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How Resilience-Building Interventions Impact Parenting Stress and Cortisol Reactivity in Mothers with Adverse Childhood Experiences

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How Resilience-Building Interventions Impact Parenting Stress and Cortisol Reactivity in Mothers with Adverse Childhood Experiences

By

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Abstract

Research has found that adverse childhood experiences (ACEs) are associated with changes in both parenting stress and cortisol. Resilience-building interventions may be able to help diminish the effects of ACEs, thus impacting parenting stress and cortisol reactivity. This study aims to examine how two resilience-building interventions (emotion-based and behavior-based) will impact parenting stress and cortisol reactivity in mothers with ACEs. This project is in the preliminary stages of data collection; as such, this honors thesis will review the relevant literature, describe current methodology and proposed analyses, and discuss possible implications and future directions. Participants (goal N=100) undergo a pre-assessment where parenting stress and cortisol reactivity are measured. Participants are then randomly assigned to receive an emotion-based curriculum (goal n= 50) or behavior-based curriculum (goal n=50) for 8 weeks. After completing their curriculum, participants' parenting stress and cortisol reactivity will be reassessed. Participants from both resilience-building interventions are hypothesized to have a reduction in parenting stress and cortisol reactivity, but participants who received the emotion-based curriculum are predicted to have greater reductions. Additionally, it is hypothesized that changes in parenting stress will be correlated with changes in cortisol reactivity, so participants with greater reductions in parenting stress are anticipated to have greater reductions in cortisol reactivity.

Keywords: adverse childhood experiences (ACEs), parenting stress, cortisol

Introduction

Over the past twenty years, psychologists have researched adverse childhood experiences (ACEs), finding that they can impact parenting and even the physiology of the brain (Shonkoff et al., 2011). Additional studies have found that ACEs not only impact parenting, but they are associated with poor mental health and intimate partner violence (Mair, Cunradi, & Todd, 2012; Monnat & Chandler, 2015). Because of the long-term consequences that often coincide with ACEs, it is important to perform more research on resilience to determine what can be done to combat ACEs and alleviate their harmful effects.

ACEs are defined as stressful or traumatic events that occur sometime from birth to eighteen years old (Steele et al., 2016). These can include abuse (physical, sexual, or emotional), neglect, and household dysfunctions like intimate partner violence, substance abuse in the household, or household mental illness (Felitti et al., 1998). ACEs are important to understand because of the long-term impacts they can have. Research has found that people with ACEs are more likely to report engaging in behavior such as binge drinking, smoking, and risky sexual behaviors; they are also more likely to report suffering from health conditions like heart attack and diabetes (Monnat & Chandler, 2015). Research has also found that people who suffered from abuse during childhood are more likely to experience and report mental distress and poor health in adulthood (Crouch, Strompolis, Radcliff, & Srivastav, 2018). In addition to researching ACEs independently, researchers have examined how ACEs impact parenting. A particular focus of this work is on how ACEs affect parenting stress, which is what comes about when the demands of parenting are greater than the predicted and actual resources available to help the parent succeed (Deater-Deckard, Chen, & El Mullah, 2017).

In addition to measuring the psychological impacts of ACEs (e.g., in the form of parenting stress), it is also important to consider the physiological manifestations of ACEs given their documented impact on hypothalamic-pituitary-adrenal (HPA) axis activity (Kalmakis, Meyer, Chiodo & Leung, 2015)**.** This can be done by measuring cortisol, commonly known as a stress hormone, because research has found it to be a physiological measure that responds to stressful stimuli (Kirschbaum & Hellhammer, 1989). Research into cortisol and ACEs intersect because ACEs can lead to neuroendocrine disruptions including irregular secretion of cortisol. For example, people with ACEs may be at an increased risk of experiencing the negative health outcomes such as mood disruption and fatigue that coincide with dysregulated cortisol (Monnat & Chandler, 2015; Starr, Dienes, Li, & Shaw, 2018).

While researching ACEs, it is also important to know that the maladaptive outcomes associated with ACEs can be combatted. When this is done, resilience—which is the ability to simultaneously minimize negative emotions and maximize adaptation (Kim et al. 2018)—is built. This implies the amount of stress that ACEs cause can be diminished if resilience is built. Unfortunately, ACEs not only have lifelong impacts on the person who directly experienced them, but also on their children. Therefore, research into this is important given the intergenerational effects of ACEs **(**Hays-Grudo & Morris, 2020). Since trauma and unhealthy amounts of stress early in life can lead to physiological brain changes that result in a diminished tolerance to overall stress, tolerance to parenting stress may be reduced as well **(**Shonkoff et al., 2011**)**. This lower tolerance for overall stress can result in maladaptive behavior and a reduced parenting capacity, having the potential to perpetuate the cycle of ACEs. This means the children of mothers with ACEs are more likely to have ACEs of their own if nothing is ever done to combat the mother's ACEs (Lesesne & Kennedy, 2005; Shonkoff et al., 2011).

Parenting Stress

In addition to investigating the long-term effects of ACEs and how they are transmitted, researchers have also examined how ACEs are related to parenting stress. For example, the Canadian Psychological Association conducted research looking particularly into mothers who had ACEs in order to see how their parenting stress was impacted as a result (Steele et al., 2016). This study found that ACEs and parenting stress are directly correlated, meaning that as the number of ACEs a mother reported experiencing in her childhood increased, so did her reported level of current parenting stress (Steele et al., 2016).

Research into parenting stress and ACEs continued as Rosenblum and colleagues (2017a, 2017b) evaluated how implementing a resilience-building program called Mom Power could combat ACEs, thus reducing risk factors and decreasing parenting stress. The Mom Power intervention was designed so mothers would receive a curriculum specifically geared to help them build resilience to combat their ACEs. Additionally, Mom Power intervention focused on helping mothers improve their parenting skills and attachment with their children (Rosenblum et al., 2017a, 2017b). To do so, the curriculum was based on five pillars: "the attachment-based parenting education pillar," "the self-care pillar," "the practice pillar," "the social support pillar," and "the connection to resources pillar" (Rosenblum et al., 2017b, p. 675-676). These five pillars allowed mothers to learn about attachment theory, emotion regulation, and stress reduction while being in a safe environment where scaffolding could be provided for them to practice. Additionally, participants were able to connect with each other, trained professionals, and outside resources to become better equipped to parent after the completion of the program (Rosenblum et al., 2017a, 2017b). Each of these pillars allowed the participants to build resilience by working through their ACEs and some of their prior trauma. Additionally, the Mom

Power program allowed the participants to learn how to handle their emotions in a healthy manner and form better attachment relationships with their children. Resilience was built while completing the pillars by having participants "engag[e] in meaningful activities" which "promote connectedness, a sense of belonging, enhanced self-efficacy, and positive coping strategies under stress" (Thomson & Jaque, 2017, p. 256). The Mom Power intervention is pivotal because it provides evidence that a resilience-building curriculum can reduce parenting stress (2017b).

Cortisol: What it is and how it is measured

In the study of ACEs and related outcomes, it is important to consider physiological mechanisms given the well documented effects of ACEs on neurobiological systems (Kalmakis et al., 2015). Cortisol has been identified as a key biomarker to consider in stress research given that this hormone is secreted in response to stressful stimuli. Cortisol, which is defined as "a glucocorticoid…whose levels in the blood may become elevated in response to physical or psychological stress" (Cortisol, n.d.)— can provide a general overview of the stress a person feels since it measures stress reactivity. Cortisol has strong empirical support as being an effective physiological measure related to psychological stress (Dickerson & Kemeny, 2004).

Cortisol is secreted by the HPA axis at routine times throughout the day based on a negative feedback loop called the diurnal cortisol rhythm. Typically, cortisol levels are higher in the morning, and they gradually decrease as the day progresses, but there are inconsistencies in previous research about HPA regulation during periods of chronic stress (Kalmakis et al., 2015; Starr et al., 2018). Some studies have found that dysregulated cortisol levels commonly occur during periods of prolonged stress, while other studies have found elevated cortisol levels to be more common (Kalmakis et al., 2015; Shonkoff et al., 2011; Starr et al., 2018). For some people, the amount of cortisol during extended periods of stress forms a dysregulated or flattened slope

because their high cortisol levels result in the breakdown of the negative feedback loop; however, for other people, the cortisol slope becomes steeper since their body believes there is a threat around all the time (Starr et al., 2018). Instead of dysregulated cortisol release, some people experience elevated cortisol levels because chronic stress can reduce the hippocampus' ability to turn off cortisol production (Shankoff et al., 2011). Whether chronic stress leads to dysregulated cortisol release or increased cortisol levels, both changes in cortisol levels have been shown to impair mood-related functions (Shonkoff et al., 2011; Starr et al., 2018).

Chronic stress is typically measured using the diurnal cortisol rhythm, which can be analyzed through cortisol levels obtained from numerous saliva samples that are collected throughout the day for at least two days **(**Starr et al., 2018**).** Chronic stress can also be studied retrospectively using cortisol analyzed from hair samples, which allows researchers to examine cortisol levels over the time period of months rather than a few days (Wright, Hickman & Laudenslager, 2015).

In addition to being released routinely throughout the day, cortisol is also released in response to threats, which allows the body to stop expending energy on unnecessary processes like digestion, so it can focus on surviving and potentially fighting off a threat (Starr et al., 2018). Specifically, cortisol reactivity is how cortisol levels change in response to stress and the body's ability to respond to and regulate these changes, which is why cortisol reactivity can be measured to assess how people respond to acute stress (Sontag-Padilla et al., 2012). This acute stress can be measured with stressor paradigms like the Trier Social Stress Test (TSST), which allows participants' acute stress response to be measured in a laboratory setting by having them complete a mock job interview (Frisch, Häusser & Mojzisch, 2015). The TSST usually consists of two parts: the speech preparation task—where the participant typically has between five to ten

minutes to prepare a speech and then deliver it to an audience while being audio or video recorded—and a calculation task, where the participant must sequentially subtract a set value from an initial number until they reach zero or a specific amount of time passes (e.g. subtracting 17 from 2023 until they reach 0 or five minutes elapses).

Research has been conducted investigating how stress responses vary when aspects of the TSST are changed or when the TSST is administered to different populations. For example, one study investigated whether participants would experience different stress responses when the TSST was completed using virtual reality compared to in person (Zimmer, Wu, & Dome, 2019). When analyzing the cortisol samples that were gathered surrounding the time the TSST was administered, this study noted that maximum cortisol levels were found at 20 minutes (Zimmer et al., 2019). Another study conducted a meta-analysis examining if biological sex causes variation in salivary cortisol levels obtained after being administered the TSST (Liu et al., 2017) This study focused on three cortisol trajectory phases-- baseline, peak, and recovery—finding that males had higher peak and recovery cortisol levels than females (Liu et al., 2017). Out of the 34 studies used in this meta-analysis, the average time for the peak cortisol level was 13 minutes after the TSST was completed, and the average recovery time was 46 minutes after the TSST (Liu et al., 2017). Additionally, research has been conducted comparing the differences in cortisol reactivity in response to electrical stimulation compared to the TSST (Maruyama et al., 2012). This study obtained salivary cortisol samples just prior, immediately after, and then 20 minutes after the stressful stimulus was administered. Salivary cortisol was noted to have a prolonged response after the TSST, exhibiting significant increases immediately after the TSST administration and 20 minutes after. Additionally, the TSST was found to increase salivary

cortisol levels significantly more than electrical stimulation, indicating that there may be a distinction in how the HPA axis responds depending on the type of stressor (Maruyama, 2012).

Due to the TSST being prevalently used to measure acute stress responses, a meta-analysis was conducted on studies that used the TSST in order to see the effects that protocol variations had on cortisol responses (Goodman, Janson, & Wolf, 2017). Although cortisol concentrations in the blood increases between 20-30 minutes after stress onset so peak cortisol levels should have been observed within the 30 minutes following the TSST, this study noted that the with all the protocol variations, the peak cortisol levels were between 35 and 45 minutes after the TSST began (Goodman et al., 2017). This meta-analysis did, however, find that "the time of day when the TSST was conducted does not significantly influence the overall cortisol response," (Goodman et al., 2017, p. 30) so consistency seems to be a more important factor here, meaning that participants should be brought into the lab during the same time period if multiple lab visits are required for the study. Additionally, variation in the amount of preparation time for the speech task did not significantly influence effect size (Goodman et al., 2017).

Cortisol in Pre-Post Designs

Cortisol has been studied using numerous methods. Not only can it be obtained using different mediums like saliva, blood, hair, and more, but it can also be examined in various ways like using diurnal cortisol rhythm, stress reactivity, or baseline cortisol. One area in which research is lacking is measuring cortisol in intervention research using pre-post designs. This section will highlight what the current literature that has included cortisol in research using pre-post methodology.

McKay and Zakzanis (2010) conducted a meta-analysis to investigate the magnitude of cortisol change after individuals with unipolar depression receive treatment. They found that

there were no statistically significant changes in the post assessment cortisol effect sizes compared to the pre-intervention cortisol effect sizes. Further, this meta-analysis included studies using a range of cortisol assessment methods including urine, blood, and saliva. This study noted that there were no significant differences in mean effect sizes when cortisol was obtained using various methods (blood vs saliva), providing evidence that salivary cortisol measures in pre-post studies are just as effective as when cortisol is obtained through blood. Results of this study also found that about 44% of patients had cortisol levels that changed significantly after receiving treatment (McKay & Zakzanis, 2010).

A handful of studies offer evidence that cortisol can be a useful assessment metric that captures changes in stress for a range of populations. For example, one study investigated salivary cortisol levels for individuals who were in remission of acute depression symptoms (rMDD) before and after they had an fMRI (Peters et al., 2019). This study not only examined cortisol levels using a within-subjects design because of the pre-post methods, but a between subjects design was also used by comparing the rMDD group to a healthy control (HC). Pre-fMRI cortisol levels did not differ between the rMDD and HC groups, nor were there sex differences for pre-fMRI cortisol levels. When comparing pre- and post-fMRI cortisol levels, a decrease was found for all participants regardless of whether they were in the rMDD group or the HC group (Peters et al., 2019). This study highlights that cortisol can be useful for measuring variation in stress reactivity following a mildly stressful task.

Cortisol has also been used as a marker of change in intervention research. One study examined how Cognitively-Based Compassion Training (CBCT), an eight-week meditation-focused intervention, would impact stress using self-report of perceived stress and hair cortisol for cumulative stress in mothers and their children (Poehlmann-Tynan et al., 2019). Results

indicated that although parents who received the CBCT intervention did not experience a statistically significant change in cortisol levels, the children of parents who received the intervention experienced lower cortisol levels at the post-assessment in comparison to the children of parents who did not receive the CBCT. In fact, while the average hair cortisol levels of children whose parents received the CBCT decreased, their peers' average cortisol levels increased (Poehlmann-Tynan, 2019).

Two studies have examined pre/post changes in salivary cortisol following an intervention. One study implemented a mindfulness-based stress reduction (MBSR) intervention for people with breast or prostate cancer to see how baseline cortisol levels, three different cortisol levels that were measured throughout the day, and average cortisol levels were impacted directly after the program, six months later, and twelve months later (Carlson et al., 2007). Pre-intervention baseline cortisol levels were compared to three post-intervention cortisol levels that were collected in the morning, midday, and evening. Results found decreases between the pre-intervention cortisol baseline and each post-intervention cortisol level as well as a decrease when comparing the baseline cortisol levels to the average cortisol levels calculated at the post-assessment and the two follow-up assessments. Additionally, the average cortisol levels had a downward linear trend, such that the twelve-month follow-up had the lowest cortisol levels out of the four time periods examined (Carlson et al., 2007). This research not only highlights the merit of examining salivary cortisol levels using pre-post methods, but also that long-term intervention effects can be measured this way.

The current literature also indicates that pre-post salivary cortisol designs can be used in intervention studies where stressor paradigms are implemented. Specifically, one study examined whether a mindfulness-based parenting intervention (Mindful Motherhood) changed self-

reported perceived stress and salivary cortisol levels in pregnant African American women (Zhang & Emory, 2014). In this study, reactive cortisol was measured by having mothers schedule a lab visit where salivary cortisol was obtained before and after listening to a brief clip of a baby crying. Participants were then divided into two groups: the intervention group that received the mindfulness program and the control group that did not receive the intervention. After the intervention, mothers returned to the lab for a post-assessment and a one-month follow-up where salivary cortisol was measured the same way as it was previously. Although this study intended to compare the stress reactivity between the intervention and control groups by comparing change scores in the salivary cortisol levels, the intervention group had very few participants complete the Mindful Motherhood program, so the groups were not compared. Instead, multiple linear regressions were used to investigate if the number of sessions the intervention group participants attended impacted their stress measures. Baseline cortisol levels collected at the post-assessment and one-month follow-up were not associated with the number of sessions the moms in the intervention group attended; however, participant attendance was negatively associated with reactive cortisol, so the more sessions one attended, the greater reduction in cortisol reactivity they showed from pre to post in response to their baby crying (Zhang & Emory, 2014). This study highlights that pre-post methods can be used for interventions that use stressor paradigms to measure cortisol reactivity.

Present Study Aims and Hypotheses

Previous research has elucidated how ACEs and parenting stress are related and how cortisol and stress are related; however, there is a gap in the current scientific literature because researchers have not explored how resilience-building factors can impact parenting stress and cortisol levels in mothers with ACEs. Although Rosenblum et al.’s trauma-informed care

program called Mom Power explored how to build resilience and reduce parenting stress for mothers with ACEs, it appears the study only measured parenting stress using self-report measures like the Parenting Stress Index instead of looking into the physiological measures associated with stress like cortisol (2017b). Additionally, the Mom Power study used a control group that received the trauma-informed resilience-building curriculum through the mail; however, this functioned to examine the social interaction aspect of Mom Power rather than providing a different type of curriculum (Rosenblum et al., 2017a, 2017b). Although Rosenblum et al.'s (2017a, 2017b) study provides evidence towards the effectiveness of an emotion-based curriculum—which teaches about emotion regulation and combatting ACEs—research has not been done to compare this type of program to a behavior-based curriculum—one that would educate mothers on developmental milestones, how to establish healthy habits for their children, how to address typical challenges for three-year-olds like toilet training and preschool, and general behaviorally based parenting practices (e.g., positive reinforcement, punishment). Furthermore, while research has shown that the Mom Power intervention is beneficial, it is time intensive (3 hours a week for families for 10 weeks) and resource intensive since it requires group leaders and one-on-one childcare, meals, and transportation are provided. There is also a need for more telehealth interventions because technology-based programs make resources more accessible, enabling underserved populations like people in rural areas to be reached (López, Qanungo, Jenkins, & Acierno, 2018). Because of the gaps within the current scientific literature and the need for more telehealth interventions, the goal of this study is to investigate how an emotion-based resilience-building program compared to a behavior-based program impacts parenting stress and cortisol levels in mothers with ACEs.

To illuminate how resilience can affect parenting stress and cortisol levels of mothers, this study intends to implement two resilience-building interventions, one emotion-based and one behavior-based. It is hypothesized that all participants, regardless of which intervention they receive, will experience a decrease in cortisol reactivity and parenting stress compared to values obtained during pre-assessments. Additionally, it is hypothesized that participants who receive the emotion-based curriculum will have a greater decrease in parenting stress scores and cortisol reactivity compared to the behavior-based intervention. Finally, it is hypothesized that changes in cortisol reactivity will be correlated with changes in parenting stress such that the greater the decrease in cortisol reactivity from pre to post, the greater the associated changes in self-reported parenting stress.

In sum, the primary study aim is to investigate how two types of resilience-building programs (emotion-based and behavior-based) will impact parenting stress and cortisol reactivity in mothers with ACEs.

Methods

Participants

A community-based sample is being used to recruit for this study. Female primary caregivers (both biological mothers or primary female guardians) with a three-year-old child who are at least eighteen years old and speak English are eligible to participate in the study. Also, these mothers or female guardians are assessed using the ACE Questionnaire to ensure they have at least one ACE. The initial target number of participants to be recruited is 100 (n = 50 per intervention type), but long-term, we hope to recruit 200 participants (n = 100 per intervention type).

Procedures

Recruiting methods for this study are being done in the Tri-Cities area (Bristol, Johnson City, and Kingsport) of East Tennessee by posting flyers in community agencies for families, community businesses, pediatrician and family medicine offices, and local daycares and preschools. The flyers used to recruit detail the eligibility requirements to be involved in the study (Figure 1 in the Appendix). The flyers also state the contact information for the Affect, Regulation, Coping, and Health (ARCH) Lab—the research lab conducting the overarching study called the 2Gen: Feeling Better Project (2Gen)—and the general goal of the research—to examine the relationship between parenting and emotion development.

Although this project focuses on maternal data, child age is a recruitment requirement given the broader study's focus on maternal and child coregulation. This developmental age was chosen because research has shown that physiological synchrony—when biological states are matched between a primary caregiver and their child (Davis, West, Bilms, Morelen, & Suveg, 2018)—is stronger during early childhood compared to middle childhood or adolescence (Hostinar, Johnson, & Gunnar, 2014). Further, 3 years old is a developmental time when children become more independent as they develop new motor and language abilities (Colonnesi, van Polanen, Tavecchio, & Fukkink, 2017). Even compared to their 2-year-old peers, 3-year-olds are becoming more independent and are transitioning from needing their caregiver to co-regulate with them to learning how to self-regulate with greater autonomy (Kanamaru & Muto, 2006).

Mothers interested in participating in the research study first go through a phone screener to obtain brief demographic information and review eligibility requirements. If they are found to be eligible after the phone screener and want to proceed with the study, then informed consent is obtained, and they are randomly assigned by flipping a coin to either the experimental or the active control group. The experimental group will receive the emotion-based resilience-building

curriculum, while the active control group will receive the behavior-based resilience-building curriculum. After obtaining informed consent, a pre-assessment survey—which is stored using the REDCap software—is emailed to participants to be completed prior to coming into the ARCH Lab where physiological data is obtained. This pre-assessment survey consists of the ACE Questionnaire and the Parental Stress Scale (PSS) to ensure the sample being assessed is mothers with ACEs and to establish a baseline parenting stress score respectively. After completing the pre-assessment survey, mothers schedule a lab visit to the ARCH Lab so physiological measures can be obtained. During this lab visit, salivary samples are periodically obtained from mothers and their children while they complete varying tasks designed to induce or reduce stress (see below for a description of the TSST used to measure cortisol reactivity for this particular project). At the end of this visit, participants are given a binder containing the eight-week curriculum that corresponds to their treatment condition, and then salivary samples are stored in a refrigerator to prevent enzymes and hormones in the saliva from breaking down. Salivary samples will be mailed to another lab so they can be assayed for cortisol and salivary alpha amylase levels, and those results will be sent back to the ARCH lab.

For eight consecutive weeks after their lab visit, participants are emailed a short video that discusses different lessons corresponding to the curriculum outlined in the binder they are given and a check-in link, which asks how their week is going and whether they have completed the week's curriculum. The emotion-based intervention videos (see Table 1 in the Appendix), focuses on things similar to the Mom Power intervention in Rosenblum et al. (2017a, 2017b), primarily discussing emotion regulation, self-care, and attachment theory. The behavior-based program (see Table 1 in the Appendix) provides information about appropriate parenting

practices and general parenting knowledge such as developmental milestones, toilet training, healthy eating habits, and how to encourage positive behavior.

Once each participant completes their eight-week resilience-building program, a post-assessment and another lab visit will be completed. This consists of the same components as the preassessment—an electronic survey consisting of the ACE Questionnaire and the PSS that will be completed through REDCap and a time where participants will come to the ARCH Lab so physiological measures can be obtained. To compensate mothers for participating in this study, they will be given up to $115 in gift cards, and their children will be given small toys. The Institutional Review Board reviewed and approved all of these procedures.

Measures

Because this research is a part of the 2Gen study, all assessments—including the pre and post-assessment surveys— obtain a variety of surveys and questionnaires examining emotion regulation, mental health (anxiety, depression, etc.), temperament, trauma history, and self-care. Because this study focuses on parenting stress in mothers with ACEs, information from the Parental Stress Scale (PSS) [Figure 2 in the Appendix] and ACE Questionnaire (Figure 3 in the Appendix) will be extracted from the larger data set.

Parental Stress Scale (PSS)

The PSS is an 18-item self-report questionnaire that assesses parenting stress (Berry & Jones, 1995). This measure uses a 5-point Likert scale ranging from strongly disagree to strongly agree. Higher scores reflect greater parenting stress. This measure has been found to be high in both reliability ($\alpha = 0.83$) and validity (Berry & Jones, 1995).

Adverse Childhood Experience (ACE) Questionnaire

The ACE Questionnaire is a 10-item self-report survey that assesses the number and specific type of adverse childhood experience (Felitti et al.,1998). It consists of yes or no questions that examines different aspects of childhood trauma that are divided into three categories: physical, sexual, and psychological abuse; neglect; and household dysfunction which examined mental illness, substance abuse, spousal abuse, and criminal behavior in the household (Felitti et al., 1998). For every question a participant answers yes to on this questionnaire, they receive a point, so scores range from 0 to 10. The total number of points reflects the total ACE score of the participant, and the questions to which they answered yes details the types of ACEs they have (Adverse childhood experience (ACE) questionnaire finding your ACE score, n.d.). Higher scores reflect greater childhood trauma, and there is a clinical cutoff of 4 or more that is associated with a higher risk for negative health outcomes. This measure has been found to be high in internal consistency ($\alpha = 0.88$) as well as test-retest reliability (Dube, Williamson, Thompson, Felitti, & Anda, 2004; Murphy et al., 2014). Although statistical analyses examining differences in parenting stress and cortisol levels for mothers with differing amounts and types of ACEs were not conducted in this study, the ACE Questionnaire was used to ensure that the sample examined was mothers with ACEs, as participants who reported no ACEs were excluded from data analysis.

Trier Social Stress Test (TSST)

The TSST is a two-part stressor paradigm used in lab settings to induce stress for participants. The TSST is made up two components: a mock interview and a counting task. The mock interview is simulated by giving participants ten minutes to prepare a five-minute speech; for the pre-assessment (Pre), they must describe why they would be a good candidate for their ideal job, and for the post-assessment (Post), they must discuss what they learned about

parenting during the 8-week video series. While preparing, participants can write notes, but they cannot use their notes while delivering their speech. Participants are videotaped while delivering their speech during both assessments, and at Pre, they are told that their video will be reviewed by a panel of judges trained in public speaking at a later time, while at Post, they are told that their video will be reviewed by a panel of parents and experts in child development. The second portion of the TSST is a calculation task where participants have five minutes to sequentially subtract the number 17 from 2023 until they reach 0. The task lasts until the participant successfully reaches 0 or the five minutes elapses.

For this study, the first salivary sample, which was used to establish a baseline in cortisol, was collected just after watching a calming video for twenty minutes but directly before the TSST was administered. The salivary sample is collected after the calming video in an attempt to reduce any stress that participants may experience by coming to the lab. A second salivary sample was collected after participants completed the speech preparation portion of the TSST. This sample was not analyzed in this study, but it was obtained because salivary alpha amylase peaks before cortisol (Gordis, Granger, Susman, & Trickett, 2008). After collecting the second salivary sample, participants completed the calculation portion of the TSST, and then they were joined by their three-year-old to complete a five minute free play task where participants were provided with a variety of developmentally appropriate toys for them to use while playing with their child. Participants and their children then cleaned up the toys used during the free play task and a third salivary sample was collected. This third salivary sample, which was obtained approximately 13 minutes after the TSST ended, was used to establish peak cortisol levels approximately 33 minutes after the baseline sample. Collecting multiple salivary samples allows cortisol reactivity to be measured since changes in cortisol can be observed. Cortisol reactivity

will be calculated by subtracting the baseline cortisol level obtained in the first salivary sample from the peak cortisol level obtained in the third salivary sample in order to see how much cortisol changed in response to the TSST. This is consistent with common methodology used to assess cortisol reactivity (Liu et al., 2017; Zimmer et al., 2019).

Power Analysis

Before collecting data, a power analysis was run in order to estimate the sample size needed. Because 2Gen was initially created to investigate the role emotion coregulation between mothers and their children may have on child internalizing symptoms and transmission of risk, a power analysis was conducted using the average effect size |0.32|, which was averaged across internalizing symptoms (anxiety and depression) and emotion regulation strategies that were studied in an emotion-regulation strategies meta-analysis (Aldao, Nolen-Hoeksema, & Schweizer, 2010). Taking standard error rates into consideration ($\alpha = 0.05$, $\beta = 0.20$) in addition to the average effect size indicated that a sample size of N = 74 is necessary. To compensate for the participant dropout that may occur and any other missing data, the target sample size was N = 100. Since the initial power analysis was conducted, the intervention component of the 2Gen project—where the emotion-based intervention is the experimental group and the behavior-based intervention is the active control—has been added, so the 2Gen project is now intended to be used as pilot data for grant submissions so a larger sample can be collected. The long-term goal is to collect a sample size of N = 200 (n = 100 per intervention type), so there will be greater statistical power for more complex analyses.

Proposed Analyses

Analyses will be conducted using JASP, a point-click statistical software package. The independent variable is the type of resilience-building curriculum participants receive (emotion-

based vs behavior-based), and the dependent variables are parenting stress and cortisol reactivity at pre and post intervention. Two regression analyses will be conducted—one for parenting stress and one for cortisol reactivity—by regressing the change scores (post-values – pre-values) for the experimental group (emotion-based intervention) onto the control group (behavior-based intervention) using the formula change = $\beta_0 + \beta_1 + \varepsilon_i$ where β_0 represents the behavior-based change scores and β_1 represents the emotion-based change scores. This will allow us to estimate pre-post changes for the behavior-based intervention and see if the emotion-based intervention showed significantly more change. One post-estimation contrast will be conducted for each measure (parenting stress and cortisol reactivity) with the formula $\beta_0 + \beta_1$ to estimate the pre-post change for the emotion-based intervention. After conducting the regressions and the post-estimation contrasts, the mean-centering parenting stress will be added to the regression model in order to examine if changes in parenting stress are associated with changes in cortisol reactivity. This will allow us to see if greater decreases in cortisol reactivity are associated with greater decreases in parenting stress.

Because participant dropout may potentially be reflective of participants' perception that the intervention they receive is not beneficial or worth their time, participant dropout rates will be reported by intervention type. Additionally, reporting will note where in the process participants dropped out (e.g. what week of the intervention).

Because COVID-19 lead to a pandemic after data collection began, any participants who completed or were in the process of completing the study prior to or during the COVID-19 pandemic will be considered pilot participants that allowed us to work out any issues with the 2Gen protocol and training, so their data will not be compared to the data of participants who are

a part of the study after the COVID-19 pandemic ends. The goal is to obtain 100 more participants once the pandemic is over and research can resume.

Discussion

Previous research has highlighted the relationship between parenting stress and ACEs as well as the relationship between stress and cortisol, but the current scientific literature has not combined these variables. While research has found that an emotion-based resilience-building program can reduce parenting stress (Rosenblum et al., 2017b), research has not been conducted to investigate if brief interventions like this can reduce cortisol reactivity. Additionally, research has not been conducted comparing emotion-based and behavior-based resilience-building interventions, so this study aims to compare emotion-based and behavior-based interventions, examining how they impact parenting stress and cortisol reactivity in mothers with ACEs. This study also aims to reach underserved populations like people living in rural areas by providing the interventions to participants as a video series.

It is hypothesized that participants receiving the experimental group (participants receiving the emotion-based resilience-building intervention) will have the greatest reductions in parenting stress and cortisol reactivity; however, all participants are hypothesized to see reductions in these variables. Also, changes in cortisol reactivity is hypothesized to be correlated to changes in parenting stress, so participants who experience greater decreases in cortisol reactivity are also expected to see greater decreases in parenting stress.

Anticipated Results

A reduction in parenting stress and cortisol reactivity is anticipated for all participants regardless of which resilience-building curriculum they receive because the information presented in these interventions may help the participants feel more equipped for motherhood,

increasing their self-efficacy thus reducing their stress. This is anticipated because previous research has shown that parenting stress and parenting self-efficacy can be improved after attending a parenting program with curriculum based on positive parenting (Bloomfield & Kendall, 2012) and that there is an inverse relationship between parenting stress and parenting self-efficacy (Dunning & Giallo, 2012).

A greater reduction in parenting stress and cortisol reactivity is anticipated for the emotion-based intervention because its goal is to educate mothers on ways to cope with and combat their ACEs, allowing the participants to emotionally regulate more efficiently. This is anticipated since Mom Power, an emotion-based trauma-informed intervention, engaged mothers with ACEs, reduced participants' parenting stress, and improved their mental health and parenting outcomes (i.e. role reversal and helplessness) (Rosenblum et al., 2017b). The emotion-based curriculum may also potentially help prevent the transgenerational perpetuation of ACEs since participants can teach their children to regulate their emotions once they learn how to emotionally regulate themselves more effectively.

A positive correlation between changes in parenting stress and changes in cortisol reactivity is also anticipated based on previous findings from physiological synchrony research. Research into physiological synchrony has examined parents' ability to buffer their children's HPA stress response, finding that parent's and children's cortisol fluctuations are related (Davis et al., 2017; Hostinar, Johnson, & Gunnar, 2014). Research has also found that children's salivary cortisol levels were positively correlated with their parents' parenting stress so that children with higher salivary cortisol had parents with higher parenting stress scores (Wagner et al., 2015). Since research has found that parents' and their children's cortisol levels are likely to be synchronous (Davis et al., 2017; Hostinar, Johnson, & Gunnar, 2014), one may speculate that

the parents of the children with higher cortisol levels in Wagner and colleague's (2015) study would likely have higher cortisol levels. Since the children with higher cortisol levels had parents with higher parenting stress scores, then the parenting stress scores would likely be correlated to the parents' cortisol levels as well since the parents likely have high cortisol levels like their children. Because cortisol levels and parenting stress are likely to be positively correlated, it is anticipated that changes in parenting stress scores and changes in cortisol reactivity will also be correlated.

Study Strengths/Limitations, Future Directions, and Potential Implications

One strength of this study is using telehealth interventions to reach underserved populations like people living in rural areas. By using telehealth interventions, this project requires relatively few resources, especially in comparison to projects like Mom Power. Additionally, this project is innovative because all the videos used in the interventions are under ten minutes, so they are not very time-consuming, meaning mothers who would typically be too busy to participate in research may be able to participate in this study. Another strength in this study is that the design allows two different resilience-building programs (emotion-based and behavior-based) to be compared to each other to see how they impact parenting stress and cortisol levels in mothers with ACEs and if one type of curriculum is more beneficial than the other.

Limitations of this study are the time-consuming aspect of the pre- and post-assessments (i.e. 3 hours each). This is a limitation for participants with multiple children, particularly for low socioeconomic status participants, because they may not have someone or be able to afford someone who can watch their other children while the lab visits take place. The time length of the lab visits is also a limitation because it can be difficult to maintain the three-year-old's

attention the entire time since they can become impatient and uncooperative after being in the lab for so long, which could potentially lead to moms feeling stressed because of their child's misbehavior. Because of these limitations, future studies should try to reduce the amount of time lab visits take or consider investigating how interventions like those used in this study impact chronic stress as measured with diurnal cortisol rhythm or hair cortisol since those measures can be obtained by researchers during home visits or by participants if detailed instructions are provided. Future research should also examine the long-term effects of both these interventions since this study only follows up with participants three months after they complete the intervention. Additionally, future directions should investigate if similar results are found when these resilience-building interventions are provided to fathers or male primary caregivers.

A possible implication of this study is the potential to provide evidence for how effective short video series are at reducing cortisol reactivity and parenting stress since all the videos in both interventions are brief. Another implication of this study is the ability to compare the effectiveness of video interventions to the effectiveness of in-person interventions. For example, this study could potentially find that the video interventions used are just as effective at reducing parenting stress as in-person interventions like Mom Power. This would likely encourage researchers to implement video interventions not only because using telehealth techniques allow more underserved populations to be reached, but also because video interventions often require less resources, making them less expensive to implement. Additionally, in light of recent events like the COVID-19 pandemic, researchers may be more likely to implement video interventions if studies like this find that they make a significant impact.

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Appendix

Table 1: Resilience-Building Curriculum Video Topics

Week	Emotion-Based Curriculum Topic	Behavior-Based Curriculum Topic
1	Attachment/The Tree	Developmental Milestones
2	Wondering and Response Wheel/Flipping Lids	Healthy Eating
3	Emotion Coping	Healthy Sleep
4	Background Music/Rings of Support	Toilet Training
5	Cup of Well-Being/Deep Breathing	Positive Behavior
6	Senses to Soothe/Progressive Muscle Relaxation	Negative Behavior
7	Emotion Coaching	Getting Ready for School
8	Putting It All Together	Putting It All Together

Figure 1: ARCH Lab 2Gen: Feeling Better Project Flyer

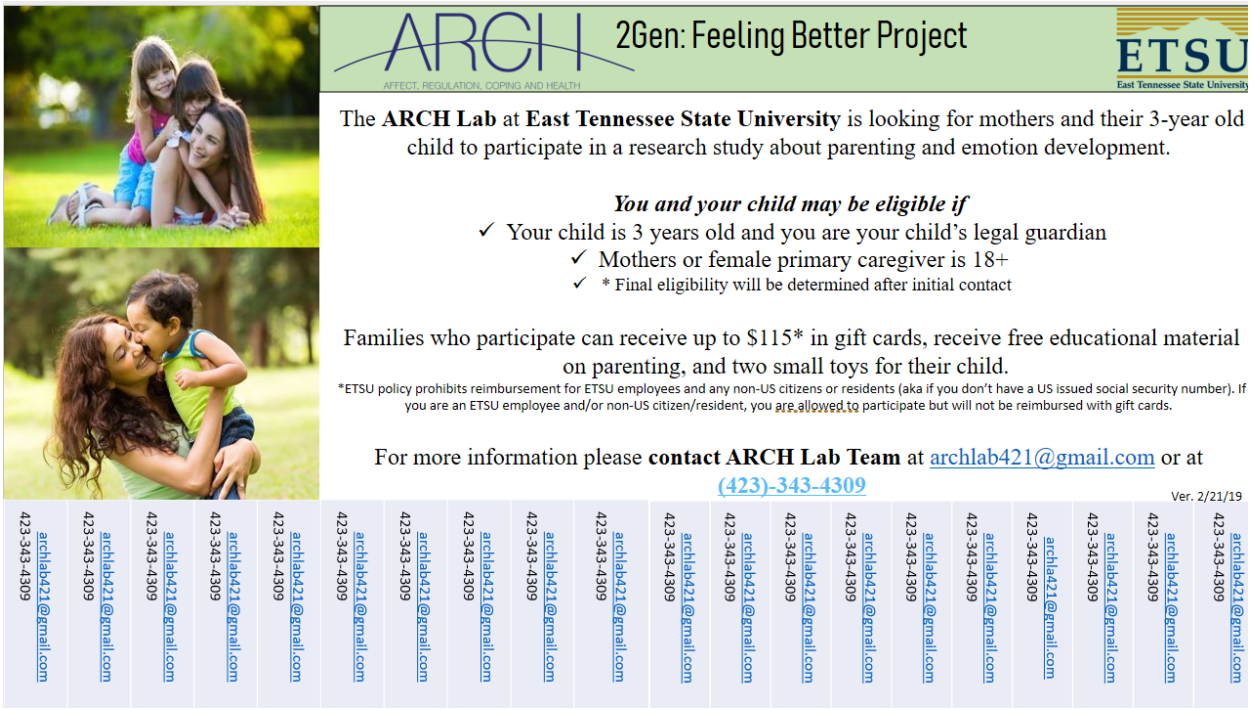

Figure 2: Parental Stress Scale (Berry & Jones, 1995)

"The following statements describe feelings and perceptions about the experience of being a parent. Think of each of the items in terms of how your relationship with your child or children typically is. Please indicate the degree to which you agree or disagree with the following items by placing the appropriate number in the space provided."

1 = *strongly disagree*

2 = *disagree*

3 = *undecided*

4 = *agree*

5 = *strongly agree*

TABLE 1
The Parental Stress Scale

*1.	I am happy in my role as a parent.
*2.	There is little or nothing I wouldn't do for my child(ren) if it was necessary.
3.	Caring for my child(ren) sometimes takes more time and energy than I have to give.
4.	I sometimes worry whether I am doing enough for my child(ren).
*5.	I feel close to my child(ren).
*6.	I enjoy spending time with my child(ren).
*7.	My child(ren) is (are) an important source of affection for me.
*8.	Having children gives me a more certain and optimistic view for the future.
9.	The major source of stress in my life is my child(ren).
10.	Having children leaves little time and flexibility in my life.
11.	Having children has been a financial burden.
12.	It is difficult to balance different responsibilities because of my child(ren).
13.	The behavior of my child(ren) is often embarrassing or stressful to me.
14.	If I had it to do over again, I might decide not to have children.
15.	I feel overwhelmed by the responsibility of being a parent.
16.	Having children has meant having too few choices and too little control over my life.
*17.	I am satisfied as a parent.
*18.	I find my child(ren) enjoyable.

* Items reversed in scoring.

Figure 3: ACE Questionnaire (Children & Families First, 2016)

Finding Your ACE Score

While you were growing up, during your first 18 years of life:

1. Did a parent or other adult in the household **often or very often**…
   Swear at you, insult you, put you down, or humiliate you?
   or
   Act in a way that made you afraid that you might be physically hurt?
   Yes No If yes enter 1 _____

2. Did a parent or other adult in the household **often or very often**…
   Push, grab, slap, or throw something at you?
   or
   Ever hit you so hard that you had marks or were injured?
   Yes No If yes enter 1 _____

3. Did an adult or person at least 5 years older than you **ever**…
   Touch or fondle you or have you touch their body in a sexual way?
   or
   Attempt or actually have oral, anal, or vaginal intercourse with you?
   Yes No If yes enter 1 _____

4. Did you **often or very often** feel that …
   No one in your family loved you or thought you were important or special?
   or
   Your family didn't look out for each other, feel close to each other, or support each other?
   Yes No If yes enter 1 _____

5. Did you **often or very often** feel that …
   You didn't have enough to eat, had to wear dirty clothes, and had no one to protect you?
   or
   Your parents were too drunk or high to take care of you or take you to the doctor if you needed it?
   Yes No If yes enter 1 _____

6. Were your parents **ever** separated or divorced?
   Yes No If yes enter 1 _____

7. Was your mother or stepmother:
   Often or very often pushed, grabbed, slapped, or had something thrown at her?
   or
   Sometimes, often, or very often kicked, bitten, hit with a fist, or hit with something hard?
   or
   Ever repeatedly hit at least a few minutes or threatened with a gun or knife?
   Yes No If yes enter 1 _____

8. Did you live with anyone who was a problem drinker or alcoholic or who used street drugs?
   Yes No If yes enter 1 _____

9. Was a household member depressed or mentally ill, or did a household member attempt suicide?
   Yes No If yes enter 1 _____

10. Did a household member go to prison?
    Yes No If yes enter 1 _____

Now add up your "Yes" answers: _____ This is your ACE Score.

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