LINKS BETWEEN ADULTS' ATTACHMENT STYLES AND THEIR REACTIONS TO AN INDUCED STRESSOR

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Abstract

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Together, stress and social relationships are thought to play key roles in health and development (Keller et al., 2012; Umberson & Montez, 2010). With a greater understanding for how one’s relationship qualities interact with their stress response systems, we may begin to take a more clearly focused approach to mental health treatment. This study examined the differences in stress management using and four-category model of attachment. To date there is limited research examining the links between stress response and the attachment system. The current study assessed both perceived psychological stress and physiological measures of stress exposure in response to a social stressor, utilizing the Trier Social Stress Test (TSST; Kirschbaum et al., 1993) as a means to induce acute social stress within a laboratory setting. The current study furthered past research by exploring the relationship between adult attachment styles (secure, avoidant, anxious and fearful) and stress. Past research has failed to evaluate the fearful attachment style. The results indicated that attachment styles act as either a risk or a protective factor for the stress response, such that participants who were classified as fearfully attached were more likely to have elevated levels of perceived stress (measured
as trait anxiety and acute stress response). The secure and anxiously attached participants had similar levels of perceived stress, raising some questions about the view of an anxious attachment as being a negative quality, or the utility of a secure attachment style for adequate stress management. The avoidantly attached participants had similarly elevated levels of trait anxiety found within the fearful group, suggesting that the avoidant tendency to reject social support may partially explain this poor stress management.
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Introduction

In an age when modern medicine has discovered the cure for many previously fatal diseases, attention has shifted to investigating the common underlying contributors to the development of physical illness. Stress has become one of the key foci of these investigations. Both simple exposure to and perceptions of subjective stress levels are predictors of an increased risk for early mortality (Keller et al., 2012). A similar link has been observed between the quality of one’s social relationships and mortality, as well as other health issues (Umberson & Montez, 2010). Both stress and social relationships are thought to play key roles in health and development (Keller et al., 2012; Umberson & Montez, 2010). With a greater understanding for how one’s relationship qualities interact with their stress response systems, we may begin to take a more clearly focused preventative approach to mental and physical health outcomes.

In light of these issues, in 2007, the American Psychological Association began a Mind/Body campaign with the goal of assessing the nationwide impact of stress. They sampled 2,020 adults, 20% of whom reported their stress levels to be within the “extreme or high” range. Furthermore, within the high stress group, only 17% perceived themselves as effectively managing their stress levels. Among the individuals reporting poor coping mechanisms, 57% perceived their stress levels to be getting worse. Additionally, 53% of those with poor coping mechanisms felt their health care provider offered “little to no support” for stress management, despite high ratings for the importance of stress management discussions. These findings indicate that not only are
adults not receiving adequate help with stress management from their health care providers, only 6% are obtaining professional psychological help (APA, 2013), suggesting a discrepancy between the need for stress management and the provision of professional aid.

This issue becomes more concerning when one considers that high levels of experienced stress can impact one’s physical health (Keller et al., 2012). Stress has also been connected to sleep problems, with college students reporting decreased sleep quality during periods of high stress (Sadeh, Keinan, & Daon, 2004). High levels of stress are associated with poorer sleep quality in addition to fatigue, shorter sleep duration, and increased risk for sleep apnea (Kashani, Eliasson, & Vernalis, 2012). Furthermore, lack of quality sleep may mediate the relationship between high levels of stress and the risk for cardiovascular disease.

Although chronic stress has become a national concern (APA, 2013), stress, per se, is not necessarily detrimental to your mental and physical health. For example, moderate levels of perceived stress provide a stimulus for experience-dependent brain development and adaptation, whereas chronic stress can result in maladaptive brain development in addition to blunted cortisol effects (Ouellet-Morin et al., 2011). Maladaptive brain development does not allow for an individual to readily adjust to environmental demands, which is predictive of increased risk for pathological outcomes such as internalizing and externalizing disorders (Boyce & Ellis, 2005; Juster et al., 2011; Ouellet-Morin et al., 2011). On the extreme end of the spectrum, the experience of an intense stressor has the potential to result in Post Traumatic Stress Disorder (PTSD),
which in turn can have an effect on diurnal cortisol levels (Meewise, Reitsma, De Vries, Gersons & Olff, 2007). Maladaptive stress reactivity has also been linked to depression (Agoston, & Rudolph, 2011). Thus, stress is a complex variable that needs to be studied with sensitivity to context, intensity, and frequency.

When studying stress, important contextual factors to consider are those pertaining to a person’s developmental history, such as their attachment style. For instance, people with insecure attachment styles tend to utilize social support less effectively as a coping mechanism when dealing with stress (Gick & Sirois, 2010; Seiffge-Krenke, 2006). This suggests a need to understand the means by which attachment styles are linked with the stress response system. With this understanding, one’s attachment system could be activated to increase a person’s sense of security for use as an adaptive coping mechanism. This need is further illustrated by the fact that a substantial number of American adults exhibit insecure attachment styles. Mickelson, Kessler, and Shaver (1997) used data from the 1994 National Comorbidity Survey (NCS), utilizing a sample of 8,098 individuals ranging in age from 15-54, identified only 59% of the American population as being securely attached, with 25.2% avoidant, 11.3% anxious, and 4.5% unclassified. This suggests that approximately 40% of the population may be at risk for less effective coping when faced with stressors.

One of the first mechanisms humans develop in order to navigate daily stressors is the attachment bond with their caregiver. Secure attachment is a protective factor, while insecure attachment acts as a risk factor for the development of psychopathology (Dozier, Stoval, & Albus, 1999; Mickelson et al., 1997). John Bowlby (1988) proposed that warm
and responsive parenting is fundamental to forming a secure attachment bond. A caregiver’s own attachment style often has an effect on the manner in which they respond to their child, thereby moderating the type of attachment bond the caregiver develops with the child (Pesonen, Räikkönen, Keltikangas-Järvinen, Strandberg, & Järvenpää, 2002). In this way, parents play a pivotal role in either a child’s development of a protective foundation, or becoming at risk for poor outcomes.

Insecure attachment is associated with various risks; however, it is not the attachment itself that acts on an individual’s health and well-being. The use of maladaptive coping strategies stemming from insecure attachments predisposes individuals to internalizing and externalizing disorders. For example, children will attempt to maximize or minimize their proximity to an attachment figure in response to stressors (Dozier et al., 1999). At the root of both of these responses is the underlying perception of the caregiver’s availability as uncontrollable. When carried into adulthood, these proximity-maximizing strategies may predispose a person to self-blaming cognitions and to internalizing disorders. In contrast, the use of proximity minimizing strategies are associated with hostility to others and externalizing disorders (Dozier et al., 1999). These minimizing and maximizing strategies are synonymous with avoidant and anxious coping mechanisms, respectively, which are assessed in adults by examining their cognitive templates about relationships (internal working models).

Although individuals generally maintain their attachment style from childhood into adulthood, there are exceptions and strategies for change (Mikulincer & Shaver, 2007). One of these strategies, referred to as “security priming,” involves the repeated
activation of a mental representation of one’s attachment figure, making the attachment figure symbolically available. This has been shown to affect an individual’s perception of their current attachment figure (usually a partner or, in younger populations, a caregiver) as more available, thereby increasing the ability to manage stress and reducing the need to employ anxious or avoidant coping mechanisms (Mikulincer & Shaver, 2007).

Additionally, this process is linked to emotional stability, which is a protective factor for mental health outcomes.

The current study examined links between attachment styles and stress reactions. Examining differences in stress responses according to internal working models of attachment may suggest that attachment can act as risk or a protective factor for stress-related outcomes such as psychopathology. The primary goal was to illuminate useful avenues for formulating more targeted prevention and treatment strategies. To date there is limited research examining the links between stress responses and the attachment system. The current study assessed both perceived psychological stress and objective physiological measures of stress exposure in response to an induced social stressor. The links between objective physiological measures and subjective perceived stress measures have not been clearly defined in past literature, which has led to conflicting findings regarding the relationship between these constructs (Ditzen et al., 2008; Murphy et al., 2010).

The literature has addressed stress reactivity within the context of the attachment system; however, many of these studies have focused on child populations (e.g., Nachmias, Gunnar, Mangelsdorf, Parritz, & Buss, 1996). Past research investigating the
associations between attachment styles and physiological stress levels via cortisol responses have utilized the Trier Social Stress Test (TSST; Kirschbaum, Pirke, & Hellhammer, 1993) as a means to induce acute social stress within a laboratory setting e.g., Ditzen et al., 2008). The current study sought to further explore the relationship between adult attachment styles and stress by also utilizing the TSST, self-report measures of trait anxiety and acute stress response, and a more objective physiological measurement of stress, assessed via salivary cortisol. The goal was to clarify the utility of focusing on the attachment system as it pertains to stress reactivity. Ultimately, these findings could provide useful information for the prevention of psychopathology by potentially focusing on the links between attachment security and stress coping mechanisms.

**Review of the Literature**

**Overview.** Stress, originally a term for a force on a material object within the physical sciences, has evolved to be understood as a motivating force, either positively or negatively affecting the mind and body (Selye, 1976). Stress will be conceptualized here in terms of allostatic load. Allostatic load refers to the additive effect of acute stressors (such as adverse childhood experiences), leading up to the experience of perceived stress. Additionally, this concept describes stress in terms of the costs and benefits of the stress response system on the body and mind. Finally, the study of allostatic load evaluates stress via multilevel analysis, its primary strength for use in research on developmental psychopathology (Cicchetti & Toth, 2009). The current study integrated a multilevel analysis of stress by measuring self-perceived trait anxiety and acute stress responses, as
well as salivary cortisol responses to a social stressor induced in the lab, the TSST. For clarity, allostatic load will be discussed differentially as perceived psychological stress (measured as trait anxiety and acute stress response) and objective, physiological stress (measured as salivary cortisol response) throughout the study.

Attachment theory, first proposed by John Bowlby (1988), has received considerable attention within the study of human development and a growing body of literature has expanded on Bowlby’s framework to focus on attachment quality as a component of stress management. A focused area of the attachment literature has concentrated on the relationship between an individual’s attachment style and their response to stress (e.g., Ditzen et al., 2008; Maunder & Hunter, 2001; Nachmias et al., 1996). The available literature reports conflicting findings, largely due to the inclusion of diverse variables of interest, such as social support and coping styles, as well as divergent measures of psychological stress and inconsistently implemented methods of statistical analyses (e.g., Ditzen et al., 2008; Seiffge-Krenke, 2006; Smeets, 2010).

The current study adds to this body of literature by expanding on some of these findings as well as assessing the potential value of examining the links between attachment style and diverse measures of stress. The following literature review will explore our current understanding of the stress response system and the attachment system in addition to the relationship between these systems.

**Stress Response System.** The empirical study of the link between stress and poor mental and physical health outcomes has come about relatively recently. Homeostasis refers to the process by which the body regulates various interactions to optimize mental
and physical functioning. Cannon’s theory of the “fight or flight” response involves the autonomic response to confront or flee from a potential stressor. Together these concepts have informed much of the research on the stress response (Selye, 1976). Since Hans Selye’s work on stress, the literature has begun to focus on the mechanisms of stress in addition to the mental and physical health consequences of chronic stress over the life span. Within this literature, researchers have explored various coping mechanisms and their outcomes (McEwen & Stellar, 1993).

Given the pervasive nature of stress, research on this construct should be conducted with sensitivity to contextual factors. This task can be accomplished by employing a multilevel analysis framework such as that utilized in the study of allostasis and allostatic load (Cicchetti & Toth, 2009). Allostatic load refers to the factors that are linked to physiological dysregulation, whereas allostasis is a broad term used to encompass the mechanisms employed by the body to regain homeostasis. For the purposes of the current study, allostatic load was assessed by the evaluation of acute stress responses, trait anxiety, and a physiological measure of the stress response via salivary cortisol.

The manner in which our stress response system develops is partially experience-dependent. In the earlier stages of life, chronic stress experienced during sensitive periods in development may alter the manner in which the brain develops, a phenomenon referred to as experience-dependent brain development, or biological embedding. Lupien et al. (2011) equated biological embedding with pathological outcomes, although Boyce and Ellis (2005) challenged this view by arguing that the experience of stress on the
developing brain has a curvilinear relationship. For example, lower levels of stress act in a motivational manner whereas higher levels of stress lead to a decline in performance. Using this lens to examine the development of the neural circuitry of the stress response system allows for the understanding of the hypothalamic-pituitary-adrenal (HPA) axis as forming in response to an interaction between early experiences of stress and a genetic predisposition towards high to low reactivity to stress, otherwise discussed as biological sensitivity to context (Boyce & Ellis, 2005). This emphasis on the importance of early experiences highlights the significance of early stage-salient tasks such as attachment.

When an individual perceives a stimulus as stressful, a series of reactions within the HPA axis occur. First, the brain alerts the hypothalamus of the potential danger, resulting in a series of chemical messages (Levine, Zagoory-Sharon, Feldman, Lewis, & Weller, 2007). The hypothalamus secretes corticotrophin-releasing hormone (CRH), signaling the pituitary gland to secrete adrenocorticotropic hormone (ACTH), which in turn signals the adrenal gland to secrete cortisol. Cortisol then binds itself to receptors throughout the body, often within various muscles, with the intention of mobilizing an individual to relocate to a secure location (as in the case of the “flight” response). Finally, negative feedback is employed to suppress the production of the above-mentioned hormones. It is important to note that cortisol is not released solely in the presence of stress, as there are diurnal (daily) cortisol fluctuations, which serve other functions (Levine et al., 2007). When studying cortisol as an indicator of stress, diurnal cortisol fluctuations should be controlled; otherwise, the researcher cannot meaningfully compare results across participants. The current study controlled for diurnal cortisol fluctuations
by assessing participants’ time of waking and scheduling participation during the afternoon (between 12pm and 5pm) when diurnal cortisol fluctuations tend to level out.

Herein lies the “problem” with the stress response system. When potential stressors are perceived as a physical or tangible stimulus, the individual is then highly motivated to flee from the threat, making this an adaptive process. Unfortunately, many of the stressors we experience in our daily lives are psychological in nature. When we identify a psychological threat, the HPA axis is activated, prompting us to prepare for mobilization. Due to a lack of a tangible object from which to flee, this message is ignored and the energy is then expended via emotional responses (Agoston & Rudolph, 2011).

Differential emotional responses occur as a result of individual genetic predispositions to stress reactivity interacting with the accumulation of stressful experiences within a given environment, which form the stress response system. This gene by environment interaction effect may predispose an individual towards pathology or engender resilience (Boyce & Ellis, 2005). For example, depression is linked to maladaptive stress responses in males in the form of anger and aggression, whereas girls are more likely to utilize social support in response to stress (Agoston & Rudolph, 2011). If an individual is unable to utilize social support and thereby regulate their emotional responses to stress, they may attempt to return to homeostasis by expending energy on suppressing emotional cognitions, potentially reaching a stage of exhaustion (Juster et al., 2011).
This progression of events is reminiscent of Hans Selye’s theory of the General Adaptation Syndrome (Selye, 1976). It is not simply the experience of stressors that leads to the development of problems, such as depression and heart disease, but the body’s chemical responses to stressful stimuli interacting with our genetics, early life experiences, personality, environment and health status. Furthermore, those with a secure attachment tend to cope adaptively with stress, as their attachment style allows them to explore their environment further and capitalize on the experience of stress as a protective factor in that it increases resilience to future stressors (Maunder & Hunter, 2001). Finally, social connections have been linked to longer lives and more positive health outcomes (Umberson & Montez, 2010)

The Attachment System’s Underlying Mechanisms. One of the first life experiences, or stage-salient tasks, humans encounter is the formation of an attachment bond with their primary caregiver. Attachment theory (Bowlby, 1988) posits that a secure attachment bond between a primary caregiver and a child facilitates survival by equipping the child with mechanisms that facilitate exploration and the ability to cope with stressors. Bowlby (1988) further theorized that this process develops via the internalization of the child’s attachment style, referred to as a cognitive internal working model.

The activation of these cognitive templates, or internal working models (IWMs), directs our responses to stressors (Bowlby, 1988). This cognitive mechanism is generally seen as adaptive for the child. For instance, if a child’s caregiver is rejecting or cold, the child may internalize negative expectations while developing their IWMs and may adapt
avoidant coping mechanisms in response to stress (Dozier et al., 1999). In the event that an attachment figure is unavailable, either physically or through cognitive representations, one of two primary coping mechanisms is employed. Anxious coping mechanisms increase efforts to activate security-related mental representations. Avoidant coping mechanisms seek to mitigate the aversive experience by shutting down the attachment system (Mikulincer & Shaver, 2007). Past research and theorizing on attachment has rarely examined the potential for an individual to activate a combined anxious and avoidant (i.e., fearful) coping mechanism, which the current study examines. Nevertheless, problems may arise later in life when coping mechanisms associated with generally “insecure” attachment styles lead to ineffectual stress management in contexts outside of the caregiving environment.

Past research has examined the relationship between attachment styles and risk for depression over a 12-month period (Bifulco, Moran, Ball & Bernazzani, 2002). Differences were examined between a community sample of 104 women with difficulties in their social relationships and a comparison group. Among those with interpersonal problems, only 24% were classified as securely attached in contrast to 49% within the comparison group. Those with interpersonal problems were also found to be at a higher risk for depression. Similarly, Agoston and Rudolph (2011) found that healthy relationships acted as a buffer against the risk of depression.

In addition to psychopathology, insecure attachment has been associated with adverse physical health outcomes. For example, among individuals suffering from inflammatory bowel disease, Crohn’s disease and colitis, attachment insecurity was
linked to increased symptom severity (Gick & Sirois, 2010). Maunder and Hunter (2001) formulated three possible pathways to explain this relationship. The first hypothesizes that insecure attachment heightens the perception of threat, prolonging the experience, or undermining the effectiveness of social support. The second pathway utilizes maladaptive coping mechanisms and the third pathway points to a failure to use available protective factors (Maunder & Hunter, 2001). Similarly defined pathways have been studied within the context of the activation of the attachment system. Mikulincer and Shaver (2007) discussed three primary domains for the activation of the attachment system in terms of monitoring and appraisal: identifying potential threats, gauging proximity to an attachment figure, and assessing the accessibility of attachment figures.

The accessibility of these cognitive IWMs is a key component of the attachment system (Bowlby, 1988). Mikulincer and Shaver (2007) proposed that an individual’s perception of their proximity to their attachment figure is gauged in terms of their own attachment style. For example, when one has an insecure attachment style, their IWM of others is cognitively represented as people being “unavailable.” This process has less to do with the physical availability of an attachment figure, but rather with the retrieval of the cognitive template based on previous experiences of availability.

Bartholomew (1990) challenged this idea that cognitive templates develop in response to previous experiences alone. It was theorized that IWMs reflect both the view of the self as well as the other, and that these views can be either negative (e.g., self as unworthy and other as unavailable) or positive (e.g., self as deserving of love and other as trustworthy). These conceptualizations can then be transferred into four categories of
IWMs. Later, Bartholomew and Horowitz (1991) defined these combinations in terms of four attachment styles: secure, preoccupied (i.e., anxious), fearful, and dismissing (i.e., avoidant). Secure individuals tend to view themselves as worthy of love and view others as supportive and available, resulting in characteristic contentment with intimacy and autonomy. Preoccupied individuals tend to require the approval and acceptance of others while maintaining a negative view of the self. Dismissing individuals view the self as autonomous while minimizing the need for closeness with others. Finally, fearful individuals struggle with both a negative view of the self (i.e., expectations of rejection) while perceiving others as unavailable and untrustworthy (Bartholomew and Horowitz, 1991). These four categories closely mirror the combinations of the more widely examined dimensions of anxious and avoidant attachment. For example, those who are both low on attachment anxiety and avoidance are understood to be secure. Individuals high on anxiety, but not avoidance, are considered to be anxiously attached and vice versa for avoidant attachment. The less understood category of fearful is defined as being both high in attachment avoidance and anxiety. The current study is among the first to examine this latter category in relation to trait anxiety, acute stress responses, and changes in cortisol after an induced stressor.

Past research has frequently used a simpler three-category conceptualization, often utilizing the Adult Attachment Interview (AAI). For instance, a longitudinal study with a sample of 112 adolescents assessed adolescents’ responses to social stressors within parenting and peer-group contexts over a seven-year period into emerging adulthood (Seiffge-Krenke, 2006). IWMs were measured at age 21 with the AAI. The
results indicated that the primary appraisal of stress was dependent on the security of their internal working models of attachment, such that those exhibiting higher levels of stress were more likely to concurrently have insecure internal working models (e.g., generally avoidant or anxious). This relationship was particularly clear when stress was due to a parental conflict, presumably because participants were utilizing their parents as their primary attachment figures, making it harder to access them as a psychological support when compared to a peer-conflict context (Seiffge-Krenke, 2006). These results indicate the important role parents play in the formation and later utility of the attachment system under stress. However, it was merely assumed that the participants in this study were activating their attachment systems, as this was not directly assessed.

Mikulincer, Gillath, and Shaver (2002) more specifically investigated the activation of the attachment system through cognitive IMWs of attachment figures with a sample of 42 adults via a computerized lexical decision task. After having been primed with neutral or threatening stimuli, participants’ reaction times to self-chosen names of attachment figures were compared to reaction times to friendly acquaintances. Faster reaction times to attachment figures were observed when the participant was primed with the threat condition. This finding implies that when threatened, or stressed, participants’ attachment systems are activated in an attempt to alleviate stress by seeking emotional support via their IWMs. The success of this coping mechanism is greater when their attachments are secure.

People with avoidant attachment styles tend to minimize the effects of stressors in their lives as well as downplaying the need for social support (Seiffge-Krenke, 2006).
This tendency supports the theory that insecure attachment styles form as an adaptive response to aversive parenting, despite the associated risk for later pathology in adulthood. When contemplating this shift from an adaptive development stemming from the infant-caregiver environment to later maladaptive coping in adulthood, it is important to understand that insecure attachment styles do not cause pathological outcomes, but are merely indicators of tendencies and expectations that influence reactivity to a variety of genetic and environmental influences, such as stress (Sroufe, Carlson, Levy, & Egeland, 1999). These tendencies and expectations can be understood in terms of how an individual activates their attachment system based on their IWMs of attachment.

Although attachment styles have the potential to change (Mikulincer & Shaver, 2007), this is generally understood as the exception to the rule. Bowlby (1988) theorized that this continuity is a function of an unconscious self-confirmatory selection of later attachment figures that mirror the internal representations formed in response to early experiences. This phenomenon has been observed in participants who displayed higher levels of anxiety and avoidance (i.e., insecure attachment) throughout their lifespan (Brooks, Robles, & Schetter, 2011). These participants are more likely to choose partners with similar scores for anxiety and avoidance, thereby perpetuating the attachment style formed with their caregiver.

**Links Between the Attachment and Stress Response Systems.** People with secure attachments are better able to activate the attachment system in order to cope with stress. For example, one seven year-long longitudinal study examined coping styles, such as active coping (problem-focused attempts such as support-seeking) and cognitive
coping (reflection about the problem) in response to stressors (Seiffge-Krenke, 2006). The secure attachment group effectively used support-seeking and active coping to reduce stress. The avoidant attachment group experienced similar stress levels to the secure attachment group, but did not employ active coping or support-seeking. This group attempted cognitive coping, but with little success in reducing stress. The anxious attachment group had high levels of stress and social withdrawal. They consistently attempted active coping but were unable to benefit from this adaptive coping style and were consistently disappointed with the results (Seiffge-Krenke, 2006). Overall, insecure attachment was related to a diminished ability to benefit from adaptive coping strategies.

In support of Seiffge-Krenke (2006), Ditzen et al. (2008) observed similar barriers to benefiting from adaptive coping (i.e. social support-seeking) among participants with insecure attachments. A sample of 63 married or cohabiting adult males was randomly assigned to either arrive at a lab alone or with their significant other. This random assignment was intended to create two groups: a social support group and a control group. All participants were exposed to the Trier Social Stress Test (TSST). Stress was evaluated with both psychological and physiological (i.e. cortisol) measures of stress. Interestingly, the results indicated that the groups did not differ in their perception of available social support, despite the fact that those with social support and secure attachments had the lowest cortisol response of all groups (Ditzen et al., 2008). These results indicate that regardless of perceived available social support, those with insecure attachments may be less likely to benefit from available social support.
In this study, the measures of perceived acute stress response and the objective physiological measure of stress (cortisol) were not correlated with each other (Ditzen et al., 2008). However, when attachment dimensions (generally anxious or avoidant) were included, this was found to be due to different results for anxious and avoidant attachment as measured by the revised version of the Experiences in Close Relationships scale (ECR-R; Fraley, Waller, & Brennan, 2000). For those high in avoidance there was no significant relationship between perceived stress and objectively measured physiological stress. However, those low in avoidance exhibited a significant relationship between the psychological and physiological measures of stress. Neither the low nor high anxious groups showed a relationship between the two measures of stress (Ditzen et al., 2008). This discontinuity between participants’ perception of their acute stress response and their objectively measured physiological stress response may indicate that attachment style is linked to cortisol response, but does not necessarily influence subjective perceptions of stress. Alternatively, these results may have been an artifact of the use of a dimensional model of attachment, such that we cannot know whether those who were low in attachment avoidance were similarly low in attachment anxiety (i.e., were actually secure) or were high in attachment anxiety. This creates confusion not only within the statistical analyses, but also for meaningful interpretation. Thus the current study utilized the four-category model of attachment to tease apart unique possible connections between different measures of stress and attachment IWMs. It is noteworthy that Ditzen et al. (2008) only examined these links in men.
Another study utilized a sample of both men and women. Smeets (2010) investigated the parallel functioning of the attachment system and the stress response system using a sample of 34 males and 34 females. As in the Ditzen et al. (2008) study, stress was induced using the TSST. However, adult attachment was measured using the Experiences in Close Relationships scale (ECR; Brennan, Clark, & Shaver, 1998) as opposed to the revised version (i.e., the ECR-R) used in the Ditzen et al. (2008) study. Physiological stress was measured using salivary cortisol levels as well as heart rate. Psychological stress was measured as state negative affect with a subscale of the Positive and Negative Affect Scale (PANAS; Watson, Clark, & Tellegen, 1988), which was designed as a mood scale. However, past literature (e.g., Ditzen et al., 2008) has predominantly made use of the State-Trait Anxiety Inventory (STAI; Speilberger, Gorusch, & Lushene, 1983), which is designed to measure subjective perceptions of one’s anxiety on a daily basis in addition to their perception of anxiety resulting from an acute stressor. The STAI defines anxiety as feelings of fear, worry and stress.

In a study that evaluated the psychometric properties of the PANAS, it was found that the negative affect subscale was moderately correlated with the state anxiety subscale of the STAI \( r = .51; \) significance value was not provided). Additionally, the creators of the PANAS indicated that only a handful of the items were similar to those from the STAI (Watson et al., 1988). Together, this indicates that there is some overlap between the constructs of negative affect and perceived stress; however, the negative affect subscale of the PANAS is measuring more general negative mood states that are not
directly related to anxiety or stress, calling into question the validity of this scale for measuring psychological stress.

These methods of measurement may have had an impact on the results. The main finding for this study was that baseline vagal tone (the activity of the vagal nerve which is responsible for homeostasis and emotion regulation) had a larger association with the stress response than attachment did. However, baseline vagal tone is largely influenced by early life experiences connected to parenting (Diamond, Fagundes, & Butterworth, 2012), the same influences on the development of attachment. In fact, low vagal tone and insecure attachment together are associated with deficits in the ability to feel empathy (Diamond, et al., 2012). It is interesting that Smeets (2010) did not find an association between different attachment styles and cortisol reactions to the TSST because attachment and vagal tone appear to be closely related. Smeets conjectured that these findings could be explained by the use of a non-attachment related induced stressor. In other words, the attachment system was not activated in the presence of a social stressor (the TSST) so this was hypothesized to be less threatening to the individuals’ close relationships. This would suggest that the attachment system is less important for managing general life stressors not connected to intimate social problems.

Smeets’ conjecture that social stressors may not activate the attachment system when compared to attachment-related threats has been investigated elsewhere (Mikulincer, Gillath, & Shaver, 2002; Quirin, Pruessner, & Kuhl, 2007). Mikulincer et al. (2002) conducted two studies in which comparisons between social threats and attachment threats were assessed. Response times to attachment figures (via self-selected
names of attachment figures) following a threat prime were measured. The threat primes were chosen to represent either a social threat, via the word “failure,” in study 1 and an attachment threat, via the word “separation,” in study 2. Anxious attachment predicted faster reaction times to attachment figures in both the attachment threat and social threat conditions. Alternatively, avoidant attachment was associated with faster reaction times for only the attachment-related prime (Mikulincer et al., 2002). These results further support the findings from Ditzen et al. (2008) as well as the assertion that different responses to stressors are found for different attachment styles, such that avoidantly attached individuals may suppress their stress response in social situations. The results from the Mikulincer et al., (2002) study also suggests that the results from the Smeets (2010) article may not have been due to a lack of activation of the attachment system in the context of a general social stressor (TSST), but instead due to their neglecting to analyze the attachment styles separately. Hence, these results suggest the importance of evaluating attachment with a four-category model, particularly as the fearful attachment style has not been adequately assessed in past work.

Another study also supported the assertion that different attachment styles are associated with different responses to stressors. This study, utilizing a sample of 45 young adult women, found that cortisol elevations in response to an auditory stressor were related to attachment anxiety but not to attachment avoidance (Quirin et al., 2007). Anxiously attached individuals may experience an increase in HPA axis responses to stressors, leading to cortisol peaks, as opposed to individuals high in avoidance, who may experience a shutting down of the HPA axis, and who therefore may be less likely to
exhibit a relationship between high avoidance and elevated cortisol. Taken together, the results from Ditzen et al. (2008), Mikulincer et al. (2002) and Quirin et al. (2007) indicate that there are divergent patterns of attachment activation in the presence of stressors that are not well understood. Furthermore, the relatively unexplored category of fearful attachment merits further investigation.

Whereas the Ditzen et al. (2008) and Quiren et al. (2007) studies utilized homogeneous samples of males or females, respectively, the current study included both men and women. Smeets (2010) controlled for sex as a covariate in the analysis due to differential effects of hormones on diurnal cortisol between the sexes. Unfortunately, the current study was unable to analyze cortisol separately for each sex due to small sample size. However, there was no significant difference in cortisol levels between men and women so results are reported on the whole sample. It should be noted, however, that five female participants’ cortisol concentrations were unreadable; therefore these data were excluded from the analyses examining cortisol.

In the Smeets (2010) study, the use of the ECR and the PANAS was at odds with the measures used in other related studies (e.g., Ditzen et al., 2008). The current study measured attachment with the revised version of the Experiences in Close Relationships scale (ECR-R; Fraley et al., 2000) as well as measuring the perceived acute stress response and trait anxiety with the STAI. The ECR-R is a newer scale and is widely used in measuring self-reported adult attachment. The current study used a median split to create combinations of highs and lows for each dimension (anxiety and avoidance) with the ECR-R to create the four-category model of attachment, as has been done in previous
work (Ditzen et al., 2008). The STAI was chosen to measure psychological stress, as it is a more direct measure of perceived stress than the PANAS.

**The Current Study**

The goal of this study was to clarify the utility of assessing and perhaps activating the attachment system after experiencing stress, as well as illuminating a better understanding of the unique responses to stress between anxious, avoidant, secure, and fearful attachment styles. The links between objectively measured physiological stress and perceived acute stress responses have not been clearly explicated in past literature, which has led to findings suggesting that these responses are independent of each other (Ditzen et al., 2008; Murphy, Denis, Ward, & Tartar, 2010). The findings from this study may help to illuminate important information for promoting resilience in the face of stress and ultimately suggest a preventative approach to illness by emphasizing the development of secure attachments in childhood intervention programs. Furthermore, understanding the links between attachment styles and the stress response system could be beneficial for devising specific treatment plans. For example, those with avoidant attachment styles might benefit from alternate coping methods that do not rely on social support, or they may develop unique skills to override the barriers to support seeking.

**Primary Research Questions.** Given the reviewed literature, the following research questions and hypotheses were generated:

Previous research has observed the activation of the attachment system in response to a threat, the success of which is most pronounced for those with secure attachments
(Mikulincer et al., 2002). Furthermore, research investigating the relationship between both subjective psychological and objective physiological measures of stress has found a weak relationship between these two measures of stress (Ditzen et al., 2008). However, this may vary by attachment classification. For example, there was a significant relationship between the acute stress response and salivary cortisol change for those low in avoidance, but not for others (Ditzen et al., 2008).

Finally, Mikulincer et al. (2002) and Quirin et al. (2007) discovered that only those with anxious attachment styles showed increases in cortisol with a non-attachment related stressor (i.e. social threat or auditory stressor). Additionally, those with avoidant attachments have been found to minimize the effects of stressors, such that these participants had similar cortisol levels to those in the securely attached group (Seiffge-Krenke, 2006). Alternatively, those high in anxiety reported high levels of stress despite actively trying to engage in coping strategies.

Primary Research Question 1. The two measures of stress (cortisol versus perceived acute stress response) were hypothesized to have differential relationships with the attachment categories, such that those with an avoidant attachment style were not expected to activate their attachment system to modulate their stress, resulting in a lower increase in salivary cortisol response. This is not expected to hold true for the perceived acute stress response or the trait anxiety measure. Thus, the possible differences in perceived stress (defined as trait anxiety and acute stress response) by attachment category was investigated, but no directional predictions were made.
Hypothesis 1. It was hypothesized that those with an avoidant attachment style (high in avoidance and low in anxiety) would have a less pronounced increase in salivary cortisol levels compared to anxiously attached participants. Because it is unclear whether secure attachment or avoidant attachment would have the lowest increase in salivary cortisol response, no predictions were made for this relationship.

Hypothesis 2. It was hypothesized that anxiously attached participants (determined by high scores on anxiety and low scores on avoidance) would have a greater increase in salivary cortisol response to the TSST compared to securely attached participants (i.e., low in both anxious and avoidant attachment).

Primary Research Question 2. As the literature has not addressed the fearful attachment style (high in both anxiety and avoidance), an exploratory approach was taken with this category, simply examining its links to change in salivary cortisol concentrations.

Secondary Research Questions. Secondary Research Question 1. Past research has indicated that women (in comparison to men) tend to have increased perceived stress in response to the TSST, but do not exhibit physiological cortisol differences (Smeets, 2010). Thus, sex differences in cortisol change were explored; however, no specific predictions were made.

Secondary Research Question 2. Ditzen et al. (2008) utilized only a sample of men in heterosexual relationships to investigate the relationship between attachment and perceived stress and physiological stress. The current study explored the possible differences in perceived and physiological stress between those who reported being in
committed relationships and those who reported being single. No specific predictions were made.

Secondary Research Question 3. Past research has evaluated the connection between attachment (measured with the AAI) and adverse childhood experiences (ACEs) in a sample of women (Murphy et al., 2014). The authors chose to focus on the prevalence of the unresolved or unclassified attachment style (versus secure, avoidant and anxious) in relation to number of ACEs experienced. Results indicated that among those who had experienced four or more ACEs, 65% were classified as unresolved or unclassified. Another study also found a disproportionate number of participants classified as unresolved within a sample of sexually abused women (Pierrehumbert et al., 2009). Thus, the current study will take an exploratory approach to identifying differences in ACEs by attachment.
Method

Participants

A convenience sample of 32 students was recruited through an online program, Sona-systems, via a university website. Extra credit points in various courses were awarded for participation. Sixty-three percent of the participants were female. The participants ranged in age from 18-30 and were predominantly heterosexual (80%, $n = 24$) and White/European-American (56.7%, $n = 17$). Class identity was determined by self-reporting on five categories ranging from “below poverty line” to “upper class.” Self-identification by class identity was utilized, as monetary categories can be subject to historical and geographical origin differences (Krieger, Williams, & Moss, 1997). No participants self-reported as upper class, thus this category was excluded.

A survey consisting of basic demographic information included age, sex, relationship status, sexual orientation, time of waking, food consumption, alcohol consumption, nicotine consumption, and body mass index (BMI). These variables were chosen based on importance in past research regarding attachment and cortisol collection (e.g., Ditzen, et al., 2008; Nachmias, et al., 1996). See this survey in Appendix A. See Table 1 for general demographics and Table 2 for means and standard deviations for cortisol-related variables.
Table 1

Participant Demographics

<table>
<thead>
<tr>
<th>Variable</th>
<th>(N = 32)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>21</td>
<td>65.6</td>
</tr>
<tr>
<td>Male</td>
<td>11</td>
<td>34.4</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-20</td>
<td>18</td>
<td>56.4</td>
</tr>
<tr>
<td>21-25</td>
<td>20</td>
<td>37.4</td>
</tr>
<tr>
<td>26-30</td>
<td>2</td>
<td>6.2</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White/European-American</td>
<td>17</td>
<td>53.1</td>
</tr>
<tr>
<td>Latina/Latino</td>
<td>7</td>
<td>21.9</td>
</tr>
<tr>
<td>Mixed ethnicity</td>
<td>6</td>
<td>18.8</td>
</tr>
<tr>
<td>Declined to state</td>
<td>1</td>
<td>3.1</td>
</tr>
<tr>
<td>Class Identity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Below the poverty line</td>
<td>4</td>
<td>12.5</td>
</tr>
<tr>
<td>Working class</td>
<td>10</td>
<td>31.3</td>
</tr>
<tr>
<td>Lower middle class</td>
<td>12</td>
<td>37.5</td>
</tr>
<tr>
<td>Upper middle class</td>
<td>6</td>
<td>18.8</td>
</tr>
<tr>
<td>Variable</td>
<td>( N = 32 )</td>
<td>( n )</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>--------------</td>
<td>--------</td>
</tr>
<tr>
<td><strong>Relationship Status</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>21</td>
<td>65.6</td>
</tr>
<tr>
<td>In a relationship</td>
<td>11</td>
<td>34.4</td>
</tr>
<tr>
<td><strong>Sexual Orientation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heterosexual</td>
<td>26</td>
<td>81.2</td>
</tr>
<tr>
<td>Bisexual</td>
<td>5</td>
<td>15.6</td>
</tr>
<tr>
<td>Asexual</td>
<td>1</td>
<td>3.1</td>
</tr>
<tr>
<td><strong>Body Mass Index (BMI)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>14</td>
<td>48.3</td>
</tr>
<tr>
<td>Overweight</td>
<td>8</td>
<td>27.6</td>
</tr>
<tr>
<td>Obese</td>
<td>7</td>
<td>24.1</td>
</tr>
</tbody>
</table>
Additionally, a shortened version of the Kaiser Permanente health providers Adverse Childhood Experiences (ACEs; Felitti et al., 1998) intake form (Family Health History; http://www.cdc.gov/ace/questionnaires.htm) was included in the demographics questionnaire. The ACEs assesses adverse childhood experiences such as growing up with incarcerated or alcoholic parents. The current study summed all ACEs for a Total ACEs score. A recent study (Howe & Friedman, 2014) found a Chronbach’s alpha reliability of .75 for this measure. The current study had an internal consistency of .42. See this measure in Appendix A (beginning after item number 16). See Table 3 for means, standard deviations, and ranges for all measures.
Table 3

*Means, Standard Deviations and Ranges for Additional Demographics*

<table>
<thead>
<tr>
<th>Variables</th>
<th>M</th>
<th>SD</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waking Time</td>
<td>8:32 AM</td>
<td>1.63*</td>
<td>4:30 AM - 12 PM</td>
</tr>
<tr>
<td>Hours since last consumed food</td>
<td>4.40</td>
<td>3.87</td>
<td>1 - 16</td>
</tr>
<tr>
<td>Days since last alcoholic beverage</td>
<td>3.33</td>
<td>3.75</td>
<td>1 - 6940</td>
</tr>
<tr>
<td>Hours since last cigarette/other</td>
<td>2.07</td>
<td>6.88</td>
<td>1 - 360</td>
</tr>
<tr>
<td>BMI</td>
<td>26.43</td>
<td>5.67</td>
<td>20 - 46</td>
</tr>
</tbody>
</table>

*Note.* * Value represents hours
Past research has found an association between increased body mass index (BMI) and lower waking cortisol as well as early drop off in diurnal cortisol fluctuations (Champaneri et al., 2013). The World Health Organization’s four BMI categories were used to disaggregate the data into underweight, average, overweight and obese (WHO, 2000). There were no participants that fit the underweight category. An ANOVA determined that there were no statistical differences in cortisol response by BMI categories, \(F(2, 21) = 2.37, p = .12, \eta_p^2 = .18\). However, this result should be interpreted with caution as the sample is small and the means indicate that the overweight group \((n = 8; M = -.02, SD = .08)\) showed a reduction in cortisol after an induced stressor, whereas the average group \((n = 14; M = .10, SD = .16)\) and the obese group \((n = 7; M = .09, SD = .08)\) were roughly equal in their cortisol change. The current study did not include BMI in further analyses due to the conflicting results between the overweight and obese categories and the restrictions in sample size.
Table 4

*Means and Standard Deviations for Measured Variables*

<table>
<thead>
<tr>
<th>Measures</th>
<th>M</th>
<th>SD</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACEs Total</td>
<td>3.78</td>
<td>1.75</td>
<td>1 - 8</td>
</tr>
<tr>
<td>Trait Anxiety</td>
<td>43.66</td>
<td>10.57</td>
<td>64 - 80</td>
</tr>
<tr>
<td>Acute Stress Response</td>
<td>55.67</td>
<td>12.22</td>
<td>34 - 80</td>
</tr>
<tr>
<td>Baseline Cortisol*</td>
<td>0.12</td>
<td>0.12</td>
<td>0.01 - 0.42</td>
</tr>
<tr>
<td>Response Cortisol*</td>
<td>0.19</td>
<td>0.16</td>
<td>0.01 - 0.65</td>
</tr>
</tbody>
</table>

*Note.* * Values are measured in microgram/deciliters (µg/dL)
There were no significant gender or relationship status differences for the variables of interest: trait anxiety, acute stress response, adverse childhood experiences (ACEs), or change in salivary cortisol concentrations. Furthermore, a one-way ANOVA did not indicate any significant differences in total ACEs by attachment style. The study lacked power to detect such differences due to small sample. Thus, gender, relationship status and adverse childhood experiences were not further investigated to address the proposed secondary research questions.

Two participants declined to complete the TSST protocol and five participants had unreadable cortisol levels. Thus, a final sample of 25 was used in the cortisol analyses, a sample of 30 was used to examine acute perceived stress response, and the full sample of 32 was used to examine trait anxiety.

**Measures**

**Experiences in Close Relationships Scale-Revised (ECR-R).** The ECR-R is a 36-item self-report scale that measures internal working models of attachment anxiety and avoidance (Fraley et al., 2000). This scale has been utilized in several studies measuring cortisol and attachment (e.g., Ditzen et al., 2008; Mikulincer, Gillath, & Shaver, 2002). Item responses are rated on a scale from 1 (*strongly disagree*) to 7 (*strongly agree*). A sample item from the anxiety subscale is “I’m afraid that I will lose my partner’s love.” A sample item from the avoidant subscale is; “I am nervous when partners get too close to me.” Higher scores on the subscales indicate insecure attachment whereas low levels indicate a secure attachment. See this measure in Appendix B.
The attachment categories (anxious, avoidant, secure, and fearful) were created by dividing the attachment dimensions into high versus low using a median split, in accordance with past research (Ditzen et al., 2008). These were then used to create a high anxious/low avoidant, or anxious, category; a low anxious/high avoidant, or avoidant, category; a low anxious/low avoidant, or secure, category; and finally, a high anxious/high avoidant, or fearful, category.

Reliability and validity for the ECR-R were demonstrated with a sample of 172 college students (Sibley, Fischer, & Liu, 2005). Internal consistency (Chronbach’s alpha) were .94 for the avoidance subscale and .93 for the anxiety subscale. With the current sample $\alpha = .95$ for the avoidance subscale and $\alpha = .91$ for the anxiety subscale. Test-retest reliability, demonstrated over three weeks, was good for both avoidance ($r = .92, p < .05$) and anxiety ($r = .90, p < .05$; Sibley et al., 2005). The ECR-R demonstrated convergent and discriminant validity by predicting social interactions with one’s romantic partner above and beyond interactions with friends and family. Finally, a factor analysis indicated that the dimensions of avoidance and anxiety are two distinct constructs.

**State-Trait Anxiety Inventory (STAI).** The STAI is a 40-item scale comprised of two subscales, one for state anxiety (STAI-S), evaluating the acute stress response one has about a particular situation, and one for generalized trait anxiety (STAI-T), evaluating the general feelings of anxiety on a daily basis (Speilberger et al., 1983). Each subscale is comprised of 20 items with a four-point response format, 1 (*almost never*) to 4 (*almost always*). The acute stress response subscale asks participants to answer questions, such as “I feel strained,” in response to a particular situation (or current moment). The trait
subscale asks participants to answer questions, such as “I feel nervous and restless,” in response to general day-to-day feelings. Total scores for each subscale range from 20-80. See this inventory in Appendix C.

The STAI has demonstrated good internal reliability. Internal consistency coefficients for the STAI-S and STAI-T ranged from $\alpha = .83$ to .95 among a range of samples (Speilberger, 1983). With the current sample, the STAI-S had a Cronbach’s alpha of .93 and .92 for the STAI-T. Test-retest reliability was established with a sample of college students in three time intervals: one hour, 20 days and 104 days. Stability coefficients for the STAI-T ranged from .73 to .86. Convergent validity was established with the Beck Depression Inventory (BDI), and the subscales of the Minnesota Multiphasic Personality Inventory (MMPI) were used to demonstrate divergent validity (Speilberger, 1983).

**The Trier Social Stress Test (TSST).** Stress was induced in a laboratory setting using the TSST (Kirschbaum et al., 1993). In the past, this test has been performed with a panel of three confederates acting as judges. The current study employed two judges and participants were told that two video cameras were recording them. The TSST begins with a 10-minute anticipatory period in which participants are instructed to prepare a speech for performance in front of the confederates. This anticipatory period is assumed to be critical to the inducement of stress, especially because social performance tends to have a negative effect on self-esteem and a resulting increase in cortisol (Gruenewald, Kemeny, Aziz & Fahey, 2004). In the current study, the speech lasted five minutes, followed by five minutes of mental arithmetic. The mental arithmetic task involved
beginning at 1,022 and consecutively subtracting 13. The entirety of the TSST lasted 20 minutes. Kirschbaum et al., (1993) reported that the highest concentration of salivary cortisol was observed 10 minutes upon termination of the TSST. Thus, the post measure of cortisol was collected at this time. The TSST has been shown to reliably increase salivary cortisol concentration two- to fourfold across five discrete studies (Kirschbaum et al., 1993).

**Endocrine Measure of Stress.** The Salimetrics high sensitivity salivary cortisol enzyme immunoassay kit (2010) was used to measure physiological stress. Two saliva samples were collected; once upon arrival to the lab as a baseline and again 10 minutes after completion of the TSST and the STAI-S. Saliva samples were stored and frozen at -20°C within 30 minutes of collection to prevent the growth of bacteria as well as serving the function of precipitating the glycoprotein constituents of the mucus. When ready for analysis, the samples were thawed to room temperature and centrifuged for 15 minutes at 3000 rpm. Samples with visible particulate matter were excluded from further assaying procedures as this can affect antibody binding, resulting in falsely elevated readings. The saliva samples were then assayed in duplicate and the average concentrations between duplicates were evaluated with the Salimetrics software and plate-reader (Salimetrics, 2010). In order to calculate the concentrations derived from the data provided by the plate-reader, MyAssays Analysis Software Solutions (www.myassays.com) was used. The resulting cortisol concentrations were used to derive a “salivary cortisol change” variable (also referred to as response cortisol concentration) by calculating the difference between the pre and post measures.
**Procedure**

Participants were required to abstain from consuming food or beverages other than water 60 minutes prior to participation, in addition to not consuming alcohol within 12 hours of participation. Reminder emails regarding the time of the study as well as the special instructions were sent out to registered prospective participants 24 hours prior to the appointed time slots. All participants reported that they complied with these instructions. Upon arrival, participants were greeted and informed about the basic procedures of the study. Participants were allowed a five-minute grace period; one participant arriving after the grace period was unable to participate due to the time constraints of the study. This requirement was also included in the reminder email.

The researcher conducting the session informed the participants that saliva samples were being collected to determine salivary biomarkers of oral health with the goal of discovering whether oral hygiene was related to communication and interpersonal skills. They were informed that the study would begin with a resting period and were provided with bland reading material. The first of two saliva samples was collected 15 to 20 minutes after the participant arrived at the lab. This timing was important to ensure the baseline cortisol concentration was reflective of the physiological stress of the participant when they arrived as opposed to due to prior experiences. The use of bland reading material (e.g., Eating Well Magazine) was also important as this ensured that any elevated cortisol levels were in response to the TSST. Direct salivation into the collection tubes was performed instead of the use of cotton swabs, due to a trial test performed by
the author and another student working with the Salimetrics kit. It was found that the swab samples did not contain enough saliva to determine a valid measure of cortisol concentration. The initial salivary cortisol assay was analyzed as a baseline and the second saliva indicated the peak cortisol response to the TSST.

Following the initial salivary sample collection, participants were provided with and completed the pen-and-paper measures in the main lab room. The measures in each protocol consisted of the demographics survey, the ECR-R, and the STAI-T. These measures were administered in a counterbalanced, randomized order for each participant.

Upon completion of the pen-and-paper measures, participants began the TSST. The primary research assistant for that session led them into an adjacent lab room (the “testing room”) and informed them that they were to take 10 minutes to prepare a speech for a hypothetical job interview which they must deliver in front of two judges scoring them on their competency, believability, and authenticity, as well as how they compared to all other participants. They were also told that two video cameras were recording their responses, which were to be reviewed by the judges for content and non-verbal behavior.

Upon completion of the instructions, the primary researcher guided the participant back into the main lab room, provided them with a note pad and pen, set a timer for 10 minutes and indicated they should begin to prepare. After 10 minutes had passed, the primary researcher collected the note pad and timer, and guided them back into the testing room. One confederate was designated to lead this portion of the study and would inform the participant to begin their speech while the other confederate set the timer and took notes. The speech itself took five minutes to complete. The research assistants were
trained to not make any comments or facial expressions in response to the participants’ performance, unless they finished with extra time, wherein they requested that the participant continue for the remainder of the five minutes. Once the interview stage was completed, participants were instructed to perform a mental arithmetic task for an additional five minutes, counting backwards from 1,022 by increments of 13. The leading confederate would ask the participant to start over at every mistake made.

In case there were adverse responses (i.e., excessive symptoms of anxiety such as shaking, crying or fainting), the leading confederate was trained to ask the participant if they felt okay to continue. If and when the participant was not able to continue, the session was immediately terminated and the participant was debriefed. There were two such reactions. Both participants indicated that they previously suffered from anxiety. One participant exited the lab immediately due to feelings of faintness. They were contacted by email and provided with the debriefing information (e.g., they were not being recorded or scored and their performance was not going to be compared to other participants and they would still receive the promised participation points) as well as directed to free counseling services. This participant indicated that they were currently being treated for anxiety. The other participant was struggling to find someone to treat their anxiety and the author directed them to the on-campus counseling services after being debriefed. All other participants completed the TSST without incident.

After the TSST was completed, the participants returned to the original lab room and were asked to complete the STAI-S in light of their experience with the TSST. The STAI-S took about five minutes to complete, allowing for another five minutes for the
participants’ cortisol levels to decline. Ten minutes after the completion of the TSST past, participants were asked to provide the second saliva sample.

Once all saliva samples were collected and questionnaires completed, the participants were debriefed about the study’s true purpose. As a gesture of gratitude for participating and adhering to the food and drink requirements, incentive snacks were provided during the debriefing stage. Total time for the study was 90 minutes.
Results

Probably due to low power resulting from small sample size, analyses of the secondary research questions regarding differences in the stress measures by gender and relationship status were all non-significant and will not be discussed further here. Similarly, evaluation of differences in total ACEs by attachment styles was also non-significant and will not be discussed further.

Descriptive Results

Pearson’s product moment correlation coefficients were calculated for all continuous variables (trait anxiety, perceived acute stress, salivary cortisol change, and ACEs total). None of these relationships were significant except for a marginally significant ($p < .10$) relationship between trait anxiety and salivary cortisol change. There was a negative relationship between trait anxiety and salivary cortisol change after the TSST, such that those with increased levels of general stress were more likely to have a reduction in their cortisol following the induced stressor. See Table 4 for correlation matrix.
Table 5

*Intercorrelations Among Key Study Variables*

<table>
<thead>
<tr>
<th>Variables</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Trait Anxiety</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Perceived Stress</td>
<td>0.20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Salivary Cortisol Change</td>
<td>-0.34*</td>
<td>-0.23</td>
<td></td>
</tr>
<tr>
<td>4. ACEs Total</td>
<td>0.25</td>
<td>0.26</td>
<td>-0.12</td>
</tr>
</tbody>
</table>

*Note.* Ns range from 25 to 32 due to missing data.

* p < .10
Evaluating Links between Attachment and Stress Response

One-way ANOVA analyzed perceived acute stress (following the TSST) as well as perceived general trait anxiety. The assumption of normality of the dependent variables and homogeneity of variance for ANOVA were examined. Normality was determined using the ratio of skew to standard error and ratio of kurtosis to standard error for both trait anxiety and perceived acute stress response. The ratios for skew and kurtosis for both variables were below the 3:1 ratio, thus the assumption was met. The ratios of variance as well as sample sizes were used to determine homogeneity of variance. The variance ratio was 3.7:1 and 3.2:1 for each analysis, which was below the 10:1 ratio guideline (Tabachnik & Fidell, 2001). The sample size ratio was 2.2:1 and 2:1 which is less than 4:1 (Tabachnik & Fidell, 2001), indicating that the assumption was met. Due to the small sample size, meaningful results can occur with marginal significance with $p < .10$. Thus, analyses with a significance value of $p < .10$ will be discussed.

Differences in trait anxiety levels were evaluated by attachment categories. There were significant differences by attachment, $F(3, 28) = 5.03, p < .01, \eta^2_p = .35$. The magnitude of this effect size indicates that a person’s attachment style is useful for explaining differences in trait anxiety. Tukey tests, shown in Table 5, demonstrate that the fearful participants reported the highest levels of trait anxiety compared to the securely attached participants. Marginally significant differences were found between the fearful and anxious attachment groups ($p = .06$) and between the avoidant and securely...
attached groups ($p = .09$). These results suggest that avoidant and fearfully attached participants are generally experiencing greater anxiety on a daily basis, compared to the anxious and securely attached participants.
Table 6

Means and (SD) for Trait Anxiety and Acute Stress Response across Attachment Styles

<table>
<thead>
<tr>
<th>Variable</th>
<th>Anxious (N = 5)</th>
<th>Avoidant (N = 6)</th>
<th>Secure (N = 9/10)</th>
<th>Fearful (N = 11/10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trait Anxiety</td>
<td>37.20 (7.36)</td>
<td>48.33 (12.94)</td>
<td>37.10 (6.72)</td>
<td>50.00 (8.88)</td>
</tr>
<tr>
<td>Acute Stress Response</td>
<td>55.20 (12.03)</td>
<td>45.67 (7.42)</td>
<td>54.22 (13.33)</td>
<td>63.20 (9.83)</td>
</tr>
</tbody>
</table>

Note. Means with differing superscripts differ significantly, $p < .10$ for trait anxiety and $p < .05$ for acute stress response using Tukey HSD.
Differences in the acute stress response (as measured by state anxiety) were
evaluated by attachment style. The results indicated that there were significant
differences in acute perceived stress by attachment styles, $F(3, 26) = 3.27, p = .04, \eta^2_p = .27$. The magnitude of this effect size indicates that a person’s attachment style is also
useful for explaining differences in the acute stress response, however this effect is not as
large as that found in the trait anxiety analysis. This suggests that differential acute stress
responses may not be explained by attachment as much as trait anxiety appears to be.
Tukey tests, also shown in Table 5, demonstrated that the fearful participants had the
highest levels of perceived acute stress post TSST compared to the avoidantly-attached
group. All other comparisons were non-significant. This suggests that most participants
perceived their acute stress levels, following the TSST, to be roughly the same, with the
exception of the fearful participants, who reported elevated levels of acute stress after the
TSST.

The trends observed for the acute stress response differ from those found for the
trait anxiety measure. Overall, it appears that fearful-attached participants not only
perceived their general anxiety levels on a daily basis (trait anxiety) as quite high, they
also perceived themselves as more anxious after an induced stressor when compared to
the other three attachment styles.

A mixed model ANOVA was used to test pre and post measures of salivary
cortisol using four attachment categories (anxious, avoidant, secure and fearful) as
independent variables. As the mixed model included a repeated measure, the assumption
of sphericity was automatically met as only two measures of cortisol were collected.
There was a main effect for time, $F(1, 21) = 7.11, p = .01, \eta^2_p = .25$, such that salivary cortisol concentrations tended to increase from Time 1 ($M = 0.12 \mu g/dL, SD = 0.12$) to Time 2 ($M = 0.19 \mu g/dL, SD = 0.16$). The main effect for attachment was not statistically significant, $F(3, 21) = 1.90, p = .16, \eta^2_p = .21$. There was no statistically significant interaction between time and attachment, $F(3, 21) = 1.02, p = .40, \eta^2_p = .13$. However, examining the mean differences between Time 1 and Time 2 (displayed in Figure 1) suggest that a larger sample might have revealed meaningful differences between attachment styles in salivary cortisol change, given the moderate effect size. For instance, pairwise comparisons revealed that there were marginally significant differences between the anxiously attached and fearfully attached participants ($p = .08$) at the post TSST cortisol measure, such that those who were classified as fearful showed minimal to no change in salivary cortisol whereas the anxious group showed the largest increase in salivary cortisol of all the groups. There were no differences among the attachment styles for the pre TSST cortisol measure, however there were differences at the post TSST cortisol measure. There was a significant difference between the securely attached participants and the fearful participants ($p = .03$) at the post TSST cortisol measure, suggesting that secure individuals were more likely to show an increase in salivary cortisol compared to the fearful participants (though not as pronounced as the anxiously attached participants). These results further suggest that both anxious and secure participants display similar reactivity to induced social stress, whereas fearful participants do not appear to be activating their HPA axis in response to the social stressor. The avoidant group was not found to significantly differ from the other three
attachment styles on cortisol. This suggests that these participants are also not activating their stress response to the degree observed for the anxious and secure participants; however, they are also not displaying the level of HPA axis blunting observed in the fearful participants. However, these results should be interpreted with caution, as the time by attachment interaction was non-significant, given the lack of power.
Figure 1. Mean Changes in Salivary Cortisol by Attachment Style.

Note. Mean values are displayed above the bars and standard deviations are displayed within the bars.
Discussion

The current study sought to illuminate the ways in which the four attachment styles (secure, anxious, avoidant and fearful) are linked to the stress response system. Stress can be defined in many ways based on duration, context and utility (e.g., experience dependent development or as a survival response). The current study examined stress with the goal of better understanding how it may contribute to being at risk for adverse outcomes and how knowledge of one’s attachment style may provide insight as to why some individuals appear to manage their stress more adaptively than others. Contextually, stress was examined in terms of the physiological stress response (changes in salivary cortisol concentrations as a response to an acute stressor) in addition to psychological, or perceived, stress. Perceived stress was observed in the context of general day to day stress levels, defined here as trait anxiety, as well as the acute stress response, defined as the perception of one’s stress following the experience of an acute social stressor (TSST). The literature on the connection between attachment and stress response is limited, and these studies have not investigated the differences between the four attachment styles, specifically. The current study sought to expand on this literature via an examination of the four attachment styles and how these relate to unique stress responses by using an experimental design. The following discussion will interpret the results as well as address the possible clinical implications.
Examination of Stress by Gender

Past research has evaluated males and females separately for use with cortisol analyses as a way to control for the differential hormonal patterns between the genders (e.g., Smeets, 2010). The current study did not observe any statistically significant differences between males and females on an aggregate measure of salivary cortisol (the calculated difference between Time 2 and Time 1), indicating that gender was not responsible for the differences in the salivary cortisol responses within the current sample. However, it should be noted that there were five female participants for whom salivary cortisol concentrations were incalculable. The process by which salivary cortisol concentrations are calculated involves the use of a 4-parameter sigmoid minus curve fit. Salivary cortisol samples that do not fit into this curve will have values greater than 3.0 µg/dL. Given this, it is possible that these female participants had substantially elevated salivary cortisol concentrations. It is unknown whether this was indeed due to hormonal differences or whether other confounding variables may have contributed to the elevation of these concentrations, such as caffeine consumption.

There were also no gender differences found for trait anxiety or the acute stress response. This result is interesting, as past research has found support for the idea that women tend to have different coping patterns compared to men. For example, women are more likely to utilize social support in response to a stressor, whereas men are more likely to respond with anger and aggression (Agoston & Rudolph, 2011). Thus, it would seem that women should have lower levels of trait anxiety, as their natural coping
mechanisms are more adaptive than men’s. However, this explanation fails to take into account the increased sensitivity to anxiety disorders among females compared to males (McLean & Anderson, 2009). Thus, future research should investigate anxious attachment in combination with symptoms of anxiety and other internalizing disorders.

**Examination of Stress by Relationship Status**

The above-mentioned explanations do not address the differences in the stress response when a social support structure is available, such as when one is in a committed relationship. The current study sought to understand the differences in the three stress measures for those in a relationship and those who reported being single, regardless of gender. The results indicated that there were no statistically significant differences between the single participants and those in relationships on the three stress measures. This finding builds on those from past research. For example, a sample of men who were in a relationship, and therefore perceived the presence of social support, showed differences in the ability to utilize support for coping based on the security of their IWMs of attachment (Ditzen et al., 2008). Those classified as insecure were unable to effectively utilize their social support structure. Thus, social support alone did not appear to explain differences in the stress response for that study either. Alternatively, within the current study, this may be explained by the fact that the participants were primarily undergraduate college students. These participants may not have the same dependence on their partners for support that a married community member might have. Furthermore, social connections in general have been shown to be associated with positive health.
outcomes (Umberson & Montez, 2010), thus college students may be utilizing non-romantic relationships for social support. Future research should investigate the links between the stress response and different relationship types as well as the extent to which these relationships contribute to the perception of social support.

**Examination of ACEs by Attachment Styles**

Past research has made use of the AAI to investigate the differences in attachment between sexually abused and a non-abused women, in addition to their differing reactions to the TSST (Pierrehumbert et al., 2009). The results indicated that, among the abused group, the likelihood of being classified as “unresolved” by the AAI was substantially higher for those in the abused group. Another study investigates ACEs, as opposed to sexual abuse, in relation to attachment (measured via the AAI) with a sample of mothers (Murphy et al., 2014). The results indicated that the likelihood of being classified as unresolved was higher when four or more ACEs had been experienced. Thus, differences in the number of adverse childhood experiences (measured as ACEs total) by attachment were explored. Interestingly, there were no statistically significant differences in ACEs by attachment in the current study. This may be explained by sample characteristics. For instance, college students may present different types and rates of adverse experiences when compared to a community sample of mothers, and this is particularly relevant when compared to a sample of women selected based on their previous experience of sexual abuse. Future research should employ a community comparison sample.
**General Relationships Between Stress and ACEs**

Overall, the only significant relationship between the measured variables (trait anxiety, acute stress response, salivary cortisol change, and ACEs) was that observed between trait anxiety and salivary cortisol change. Higher levels of trait anxiety were related to a reduction in the salivary cortisol response after an induced stressor. This finding is congruent with the literature, as studies have reported on the potentially blunting effects prolonged experiences of stress (i.e., trait anxiety) can have on cortisol (e.g., Ouellet-Morin, 2011). Furthermore, past research has found differential trends in salivary cortisol change between a mild chronic stress period and low stress period (Viena, Banks, Barbu, Schulman & Tartar, 2012). That work found that college students had elevated baseline salivary cortisol levels in conjunction with a blunted response such that cortisol concentrations decreased from pre to post measures following an acute physical stressor (cold press) during mild chronic stress periods (exam week). Together, these relationships point to the importance of studying trait anxiety when evaluating salivary cortisol responses to induced stressors.

**Examination of Attachment styles and Differences in Perceived Stress**

The current study observed a large effect size for the relationship between trait anxiety and attachment. This suggests that attachment is an important indicator for chronic stress (i.e., trait anxiety). Clinicians may wish to evaluate clients’ attachment
styles to determine their potential risk for the development or worsening of psychopathology.

This would be particularly helpful for clients with a fearful attachment style, as the current study found that participants with this attachment style had the highest trait anxiety levels compared to the other three attachment styles. This finding supports the need for better treatment tailored for individuals with a fearful attachment style. Clinicians may need to focus on teaching fearfully attached clients a variety stress management strategies for day-to-day use. A reduction in the chronic stress generally experienced by these participants may help pave the way for introspection and behavioral change towards more adaptive coping mechanisms.

Participants with an avoidant attachment style reported similarly elevated levels of trait anxiety as seen with the fearful group. This finding suggests that the autonomy and rejection of social support associated with avoidant attachment (Bartholomew & Horowitz, 1991) may act as a risk factor for trait anxiety. The securely attached individuals and anxiously attached participants reported roughly the same trait anxiety levels. As a secure attachment is understood as being a protective factor, this similarity between the trait anxiety levels for the securely and anxiously attached participants suggests that an anxious attachment may not be a risk factor for trait anxiety. This may be further explained by the tendency for anxiously attached individuals to seek social support (Bartholomew & Horowitz, 1991), thus this attachment style appears to be adaptive for perceived psychological stress.
Participants with a secure attachment style had the lowest trait anxiety level. This result further supports the utility of secure attachments as a protective factor for daily stressors. However, the similarities between the secure group and the anxious group may tell a different story. Thus, these results suggest that there is more to learn about how attachment styles relate to chronic experiences of stress, especially for those who present with a fearful attachment style. This is particularly important as the literature indicates that chronic stress is the largest contributor to mental and physical health outcomes (Keller et al., 2012).

The trends observed in the trait anxiety analysis were partially maintained when the acute stress response was assessed. However, the effect size observed for the acute stress response was slightly smaller than that observed in the trait anxiety analysis. This suggests that attachment may be more useful for understand differences in trait anxiety, compared to the acute stress response. Participants with a fearful attachment style tended to have the highest levels of perceived acute stress compared to the avoidantly attached participants, who reported the lowest levels of acute stress response. There were no statistically significant differences between the fearful participants and the anxious and secure participants for the acute stress response. This suggests that, unlike with the trait anxiety findings, fearful participants may manage acute stressors similarly to those with an anxious or secure attachment style. Alternatively, this may have been an artifact of the sample size, or it could be the case that an acute social stressor does not have the same intensity when compared with the numerous other stressors experienced as a part of daily life for fearfully attached participants.
Future research should investigate what kinds of daily stressors contribute to trait anxiety and which ones increase the acute stress response. For instance, the current study made use of a social stressor (the TSST). Past studies have found that social and physical stressors do not activate the stress response (i.e. salivary cortisol change; Quien et al., 2007) or the attachment system (Mikulincer et al., 2002) in avoidantly attached participants. As fearful attachment is associated with higher attachment avoidance, this pattern may hold true for these participants as well. If better understood, this information could be used to tailor treatment strategies based on the both attachment styles and stressor types.

In answer to primary research question 1, it was investigated whether the acute stress response trends would be similar to the hypothesized directions for the salivary cortisol analysis. The trends in the acute stress response did partially correspond to the salivary cortisol predictions such that participants with an avoidant attachment style had the lowest acute stress response compared to the anxiously attached participants, despite this prediction not being supported in the salivary cortisol analysis. Hypothesis 2 predicted that the anxious attachment group would have the highest salivary cortisol response, which was supported by the salivary cortisol results. However, those with an anxious attachment style reported acute stress responses that were similar to those with a secure attachment. The relationship between the acute stress response and the salivary cortisol response is more complex when the fearfully attached participants are taken into account.
Examination of Differences in Cortisol by Attachment Styles

Despite the finding that increased trait anxiety was related to reductions in salivary cortisol change, there was an overall increase in salivary cortisol between Time 1 and Time 2 as a response to the TSST. This result indicated that the social stressor manipulation was successful in increasing cortisol production for the majority of the participants. However, there was no overall statistically significant interaction effect in salivary cortisol change over time by attachment style, despite a medium effect size. This may be due to small sample size, as pairwise comparisons did suggest differences might be occurring.

Avoidantly attached persons are characterized as being dismissing of others in various contexts such as intimacy, reliance on others, and self-disclosure (Bartholomew & Horowitz, 1991). Furthermore, past research has found that participants with an avoidant attachment style did not experience increases in salivary cortisol in response to a social stressor (Mikulincer et al., 2002; Quiren et al., 2007). Thus, in the current study, Hypothesis 1 predicted that participants with an avoidant attachment would have a less pronounced increase in salivary cortisol compared to participants with an anxious attachment. This assertion was not supported by the pairwise comparisons, which showed that avoidantly attached individuals did not differ from the other groups. This result is perplexing but may be due to small sample and limited power to detect differences. In Figure 1, we see that the increase in salivary cortisol for the avoidant group was less than that of the anxious and secure groups, yet it was greater than that of the fearfully attached
group. This lack of meaningful differences between the avoidantly attached and the securely attached participants may be explained by the use of internal coping strategies (i.e., solution seeking cognitions and openness to compromise), as similarities in the use of internal coping between secure and avoidant individuals have been observed in past research (Seiffge-Krenke, 2006).

This result may also suggest that participants with an avoidant attachment style are suppressing their HPA axis as a stress management technique for coping with social stressors, which fits with assertions made in past work that they tend to reject social support. Finally, this attachment style is also associated with positive psychological characteristics. For instance, persons with an avoidant attachment style tend to have higher levels of self-confidence and self-acceptance (Bartholomew & Horowitz, 1991). These adaptive qualities could be used in a clinical setting to help avoidant participants apply self-confidence to interactions with others as well as effectively make compromises, thus learning how to seek social support in a healthier manner. However, with such a small sub-sample of avoidantly-attached participants, these results should be interpreted with caution.

In Hypothesis 2, it was predicted that participants with an anxious attachment style would display the largest increase in salivary cortisol in response to the TSST compared to securely attached participants. Mean scores for this group suggest that anxiously attached participants had the greatest increase in salivary cortisol. However, the anxiously attached participants did not significantly differ from those classified as secure. This result suggests that anxious participants may not be hyper activating their
HPA axis to the extent that it has been theorized previously, considering that secure participants (who are thought to be better equipped to manage stress) are displaying a similar level of cortisol reactivity. This may be explained by the characteristics associated with an anxious attachment. For instance, individuals with this attachment style have been found to be more likely to rely on others as well as use others as a secure base compared to those with the other three attachment styles (Bartholomew & Horowitz, 1991). This tendency implies that, despite having an insecure attachment, these participants are attempting adaptive coping regularly. It is interesting to note that this trend between the anxious and secure participants with respect to salivary cortisol response was also found in the perceived stress measures.

However, the anxious participants had minimally greater increases in salivary cortisol compared to secure participants. If a larger sample were able to replicate this with statistically significant findings, this may indicate that the anxious individuals are not utilizing social support resources as effectively as their secure counterparts. Future research should investigate the mechanisms underlying the use of effective social support seeking in people with anxious attachments. Once better understood, this information could help clinicians tailor treatment that takes advantage of the anxious tendency to depend on others and perhaps encourage them to use this behavior in a manner that benefits their psychological adjustment.

As no predictions were made with regard to the fearfully attached participants, an exploratory approach was taken with regard to salivary cortisol change in response to the TSST for this group. The attachment literature has theorized that the avoidant attachment
coping mechanism seeks to reduce stress via a shutting down of the HPA axis (Mikulincer & Shaver, 2007). The results of the current study suggest that this may only be partially true, and that the concurrent experience of avoidance with higher attachment anxiety may be what determines this hormonal blunting. Alternatively, this relationship might be mediated by the experience of chronic stress, or trait anxiety, as it is defined in the current study.

The results of the trait anxiety analysis support this conjecture, as the fearful avoidant group had the highest levels of trait anxiety. As noted earlier, this group is characterized as not only distrusting others, but also lacking confidence in themselves as deserving of love (Bartholomew & Horowitz, 1991). It stands to reason, then, that these individuals are at the greatest risk for poor stress management.

This assertion is supported by the findings that this group appears to display no activation of the HPA axis, thus it can reasonably be assumed that the fearfully attached participants struggle the most with their stress management. Additionally, clinicians should take into account that the other two insecure attachment styles (anxious and avoidant) have positive aspects associated with them, whereas as the fearful style is characterized by both a negative view of the self and others (Bartholomew & Horowitz, 1991). These individuals will need a treatment plan that first engenders love and confidence in the self before attempting to transfer these feelings into social interactions and trust of others.
Limitations and Future Directions

One of the major limitations of the current study is the small sample size. This limitation was particularly relevant for the salivary cortisol analysis. Nonetheless, the lack of statistically significant findings for the interaction between time and attachment for the salivary cortisol analysis was also congruent with past literature (Ditzen et al., 2008; Smeets, 2010). Power analysis suggested that the current study needed 116 participants to achieve adequate power to detect a small to moderate effect size. No previous studies had samples this large either. For instance, Smeets (2010) used a sample of 68 participants disaggregated by men ($n = 34$) and women ($n = 34$). Ditzen et al., (2008) utilized a sample of 63 men, who were disaggregated by a social support condition ($n = 29$) and a no support condition ($n = 34$). It should be noted that the above-mentioned studies did not include effect sizes, hindering meaningful comparisons. Smeets (2010) suggested that, contrary to theory, attachment is not related to salivary cortisol changes after an induced social stressor, despite other studies having reported otherwise (Mikulincer et al., 2002). Alternatively, the current results may have been the product of sample characteristics, such as BMI, smoking habits and other lifestyle choices. Further research must evaluate these factors in more depth with a larger sample to determine if results are confounded by these variables.

Moreover, the use of college students who regularly experience many stressors may have influenced the results by blunting the effects of salivary cortisol. The study of college students during a mild chronic stress period (exam week) revealed that this
experience had an effect on cortisol responses to an acute stressor when compared to responses during a low stress period (Viena et al., 2012). Viena et al. (2012) utilized a sample of 30 college students. Participants’ salivary cortisol change in response to a stressor was measured four weeks prior to finals week (i.e., the low stress period) and again during finals week (i.e., mild chronic stress period). The results indicated that the mild chronic stress influenced cortisol by increasing baseline measures of cortisol and resulting in a reduction in cortisol following an acute stressor.

The current study ended data collection a week before finals week; however, midterm weeks were not taken into account and many classes require research reports, both of which can reasonably contribute to mild chronic stress. Furthermore, several participants showed reductions in salivary cortisol between Time 1 and Time 2, a result that did not appear to be systematically related to any one attachment style. Future research should utilize a comparison community sample that is not subject to the pressures of academia.

Another limitation was the inability to assess males and females separately. The results indicated that there were no statistically significant gender differences for this sample; however, this may be an artifact of the small sample size. Nevertheless, Smeets (2010) also found no statistically significant differences in salivary cortisol responses to the TSST between males and females. It is important to note, however, that in the current study the five cortisol samples that could not be calculated were all derived from female participants, suggesting that there may be differences in cortisol by gender. Future
research should analyze salivary cortisol change in response to a stressor for males and females separately.

**Conclusion**

The current study builds on the existing literature regarding the relationship between attachment and the stress response by investigating attachment based on a more nuanced four-category model than has been used in past work. Overall, it was found that participants with a fearful attachment style are the most likely to suffer from higher levels of trait anxiety as well as a greater acute stress response to a social stressor (i.e., the TSST). Furthermore, as a group, these participants did not increase their salivary cortisol in response to the TSST. Together, these results suggest that persons with a fearful attachment style may experience a blunting effect on the HPA axis, possibly as a consequence of their high levels of trait anxiety. Further research is needed to replicate these findings and better illuminate the underlying mechanisms that may create this stress response pattern and better inform clinicians regarding effective treatment and stress management practices.

Participants with an avoidant attachment style were predicted to have the smallest increase in salivary cortisol in response to the social stressor, a prediction that was not supported by the results. Additionally, these participants reported the lowest levels of trait anxiety. The results of this study clarified that this group was not at the same level of risk for poor coping as the fearfully attached group. Furthermore, avoidantly attached persons
may actually have protective factors in the form of positive self-concepts that can be useful for stress management.

Finally, there were no statistically significant differences between the anxiously attached and securely attached participants in any of the three stress measures. This suggests that the anxious attachment style may not be as risky in terms of poor stress management compared to the avoidant and fearful attachment styles. Alternatively, this may indicate that a secure attachment style is not as useful for stress management as previously thought.

Future research should continue to use a four-category model of attachment with a larger sample so as to incorporate the assessment of sample characteristics such as gender, BMI, quality of relationships, ACEs, and other lifestyle choices, such as smoking. Additionally, the use of a comparison sample to control for chronic stress situations and trait anxiety would be useful.

Clinicians could benefit from the results of this study by assessing clients on the four-category attachment model and tailor treatment based on the attachment characteristics. This would be particularly helpful for clients with a fearful attachment style as the current study suggested these individuals are at a high risk for poor stress management.
References


Mikulincer, M., & Shaver, P. R. (2007). Boosting attachment security to promote mental health, prosocial values, and inter-group tolerance. *Psychological Inquiry, 18*, 139-156. doi 10.1080/10478400701512646


Appendix A

Demographics Questionnaire

1. Age: ___
2. Gender Identity:
   ___ Male
   ___ Female
   ___ Other (please specify) ____________________________________________
3. Predominant Sexual Orientation:
   ___ Predominately heterosexual
   ___ Predominately homosexual
   ___ Bisexual
   ___ Other (please specify) ____________________________________________
4. What is your relationship status?
   ___ Single
   ___ In a relationship
   ___ Cohabiting with current partner
   ___ Domestic partnership
   ___ Married
   ___ Divorced
   ___ Widowed
   ___ Other (please specify) ____________________________________________
5. If in a relationship, how long have you and your partner been involved?
   ___ years, ___ months
6. Ethnicity:
   ___ White or European-American
   ___ Black or African-American
   ___ Hispanic or Latino-American
   ___ Asian or Asian-American
   ___ Native American or American Indian
   ___ Mixed Ethnicity (please specify) ______________________________________
   ___ Other (please specify) ____________________________________________
7. Socioeconomic background while you were growing up:
   ___ Below the poverty line
   ___ Working class
   ___ Lower middle class
   ___ Upper middle class
   ___ Upper class
8. Current socioeconomic background:
   ___ Below the poverty line
   ___ Working class
   ___ Lower middle class
___ Upper middle class
___ Upper class
9. Class standing:
   ___ Freshperson
   ___ Sophomore
   ___ Junior
   ___ Senior
   ___ Graduate
10. Major: ________________________________________
11. Time you woke up this morning: ___________________
12. How long since you consumed food? ________________
13. How long since you consumed an alcoholic beverage? ________________
14. Do you smoke cigarettes (or other)?
   ___ Yes
   ___ No
   a. How long since you smoked? ________________
15. Height: ________________
16. Weight: ________________
17. Have you ever had a problem with your use of alcohol?
   ___ Yes
   ___ No
   17a. Please explain your answer (100 words or less):
18. During your first 18 years of life, did you live with anyone who had a problem with their use of alcohol or was an alcoholic?
   ___ Yes
   ___ No
   18a. If yes, check all that apply:
   ___ Father
   ___ Mother
   ___ Step-father
   ___ Step-mother
   ___ Brother
   ___ Sister
   ___ Other relative
19. Have you ever had a problem with drugs, either prescription or street drugs?
   ____ Yes
   ____ No

19a. Please explain your answer (100 words or less):

______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

20. During your first 18 years of life, did you live with anyone who had a problem with their use of prescription or street drugs?
   ____ Yes
   ____ No

20a. If yes, check all that apply:
   ____ Father
   ____ Mother
   ____ Step-father
   ____ Step-mother
   ____ Brother
   ____ Sister
   ____ Other relative
   ____ Non-relative

21. How many close friends or relatives do you currently have available who would help you with your emotional problems or feelings if you need it?
   ____ 0
   ____ 1
   ____ 2
22. Have you ever been under the care of a psychologist, psychiatrist, or therapist?
   ____ Yes
   ____ No

   12a. If yes, please describe the reason (100 words or less)

23. Did you grow up with two parents in the home?
   ____ Yes
   ____ No

24. Were your parents divorced or separated?
   ____ Yes
   ____ No

25. Were you ever a foster child?
   ____ Yes
   ____ No

26. Did you ever run away from home for more than a day?
   ____ Yes
   ____ No

27. Was anyone in your household mentally ill?
   ____ Yes
   ____ No

   27a. If yes, check all that apply:

   ____ Father
   ____ Mother
   ____ Step-father
28. Did anyone in your household commit suicide?

____ Yes
____ No

28a. If yes, check all that apply:

____ Father
____ Mother
____ Step-father
____ Step-mother
____ Brother
____ Sister
____ Other relative
____ Non-relative

29. Did anyone in your household go to prison?

____ Yes
____ No

29a. If yes, check all that apply:

____ Father
____ Mother
____ Step-father
30. Did anyone in your household commit a serious crime?
   ____ Yes
   ____ No

30a. If yes, check all that apply:
   ____ Father
   ____ Mother
   ____ Step-father
   ____ Step-mother
   ____ Brother
   ____ Sister
   ____ Other relative
   ____ Non-relative

31. Have you ever attempted suicide?
   ____ Yes
   ____ No

32. How old were you the first time you had sexual intercourse? _______ Never have ______

33. How many sexual partners have you had in the past year? _______

34. How many sexual partners have you had in your lifetime? _______

35. In your first 18 years of life, did your father, step-father, or mother’s boyfriend/girlfriend ever hit, slap, push, bite, or kick your mother?
   ____ Yes
   ____ No
35a. If yes, how often?

___ Once
___ A couple of times
___ A few times
___ At least once a year
___ At least once a month
___ At least once a week
___ Almost daily

36. In your first 18 years of life, did your mother, step-mother, or father’s girlfriend/boyfriend ever hit, slap, push, bite, or kick your father?
___ Yes
___ No

36a. If yes, how often?

___ Once
___ A couple of times
___ A few times
___ At least once a year
___ At least once a month
___ At least once a week
___ Almost daily

37. How many children do you have? _______ (if zero, skip to #39)

38. Do you live with all of your children?
___ Yes
___ No

Please explain your answer (100 words or less):
39. Did either parent die before you were age 17?
   ____ Yes
   ____ No

   39a. If yes, how old were you? _______

40. Were you ever separated from either of your parents for one year or more before age 17?
   ____ Yes
   ____ No

   40a. If yes, how long was the separation? _______

   40b. If yes, what was the reason for the separation? Please check all that apply:

   ____ Illness (mental or physical)
   ____ Work, divorce/separation
   ____ Never knew my parent
   ____ Parent abandoned me

   Other ______________________
Appendix B

The Experiences in Close Relationships-Revised (ECR-R) Questionnaire

Instructions: The statements below concern how you feel in emotionally intimate relationships.
We are interested in how you *generally* experience relationships, not just in what is happening in a current relationship. Respond to each statement by circling a number to indicate how much you agree or disagree with the statement, with 1 being “strongly disagree” and 7 being “strongly agree.”

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Slightly Disagree</th>
<th>Neutral</th>
<th>Slightly Agree</th>
<th>Agree</th>
<th>Strongly Agree</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>I'm afraid that I will lose my partner's love.</td>
<td>1</td>
<td>2</td>
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<td>2</td>
<td>I often worry that my partner will not want to stay with me.</td>
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<td>3</td>
<td>I often worry that my partner doesn't really love me.</td>
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<td>4</td>
<td>I worry that romantic partners won’t care about me as much as I care about them.</td>
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<td>5</td>
<td>I often wish that my partner's feelings for me were as strong as my feelings for him or her.</td>
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<td>6</td>
<td>I worry a lot about my relationships.</td>
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<td>7</td>
<td>When my partner is out of sight, I worry that he or she might become interested in someone</td>
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<td></td>
<td>Strongly Disagree</td>
<td>Disagree</td>
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<td>8. When I show my feelings for romantic partners, I'm afraid they will not feel the same about me.</td>
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<td>9. I rarely worry about my partner leaving me.</td>
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<td>10. My romantic partner makes me doubt myself.</td>
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<td>11. I do not often worry about being abandoned.</td>
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<td>12. I find that my partner(s) don't want to get as close as I would like.</td>
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<td>13. Sometimes romantic partners change their feelings about me for no apparent reason.</td>
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<td>14. My desire to be very close sometimes scares people away.</td>
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<td>15. I'm afraid that once a romantic partner gets to know me, he or she won't like who I really am.</td>
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<td>16. It makes me mad that I don't get the affection and support I need from my partner.</td>
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<td>17. I worry that I won't measure up to other people.</td>
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<td>18. My partner only seems to notice me when I’m angry.</td>
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<td>19. I prefer not to</td>
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<td>show a partner how I feel deep down.</td>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Slightly Disagree</td>
<td>Neutral</td>
<td>Slightly Agree</td>
<td>Agree</td>
<td>Strongly Agree</td>
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<td>20. I feel comfortable sharing my private thoughts and feelings with my partner.</td>
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<td>21. I find it difficult to allow myself to depend on romantic partners.</td>
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<tr>
<td>22. I am very comfortable being close to romantic partners.</td>
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<td>23. I don't feel comfortable opening up to romantic partners.</td>
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<td>24. I prefer not to be too close to romantic partners.</td>
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<td>25. I get uncomfortable when a romantic partner wants to be very close.</td>
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<td>26. I find it relatively easy to get close to my partner.</td>
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<td>27. It's not difficult for me to get close to my partner.</td>
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<td>28. I usually discuss my problems and concerns with my partner.</td>
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<td>29. It helps to turn to my romantic partner in times of need.</td>
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<td>30. I tell my partner just about everything.</td>
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<td>31. I talk things over with my partner.</td>
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<td>32. I am nervous when partners get too close to me.</td>
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<tr>
<td>33. I feel comfortable depending on romantic partners.</td>
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<tr>
<td>34. I find it easy to depend on romantic partners.</td>
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<td>7</td>
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<tr>
<td>35. It's easy for me to be affectionate with my partner.</td>
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<td>36. My partner really understands me and my needs.</td>
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Appendix C

State-Trait Anxiety Inventory (STAI)

SELF-EVALUATION QUESTIONNAIRE STAI Form Y-1

Please provide the following information:

Name_________________________ Date__________________ S____

Age_________________________ Gender (Circle) M F T____

DIRECTIONS:
A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you feel right now, that is, at this moment. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

1. I feel calm............................ 1 2 3 4
2. I feel secure ........................................ 1 2 3 4
3. I am tense ........................................... 1 2 3 4
4. I feel strained ....................................... 1 2 3 4
5. I feel at ease ........................................ 1 2 3 4
6. I feel upset ......................................... 1 2 3 4
7. I am presently worrying over possible misfortunes ............... 1 2 3 4
8. I feel satisfied ...................................... 1 2 3 4
9. I feel frightened .................................... 1 2 3 4
10. I feel comfortable ................................ 1 2 3 4
11. I feel self-confident ............................... 1 2 3 4
12. I feel nervous .................................... 1 2 3 4
13. I am jittery ........................................ 1 2 3 4
14. I feel indecisive ................................... 1 2 3 4
15. I am relaxed ...................................... 1 2 3 4
16. I feel content ..................................... 1 2 3 4
17. I am worried ..................................... 1 2 3 4
18. I feel confused ................................... 1 2 3 4
19. I feel steady ..................................... 1 2 3 4
20. I feel pleasant ................................... 1 2 3 4
SELF-EVALUATION QUESTIONNAIRE
STAI Form Y-2

Name _____________________________ Date ___________

DIRECTIONS

A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you generally feel. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe how you generally feel.

21. I feel pleasant ................................................................. 1 2 3 4
22. I feel nervous and restless .................................................... 1 2 3 4
23. I feel satisfied with myself ................................................... 1 2 3 4
24. I wish I could be as happy as others seem to be ....................... 1 2 3 4
25. I feel like a failure ............................................................ 1 2 3 4
26. I feel rested ................................................................ 1 2 3 4
27. I am "calm, cool, and collected" ............................................ 1 2 3 4
28. I feel that difficulties are piling up so that I cannot overcome them 1 2 3 4
29. I worry too much over something that really doesn't matter .......... 1 2 3 4
30. I am happy .................................................................. 1 2 3 4
31. I have disturbing thoughts .................................................... 1 2 3 4
32. I lack self-confidence .......................................................... 1 2 3 4
33. I feel secure .................................................................. 1 2 3 4
34. I make decisions easily ......................................................... 1 2 3 4
35. I feel inadequate ............................................................... 1 2 3 4
36. I am content .................................................................. 1 2 3 4
37. Some unimportant thought runs through my mind and bothers me 1 2 3 4
38. I take disappointments so keenly that I can't put them out of my mind 1 2 3 4
39. I am a steady person .......................................................... 1 2 3 4
40. I get in a state of tension or turmoil as I think over my recent concerns and interests .................................................. 1 2 3 4