, social skills, and behavioural control (Chu et al., 2010; Knoche et al., 2012). Specifically, sensitive parent-child relationships can buffer children from the physiological effects of acute stress and mitigate some of the biological "wear and tear" associated with prolonged stress exposure (Asok et al., 2013; Gunnar & Hostinar, 2015; Köhler-Dauner et al.,2019; Rickmeyer et al., 2017; Roos et al., 2019). This process, social buffering, occurs when the stress system's response to a threat or challenge is dampened in the presence of a supportive person (Gunnar & Hostinar, 2015; Hostinar et al., 2014). Social buffering is vital for children's development. Nurturing and supportive parent-child relationships can act as a bulwark against neurobiological changes that come along with stress exposure, leading to better long-term outcomes for children (Thompson, 2014). However, the exact supportive behaviors through which social buffering of preschool aged children are poorly understood (Shonkoff et al., 2012).

Mothers experiencing depression are documented to be less effective at stress buffering as they often demonstrate deviations in expected aspects of sensitive caregiving, affecting their children's neurotypical development (Drury et al., 2016). Prolonged exposure to maternal depression and associated negative parenting behaviours is shown to be related to alterations in children's stress system (Apter-Levi et al., 2016). Stress system dysregulation is then related to more social-emotional difficulties, internalizing, and externalizing symptoms (Feldman et al., 2009; Palmer et al., 2013; Laurent et al., 2013). Therefore, understanding parenting behaviours that support social buffering of young children is critical.

The purpose of the research was to better understand parenting behaviours in a sample of mothers with depression that are associated with children's stress reactivity and recovery to a novel online stressor task. In doing so, this research has the potential to offer insight on the specific behaviours and types of interactions that promote healthy child development and coping with difficult challenges. This, in turn, holds promise for informing programs developed to promote family well-being (Shonkoff & Fisher, 2013).

Video-Coding Systems to Understand Parent-Child Behaviour

Despite documented importance of the parent-child relationship to foster child development, particularly in the domain of social adjustment, it is challenging to assess the quality of such interactions. Self-report approaches to investigating parent-child interactions are a relatively simple approach that can be administered via interviews or questionnaires (Eddy et al., 1998; Prescott et al., 2000). However, validity of such questionnaires has well-documented limitations due to the difficulty of people to recall their past accurately as well as the potential for self-report biases that may influence parents to respond in a way that is viewed as favourable (i.e., recall bias and desirability bias; Aspland & Gardner, 2003; Van de Mortel, 2008).

In contrast, observational data provides a wealth of information regarding parent-child interactions with less influence from bias and accurate recall (Aspland & Gardner, 2003). Observational data collection occurs when parents and children are video recorded during a structured or naturalistic interaction. Afterwards, specific details of the interaction are coded from the video. "Microanalytic" coding produces information about distinct and specific qualities of the parent-child interactions (Bornstein et al., 2011). Whereas "macroanalytic" coding of interactions emphasize broader long-lasting interaction styles that are not dependent on the specific moment (Bornstein et al., 2011). Both styles of coding provide researchers and clinicians with vital knowledge to assist in quantifying nuances of parent-child relationships. Although several observational coding systems have been developed to assess parental behaviours, many of these systems do not address specific aspects of parent-child interactions that are theorized to support buffering of stress in children such as responding appropriately and promptly to children's cues (Albers et al., 2008). Further, validity, the extent to which a tool measures what it is intended to measure, is often not reported (Aspland & Gardner, 2003). One way in which validity is established is through analyzing associations between two measures intended to capture similar constructs (Gardner, 2000). Therefore, there is a key gap in the literature for researchers looking to analyze parental buffering in the context of acute stress with a validated system.

Parenting Behaviours and Children's Stress

Supportive parenting often serves as a protective factor for young children experiencing stress, indirectly affecting their stress physiology. Extant literature demonstrates that parents may moderate, or *buffer*, the effects of stressful experiences for their children (Gunnar & Hostinar, 2015). The impact of parents on children's stress physiology is twofold. First, the mere presence of a parent during a stressful task is linked to lower stress reactivity for children across varying contexts (Berry et al., 2017; Johnson et al., 2018). Further, there is a large body of research examining positive parent-child interactions after a stressor with children's stress physiology (Brown et al., 2020; Ha & Granger, 2016).

Parental Presence

For much of children's lives, their parents are present and offer a consistent support for children to explore their world. Therefore, it is important to understand the impact of parental presence and absence on children's stress physiology during experiences of acute stress. To date, several articles have investigated children's stress reactivity when in the presence of a supportive parent and/or a secure attachment. Collectively, this research indicates that children experience lesser reactivity when a parental presence is near (Berry et al., 2017; Hostinar et al., 2015; Johnson et al., 2018). Consequently, understanding the impact of maternal presence in the context of an acute stressor during the preschool years is essential.

Maternal Sensitivity

Maternal sensitivity is a concept derived from the work of attachment theory in the 1970s (Ainsworth et al., 1978). Decades of subsequent research has reported maternal sensitivity as being an important factor in positive child outcomes (Deans, 2020). Despite this link to child-well-being, maternal sensitivity continues to be a broad concept encompassing many different caregiving behaviours and attributes (van Doesum et al., 2007). Examples of sensitive parenting are demonstrated through positive interactions, warmth, along with quick and appropriate reactions to children's needs (Fay-Stammbach et al., 2014). One systematic review highlights the impact of maternal sensitivity across children's language acquisition, cognitive development, behavioural problems, social skills, temperament, emotionality, sleep, and obesity (Deans, 2020). It is therefore important to highlight maternal depression as a risk factor for lower maternal sensitivity (Kemppinen et al., 2006). Mothers experiencing depression may encounter difficulties interacting with their child in an optimally sensitive or psychologically available way (Martins & Gaffan, 2000).

Serve and Return Parenting

Parenting behaviours that are often studied for their association with child development include reciprocal and responsive interactions (Fay-Stammbach et al., 2014). This pattern of parent-child interaction style is often referred to as ‘serve and return’ parenting (Fisher et al., 2016; Shonkoff et al., 2016). This metaphor is used to describe when parents provide an appropriate response (e.g., ‘return’) to a child’s interaction initiation (e.g., ‘serve’). When a parent consistently provides appropriate responses that are contingent on a child’s behaviour, the child’s developing brain practices skills such as emotional judgment, attention, and impulse control (Shonkoff et al., 2016). However, when parents frequently fail to provide an appropriate ‘return’ to a child, the architecture of the developing brain may be disrupted or impaired (Shonkoff et al., 2016). Breakdown of these reciprocal interactions are often predisposed by many factors ranging from socioeconomic risk factors, social isolation, or mental health difficulties (National Scientific Council on the Developing Child, 2012).

Scaffolding

Scaffolding is defined as an action, verbal or nonverbal, provided by parents that delicately balances between supportive control and freedom to experiment to during a child’s task (Fay-Stammbach et al., 2014; Lewis & Carpendale, 2009; Wood et al., 1976). Research has demonstrated that this parenting behaviour is associated with children’s subsequent executive function, cognitive, and socio-emotional development (Bernier et al., 2010; Lowe et al., 2013). In the context of stressful situations, parents may utilize scaffolding to support their child during or after a task, unknowingly buffering their child’s stress reactivity. A study of parents and adolescents demonstrated that positive scaffolding behaviours exhibited by parents was related to less stress reactivity of adolescents during a challenging event (Manczak et al., 2015). For parents of young children, opportunities for such buffering through scaffolding may be provided in a few different ways: providing prompts (e.g., task simplification or demonstration) or emotional support to increase motivation or task persistence (Mermelshtine, 2017).

Stress Physiology

Relationships between parents and their children can affect children's stress physiology. The hypothalamic-pituitary-adrenocortical (HPA) axis produces glucocorticoids, cortisol, when children are exposed to stressful experiences (Lupien et al., 2009). Although this stress response system is critical for survival, excessive activation can lead to physiological damage such as inflammation and "wear and tear" on many organs (Shonkoff et al., 2012). The deleterious stress response, chronic stress, is produced when a child is within a stressful ecological system without the presence of a buffer, such as a parent (Shonkoff et al., 2012). The plastic nature of the child's brain makes it susceptible to experiential learning from cortisol produced during these events. Children who have more experiences without buffering from these physiological reactions, are at a higher risk to experience depression, anxiety, and hippocampal dysfunction that can lead to memory impairments and dysregulated mood (Lupien et al., 2000; McEwen & Gianaros, 2011; Shonkoff et al., 2012). Research indicates that children with a secure attachment to their parents show a completely blocked increase in HPA axis activity when their parents are with them during stressful situation (Gunnar et al., 1996). By promoting positive interactions between parents and their children, it is possible to indirectly minimize the risks associated with cortisol dysregulation.

A secondary measurement of children's stress physiology in the context of an acute stressor is heart rate acceleration related to the coordination of the sympathetic and parasympathetic nervous system branches (Nelson et al., 2020). Engagement of these systems foster rest in the absence of stressful scenarios, while it allows for sustained attention and utilization of adaptive resources during stressors (Porges, 2001). Research suggests that heart rate regulation may help to moderate developmental effects of childhood adversity and of less sensitive parenting practices (Boyce & Ellis, 2005; Rudd et al., 2017). Further, it has been demonstrated that maternal behaviour impacts child heart rate regulation, such that negative maternal behaviours are related to less adaptive physiology (Calkins et al., 1997; Perry et al., 2013). Consequently, exploring children's ability to regulate their heart rate along with its relation to maternal behaviors is critical in understanding the influence of parent-child relationships on children's long-term development.

Research in an Online Context

The COVID-19 pandemic has presented researchers with both challenges and opportunities to innovate methodology to study family function through remote research protocols (Sy et al., 2020). Although mental health services have shown to be efficacious in a telehealth model, there is minimal published research regarding remote data collection, particularly in stress assessment of preschool-aged children (Lo Iacono et al., 2016; Osenbach et al., 2013). Recently, three studies have examined adaptations of stress assessments remotely, one in adolescents and two others in adults, demonstrating the feasibility of such procedures (Eagle et al., 2021; Gunnar et al., 2021; Harvie et al., 2021). However, this leaves a gap in the literature for researchers aiming to understand young children's stress reactivity and parental support, specifically via remote assessments. Utilizing remote assessments is hypothesized to reduce barriers for families with preschoolers as it minimizes the need for parents to secure childcare for other children, transportation to the research lab, and fosters a more relaxed environment.

The Present Study

The objectives of the study were to: 1) develop a "social buffering" microsocial coding scheme and its procedural guidelines for mother-child interactions after a child experiences an acute stressor and 2) conduct a pilot study of the associations between mother-child interactions, including microsocial behaviors and broad macro social measures of maternal involvement with measures of children's stress physiology using a novel online assessment method.

Research Question 1

Is it possible to develop a reliable coding scheme of microsocial parenting behaviours that is associated with maternal self-report of parenting strategies and stress?

Numerous video coding schemes have been created to quantify parenting behaviours across varying contexts (Aspland & Garner, 2003). However, many are specific to the task or setting (e.g., mealtime, tidy up task) and may not capture social buffering behaviours. Due to this, it is hypothesized that creating a new coding scheme will be associated with maternal questionnaire data and children's stress reactivity and recovery.

Research Question 2

Does maternal presence and/or involvement during a virtually administered acute stressor task blunt a child's stress physiology reactivity?

Social buffering theory suggests that children who have a supportive presence near them during a challenging task may diminish a child's physiological stress reactivity (Hostinar et al., 2014). Consequently, it is hypothesized that children whose mother is present and involved during the acute stressor task will show lowered heart rate and cortisol reactivity.

Research Question 3

Do maternal parenting behaviours predict children's patterns of stress recovery, following acute stressor?

Extant research has demonstrated that supportive social relationships promote overall health and well-being throughout life (Cohen, 2004; Chu et al., 2010). Furthermore, social buffering research has demonstrated that children who experience a stressor with supportive parent show blocked increases in cortisol, whereas children without such presence demonstrated cortisol increases (Gunnar et al., 1996; Nachmias et al., 1996). Additionally, literature demonstrates that parenting styles and behaviours interact with children's heart rate acceleration response to threats or acute stressors (Price-Evans & Field, 2008). Therefore, it is hypothesized that, amongst children who exhibit cortisol and heart rate reactivity to acute stress, positive maternal behaviours exhibited after the stressor will predict more recovery to baseline levels.

Methods

Participants

Mother-child dyads completed the online assessment as part of the baseline data larger clinical trial for mothers experiencing symptoms of depression (Roos et al., 2020; Roos et al., 2021). Participants were recruited from the community using non-random, purposeful sampling. Interested mothers were screened using the Patient Health Questionnaire-9 on the REDCap electronic capture tool hosted at the University of Manitoba (Harris et al., 2009; Kroenke & Spitzer, 2002) and mothers who scored higher than 10 then completed the Mini International Neuropsychiatric Interview with a graduate student via Zoom Healthcare platform (Sheehan et al., 1998). Those who met the criteria for a Major Depressive Episode (MDE) and had a preschool child aged 3-5 years were included. A total of 40 mother-child dyads participated in the study. Children ranged in age from 3-5 years of age (*M* = 4.30, *SD* = 0.96) with 40% (N = 16) of children being female. Mothers reported a wide range of household incomes (median = $50,001-60,000; range $<10,000-140,000), with many families falling in the low-income range

(N = 18, $1-50,000). Maternal education was also varied, with some participants reporting high school education and others reporting graduate or professional degree education (median = college/technical school). Descriptive statistics are presented in Table 1.

Procedure

After being notified of their eligibility in the study, mothers booked an online 90-minute Zoom assessment for themselves and their preschooler to participate in. For families living within the city of Winnipeg, all materials (e.g., laptop, webcam, Wi-Fi stick, place mat demonstrating where materials should go, Salivettes, Fitbits, sticker chart, stickers, toys, stressor task prize, insulated lunch pack, and ice packs) were delivered to their home by a research assistant on the morning of their assessment. At this time, mothers also provided their consent to participate in the Zoom assessment. For dyads living outside of the city, participants were mailed a smaller package that included Salivettes, a Fitbit, sticker chart, stickers, and stressor task prize. Rural participants were required to confirm they had access to their own computer, webcam, and Wi-Fi to participate. Rural mother-child dyads provided their consent to participate once they had logged onto the Zoom Healthcare call.

Two research assistants joined the mother-child dyad on a Zoom Healthcare call for the duration of the assessment. The main research assistant reviewed the activities they would be participating in during the call and gained child assent. The second research assistant, the acute stressor administrator, left their video and microphone off until it was time for the acute stressor to be administered. The main research assistant led the mother child-dyad through a battery of tasks including fitting of Fitbits, saliva collection, and reunification post-stressor with a positive and friendly demeanor. The second research assistant administered the acute stressor with an unfriendly manner, in contrast to the main research assistant.

After the Zoom assessment concluded, a research assistant picked up the assessment package from Winnipeg-based families, and rural families mailed back the materials in a pre-paid envelope. Participants were provided a $25 Amazon gift card for renumeration of their time. Following this, mothers were sent an email with a link to the online questionnaire via REDCap.

Acute Stressor Task

Children participated in a frustrating task which was previously demonstrated to engage both the HPA and cardiac responsivity (Tolep & Dougherty, 2012). Prior to the online assessment beginning, the child picked a desired prize that they could earn if they completed the matching task in three minutes. The task required that the child match coloured-stickers to transportation images on a grid (e.g., placing a yellow sticker on all pictures of cars or red stickers on bicycles). The child is told that, "most children your age are able to perform the task on time," however the task is designed so that time runs out and the child hears a loud beep along with a red stop light before they complete the task (Tolep & Dougherty, 2012). The child completed the process three times and then were told that they did not win their desired prize. At the end of the online assessment, the main assessor informed the child that there was a mistake with the matching task and that the child did in fact win the desired prize, leaving the child with the prize.

Reunification Period

After the child completed the acute stressor task, their mother, who returned to the screen was reminded that their child just experienced a frustrating task in which they did not earn their desired prize, and therefore, they may be experiencing emotions of frustration. Mothers were instructed to comfort their child in whatever way they felt appropriate using the toys, colouring supplies, or books that they had been delivered. The dyad's interactions were video recorded for 10 minutes.

Measures

Maternal Questionnaires

Coping with Children's Negative Emotions Scale. The Coping with Children's Negative Emotions Scale (CCNES) is a self-report questionnaire that utilizes a 7-point Likert scale to assess how parents respond to their young children's negative emotions by presenting parents with hypothetical scenarios and asking how they would respond (Fabes et al., 1990). The tool has six subscales which delineate parents' different responses. *Problem-Focused Responses* reflects the degree to which parents support children in solving a problem that has caused them distress. On the other hand, *Emotion-Focused Responses*, reflect parental responses that are aimed at helping the child feel better, such as providing comfort or distraction. These subscales reflect the two main types of coping responses: designed to address the cause of emotion (e.g., problem-focused) and the emotion itself (e.g., emotion-focused) (Folkman & Lazarus, 1990). The *Expressive Encouragement* scale reflects the degree to which parents are accepting and encouraging of children's negative emotions. Research on parental emotion coaching, including encouragement of negative feelings, indicates a relation with children's adaptive social-emotional skills (Ramsden & Hubbard, 2002). Additionally, there are two subscales that focus on unsupportive coping behaviours of parents. First, the *Minimization Reactions* subscale focuses on the degree to which parents discount or diminish their child's emotional reactions. Second, the *Punitive Reactions* subscale measures the degree to which parents use physical or verbal punishment in attempt to dampen a child's negative emotions. Both of these unsupportive parenting behaviours have demonstrated relationships to less favourable child outcomes such as lower social-emotional skills (Fabes et al., 2002). The final subscale is *Distress Reactions* which measure the extent to which parents feel their own distress when a child is displaying negative emotions (Fabes et al., 2002). Parents who experience their own distress to children's negative emotions are theorized to be less able to support their child and instead are more likely to use unsupportive parenting strategies (Fabes et al., 2002). The CCNES has good internal reliability and test-retest reliability (Fabes et al., 2002).

Child Salivary Cortisol

Using Salivette cotton swabs, children produced salivary cortisol samples as a measure of their acute stress response to an acute task (Flom et al., 2017; Sarstedt, Inc., Newton, NC). Their saliva was taken at five separate time points which included right before the acute stressor task, immediately following the task, 15 minutes after the stressor, 30 minutes after the stressor, and then again 45 minutes after the stressor. Mothers were instructed to ensure their child was awake at least one hour prior to the start of the online assessment and to ensure they did not consume any food or drink other than water for at least 30 minutes before the assessment. Families received six Salivettes in total, with five being labeled 1 through 5 and the remaining being labeled 'X' to indicate a spare. During the collection of each sample, the assessor instructed the mother to help insert the cotton into the child's mouth for 30 seconds while the child watched a video of a person eating ice cream. After the 30 seconds was complete, mothers were cued to remove the saturated cotton and place it back in the tube. All samples were stored with ice packs in an insulated lunch kit for the duration of the assessment and then were frozen (20ºC). The saliva samples were sent off for duplicate assay (inter- and intra-assay) to the University of Trier. The cortisol values were averaged across duplicate assays with coefficients of variants not varying more than 10%. Due to skewness of the data, cortisol was derived from natural log-transformed values, as is standard for cortisol analyses (Dettling et al., 2000). One participant's cortisol results were not biologically possible, and their data was removed. Child refusal resulted in seven participants being excluded from cortisol reactivity analyses (N=32) and eight excluded from cortisol recovery analyses (N=31).

Child Heart Rate

Children wore Fitbit Inspire HR watches for the duration of the assessment to measure their heart rate. Heart rate data was processed using R-software in 1-minute intervals for the entire duration of the assessment (R Core Team, 2017). These intervals were then averaged and examined for change relative to the baseline measures, which were the tasks immediately prior to and following the matching task. Six participants were excluded from heart rate reactivity analyses (N=34) and five from recovery analyses (N=35) due to child refusal.

Video Coding Scheme

Maternal Presence During Stressor Coding. Due to the online nature of the acute stressor task, an additional code was created to measure maternal involvement during the stressful task, despite assessors' instructions to remain as uninvolved as possible. Here, coders watched the entire acute stressor task and then provided a global rating of maternal involvement on a 3-point Likert scale 0 = *Mom Completely Absent/ Distanced/ Uninvolved*, 1 = *Mom Partially Involved* [e.g., handling <50% of stickers or 1-2 encouraging comments, or 1-2 physical touch], 2 = *Mom Completely Involved* [e.g., handling >50% of stickers, provides 3+ either supportive comments or physical touch]). This rating was then re-coded into a dichotomous variable rating mothers as involved or uninvolved. One participant was not given this rating as the child did not participate in any portion of the acute stressor task (N=39).

Maternal Buffering Post-Stressor Coding. Immediately after the child finished the acute stressor task, the mother-child dyad began a 10-minute reunification period. The main research assistant on the remote assessment reminded the mother that their child had just completed a frustrating task and they were welcome to support them however they deemed best. This period was coded using a novel microanalytic coding scheme developed for this study, as described below.

Initial Transcription of Interactions. After the collection of all reunification period videos occurred, the video coding team viewed a select few videos to gain insight into what parenting behaviours mothers displayed during this unstructured time. While viewing, the team transcribed the mothers' behaviours and verbalizations.

Consolidation of Parenting Behaviours. After transcription, the examples were scrutinized by individuals with clinical training to categorize parenting behaviours and verbal utterances. This categorization process was based on an extant coding system which aimed to understand parental strategies for promoting their child's self-regulation (Stansbury & Sigman, 2000). The extant coding scheme identified four categories (e.g., self-comforting, instrumental regulation, distraction, and cognitive regulation) (Stansbury & Sigman, 2000).

Refinement of Coding Scheme. Based on the behaviours and verbalizations viewed in the videos and literature review of each concept, six codes were created for this study's coding scheme. These included *unsupportive parenting* (e.g., distant body language, dismisses child's bids for attention), *supportive parenting* (e.g., provides hugs or verbal reassurance), *negative control* (e.g., helps child when not required, commands), *positive behavioural control* (e.g., giving choices, setting limits, scaffolding), *negative emotion* (e.g., frowning, sighs), and *positive emotion* (e.g., smiles, laughter). The full coding scheme is presented in Appendix A.

Training of Coding Team. Research assistants on the coding team underwent a 12-week training period prior to processing actual video data. This training included transcribing practice videos, relevant journal article readings, behavioural coding of practice videos, reliability discussion, and completing both the PHIA and TCPS2-CORE training courses. Following training completion, two undergraduate research assistants, one graduate research assistant, and the first author met on a weekly basis to discuss challenging videos or interactions to support reliability.

Reliability of Coding Team. Interrater reliability was established among the video coding team members. Although there is no consensus in the field regarding acceptable level of agreement, 0.7 or 70% is typically acceptable (Aspland & Garner, 2003). To be more conservative due to the originality of the coding scheme, Cronbach's intra-class coefficient was analyzed to ensure the coders reached 80% reliability on three separate videos when compared to an expert coder (Cohen, 1960). Once they reached this threshold, research assistants were allowed to code independently with 25% of all videos being double coded by a second research assistant to ensure the team maintained 80% interrater reliability. The team maintained a great interrater reliability (r = .829 - .995).

Analytic Plan

Analyses were conducted in IBM SPSS Statistics Version 25. Pairwise deletion was utilized for missing data across all correlations (Peugh & Enders, 2004). Outliers that were three standard deviations above or below the mean were assigned the next closest value using winsorizing across all variables (Ghosh & Vogt, 2012).

First, descriptive statistics investigating the children who dropped out of the stress physiology measures were first analyzed to gain insight into any differences among their age and sex. Independent sample t-tests were examined to identify any differences in parent-reported behaviour challenges (e.g., externalizing or internalizing behaviours) among children who participated or refused to complete the measures of cortisol and heart rate physiology.

Following this, to establish a better understanding of the novel video coding scheme, bivariate correlations among all video codes were completed. Codes that were theoretically overlapping and positively correlated above a $r = 0.6$ were considered for data amalgamation techniques. Following this, the observed maternal behaviour codes and maternal-reported parenting behaviour (i.e., CCNES) were included in correlational analyses to establish construct validity of the new video coding scheme.

Next, repeated-measures ANOVAs were used to assess the effects of the online acute stressor on children's stress responsivity across time using mean cortisol and heart rate averaged over time. For cortisol, mean levels were averaged across five time points (i.e., before the stressor, immediately after the stressor, 15 minutes after, 30 minutes after, and 45 minutes after the stressor). Mean heart rate was averaged across four time points in the online assessment (i.e., task immediately before the stressor, during the first half of stressor, during second half of stressor, and at reunification). Following this, all variables of interest were included in bivariate correlations to examine the extent to which individual differences in children's stress reactivity and recovery were related to maternal behaviour codes and specific sociodemographic variables (i.e., child sex, child age, household income, maternal education). Cortisol reactivity was defined as the difference between time points two and three (i.e., immediately after and 15-minutes after stressor) while recovery was defined as the difference between points three and four (i.e., 30- and 45-minutes post stressor) based on the established timeline of the HPA response system. Heart rate reactivity was defined as the difference between average heart rate during the second half of the stressor and average heart rate during the Stroop tasks (occurring immediately before the stressor). Further, heart rate recovery was defined as the difference between average heart rate during the second half of the stressor and average heart rate during reunification.

Following this, all variables of interest were included in bivariate correlations to examine the extent to which individual differences in children's stress reactivity and recovery were associated with specific sociodemographic variables (i.e., child sex, child age, household income, maternal education) and observed maternal behaviour codes. Significant variables identified at the correlation level were then entered into linear regressions to understand cortisol reactivity, cortisol recovery, heart rate reactivity, and heart rate recovery.

Results

To better understand the sample of children who refused to participate in stress physiology collection, we analyzed their age and sex. Children who refused to produce saliva samples during the cortisol reactivity or recovery variables were mostly male (N=7, 78%) and all children who refused to wear the FitBit watch during heart rate reactivity or recovery were male (N=6, 100%). Further, children who refused during cortisol collection were younger (M=3.58 years, *SD*= .70) than children who produced all samples (M= 4.49 years, *SD*= .94). A similar trend was seen in the heart rate analyses, with children who refused to wear the FitBit being younger (M=3.29 years, *SD* = .45) than their peers who wore the FitBit (M=4.46 years, *SD* =.92).

Independent samples t-tests on children's internalizing and externalizing behaviours were examined among children who participated and dropped out of stress physiology collection. The results indicated there were no significant differences in internalizing scores [$t(33) = -.496$, $p = .623$] or externalizing scores [$t(33) = 1.354$, $p = .185$] between the two groups. Similar results were found for children who dropped out of the heart rate collection. There were no significant differences in internalizing scores [$t(33) = -.901$, $p = .354$] or externalizing scores [$t(33) = .674$, $p = .505$] between the two groups.

Construct Validation of Video Coded Maternal Behaviours

Bivariate correlations were conducted with the observed maternal behaviours (e.g., supportive parenting, unsupportive parenting, positive behavioural control, negative control, positive emotion, negative emotion, and maternal involvement) to screen for collinearity and to understand how the codes were associated with one another (Table 2). Positive behavioural control and positive emotion were significantly correlated with each other ($r = .686$, $p = .000$). Due to their high overlap, these two codes were assumed to be tapping similar constructs and were amalgamated to become *Positive Engagement* in subsequent analyses.

To examine construct validity, associations among the observed maternal behaviours (e.g., video codes) and the parent-report behaviours (e.g., CCNES) were completed (Table 3). The supportive parenting code was positively related to the CCNES' problem-focused reactions subscale ($r = .431$, $p = .009$), emotion-focused reactions subscale ($r = .594$, $p < .001$), and expressive reactions subscale ($r = .443$, $p = .007$). Further, the unsupportive parenting code was positively associated with the CCNES minimization reactions subscale ($r = .360$, $p = .031$). There were no significant correlations between observed positive engagement, negative emotion, negative control, maternal involvement, and the parent self-reported behaviours.

Investigating Links Between Observed Maternal Behaviours and Child Stress Physiology

Repeated measures ANOVAs were conducted to assess children's overall cortisol responsivity to the acute stressor task. Cortisol levels immediately after the task, 15 minutes after, 30 minutes after, and 45 minutes after were examined. Descriptive statistics are presented in Table 5. Mauchly's Test of Sphericity was not violated for the main effect of cortisol ($\chi^2(5)$ =

4.401, p = .494) and sphericity was assumed. There was not a significant main effect of time on cortisol levels ($F(3, 87) = 1.385$, p = .253). This indicates that the acute stressor did not elicit cortisol responsivity for the group, as a whole (Figure 1).

Similarly, repeated measures ANOVAs were conducted to assess children's heart rate responsivity in response to the acute stressor task. Heart rate descriptive statistics are presented in Table 5. Mauchly's Test of Sphericity was violated for the main effect of heart rate ($\chi^2(9)$ = 32.822, p = .000). Using Greenhouse-Geiser estimates of sphericity (ε = .64) the degrees of freedom were corrected. There was a significant main effect of time on heart rate levels ($F(2.563, 84.573)$ = .5.273, p = .004, $\eta^2_{partial}$ = .138). This indicates that the acute stressor did elicit heart rate responsivity for the entire group (Figure 2).

Bivariate correlations were also conducted with child stress physiology outcomes (e.g., cortisol reactivity/recovery, heart rate reactivity/recovery), observed maternal behaviours (e.g., supportive parenting, unsupportive parenting, positive engagement, negative control, negative emotion, and maternal involvement), and relevant covariates (e.g., child age, child sex, maternal education, household income) to inform linear regressions (Table 4). Pearson's correlations were used for continuous variables while point-biserial correlations were used for continuous and dichotomous variables.

Child sex was negatively associated with cortisol recovery (r = -.371, p =.026), such that girls exhibited more cortisol recovery and boys exhibited less. Both cortisol reactivity (r = -.372, p = .036) and heart rate reactivity (r = -.398, p = .024) were negatively associated with maternal involvement, such that children whose mother was involved experienced less reactivity. Heart rate reactivity was also positively related to cortisol reactivity (r = .398, p = .026) and negatively to heart rate recovery (r = -.417, p = .014). Heart rate recovery was marginally associated with maternal involvement (r = .299, p = .091), such that children whose mother was involved experienced more recovery. All micro-coded maternal behaviours were not significantly related to children's stress physiology (p> .10). The mean cortisol (Figure 3) and heart rate reactivity (Figure 4) are presented based on mothers involvement during the acute stressor task, with the uninvolved mother group demonstrating more reactivity.

Linear regressions were conducted for each outcome variable with significant bivariate predictor variables (Table 6). In the cortisol reactivity regression, both maternal involvement (β = -.404, t= -2.596, p = .015) and child sex (β = .349, t= 2.230, p = .034) were significant predictors. The results of the regression suggest that maternal involvement and child sex explained 26.4% of the variance (R^2 = .264, F(2,31) = 5.208, p = .012, f^2=.359).

In the cortisol recovery regression, child sex was a significant predictor (β = -.224, t= -2.083, p = .047). Maternal involvement was not a significant predictor. The results of the regression suggest that child sex and maternal involvement accounted for 14.0% of the variance (R^2 = .140, F(2,30) = 2.271, p = .122, f^2=.163).

In the heart rate reactivity regression, maternal involvement was a significant predictor (β = -.6.6997, t= -2.495, p = .019). Child sex was not a significant predictor. Results of the linear regression suggested that 18.9% of the variance in heart rate reactivity was explained by maternal involvement and cortisol reactivity (R^2 = .189, F(2,31) = 3.369, p = .048, f^2=.233).

In the heart rate recovery regression neither maternal involvement nor child sex were significant predictors. The linear regression demonstrated that 11.7% of the variance in recovery was explained by maternal involvement and child sex (R^2 = .117, F(1,32) = 1.989, p = .154, f^2=.133).

Discussion

This study aimed to create a novel video-coding scheme to capture distinct aspects of maternal behaviours and their associations to children's stress system reactivity and recovery. We utilized an online assessment procedure, including an acute stressor task, and documented maternal involvement during the task along with their behaviours post-stressor. Notably, maternal involvement during the acute stressor was the most prominent predictor of child stress physiology reactivity.

Many video coding schemes have evidence to support their validity for answering theoretical and clinical questions regarding parent-child interactions and well-being as demonstrated through their associations with change over time (i.e., predictive validity) or other validated measures (i.e., construct validity; Gardner, 2000). In this study, we aimed to develop construct validity of the novel coding scheme by comparing the observed maternal behaviours to a validated measure of parenting behaviour, the CCNES parent-report scale (Fabes et al., 1990). The subscales of the CCNES cover both positive and negative parenting behaviours, as does the coding scheme. Therefore, we hypothesized that the positive measures of parenting behaviours across the self-report scale and the coding scheme would be associated, while the negative measures would also be associated.

Our results indicate partial support for construct validity of the coding scheme. The supportive parenting code was positively associated to the emotion-focused, expressive encouragement, and problem-focused subscales of the CCNES. Particularly, the positive association between the supportive parenting code and emotion-focused CCNES subscale is indicative of construct validity. The emotion-focused subscale reflects the degree to which parents try to help their child feel better through comfort and sensitivity, similarly to how the code supportive parenting was developed (Fabes et al., 2002). Furthermore, the positive association between the expressive encouragement subscale and supportive parenting code supports the scheme's construct validity. The expressive encouragement measure encapsulates a parent's acceptance of their child's negative emotional displays (Fabes et al., 2002). Similarly, the supportive parenting code also captured such behaviours. The final association between supportive parenting is with the problem-focused subscale of the CCNES. Although the problem-focused subscale is a measure of positive parenting behaviours, it captures the extent to which parents aim to fix the source of their child's distress (Fabes et al., 2002). Following an acute stressor, this may not truly supportive to the child and could potentially be viewed as approaching intrusive parenting (Ispa et al., 2004). In summary, there was good construct validity support for the supportive parenting code when compared to the parent-report measure.

Comparably, the unsupportive parenting code was positively associated with the minimization reaction subscale from the CCNES. The minimization subscale encompasses less compassionate parenting behaviours such as diminishing a child's feelings, similar to the unsupportive parenting code's definition which supports its construct validity (Fabes et al., 2002). Conversely, there were no significant correlations between positive engagement, negative emotion, negative control, or maternal involvement with the CCNES subscales. The negative emotion code was hypothesized to be associated to the distress reactions subscale from the CCNES as both measure aspects of negative parental emotions. Alternatively, it is unsurprising that the positive engagement, negative control, or maternal involvement were not associated to any CCNES subscales as they are theorized to capture different aspects of parenting. Due to the novel nature of the video coding scheme, further refinement may be warranted for those codes to ensure they are valid. In short, the novel video coding scheme holds preliminary construct validity as some, but not all, of the codes demonstrated significant hypothesized correlations with the questionnaire measure of parenting.

The acute stressor utilized in this study was based on a paradigm validated for in laboratory (Roos et al., 2017). We adapted the paradigm to be feasible in an online context. Our results found that the new model effectively elicited children's heart rate acceleration, but not cortisol reactivity. This is unsurprising due to the difficult nature of reliability eliciting cortisol reactivity in the 2-5 years age range, especially when preschoolers' parents are present (Gunnar et al., 2009). To successfully adapt the stressor to the online platform, this was one of the changes that had to be implemented.

Due to the online nature of the assessment and young age of the children, our research team determined it would not be appropriate to ask mothers to leave the room during the acute stressor task, unlike similar in-person stressor tasks (Kryski et al., 2011; Roos et al., 2017; Stülb et al., 2019). This procedural shift was put in place to balance maternal comfort and their sense of safety regarding their child interacting with a stranger on the computer. Despite all mothers being instructed to remain uninvolved, move their chair a few feet away their child, and stay out of their child's view, many mothers still engaged with their child. Consequently, having mothers in the room produced a natural manipulation across participants, with some mothers being involved during the stressor and others remaining completely uninvolved. Interestingly, there were notable differences in children's stress system reactivity based on their mother's involvement during the acute stressor.

Cues from a sensitive parent during a challenging environmental context have been theorized to influence children's appraisal of certain stimuli, minimizing their stress response (Hostinar et al., 2014). Extrapolating to our online research context, maternal involvement during the acute stressor task was a critical piece to examine in relation to children's stress physiology. Our results are consistent with social buffering theory on the essential role of maternal presence, in that, children whose mother was more involved during the stressor, exhibited less heart rate and cortisol reactivity. An interesting consideration is whether this result aligns with extant literature on 'helicopter parenting', which is when parents become involved in improving their child's personal success in a way that does not match their child's developmental stage (LeMoyne & Buchanan, 2011). Research suggests there are associations between maternal overinvolvement, or helicopter parenting, and less desirable child outcomes such as anxiety disorders in preschoolers (Otto et al., 2016). In our sample, maternal involvement had a promising impact on children's stress reactivity, differing from the typical narrative of helicopter parenting. However, more research is warranted to better understand if maternal involvement during the acute stressor is similar to the over involvement of helicopter parenting styles.

Regardless, this result has considerable implications for researchers, clinicians, and program developers. First, for researchers aiming to assess children's stress response, it is important that maternal presence during stress paradigms be systematically quantified and appropriately included in results, as our findings indicate the considerable sensitivity of children's stress responses to this variable. For clinicians or program developers, our results show that one of the most important things parents of preschoolers can do for their children in times of challenge or stress, is to physically be proximal to them. This information should be disseminated throughout parenting programs aimed at supporting children's self-regulation.

Contrarily, maternal involvement was not significantly related to children's cortisol or heart rate recovery. This is interesting, as mothers who offered support during the acute stressor would be hypothesized to offer similar levels of sensitive parenting after the acute stressor task, inducing acceleration to cortisol and heart rate recovery (Berlin et al., 2019; Gunnar, 2016). However, it is also possible that for children whose mother was present and supportive during the stressor, they did not require additional support to recover as their stress system reactivity was buffered by their mother's presence. To better understand this relationship, the role of maternal involvement during an acute stressor should be further investigated in a controlled environment, and the results should be leveraged to inform parenting programs to support children's well-being.

The online administration of the acute stressor in preschool-aged children presents both advantages and disadvantages compared to in-person administration. The online setting decreased barriers for mothers and their children to attend the assessment, but in turn, increased variability outside of the research team's control. This included other family members interrupting the assessment, electronic distractions (e.g., iPad or television), and challenges maintaining the preschoolers' attention. However, this variation was skillfully handled by research assistants, ultimately leading to a high attendance and completion rate of the remote stressor administration.

To guide future research in online assessments, we note some technical considerations those wishing to administer an acute stressor task remotely should consider. First, it is recommended that parents complete a 'task', such as a paper-copy questionnaire, during the time when their child is participating in the acute stressor. This may help to minimize the variability in parent involvement/presence during the stressor. Moreover, the person administering the acute stressor should take extra time to deliver clear and explicit instructions to parents. Asking parents to move away from their child, but remain in the room, may also help to minimize their involvement in the stressor task. Finally, online teleconference settings such as the "pin video" feature in Zoom Healthcare should be utilized so that the parent-child dyad are the prominent image on the video recording, allowing for subsequent data to be collected (e.g., observational video coding). With these lessons learned in mind, the administration of remote acute stressors holds much promise for utilization in the field of psychophysiology.

Strengths and Limitations

The current study had numerous strengths. The research collected data using multiple different methodologies: child physiological data, parent-report questionnaires, and observational data, providing an in-depth view of all aspects of the online assessment. A further strength of the observational data was that the mother-child interactions were unstructured, allowing for the most accurate insight into parenting strategies of mothers (Ginsburg et al., 2006). Additionally, the remote assessments and delivery/mailing of required materials increased accessibility and minimized discomfort of attending an assessment in a novel lab setting. Finally, this study investigated an age-group of children, preschoolers, that is an age often missed in the literature.

There are some limitations that should be kept in mind when interpreting these findings. Participants in the study completed the online assessment as one piece of a larger research project and clinical trial, limiting the sample size of mother-child dyads. Our sample size was further limited by child refusal to participate in stress physiology collection. Future research should consider utilizing a power analysis prior to recruitment efforts to establish a sufficient sample size to investigate effect sizes of significant findings. Additionally, mothers participating in this research were a clinical sample with depression, limiting generalizability to the wider population (e.g., non-clinical mothers, fathers). In considering this clinical population, it is also important to note that there may have been less variability in the responsivity and engagement of mothers during the reunification period, as mothers with depression often speak less, show less responsivity, and exhibit a flat affect (Righetti-Veltema et al., 2002). Future research should include a non-clinical group to investigate any differences in maternal behaviours and their implication on children's stress physiology. An additional limitation is that demographic information such as ethnicity/race was not collected. However, due to the small sample size analyzing ethnicity would not have been appropriate. Although utilizing the Zoom platform was very convenient for most participants, it may have created challenges for the online assessment including mothers experiencing social desirability bias when supporting their child after the frustrating task due to their awareness of being video recorded, similar to being video recorded in laboratory. The home environment in which mother-child dyads completed online assessments also resulted in the researchers having less experimental control for maternal involvement across the assessment, similar to other researchers' experiences (MacDonald & Greggans, 2008).

Potential Implications

This research produced a novel video-coding system designed to meet the needs of researchers interested in understanding parenting strategies that are associated with parental buffering and children's stress system recovery. Although the microcoding system was not relevant in this context, due to the strong impacts of maternal involvement during the stressor, the system has demonstrated partial construct validity and has potential to be a reliable and valid system in a field lacking a "gold standard" measure (Aspland & Gardner, 2003; Gardner, 2000). Future research may utilize this system to evaluate longitudinal intervention changes of maternal behaviours or to compliment measures of self-reported parenting behaviours. Further, the novel coding scheme would be useful in contexts of in-person buffering periods and potentially among children of broader childhood ages. Notably, the resultant associations between maternal presence and stress buffering provides insight into the role mothers play in coregulating their child's stress reactivity. This, in turn, provides researchers information to develop precise interventions to proactively protect children on a trajectory towards mental health symptoms. Understanding the role that mothers' parenting behaviours have on children's stress physiology may inform future programming and targeted parenting interventions.

References

Ainsworth, M. D., Blehar, M., Waters, E., & Wall, S. (1978). Patterns of attachment.

Albers, E. M., Marianne Riksen-Walraven, J., Sweep, F. C., & Weerth, C. D. (2008). Maternal behavior predicts infant cortisol recovery from a mild everyday stressor. *Journal of Child Psychology and Psychiatry*, *49*(1), 97-103.

Apter-Levi, Y., Pratt, M., Vakart, A., Feldman, M., Zagoory-Sharon, O., & Feldman, R. (2016). Maternal depression across the first years of life compromises child psychosocial adjustment; relations to child HPA-axis functioning. *Psychoneuroendocrinology*, *64*, 47-56.

Asok, A., Bernard, K., Roth, T. L., Rosen, J. B., & Dozier, M. (2013). Parental responsiveness moderates the association between early-life stress and reduced telomere length. *Development and psychopathology*, *25*(3), 577-585.

Aspland, H., & Gardner, F. (2003). Observational measures of parent-child interaction: an introductory review. *Child and Adolescent Mental Health*, *8*(3), 136-143.

Berlin, L. J., Martoccio, T. L., Bryce, C. I., & Harden, B. J. (2019). Improving infants' stress-induced cortisol regulation through attachment-based intervention: A randomized controlled trial. *Psychoneuroendocrinology*, *103*, 225-232.

Bernier, A., Carlson, S. M., & Whipple, N. (2010). From external regulation to self-regulation: Early parenting precursors of young children's executive functioning. *Child development*, *81*(1), 326-339.

Berry, D., Clancy Blair, M. W., Granger D. A., Mills-Koonce, W. R., & Investigators, T. F. L. P. K. (2017). Maternal sensitivity and adrenocortical functioning across infancy and toddlerhood: Physiological adaptation to context?. *Development and psychopathology*, *29*(1), 303.

Bornstein, M. H., Hahn, C. S., Suwalsky, J. T., & Haynes, O. M. (2011). Maternal and infant behavior and context associations with mutual emotion availability. *Infant Mental Health Journal*, *32*(1), 70-94.

Boyce, W. T., & Ellis, B. J. (2005). Biological sensitivity to context: I. An evolutionary–developmental theory of the origins and functions of stress reactivity. *Development and psychopathology*, *17*(2), 271-301.

Brown, S. M., Schlueter, L. J., Hurwich-Reiss, E., Dmitrieva, J., Miles, E., & Watamura, S. E. (2020). Parental buffering in the context of poverty: positive parenting behaviors differentiate young children's stress reactivity profiles. *Development and Psychopathology*, *32*(5), 1778-1787.

Calkins, S. D., Smith, C. L., Gill, K. L., & Johnson, M. C. (1998). Maternal interactive style across contexts: Relations to emotional, behavioral and physiological regulation during toddlerhood. *Social development*, *7*(3), 350-369.

Cohen, J. (1960). A coefficient of agreement for nominal scales. *Educational and psychological measurement*, *20*(1), 37-46.

Cohen, S. (2004). Social relationships and health. *American psychologist*, *59*(8), 676.

Chu, P. S., Saucier, D. A., & Hafner, E. (2010). Meta-analysis of the relationships between social support and well-being in children and adolescents. *Journal of Social and Clinical Psychology*, *29*(6), 624-645.

Deans, C. L. (2020). Maternal sensitivity, its relationship with child outcomes, and interventions that address it: a systematic literature review. *Early Child Development and Care*, *190*(2), 252-275.

Dettling, A. C., Parker, S. W., Lane, S., Sebanc, A., & Gunnar, M. R. (2000). Quality of care and temperament determine changes in cortisol concentrations over the day for young children in childcare. *Psychoneuroendocrinology*, *25*(8), 819-836.

Drury, S. S., Scaramella, L., & Zeanah, C. H. (2016). The neurobiological impact of postpartum maternal depression: prevention and intervention approaches. *Child and Adolescent Psychiatric Clinics*, *25*(2), 179-200.

Eagle, D. E., Rash, J. A., Tice, L., & Proeschold-Bell, R. J. (2021). Evaluation of a remote, internet-delivered version of the Trier Social Stress Test. *International Journal of Psychophysiology*, *165*, 137-144.

Eddy, J. M., Dishion, T. J., & Stoolmiller, M. (1998). The analysis of intervention change in children and families: Methodological and conceptual issues embedded in intervention studies. *Journal of Abnormal Child Psychology*, *26*(1), 53-69.

Fabes, R. A., Eisenberg, N., & Bernzweig, J. (1990). *Coping with Children's Negative Emotions Scale (CCNES): Description and Scoring.* Tempe, AZ: Arizona State University

Fabes, R. A., Leonard, S. A., Kupanoff, K., & Martin, C. L. (2001). Parental coping with children's negative emotions: Relations with children's emotional and social responding. *Child development*, *72*(3), 907-920.

Fabes, R. A., Poulin, R. E., Eisenberg, N., & Madden-Derdich, D. A. (2002). The Coping with Children's Negative Emotions Scale (CCNES): Psychometric properties and relations with children's emotional competence. *Marriage & Family Review, 34*, 285-310.

Fay-Stammbach, T., Hawes, D. J., & Meredith, P. (2014). Parenting influences on executive function in early childhood: A review. *Child Development Perspectives*, *8*(4), 258-264.

Feldman, R., Granat, A. D. I., Pariente, C., Kanety, H., Kuint, J., & Gilboa-Schechtman, E. (2009). Maternal depression and anxiety across the postpartum year and infant social engagement, fear regulation, and stress reactivity. *Journal of the American Academy of Child & Adolescent Psychiatry*, *48*(9), 919-927.

Fisher, P. A., Frenkel, T. I., Noll, L. K., Berry, M., & Yockelson, M. (2016). Promoting healthy child development via a two-generation translational neuroscience framework: the Filming Interactions to Nurture Development video coaching program. *Child Development Perspectives*, *10*(4), 251-256.

Flom, M., St. John, A. M., Meyer, J. S., & Tarullo, A. R. (2017). Infant hair cortisol: associations with salivary cortisol and environmental context. *Developmental Psychobiology*, *59*(1), 26–38. doi.org/10.1002/dev.21449

Folkman, S., & Lazarus, S. (1990). Coping and emotion. *Psychological and biological approaches to emotion. Hillsdale, NJ: Lawrence Erlbaum*.

Gardner, F. (2000). Methodological issues in the direct observation of parent–child interaction: Do observational findings reflect the natural behavior of participants?. *Clinical child and family psychology review*, *3*(3), 185-198.

Ghosh, D., & Vogt, A. (2012, July). Outliers: An evaluation of methodologies. In *Joint statistical meetings* (Vol. 2012).

Ginsburg, G. S., Grover, R. L., Cord, J. J., & Ialongo, N. (2006). Observational measures of parenting in anxious and nonanxious mothers: Does type of task matter?. *Journal of Clinical Child & Adolescent Psychology, 35*(2), 323-328.

Gunnar, M. R., & Vazquez, D. M. (2001). Low cortisol and a flattening of expected daytime rhythm: Potential indices of risk in human development. *Development and psychopathology*, *13*(3), 515-538.

Gunnar, M. R., Talge, N. M., & Herrera, A. (2009). Stressor paradigms in developmental studies: What does and does not work to produce mean increases in salivary cortisol. *Psychoneuroendocrinology*, *34*(7), 953-967.

Gunnar, M. R., & Hostinar, C. E. (2015). The social buffering of the hypothalamic–pituitary–adrenocortical axis in humans: Developmental and experiential determinants. *Social neuroscience*, *10*(5), 479-488.

Gunnar, M. R. (2016). Early life stress: What is the human chapter of the mammalian story?. *Child Development Perspectives*, *10*(3), 178-183.

Gunnar, M. R., Reid, B.M., Donzella, B., Miller, Z. R., Gardow, S., Tsakonas, N.C., Thomas, K., M., DeJoseph, M., & Bendezú, J.J. (2021). Validation of an online version of the Trier Social Stress Test in a study of adolescents. *Psychoneuroendocrinology, 125*, 105-111.

Ha, T., & Granger, D. A. (2016). Family relations, stress, and vulnerability: Biobehavioral implications for prevention and practice. *Family Relations*, *65*(1), 9-23.

Harris, P. A., Taylor, R., Thielke, R., Payne, J., Gonzalez, N., & Conde, J. G. (2009). Research electronic data capture (REDCap) - A metadata-driven methodology and workflow process for providing translational research informatics support. *Journal of Biomedical Informatics*, *42*(2), 377–381. https://doi.org/10.1016/j.jbi.2008.08.010

Harvie, H., Jain, B., Nelson, B., Knight, E., Roos, L. E., & Giuliano, R. J. (2021). *Induction of acute stress through an internet-delivered Trier Social Stress Test as assessed by photoplethysmography on a smartphone.* PsyArXiv Preprints. https://doi.org/10.31234/osf.io/rjkmv

Hostinar, C. E., Sullivan, R. M., & Gunnar, M. R. (2014). Psychobiological mechanisms underlying the social buffering of the hypothalamic–pituitary–adrenocortical axis: A review of animal models and human studies across development. *Psychological bulletin*, *140*(1), 256.

Hostinar, C. E., Johnson, A. E., & Gunnar, M. R. (2015). Parent support is less effective in buffering cortisol stress reactivity for adolescents compared to children. *Developmental science*, *18*(2), 281-297.

Ispa, J. M., Fine, M. A., Halgunseth, L. C., Harper, S., Robinson, J., Boyce, L., Brooks-Gunn, J., & Brady-Smith, C. (2004). Maternal intrusiveness, maternal warmth, and mother–toddler relationship outcomes: Variations across low-income ethnic and acculturation groups. *Child development*, *75*(6), 1613-1631.

Johnson, A. B., Mliner, S. B., Depasquale, C. E., Troy, M., & Gunnar, M. R. (2018). Attachment security buffers the HPA axis of toddlers growing up in poverty or near poverty: Assessment during pediatric well-child exams with inoculations. *Psychoneuroendocrinology*, *95*, 120-127.

Kryski, K. R., Smith, H. J., Sheikh, H. I., Singh, S. M., & Hayden, E. P. (2011). Assessing stress reactivity indexed via salivary cortisol in preschool-aged children. *Psychoneuroendocrinology*, *36*(8), 1127-1136.

Laurent, H. K., Leve, L. D., Neiderhiser, J. M., Natsuaki, M. N., Shaw, D. S., Fisher, P. A., Marceau, K., Harold, G. T., & Reiss, D. (2013). Effects of parental depressive symptoms on child adjustment moderated by hypothalamic pituitary adrenal activity: Within-and between-family risk. *Child development*, *84*(2), 528-542.

LeMoyne, T., & Buchanan, T. (2011). Does "hovering" matter? Helicopter parenting and its effect on well-being. *Sociological Spectrum*, *31*(4), 399-418.

Lewis, C., & Carpendale, J. I. (2009). Introduction: Links between social interaction and executive function. *New Directions for Child and Adolescent Development*, *2009*(123), 1-15.

Lo Iacono, V., Symonds, P., & Brown, D. H. (2016). Skype as a tool for qualitative research interviews. *Sociological Research Online*, *21*(2), 103-117.

Lovallo, W. R. (2015). *Stress and health: Biological and psychological interactions*. Sage publications.

Lowe, J. R., Erickson, S. J., MacLean, P., Schrader, R., & Fuller, J. (2013). Association of maternal scaffolding to maternal education and cognition in toddlers born preterm and full term. *Acta Paediatrica*, *102*(1), 72-77.

Lupien, S. J., McEwen, B. S., Gunnar, M. R., & Heim, C. (2009). Effects of stress throughout the lifespan on the brain, behaviour and cognition. *Nature reviews neuroscience*, *10*(6), 434.

Lupien, S. J., King, S., Meaney, M. J., & McEwen, B. S. (2000). Child's stress hormone levels correlate with mother's socioeconomic status and depressive state. *Biological psychiatry*, *48*(10), 976-980.

MacDonald, K., & Greggans, A. (2008). Dealing with chaos and complexity: The reality of interviewing children and families in their own homes. *Journal of Clinical Nursing*, *17*(23), 3123-3130.

Martins, C., & Gaffan, E. A. (2000). Effects of early maternal depression on patterns of infant–mother attachment: A meta-analytic investigation. *The Journal of Child Psychology and Psychiatry and Allied Disciplines*, *41*(6), 737-746.

Manczak, E. M., McLean, K. C., McAdams, D. P., & Chen, E. (2015). Physiological reactivity during parent-adolescent discussions: Associations with scaffolding behaviors and relationship quality. *Annals of Behavioral Medicine*, *49*(4), 522-531.

McEwen, B. S., & Gianaros, P. J. (2011). Stress-and allostasis-induced brain plasticity. *Annual review of medicine*, *62*, 431-445.

Mermelshtine, R. (2017). Parent–child learning interactions: A review of the literature on scaffolding. *British Journal of Educational Psychology*, *87*(2), 241-254.

Mortensen, J. A., & Mastergeorge, A. M. (2014). A meta-analytic review of relationship-based interventions for low-income families with infants and toddlers: Facilitating supportive parent–child interactions. *Infant Mental Health Journal*, *35*(4), 336-353.

Nachmias, M., Gunnar, M., Mangelsdorf, S., Parritz, R. H., & Buss, K. (1996). Behavioral inhibition and stress reactivity: The moderating role of attachment security. *Child development*, *67*(2), 508-522.

Nelson, B. W., Low, C. A., Jacobson, N., Areán, P., Torous, J., & Allen, N. B. (2020). Guidelines for wrist-worn consumer wearable assessment of heart rate in biobehavioral research. *NPJ digital medicine*, *3*(1), 1-9.

National Scientific Council on the Developing Child (2012). *The Science of Neglect: The Persistent Absence of Responsive Care Disrupts the Developing Brain: Working Paper No. 12*. Retrieved from www.developingchild.harvard.edu.

Osenbach, J. E., O'Brien, K. M., Mishkind, M., & Smolenski, D. J. (2013). Synchronous telehealth technologies in psychotherapy for depression: A meta-analysis. *Depression and Anxiety*, *30*(11), 1058-1067.

Otto, Y., Kolmorgen, K., Sierau, S., Weis, S., von Klitzing, K., & Klein, A. M. (2016). Parenting behaviors of mothers and fathers of preschool age children with internalizing disorders. *Journal of Child and Family Studies*, *25*(2), 381-395.

Palmer, F. B., Anand, K. J., Graff, J. C., Murphy, L. E., Qu, Y., Völgyi, E., Rovnaghi, C. R., Moore, A., Tran, Q. T., & Tylavsky, F. A. (2013). Early adversity, socioemotional development, and stress in urban 1-year-old children. *The Journal of pediatrics*, *163*(6), 1733-1739.

Perry, N. B., Nelson, J. A., Swingler, M. M., Leerkes, E. M., Calkins, S. D., Marcovitch, S., & O'Brien, M. (2013). The relation between maternal emotional support and child physiological regulation across the preschool years. *Developmental psychobiology*, *55*(4), 382-394.

Peugh, J. L., & Enders, C. K. (2004). Missing data in educational research: A review of reporting practices and suggestions for improvement. *Review of educational research*, *74*(4), 525-556.

Price-Evans, K., & Field, A. P. (2008). A neglectful parenting style moderates the effect of the verbal threat information pathway on children's heart rate responses to novel animals. *Behavioural and Cognitive Psychotherapy*, *36*(4), 473-482.

Kalmakis, K. A., & Chandler, G. E. (2015). Health consequences of adverse childhood experiences: a systematic review. *Journal of the American Association of Nurse Practitioners*, *27*(8), 457-465.

Kemppinen, K., Kumpulainen, K., Moilanen, I., & Ebeling, H. (2006). Recurrent and transient depressive symptoms around delivery and maternal sensitivity. *Nordic Journal of Psychiatry*, *60*(3), 191-199.

Knoche, L. L., Edwards, C. P., Sheridan, S. M., Kupzyk, K. A., Marvin, C. A., Cline, K. D., & Clarke, B. L. (2012). Getting ready: Results of a randomized trial of a relationship-focused intervention on the parent–infant relationship in rural early head start. *Infant Mental Health Journal*, *33*(5), 439-458.

Köhler-Dauner, F., Fegert, J. M., Anna, B., Krause, S., Gündel, H., Waller, C., & Ziegenhain, U. (2019). Maternal Behavior Affects Child’s Attachment-related Cortisol Stress Response. *Journal of Child and Adolescent Psychiatry*, *1*(1), 46.

Kroenke, K. & Spitzer, R.L. (2002). The PHQ-9: A new depression and diagnostic severity measure. *Psychiatric Annals, 32*, 509-521.

Petruccelli, K., Davis, J., & Berman, T. (2019). Adverse childhood experiences and associated health outcomes: a systematic review and meta-analysis. *Child abuse & neglect*, *97*, 104127.

Porges, S. W. (2001) Polyvagal theory: phylogenetic substrates of a social nervous system, *International Journal of Psychophysiology*, *42*, 123-146.

Prescott, A., Bank, L., Reid, J. B., Knutson, J. F., Burraston, B. O., & Eddy, J. M. (2000). The veridicality of punitive childhood experiences reported by adolescents and young adults. *Child Abuse & Neglect*, *24*(3), 411-423.

R Core Team (2017). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing, Vienna, Austria. https://www.R-project.org/

Ramsden, S. R., & Hubbard, J. A. (2002). Family expressiveness and parental emotion coaching: Their role in children's emotion regulation and aggression. *Journal of abnormal child psychology*, *30*(6), 657-667.

Rickmeyer, C., Lebiger-Vogel, J., & Leuzinger-Bohleber, M. (2017). Transition to kindergarten: negative associations between the emotional availability in Mother–Child relationships and elevated cortisol levels in children with an immigrant background. *Frontiers in psychology*, *8*, 425.

Righetti-Veltema, M., Conne-Perréard, E., Bousquet, A., & Manzano, J. (2002). Postpartum depression and mother–infant relationship at 3 months old. *Journal of affective disorders*, *70*(3), 291-306.

Roos, L. E., Giuliano, R. J., Beauchamp, K. G., Gunnar, M., Amidon, B., & Fisher, P. A. (2017). Validation of autonomic and endocrine reactivity to a laboratory stressor in young children. *Psychoneuroendocrinology*, *77*, 51-55.

Roos, L. E., Giuliano, R. J., Beauchamp, K. G., Berkman, E. T., Knight, E. L., & Fisher, P. A. (2019). Acute stress impairs children's sustained attention with increased vulnerability for children of mothers reporting higher parenting stress. *Developmental psychobiology*.

Roos, L. E., Kaminski, L., Stienwandt, S., Hunter, S., Giuliano, R. J., Mota, N., Katz, L. Y., & Zalewski, M. (2020). *The Building Regulation in Dual-Generations Program (BRIDGE): A mixed-methods feasibility pilot of a parenting program for depressed mothers of preschoolers, matched with dialectical behavior therapy skills.* PsyArXiv Preprints. http://dx.doi.org/10.31234/OSF.IO/KD2UA

Roos, L.E., Giuliano R.J., Mota, N., Katz, L.Y., & Zalewski, M. (2020, September 1-). *Building regulation in dual generations – Telehealth model (BRIDGE).* Identifier NCT04639557. https://clinicaltrials.gov/ct2/show/study/NCT04639557

Rudd, K. L., Alkon, A., & Yates, T. M. (2017). Prospective relations between intrusive parenting and child behavior problems: Differential moderation by parasympathetic nervous system regulation and child sex. *Physiology and Behavior*, *180*, 120–130. https://doi.org/10.1016/j.physbeh.2017.08.014

Sheehan, D. V., Lecrubier, Y., Hartneet-Sheehan, K., Amorim, P., Janavs, J., Weiller, E., Hergueta, T., Baker, R., & Dunbar, G. (1998). The Mini-International Neuropsychiatric Interview (MINI): the development and validation of a structured diagnostic psychiatric interview. *Journal of Clinical Psychiatry*, *59*(20), 22-33.

Shonkoff, J. P., & Fisher, P. A. (2013). Rethinking evidence-based practice and two-generation programs to create the future of early childhood policy. *Development and psychopathology*, *25*(4pt2), 1635-1653.

Shonkoff, J. P., Garner, A. S., Siegel, B. S., Dobbins, M. I., Earls, M. F., McGuinn, L., Pascoe, J., Wood, D.L., & Committee on Early Childhood, Adoption, and Dependent Care. (2012). The lifelong effects of early childhood adversity and toxic stress. *Pediatrics*, *129*(1), e232-e246.

Shonkoff, J. P., Richmond, J., Levitt, P., Bunge, S. A., Cameron, J. L., Duncan, G. J., & Nelson III, C. A. (2016). From best practices to breakthrough impacts a science-based approach to building a more promising future for young children and families. *Cambirdge, MA: Harvard University, Center on the Developing Child*.

Stansbury, K., & Sigman, M. (2000). Responses of preschoolers in two frustrating episodes: Emergence of complex strategies for emotion regulation. *The Journal of Genetic Psychology*, *161*(2), 182-202.

Stülb, K., Messerli-Bürgy, N., Kakebeeke, T. H., Arhab, A., Zysset, A. E., Leeger-Aschmann, C. S., Schmutz, E. A., Meyer, A. H., Garcia-Burgos, D., Ehlert, U., Kriemler, S., Jenni, O. G., Puder, J. J., & Munsch, S. (2019). Age-adapted stress task in preschoolers does not lead to uniform stress responses. *Journal of abnormal child psychology*, *47*(4), 571-587.

Sy, M., O'Leary, N., Nagraj, S., El-Awaisi, A., O'Carroll, V., & Xyrichis, A. (2020). Doing interprofessional research in the COVID-19 era: a discussion paper. *Journal of Interprofessional Care*, *34*(5), 600-606.

Tolep, M. R. & Dougherty, L.R. (2012). Parental depression, parenting, and cortisol reactivity in preschoolers (Doctoral dissertation). Retrieved from http://hdl.handle.net/1903/12791

Thompson, R. A. (2014). Stress and child development. *The Future of Children*, 41-59.

van Doesum, K. T., Hosman, C. M., Riksen-Walraven, J. M., & Hoefnagels, C. (2007). Correlates of depressed mothers' sensitivity toward their infants: the role of maternal, child, and contextual characteristics. *Journal of the American Academy of Child & Adolescent Psychiatry*, *46*(6), 747-756.

Van de Mortel, T. F. (2008). Faking it: social desirability response bias in self-report research. *Australian Journal of Advanced Nursing, The*, *25*(4), 40.

Wood, D., Bruner, J. S., & Ross, G. (1976). The role of tutoring in problem solving. *Journal of Child Psychology and Psychiatry*, *17*(2), 89-100.

Table 1

Sample Characteristics

Characteristic	Valid %	Valid N
Child Age		
2 years	10.4	4
3 years	28.6	11
4 years	33.8	13
5 years	28.6	11
Child Sex		
Female	40.0	16
Male	60.0	24
Maternal Education		
Some high school	5.1	2
High school diploma	30.8	12
College/technical school	30.8	12
Bachelor’s degree	23.1	9
Master’s degree	5.1	2
Professional degree	5.1	2
Total Annual Household Income		
$1-10,000	5.6	2
$10,001 – 20,000	19.4	7
$20,001 – 30,000	2.8	1
$30,001 - 40,000	13.9	5
$40,001 – 50,000	8.3	3
$50,001 – 60,000	2.8	1
$60,001 – 70,000	11.1	4
$70,001 – 80,000	8.3	3
$80,001 – 90,000	5.6	2
$90,001- 100,000	11.1	4
>$100,000	11.1	4

Table 2

Maternal Behaviour Correlations

Measure	*1*	*2*	*3*	*4*	*5*	*6*	*7*
1. Supportive code	-						
2. Unsupportive code	-.158	-					
3. Beh. post. ctrl code	**-.437****	-.070	-				
4. Neg ctrl code	**.521****	.133	**-.392***	-			
5. Pos emotion code	**-.416****	-.087	**.686****	**-.418****	-		
6. Neg emotion code	**.448****	.218	**-.531****	**.428****	**-.481****	-	
7. Mom involvement code	-.0.48	.259	.061	-.119	-.089	-.132	-

Note: $^{*}p \leq .05$, $^{**}p \leq .01$.

Table 3

Maternal Behaviours and Parent-Reported Behaviour Correlations

Measure	*7*	*8*	*9*	*10*	*11*	*12*
1. Supportive code	-.278	**.431****	**.594****	**.443****	-.232	.019
2. Unsupportive code	**.360***	-.118	-.071	-.136	.321	-.034
3. Positive engagement code	-.070	-.250	-.199	-.110	.066	.158
4. Neg control code	-.071	.161	.226	.184	-.005	.259
5. Neg emotion code	-.274	.122	.235	.105	-.127	-.012
6. Mom involvement code	.047	.159	.246	.120	.058	-.181
7. CCNES: Minimization	-	-	-	-	-	-
8. CCNES: Prob-focused						
9. CCNES: Emotion-focused						
10. CCNES: Expressive rx						
11. CCNES: Punitive rx						
12. CCNES: Distress						

Note: *$p \leq .05$, **$p \leq .01$.

Table 4

Demographics, Maternal Behaviours, and Child Stress Physiology Correlations

Measure	*1*	*2*	*3*	*4*	*6*	*7*	8	9	10	11	12	13	14	15
1. Supportive code	-													
2. Unsupportive code	-.158	-												
3. Pos engagement code	**-.465****	-.085	-											
4. Neg ctrl code	**.521****	.133	**-.440***	-										
6. Neg emotion code	**.448****	.218	**-.552****	**.428****	-									
7. Mom involvement code	-.0.48	.259	-.011	-.119	-.132	-								
8. Child age (months)	**.323***	-.304	-.030	.030	.027	**-.365***	-							
9. Child sex	.136	.135	-.309	-.165	.135	.233	-.205	-						
10. Maternal education	.177	.149	.034	-.037	.169	-.247	**.386***	-.078	-					
11. Household income	.153	**.406***	-.014	.192	.018	-.112	.059	.050	**.492****	-				
12. Cortisol reactivity	.024	-.023	-.283	.100	.212	**-.372***	-.240	.305	.164	.217	-			
13. Cortisol recovery	.060	-.051	.002	.014	.183	-.079	.140	**-.371***	.043	-.193	-.117	-		
14. Heart rate reactivity	-.028	-.189	-.111	-.155	-.023	**-.398***	.121	.084	.059	.160	**.398***	-.094	-	
15. Heart rate recovery	-.174	.105	-.036	-.028	-.126	.299	-.290	.226	-.136	-.169	-.143	-.205	**-.417***	-

Note: $^{*}p \leq .05$, $^{**}p \leq .01$.

Table 5

Descriptive Statistics for Biological Measures Across Time

Measure	Total *M(SD)*
Cortisol (LnT nmol/L)	
0 min post stressor	0.793(.652)
15 min post stressor	0.831(.700)
30 min post stressor	.694(.695)
45 min post stressor	.729(.641)
Heart rate (BPM)	
Baseline	100.718(12.013)
Stroop average	106.541(12.821)
First ½ of stressor	106.528(13.980)
Second ½ of stressor	107.059(13.870)
Reunification	107.66(14.952)

Note. LnT nmol/L = natural log-transformed nanomole per litre; BPM = beats per minute

Table 6

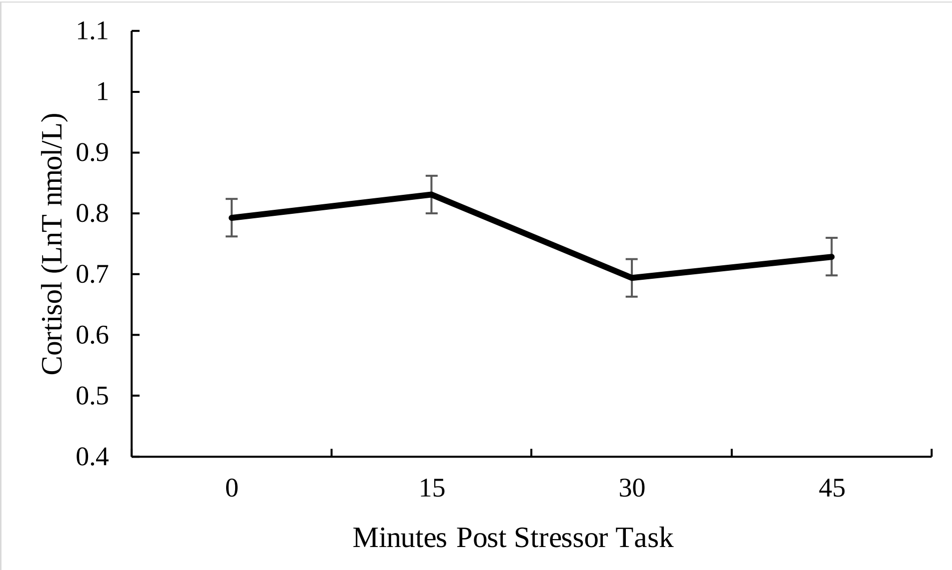
Linear Regression Models for Child Stress Physiology

	β	*SE*	*t*	*p*
Cortisol Reactivity				
Maternal Involvement	**-.404**	**.155**	**-2.596**	**.015**
Child Sex	**.349**	**.157**	**2.230**	**.034**
Cortisol Recovery				
Maternal Involvement	-.026	.107	-.240	.812
Child Sex	**-.224**	**.107**	**-2.083**	**.047**
HR Reactivity				
Maternal Involvement	**-6.997**	**2.804**	**-2.495**	**.019**
Child Sex	2.899	2.803	1.034	.310
HR Recovery				
Maternal Involvement	5.127	3.267	1.569	.127
Child Sex	3.192	3.279	.973	.338

Note. HR = heart rate

Figure 1

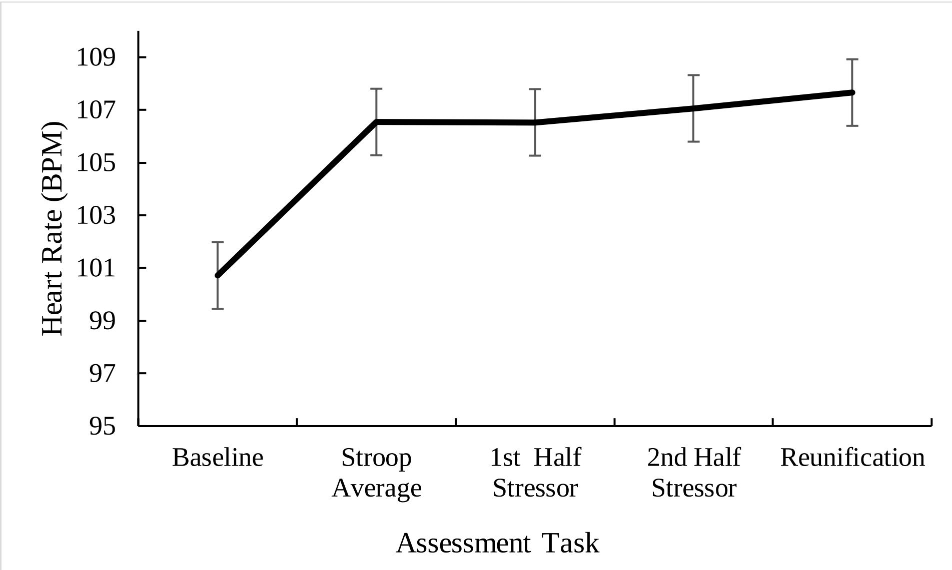
Cortisol Responsivity to Acute Stressor Task



Note. LnT nmol/L = natural log-transformed nanomole per litre

Figure 2

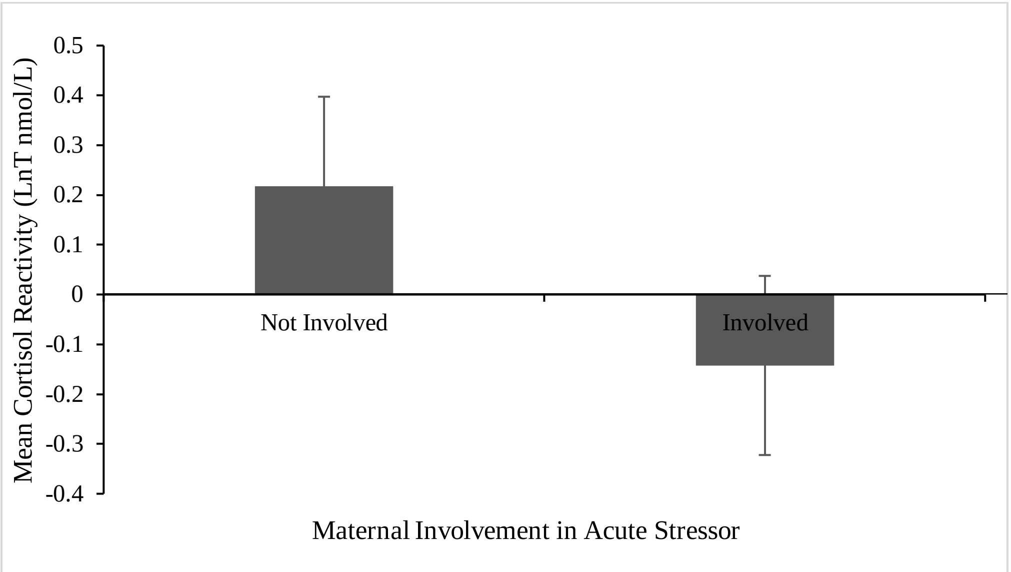
Heart Rate Responsivity to Acute Stressor Task



Note. BPM = beats per minute

Figure 3

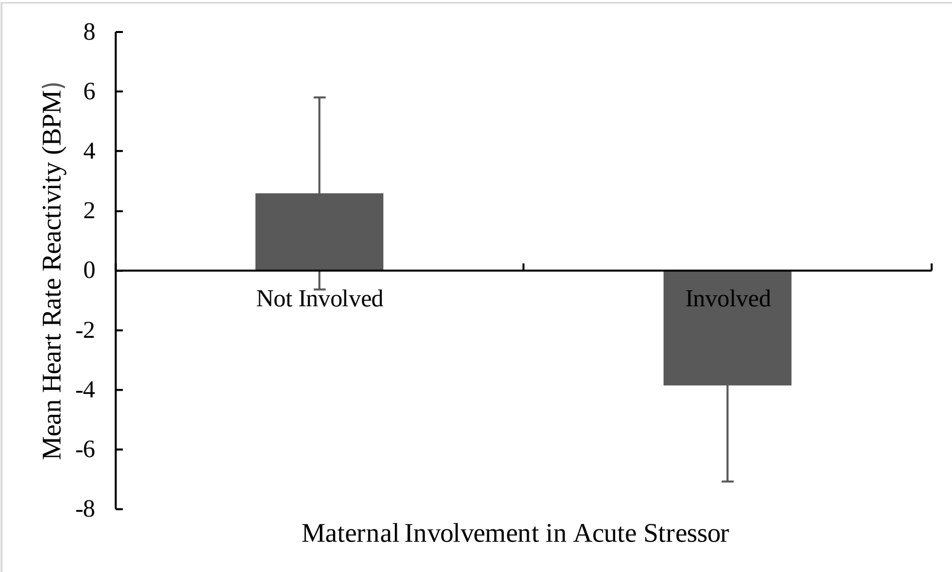
Maternal Involvement and Child Cortisol Reactivity



Note. LnT nmol/L = natural log-transformed nanomole per litre

Figure 4

Maternal Involvement and Child Heart Rate Reactivity



Note. BPM = beats per minute

Appendix A

Video Coding Scheme

Less Sensitive Parenting ↓		*More Sensitive Parenting* ↓	
Supportive Parenting Dimension			
Unsupportive (Avoidance, Lack of Support, Affect Suppression, Rejection)		**Supportive** (Warmth/Comfort, Responsivity, Praise/Encouragement)	
Distant body language (e.g. leaning away, chair not directed toward child) *No eye contact/looking away from child* *Looks at phone* *Dismisses child's bids*	*"Play by yourself please"* *Absence of vocal response to child's vocal bid for attention*	*Hugs* *Kisses* *Hand holding* *Rubs child's back* *High fives* *Nodding* *Holds eye contact while child speaks* *Engages in dyadic play*	*"Everything's okay"* *"It's okay, what's wrong?"* *"Nice work!"* *"You've got this"* *Responds appropriately verbally* → *"Wow! I'm so hungry, thanks for making that hot dog for me"*
Controlling/Intrusive Parenting Dimension			
Negative Control (Coercive, Restrictive, Lack of Autonomy Granting, Over-Directiveness)		**Behavioural Positive Control** (Scaffolding, Guidance)	
Moves child's hands/chair *Helps child when not required* *Offers only one option of toys/games to play with*	*Listen to me, okay?"* *"Do this instead" (commands)* *Vocally cuts child off* *"If you do X, then you don't get Y"*	*Offers a toy/book to child* *Monitoring behaviour (Observing and intervening when necessary)*	*"Maybe we could do X or Y"* *"Hmm, what do you think?"* *Setting clear guidelines (Let's play with this until she comes back, okay?")*
Emotion Reactions Dimension			
Negative Emotion		**Positive Emotion**	
Frowning *Eye rolls*	*"Ugh"* *"You're not doing it right. You're not listening"*	*Smiles* *Tickles kiddo*	*Laughter* *"Woohoo"* *"Yay!"*