

Adversity's Impact on Parents' Self-Report and Physiological Difficulties with
Emotion Regulation: Appraisal as a Moderating Mechanism

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Abstract

Globally, there is a high prevalence of adversity exposure, and there is evidence indicating a linear association between adversity exposure, particularly childhood adversity, and adults' psychological distress. To better understand this association, researchers have examined the role of emotion regulation abilities (i.e., the ability to modulate emotional experiences and expressions), which are thought to impact and underlie one's psychological well-being. The present study examined the association between childhood versus adulthood adversity exposure and self-report difficulties with emotion regulation and physiological indicators of emotion regulation (e.g., resting respiratory sinus arrhythmia (RSA), RSA reactivity, and RSA recovery). Further, the study assessed appraisal styles (i.e., patterns of subjective interpretations) across adverse life events as a possible moderator to help explain why some, but not all, exposed to adversity may display emotion regulation difficulties. Data came from 161 parents of preschoolers who participated in a large federally funded project, the Preschoolers Adjustment and Intergenerational Risk (PAIR) project. Results found no direct association between childhood or adulthood adversity exposure and self-report difficulties with emotion regulation, resting RSA, RSA reactivity, or RSA recovery. However, negative appraisal styles were associated with greater self-report difficulties with emotion regulation and greater RSA reactivity. Results also showed interactions between greater childhood adversity and more negative appraisals for lower resting RSA and greater RSA recovery. Implications and future directions are discussed.

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Introduction

The prevalence of adversity exposure (e.g., maltreatment, witnessing violence, caregiver incarceration, or assault) in one's lifetime is high, with global estimates of 70.4 % (Benjet et al., 2016) and United States national estimates as high as 89.7% (Kilpatrick et al., 2013). Further, there is a great amount of evidence indicating a linear association between adversity exposure, particularly childhood adversity, and adults' psychological distress (e.g., Hayward et al., 2020; Heidinger et al., 2019; Turner & Loyd, 1995). In attempts to better understand this association, researchers have examined the connection between adversity exposure and emotion regulation abilities, which are thought to impact and underlie one's psychological well-being (De Castella et al., 2013; Gross, 2008). Among this literature, existing research has consistently found childhood adversity to be associated with difficulties regulating emotions in adulthood (Barlow et al., 2017; Espeleta et al., 2018; Smith et al., 2014). However, it remains unclear whether this association is specific to childhood adversity, which may disrupt the development of adaptive regulatory processes (Calkins & Hill, 2007), or whether adversities occurring in adulthood equally contribute to adults' difficulties with emotion regulation.

Additionally, much of the prior literature has examined difficulties with emotion regulation through only subjective self-report measures (e.g., Barlow et al., 2017) or through only physiological indicators (e.g., Cyranowski et al., 2011), thus only measuring either the conscious aspects of emotion regulation that individuals are aware of or willing to report on, or only measuring the internal more automatic components of emotion regulation. Also, there have been discrepant results across studies, particularly in effect sizes, for the association between adversity and different measures of emotion regulation (e.g., Barlow et al., 2017; Daches et al., 2017; Espeleta et al., 2018). This existing work leaves the question as to why some, but not all

individuals exposed to adversity experience difficulties with emotion regulation. Conceptual models of emotion regulation (Gross & Thompson, 2008), highlight a key role of subjective cognitive appraisals (i.e., personal interpretations of events) in determining regulatory processes. Yet, little empirical work has examined appraisals as a mechanism accounting for variability in the relation between adversity exposure and emotion regulation difficulties (Barlow et al., 2017).

The present study attempted to address these gaps in the literature in several ways. First, the unique contribution of childhood and adulthood adversities was systematically examined in an effort to explain the variance in difficulties with emotion regulation, using a more comprehensive assessment of possible adversities, occurring across the lifespan, than have been previously examined (e.g., Abravanel & Sinha, 2015; Dunn et al., 2018). Second, the present study provided a more complete assessment of emotion regulation than much of the prior literature (e.g., Barlow et al., 2017; Cyranowski et al., 2011), by including both self-reported difficulties as well as physiological indicators of the ability to maintain homeostasis, adapt to stress, and recover from stress. Additionally, the present study examined how each of these methods of emotion regulation assessment are distinctly associated with the experience of adverse life events. Lastly, the present study assessed a possible interaction between the experience of adverse events and appraisals styles, to help explain variability in the association between adversity and difficulties with emotion regulation.

Defining Emotion Regulation and Its Importance

The present study utilized Thompson's (1994) definition of emotion regulation as consisting of "the extrinsic and intrinsic processes responsible for monitoring, evaluating, and modifying emotional reactions, especially their intensive and temporal features, to accomplish one's goals" (p. 27-28). This definition is consistent with theoretical work by Gross and

Thompson (2007), who have also described the processes by which emotion regulation occurs (Figure 1). According to Gross and Thompson (2007), the process of emotion regulation begins when one encounters a situation that elicits their attention, and then one cognitively appraises the situation, which ultimately leads to the individual's emotional experience. Following this experience of an emotion, individuals' ability to modulate their emotional experiences (e.g., modifying how strongly an emotion is experienced or for how long it is experienced), occurs through conscious, effortful processes (e.g., conscious use of skills to actively influence emotional experiences) as well as more automatic, internal processes (e.g., automatic physiological arousal to situations, such as increased heart rate in response to stress; Gross & Thompson, 2007).

One's ability to regulate their emotions develops through biological as well as environmental means. Specifically, regulatory processes stem from the central nervous system's excitatory and inhibitory mechanisms, largely controlled by the autonomic nervous system, which allows individuals to maintain homeostasis, react to stressors, and direct attention and cognitive processes (Thompson, 1994). As such, biological predispositions for low thresholds for arousal, can impact the development of one's ability to regulate emotions, by influencing which emotion regulation strategies one uses (Calkins & Hill, 2007). For example, lower thresholds for arousal can make it more difficult to disengage or shift attention in emotion inducing situations (Calkins & Hill, 2007). Further, an individual's environment (e.g., social interactions with caregivers and exposure to stress or adversity), also has implications for one's use of emotion regulation strategies (Calkins & Hill, 2007; Calkins & Perry, 2016; Thompson, 1994). For example, positive social interactions with caregivers has been linked with children's development of helpful emotional social support regulatory strategies (Thompson & Meyer,

2007) and greater physiological regulation, indicated by reduced heart rate during a recovery period following a stressor (Haley & Stansbury, 2003). In sum, this developmental literature demonstrates that difficulties with emotion regulation can develop through one's biology and genetics as well as one's environment, particularly one's early childhood rearing environment (Calkins & Hill, 2007).

Difficulties with emotion regulation are most often manifested behaviorally through externalizing problems such as impulsivity, aggression, hostility, or displaying affect that is not appropriate to the context either in type or intensity (e.g., cursing loudly in a public setting if a desired item was not available or laughing while at a funeral; Gross & Jazaieri, 2014). However, emotion regulation difficulties are also implicated in internalizing symptoms. Specifically, for adults, research shows associations between self-reported difficulties with emotion regulation and depressive symptoms (Abravanel & Sinha, 2015), post-traumatic stress symptoms (Messman-Moore & Bhuptani, 2017), and anxiety symptoms (Poole et al., 2017). Given that difficulty regulating emotions is thought to be a mechanism for the development of various psychological disorders, it is unsurprising that emotion regulation difficulties have been empirically associated with psychological symptoms (Gross, 2008).

Considering the behavioral and psychological manifestations of difficulties with emotion regulation, it is unsurprising that parents' emotion regulation also plays an important role in their ability to provide a safe and stable home for their children (Crandall et al., 2015; Rodriguez et al., 2017). More specifically, a recent literature review of over 35 empirical studies found that, across studies, maternal difficulty regulating emotions were associated with a risk for physical abuse, measured through self-report of parenting practices and child abuse potential measures (Crandall et al., 2015). Similarly, Rodriguez and colleagues (2017) found that parents' difficulty

regulating their emotions was positively associated with an increased risk in aggressive behaviors towards their child. Due to the number of important implications of emotion regulation, particularly among parents, it is critical to increase our understanding of these processes. One current limitation is that this literature on parents' emotion regulation difficulties has focused primarily on self-report measures of emotion regulation (e.g., Crandall et al., 2015; Rodriguez et al., 2017), thus not capturing other, and perhaps equally important, unconscious components of emotion regulation that can be assessed through physiological assessments (Calkins & Perry, 2016).

Emotion Regulation Measurement

For adults, the most common method for measuring emotion regulation is self-report, through measures such as the Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004) or the Emotion Regulation Questionnaire (Gross & John, 2003). These measures offer subjective insight into individuals' behavioral responses and perception of their own regulatory abilities across situations and contexts (Calkins & Perry, 2016).

The DERS has several strengths. First, the DERS captures multiple dimensions of emotion regulation, such as awareness of emotions (e.g., "I pay attention to how I feel"), understanding emotional responses (e.g., "I know exactly how I am feeling"), use of emotion regulation strategies (e.g., "when I'm upset, I know I will eventually find a way to feel better"), and exhibiting adaptive behavior in light of negative emotions (e.g., "when I'm upset, I can still get things done"), which empirically work together to create an overall score of difficulties with emotion regulation (Gratz & Roemer, 2004, p. 48). Second, in establishing the initial predictive validity of the DERS, Gratz and Roemer (2004) found that higher values in the overall score of difficulties with emotion regulation was positively correlated with self-harm behaviors and

males' violence against intimate partners. Further work has also found a significant positive association between the overall DERS score and posttraumatic stress symptoms (Barlow et al., 2017), as well as depressive symptoms (Abravanel & Sinha, 2015). These associated outcomes provide support for the construct validity of the DERS as a measure of difficulties with emotion regulation, as psychological symptoms are a manifestation of underlying difficulties regulating emotions (Gross, 2008). A third strength of the DERS is that it has evidenced measurement invariance and excellent internal reliability across different racial/ethnic groups (Ritschel et al., 2015), and the DERS has been previously used successfully with low income primarily African American samples (Gratz et al., 2008; Stevens et al., 2013), similar to the present study.

Although self-report measures, such as the DERS, can provide information on one's interpretation of personal emotion regulation, which is a crucial component to understanding emotion regulation abilities, this measurement approach is limited by the participants' emotional and behavioral self-awareness. This is a significant limitation of using only self-report measures, as emotion regulation is also determined by physiological responses (Thompson, 1994). Thus, to gather a complete understanding of one's emotion regulation a multi-method approach is needed, which includes both subjective self-report indicators of emotion regulation as well as physiological indicators (e.g., Calkins & Perry, 2016).

One such physiological marker is respiratory sinus arrhythmia (RSA; Porges, 2007). RSA is the measure of "heart rate variability that occurs at the frequency of breathing" (Calkins & Perry, 2016, p. 202) and captures parasympathetic activity in response to stress, which is linked to one's ability to regulate their emotions (Porges, 2007). The parasympathetic nervous system is responsible for the inhibitory control of physiological processes such as heart rate, by way of the vagus nerve. The vagus nerve is commonly known as the "vagal brake" because it reduces one's

heart rate as a means of energy conservation when one is safely at rest. However, the “brake” is withdrawn in situations of stress to help prepare the body to respond to potential threats (Cyranowski et al., 2011; Porges, 2007). According to polyvagal theory, measuring the vagal brake is an important indicator for ones’ ability to regulate and return to homeostasis after responding to a stressor (Porges, 2007). In understanding the meaning of RSA values, greater values indicate a greater time between heart beats, and lower RSA values indicate a shorter period of time between heart beats (e.g., Figure 2). To measure one’s vagal brake application or withdrawal, it is important to assess for changes in RSA values. For example, decreases in RSA, in response to a stressor, are indicative of vagal brake withdrawal and increased heart rate (Porges, 2007). Although there is consensus that RSA is indicative of vagal control and thereby physiological regulation (e.g., Cyranowski et al., 2011; Porges, 2007), there have been differences in the ways in which researchers have measured RSA and used it as an indicator for emotion regulation.

The bulk of the literature has focused on measuring RSA while an individual is at rest, or ‘resting RSA.’ Among this research, lower resting RSA has consistently been used as an indicator of greater difficulties with emotion regulation (Deater Deckard et al., 2016; Porges, 2007; Zisner & Beauchaine, 2016). Lower resting RSA is a physiological indicator of greater vulnerability to stress, as it indicates that even at rest the individual’s vagal brake is withdrawn, thereby limiting one’s ability to maintain homeostasis or adaptively regulate emotions (Porges, 2007).

Researchers have also examined RSA reactivity or the discrepancy between ones’ resting RSA and RSA during stress (e.g., Figure 3). Although this measurement is less frequently used than resting RSA, polyvagal theory suggests that measuring RSA withdrawal is a key component

in one's ability to regulate. According to polyvagal theory, RSA reactivity or vagal withdrawal (i.e., decrease in RSA from resting period to a stressor period) is associated with one's efforts to regulate. However, there is empirical evidence that the adaptive functioning of RSA reactivity can vary from situation to situation (Laborde et al., 2018). For example, in a study with adults, using a serial arithmetic task meant to induce stress, participants in the experimental condition which primed the use of emotional support regulatory strategies, showed less RSA reactivity during the stressor, than those not primed (Wells et al., 2016). This result indicates that those not primed for the use of a positive emotional regulation strategy showed greater stress reactivity than those that were primed (Wells et al., 2016). Along similar lines, Cyranowski and colleagues (2011) found that women with a diagnosis of a depressive disorder showed greater RSA reactivity in response to a speech stressor task than women who did not have a diagnosis of depression. Although this study examined depression and not specifically emotion regulation, these results may suggest that high reactivity or vagal withdrawal is more common among those with difficulties with emotion regulation, given that depression can be a manifestation of emotion regulation difficulties (Abravanel & Sinha, 2015).

However, contrary results have been found in a sample of adolescents, for which those with greater exposure to childhood maltreatment showed lower RSA reactivity, when watching a video meant to elicit an emotion response, than those with less maltreatment exposure (Daches et al., 2017). The results are contrary to those of Cyranowski et al. (2011) and Wells et al. (2016), as they suggest that low RSA reactivity is more common in those with difficulties regulating emotions, given an established correlation between childhood maltreatment and difficulties with emotion regulation (e.g., Bradley et al., 2011; Oshri et al., 2015). Therefore, results using RSA reactivity are mixed and appear dependent on the stressor applied in the study. The situation

dependent results may be because RSA reactivity measures one's body preparing to respond to a stressor (Laborde et al., 2018), and what it means to respond successfully, and the physical resources needed to do so, is likely dependent on the situation itself.

Few studies have focused on RSA recovery, or the difference between RSA in response to a stressor and RSA post-stressor exposure or return to resting state (e.g., Figure 3). It is surprising that so little research has used RSA recovery as an indicator for emotion regulation considering that most definitions of emotion regulation processes have highlighted recovery from stress as a key part of one's emotion regulation abilities (e.g., Calkins & Perry, 2016; Thompson, 1994). Although RSA recovery has been quantified differently across studies, RSA recovery calculated by the difference between the mean RSA during a stressor and mean RSA during a recovery period, is consistent with polyvagal theory. Specifically, using this quantification of RSA recovery, greater RSA recovery values would be indicative of the vagal break being exerted following the stressor to help an individual return to homeostasis (Porges, 2007; Porges et al., 1994; Rigoni et al., 2017). The research that has examined RSA recovery has focused on child samples. For example, Santucci and colleagues (2008) found that young children who had lower RSA recovery values displayed greater difficulties with emotion regulation, as coded from their behavioral responses to a frustration, again consistent with polyvagal theory.

Considering the evidence available thus far, it is unclear which measure of vagal control (resting, reactivity, or recovery) may be the best physiological indicator of emotion regulation. In fact, emerging evidence is suggesting that these three measures of vagal control are indicative of distinct processes of emotion regulation and as such, each should be considered (Laborde et al., 2018). Specifically, resting RSA is indicative of an individuals' ability to maintain homeostasis

while at rest; RSA reactivity measures one's ability to adapt to the demands of the stressor to respond in a goal-oriented way; and RSA recovery measures an individuals' ability to recover from the stressor and attempt to regain homeostasis (Laborde et al., 2018). Although, empirical evidence suggests that these three indicators are correlated (Daches et al., 2017), theoretically these are each related but distinct pieces of the regulatory process (Porges 2007, Laborde et al., 2018). A study by Calkins and colleagues (2007) illustrates that in measuring only one of the RSA indicators, researchers may be missing components of the regulatory process. Specifically, this study found that children with greater externalizing (e.g., hyperactivity and aggression) and internalizing (e.g., anxiety and sadness) problems had greater RSA reactivity than those with fewer behavior problems, but these children did not differ in regard to their resting RSA (Calkins et al., 2007). Thus, in measuring only a piece of the physiological process, researchers are not fully capturing individuals' internal regulatory abilities.

To date, the bulk of prior research, with adults, has assessed emotion regulation through only subjective self-report measures (e.g., Barlow et al., 2017) or through only physiological indicators such as RSA (e.g., Daches et al., 2017). However, a few studies have used both physiological and self-report methods to obtain a more complete assessment of emotion regulation (Deater-Deckard et al., 2016; Rigoni et al., 2017). One study that did include both methods measured emotion regulation through resting RSA, self-reported ability to control attention and impulses, and self-reported emotional impact of a laboratory stressor, and found each of these variables to be significantly correlated indicators of a latent construct of emotion regulation (Deater-Deckard et al., 2016). Yet, this study may have missed physiological components in the emotion regulation process, as participants' ability to adapt to and recover from a stressor were not measured (e.g., reactivity and recovery). The only study to date that has

included all three indicators of RSA as well as a self-report measure of emotion regulation, has found that although the RSA indicators were correlated with each other, they were not correlated with the self-report measure of emotion regulation (Rigoni et al., 2017). The results from this study suggest that physiological and self-report measures of emotion regulation are capturing separate aspects of emotion regulation, but this study did not examine what factors may contribute to these distinct physiological and self-report components. The present study provided a comprehensive examination of emotion regulation, capturing processes individuals are aware of as well as their physiological ability to maintain homeostasis (resting RSA), adapt to stress (RSA reactivity), and recover from stress (RSA recovery), and the present study extended prior research (e.g., Rignoi et al., 2017) by examining if these components are each distinctly associated with the experience of adverse life events.

Association Between Adversity and Difficulties with Emotion Regulation

Prior research has consistently found adversity in childhood to be associated with difficulties with emotion regulation in adulthood (e.g., Espeleta et al., 2018; Poole et al., 2017). However, it is unclear whether this association is specific to childhood adversity, unsettling the development of adaptive regulation (Calkins & Hill, 2007), or if more recent adversities in adulthood also contribute to difficulties with emotion regulation.

Much of the prior literature on childhood adversities and difficulties with emotion regulation in adulthood has focused on the experience of childhood maltreatment (e.g., Bradley et al., 2011; Oshri et al., 2015). This research has found that the experience of childhood maltreatment is positively associated with self-reported difficulties with emotion regulation, across different self-report measures and in differing samples (e.g., primarily White young adults [Barlow et al., 2017; Oshri et al., 2015] and primarily African American adult women [Bradley

et al., 2011; Stevens et al., 2013]). Similar results have been found in examining the relation between childhood maltreatment and physiological indicators of emotion regulation. For example, in a sample of women aged 18-22, those with childhood maltreatment histories showed lower resting RSA values, than those with no maltreatment history (Dale et al., 2018).

It is unsurprising that child maltreatment is related to adults' difficulties with emotion regulation, since maltreatment, in all of its forms, threatens the child's physical and psychological safety, likely requiring a significant effort by the child to manage emotions, which then challenges the healthy development of emotional management (Messman-Moore & Bhuptani, 2017). However, maltreatment is not the only stressor that puts individuals at risk for difficulties with emotion regulation. Researchers are also beginning to examine the impact of cumulative childhood adversities, in addition to maltreatment, as influential to difficulties with emotion regulation. For example, Poole and colleagues (2017) and Espeleta and colleagues (2018) have found that the experience of childhood adversities (e.g., maltreatment, poverty, parental substance use, and household dysfunction) were positively associated with adult's self-report of difficulties with emotion regulation. A similar result has been shown using physiological indicators of emotion regulation, where adolescents' greater cumulative childhood adversity (e.g., maltreatment, parental illness/hospitalization, death of a close relative, and unstable housing) was associated with blunted, or lower, RSA reactivity and recovery than less childhood adversity exposure (Daches et al., 2017). In summary, prior research has found a significant correlation between childhood maltreatment and adversity, more broadly, and self-report difficulties with emotion regulation as well as physiological indicators of emotion regulation difficulties.

Research that has examined adversity in adulthood and emotion regulation has focused on lifetime cumulative adversity (e.g., Cyranowski et al., 2011), combining childhood and adulthood adverse events, and not examining the potential unique contribution of each, in accounting for difficulties with emotion regulation. This research has found that lifetime cumulative adversity is positively associated with self-report (Abravanel & Sinha, 2015) and physiological (Cyranowski et al., 2011) indicators of difficulties with emotion regulation. For example, Cyranowski and colleagues (2011) found that in a sample of adult women, with diagnoses of depression, women with greater lifetime adversity exposure (e.g., greater number of adverse events experienced in both childhood and adulthood) showed a lower mean RSA value during a speech task, indicative of vagal withdrawal and high RSA reactivity, than women with less adversity exposure. Similarly, Abravanel and Sinha (2015) found that the frequency of cumulative adversity exposure, across childhood and adulthood, was positively associated with self-reported difficulties with emotion regulation.

However, little work has examined the unique role of adult adversities versus childhood adversities. Deater-Deckard and colleagues (2016) assessed for maternal adulthood stressors, such as being a single mother, having a greater number of children living in the home, and having a child with a disability. They found that a greater number of adulthood stressors were correlated with more difficulties regulating emotions, indicated through self-report and lower resting RSA (Deater-Deckard et al., 2016), demonstrating that stressors occurring specifically in adulthood can be related to difficulties with emotion regulation. Although, the assessment of types of stressors used in this study was very limited (e.g., unemployment, education, number of children in the home, being a single parent, household chaos, caring for a child with a disability, and child behavior problems), thus not fully assessing for adversity exposure in adulthood.

Further, the study did not account for childhood adversities. Thus, the relative contribution of childhood and adulthood adversity on adulthood emotion regulation remains unclear.

Nonetheless, some research has indicated that the impact of adversity on difficulties with emotion regulation is specific to the developmental timing in which adversity was experienced. For example, Daches and colleagues' (2017) longitudinal research with children and adolescents found that adverse events occurring later into adolescence or early adulthood had less impact on RSA reactivity and recovery values than events in participants' childhoods, prior to age 14. This result suggests that adverse events occurring during adolescence or later may have less of an impact on physiological indicators of emotion regulation than events occurring earlier in development (Daches et al., 2017). Recent retrospective research, with primarily low-income adults, has also attempted to shed light on the question as to whether childhood versus adulthood adversity exposure is more impactful to difficulties with emotion regulation (Dunn et al., 2018). In this study, adversities occurring between the ages of six to ten were more significantly associated with self-reported difficulties with emotion regulation, than adversities occurring in adulthood. Taken together, this research suggests that developmentally, adversities occurring in childhood may be more strongly associated with difficulties in emotion regulation in adulthood, than more recent adversities. However, both Daches and colleagues (2017) and Dunn and colleagues (2018) assessment of adversity was limited in only assessing for a small number of adversities, and did not assess for many adversities that may be experienced in adulthood (e.g., poverty, homelessness, divorce/separation, domestic violence, or sexual assault) thus potentially missing critical information that may contribute to adult's current difficulties with emotion regulation, both self-reported and physiologically.

In sum, the field is left with a gap in the current literature regarding the unique role of childhood versus adulthood adversities in contributing to physiological and self-report difficulties with emotion regulation. To attempt to address this gap, the present study systematically examined the contribution of childhood and adulthood adversities, using a more comprehensive assessment of possible adversities than have been previously examined (e.g., Abravanel & Sinha, 2015; Dunn et al., 2018).

Further, the present study examined the average “dose” of these more comprehensive childhood and adulthood adverse experiences, as prior research has found that the frequency of adverse interpersonal childhood events was positively associated with adults’ self-report difficulties with emotion regulation (Thompson et al., 2014). Similarly, Abravanel and Sinha (2015) found that frequency of lifetime adverse events was associated with adults’ self-report difficulties with emotion regulation. Therefore, this prior research suggests that it is important to consider the frequency at which adverse events occur, to distinguish between those who have experienced adverse events (e.g., divorce, reduction of standard of living, and death of someone close) at a low frequency (e.g., only experiencing these events once in their lives) versus those who have experienced adverse events at a high frequency (e.g., experiencing adversity several times throughout their lives). Furthermore, the present study was the first to examine the impact of the frequency of adversity on physiological indicators of emotion regulation, rather than the number of adverse events experienced, as commonly done in prior research (e.g., Cyranowski et al., 2011; Deater-Deckard et al., 2016)

In addition to attempting to address the current gaps in the literature on childhood versus adulthood adversity exposure in the relation with difficulties with emotion regulation, the present study examined what may help explain variability in this association. Specifically, why do some

individuals exposed to adversity show greater problems with emotion regulation than others?

Although prior research has found significant correlations between childhood adversity and adult difficulties with emotion regulation (e.g., Barlow et al., 2017; Espeleta, 2018; Poole et al., 2017), there is also evidence to suggest that the path may not be straightforward. For example, the size of correlations has varied across studies, from small non-significant correlations between childhood adversity and resting RSA ($r = -.04$; Daches et al., 2017) and small significant correlations between self-report difficulties with emotion regulation ($r = .15$; Espeleta et al., 2018) to larger moderate correlations between childhood adversity and self-report emotion regulation difficulties (e.g., $r = .37$; Barlow et al., 2017) and lower resting RSA ($\eta^2 = .07$; Dale et al., 2018). However, little work has examined what may account for this variability in why some but not all who have experienced adversity display difficulties with emotion regulation. The present study addressed this question by examining if appraisals of adverse experiences help explain this complexity.

Appraisals as a Moderator for Adversity and Difficulties with Emotion Regulation

Appraisals can be broadly defined as one's cognitive subjective interpretation of events, the self, or others (Lazarus & Folkman, 1984). Lazarus and Folkman's appraisal theory asserts that it is through cognitive appraisals that our emotions are determined, and it is therefore through appraisals that individuals are able to cope effectively, or not, following a stressor. Specifically, in their seminal work, they posit one's cognitive appraisal of situations can influence the emotional impact of that situation. Thus, when individuals appraise situations as less negatively impactful, the situation will be less likely to elicit distress (Lazarus & Folkman, 1984).

Lazarus' appraisal theory is consistent with Gross and Thompson's (2007) model of emotion regulation, in which appraisals of a given situation are antecedents to one's emotional response. Empirically, a large amount of research on cognitive appraisal and emotion regulation has focused on appraisals of stressful laboratory activities and the associated emotional responses to the activities. One such study was conducted by Wells and colleagues (2016) who found that women with child abuse histories, who appraised a mental arithmetic task as challenging or intimidating, reported greater feelings of anger during the task, than those who did not appraise the task as being as challenging or intimidating. This supports the notion that appraisals can impact one's emotional response to stressors, but it is not clear whether patterns in cognitive appraisals across events can impact emotion regulation more broadly.

Prior research on appraisals of adverse life events has focused on appraisals of one event, rather than patterns of appraisals across events, and how these appraisals may impact psychological distress rather than emotion regulation. For example, in a sample of adolescent females who had known histories of maltreatment, participants were asked to recall one traumatic event and answer a series of questions on their appraisals of that one event (Srinivas et al., 2015). Self-blame appraisals (e.g., feeling as though the event was their fault or they were to blame) and appraisals of alienation (e.g., feeling as though the event made them feel isolated from others) were more strongly associated with the severity of depression, than the number of traumatic events experienced (Srinivas et al., 2015). Although emotion regulation has been found to serve as a mechanism for symptoms such as depression (Abravanel & Sinha, 2015), this leaves the question as to what extent appraisals of experienced adversity impact one's emotion regulation.

A study by Barlow and colleagues (2017) has provided first steps towards answering this question in a sample of young adult college students. These students completed a continuous measure of maltreatment history and identified an event from their childhood that was the most stressful (it did not have to be maltreatment-specific) and the participants then responded to a series of appraisal questions about that selected event. Results showed that greater trauma appraisals (i.e., a composite of appraisals of betrayal, self-blame, fear, alienation, anger, and shame) were correlated with greater self-reported difficulties with emotion regulation. Further, their results found that there was an indirect effect of childhood abuse on posttraumatic stress disorder symptoms through appraisal and emotion regulation difficulties. Their regression analysis showed a significant positive association between trauma appraisals and emotion regulation difficulties. These results support the notion that appraisals are associated with difficulties with emotion regulation, and the results suggest that it is through appraisals' impact on emotion regulation difficulties that those who have experienced child abuse display posttraumatic stress symptoms in adulthood.

Results from Barlow and colleagues (2017) are consistent with appraisal theory (Lazarus & Folkman, 1984) and Gross and Thompson's model of emotion regulation (2007) by demonstrating the significant association between appraisals of an adverse event and difficulties with emotion regulation. However, the prior results did not systematically examine a possible interaction between adversity exposure and appraisals in contributing to difficulties with emotion regulation. This is a gap in the current literature, as we currently only know that adversity (Poole et al., 2017) and appraisals of one adverse event (Barlow et al., 2017) are related to difficulties with emotion regulation, but we do not know of the potential moderating effect of appraisals on the association between adversity and difficulties with emotion regulation or the impact of

appraisal styles, across multiple adverse events. Theoretically, this interaction is justified, since appraisal theory (Lazarus & Folkman, 1984) describes appraisals of events as influencing the impact of the events on an individual, indicating that adversity's impact on difficulties with emotion regulation may be influenced by one's appraisals of adverse experiences.

However, it is important to note that prior assessments of appraisals may be significantly limited in that they only ask participants to appraise one event, such as a specific laboratory task or a specific stressful event from their life. This may be a significant limitation, as it only allows researchers to know how individuals appraise one stressor or one significant adverse event; thus, failing to see if there are patterns in individuals' appraisal styles that may account for emotion regulation problems across events. Some prior research has shown that across stressful situations (e.g., running late to work, arguing with a romantic partner or friend, or loss of money), there is moderate consistency among appraisals (e.g., threat, perceived significance, manageability, self-blame, blaming others, and predictability), suggesting that individuals may have general appraisal styles across stressful events (Power & Hill, 2010). Further, research with adolescents has shown an importance in examining appraisals across different adverse life events, showing that these overall styles in appraisals are correlated with hardiness, optimism, hope (Power & Hill, 2010), and anxiety (Hood et al., 2009). Nonetheless, it is currently unknown as to whether appraisals of a specific event or appraisal styles across multiple events are more associated with difficulties in emotion regulation, as no study has examined appraisal styles in relation to emotion regulation.

Also, important to note is that no study has examined the impact of appraisals of adversities on physiological indicators of emotion regulation, instead relying solely on self-report measures of difficulties with emotion regulation (e.g., Barlow et al., 2017; Srinivas et al., 2015).

Therefore, it remains to be seen if appraisals of adverse events are as related to physiological difficulties with emotion regulation as they are with self-report difficulties. However, one study has examined the impact of appraisals of a laboratory stressor and physiological regulation (Wells et al., 2016). These results showed that when completing a mental arithmetic stressor task, participants who appraised the task as being challenging, or intimidating showed higher RSA reactivity on the task (Wells et al., 2016). This suggests that appraisals may impact physiological as well as self-report difficulties with emotion regulation, but it is not yet clear in the literature if appraisals of adverse life events, opposed to a laboratory stressor task, are related with physiological difficulties with emotion regulation.

By examining appraisals across adverse life events as a potential moderator for the relation between adversity and difficulties with emotion regulation, the present study addressed several gaps in the current literature. First, the present study examined if appraisals were associated with difficulties in emotion regulation, irrespective of adversity exposure, or if it is the interaction of adversity exposure and appraisals of that exposure that impact difficulties with emotion regulation. Second, the present study examined appraisals across adverse life events, rather than appraisals of only one event, to assess the role of appraisal styles. Third, the present study was the first to examine the role of appraisals of adverse experiences on resting RSA, RSA reactivity, and RSA recovery.

Further Considerations

There are additional factors to consider that may influence, or be confounds for, the primary variables of interest (e.g., adversity exposure and RSA). First, in measuring RSA reactivity and recovery, the present study utilized a commonly used stressor task for adults, requiring participants to perform serial mental arithmetic (Rigoni et al., 2017; Sloan et al., 1991;

Wells et al., 2016). Although this task has been found to be a reliable task used to measure physiological emotion regulation (e.g., Rigoni et al., 2017), the studies that have used this task have often used undergraduate samples (Rigoni et al., 2017; Wells et al., 2016). As such, it is unclear if this task may be more stressful for participants with lower levels of education than for participants with higher levels of education. Second, body mass index (BMI) has been shown to affect RSA scores, such as higher BMI being correlated with lower resting RSA (Yaptangco et al., 2015). Third, participants' age is an important factor to consider when examining adversities across both childhood and adulthood. As participants who are older may report greater adulthood adversity due to having more chances to experience adverse events since the age of 18. Additionally, age may also influence RSA values, as negative associations have been found between resting RSA and age (Campbell et al., 2019; Masi et al., 2007). Thus, education level, BMI, and age are variables to be considered as possible confounds for RSA values and adversity exposure.

Summary of the Present Study and Hypotheses

Prior research has laid a foundation for understanding the connection between adversity and difficulties with emotion regulation, measured through self-report or RSA, but several questions remain unanswered. The first of these unanswered questions that the present study addressed was whether childhood and adulthood adversity exposure were related to the physiological ability to maintain homeostasis (resting RSA), adapt to stress (RSA reactivity), and recover from stress (RSA recovery), as well as self-report difficulties with emotion regulation. It was predicted that childhood and adulthood adversity exposure would be positively associated with self-reported difficulties in emotion regulation (H1.1), negatively associated with resting

RSA (H1.2), positively associated with RSA reactivity (H1.3), and negatively associated with RSA recovery (H1.4).

Secondly, the extent to which childhood adversities versus adversities in adulthood account for difficulties with emotion regulation remains unclear. As such, the present study addressed the unique contribution of childhood versus adulthood adversity exposure in explaining variance in adults' difficulties with emotion regulation. It was expected that, when entered into the same model, childhood adversities would account for greater variance in difficulties in emotion regulation (e.g., higher self-report values [H2.1], lower resting RSA [H2.2], higher RSA reactivity [H2.3], and lower RSA recovery [H2.4]) than adulthood adversities, given prior literature highlighting the importance of early adversity in the development of emotion regulation difficulties (e.g., Daches et al., 2017; Dunn et al., 2018).

Third, to help explain variability in the association between adversity and emotion regulation difficulties, the present study examined appraisal styles, across adverse events, as a possible moderator in the association between adversity and self-reported and physiological difficulties with emotion regulation. It was hypothesized that participants' appraisal styles across adverse events would moderate the associations between childhood and adulthood adversity and difficulties with emotion regulation, such that the interaction between greater frequency of adversity and more negative appraisal styles would be associated with higher self-report values of difficulties with emotion regulation (H3.1), lower resting RSA (H3.2), higher RSA reactivity (H3.3), and lower RSA recovery (H3.4).

In testing these hypotheses, the present study also examined variables that may be important to control for in analyses, such as participants' education level, age, and body mass index (BMI).

Methods

Participants

Participants were 161 caregivers participating in an ongoing longitudinal research study, the Preschoolers' Adjustment and Intergenerational Risk (PAIR) project, with their children ages 3-5. This study was approved by the University Institutional Review Board of the author's home institution. The PAIR project collected data from participants at four time points, six months apart. Time one data was included in the present study. The sample was recruited from families who received family-centered services from the Missouri Department of Family Services due to current risk for placement in foster care and families who were enrolled in community programs in Kansas City, MO that serve families living in poverty.

Participant demographics are presented in Table 1. Most participants were the biological mother (90.7%) of a preschooler participating in the larger study, 5% were the biological father, 2.5% were the grandmother, and 1.9% identified as having an "other" relationship to the preschooler (e.g., adoptive parent). Among participants, 70.2% identified as Black or African American, 14.3% identified as White, 9.9% as multiracial, 2.4% as Hispanic, 1.2% as American Indian, 1.2% as Asian or Other Pacific Islander, and .8% as other or unidentified. The mean age of participants was 30.48 (range 19-48; $SD= 6.1$). The majority of participants reported being single (70.2%), followed by 21.1% being married, 7.5% being divorced/separated, .6% being widowed, and .6% being remarried. The average number of children in the participants' homes was 2.88 ($SD= 1.22$), and 63.2% of participants had a yearly income of \$20,000 or less. Twenty-nine percent of participants reported their highest level of completed education to be some college, 27.1% reported having a high school diploma or GED, 16.8% reported having a trade school or community college degree, 16.2% reported some high school or lower, 10.3% reported

a four year college degree or graduate degree, and .6% reported completing some grade school. The average BMI of participants was 33.87 ($SD= 9.40$), which falls in the obesity range (Centers for Disease Control and Prevention [CDC], 2020).

Procedure

Prior to being included in the study, participants were screened over the phone. Exclusion criteria included: being non-fluent in English (as all questionnaires are presented in English), taking cardiac medications such as beta-blockers, anticoagulants, or diuretics, having a pacemaker, and taking medications for seizures (as these can confound heart rate data). For the present study, given that exposure and appraisal were central to the research questions, participants were also not included if they reported no adverse experiences ($n= 12$) or reported that none of the adverse experiences they endorsed were important to them and therefore did not appraise any adverse events ($n= 25$).

Once scheduled, participants were asked to refrain from using caffeine, nicotine products, medications that cause drowsiness, or alcohol on the day of data collection, to avoid additional confounding influences on participants' heart rate data. With the help of research assistants, participants thoroughly reviewed the study's informed consent protocol to ensure that they understood the project, their rights to withdraw participation at any time, and the voluntary nature of the project. Throughout the consenting process, participants were invited to ask questions and research assistants asked participants to summarize what they heard, to ensure they knew what to expect from participation.

Following consent, participants began completing questionnaires using the Audio Computer-Assisted Self-Interview (A-CASI) on laptop computers. The A-CASI software presented each question individually on the computer screen, and an automated voice read the

question and answer choices in English to participants. As such, all participants were required to wear headphones during the A-CASI to hear the reading of each question and answer choices. Using the A-CASI, participants were required to answer each question but had the option of selecting “I don’t know” or “I don’t want to answer” for any question. Participants completed the adverse experiences and appraisal measures after completion of all laboratory activities and other study measures.

As a part of the larger PAIR project, children began their individual laboratory activities while their caregiver began completing study measures. When their child had completed individual activities, the caregiver joined their child for a series of caregiver-child activities. Once this was completed, the child left the room and the caregiver completed an individual stressor task that was used in the present study. At the completion of these laboratory activities, participants returned to the A-CASI to complete the remaining measures including the adverse experiences and appraisal measures. A research assistant asked the participants if they would like a break before proceeding to the adverse experiences and appraisal measures. Additionally, a research assistant asked the participants, prior to and after completing the adverse experiences and appraisal measures, how they were feeling on a scale of 1 “the worst they have ever felt” to 10 “the best they have ever felt.” This was to help assess for any distress related to answering the adverse experiences measure. The feeling rating was also discussed at debriefing to ensure the participant was not experiencing any distress prior to leaving the data collection session. Prior to beginning the adverse experiences measures, participants height and weight was obtained, using a stadiometer and scale that measures height in centimeters and weight in kilograms. This information was used to calculate each participant’s BMI, by dividing each participants’ weight in kilograms by their height in centimeters squared.

Participant laboratory tasks. During the laboratory tasks, participants wore a Firstbeat Bodyguard-2 heart rate monitor, and all interactions were videotaped. For resting RSA, participants watched a two-minute neutral video clip with their child and were instructed to be still and quiet during the clip. The use of a neutral video clip has been used previously to aide in participants sitting still and remaining quiet, to achieve a resting RSA value (Wells et al., 2016). Next, parents and children completed a series of tasks, together, as part of the larger study, that are not included in analyses within the present study. Following tasks with their child, participants completed an individual task meant to illicit stress, which was a serial arithmetic task, commonly used to measure adults' stress response (e.g., Rigoni et al., 2017; Sloan et al., 1991; Wells et al., 2016). For this task, participants were asked to complete six one-minute trials requiring them to serially subtract a given number by seven. At the end of each minute, participants were given a new number to begin serially subtracting seven from. When participants stated an incorrect number, they were corrected and told to begin subtracting from the first number they were given. To help ensure that this task elicited stress from participants, participants completed the arithmetic task while a car horn along with a ticking timer was played in the background, at a standardized volume. The use of a car horn noise has been found in previous research to be effective in eliciting a stress response from women (Casanova et al., 1992). This individual stressor task was used in calculations for RSA reactivity. Following the stressor task, participants watched a two-minute neutral video and were instructed to sit quietly and watch the entire video; this task was used for calculations of RSA recovery.

Debriefing and follow up. Following completion of all laboratory tasks and questionnaires, trained research assistants completed a debriefing session with participants. Participants were first thanked for their time and participation. Participants were then asked how

they were feeling on a scale of 1 “the worst they have ever felt” to 10 “the best they have ever felt.” This scale was used to help assess for any distress participants may have felt from completing the adverse life events measures. If participants reported distress, as evidenced by a decline in rating from pre-questionnaire to post-questionnaire debriefing session, the research assistants allowed the on-site clinical graduate research assistant to complete the debriefing. Clinical graduate research assistants then talked briefly about how the participant was feeling and helped plan what they could do later in the day to relieve distress. All participants also received a handout on warning signs of distress and local mental health resources. Participants were encouraged to ask questions during this time about the activities completed, and they were told they would receive a follow-up call within 48 hours to check on their well-being. At the end of the debriefing session, participants were compensated for their time with a \$60 gift card from a location they chose upon scheduling. Within 48-hours, a clinical graduate research assistant called each participant and asked how they were feeling, reminding them of the mental health resources if necessary, and answering any remaining questions.

Data security. Given the highly sensitive nature of this research, strict HIPPA compliant confidentiality and data security protocols were in place. Specifically, no data (e.g., video, heart rate, or questionnaire) was directly connected with participants’ names. Participants were given ID numbers which were used for all data. Participants’ names and identifying information were stored in REDCap, on a HIPPA compliant server. Furthermore, electronic data files were stored on Box, a HIPPA compliant online file storage system only accessible via encrypted password protected computers.

Measures

Demographics. Participants reported on their demographic information such as gender, age, age and gender of child participating in the larger study, relationship to the child in the larger study, education, income, race/ethnicity, relationship status, and number of children living in the home.

Emotion regulation.

Self-report. Participants' self-reported emotion regulation was measured by the Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004). The DERS is a 36-item measure of emotion regulation abilities in adults. Each item is rated on a 5-point Likert scale (1= Almost Never – 5=Almost Always). The DERS consists of subscales for emotional awareness, emotional clarity, nonacceptance of emotions, regulation strategies, impulse control, and goal-oriented behavior. However, the measure also allows for the calculation of an overall sum score, which is a sum of each subscale. For the present study, this overall sum score was used in analyses, with higher scores indicating greater difficulties with emotion regulation. The DERS total score evidenced excellent internal consistency ($\alpha = .93$) in the study sample.

The DERS is a commonly used self-report measure of adults' emotion regulation and has demonstrated good psychometric properties, such as good test-retest reliability at a four to eight-week retest period ($r=.88$; Gratz & Roemer, 2004). Just as in the current sample, the DERS total score has shown excellent internal consistency in prior research ($\alpha = .93$; Gratz & Roemer, 2004), providing evidence to suggest that each item works together to make-up the total DERS score. Within a sample of undergraduate students, construct validity has also been supported with the DERS being significantly correlated with the Negative Mood Regulation Scale (NMR). However, the DERS was found to account for greater variability in outcomes such as self-harm and engagement in intimate partner abuse, than the NMR, providing evidence for its concurrent

validity (Gratz & Roemer, 2004). The DERS has also been shown to have excellent internal consistency and evidenced construct and concurrent validity with samples of low income primarily African American adults (Gratz et al., 2008; Stevens et al., 2013). In Gratz and colleagues' (2008) sample of primarily African American adults living in the inner-city of Washington, DC, the internal consistency was high ($\alpha = .94$) and the DERS showed a significant positive correlation with self-reported negative affect and affect intensity across life situations. Stevens and colleagues (2013) also found an excellent internal consistency for the DERS total score ($\alpha = .95$) and a significant positive association between the DERS and posttraumatic stress symptoms, among primarily African American women living in the inner-city of Chicago.

RSA. Participants' RSA values across laboratory tasks were recorded using Firstbeat Bodyguard-2 heart rate monitors, which measured continuous R-R intervals at a 1 ms resolution (e.g., Figure 2). This device was worn by participants, who were instructed to place one disposable electrocardiograph (ECG) electrode under the right side of their collarbone which was connected via one lead to an electrode on their left ribcage (Parak & Korhonen, 2013). Participants were provided with an image diagram of where the heart rate monitor should be placed, and for privacy reasons were instructed to secure their own monitor, while the research assistant turned the camera lens facing away from the participant and stepped out of the room.

RSA was calculated using the CardioBatch/Cardio Edit software, which uses the Porges-Bohrer (Porges & Bohrer, 1990) method to extract RSA from the R-R output that the Firstbeat Bodyguard-2 monitors provide, in which RSA values are calculated in short 30 second epochs, which are then transformed using natural logarithms. Lewis, Furman, McCool, and Porges (2012) compared Porges-Bohrer's method of extracting RSA values to other methods (e.g., the peak-to-trough algorithm) and found that the Porges-Bohrer method was the most sensitive to

vagal activity, most effective for eliminating variance or noise from the heart rate measurement, and demonstrated the best test-retest reliability. RSA calculations were completed by an expert in RSA, who was a previous student of Porges, and was trained in the reliable use of the Porges-Bohrer method. This expert used the Porges-Bohrer method to (1) provide RSA values after editing the heart rate data for artifacts and significant arrhythmias; (2) use CardioBatch to transform each 30 second epoch by its natural logarithm; and (3) calculate mean RSA values across the 30 second epochs of the resting period, stressor task, and recovery period (Riniolo & Porges, 2000).

To fully capture the physiological indicators of emotion regulation, multiple RSA values were used: participants' mean resting RSA, mean RSA during a stressor task, and mean RSA for a recovery period following the stressor task. For the present study, the resting RSA value was the mean RSA value during the resting task, the RSA reactivity value was the mean resting RSA value minus the mean RSA value during the stressor task, and the RSA recovery was the mean RSA value during the recovery period minus the mean RSA value during the stressor task (Figure 3). The quantification of these RSA values is consistent with previous research using these three RSA indicators (Dale et al., 2018; Rigoni et al., 2017). When interpreting these values, lower values for resting RSA and recovery and higher values for RSA reactivity are thought to be indicative of greater difficulties with emotion regulation.

Adverse experiences. A measure of participants' childhood and adulthood experiences (i.e., Parent Childhood Adverse Experiences Measure and Parent Adulthood Adverse Experiences Measure) was created for the purposes of the larger study. These measures were created by compiling a comprehensive list of adverse life events that have been used in previously validated measures such as, the Adverse Childhood Experiences questionnaire (Felitti

et al., 1998), the Life Events Checklist (Weathers et al., 2013), the Trauma History Questionnaire (Hooper et al., 2011), and the Juvenile Victimization Questionnaire (Finkelhor et al., 2005).

However, as pointed out in Grant and colleagues' review (2004), current adverse life events assessments only include a subset of adverse events, rather than a comprehensive list.

Additionally, many of these assessments only include a checklist of events for which participants respond yes or no, rather than assessing for frequency or severity of events. Therefore, two measures of adversity were created for the larger study, to address the limitations of existing measures, by combining past assessments into a larger comprehensive assessment – one on the adult's childhood period and one covering the time since the participant was 18 years old.

In determining items to include in the measures used in the larger study, an expert in adversity assessment was consulted regarding which items, from the comprehensive list of events, should be included. For example, events from other measures that were specific to military or refugee populations were collapsed into two items (e.g., “were you involved in war or terrorism events” and “Did you move to a different country”), to make items possibly more relevant to the population targeted in the larger study. In addition to consulting an expert, a focus group of mothers from the sample community provided input regarding events that should be included in the questionnaires and how questions should be phrased to ensure comprehension. This focus group was recruited from the same community organizations from which the larger study recruited, but who did not have a preschool-aged child at the time and thus were not eligible to participate in the study.

Parent childhood adversity measure. The Parent Childhood Adversity Measure (see Appendix B) was administered to assess for participants' exposure to adverse experiences in their childhood. The Parent Childhood Adversity Measure assesses for exposure, severity,

frequency, and level of injury to 55 different potentially adverse life events before the age of 18 years old (e.g., violence exposure, natural disaster, childhood maltreatment, household dysfunction, parental substance use, and parental incarceration). The frequency at which each event was endorsed (1= 1 time, 2= 2 times, 3= 3-5 times, 4= 6-10 times, and 5=More than 10 times) was utilized for the present study. For the present study, a sum frequency score of all endorsed childhood adverse events was composed to quantify the cumulative frequency of childhood adverse experiences, and a sum frequency score of the number of events endorsed was created. The sum frequency was then divided by the sum number of events endorsed to determine the dose of adversity across all events from childhood (e.g., if the participant endorsed six adverse events, four at a frequency of two and two at a frequency of five, their exposure to childhood adversity score would be three). This score was then used in all analyses to quantify participant childhood adversity exposure, with higher scores indicating a higher average frequency relative to the number of total events experienced.

Parent adulthood adversity measure. The Parent Adulthood Adversity Measure (see Appendix C) was administered to assess for participants' exposure to life adversities, since the age of 18 years old. This measure assesses for exposure to 45 potentially adverse events (e.g., physical or sexual assaults, divorce or separation, miscarriage, reduction in standard of living, and being forced to leave their home). For each event participants endorsed, a question about the frequency of these experiences (1= 1 time, 2= 2 times, 3= 3-5 times, 4= 6-10 times, and 5=More than 10 times) was also administered. A sum frequency score of all experienced adulthood adverse events was composed to quantify the cumulative frequency of adulthood adverse experiences, and a sum frequency score of the number of events endorsed was created. The sum frequency was then divided by the sum number of events to examine the average dose of

adversity across all events experienced from adulthood (e.g., if a participant endorsed experiencing 20 events, all at a frequency of one, their exposure to adulthood adversity score would be one). This score was then used in all analyses to quantify participant adulthood adversity, with higher scores indicating a higher average frequency relative to the number of total adulthood events experienced.

Appraisal questionnaire. The Appraisal Questionnaire (AQ), was also created for the purposes of the larger study, to capture participants' pattern of subjective interpretations across adverse events. Existing appraisal measures had a number of limitations, which led to the decision to create a new measure that expanded upon pre-existing tools. The primary measures used in the development of this tool were the Stress Appraisal Measure (SAM; Peacock & Wong, 1990) and the Trauma Appraisal Questionnaire (TAQ; DePrince et al., 2010). The SAM was designed to measure appraisal of more benign commonly occurring stressors, such as taking an exam or looking for new employment (Peacock & Wong, 1990), and it does not fully capture appraisals such as negative cognitions about one's self or the world that can occur following trauma or adversity and which are linked to traumatic stress symptoms (Ehlers & Clark, 2000). Conversely, the TAQ was designed with the purpose of assessing appraisals of potentially life-threatening traumatic events, such as sexual or physical abuse (DePrince et al., 2010), and many of the items included in this measure would not be applicable or relevant for a broad range of adverse events (e.g., "its as if my insides are dirty," "I don't know whether I will live or die," and "I've lost my sense of manhood or womanhood"). Thus, neither of these measures contained items that appeared to be equally relevant for adversities such as loss of job or home and adversities such as sexual or physical assault. Further, both the TAQ and the SAM were designed to be answered about one specific adverse event and were not created to capture patterns in

cognitive appraisal across events (DePrince et al., 2010; Peacock & Wong, 1990). As such, the current measure was created to capture appraisal styles across threatening traumatic events, such as sexual assault or being diagnosed with a chronic illness, as well as potentially milder adversities, such as separation of caregivers or losing one's job. However, because the SAM and TAQ have evidenced good reliability and validity psychometrics (DePrince et al., 2010; Peacock & Wong, 1990), items from these measures were used in the development of items for the larger study. Also used in the development of items for the larger study's appraisal measure, to aide in the goal of capturing appraisal patterns across a wide range of adverse events, was Frijda (1987) and Frijda and colleagues' (1989) seminal work, in which dimensions of appraisal (e.g., valence, certainty, expectedness, importance, agency, and familiarity) were found by asking adults to describe events that elicited certain emotions and rate potential appraisals of each event,

The final Appraisal Questionnaire consisted of 24 primary quantitative items, which participants responded to on a scale from 1 "Strongly Disagree" to 5 "Strongly Agree." Each of the 24 items asked the participants about why the event being appraised may be important to them (e.g., "the event is important for me because: I was responsible for what happened") or how the participant feels when thinking about the event (e.g., "thinking about the event makes me feel shameful"). Participants answered each item about a randomly selected event, if they first answered "yes" to a question asking if the event was important or significant to them.

Participants completed the AQ following the adverse life events measures. The A-CASI system, used to complete the questionnaires, randomly selected up to 10 events that the participant endorsed (up to five from their childhood and up to five from their adulthood), and then asked participants if each randomly selected event was important or impactful for them. If participants answered "no" to this question they did not receive any of the following 24 items

appraising the event. If a participant did not appraise any events or answered “no” that the event was not important to them for all of the randomly selected events, that participant’s data were excluded from the present study. For each randomly selected event the participants endorsed as important to them, 24 appraisal items were administered. The random selection of events, rather than asking participants to appraise each event was done to avoid possible fatigue and burden for participants who had experienced many adverse events. As such, participants never had to answer appraisal items for more than 10 events. However, having the participants complete the AQ for multiple events they endorse as important to them allows for the measurement of patterns of appraisal, but is not potentially skewed by events that participants may not perceive as stressful or relevant to them.

AQ exploratory factor analysis. An exploratory factor analysis (EFA) was conducted to identify possible latent constructs, given that the AQ was created for the purposes of the larger PAIR project, and that the measures used to develop the AQ all contained subscales or multiple latent constructs. An EFA was completed to use a data-driven approach to latent construct identification, as the items in the AQ were drawn from several other measures, and the latent constructs varied greatly from measure to measure providing no clear structure with which to base predictions or specification for a confirmatory factor analysis (CFA). However, given that the AQ consisted of repeated measures data, in which participants answered the AQ about multiple adverse events ($M= 3.01$ events appraised, $SD= 1.99$), a multilevel EFA (ML-EFA) is recommended (Heck, 1999; Muthen, 1994; Reise et al., 2005). A ML-EFA accounts for item variance at both a within-individual and between-individual level (Dunn et al., 2015; Reise et al., 2005). This multilevel approach is preferable to alternatives such as counting each response as an independent observation, which does not account for the responses nested within-individuals.

Not accounting for this nested data structure would have introduced bias and misleading parameter estimates (Reise et al., 2005).

Further, prior to conducting the ML-EFA, an interclass correlation coefficient (ICC) was calculated for each item, using MPLUS. An ICC quantifies the amount of variation that can be attributed to nesting or clustering; in this case, referring to the clustering or nesting of individuals' multiple responses. Higher ICCs (e.g., closer to one) indicate higher correlations within individuals' responses, suggesting that larger portions of outcome variation can be attributed to between-person differences rather than within-person differences. Conversely, lower ICCs (e.g., closer to zero) indicate lower correlations within individuals' multiple responses, indicating greater within person variability (Hoffman, 2015; Reise et al., 2005). Among the 24 AQ items, ICCs ranged from .451 to .626. This indicates that about 45%- 63% of the outcome variation can be accounted for by between-person mean differences (Hoffman, 2015).

In specifying the ML-EFA model, using MPLUS, a weighted least squares estimator was used, which is most appropriate for ordinal data (Flora & Curran, 2004). An oblique rotation was then used to allow for correlations among items and factors (Kline, 2016), which previous measures of appraisal have found (e.g., TAQ; DePrince et al., 2010). Multiple indicators were used to evaluate the ML-EFA results and the most appropriate factor structure. First a scree-plot, for both the within person and between person factor structure was assessed, in which the number of possible factors and eigenvalues (i.e., variance explained by each factor) were plotted. The scree-plot showed that the slope of the plot began to level out after two factors, for both the within and between factor models, indicating that subsequent number of factors were not contributing significantly to variance explained (Brown, 2006). Additionally, the within and

between models evidenced acceptable fit, by their root mean square error of approximation (RMSEA; .068) and standardized root mean square residual (SRMR; within= .094, between= .10), using criteria outlined by Kline (2010) which suggests that SRMR values $>.10$ and RMSEA values $\geq .10$ indicate poor fit. Model fit, and conceptual/theoretical justification, did not significantly improve with a greater number of factors.

Factor loadings of the rotated model were also examined, along with p-values and the size of the loading. According to Brown (2006), factor loadings greater than .3 are considered robust, and therefore, even if an item's p-value indicated it significantly loaded onto a factor, at an alpha of $< .05$, if the loading was less than .3 it was not considered robust and was not included in further analyses using the appraisal factors. For items that loaded significantly onto both factors, the factor for which the loading was the largest was the factor in which that item was specified in for future analyses. Factor loadings from this EFA are presented in Table 2.

For the purposes of the present study's hypothesis testing, the between-individual factor structure was used to create two different subscales or dimensions of the AQ. The between-individual factor structure was used, as this structure is based on differences between individuals in regard to their average item ratings (Reise et al., 2005), which is consistent with the present study's aim of examining the role of individuals' average appraisal styles across adverse events. This is also consistent with the relatively large, ICC which suggested that about 45%- 63% of the outcome variation was accounted for by between-person mean differences.

These results show two thematically different factors. The first factor consisted of nine items which had significant factor loadings that were .3 or higher and did not have a higher loading on factor two. Items from this factor appear to represent "positive" impact or significance appraisals of events, such as positive impact on life, expected, predictable, and

positive emotions when thinking about the event. Given the negative factor loading for item four (e.g., “The event is important for me because: It had a negative impact on my life”), nine (e.g., “The event is important for me because: I could not stop this event from happening to me”), and 20 (e.g., “Thinking about the event makes me feel sadness/grief), these items were reversed scored for future analyses. The second factor consisted of 11 items which had significant factor loadings that were .3 or higher and did not have a higher loading on factor one. Items from this factor thematically represent “negative” appraisals of events (e.g., feeling like life was threatened, event happening because of the sort of person they are, and feeling shameful when thinking about the event).

Internal consistency of factor structure for average appraisal across events. Among the 161 participants, all of whom appraised at least one event, 152 appraised at least one event from their adulthood ($M= 2.2$ events, $SD= 1.27$), and 76 participants appraised at least one event from their childhood ($M= 1.0$, $SD= 1.22$). To capture styles of appraisal across adverse events, a mean score was created for each item across all appraised events. The internal consistency of these mean item scores was then assessed using the between-individual factor structure from the ML-EFA. For the first factor, positive appraisals, the internal consistency was good ($\alpha= .85$), and for the second factor, negative appraisals, the internal consistency was also good ($\alpha= .83$). As such, for further analyses, a sum score of the averaged items across adverse events was created for the positive appraisals factor, in which higher values were indicative of more positive or adaptive appraisals of adverse events, and a sum score of the averaged items across adverse events was created for the negative appraisals factor, in which higher values were indicative of more negative or less adaptive appraisals of adverse events.

Data Analysis Plan

Outliers and missing data. Prior to conducting any analyses, outliers, or extreme values that may bias results by skewing the mean distribution (Meyers et al., 2013), were examined. To detect any outliers within the data, main study variables were converted into z-scores, with a mean of zero and standard deviation of one, in which absolute values of z-scores greater than three were identified as outliers (Hair et al., 2010; Kline, 2016). This showed one outlier for resting RSA, three outliers for RSA reactivity, one outlier for adulthood adversity exposure, four outliers for childhood adversity exposure, two outliers for self-report DERS, one outlier for negative appraisal, and two outliers for positive appraisal. Each of these extreme scores (the original value not the z-score used for outlier detection) were then converted to the value of the next most extreme score that was not an outlier. This was done to avoid removing these cases, thus potentially having a negative impact on the power of analyses, but also reducing the bias they introduced by shifting the central tendency of values (Kline et al., 2016).

Once outliers were detected and converted, missing data was assessed. All missing data, aside from RSA values were between 0%-1.9% missing. However, 11% of resting RSA values were missing, 18% of RSA reactivity, and 17% of RSA recovery were missing. Among the 11% missing resting RSA, all 11% were also missing RSA recovery, but only 6.8% were missing RSA reactivity. For the 18% missing RSA reactivity, 4.4% were also missing RSA recovery. Missing RSA data was caused by machine error (e.g., the heart rate monitor falling off, files with large number of artifacts that could not be reliably corrected, heart rate monitor failure to record data) or administration error (e.g., heart rate monitor not being set up properly or not being securely attached to the electrodes). Because the missing data from the non-RSA measures was small and considered, by most standards of practice, to be non-impactful to data analyses (Jakobsen et al., 2017), this missing data was not imputed. Multiple imputation, however, was

used to address the missing RSA values. Multiple imputation is a missing data technique in which missing values are calculated multiple times with estimates for the missing values based on the existing data, and then these multiple imputed data values are combined into a final or pooled imputed value (Enders, 2010; Meyers et al., 2013). To assess the mechanism for missingness, t-test showed no significant difference ($p > .05$) between participants' who were missing RSA data and those who were not on variables of interest (e.g., BMI, education level, age, adversity exposure, DERS, and appraisals), providing support that data may be missing completely at random (MCAR) or missing at random (MAR). As such, listwise or pairwise deletion could have been used to handle missingness, but these approaches would have reduced statistical power of the regression models, and as such multiple imputation is the preferred and acceptable means of handling missing data in the present study (Enders, 2010; Lang & Little, 2016). Although there is some debate regarding the use of multiple imputation when only the dependent variable is missing, as in the present study (Jakobsen et al., 2017; Lang & Little, 2016), the bulk of the literature from experts in missing data analysis suggests that multiple imputation of dependent variables is acceptable, especially when there are multiple predictors along with the inclusion of auxiliary variables as predictors in imputation (e.g., Allison, 2002; Enders, 2010; Lang & Little, 2016). Auxiliary variables are those that are not main variables within the predicted models but are associated with missingness (Enders, 2010; Lang & Little, 2016). As such, all demographic variables not predicted to be potential covariates within the larger models (e.g., parents' child's age, gender, and race, number of children in the home, child's health, participants' health, and number of adults living in the home), were examined using t-tests for potential differences among participants missing data from those not missing RSA data. This found a significant difference between those missing RSA data and those not

missing RSA data for age of child participating in the larger study ($t(123)= 2.02, p= .04$), if the participant reported their child had elevated blood pressure ($t(123)= 2.71, p= .01$), if the participant reported their child was ever diagnosed with an emotional or psychological problem ($t(123)= 2.50, p= .01$), and if the participant reported their own elevated blood pressure ($t(95)= 2.35, p= .02$). As such, each of these variables were included in multiple imputation as auxiliary predictor variables along with the main variables of interest in the study (e.g., adversity exposure, DERS, positive appraisal, negative appraisal, adversity exposure appraisal interactions, participants' age, participants' BMI, and participants' level of education) to strengthen the accuracy of the imputation process. Fifty imputations were conducted and pooled results across the imputations were used for correlation and regression analyses.

Descriptive statistics. Before testing the present study's hypotheses, means and standard deviations were computed. Using bivariate correlations, participants' age, education level, and BMI were assessed to determine their possible association with the other study variables (e.g., frequency of adult and childhood adversity and RSA values). When examining these correlations, r values of .10 were interpreted as small correlations, r values of .30 were interpreted as medium correlations, and r values of .50 or more were interpreted as large correlations (Cohen, 1988). Any of the three potential control variables (e.g., BMI, education level, and age) that were significantly correlated with a primary study variable (e.g., RSA, adversity exposure, self-report difficulties with emotion regulation, and appraisal) were included in the relevant analysis for hypothesis testing.

Hypothesis testing. To test the hypotheses of the present study, four hierarchical linear regression analyses were used, one for each dependent variable (e.g., DERS, resting RSA, RSA reactivity, and RSA recovery). Prior to testing regression analyses, childhood and adulthood

adversity, appraisal, and control variables were mean centered, following recommendations from Meyers and colleagues (2013), to aide in the interpretation of results by having all variables have a meaningful zero value. These analyses allowed for the examination of main effects of childhood and adulthood adversity and positive and negative appraisals, in step one of each regression. In step two, these analyses allowed for the examination of the interaction terms created for childhood adversity x positive appraisal, for adulthood adversity x positive appraisal, for childhood adversity x negative appraisal and for adulthood adversity x negative appraisal. If significant interactions were found, an examination at low (-1 *SD*) and high (+1 *SD*) ends of the moderator were used to further understand the direction of results (Aiken & West, 1991).

Power analysis. A power analysis using G*Power 3.1.9.2 (Faul et al., 2009) was conducted. In G*Power, an a priori test of a linear multiple regression including all three control variables (e.g., participants' age, education level, and BMI) and main study variables (e.g., childhood adversity, adult adversity, positive appraisals, negative appraisals, childhood adversity x positive appraisals adulthood adversity x positive appraisals, childhood adversity x negative appraisals, and adulthood adversity x negative appraisals) was conducted. This power analysis indicated that a sample size of at least 118 is required to detect a medium effect size ($f^2=.15$) at a power of .80. A medium effect size was chosen based on prior results finding a medium effect size for the association between adversity exposure and self-report emotion regulation difficulties ($r= .37$; Barlow et al., 2017).

A post-hoc power analysis was also performed using G*Power 3.1.9.2 (Faul et al., 2009). For the model examining associations with DERS scores and resting RSA with imputed data, including nine predictors, with a sample size of 161, the power to detect a medium effect size ($f^2=.15$) was .99, and the power to detect a small effect size ($f^2=.02$) was .43. For RSA reactivity

and recovery, using eight predictors, with a sample size of 161, the power to detect a medium effect size ($f^2=.15$) was .99 and the power to detect a small effect size ($f^2=.02$) was .43.

Further, power analyses were conducted for the non-imputed sample sizes to determine the impact to power if relying on pairwise deletion for missing RSA data. For resting RSA, with a sample size of 142, the power to detect a medium effect size ($f^2=.15$) was .99 and the power to detect a small effect size ($f^2=.02$) was .38. For RSA reactivity, with non-imputed data, with a sample size of 131, the power to detect a medium effect size ($f^2=.15$) was .99 and the power to detect a small effect size ($f^2=.02$) was .36. For RSA recovery, with non-imputed data, with a sample size of 132, the power to detect a medium effect size ($f^2=.15$) was .99 and the power to detect a small effect size ($f^2=.02$) was .36. These results suggest sufficient power to detect medium effect sizes, among both imputed models and models using pairwise deletion. However, these power analyses indicate that models with imputed data have a greater probability of correctly rejecting the null hypothesis when effects are small, compared to non-imputed data. This further supports the present study's use of multiple imputation for handling missing RSA values.

Results

Descriptive Statistics

First, means, standard deviations, and correlations among all study variables were examined. Concerning participants' adversity history, participants reported an average of 9.92 ($SD= 6.05$) adverse events from their adulthood, and participants average number of years into adulthood (i.e., years since 18-years old) was 12.48 years ($SD= 6.12$). Participants also reported an average of 8.52 ($SD= 7.45$) events from their childhood (i.e., across their first 17 years of life). Adversity exposure (i.e., the sum frequency of events divided by number of endorsed

adverse events) ranged from 0-3.50 for adulthood adversities, from 0-4.10 for childhood adversities, and from 1-3.75 for total adversities across the lifespan. Table 3, displays means, standard deviations, and correlation statistics.

In examining correlations, adulthood adversity exposure was significantly positively correlated with negative appraisals of adverse experiences. This indicates an association between greater adulthood adversity exposure and more negative appraisal styles for adverse events. No significant correlations were found between childhood adversity exposure and other study variables. Regarding the four indicators of difficulties with emotion regulation, participants' self-reported difficulties were negatively correlated with positive appraisals of adversity and participants' education level and positively correlated with negative appraisals. This indicates an association between more difficulties in emotion regulation and less positive adversity appraisals, more negative adversity appraisals, and lower education level. For participants' resting RSA, higher resting RSA was correlated with higher RSA reactivity and younger participant age. Lastly, higher RSA reactivity was correlated with higher RSA recovery and more negative adversity appraisals.

Based on the correlation results, for the regression model predicting the DERS scores, participants' education level was included as a covariate, and for the model predicting resting RSA, participants' age was included as a covariate, along with the primary variables of interest (e.g., adversity exposure and appraisals).

Hierarchical Linear Regression Analyses

Self-report difficulties with emotion regulation. Results of the hierarchical regression for the DERS, self-report difficulties with emotion regulation are shown in Table 4. Direct effects of adulthood adversity, childhood adversity, positive appraisal, negative appraisal, and

participants' education level were examined in step one for the hierarchical regression analysis. In this step, positive appraisal of adversity ($b = -.48, p = .04$), negative appraisal of adversity ($b = .94, p = .00$) and participants' education level ($b = -2.50, p = .03$) were significantly associated with difficulties with emotion regulation. Step two of the hierarchical regression analysis added interaction effects for adulthood adversity and positive and negative appraisal and for childhood adversity and positive and negative appraisal. These interaction effects were not significantly associated with self-report difficulties with emotion regulation; however, positive appraisal ($b = -.49, p = .04$), negative appraisal ($b = .96, p = .00$), and participants' education level ($b = -2.45, p = .04$) remained significantly associated with difficulties with emotion regulation when accounting for interaction effects. This indicates significant associations between less positive adversity appraisals and greater emotion regulation difficulties, more negative adversity appraisals and greater difficulties with emotion regulation, and lower education level and greater difficulties with emotion regulation.

Resting RSA. Results of the hierarchical regression analysis for resting RSA are shown in Table 5. In step one of the regression model, examining direct effects of adulthood adversity, childhood adversity, positive appraisal, negative appraisal, and participants' age on resting RSA, only participants' age was significantly associated with resting RSA ($b = -.09, p = .00$). In step two, adding the interaction effects of adulthood adversity and positive and negative appraisal and childhood adversity and positive and negative appraisal, again participants' age was significantly associated with resting RSA ($b = -.10, p = .00$). This effect indicates that higher resting RSA was associated with younger participant age. Also, in step two, there was a significant interaction between childhood adversity and negative appraisals in resting RSA ($b = -.05, p = .04$). The pattern of the interaction when examining the moderated effect at 1 *SD* above and below the

mean for childhood adversity and negative appraisals, is shown in Figure 4. This pattern of results shows that those with lower childhood adversity exposure had lower resting RSA when appraisal styles were less negative, but those with higher childhood adversity exposure had lower resting RSA when appraisal styles were more negative.

The same pattern of results was seen for the regression model using non-imputed data, with pairwise deletion, as shown in Appendix A, Supplementary Table 1.

RSA reactivity. The results of the hierarchical regression analysis for RSA reactivity are shown in Table 6. Negative appraisal was significantly positively associated with reactivity in step one ($b = .02, p = .04$) and step two ($b = .03, p = .03$). No other significant direct or interaction effects were found.

Results for the regression model using non-imputed data, with pairwise deletion, are shown in Appendix A, Supplementary Table 2.

RSA recovery. The results of the hierarchical regression analysis for RSA recovery are shown in Table 7. In step one, examining the direct effects of adulthood adversity, childhood adversity, positive appraisal, and negative appraisal, there were no significant effects. In step two there was a significant interaction of childhood adversity and negative appraisal in RSA recovery ($b = .02, p = .03$). The results of probing this interaction at high and low values of the moderator (i.e., $+1 SD$ and $-1 SD$), are shown in Figure 5. These results indicated that those with lower doses of childhood adversity had lower RSA recovery when appraisal styles were more negative, but those with high doses of childhood adversity had lower RSA recovery when appraisals were less negative.

Results for the regression model using non-imputed data, with pairwise deletion, are shown in Appendix A, Supplementary Table 3.

Post-Hoc Exploratory Analyses

Given the unexpected non-significant correlation and direct effects of adversity exposure on emotion regulation difficulties, multiple post-hoc analyses, using imputed data, were run to determine if this non-significance could be due to how adversity exposure was quantified in the present study. First, the correlations between lifetime adversity exposure dose (i.e., sum frequency of adverse events across the lifespan divided by the number of events endorsed) and emotion regulation variables were examined. Lifetime adversity exposure dose was not significantly associated with self-report emotion regulation difficulties ($r = .14, p = .08$), resting RSA ($r = -.02, p = .84$), RSA reactivity ($r = .09, p = .33$), or RSA recovery ($r = .00, p = .97$).

Second, correlations were examined for the sum frequency score, across events, rather than the average frequency score. The sum frequency for adulthood events was not significantly associated with self-report emotion regulation difficulties ($r = .13, p = .10$), resting RSA ($r = -.08, p = .34$), RSA reactivity ($r = .12, p = .17$), or RSA recovery ($r = .03, p = .74$). Similarly, the sum frequency of childhood events was not significantly associated with self-report emotion regulation difficulties ($r = .10, p = .19$), resting RSA ($r = -.07, p = .43$), RSA reactivity ($r = .10, p = .19$), or RSA recovery ($r = -.05, p = .62$). Lastly, the same pattern was seen for the sum frequency of all adverse events across the lifespan, with no significant correlations with self-report emotion regulation difficulties ($r = .13, p = .10$), resting RSA ($r = -.08, p = .34$), RSA reactivity ($r = .12, p = .18$), or RSA recovery ($r = -.01, p = .88$).

Third, the association between the number of adverse events endorsed and emotion regulation difficulties were examined. The association between self-report difficulties with emotion regulation and the number of adulthood adverse events ($r = .10, p = .22$), childhood adverse events ($r = .11, p = .18$), and lifetime adverse events ($r = .11, p = .16$) were all non-

significant. Correlations between the total number of adverse lifetime events and resting RSA ($r = -.08, p = .35$), RSA reactivity ($r = .12, p = .18$), and RSA recovery ($r = .00, p = .98$) were not significant. Similarly, correlations between the number of childhood adverse events and resting RSA ($r = -.06, p = .47$), RSA reactivity ($r = .08, p = .35$), and RSA recovery ($r = -.02, p = .85$) were also not significant. Also, correlations between number of adulthood adverse events and resting RSA ($r = -.08, p = .32$), RSA reactivity ($r = .13, p = .12$), and RSA recovery ($r = .02, p = .79$) were not significant.

Fourth, post hoc analyses were done to determine if there were differences in difficulties with emotion regulation based on high versus low levels of adversity exposure (captured by creating a grouping variable, in which those with adversity exposure scores at or above one *SD* from the mean were grouped into the high adversity exposure group and those with adversity exposure scores at or below one *SD* from the mean were grouped into the low adversity exposure group). For childhood adversity, there was no significant difference between those in the high exposure group and those in the low exposure group in self-report difficulties with emotion regulation ($t(39) = .40, p = .70$), resting RSA ($t(39) = -.78, p = .43$), RSA reactivity ($t(39) = -.44, p = .66$), or RSA recovery ($t(39) = -.51, p = .61$). The same pattern was seen for adulthood adversity, in which there was no significant difference between those in the high exposure group and those in the low exposure group in self-report difficulties with emotion regulation ($t(47) = 1.67, p = .10$), resting RSA ($t(47) = -.41, p = .68$), RSA reactivity ($t(47) = .92, p = .36$), or RSA recovery ($t(47) = .27, p = .79$). For lifetime adversity there was also no significant difference between those in the high exposure group and those in the low exposure group in self-report difficulties with emotion regulation ($t(49) = 1.58, p = .11$), resting RSA ($t(49) = .06, p = .95$), RSA reactivity ($t(49) = .81, p = .42$), or RSA recovery ($t(49) = .27, p = .79$).

Fifth, post-hoc correlation analyses were examined for the dose of childhood maltreatment exposure (i.e., sum frequency of maltreatment experiences divided by the number of maltreatment events endorsed) and measures of difficulties with emotion regulation. However, these post-hoc analyses found that there was also no correlation between childhood maltreatment and self-report difficulties with emotion regulation ($r = .07, p = .57$), resting RSA ($r = -.08, p = .54$), RSA reactivity ($r = .10, p = .45$), or RSA recovery ($r = -.16, p = .23$).

Sixth, correlations were examined for the dose (i.e., sum frequency divided by the number of events) of adulthood interpersonal adversity (e.g., sexual assault, intimate partner violence, and physical assault) and difficulties with emotion regulation. There was a significant correlation between greater dose of interpersonal adulthood adversity and greater self-report difficulties with emotion regulation ($r = .22, p = .02$). However, adulthood interpersonal adversity was not associated with resting RSA ($r = -.03, p = .80$), RSA reactivity ($r = -.01, p = .90$), or RSA recovery ($r = .03, p = .77$).

Discussion

The present study examined the relation between childhood versus adulthood adversity exposure and self-report as well as physiological indicators of emotion regulation difficulties, to better understand how adversity exposure at different time points in one's life, effects multiple processes of adults' emotion regulation. Further, given the variability in reported effect sizes in past research on the relation between adversity exposure and emotion regulation difficulties, the present study examined appraisal styles as a potential moderating factor helping to account for this variability. Illuminating factors contributing to emotion regulation difficulties is important given the psychological and behavioral manifestations of adults' emotion regulation difficulties (e.g., depressive symptoms [Abravanel & Sinha, 2015], post-traumatic stress symptoms

[Messman-Moore & Bhuptani, 2017], aggression, and impulsivity [Gross & Jazaieri, 2014]), as well as the critical role of emotion regulation in a parent's ability to provide a stable and positive environment for their child (e.g., Crandall et al., 2015; Rodriguez et al., 2017).

However, to inform research and interventions on parents' emotion regulation, more information is needed on what factors are associated with multiple processes of emotion regulation difficulties, and the present results provide several important findings. First, in comparing results to those of previous studies, it is evident that the relation between adversity exposure and different indicators of emotion regulation difficulties vary from sample to sample and may be dependent on sample demographics and type or timing of adversity experienced. Second, the present results suggest that adulthood adversity exposure is associated with current cognitive processes in the form of more negative appraisal styles across events. Third, results extend existing literature on appraisals of adverse events by demonstrating that appraisal styles, across multiple events, rather than appraisals of one singular event, are important factors in understanding individuals' difficulties with emotion regulation. Fourth, results show that the combination of current negative appraisal styles and childhood adversity is associated with physiological processes of regulation. Fifth, control variables such as education level and age emerged as important, yet seldomly examined, factors for self-report difficulties with emotion regulation and resting RSA, respectively. Each one of these conclusions is discussed in turn below.

Adversity Exposure and Emotion Regulation Difficulties

The present study's first hypotheses (H1.1-H1.4) were that childhood and adulthood adversity exposure would be associated with self-report and all three measures of physiological emotion regulation difficulties (e.g., lower resting RSA, higher RSA reactivity, and lower RSA

recovery). Contrary to prior research (e.g., Cyranowski et al., 2011; Daches et al., 2017; Poole et al., 2017), these hypotheses were not supported. Surprisingly, in both correlation and regression analyses there were no direct associations between childhood or adulthood adversity exposure and self-report difficulties with emotion regulation, resting RSA, RSA reactivity, or RSA recovery.

Taking a close look at prior studies that supported the association between adversity and emotion regulation difficulties (e.g., Barlow et al., 2017; Dale et al., 2018; Stevens et al., 2013) there are several methodological differences that may help explain the discrepancy between prior results and results of the present study. One, several prior studies utilized samples of college students, or primarily White, middle to upper income samples (Abravenel & Sinha, 2015; Barlow et al., 2017, Dale et al., 2018; Deater-Deckard et al., 2016; Espeleta et al., 2018; Oshri et al., 2015, Poole et al., 2017). This difference in sample demographics could have an impact on results in multiple ways. For example, the present study's sample of primarily African American, lower income adults reported greater average adversity exposure than samples of primarily White, higher income adults (e.g., Barlow et al., 2017; Espeleta et al., 2018), and as such perhaps the association between adversity and emotion regulation is more evident in samples with a lower average rate of exposure, where adversity exposure is less expected or common, or where there is greater variability among participants' level of exposure.

Additionally, it is very important to note that the present study was the first to examine resting RSA, RSA reactivity, and RSA recovery among an adult sample of primarily African American women exposed to high levels of adversity. An example of how this may impact results can be seen in comparing the present study to that of Dale and colleagues (2018) who found that childhood maltreatment was associated with lower resting RSA. Dale and colleagues

(2018) utilized a small sample of college women and split them into groups based on maltreatment history. Those who did not have a maltreatment history had a significantly higher resting RSA ($M= 7.80$, $SD= .90$) than those who had experienced maltreatment ($M= 7.28$, $SD= .98$). Conversely, in the present study's sample, who were generally exposed to large amounts of adversity, the resting RSA value was lower with greater variability ($M= 6.23$, $SD= 1.46$) than that of Dale and colleagues' (2018) sample who had experienced maltreatment. This demonstrates that the average resting RSA value for the present sample was lower, indicative of greater physiological regulation difficulties, than prior research utilizing college student samples who experienced maltreatment (Dale et al., 2018). However, the post-hoc analyses of the present study showed that there were no significant differences in indicators of emotion regulation difficulties between those at the high versus low end of the overall sample's adversity exposure. Taken together, this suggests that the relation between adversity exposure and multiple processes of emotion regulation may be more evident in samples with lower, less chronic, adversity exposure, or in comparing those who have not experienced adversity to those that have, rather than with a sample such as that used in the present study where all individuals have experienced adversity and on average endorsed high levels of exposure.

In addition to sample demographic differences, prior research finding a significant association between adversity and emotion regulation difficulties also quantified adversity exposure differently than the present study (e.g., Barlow et al., 2017; Bradley et al., 2011; Daches et al., 2017; Oshri et al., 2015). Adversity exposure is a complex construct to measure and has been quantified in numerous different ways (e.g., differences in types and timing of adversities assessed and quantifying in terms of number of events endorsed versus frequency of endorsed events) leaving no standard guidelines as to best capture exposure to adversity (Grant et

al., 2004). As such, post-hoc analyses were conducted to determine the impact of this difference on associations with self-report and physiological difficulties with emotion regulation, examining lifetime exposure, sum frequency across events, number of events, and childhood maltreatment and adult interpersonal adversities. Among, these post-hoc analyses, only adulthood interpersonal adversity exposure was associated with self-report difficulties with emotion regulation. These results and comparisons with prior research, suggests that the association between adversity and emotion regulation difficulties may be dependent, not only on the sample demographics, but also on the type and timing of adversity assessed.

Furthermore, although results were discrepant with some prior research, it is important to note that some studies only found a small effect size for the relation between adversity and difficulties with emotion regulation (e.g., $r = .17$, Abravenel & Sinha, 2015; $r = .15$; Espeleta et al., 2018); thus, further suggesting that the association between adversity and emotion regulation difficulties is not consistently strong or clearly evidenced across studies. Also, the results were consistent with some RSA research. For example, Daches and colleagues (2017) found a non-significant correlation between childhood adversity and lower resting RSA, and Dale and colleagues (2018) found no relation between adversities such as child maltreatment and RSA reactivity and recovery. In sum, the present study results highlight variability in the association between adversity and emotion regulation difficulties, which may be partially explained by sample difference and adversity type and timing.

Childhood Versus Adulthood Adversity Exposure

The second series of hypotheses (H2.1-H2.4) was that childhood adversity would account for greater variance in all emotion regulation processes than would adulthood adversities. These hypotheses stemmed from the large amounts of both self-report (e.g., Barlow et al., 2017; Oshri

et al., 2015; Stevens et al., 2013) and physiological literature (e.g., Dale et al., 2018; Daches et al., 2017) that focused on childhood adversities such as childhood maltreatment. However, neither childhood nor adulthood adversities had a direct effect on any indicators of emotion regulation difficulties. Again, this may be due to the present sample's high levels of both childhood and adulthood adversity. In fact, the current sample reported a similar average number of adverse events and average frequency of events in their childhood ($M= 8.52$ events; $M= 1.86$ frequency) and in their adulthood ($M=9.92$ events; $M= 2.14$ frequency) suggesting chronic lifetime exposure. Perhaps the timing is more significant for individuals with more isolated exposure to adverse events, rather than more chronic lifetime exposure as was common in the present sample. Nonetheless, it is important to note, that post-hoc correlations did reveal a significant association between adulthood interpersonal adversity and self-report difficulties with emotion regulation. This is consistent with literature showing a significant association between the experience of intimate partner violence and self-report emotion regulation difficulties among adults (Weiss et al., 2018).

Furthermore, correlations did reveal that the dose of adulthood adversity but not childhood adversity was associated with more negative appraisals of adverse events. Although across participants, more adulthood events were appraised than childhood events, this effect was not found for positive appraisal styles. These results suggest that individuals with frequent adversities in their adulthood are more likely to interpret their experiences negatively (e.g., report stronger self-blame, and negative emotionality) than those with less frequency adulthood adversity. Therefore, in attempting to understand current cognitive appraisal styles, which are often targeted in evidence-based interventions (e.g., Cognitive Behavioral Therapy, Beck, 2011;

Cognitive Processing Therapy; Resick et al., 2016), adulthood adverse experiences may be more impactful in understanding negative appraisal styles, than childhood adversity.

Since the publication of the Adverse Childhood Experiences (ACE) study, which found that the experience of multiple adverse childhood events is associated with an increased risk for multiple psychological and physical health problems (Felitti et al., 1998), more attention has been given to the influence of childhood adversity on adults' well-being and current functioning (e.g., Dube, 2018). However, results of the present study show the importance of adulthood adverse experiences in adults' current negative appraisal styles, which may be a mechanistic factor underlying psychological distress (e.g., Srinivas et al., 2015). As such, within mental health, current results demonstrate the importance of not excluding adults' more recent adverse experiences in screening for adversity exposure.

Adversity Appraisals

The final series of hypotheses (H3.1-H3.4) predicted that appraisal styles across adverse life events would moderate a relation between adversity exposure and processes of emotion regulation difficulties. These hypotheses were not fully supported, though direct and interaction effects were found for adversity appraisals and indicators of emotion regulation difficulties.

Adversity appraisals and self-report emotion regulation difficulties. Negative and positive adversity appraisals had a direct effect on self-report emotion regulation difficulties. That is, those who had more negative appraisal styles across adverse life events also reported greater difficulties with emotion regulation, but those with more positive appraisal styles reported fewer emotion regulation difficulties. This result is consistent with prior literature which has examined appraisals of one adverse life event and found an association between more negative appraisals (e.g., self-blame and strong negative emotionality such as anger) and

reported emotion regulation difficulties (Barlow et al., 2017). Theoretically, this result is also consistent with Gross and Thompson's (2007) model of emotion regulation processes whereby cognitive appraisals influence one's emotional expression and ability to modulate emotions. However, the present results extend existing literature by demonstrating that appraisal styles, across adverse events, rather than appraisals of one isolated event, are also impactful to one's reported emotion regulation difficulties. Results also provide initial steps towards supporting the concurrent validity of the appraisal measure created for the larger study, by demonstrating its association with the DERS, which other appraisal measures such as the Trauma Appraisal Measure (DePrince et al., 2010) have been correlated with in previous research (Barlow et al., 2017).

Correlation and regression analyses also showed an association and direct effect of more positive appraisals of adverse experiences (e.g., positive impact, predictability/expected, and positive emotions) and less self-reported difficulties with emotion regulation. This extends the bulk of prior literature which has focused solely on negative or less adaptive adversity appraisals such as (e.g., self-blame, alienation, shame, and fear) in relation to emotion regulation (e.g., Barlow et al., 2017; Srinivas et al., 2015). In combination with prior results, the present findings highlight the importance of assessing for appraisal styles, both positive and negative, when examining individual differences in self-reported emotion regulation difficulties.

Negative adversity appraisals in RSA. The only direct effect found between appraisal styles and RSA indicators of emotion regulation, was a positive association between negative appraisal styles and RSA reactivity, such that more negative appraisal styles were associated with greater RSA reactivity. This result is consistent with prior literature showing that appraisals of a stressor task are associated with greater self-reported emotional reactivity to the task (Wells

et al., 2016). However, the present result extends prior literature in multiple ways. One, the present result showed an association between negative appraisals and physiological reactivity, not just self-reported emotion reactivity. Two the results demonstrate that negative appraisal styles of adverse events are associated with physiological reactivity to stressors unrelated to the adverse events.

However, it is important to note that for RSA reactivity, or one's physiological ability to respond to stress as evidenced by vagal brake withdrawal, there has been little consistency across prior literature, with some suggesting that higher RSA reactivity is indicative of greater physiological difficulties (Cyranowski et al., 2011) and others suggesting that those with regulation difficulties have blunted reactivities (Daches et al., 2017). For the present study, the range of reactivity was from -1.72- 1.87, which suggests that some individuals' RSA reactivity was higher during the stressor task than during the resting period. This is indicative of the vagal break being more withdrawn during the resting period than during the stressor, which could be indicative of an individual not physiologically adapting to stress. As such, it may be the case that scores on both the high and low end of the RSA reactivity range may both be representative of difficulties with emotion regulation. Thus, while the present study hypothesized that greater reactivity would be indicative of emotion regulation difficulties, the fact that greater reactivity was not significantly associated with more established indicators of emotion regulation difficulties, such as self-reported difficulties, and that many individuals had negative reactivity scores, there remains ambiguity about what greater versus lower RSA reactivity values truly indicate.

Interaction between childhood adversity and negative appraisals. Although there were no significant direct effects of adversity exposure or appraisals for resting RSA and RSA

recovery, a significant interaction between childhood adversity and negative adversity appraisals was identified for both resting RSA and RSA recovery.

In support of hypothesis 3.2, there was a significant interaction indicating that those with higher childhood adversity exposure had lower resting RSA when appraisal styles were more negative. Lower resting RSA values are indicative of greater physiological regulation difficulties, so the present results suggest that more difficulties maintaining physiological homeostasis is seen when childhood adversity exposure *and* negative appraisals are high. This result was consistent with prior literature showing a negative association between negative appraisals and self-report emotion regulation difficulties among those that had experienced childhood maltreatment (Barlow et al., 2017). However, the pattern of results also showed that those with lower childhood adversity exposure had lower resting RSA (e.g., greater emotion regulation difficulties) when appraisal styles were less negative. These results suggest that adults' negative appraisal styles are related to greater emotion regulation difficulties, only when the adults have also experienced more childhood adversity. Conversely, negative appraisal styles when adults have experienced a lower dose of childhood adversity, was associated with a better ability to maintain physiological homeostasis. This was an unexpected result and is inconsistent with literature connecting negative appraisals and greater self-report emotion regulation difficulties (e.g. Barlow et al., 2017). However, the present study was the first to examine the relation between appraisal styles and resting RSA, and these results suggest that negative appraisal styles may contribute to better physiological regulation if the exposure to childhood adversity is low.

For RSA recovery, a significant interaction between childhood adversity and negative appraisals was also found. RSA recovery is a measure of the vagal break being applied following

a stressor, or one's ability to return to homeostasis (Porges, 2007). The present study predicted that lower RSA recovery values would indicate greater difficulties with emotion regulation, as this indicates less physiological difference between one's state during a stressor and while at rest following the stressor. Further, negative RSA recovery values indicate that the individuals' RSA reactivity during a stressor was higher than their RSA during the recovery period, which suggests that the individuals' vagal break is more withdrawn during a recovery period than a stressor period. However, contrary to the hypothesis (H3.4), the pattern of this interaction showed that when the dose of childhood adversity was high, less negative appraisals were associated with lower RSA recovery values (greater regulation difficulties), but when the dose of childhood adversity was low, more negative appraisals were associated with lower RSA recovery values (greater regulation difficulties). Thus, those who had less childhood adversity had greater difficulties physiologically returning to homeostasis, following stress, when they had a more negative appraisal style. This result also suggests that negative appraisal styles in combination with high doses of childhood adversity, may be helpful in the physiological recovery from a stressor. Although this result was conflicting with the hypothesis, very little previous research has examined RSA recovery and that which has, has utilized child samples outside of the context of adversity exposure (e.g., Santucci et al., 2008). As such, this is the first study to assess for patterns in RSA recovery among adults exposed to chronic adversity.

In summary, these two significant interactions point to different patterns among processes of emotion regulation. Specifically, these results indicate that those with less childhood adversity exposure and more negative appraisal styles are able to maintain homeostasis (i.e., have the vagal break applied while at rest) but have difficulties recovering from a stressor (i.e., applying the vagal break following stress). On the contrary, those with greater childhood adversity

exposure and more negative appraisal styles have difficulties maintaining physiological homeostasis at rest (i.e., having the vagal break withdrawn when at rest, such that their bodies are physiologically preparing to respond to stress even when no stressor is present) but are able to recover from a stressor (i.e., apply the vagal break).

These results highlight and support prior literature showing that physiological emotion regulation is dynamic and made up of distinct processes (e.g., Porges 2007, Laborde et al., 2018). Further, present results extend existing literature suggesting that only examining one process or part of emotion regulation is not fully capturing the internal regulatory process (Calkins et al., 2007). However, it remains unclear which patterns among the internal processes of resting RSA, RSA reactivity, and RSA recovery are most adaptive and which patterns across all three processes are most indicative of emotion regulation difficulties. Nonetheless, the present results are very informative in terms of demonstrating that it may not be the experience of early childhood adversity, but more so the combination of childhood adversity exposure and current negative appraisal styles that influence adult's physiological regulation.

Age and Education Level

Of the examined possible control variables (e.g., BMI, age, and education level), participants' age and education level emerged as significant variables associated with different emotion regulation processes. These results are important as they identify additional risk factors for difficulties with self-report and physiological regulation among adults with adversity exposure.

Education level was included in the present study as a covariate, out of concern that the laboratory arithmetic stressor task may be more stressful for individuals with lower levels of education. An association was not found between education level and RSA reactivity to the

stressor. Interestingly, education level was negatively associated with self-reported difficulties with emotion regulation, such that those who reported greater emotion regulation difficulties also reported having a lower level of completed education than those with less emotion regulation difficulties. This result aligns with literature indicating that adults' level of completed education is related to their emotion regulation strategies, as those with lower levels of education are more likely to use less adaptive strategies such as confrontation or temporary distraction (Vitulic & Prosen, 2015). Education level is seldomly considered as a covariate for emotion regulation difficulties. As such, the present results point to the importance of this factor in self-reported difficulties with emotion regulation, and thus the need for more research to include education level, which may help account for variability in emotion regulation difficulties.

Regarding participants' age, this was originally examined as a covariate out of concern that older participants may report higher doses of adulthood trauma exposure, but this relation was not found. Instead, lower resting RSA values, indicative of physiological emotion regulation difficulties were associated with older participants' ages. This result is consistent with prior research finding that resting RSA declines, on average, as individuals age (Campbell et al., 2019; Masi et al., 2007). However, many studies examining trauma or adversity exposures and RSA have not controlled for participants' age, rather relying on restricting age to college-aged adults (e.g., Dale et al., 2018) or individuals over 18 (e.g., Deater-Deckard et al., 2016). As such, the present results demonstrate the role of age, in understanding variations across individuals' baseline or resting physiological regulation. Further examining age and resting RSA is particularly important among research with samples exposed to adversity, even when utilizing samples with relatively small age ranges, given that this has not consistently been examined in prior literature.

Limitations

The present study is novel in many ways and results extend existing literature, but the study is not without limitations. First, although careful consideration went into the selection of each measurement tool, the measurements used in the present study do have some need for caution. The tools used to capture childhood and adulthood adversity are more comprehensive, in terms of the range of adverse events assessed, than tools used by prior studies. However, because the tools were created for the purposes of the larger PAIR project, the results cannot be directly compared to results of prior studies using different measurements for adversity exposure, such as the ACE questionnaire (e.g., Poole et al., 2017) or the Child Abuse and Trauma Scale (e.g., Oshri et al., 2015). Similarly, the appraisal measurement was also created for the larger project and the present study was the first examination of its factor structure and psychometric properties, which is a limitation to the generalizability of the present study's appraisal results. As such, future research should continue to examine the reliability, validity, and factor structure found in the present study, with different samples.

Second, in addition to limitations of measurement tools, there are limitations of using laboratory tasks for RSA indicators of physiological regulation. Specifically, all measures of RSA regulatory processes were captured while participants were in a non-natural setting (e.g., asked to do math problems with a research assistant watching and a car horn noise in the background). Although this process is consistent with existing literature examining RSA as an indicator of physiological emotion regulation (e.g., Dale et al., 2018; Deater-Deckard et al., 2016), the resting, reactivity, and recovery heart rate data may not represent participants' physiological regulatory processes in their lived environments, thus limiting the external validity of the present findings.

Third, the study was cross-sectional in nature, which does not allow for causal interpretations of results and can only provide insight into associations between study variables.

Conclusions and Future Directions

The present study addressed gaps among existing literature by providing the most comprehensive assessment, to-date, of self-report and physiological emotion regulation difficulties among adults exposed to adversity. Emotion regulation is a construct that many researchers point to as an underlying mechanism for behavioral and psychological difficulties (e.g., Abravanel & Sinha, 2015; Gross & Jazaieri, 2014; Poole et al., 2017); however, as demonstrated by the present study, emotion regulation is complex, dynamic, and has multiple dimensions (e.g., conscious, self-reportable aspects, as well as multiple physiological processes).

In attempts to better understand factors contributing to difficulties with emotion regulation, the present study adds to existing literature by showing that appraisal styles and education level are important in self-reported difficulties with emotion regulation. However, regarding physiological processes of emotion regulation, present results do point to the specificity of childhood adversity in impacting internal and more automatic regulatory processes, compared to adulthood adversity, but only in conjunction with negative appraisal styles across events. Nonetheless, questions regarding the true implications or meaning of different patterns across RSA values remain unclear.

Thus, results point to multiple future directions. First, future research is needed to understand emotion and behavioral associations between RSA reactivity and recovery values and between different patterns across resting RSA, RSA reactivity, and RSA recovery, to inform the meaning of these values and if high versus low values are more indicative of greater regulation difficulties. For example, more research, similar to that of self-report difficulties with emotion

regulation, linking high versus low values of RSA reactivity and recovery to psychological and behavioral manifestations of emotion regulation difficulties will inform the construct validity of RSA reactivity and recovery scores. Similarly, examining the pattern of high versus low scores across resting RSA, RSA reactivity, and RSA recovery, and which pattern is most associated with behavioral and psychological manifestations would help inform which pattern of physiological regulation is most indicative of emotion regulation difficulties. Further, the present study found that physiological processes were not associated with self-reported emotion regulation difficulties, and thus further examinations of behavioral or psychological constructs that RSA values are associated with is needed to truly understand the meaning and implications of RSA values.

Secondly, a question remaining after the present study is what factors, specifically, contribute to a significant versus non-significant association between adversity exposure and emotion regulation difficulties. Present results suggest sample demographics and adversity type may play a role, and this is an area apt for future research to explore.

Third, the present study examined appraisal styles across adverse events, but excluded participants who experienced adversity but did not appraise any adverse events (e.g., stated that none of the randomly selected adverse events were important or impactful for them). Future research is needed to examine if those reporting that no events were important or impactful to them show differences in their emotion regulation compared to those who reported multiple events were impactful to them. This would help further knowledge into different cognitive processes or styles that may be implicated in emotion regulation. Additionally, results suggested that when exposure to childhood adversity was low, more negative appraisal styles were related to better physiological ability to maintain homeostasis, than when appraisal styles were less

negative. Thus, future research should examine if there are circumstances when negative appraisals would be physiologically adaptive and if this would be associated with positive mental health outcomes.

Additionally, education level was found to be an important contributing factor to self-report emotion regulation difficulties. This opens steps for future research to examine mechanisms by which higher completed education levels are associated with less reported emotion regulation difficulties. For example, future studies should examine mechanisms for the relation such as income, housing stability, emotional insight/knowledge, and emotion regulation strategies, which could be targeted in interventions or social programs aimed at promoting emotion regulation.

In sum, the present study is novel in many ways and helps to extend existing literature. Results demonstrate complexity in any potential relation between adversity exposure and emotion regulation difficulties. Further, support was found for the influence of appraisals on self-reported difficulties with emotion regulation and physiological reactivity. However, it was the interaction among childhood adversity and negative appraisals that was shown to influence resting RSA and RSA recovery. Notably, the results highlight that physiological emotion regulation is dynamic and examining only one part of this process is likely oversimplifying internal emotion regulation. Therefore, results not only extend prior literature but also raise new questions and areas for future empirical work to address.

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Figure 1

Emotion regulation model as depicted in Gross & Thompson (2007)

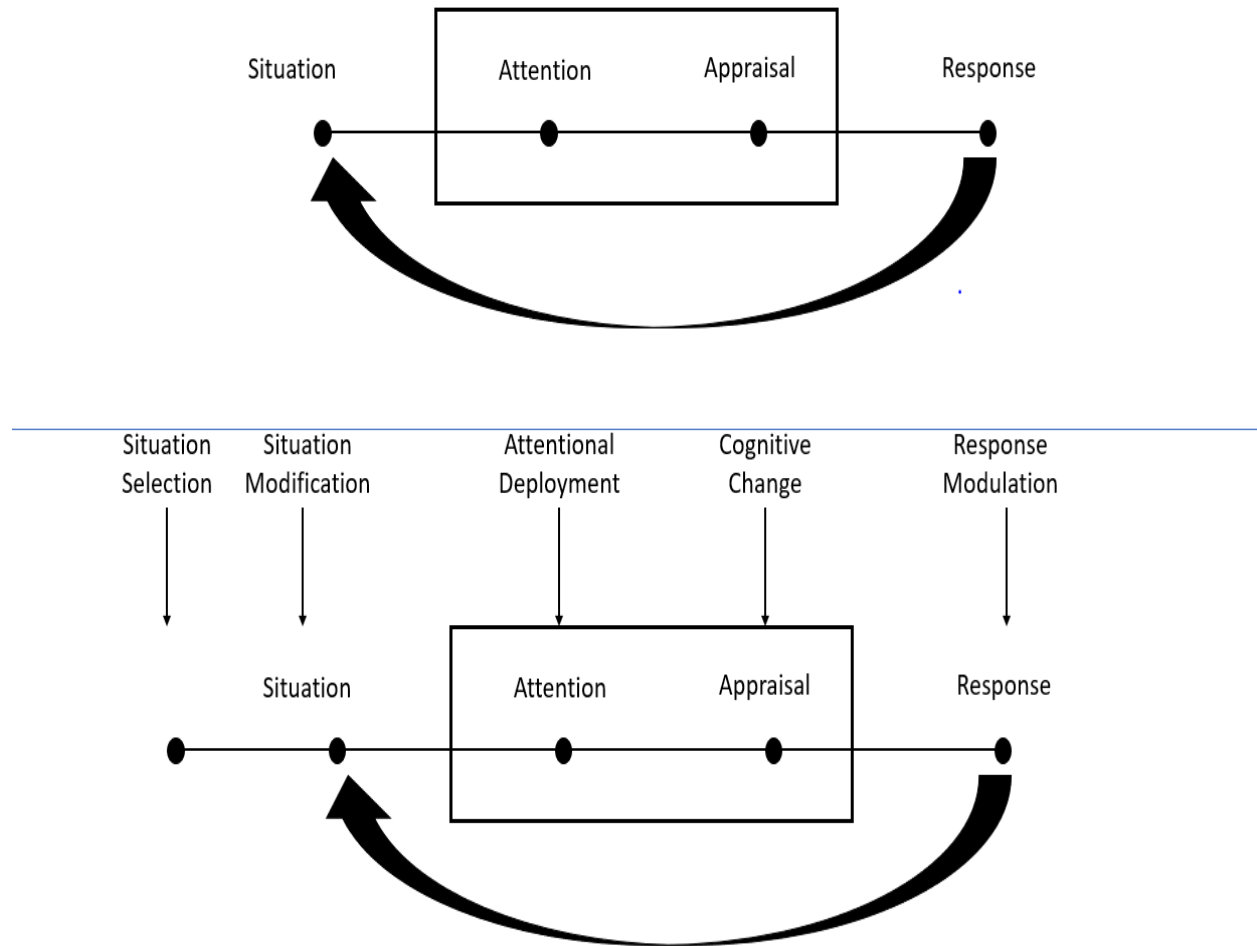


Figure 2

Heart rate variability depiction, taken from Laborde, Mosley, & Mertgen (2018)

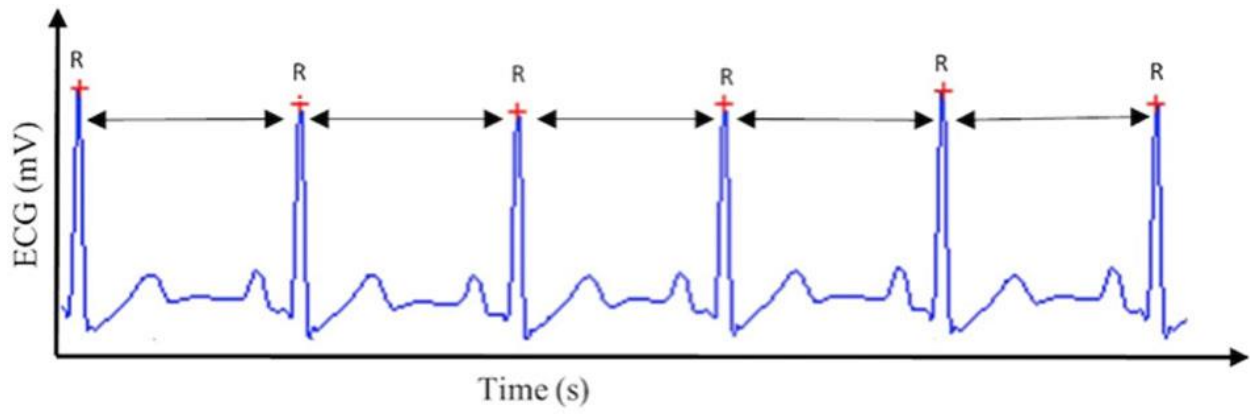


Figure 3

Example depiction of Resting RSA, RSA reactivity, RSA recovery

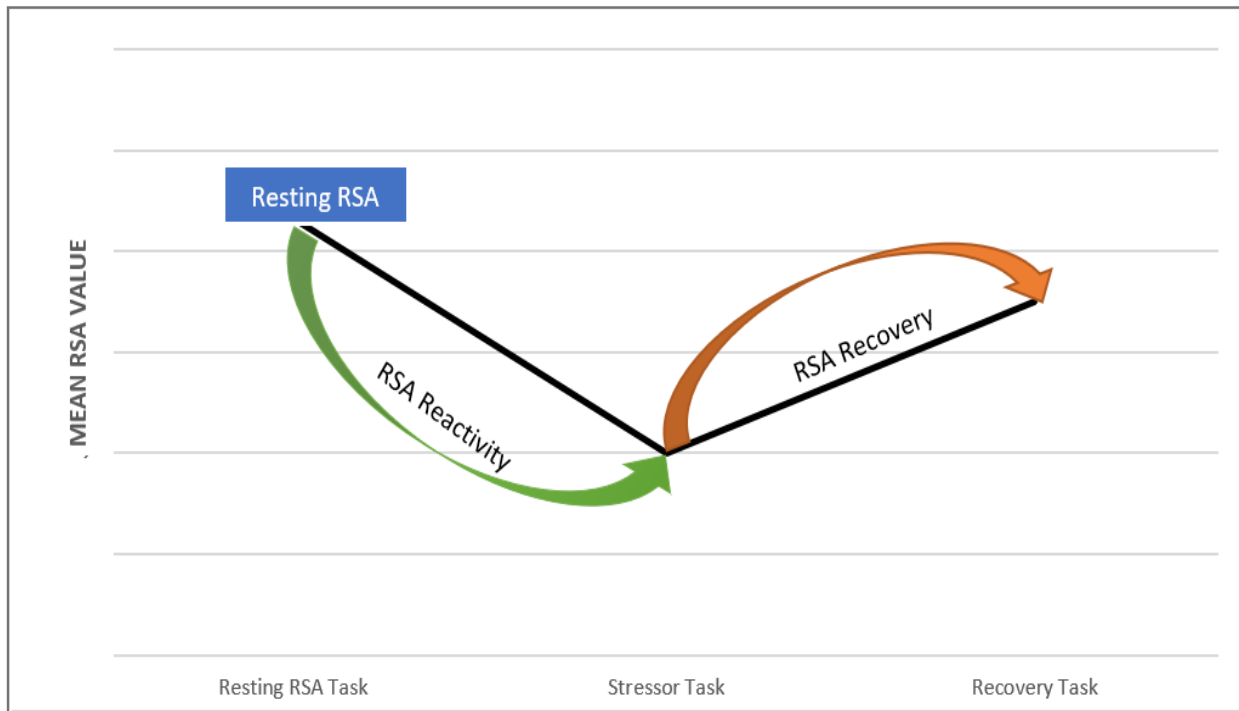


Table 1*Participant Demographics*

Age	<i>M</i> = 30.48 (<i>SD</i> = 6.1)
Number of children in the home	<i>M</i> = 2.88 (<i>SD</i> = 1.22)
Race/Ethnicity	
• Black or African American	70.2%
• White	14.3%
• Multiracial	9.9%
• Hispanic	2.4%
• American Indian	1.2%
• Asian or Other Pacific Islander	1.2%
• Other or unidentified	.8%
Relationship to child	
• Biological mother	90.7%
• Biological father	5%
• Grandmother	2.5%
• Other	1.9%
Relationship Status	
• Single	70.2%
• Married	21.1%
• Divorced/Separated	7.5%
• Widowed	.6%
• Remarried	.6%
Yearly Income	
• 10,000 or less	41.3%
• 10,001-20,000	21.9%
• 20,001-30,000	12.5%
• 30,001-40,000	10%
• 40,001-50,000	6.3%
• 50,001-60,000	3.8%
• 60,001 or higher	4.4%
BMI	<i>M</i> = 33.87 (<i>SD</i> = 9.40)
• Underweight (below 18.5)	2.4%
• Health Weight (18.5-24.9)	17.7%
• Overweight (25-29.9)	14.9%
• Obese (30-39.9)	65.4%
Participant Education	
• 1= Some Grade School	.6%
• 2= Some High School	16.2%
• 3= High School Graduate or GED	27.1%
• 4= Trade School or Community College Graduate	16.8%
• 5= Some College	29%
• 6= Four-Year Degree College Graduate	7.1%
• 7= Graduate or Professional School	3.2%

Table 2*ML-EFA Factor Loadings*

	Within Factor Loadings		Between Factor Loadings	
	1	2	1	2
1. The event is important for me because: It affected someone else's well-being.	-.23*	.18*	-.127	.050
2. The event is important for me because: It had important consequences for me	.052	.563*	.017	.151*
3. The event is important for me because: It had a positive impact on my life.	.665*	-.005	.675*	-.312*
4. The event is important for me because: It had a negative impact on my life.	-.575*	.344*	-.642*	.322*
5. The event is important for me because: It had a lasting impact for me.	-.174*	.307*	-.210*	-.134
6. The event is important for me because: It had a significant impact on me, but it wasn't long lasting.	.231*	-.090*	.296*	.336*
7. The event is important for me because: I felt that my life was threatened because of the event.	-.004	.467*	-.033	.673*
8. The event is important for me because: It happened to me because of the sort of person I am	.268*	.365*	.340*	.475*
9. The event is important for me because: I couldn't stop this event from happening to me.	-.408*	.036	-.440*	.105
10. The event is important for me because: I was responsible for what happened.	.577*	.456*	.672*	.401*
11. The event is important for me because: I understand what happened and what the consequences were.	.248*	.237*	.112	-.166*
12. The event is important for me because: When it happened, I could predict how the event was going to end.	.287*	.101*	.398*	.047
13. The event is important for me because: The event was expected. Meaning, I knew the event was going to happen.	.613*	.114*	.831*	-.007
14. The event is important for me because: I had experienced the event before; I was familiar with it.	.343*	.010	.387*	.410*
15. Thinking about the event makes me feel: Lonely	-.521*	.278*	-.344*	.581*
16. Thinking about the event makes me feel: Angry	-.547*	.518*	-.508*	.680*
17. Thinking about the event makes me feel: Happy/joyful	.779*	.033	.874*	.064
18. Thinking about the event makes me feel: Embarrassed	.024	.778*	.055	.815*
19. Thinking about the event makes me feel: Anxious/afraid	-.247*	.576*	-.217*	.841*
20. Thinking about the event makes me feel: Sadness/grief	-.648*	.246*	-.744*	.476*
21. Thinking about the event makes me feel: Guilty	.010	.642*	.017	.917*
22. Thinking about the event makes me feel: Shameful	-.004	.925*	.108	.880*
23. Thinking about the event makes me feel: Proud	.783*	.091*	.811*	.136
24. Thinking about the event makes me feel: Confused	-.494*	.362*	-.029	.721*

Note. * $p < .05$. Factor loadings, for the factor the item was specified under, are in bold

Table 3*Descriptives and Correlations*

	1	2	3	4	5	6	7	8	9	10	11
1. Childhood Adversity Exposure	--										
2. Adulthood Adversity Exposure	.13	--									
3. DERS	.02	.14	--								
4. RSA Resting	-.07	-.02	-.04	--							
5. RSA Reactivity	.01	.04	.06	.41**	--						
6. RSA Recovery	-.07	.04	.03	.08	.45**	--					
7. Positive Appraisal	.07	-.10	-.19*	.02	-.02	-.02	--				
8. Negative Appraisal	.07	.21**	.36**	.13		.05	-.13	--			
9. Age	-.03	.11	-.11	-.38**	-.12	.02	.01	-.05	--		
10. BMI	.02	.09	-.03	-.12	.13	.05	.00	-.04	.08	--	
11. Education Level	.15	-.15	-.20*	-.05	-.08	.05	-.01	-.12	.09	-.02	--
Mean (SD)	1.86 (.87)	2.14 (.63)	71.22 (20.42)	6.23 (1.46)	-.09 (.79)	.11 (.65)	23.44 (6.51)	25.56 (6.75)	30.48 (6.12)	33.87 (9.40)	3.91 (1.36)
Skewness	-.51	-.28	.31	-.24	.17	.34	.58	.01	.61	.39	.19
Kurtosis	.10	.52	-.80	.38	.18	.77	1.23	-.39	-.45	-.24	-.75

Note. * $p < .05$, ** $p < .01$. *SD*, Skewness, and Kurtosis for Resting RSA, RSA Reactivity, and RSA Recovery are the average values across imputations. RSA means and correlations are from multiple imputation pooled values.

Table 4*Regression Model for Self-Report Difficulties with Emotion Regulation (n= 161)*

Step	Variables	Unstandardized		Standardized		R ²	R ² Change
		B	SE	β	p		
1	Adulthood Adversity	.87	2.50	.03	.73	.18	
	Childhood Adversity	.59	1.79	.03	.74		
	Positive Appraisal	-.48	.23	-.16	.04*		
	Negative Appraisal	.94	.23	.31	.00**		
	Education Level	-2.50	1.15	-.17	.03*		
2	Adulthood Adversity	.87	2.54	.03	.73	.19	.01
	Childhood Adversity	.20	1.85	.01	.92		
	Positive Appraisal	-.49	.24	-.16	.04*		
	Negative Appraisal	.96	.24	.32	.00**		
	Education Level	-2.45	1.18	-.16	.04*		
	Adulthood Adversity	-.28	.42	-.05	.50		
	* Positive Appraisal						
	Adulthood Adversity	-.10	.36	-.02	.78		
	* Negative Appraisal						
	Childhood Adversity	.31	.28	.09	.28		
	* Positive Appraisal						
Childhood Adversity	.18	.27	.05	.51			
* Negative Appraisal							

Note. Variables in bold were significant at either **p< .01 or *p< .05.

Table 5*Regression Model for Resting RSA (n= 161)*

Step	Variables	Unstandardized		
		B	SE	p
1	Adulthood Adversity	.02	.19	.91
	Childhood Aversity	-.15	.14	.28
	Positive Appraisal	.01	.02	.55
	Negative Appraisal	.03	.02	.15
	Age	-.09	.02	.00**
2	Adulthood Adversity	.08	.19	.68
	Childhood Aversity	-.10	.14	.48
	Positive Appraisal	.01	.02	.68
	Negative Appraisal	.02	.02	.22
	Age	-.10	.02	.00**
	Adulthood Adversity	.00	.03	.96
	* Positive Appraisal			
	Adulthood Adversity	.00	.03	.96
	* Negative Appraisal			
	Childhood Adversity *	-.01	.03	.62
	Positive Appraisal			
	Childhood Adversity	-.05	.02	.04*
	* Negative Appraisal			

Note. Variables in bold were significant at either ** $p < .01$, * $p < .05$.

Figure 4

Significant interaction for Resting RSA

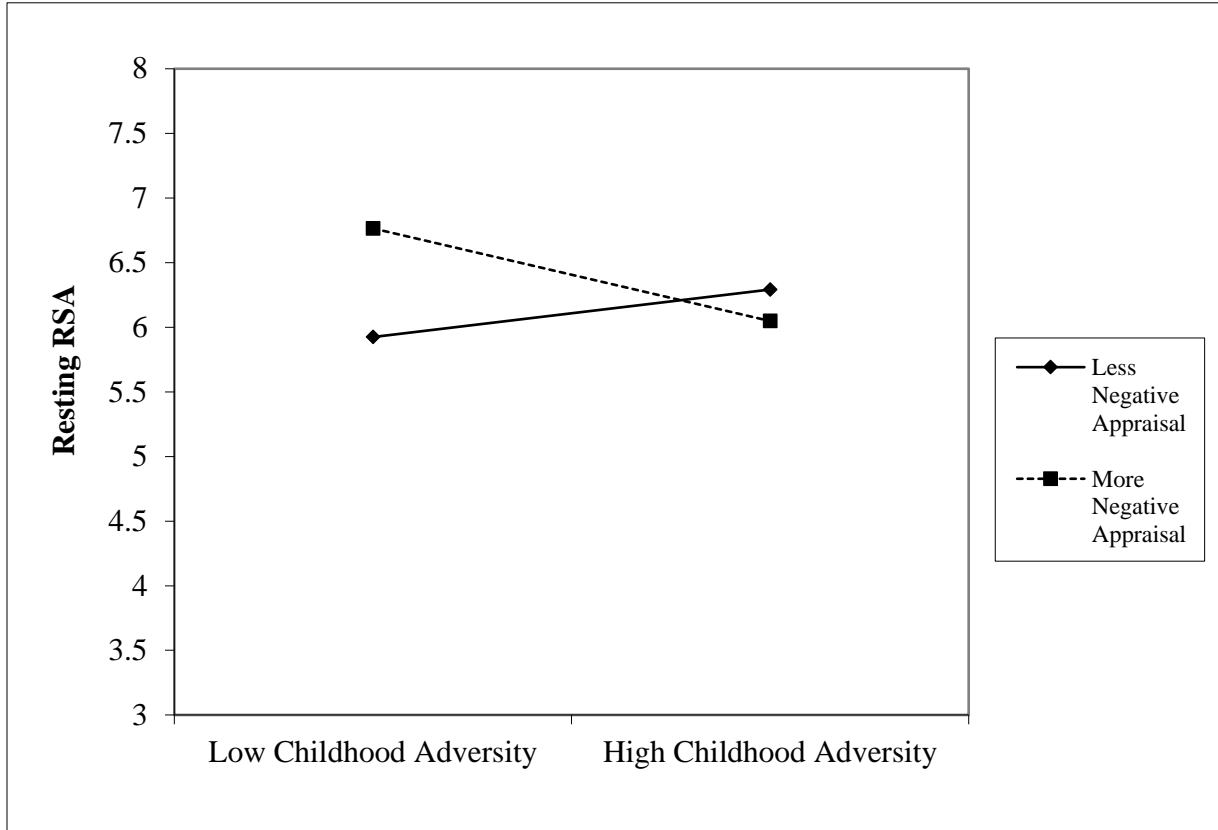


Table 6*Regression Model for RSA Reactivity (n= 161)*

Step	Variables	Unstandardized		
		B	SE	p
1	Adulthood Adversity	.00	.11	.99
	Childhood Aversity	.00	.08	.96
	Positive Appraisal	.00	.01	.97
	Negative Appraisal	.02	.01	.04*
2	Adulthood Adversity	-.02	.11	.85
	Childhood Aversity	-.03	.09	.71
	Positive Appraisal	.00	.01	.85
	Negative Appraisal	.03	.01	.03*
	Adulthood Adversity	.00	.02	.89
	* Positive Appraisal			
	Adulthood Adversity	.01	.02	.48
	* Negative Appraisal			
	Childhood Adversity *	.01	.02	.68
	Positive Appraisal			
Childhood Adversity *	.02	.01	.17	
Negative Appraisal				

Note. **p< .01, *p< .05.

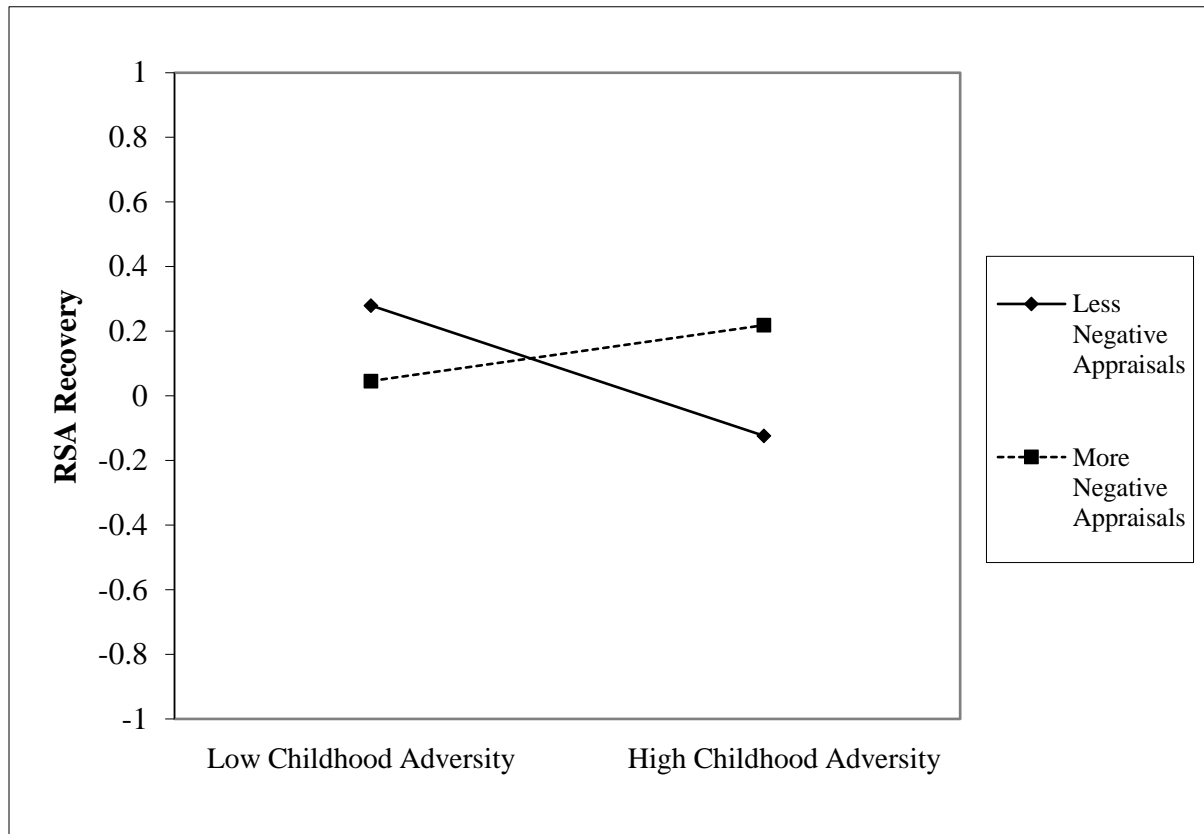
Table 7*Regression Model for RSA Recovery (n= 161)*

Step	Variables	Unstandardized		p
		B	SE	
1	Adulthood Adversity	.04	.10	.69
	Childhood Aversity	-.06	.08	.46
	Positive Appraisal	.00	.01	.94
	Negative Appraisal	.00	.01	.67
2	Adulthood Adversity	.02	.10	.88
	Childhood Aversity	-.07	.07	.37
	Positive Appraisal	.00	.01	.83
	Negative Appraisal	.00	.01	.64
	Adulthood Adversity	.00	.02	.92
	* Positive Appraisal			
	Adulthood Adversity	.00	.01	.61
	* Negative Appraisal			
	Childhood Adversity *	-.01	.01	.43
	Positive Appraisal			
Childhood Adversity	.02	.01	.03*	
* Negative Appraisal				

Note. **p< .01, *p< .05.

Figure 5

Significant interaction for RSA Recovery



Appendix A

Supplementary Table 1

Regression Model for Resting RSA Non-Imputed Data (n= 142)

Step	Variables	Unstandardized		Standardized		R ²	R ² Change
		B	SE	β	p		
1	Adulthood Adversity	.07	.18	.03	.71	.16	
	Childhood Adversity	-.18	.13	-.11	.17		
	Positive Appraisal	.01	.02	.05	.50		
	Negative Appraisal	.02	.02	.11	.18		
	Age	-.09	.02	-.37	.00**		
2	Adulthood Adversity	.12	.19	.05	.52	.18	.03
	Childhood Adversity	-.13	.13	-.08	.35		
	Positive Appraisal	.01	.02	.04	.64		
	Negative Appraisal	.02	.02	.10	.25		
	Age	-.09	.02	-.40	.00**		
	Adulthood Adversity *	.01	.03	.02	.84		
	Positive Appraisal						
	Adulthood Adversity *	-.01	.03	-.02	.79		
	Negative Appraisal						
	Childhood Adversity *	-.01	.02	-.04	.63		
	Positive Appraisal						
	Childhood Adversity	-.04	.02	-.17	.04*		
	* Negative Appraisal						

Note. Variables in bold were significant at either **p< .01, *p< .05.

Supplementary Table 2

Regression Model for RSA Reactivity, Non-Imputed Data (n= 131)

Step	Variables	Unstandardized		Standardized		R ²	R ² Change
		B	SE	β	p		
1	Adulthood Adversity	.03	.11	.02	.79	.03	
	Childhood Aversity	.00	.08	.00	.96		
	Positive Appraisal	.00	.01	.00	.98		
	Negative Appraisal	.02	.01	.17	.06		
2	Adulthood Adversity	.01	.11	.00	.96	.05	.02
	Childhood Aversity	-.02	.08	-.02	.83		
	Positive Appraisal	.00	.01	.02	.86		
	Negative Appraisal	.02	.01	.18	.04*		
	Adulthood Adversity *	.01	.02	.03	.73		
	Positive Appraisal						
	Adulthood Adversity *	.00	.02	.02	.84		
	Negative Appraisal						
	Childhood Adversity *	.00	.01	.02	.81		
	Positive Appraisal						
	Childhood Adversity *	.02	.01	.16	.09		
Negative Appraisal							

Note. **p< .01, *p< .05.

Supplementary Table 3

Regression Model for RSA Recovery, Non-Imputed Data (n= 132)

Step	Variables	Unstandardized		Standardized		R ²	R ² Change
		B	SE	β	p		
1	Adulthood Adversity	.04	.09	.04	.63	.01	
	Childhood Aversity	-.05	.06	-.08	.40		
	Positive Appraisal	.00	.01	.01	.93		
	Negative Appraisal	.01	.01	.08	.40		
2	Adulthood Adversity	.02	.09	.02	.81	.06	.05
	Childhood Aversity	-.07	.07	-.09	.32		
	Positive Appraisal	.00	.01	.03	.70		
	Negative Appraisal	.01	.01	.08	.38		
	Adulthood Adversity *	.00	.02	-.01	.95		
	Positive Appraisal						
	Adulthood Adversity *	.00	.01	-.03	.78		
	Negative Appraisal						
	Childhood Adversity *	-.01	.01	-.08	.36		
	Positive Appraisal						
Childhood Adversity	.02	.01	.20	.03*			
* Negative Appraisal							

Note. Variables in bold were significant at either **p< .01, *p< .05.

Appendix B

Parent Childhood Adversity Measure

Variable Name	Question	Answer Options
PC_01_00	Before you were 18, did any new children less than 18 years of age come to live permanently in the same home as you? This can include any newborn, adopted, foster, or any other type of child.	1. Yes [1] 2. No [0]
PC_01_01	Before you were 18, how many times did a new child come to live permanently in the same home as you?	1= 1 time 2= 2 times 3= 3-5 times 4=6-10 times 5=More than 10 times
PC_02_00	Before you were 18, was there an instance where your parental figures separated? This includes your mom, dad, or another caretaker moving out of the house, possibly permanently.	1. Yes [1] 2. No [0]
PC_02_01	Before you were 18, how many times did your parental figures separate?	1= 1 time 2= 2 times 3= 3-5 times 4=6-10 times 5=More than 10 times
PC_03_00	Before you were 18, did your primary caregiver get a divorce?	1. Yes [1] 2. No [0]
PC_03_01	Before you were 18, how many times did your primary caregiver divorce?	1= 1 time 2= 2 times 3= 3-5 times 4=6-10 times 5=More than 10 times
PC_04_00	Before you were 18, was there a new parental figure (for example, new boyfriend, grandma, other adult) that moved into the house for at least one month?	1. Yes [1] 2. No [0]
PC_04_01	Before you were 18, how many times did a new parental figure move into your home?	1= 1 time 2= 2 times 3= 3-5 times 4= 6-10 times 5= More than 10 times
PC_05_00	Before you were 18, did you move homes?	1. Yes [1] 2. No [0]
PC_05_01	Before you were 18, how many times did you move homes?	1= 1 time 2= 2 times 3= 3-5 times 4=6-10 times

		5=More than 10 times
PC_06_00	Before you were 18, did you have a pet you cared about die?	1. Yes [1] 2. No [0]
PC_06_01	Before you were 18, how many times did you experience the death of a pet you cared for?	1= 1 time 2= 2 times 3= 3-5 times 4=6-10 times 5=More than 10 times
PC_07_00	Before you were 18, did you experience a change in daycare or childcare provider?	1. Yes [1] 2. No [0]
PC_07_01	Before you were 18, how many times did you change daycare or childcare providers?	1= 1 time 2= 2 times 3= 3-5 times 4=6-10 times 5=More than 10 times
PC_08_00	Before you were 18, did you lose contact with someone you cared about because of a move?	1. Yes [1] 2. No [0]
PC_08_01	Before you were 18, how many times did you lose contact with someone you cared about because of a move?	1= 1 time 2= 2 times 3= 3-5 times 4=6-10 times 5=More than 10 times
PC_09_00	Before you were 18, did you attend daycare or childcare in an unsafe neighborhood?	1. Yes [1] 2. No [0]
PC_09_01	Before you were 18, how often did you attend daycare, childcare, or school in an unsafe neighborhood?	1= Almost never 2= Sometimes 3= Often 4= Almost always 5=Always
PC_10_00	Before you were 18, did your family experience a significant reduction in standard of living? This includes events such as a loss of housing, not getting enough food or clothing, or having to go on welfare or food stamps.	1. Yes [1] 2. No [0]
PC_10_01	Before you were 18, how many times did you experience a significant reduction in standard of living?	1= 1 time 2= 2 times 3= 3-5 times 4=6-10 times 5=More than 10 times
PC_11_00	Before you were 18, were you forced to leave your home?	1. Yes [1] 2. No [0]
PC_11_01	Before you were 18, how many times were you forced to leave your home?	1= 1 time 2= 2 times 3= 3-5 times 4=6-10 times

		5=More than 10 times
PC_12_00	Before you were 18, were either of your parents or another primary caretaker admitted to a hospital?	1. Yes [1] 2. No [0]
PC_12_01	Before you were 18, how many times was your parent or other primary caregiver admitted to a hospital?	1= 1 time 2= 2 times 3= 3-5 times 4=6-10 times 5=More than 10 times
PC_13_00	Before you were 18, were you in a car accident?	1. Yes [1] 2. No [0]
PC_13_01	Before you were 18, how many times were you in a car accident?	1= 1 time 2= 2 times 3= 3-5 times 4=6-10 times 5=More than 10 times
PC_14_00	Before you were 18, were you hit by a car? This does not include being in a car when the event happened.	1. Yes [1] 2. No [0]
PC_14_01	Before you were 18, how many times were you hit by a car?	1= 1 time 2= 2 times 3= 3-5 times 4=6-10 times 5=More than 10 times
PC_15_00	Before you were 18, were one or both of your parents or other caretaker arrested?	1. Yes [1] 2. No [0]
PC_15_01	Before you were 18, how many times was your parent or other caregiver arrested?	1= 1 time 2= 2 times 3= 3-5 times 4=6-10 times 5=More than 10 times
PC_16_00	Before you were 18, were you poisoned?	1. Yes [1] 2. No [0]
PC_16_01	Before you were 18, how many times were you poisoned?	1= 1 time 2= 2 times 3= 3-5 times 4= 6-10 times 5= More than 10 times
PC_17_00	Before you were 18, were you burned? This includes when you accidentally suffered an injury caused by fire or excessive heat that is not a sunburn.	1. Yes [1] 2. No [0]
PC_17_01	Before you were 18, how many times were you burned?	1= 1 time 2= 2 times 3= 3-5 times 4= 6-10 times 5= More than 10 times

PC_18_00	Before you were 18, did you almost drown?	1. Yes [1] 2. No [0]
PC_18_01	Before you were 18, how many times did you almost drown?	1= 1 time 2= 2 times 3= 3-5 times 4=6-10 times 5=More than 10 times
PC_19_00	Before you were 18, did you experience an accidental serious fall?	1. Yes [1] 2. No [0]
PC_19_01	Before you were 18, how many times did you have a serious fall?	1= 1 time 2= 2 times 3= 3-5 times 4=6-10 times 5=More than 10 times
PC_20_00	Before you were 18, were you attacked by an animal?	1. Yes [1] 2. No [0]
PC_20_01	Before you were 18, how many times were you attacked by an animal?	1= 1 time 2= 2 times 3= 3-5 times 4= 6-10 times 5= More than 10 times
PC_21_00	Before you were 18, did you break any bones? This includes all broken bones whatever the cause.	1. Yes [1] 2. No [0]
PC_21_01	Before you were 18, how many times did you break any bones?	1= 1 time 2= 2 times 3= 3-5 times 4=6-10 times 5=More than 10 times
PC_22_00	Before you were 18, did you require hospitalization? This includes being admitted to a medical or psychiatric hospital for more than 24 hours or spending more than 24 hours in a hospital emergency room.	1. Yes [1] 2. No [0]
PC_22_01	Before you were 18, how many times did you require hospitalization?	1= 1 time 2= 2 times 3= 3-5 times 4= 6-10 times 5= More than 10 times
PC_23_00	Before you were 18, did one of your primary caretakers die?	1. Yes [1] 2. No [0]
PC_23_01	Before you were 18, how many times did you experience the death of a primary caregiver?	1= 1 time 2= 2 times 3= 3-5 times 4= 6-10 times

		5= More than 10 times
PC_24_00	Before you were 18, did any adult close to you die? This does not include primary caretakers.	1. Yes [1] 2. No [0]
PC_24_01	Before you were 18, how many times did you experience the death of an adult close to you?	1= 1 time 2= 2 times 3= 3-5 times 4= 6-10 times 5= More than 10 times
PC_25_00	Before you were 18, did you have a sibling die?	1. Yes [1] 2. No [0]
PC_25_01	Before you were 18, how many times did you experience the death of a sibling?	1= 1 time 2= 2 times 3= 3-5 times 4= 6-10 times 5= More than 10 times
PC_26_00	Before you were 18, did you have a peer or friend die?	1. Yes [1] 2. No [0]
PC_26_01	Before you were 18, how many times did you experience the death of a peer or friend?	1= 1 time 2= 2 times 3= 3-5 times 4= 6-10 times 5= More than 10 times
PC_27_00	Before you were 18, were you in a natural disaster? This includes events such as floods, tornados, and hurricanes.	1. Yes [1] 2. No [0]
PC_27_01	Before you were 18, how many times were you in a natural disaster?	1= 1 time 2= 2 times 3= 3-5 times 4= 6-10 times 5= More than 10 times
PC_28_00	Before you were 18, were you in a house fire?	1. Yes [1] 2. No [0]
PC_28_01	Before you were 18, how many times were you in a house fire?	1= 1 time 2= 2 times 3= 3-5 times 4= 6-10 times 5= More than 10 times

PC_29_00	Before you were 18, were you involved in war or terrorism events?	1. Yes [1] 2. No [0]
PC_29_01	Before you were 18, how many times were you involved in war or terrorism events?	1= 1 time 2= 2 times 3= 3-5 times 4=6-10 times 5=More than 10 times
PC_30_00	Before you were 18, were you consistently ignored by peers? This includes instances where you had an opportunity to socialize with peers, but peers did not socialize with you.	1. Yes [1] 2. No [0]
PC_30_01	Before you were 18, how many often were you consistently ignored by peers?	1= Almost never 2= Sometimes 3= Often 4=Almost always 5=Always
PC_31_00	Before you were 18, did you SEE something really terrible happen to someone? This includes events where you saw an event but were not the target of the event.	1. Yes [1] 2. No [0]
PC_31_01	Before you were 18, how many times did you see something really terrible happen to someone?	1= 1 time 2= 2 times 3= 3-5 times 4= 6-10 times 5= More than 10 times
PC_32_00	Before you were 18, did you HEAR of something really terrible happening to someone? This includes times when you heard about something with potential for severe physical injury, but did not see it happen.	1. Yes [1] 2. No [0]
PC_32_01	Before you were 18, how many times did you hear of something really terrible happening to someone?	1= 1 time 2= 2 times 3= 3-5 times 4= 6-10 times 5= More than 10 times
PC_33_00	Before you were 18, did someone in your presence hurt another person badly? This includes any event resulting in death or severe physical injury, such as causing a car accident, shooting or otherwise injuring another person, or starting a fire.	1. Yes [1] 2. No [0]
PC_33_01	Before you were 18, how many times did someone hurt another person badly in front of you?	1= 1 time 2= 2 times 3= 3-5 times 4=6-10 times 5=More than 10 times
PC_34_00	Before you were 18, were you physically attacked or injured by another child?	1. Yes [1] 2. No [0]

PC_34_01	Before you were 18, how many times were you physically attacked or injured by another child?	1= 1 time 2= 2 times 3= 3-5 times 4= 6-10 times 5= More than 10 times
PC_35_00	Before you were 18, were you robbed or mugged?	1. Yes [1] 2. No [0]
PC_35_01	Before you were 18, how many times were you robbed or mugged?	1= 1 time 2= 2 times 3= 3-5 times 4= 6-10 times 5= More than 10 times
PC_36_00	Before you were 18, were you exposed to domestic violence? This includes physical, sexual, verbal, and emotional violence.	1. Yes [1] 2. No [0]
PC_36_01	Before you were 18, how often were you exposed to domestic violence?	1= Almost never 2= Sometimes 3= Often 4=Almost always 5=Always
PC_37_00	Before you were 18, were you removed from the home because of neglect?	1. Yes [1] 2. No [0]
PC_37_01	How many times were you removed from the home because of neglect?	1= 1 time 2= 2 times 3= 3-5 times 4= 6-10 times 5= More than 10 times
PC_38_00	Before you were 18, did a member of your family or other close significant person serve time in jail or prison?	1. Yes [1] 2. No [0]
PC_38_01	Before you were 18, how many times did family members or other close significant people you know serve time in jail or prison?	1= 1 time 2= 2 times 3= 3-5 times 4= 6-10 times 5= More than 10 times
PC_39_00	Before you were 18, were you removed from the home because of physical abuse?	1. Yes [1] 2. No [0]
PC_39_01	Before you were 18, how many times were you removed from the home because of physical abuse?	1= 1 time 2= 2 times 3= 3-5 times 4= 6-10 times 5= More than 10 times

PC_39_02	What was the longest you were removed for physical abuse?	1= One day 2= One week 3= One month 4= More than one month 5= More than one year
PC_40_00	Before you were 18, were you kidnapped or taken hostage? This includes events where you were held against your will under circumstances with potential for death, severe physical injury, sexual, or physical assault.	1. Yes [1] 2. No [0]
PC_40_01	Before you were 18, how many times were you kidnapped or taken hostage?	1= 1 time 2= 2 times 3= 3-5 times 4=6-10 times 5=More than 10 times
PC_41_00	Before you were 18, did you have a parent or other primary caregiver diagnosed with a mental illness?	1. Yes [1] 2. No [0]
PC_41_01	Before you were 18, how many times was your parent or other primary caregiver diagnosed with a mental illness?	1= 1 time 2= 2 times 3= 3-5 times 4= 6-10 times 5= More than 10 times
PC_42_00	Before you were 18, were you the victim of discrimination?	1. Yes [1] 2. No [0]
PC_42_01	Before you were 18, how often were you the victim of discrimination?	1= Almost Never 2= Sometimes 3= Often 4=Almost Always 5=Always
PC_43_00	Before you were 18, were you removed from the home because of sexual abuse?	1. Yes [1] 2. No [0]
PC_43_01	Before you were 18, how many times were you removed from the home because of sexual abuse?	1= 1 time 2= 2 times 3= 3-5 times 4=6-10 times 5=More than 10 times
PC_44_00	Before you were 18, did you have a parent or other caregiver have issues with alcoholism or drug use?	1. Yes [1] 2. No [0]
PC_44_01	Before you were 18, how often did your parent or other primary caregiver have an issue with alcohol or drugs?	1= Almost Never 2= Sometimes 3= Often 4=Almost Always 5=Always
PC_45_00	Before you were 18, were you removed from the home because of emotional or psychological abuse?	1. Yes [1] 2. No [0]

PC_45_01	Before you were 18, how many times were you removed from the home because of emotional or psychological abuse?	1= 1 time 2= 2 times 3= 3-5 times 4= 6-10 times 5= More than 10 times
PC_46_00	Before you were 18, were you seriously ill and diagnosed with a physical illness (for example, chickenpox, measles, high fever)?	1. Yes [1] 2. No [0]
PC_46_01	Before you were 18, how many times were you seriously ill and diagnosed with a physical illness (for example, chickenpox, measles, high fever)?	1= 1 time 2= 2 times 3= 3-5 times 4=6-10 times 5=More than 10 times
PC_47_00	Before you were 18, were you seriously ill and diagnosed with a chronic physical illness (for example, asthma, cancer, epilepsy, obesity)?	1. Yes [1] 2. No [0]
PC_47_01	Before you were 18, how many times were you seriously ill and diagnosed with a chronic physical illness (for example, asthma, cancer, epilepsy, obesity)?	1= 1 time 2= 2 times 3= 3-5 times 4= 6-10 times 5= More than 10 times
PC_48_00	Before you were 18, were you exposed to violent events around your home and in your community?	1. Yes [1] 2. No [0]
PC_48_01	Before you were 18, how often were you exposed to violent events around your home and in your community?	1= Almost Never 2= Sometimes 3= Often 4=Almost Always 5=Always
PC_49_00	Before you were 18, did you move to a new country?	1. Yes [1] 2. No [0]
PC_49_01	Before you were 18, how many times did you move to a new country?	1= 1 time 2= 2 times 3= 3-5 times 4= 6-10 times 5= More than 10 times
PC_50_00	Before you were 18, did anyone close to you attempt or complete suicide?	1. Yes [1] 2. No [0]
PC_50_01	Before you were 18, how many times did someone close to you attempt or complete suicide?	1= 1 time 2= 2 times 3= 3-5 times 4= 6-10 times 5= More than 10 times

PC_51_00	Before you were 18, were you the victim of neglect? This includes times when you did not receive basic needs like food, shelter, or loving care.	1. Yes [1] 2. No [0]
PC_51_01	Before you were 18, how often were you the victim of neglect?	1= Almost Never 2= Sometimes 3= Often 4= Almost Always 5= Always
PC_52_00	Before you were 18, were you the victim of physical abuse?	1. Yes [1] 2. No [0]
PC_52_01	Before you were 18, how often were you the victim of physical abuse?	1= Almost Never 2= Sometimes 3= Often 4=Almost Always 5=Always
PC_53_00	Before you were 18, were you the victim of non-contact sexual abuse? This includes incidents such as being forced to look at others' private areas, watch sexual acts, or watch explicit sexual material.	1. Yes [1] 2. No [0]
PC_53_01	Before you were 18, how often were you the victim of non-contact sexual abuse?	1= Almost Never 2= Sometimes 3= Often 4= Almost Always 5= Always
PC_54_00	Before you were 18, were you the victim of contact sexual abuse? This includes incidents such as being touched or fondled in private areas, forced touching of others' private parts, or forced sexual intercourse.	1. Yes [1] 2. No [0]
PC_54_01	Before you were 18, how often were you the victim of contact sexual abuse?	1= Almost Never 2= Sometimes 3= Often 4=Almost Always 5=Always
PC_55_00	Before you were 18, were you the victim of emotional or psychological abuse? This includes insults or humiliation.	1. Yes [1] 2. No [0]
PC_55_01	Before you were 18, how often were you the victim of emotional or psychological abuse?	1= Almost Never 2= Sometimes 3= Often 4= Almost Always 5= Always

Appendix C

Parent Adulthood Adversity Measure

Variable Name	Text (Question)	Answer Options
PA_01_00	At any time in your life, have you had a divorce?	1. Yes [1] 2. No [0]
PA_01_01	How many times have you been divorced?	1. 1 time [1] 2. 2 times [2] 3. 3-5 times [3] 4. 6-10 times [4] 5. More than 10 times [5]
PA_02_00	Since you were 18, have you lost contact with someone you cared about because of a move?	1. Yes [1] 2. No [0]
PA_02_01	How many times have you lost contact with someone you cared about because of a move?	1. 1 time [1] 2. 2 times [2] 3. 3-5 times [3] 4. 6-10 times [4] 5. More than 10 times [5]
PA_03_00	Since you were 18, have you worked in a place that is risky to your safety and health? This includes work with physical, chemical, or biological hazards.	1. Yes [1] 2. No [0]
PA_03_01	How often have you worked in a place that was risky to your safety and health?	1. Almost never [1] 2. Sometimes [2] 3. Often [3] 4. Almost always [4] 5. Always [5]
PA_04_00	Since you were 18, have you experienced a significant reduction in standard of living? This includes events such as a loss of housing, not getting enough food or clothing, or having to go on welfare or food stamps.	1. Yes [1] 2. No [0]
PA_04_01	How many times have you experienced a significant reduction in standard of living?	1. 1 time [1] 2. 2 times [2] 3. 3-5 times [3] 4. 6-10 times [4] 5. More than 10 times [5]
PA_05_00	Since you were 18, were you ever forced to leave your home when you had not planned or wanted to move? This only includes instances where you were living on your own or when your child was not living in the home.	1. Yes [1] 2. No [0]
PA_05_01	How many times were you forced to leave your home when you had not planned or wanted to move?	1. 1 time [1] 2. 2 times [2] 3. 3-5 times [3] 4. 6-10 times [4] 5. More than 10 times [5]

PA_06_00	Since you were 18, have you been in a car accident?	1. Yes [1] 2. No [0]
PA_06_01	How many times have you been in a car accident?	1. 1 time [1] 2. 2 times [2] 3. 3-5 times [3] 4. 6-10 times [4] 5. More than 10 times [5]
PA_06_02	<i>(if 'times' = 1)</i> When did this happen? <i>(if 'times' > 1)</i> When was the <u>first time</u> this happened?	1. Within the last month [1] 2. Within the last 6 months [2] 3. Within the last year [3] 4. More than a year ago [4] 5. More than 3 years ago [5]
PA_06_03	<i>(if 'times' > 1)</i> When was the <u>last time</u> this happened?	1. Within the last month [1] 2. Within the last 6 months [2] 3. Within the last year [3] 4. More than a year ago [4] 5. More than 3 years ago [5]
PA_06_04	Thinking about the last time this happened, were you injured as a result?	2. Mild: No medical attention needed or sought [2] 3. Moderate: Medical attention needed and/or sought but intervention or treatment did not require continuous care or hospitalization [3] 4. Serious: required overnight stay at hospital [4] 5. Serious medical attention required and lasting physical effects from the event [5]
PA_06_05_01 PA_06_05_02 PA_06_05_03 PA_06_05_04 PA_06_05_05 PA_06_05_06 PA_06_05_NO NE PA_06_05_GR OUP	Thinking about the last time this happened, if others were injured in the accident, what happened to the other individuals? Please check all that apply.	1. No other individuals were involved [1] 2. Mild: No medical attention needed or sought [2] 3. Moderate: Medical attention needed and/or sought but intervention or treatment did not require continuous care or hospitalization [3] 4. Serious: required overnight stay at hospital [4]

		5. Serious medical attention required and lasting physical effects from the event [5] 6. Death [6]
PA_07_00	Since you were 18, have you been hit by a car? This does not include being in another car.	1. Yes [1] 2. No [0]
PA_08_00	Since you were 18, have you been poisoned?	1. Yes [1] 2. No [0]
PA_08_01	How many times have you been poisoned?	1. 1 time [1] 2. 2 times [2] 3. 3-5 times [3] 4. 6-10 times [4] 5. More than 10 times [5]
PA_09_00	Since you were 18, have you been burned? This includes when you suffered an injury caused by fire or excessive or intense heat that is not a sunburn.	1. Yes [1] 2. No [0]
PA_09_01	How many times have you been burned?	1. 1 time [1] 2. 2 times [2] 3. 3-5 times [3] 4. 6-10 times [4] 5. More than 10 times [5]
PA_10_00	Since you were 18, have you almost drowned?	1. Yes [1] 2. No [0]
PA_10_01	How many times have you almost drowned?	1. 1 time [1] 2. 2 times [2] 3. 3-5 times [3] 4. 6-10 times [4] 5. More than 10 times [5]
PA_11_00	Since you were 18, have you been seriously injured? This includes instances such as a serious fall at home or at work, head trauma or broken bones.	1. Yes [1] 2. No [0]
PA_11_01	How many times have you been seriously injured?	1. 1 time [1] 2. 2 times [2] 3. 3-5 times [3] 4. 6-10 times [4] 5. More than 10 times [5]
PA_12_00	Since you were 18, have you been attacked by an animal? This includes animal attacks where there was a risk for an injury requiring medical attention.	1. Yes [1] 2. No [0]
PA_12_01	How many times have you been attacked by an animal?	1. 1 time [1] 2. 2 times [2] 3. 3-5 times [3] 4. 6-10 times [4] 5. More than 10 times [5]
PA_13_00	Since you were 18, have you been admitted to a hospital? This includes being admitted to a medical or psychiatric hospital for more than 24 hours or spending more than 24 hours in a hospital emergency room.	1. Yes [1] 2. No [0]

PA_13_01	How many times have you been admitted to a hospital?	1. 1 time [1] 2. 2 times [2] 3. 3-5 times [3] 4. 6-10 times [4] 5. More than 10 times [5]
PA_14_00	Since you were 18, has your spouse or significant other died?	1. Yes [1] 2. No [0]
PA_14_01	How many times have you experienced the death of a spouse or significant other?	1. 1 time [1] 2. 2 times [2] 3. 3 or more times [3]
PA_15_00	At any time in your life, have you had a child die? This does not include stillbirths or miscarriages.	1. Yes [1] 2. No [0]
PA_15_01	How many times have you experienced the death of a child?	1. 1 time [1] 2. 2 times [2] 3. 3 or more times [3]
PA_16_00	Since you were 18 years, have you had a close family member die?	1. Yes [1] 2. No [0]
PA_16_01	How many times have you experienced the death of a close family member?	1. 1 time [1] 2. 2 times [2] 3. 3-5 times [3] 4. 6-10 times [4] 5. More than 10 times [5]
PA_17_00	Since you were 18, have you had someone close to you die? This does not include members of your family.	1. Yes [1] 2. No [0]
PA_17_01	How many times have you had someone close to you die?	1. 1 time [1] 2. 2 times [2] 3. 3-5 times [3] 4. 6-10 times [4] 5. More than 10 times [5]
PA_18_00	Since you were 18, have you experienced a flood, tornado, hurricane, or other natural disaster?	1. Yes [1] 2. No [0]
PA_18_01	How many times have you experienced a flood, tornado, or hurricane?	1. 1 time [1] 2. 2 times [2] 3. 3-5 times [3] 4. 6-10 times [4] 5. More than 10 times [5]
PA_19_00	Since you were 18, have you been in a fire? The fire could have been accidental or deliberately set, in which people actually died or were badly injured, or property was extensively damaged, or there was a serious risk for these outcomes.	1. Yes [1] 2. No [0]
PA_19_01	How many times have you been in a fire?	1. 1 time [1] 2. 2 times [2] 3. 3-5 times [3] 4. 6-10 times [4] 5. More than 10 times [5]

PA_20_00	Since you were 18, have you been involved in war or terrorism events?	1. Yes [1] 2. No [0]
PA_20_01	How many times have you been involved in war or terrorism events?	1. 1 time [1] 2. 2 times [2] 3. 3-5 times [3] 4. 6-10 times [4] 5. More than 10 times [5]
PA_21_00	Since you were 18, have you <u>SEEN</u> something really terrible happen to anyone? This includes events anywhere or at any time where you saw an event such as fighting, robbery, shooting, but were not the target of the event.	1. Yes [1] 2. No [0]
PA_21_01	How many times have you seen something terrible happen to another person?	1. 1 time [1] 2. 2 times [2] 3. 3-5 times [3] 4. 6-10 times [4] 5. More than 10 times [5]
PA_22_00	Since you were 18, have you <u>HEARD</u> of something really terrible happening to anyone close to you? This includes times when you heard about something with potential for severe physical injury, but did not see it happen.	1. Yes [1] 2. No [0]
PA_22_01	How many times have you heard about something really terrible happening to anyone close to you?	1. 1 time [1] 2. 2 times [2] 3. 3-5 times [3] 4. 6-10 times [4] 5. More than 10 times [5]
PA_23_00	Since you were 18, has someone hurt another person badly, in front of you? This includes any event resulting in death or severe physical injury, such as causing a car accident, shooting or otherwise injuring another person, or starting a fire.	1. Yes [1] 2. No [0]
PA_23_01	How many times has someone hurt another person badly, in front of you?	1. 1 time [1] 2. 2 times [2] 3. 3-5 times [3] 4. 6-10 times [4] 5. More than 10 times [5]
PA_24_00	Since you were 18, have you been physically attacked or injured by another person?	1. Yes [1] 2. No [0]
PA_24_01	How many times have you been physically attacked or injured by another person?	1. 1 time [1] 2. 2 times [2] 3. 3-5 times [3] 4. 6-10 times [4] 5. More than 10 times [5]
PA_25_00	Since you were 18, have you been robbed or mugged?	1. Yes [1] 2. No [0]
PA_25_01	How many times have you been robbed or mugged?	1. 1 time [1] 2. 2 times [2]

		3. 3-5 times [3] 4. 6-10 times [4] 5. More than 10 times [5]
PA_26_00	Since you were 18, have you been kidnapped or taken hostage? This includes events where you were held against your will under circumstances with potential for death, severe physical injury, sexual or physical assault.	1. Yes [1] 2. No [0]
PA_26_01	How many times have you been kidnapped or taken hostage?	1. 1 time [1] 2. 2 times [2] 3. 3-5 times [3] 4. 6-10 times [4] 5. More than 10 times [5]
PA_27_00	Since you were 18, have you gotten seriously sick and been diagnosed with a non-chronic physical illness?	1. Yes [1] 2. No [0]
PA_27_01	How many times were you seriously sick with a non-chronic physical illness?	1. 1 time [1] 2. 2 times [2] 3. 3-5 times [3] 4. 6-10 times [4] 5. More than 10 times [5]
PA_28_00	Since you were 18, have you gotten seriously sick and been diagnosed with a chronic physical illness?	1. Yes [1] 2. No [0]
PA_28_01	How many times have you been diagnosed with a chronic physical illness?	1. 1 time [1] 2. 2 times [2] 3. 3-5 times [3] 4. 6-10 times [4] 5. More than 10 times [5]
PA_29_00	Since you were 18, have you been personally exposed to violent events in your community? This includes instances where you were present during the violent event.	1. Yes [1] 2. No [0]
PA_29_01	How often have you been exposed to violent events in the community?	1. Almost never [1] 2. Sometimes [2] 3. Often [3] 4. Almost always [4] 5. Always [5]
PA_30_00	Since you were 18, have you had to move to a new country?	1. Yes [1] 2. No [0]
PA_30_01	How many times have you moved to a new country?	1. 1 time [1] 2. 2 times [2] 3. 3-5 times [3] 4. 6-10 times [4] 5. More than 10 times [5]
PA_31_00	Since you were 18, has anyone close to you attempted or completed suicide?	1. Yes [1] 2. No [0]
PA_31_01	How many times has someone close to you attempted or completed suicide?	1. 1 time [1] 2. 2 times [2] 3. 3-5 times [3]

		4. 6-10 times [4] 5. More than 10 times [5]
PA_32_00	At any time in your life, have you had any issues with alcohol or drug use?	1. Yes [1] 2. No [0]
PA_32_01	How often have you had issues with alcohol and drugs?	1. Almost never [1] 2. Sometimes [2] 3. Often [3] 4. Almost always [4] 5. Always [5]
PA_33_00	At any time in your life, have you had a miscarriage or stillbirth?	1. Yes [1] 2. No [0]
PA_33_01	How many times have you had a miscarriage or stillbirth?	1. 1 time [1] 2. 2 times [2] 3. 3-5 times [3] 4. 6-10 times [4] 5. More than 10 times [5]
PA_34_00	At any time in your life, have you had an abortion?	1. Yes [1] 2. No [0]
PA_34_01	How many times have you had an abortion?	1. 1 time [1] 2. 2 times [2] 3. 3-5 times [3] 4. 6-10 times [4] 5. More than 10 times [5]
PA_35_00	Since you were 18, have you been the victim of discrimination? This includes instances such as unfair treatment, insults or name-calling, or harassment because of your sex, race, religion, age, culture, or sexual orientation.	1. Yes [1] 2. No [0]
PA_35_01	How often have you experienced discrimination?	1. Almost never [1] 2. Sometimes [2] 3. Often [3] 4. Almost always [4] 5. Always [5]
PA_36_00	At any time in your life, have you served time in jail or prison?	1. Yes [1] 2. No [0]
PA_36_01	How many times have you served time in jail or prison?	1. 1 time [1] 2. 2 times [2] 3. 3-5 times [3] 4. 6-10 times [4] 5. More than 10 times [5]
PA_37_00	Since you were 18, has anyone close to you served time in jail or prison?	1. Yes [1] 2. No [0]
PA_37_01	How many people close to you have served time in jail or prison?	A. 1 person [1] B. 2 people [2] C. 3-5 people [3] D. 6-10 people [4] E. More than 10 people [5]

PA_38_00	Since you were 18, have you been the victim of domestic violence?	1. Yes [1] 2. No [0]
PA_38_01	How often were you the victim of domestic violence?	1. Almost never [1] 2. Sometimes [2] 3. Often [3] 4. Almost always [4] 5. Always [5]
PA_39_00	Since you were 18, have you been sexually assaulted? This includes incidents where there was rape, attempted rape, or any other time you were forced or threatened into performing sexual acts.	1. Yes [1] 2. No [0]
PA_39_01	How many times have you been sexually assaulted?	1. 1 time [1] 2. 2 times [2] 3. 3-5 times [3] 4. 6-10 times [4] 5. More than 10 times [5]
PA_40_00	Since you were 18, have you experienced sexual harassment or unwanted sexual contact? This includes incidents where you received unwanted sexual advances, including requests for sexual favors, or verbal or physical sexual behaviors.	1. Yes [1] 2. No [0]
PA_40_01	How often have you experienced sexual harassment or unwanted sexual contact?	1. Almost never [1] 2. Sometimes [2] 3. Often [3] 4. Almost always [4] 5. Always [5]
PA_41_00	Since you were 18, have you wrongfully lost your job? This includes instances where you were fired from work for reasons not related to your own actions.	1. Yes [1] 2. No [0]
PA_41_01	How many times have you wrongfully lost your job?	1. 1 time [1] 2. 2 times [2] 3. 3-5 times [3] 4. 6-10 times [4] 5. More than 10 times [5]
PA_42_00	At any time in your life, have you been arrested?	1. Yes [1] 2. No [0]
PA_42_01	How many times have you been arrested?	1. 1 time [1] 2. 2 times [2] 3. 3-5 times [3] 4. 6-10 times [4] 5. More than 10 times [5]
PA_43_00	Since you were 18, has anyone close to you been arrested?	1. Yes [1] 2. No [0]
PA_43_01	How many people close to you have been arrested?	A. 1 person [1] B. 2 people [2] C. 3-5 people [3] D. 6-10 people [4] E. More than 10 people [5]

PA_44_00	At any time in your life, have you ever been separated from one or more of your children against your will? This includes times when you lost custody or visitation rights, or your child went to jail.	1. Yes [1] 2. No [0]
PA_44_01	How many times have you been separated from one or more of your children against your will?	1. 1 time [1] 2. 2 times [2] 3. 3-5 times [3] 4. 6-10 times [4] 5. More than 10 times [5]
PA_45_00	At any time in your life, have you had to take care of someone with a severe physical or mental handicap for an extended amount of time? This does not include taking care of your child or taking care of someone for your job.	1. Yes [1] 2. No [0]
PA_45_01	How often did you care for someone with a severe physical or mental handicap?	1. Almost never [1] 2. Sometimes [2] 3. Often [3] 4. Almost always [4] 5. Always [5]