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Late adolescent couples' rejection sensitivity and patterns of cortisol reactivity and recovery in relationship conflict.

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LATE ADOLESCENT COUPLES' REJECTION SENSITIVITY AND
PATTERNS OF CORTISOL REACTIVITY AND RECOVERY IN
RELATIONSHIP CONFLICT

A Thesis Presented

by

SUSAN F. BALABAN

Submitted to the Graduate School of the
University of Massachusetts in partial fulfillment
of the requirements of the degree of

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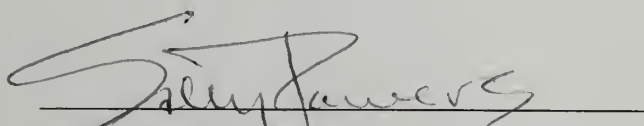
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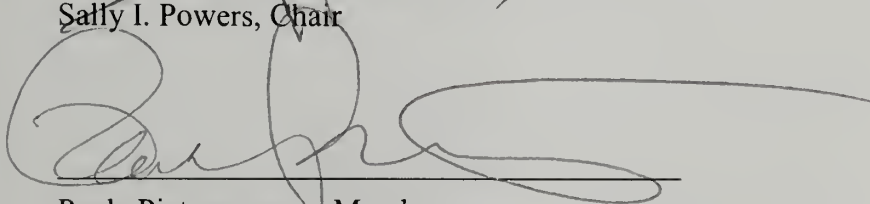
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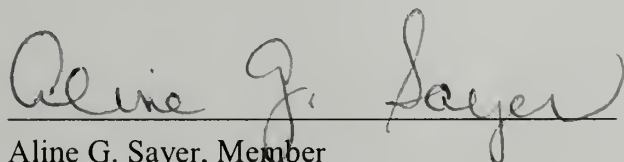
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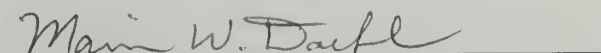
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ABSTRACT

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FEBRUARY 2007

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Theory and empirical evidence suggest that rejection sensitivity (RS) should relate to a heightened physiological stress response to relationship conflict. The hypothalamic-pituitary-adrenal (HPA) axis is the body's major neuroendocrine stress response system and cortisol is its product. This study hypothesized that 198 late adolescent heterosexual dating couples would demonstrate heightened HPA axis reactivity and a slower rate of recovery in response to an experimental conflict negotiation task. Cortisol samples were collected at entry to the lab, in anticipation, and five times after the conflict task to measure individuals' response to conflict and recovery. Growth modeling techniques were used to plot temporal stress response trajectories predicted by rejection sensitivity questionnaire (RSQ) scores. Most of these hypotheses were not confirmed, however, RS was a significant predictor of the rate at which males' secrete cortisol in response to relationship conflict, and this effect was not mediated by attachment anxiety.

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CHAPTER 1

INTRODUCTION

Rejection sensitivity (RS) is a theoretical construct, which is defined as the tendency to anxiously expect, readily perceive, and overreact to social rejection. It is related to Bowlby's concept of attachment (Bowlby 1969, 1973, 1980) in that RS theorists initially argued that this construct constitutes a predisposition towards a circumscribed set of thoughts and behaviors that are associated with insecure attachment styles (Feldman & Downey, 1994). RS may account for certain relationship difficulties that individuals' with avoidant and anxious attachment styles encounter. Like insecure attachment styles, RS is hypothesized as a risk factor for psychopathology and interpersonal difficulties (Ayduk, Downey, & Kim, 2001; Ayduk, Downey, Testa, Ying, & Yuichi, 1999; Balaban, Powers, Kaiser, & Gunlicks, 2005, Downey & Feldman, 1996).

The RS construct implies a sequence in which negative affectivity and stress consistently follow an individuals' perception of the threat of rejection (Downey & Feldman, 1996). Interpersonal conflict, a situation with high potential for rejection, provides a framework for evaluating this sequence, along with its cognitive, affective, and behavioral manifestations. There is empirical evidence that there are several stages of this sequence and that at each stage RS positively predicts stress and negative emotions: 1) Individuals with high RS experience anxiety about impending rejection from significant others as they reach out for support because they expect that their partners' responses will be hurtful, dismissive and rejecting (Downey & Feldman, 1996); 2) Individuals with high RS perceive rejection regardless of the intent behind

their partners' behavior (Downey & Feldman, 1996; Downey, Freitas, Michaelis, & Khouri, 1998); 3) Individuals with high RS tend to overreact by expressing hostility, dysphoria, and withdrawal of support from their partners (Downey et al., 1998); 4) Individuals leave conflict events (e.g. an argument) in more negative moods in direct relation to their RS, typically feeling that they have indeed been rejected by their partners (Downey & Feldman, 1996). It is important to emphasize that RS is not thought to influence cognition and behavior at the same intensity all of the time, but remains dormant until activated in a socially stressful situation that specifically has potential for interpersonal rejection. This paper explores the possibility that these emotional processes may be accompanied by an analogous physiological stress response.

Development of RS Theory

RS has been identified as a symptom of several psychological disorders. As the propensity to become intensely dejected after perceived social rejection, RS has historically been considered a core characteristic of social phobia, atypical depression, and dependent personality disorder (Leibowitz et al., 1988, 1992). The RS construct developed as a blend of attachment theory and social cognitive theory (Feldman & Downey, 1994; Downey & Feldman, 1996).

RS and attachment theory share a focus on the dynamics and quality of early interpersonal experiences, how these experiences are mentally internalized, and how they are processed in adult interpersonal contexts. Using this framework, Downey and her colleagues have found evidence that the early childhood experience of being neglected or abused by parents communicates an enduring message of rejection. This is channeled into the subsequent defensive expectations of rejection in close relationships. RS theorists initially proposed that rejection sensitivity contributed to the difficulty functioning and feeling secure in close relationships that is associated with insecure adult attachment styles (Hazan & Shaver, 1987; Feldman & Downey,

1994). These styles include *attachment avoidance* and *attachment anxiety* (Ainsworth, Blehar, Waters, & Wall, 1978; Brennan, Clark, & Shaver, 1998).

Attachment avoidance involves reluctance towards relying on others and a preference for maintaining emotional distance. Attachment anxiety entails a simultaneous desire for intimacy and inability to feel secure in close relationships (Bowlby, 1973). Linking the RS construct directly to attachment theory, Feldman and Downey (1994) argued that RS actually mediates, or explains, the relationship between the experience of maltreatment in early life and insecure attachment styles in adulthood.

In developing a measure to assess RS, Downey and Feldman (1996) expected that their construct would be correlated with both anxiety and avoidance and their findings confirmed this. However, they also found that RS level predicted the extent that individuals attributed hurtful intent to their partners' behaviors independently from their level of attachment anxiety and avoidance, demonstrating that RS has unique implications for individuals' social cognition. Attachment styles were also included as control variables in a study linking RS with depressive symptoms following relationship break-up (Ayduk et al., 1998). These results confirmed that RS had an independent effect on negative affectivity. These studies provide general but substantive evidence that RS is related but not redundant with insecure attachment styles, and that it exerts a unique influence on emotions and cognitions.

Attachment theorists describe insecurely attached individuals as behaving in similarly negative ways during conflict as high RS individuals. Anxiously attached individuals exhibit more anxiety, hostility and more relationship-damaging behaviors than less anxious individuals. Avoidant individuals are more likely to withdraw support and believe that their partners are less supportive (Simpson, Rholes, & Phillips 1996). Attachment anxiety, like RS, is related to

heightened anxiety during conflict. Conversely, avoidance is associated with a tendency to emotionally disengage from romantic partners and in doing so avoid the experience of distress (Main, Kaplan, & Cassidy, 1985; Simpson & Rholes, 1994). Thus, in the context of interpersonal stress, the attachment anxiety may be more closely related to RS than avoidance. In defining the RS constructs, its authors also employed a social-cognitive approach (Downey & Feldman, 1996) RS focuses on a combination of cognitive and affective processes, and these processes are believed to generate behavior patterns in specific social situations (Dweck & Leggett, 1988). RS determines the encoding and perception of information by individuals (Kelly, 1955), and their expectations about the consequences of their behavioral responses (Rotter, 1954). From this the sequential structure of RS derives anxious-expectancy of rejection, which leads to ready perception of rejection, and causes emotional and behavioral responses to interpersonal rejection that are exaggerated and negative.

RS theorists have recently adopted the motivational system paradigm from Albert Bandura (Downey, Mougios, Ayduk, London, & Shoda, 2005; Bandura, 1986) to explain the RS dynamic. A defensive motivational system (DMS) of entrenched and automatically activated behaviors operates to protect the individual from threats of interpersonal rejection (Downey et al. 2005). Interpersonal problems follow when the DMS is activated, prompting hyper-vigilance to rejection cues and hostility in response to perceived rejection. These reactions are generally inappropriate and maladaptive in the relatively benign context of romantic relationships. There is some evidence that the DMS relates to biological phenomena as well. One of Downey's studies showed that RS is associated with heightened eye-blink startle magnitude, a measure of physiological arousal (Downey et al., 2005). These findings suggest that RS facilitates a neurobiological stress response to the threat of interpersonal rejection.

Hypothalamic-Pituitary-Adrenal Axis

Little attention has been given to other physiological dynamics that could be related to RS. Further research in this area would make an important contribution towards our understanding of the impact of social context and processes on our biological development and how this contributes to psychopathology and relationship difficulties. There is a wide body of literature linking the functioning of the hypothalamic-pituitary-adrenal (HPA) axis to interpersonal stress (Stansbury & Gunnar, 1994; Diamond, 2001; Stroud, Salovey, & Epel, 2002). While the HPA axis is not the only neuroendocrine system involved in responding to stressful situations, it is thought to be the specific stress response system that is activated when individuals perceive threats that they do not feel competent to deal with (Cacioppo 1994).

The HPA axis functions in the following sequence: a threatening stimulus is perceived in the cerebral cortex of the brain and reaches the hypothalamus via limbic circuits. Stress related inputs converge in the nuclei of the hypothalamus. This triggers neurons in the paraventricular nucleus (PVN) of the hypothalamus to produce corticotrophin releasing hormone (CRH) along with vasopressin and other neuropeptides that influence behavioral and physiological processes. These neurons project into the median eminence at the portal of the pituitary gland where they release these neuropeptides. These neuropeptides bind with corticotrophs which, through a sequence of intracellular steps, increases proopiomelanocortin (POMC) gene expression and the release of POMC derived peptides. These include adrenocorticotrophic hormone (ACTH). ACTH enters the bloodstream and induces the production and release of glucocorticoids (the class of stress hormones which includes cortisol) from the adrenal cortex. Glucocorticoids bind with glucocorticoid (GR) and mineralcorticoid receptors (MR) in the brain to initiate down regulation of the HPA system through negative feedback. It is generally thought that naturally

occurring glucocorticoids like cortisol have a higher affinity with MRs rather than GRs. When stress levels rise, MRs saturate with cortisol and the remaining cortisol acts on GRs, which are thought to inhibit CRH release and the HPA stress response in general. (Heim & Nemeroff, 2001).

Salivary cortisol has been used as a measure of physiological response to interpersonal stress in various social contexts including close relationships (Feeney & Kirkpatrick, 1996; Fehm-Wolfsdorf, Groth, Kaiser, & Halwag, 1999; Loving, Heffner, Kiecolt-Glaser, Glaser, & Malarkey, 2004; Powers et al., 2006). Measures of cortisol before, during, and after relationship conflict reflect stress in anticipation of conflict, stress from the experience of conflict, and the ability to recover from the stress elicited from interpersonal conflict. An individual's cortisol emission pattern in response to stress will indicate the extent to which he or she is physiologically reactive to stress and the individual's ability to regulate his or her stress response and recover from conflict (Gunnar & Stansbury, 1994).

RS and the HPA Axis

The RS construct has several salient features that suggest a connection to the HPA axis. If rejection sensitive people approach relationship conflict with anxious-expectancy about rejection (Downey & Feldman, 1996), this may be related to increased secretion of cortisol while they are anticipating conflict. Similarly, the increased hostility, negative affectivity, and stress (Downey et al., 1998) they will experience during conflict could be associated with increased cortisol. Finally, an individual's level of RS should relate to their negative affectivity following conflict, in that they are more likely to feel rejected and to have a negative emotional and behavioral response to that rejection (Downey et al., 1996). This may slow their physiological recovery, with cortisol levels remaining high after the acute stress of conflict has been removed. Thus, RS

should be associated with trajectory of cortisol levels that is higher at all points surrounding conflict.

Research on both the HPA axis and RS suggests a relationship between the two constructs. In both paradigms an individual's perception of his or her own control over a stressful situation, e.g. relationship conflict, is likely to moderate his or her experience of emotional and physiological stress (Stansbury & Gunnar, 1994; Downey et al., 2005; McBurnett, 1991). RS theorists argue that interpersonal stress is intensified by the high RS individual's tendency to worry about the outcome that he or she can not control and his or her pessimistic assumption that that outcome will be rejection (Downey & Feldman 1996; Downey et al. 1998; Downey et al 2005). Similarly, research in neuroendocrinology suggest that the cortisol response is triggered in social situations perceived as uncontrollable (Breier, 1989; Croes, Merz, & Netter, 1993; Peters et al., 1998), especially when overt behaviors cannot control or avert negative outcomes (Averill, 1973; Levine & Ursin, 1991).

Like RS, the HPA axis initiates a defensive response to perceived threat. Studies on the behavior of wild house mice suggest that the stress hormones produced by the HPA axis accompany behavioral strategies that attempt to control or reduce threat in the environment (De Kloet, 1991). Researchers in that field continue to test and further explain this phenomenon. A more recent study found that the HPA system was more responsive in mice that exhibited more aggressive coping styles in the face of threat (Veenema, Meijer, de Kloet, Koolhaas, & Bohus, 2002).

Considering the etiology of both RS and hypersensitivity of the HPA response may also be helpful. An abnormally reactive HPA axis may be forged by the same experiences that are thought to cause RS. Research has indicated that HPA dysfunction, like RS, is also related to

exposure to abuse during childhood (Ladd, Huot, & Thirivikraman, 2000). RS and HPA reactivity both have a hypothesized link to a history of childhood maltreatment, and both have similar functions of initiating defensive reactions to a lack of control in threatening situation. The typically hostile behaviors exhibited and dysphoria reported by high RS individuals suggest that they experience heightened stress around relationship conflict. Further, both RS and HPA dysregulation have been linked to the development of psychopathology (Ayduk et al. 1998, Heim & Nemeroff, 2001). This suggests that these two phenomena will be empirically related. We expect that persons with higher levels of RS will demonstrate higher levels of salivary cortisol as they anticipate, experience, and recover from conflict with a romantic partner.

Prior analyses in this sample established that attachment style related to the HPA stress response in relationship conflict (Powers et al., 2006). Powers et al. found that males' attachment anxiety and female avoidance predicted the stress response. Therefore, in determining whether RS predicts the rate of cortisol secretion, it is necessary to clarify that this effect is separate from the effect of attachment style. More specifically, there is a possibility that the effects of RS on HPA reactivity are mediated or explained by attachment insecurity and avoidance since these construct are theoretically related. Because attachment anxiety, like RS is associated with more vigilance and anxiousness during conflict than avoidance, it is more likely that anxiety would explain the effects of RS on the stress response.

Partners' HPA reactivity and RS

While individuals' RS is associated with hostility and relationship violence, romantic partners are the recipients of the negative behaviors that high RS individuals use during conflict. As this must be stressful, individuals could be expected to show raised levels of salivary cortisol during conflict in relation to their partners' heightened RS. Research suggests a significant

relationship between individuals' RS and partners' negative affect and hostility (Downey et al., 1998). A previous study using this same sample did show that partners' attachment style predicted cortisol reactivity (Powers et al. 2006). While there have been no other studies examining the relationship between individuals' RS and partners' cortisol response, the research cited above suggested that there would be a significant connection.

Gender Differences

There is evidence to indicate that females may experience more stress relative to their RS in the context of private relationship conflict than males. Research on behaviors associated with RS indicate that female RS is more often associated with hostility in the dyadic context of private argument (Ayduk, Downey, Testa, & Shoda, 1999), whereas male RS is more often associated with hostility when the rejection is witnessed by other people (Downey & Romero-Canyas, 2004). High RS females also exhibit more negative and hostile behavior during relationship conflict than high RS males (Downey et al. 1998). This may suggest that high RS females' are experiencing a more intense stress-response during relationship conflict than their male counterpart.

There is also some evidence that females generally have a more acute response to relationship conflict than males. The Fehm-Wolfsdorf et al. (1999) study of marital conflict demonstrated that females had higher cortisol reactivity than males during conflict. However there are also research findings supporting the opposite: that male RS will have a stronger influence on the stress response than female RS. A study evaluating the stress response relative to attachment style indicated that males endorsing higher levels of attachment anxiety showed higher salivary cortisol levels in response to conflict than highly anxious females (Powers et al., 2006). Taken together these findings present an unclear picture, but they also suggest that there

may be gender differences in how RS relates to the stress response.

Gender may also moderate the impact of an individual's RS on their partner's stress response. There is evidence that females' attachment avoidance predicts their male partners' cortisol levels, while male avoidance did not have the same impact on their female partners (Powers et al., 2006). Similarly, high RS females exhibit higher levels of hostility and withdrawal of support from their partners during conflict (Downey et al., 1998), which may cause their male partners to experience more stress during conflict. Males also tend to react more negatively to high RS females' behavior during conflict and report being more upset after conflict (Downey et al. 1998). Applying the same logic, male partners could be expected to have slower HPA axis recovery after relationship conflict because they become more upset by their partners.

Research Hypotheses

Based on RS theory and the findings of the prior related research discussed above, I expected to find the following relationship between HPA reactivity and RS:

1. Because individuals with high RS are more likely to be anxiously expecting rejection, higher levels of RS will be related to higher levels of cortisol in anticipation of the conflict discussion.
2. Because individuals with high RS have more perceptions of rejection and overreact to these perceptions, higher levels of RS will predict higher concentrations of salivary cortisol during conflict.
3. Because individuals with high RS have more post-conflict feelings of rejection, which are stressful and upsetting, higher RS will be related to slower HPA recovery and return to pre-conflict task levels of salivary cortisol.

4. Women's RS levels will be more strongly related to the salivary cortisol levels than males' RS levels.
5. Higher levels of RS will predict partners' increased cortisol levels during conflict, with female RS having the greatest impact on male partners.
6. Individuals in couples in which both male and female members show high levels of RS will have the highest levels of cortisol before, during, and after the conflict task.
7. While RS should relate to the HPA stress response, this effect may be mediated by individuals' insecure attachment style. If this is so, it is more likely that attachment anxiety mediates this relationship than attachment avoidance.

CHAPTER 2

METHOD

Participants

The sample consists of 199 late adolescent heterosexual couples who had been dating for at least two months. Participants' ages ranged from 18 to 20, with a mean age of 19.3 years ($SD = .82$). The sample was representative of late adolescents in the western Massachusetts community from which the participants were recruited, based on the 2000 census data statistics collected by the Massachusetts Institute for Social and Economic Research. Participants reported their ethnic backgrounds as non-Hispanic European-American (89.6%), Hispanic (4.3%), African American (1%), Asian American/Pacific Islander (3.5%), Native American (.5%), or other (1%).

Recruitment methods included flyers, posters, and presentations in university undergraduate courses. Each participant received \$20, and those who were university students received extra credit points, if applicable.

Procedure

As hormones are regulated by circadian rhythms, participants were asked to come to the lab with their partners at 4 p.m., a time of day at which cortisol levels are relatively stable. In the interest of further reducing error variance in the cortisol measures, participants were instructed not to consume alcohol, illegal drugs, or visit the dentist within the 24 hours before their first session; and not to exercise, eat, drink, smoke cigarettes or brush their teeth within the two hours before their first session.

The partners were seated at two separate computers that faced each other, but had a

curtain between them so that they could not see or discuss each other's answers. From this position they completed questionnaires and provided saliva samples. The questionnaires included items about variables that could affect the hormone levels in the saliva samples. They were asked to report the number of hours they slept the night before; daily use of medication, vitamins, and oral contraceptives; phase of the menstrual cycle, and the possibility of pregnancy. Participants were asked to reschedule their session for a later date if they had elevated temperature or felt ill; reported use of alcohol, illegal drugs, or had any mouth or gum abrasions in the past 24 hours; or if they reported brushing their teeth, consuming food or caffeinated beverages, or exercising in the past two hours.

After the first saliva sample was taken, the research assistants described the upcoming conflict task, and explained that this discussion "might take the form of an argument." After the first two saliva samples were taken, each partner was asked to identify a topic of heated and unresolved conflict for the couple within the past month. Research assistants selected one of the topics by flipping a coin. The couple then went into an adjoining room furnished with a couch and three video cameras, where they were instructed to discuss the selected conflict topic in an attempt to resolve the issue. The couple remained alone in the room for 15 minutes. Afterwards they returned to the first room, completed questionnaires and provided 5 additional saliva samples at regular intervals throughout the next hour.

Measures

Physiological response to conflict stress assessed using salivary cortisol samples. Seven salivary cortisol samples were collected over a period of an hour and thirty-five minutes. Participants were asked to passively drool down a straw into a plastic vial with their heads tilted forward until the required amount of saliva was collected. The vial was then sealed and

immediately placed in frozen storage (-20 degrees C) until shipment to Salimetrics LLC (on dry ice) for analysis.

It takes 15 to 20 minutes for cortisol to enter saliva from the time it is secreted by the adrenal gland, so measures represented the stress response from 15 to 20 minutes prior (Stansbury & Gunnar, 1994). The first sample, collected ten minutes after the couple's arrival, assessed participants' cortisol levels 5-10 minutes prior to arrival. The second sample was taken 15 minutes after the participants learned about the conflict task, which measured their stress response to anticipation of the discussion and potential argument. After the 15-minute conflict discussion, saliva samples (#3-#7) were collected at 10 minutes, 20 minutes, 30 minutes, 45 minutes, and 60 minutes. This sequence of samples allows for assessment of the entire trajectory of participants' stress response: from before their arrival at the lab, through their anticipation of the conflict discussion with their partner, their stress response to the conflict, and 40 minutes of recovery following the conflict exercise.

All participants completed a questionnaire designed to measure variables that might influence HPA reactivity. This entailed drugs and medications, including allergy medications and alcohol (Kirschbaum, Kudielka, Gaab, Schommer, & Hellhammer, 1999), oral contraceptives (Kirschbaum, Strasburger, & Langkrar, 1993), psychotropic medications (Wilson, McFarlane, & Lipworth, 1998), caffeine (King, Houle, De Wit, Holdstock, & Schuster, 2002), and nicotine (Lovallo, Al'absi, Blick, & Whitsett, 1996). Questions also addressed participants' recent amounts of sleep, exercise, and meals; as well as current illnesses and menstrual phase. These variables were included in the analyses as control variables. Preliminary analysis revealed substantial right skewness (7.02, SE = .033) and kurtosis (87.22, SE = .066) in cortisol levels. These analyses assume normal distribution. To ensure that they had normal distributions the

natural log was taken for cortisol at each occasion.

Rejection Sensitivity Questionnaire. The Rejection Sensitivity Questionnaire (RSQ) assesses the anxious-expectancy component of the RS construct (Downey & Feldman, 1996). The measure consists of 18 hypothetical social situations in which the respondent is asked to imagine that they are asking someone to do something for them (e.g., “You ask your boyfriend/girlfriend to move in with you,” “You ask someone you don’t know well out on a date”). For each hypothetical situation, respondents are next asked about their degree of concern about the outcome (e.g., “How concerned or anxious would you be over whether or not he/she also would want to move in with you?”, “How concerned or anxious would you be over whether or not the person would want to go out with you?”) on a scale of 1 (very unconcerned) to 6 (very concerned). Participants are then asked to indicate the likelihood that the other person would respond in an accepting fashion (e.g., “I would expect that he/she would want to move in with me”, “I would expect that the person would want to go out on a date with me”) on a scale of 1 (very unlikely) to 6 (very likely). High likelihood reflects an expectation of acceptance, whereas low likelihood reflects an expectation of rejection. An RS score is calculated for each item by taking the reverse score of *expectancy* (7-response) and multiplying by the *level of concern* response. Higher scores, indicate higher levels of RS.

In our sample, these scales yielded good reliability (Cronbach’s alpha) scores of .90 for the 18 questions assessing anxiety about rejection, and .84 for the questions assessing expectancy of rejection. The measure has also been shown to demonstrate good test retest reliability and internal consistency in other studies (Feldman & Downey, 1996).

Experience in Close Relationships (Brennan, Clark, & Shaver, 1998). Since earlier analysis of our data showed a relationship between the HPA stress response and adult attachment

style (Powers et al., 2006), the Experience in Close Relationships (ERC) a measure of adult attachment styles are included in this study. The ERC is a 36-item self report measure. Items breakdown into Anxious and Avoidance subscales, categories derived from factor analysis. The Anxious subscale measures an individual's concern about rejection and abandonment, and the Avoidance subscale measures an individual's negative attitude towards intimacy and interpersonal dependence. Items are rated on a 7-point Likert scale, ranging from 1 (disagree strongly) to 7 (agree strongly). Attachment anxiety and avoidance are included as a predictor variables in these analyses to determine if they mediate or explain the effect of RS on cortisol levels.

In our sample, these scales yielded reliability scores (Cronbach's alpha) of .55 for the avoidant attachment scale, and .88 for the anxious attachment scale. The ERC has been shown to demonstrate good internal consistency and test retest reliability. Psychometric evaluation of this measure has also yielded evidence indicating the measure's construct validity and predictive validity (Brennan, Fraley, & Shaver, 1998; Fraley, Waller, & Brennan, 2000).

It is noteworthy that the ERC differs from the RSQ in style. While the ERC is specific to romantic relationships, RSQ evaluates RS in a variety of social situations including family and friendship contexts. These measures are also very different in style in that the RSQ elicits the endorsement of personal RS in a covert fashion, e.g. "How concerned or anxious would you be over whether or not the person would want to go out with you?" ERC is more explicit in how it gauges sensitivity to interpersonal rejection, e.g., "I worry about being abandoned."

Analytic Strategy

Growth modeling techniques were used to plot temporal trajectories of participants' hormonal stress responses, and to predict variance in these stress trajectories from participants' scores of RS. The HLM6 program of Raudenbush and Bryk (2005) was used to estimate the parameters of these growth models. HLM has several distinct advantages that address challenges inherent in the analysis of dependent data from couples and from repeated measurements of cortisol levels in response to an experimental task. For these analyses, the couple is the unit of analysis, with female cortisol responses and male cortisol responses nested within a couple. Information about the association between the scores of the couple and among repeated measures was used to compute the accurate standard error for testing regression coefficients. HLM also allows for the prediction of individuals' outcomes from their partner's scores.

Growth curve modeling yielded two linked models. The level 1 model had three within-person coefficients that estimated participants' curvilinear stress response trajectories. The level 2 model included between person control variables and predictors to explain variance in these parameters.

The Level 1 HLM Model

The level 1 model was represented by the following equation: $Y_{ij} = \beta_{1j}(\text{female intercept})_{ij} + \beta_{2j}(\text{female linear})_{ij} + \beta_{3j}(\text{female quadratic})_{ij} + \beta_{4j}(\text{male intercept})_{ij} + \beta_{5j}(\text{male linear})_{ij} + \beta_{6j}(\text{male quadratic})_{ij} + e_{ij}$. Y_{ij} is the cortisol score I in couple j , with $j = 1 \dots 199$ couples. For females β_{1j} is the model intercept. The intercept reflects the predicted outcome (cortisol level) when the origin of time is 0. Time was rescaled so that the intercept reflects cortisol levels at the discussion point midway through the interaction task (third sample). β_{2j} is the linear rate of change in cortisol level at time zero, which indicates how fast the curve is changing at the time

point where the data are centered. β_{3j} is the rate of change in cortisol over the entire time span of the assessment (also called the quadratic effect or curvature of the growth trajectory). Finally, e is the residual error, which is assumed to have a mean of zero and a constant variance σ squared. β_{m4j} , β_{m5j} , and β_{m6j} represent the same parameters for the men's trajectories.

The Level 2 HLM Model

The level 2 model is represented by the following equations:

$$B_{f1j} = \gamma_{10} + \gamma_{11} + \gamma_{12} + u_{1j}$$

$$B_{2j} = \gamma_{20} + \gamma_{21} + \gamma_{22} + u_{2j}$$

$$B_{f3j} = \gamma_{30} + \gamma_{31} + \gamma_{32} + u_{3j}$$

$$B_{f4j} = \gamma_{40} + \gamma_{41} + \gamma_{42} + u_{4j}$$

$$B_{f5j} = \gamma_{50} + \gamma_{51} + \gamma_{52} + u_{5j}$$

$$B_{f6j} = \gamma_{60} + \gamma_{61} + \gamma_{62} + u_{6j}$$

In the level 2 model every β is equal to a predictor (e.g. RS scores) or a control variable (e.g. allergy medications) plus a random effect, which represents the residual for each dyad around the mean of the outcome. These linked level 1 and level 2 growth models present statistical tests of the relationship between RS and cortisol level at the discussion point, the instantaneous rate of change in cortisol level at the discussion point, as well as the association of RS to the curvature of the stress trajectory across all seven time points.

CHAPTER 3

RESULTS

Descriptive Characteristics of the Sample

Means and standard deviations for male and female participants' log cortisol levels for the seven saliva samples are reported in Table 1. Based on an evaluation of the Mahalanobis distance¹ of participants' seven cortisol samples and RSQ scores, I determined that two couples were multivariate outliers. The simple analyses of correlation described below were performed on participants' RSQ scores with and without the multivariate outliers and no differences in results were found. Therefore the following results are for descriptive analyses based on the entire sample.

Descriptive statistics for both RSQ scores and ECR anxiety and avoidance scores are reported in Table 2. The ECR predictors are included as control variables to determine if RSQ exerts an independent effect on cortisol secretion patterns independent of attachment style. Partners' RSQ scores were not significantly correlated, $r = .107, p > .10$. However partner's attachment anxiety scores were significantly correlated with each other, $r = .144, p < .05$. For attachment avoidance, partners' scores were also significantly correlated, $r = .173, p < .05$. Individuals' RSQ scores and attachment anxiety scores were moderately correlated at the level of statistical significance ($r = .222, p < .01$), whereas RSQ score and attachment avoidance scores had a non-significant negative correlation ($r = -.065, p > .10$).

¹ Mahalanobis distance is the distance from the center of a three dimensional distribution that is formed by the three random effects evaluated here.

Growth Models of Cortisol Reactivity and Recovery

Before testing the hypothesis that men and women's levels of RS would predict their stress reactivity and recovery, an unconditional HLM model was fit with no predictors at level 2 to determine if there was enough variance unaccounted for in the level 1 coefficients to warrant an analysis of predictor variables (See Table 3). This unconditional model included participants' seven cortisol samples as the dependent variable. There was significant individual variation in the predicted coefficients for levels of cortisol for males ($\tau_{00m} = .422$, $\chi^2 = 13692.87$, $p < .001$) and females ($\tau_{00f} = .354$, $\chi^2 = 11928.79$, $p < .001$); the rates of change in cortisol for males ($\tau_{11m} = .095$, $\chi^2 = 2398.75$, $p < .001$) and females ($\tau_{11f} = .068$, $\chi^2 = 1738.77$, $p < .001$); and in the curvature of the entire stress trajectory for both men ($\tau_{22m} = .154$, $\chi^2 = 1115.50$, $p < .001$) and women ($\tau_{22f} = .116$, $\chi^2 = 879.56$, $p < .001$). This significant variation meant that participants did not all respond to the conflict task in the same way. Participants' cortisol levels at each time point significantly differed for the average cortisol levels in the sample. This model also clarified the importance of using a statistical technique that took account of the shared variance between romantic partners' scores. This dependency in the data is estimated as a set of covariances in the Tau matrix. These are interclass covariances, converted to correlations between male and female partners' levels of cortisol ($r = .34$), rates of change in cortisol ($r = -.03$), and the curvatures of their stress trajectories across the seven measurement points ($r = .01$).

It was then necessary to fit a second model including the control variables detailed above, including blood contamination, antibiotics, and allergy medications at level 2. Similar to the first model, this second model did not wholly explain the variance in the cortisol samples (see Table 3). Again, there was significant individual variation of predicted coefficients for males' cortisol level ($\tau_{00m} = .403$, $\chi^2 = 13222.15$, $p < .001$) and females' cortisol level ($\tau_{00f} = .332$, $\chi^2 =$

11220.87, $p < .001$); the rates of change in cortisol for males ($\tau_{11m} = .093$, $\chi^2 = 2343.92$, $p < .001$) and females ($\tau_{11f} = .066$, $\chi^2 = 1719.54$, $p < .001$); and in the curvature of the entire stress trajectory for both males ($\tau_{22m} = .154$, $\chi^2 = 1115.54$, $p < .001$) and females ($\tau_{22f} = .111$, $\chi^2 = 856.52$, $p < .001$)). There was still significant unexplained variance after evaluating the influence of these control variables. Thus, it was useful to examine whether RS of self and partner might account for the variance among participants' stress trajectories.

Do Late Adolescents' RS Levels Predict Their Stress Reactivity and Recovery?

HLM models used to evaluate the relationship between RS and cortisol reactivity were centered at the time point of the third cortisol sample (discussion) to provide a parameter that captured cortisol during the discussion, a time of potential conflict. Thus a model could be fit to predict the effect of RS on cortisol parameters in response to relationship conflict. Table 3 shows the fixed and random effects for the models evaluated sided by side: Each successive model first including actors' RSQ scores, then partners' RSQ, then the interaction between both actors' and partners' RSQ scores. In the top portion of the table the fixed effects show the average relationship between each of the predictors and the predicted cortisol coefficients. Below the fixed effects are the reported deviance and number of parameters for each model. Next are the test statistics for likelihood ratio tests comparing each successive model to the prior model. This strategy compares two models to test the null hypothesis that there is no difference in fit between the two models. It uses a chi-square test statistic that is calculated e.g. deviance (Actor*Partner RS Model) – deviance (Control Model) where the minuend is always the model with the greater number of parameters. The degrees of freedom for the test are calculated as df (Actor*Partner RS Model) – df (Control Model). We reject the null hypothesis at a .05 level of confidence.

The next portion of the table includes males' and then females' random effects, which illustrate the extent to which individuals' cortisol parameters vary. With predictors at level 2, these variance components indicate the relationship between each cortisol parameter and the predictors for individuals as they vary from the mean. Finally, the table shows the proportion of additional variance in the predicted coefficients that each successive model explains.

The actor model suggested a direct effect of RS on one male cortisol parameter, but did not predict any of the female cortisol parameters. Late adolescent male RS predicted the instantaneous rate of change of cortisol level at the discussion point ($\gamma_{11m} = .011$, $t = 2.35$, $p < .05$). For every 1 unit difference in RSQ score, males' rate of change in cortisol level at the discussion point differs by $.011 \mu\text{g/dl}$. This suggests that increases in males' RS are associated with smaller decreases in the rate of change at the discussion point. The net effect is a flattening of the trajectory such that males who are higher in RS remain stressed for longer. Although this effect was statistically significant, the proportion of variance explained in the instantaneous rate of change, 4%, was small. Figure 1 shows a comparison of prototypical males' cortisol response with high (75th percentile) and low (25th percentile) RSQ scores.

This model did not show significant effects for males' RS on cortisol level at the discussion point or curvature of the trajectory across all seven time points. There was no significant effect for partners' RSQ score or the interaction between actor and partner on males' cortisol parameters, nor did inclusion of these variables improve the fit of the model to these data.

A likelihood ratio test was used to determine if including Actor RS, Partner RS, and their interaction as predictors at level 2 improved the fit of the model from the model that only included biological control variables. Including Actor RS, Partner RS, and their interaction as

level 2 predictors in the model explained more variance in the cortisol parameters, but did not significantly improve the overall fit of the model when compared to the model that only included control predictors, $\chi^2 (18) = 12.387, p > .50$.

There were no statistically significant relationships between female RSQ scores and the cortisol parameters for females. Figure 2 shows a comparison of prototypical females' cortisol response with high (75th percentile) and low (25th percentile) RSQ scores.

The next model attempts to gauge the extent to which RS and insecure attachment style, as similar constructs, overlap or exert distinct influence on cortisol reactivity and recovery. This model included actors' attachment anxiety and avoidance scores as predictors, along with RSQ scores as level 2 predictors. Neither male attachment anxiety nor avoidance was significantly related to males' instantaneous rate of change in cortisol and the effect of RS on males' acceleration of cortisol level at the discussion point maintained statistical significance controlling for attachment anxiety and avoidance. This suggests that RS exerts a small, but unique influence on males' physiological response to interpersonal conflict over and above over the impact of attachment style. Controlling for RS and avoidance, males' anxiety was a significant predictor of males' cortisol level at the discussion point ($\gamma_{00m} = .169, t = 3.72, p < .01$). This coefficient suggests that a 1 unit change in attachment anxiety is associated with a .169 increase in cortisol level at the discussion point. Males' attachment anxiety was also a significant predictor of their total trajectory of cortisol levels ($\gamma_{22m} = .077, t = -2.39, p < .05$). This indicates that attachment anxiety influences males' stress response in anticipation of conflict, during conflict, and in recovery from conflict.

Controlling for RS and avoidance, females' anxiety significantly predicted cortisol level at the discussion point ($\gamma_{00f} = .095, t = 2.11, p < .05$), as well as the linear rate of change at a

trend level of significance ($\gamma_{11f} = .038$, $t = 1.69$ $p = .09$). Controlling for attachment anxiety, neither RSQ score nor attachment avoidance related to females' cortisol response parameters. Controlling for RS and attachment avoidance, attachment anxiety related to males' cortisol level at the discussion point. Compared to the model that only included biological control variables, the addition of RS did not significantly improve the fit of the model, $\chi^2 (6) = 8.928$, $p > .10$. The subsequent addition of attachment avoidance and anxiety significantly improved the fit, $\chi^2 (18) = 35.996$, $p < .01$

CHAPTER 4

DISCUSSION

These data revealed that the majority of hypotheses regarding the relation of individuals' RS to their own HPA reactions to interpersonal stress were not confirmed. RS did not, as was hypothesized, relate to higher levels of cortisol for either late adolescent males or females in anticipation of conflict or to higher levels of salivary cortisol following the conflict discussion. RS also did not relate to differences in the overall shape of the stress response trajectory as reflected by cortisol levels at the different sampling points. What RS did influence, at least for late adolescent males, was their specific stress response to the experience of conflict.

The most meaningful finding yielded by these analyses was that males' RS related to a slower decrease in cortisol secretion specifically in response to relationship conflict. Males' RS did not predict higher cortisol levels at all points around conflict. Indeed, high RS males' actually showed lower mean levels of cortisol in anticipation of the conflict task. However, high RS males' exhibited a distinct change in cortisol secretion patterns relative to the experience of conflict. This indicates that RS may sensitize males' stress response to relationship conflict and that it may interfere with timely recovery from the stress response. It is interesting that the actual shape of males' stress response trajectory is not differentiated by level of RS, but the timing of cortisol secretion increase and decrease is different. The difference seems to be accounted for by males RS level and the activating experience of interpersonal stress. This may suggest a temporal reframing from my original hypothesis that assumed that individuals might perceive the threat of rejection in anticipation of the conflict discussion. Perhaps the RS defensive motivational system manifests only in the presence of acute threat of rejection so that individuals need to be engaged in conflict before the stress response will be activated relative to their RS level.

Gender differences

Females did not show the same stress response pattern to interpersonal stress that males did.. It is notable that while mean levels of cortisol are higher for high RS females' than low RS females, their stress response to the experience of conflict was not altered by the experience of conflict relative to their level of RS as it was for males. This is inconsistent with beginning research evidence that females' stress system is more responsive to the experience of relationship conflict (Fehm-Wolfsdorf et al. 1999) and that high RS females exhibit more negative behaviors and affect during conflict. However, the findings reported by Fehm-Wolfsdorf have not been yet replicated. Furthermore, as RS is conceptually more similar to attachment anxiety than avoidance, this difference falls in line with Powers et al.(2006) findings in which males' anxiety related to the stress response, while females' anxiety did not.

Rejection Sensitivity and Insecure Attachment Styles

RS and insecure attachment styles related to distinctly different components of the stress response, and these differences depended on gender. Males' anxious attachment predicted a higher level of salivary cortisol during the conflict discussion and the overall shape of the stress response. However, anxiety did not relate to the same alteration in the rate of cortisol secretion during the conflict discussion that RS did. Neither attachment anxiety nor attachment avoidance related to males' instantaneous rate of change during the conflict discussion. Nor did the inclusion of these variables in the analytic model diminish the relation between RS and this change in males' rate of cortisol secretion in response to an interpersonal stressor. Thus, it is clear that neither of these insecure attachment dimensions explain the effects of RS on males' stress response patterns.

While these findings did not indicate a connection between RS and females' stress-response,

attachment anxiety was shown to have an impact on their HPA reaction to their experience of the conflict discussion. This contrasts with earlier analysis of a smaller subset of this sample in which it was attachment avoidance, and not attachment anxiety, that related to females' stress reactivity (Powers et al., 2006). The absence of any effect from RS on females' HPA response to interpersonal stress provides further evidence that RS, while conceptually related to insecure attachment styles, does not necessarily overlap with these constructs.

These findings suggest that RS is more closely related to attachment anxiety than attachment avoidance. Both RS and attachment anxiety relate to the stress response during relationship conflict in these analyses, whereas attachment avoidance did not. Furthermore, zero-order correlations (Table 2) showed an inverse relationship between RS and attachment avoidance, and a small but positive correlation between RS and attachment anxiety. The relationship between RS and insecure attachment may be more specific than Downey and Feldman (1994) had originally conceptualized. RS may be more typical in individuals that endorse an anxious attachment style than those that report avoidance.

Partners' Stress Response to Rejection Sensitive Behavior During Conflict

In our sample, stress response patterns in anticipation of conflict, during conflict, and in recovery from conflict did not relate to partners' level of RS. The hypothesis that partners of highly RS individuals would be more reactive to conflict was based on prior research evaluating attachment style and the HPA axis (Powers et al 2006). The findings in this study suggest further differentiation between RS and insecure attachment constructs in that attachment seems to imply a matrix of interpersonal dynamics whereas the impact of RS is specific to individuals' reaction to the perception of rejection. For the purpose of conceptualizing the stress response, RS is limited to the individual.

Neither males nor females exhibited distinct stress response patterns relative to their partners' RS level. The hypothesis that males' would be more reactive to highly RS females was based on evidence that males have more angry reactions to their female partners' RS behaviors (Downey et al. 1998). Even if we suppose that males are more offended by typical RS behaviors, in this sample this did not result in a more pronounced physiological stress response during conflict. This finding is useful in that it helps us to parcel out what may be most stressful for individuals engaged in conflict. Anger, while being a potent emotion, is not the same thing is stress, and may not trigger HPA reactivity.

Interaction Between Male and Female Partners' RS and the Stress Response

It was also hypothesized that the interaction between partners' RS levels may have an impact on the stress response. While this has not been evaluated in prior studies, the hostile behaviors and withdrawal of support associated with RS were expected to elicit a more potent response from individuals that are highly RS. These findings did not suggest that these internal relationships dynamics related to either males' or females' stress responses. This demonstrates, once again, that the RS may be most clearly applied to an individual's perceptions and reactions, but may not generalize to interpersonal dynamics.

Limitations

These interpretations are constrained by the cross-sectional design of this study. In order to fully understand the origins of the particular HPA axis patterns observed in late adolescent males within these data, it would be necessary to employ a longitudinal design. This could include earlier measurements of RS and cortisol reactivity in interpersonal contexts at earlier points in development to determine if the RS tendency is precedent or antecedent to this particular stress response pattern. Contextualizing these analyses in a developmental framework

would help to clarify whether RS sensitizes individuals to the experience of stress, or RS is a cognitive-affective interpretation of the physical feeling of stress.

The results of this study are somewhat limited in how they can be generalized to the population. The vast majority of subjects are European-American, so that these findings can not be extended to other ethnic and racial groups. All of the couples included in these analyses were heterosexual pairs, so that it cannot be determined if the interpersonal dynamics analyzed and discussed can be generalized to homosexual partners.

Conclusion

Males engaged in conflict show stress response patterns related to their level of RS. This is true even when attachment anxiety and avoidance are statistically controlled. This same pattern was not demonstrated in females and the reason for this gender difference is not particularly clear. Males' and females' RS does not seem to relate to their partners' stress response to relationship conflict. Further study of RS and HPA functioning will be important for our understanding of how interpersonal styles relate to the development of psychopathology.

Table 1.

Late Adolescents' Mean Cortisol Levels ($\mu\text{g/dl}$) for the Seven Saliva Samples

	Males			Females		
	<i>M</i>	<i>SD</i>	<i>N</i>	<i>M</i>	<i>SD</i>	<i>N</i>
Sample # 1 (entry)	.26	.30	193	.20	.12	193
Sample # 2 (anticipation)	.29	.30	197	.24	.20	197
Sample # 3 (discussion)	.25	.20	198	.24	.21	196
Sample # 4 (completion)	.22	.17	197	.23	.19	196
Sample # 5 (recovery)	.20	.16	198	.22	.19	197
Sample # 6 (recovery)	.17	.11	197	.22	.31	197
Sample # 7 (recovery)	.17	.17	198	.20	.24	197

Table 2.

Descriptive Statistics						
Predictor	Males			Females		
	<i>N</i>	<i>M</i>	<i>SD</i>	<i>N</i>	<i>M</i>	<i>SD</i>
RSQ	180	14.48	5.16	184	14.64	4.80
ECR						
Anxiety dimension	188	3.54	1.02	194	3.66	1.02
Avoidance dimension	185	2.64	.78	193	2.47	.77

Table 3. Parameter Estimates of Level 2 Rejection Sensitivity Predicting Their Cortisol Reactivity

<i>Fixed Effects</i>	Baseline Model		Control Model		Actor Model		Partner Model		Actor-Partner Model		Interaction Model	
	<i>Coefficient</i>	<i>SE</i>	<i>Coefficient</i>	<i>SE</i>	<i>Coefficient</i>	<i>SE</i>	<i>Coefficient</i>	<i>SE</i>	<i>Coefficient</i>	<i>SE</i>	<i>Coefficient</i>	<i>SE</i>
Males												
Discussion												
Point												
Instantaneous												
Rate of Change												
Curvature Across Trajectory												
Females												
Discussion												
Point												
Instantaneous												
Rate of Change												
Curvature Across Trajectory												

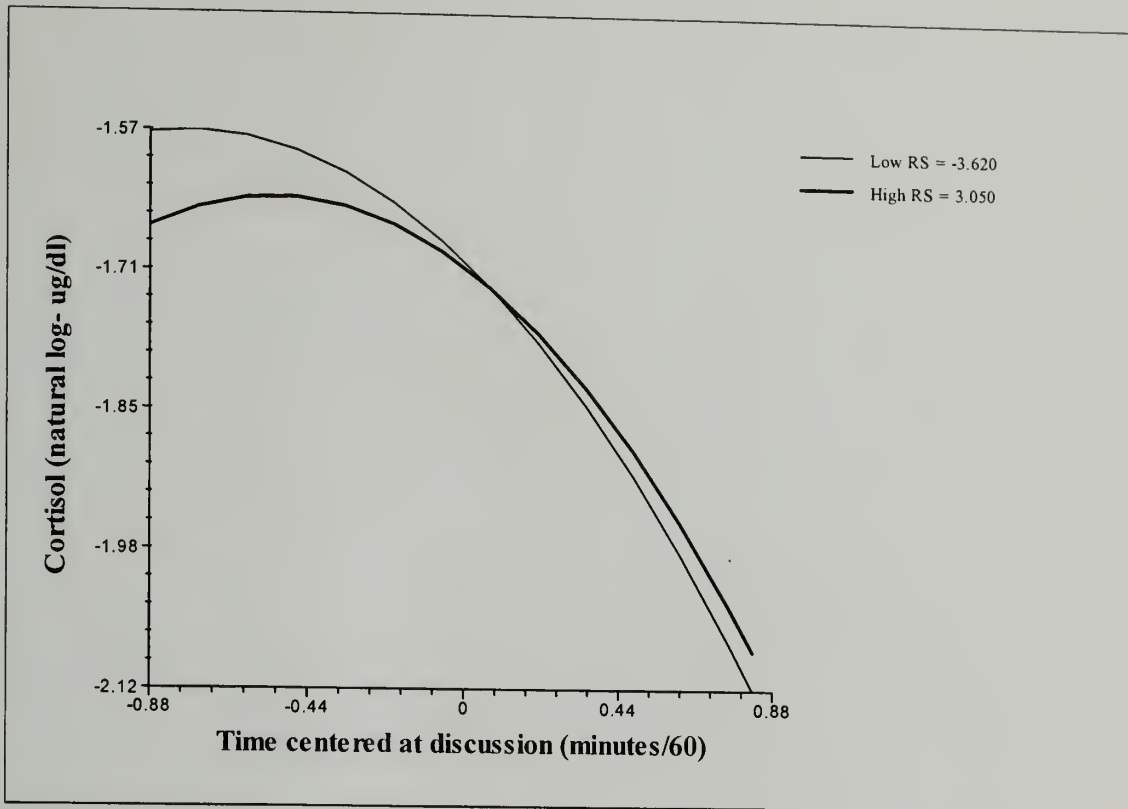
Note: * p<.05

Table 4. Parameter Estimates of Level 2 Rejection Sensitivity and Attachment Predicting Actor Cortisol Reactivity

<i>Fixed Effects</i>	Baseline Model			Control Model			RS Model			RS and Attachment Model		
	<i>Coefficient</i>	<i>SE</i>	<i>Coefficient</i>	<i>SE</i>	<i>Coefficient</i>	<i>SE</i>	<i>Coefficient</i>	<i>SE</i>	<i>Coefficient</i>	<i>SE</i>	<i>Coefficient</i>	<i>SE</i>
Males												
Discussion Point	Intercept	-1.655	.051		-1.655	.050	-1.655	.050	-1.655	.048		
	<i>Blood Contamination</i>				.589	.159	.542	.165	.545	.156		
	Rejection Sensitivity						-.001	-.009	-.008	.009		
	Attachment Anxiety								.169 **	.045		
	Attachment Avoidance								.017	.058		
Instantaneous Rate of Change	Intercept	-.288	.025		-.288	.025	-.289	.024	-.289	.024		
	<i>Allergy Medication</i>				.286	.152	.250	.132	.262	.127		
	Rejection Sensitivity						.011 *	.005	.010 *	.005		
	Attachment Anxiety								.017	.024		
	Attachment Avoidance								.017	.031		
Curvature Across Trajectory	Intercept	-.229	.033		-.229	.033	-.229	.033	-.229	.033		
	Rejection Sensitivity						-.004	.006	.000	.006		
	Attachment Anxiety								-.077 *	.032		
	Attachment Avoidance								.005	.041		
Females												
Discussion Point	Intercept	-1.675	.047		-1.675	.046	-1.676	.045	-1.680	.045		
	<i>Blood Contamination</i>				.531	.109	.663	.133	.579	.129		
	<i>Antibiotics</i>				.602	.335	.614	.241	.544	.238		
	Rejection Sensitivity						.013	.009	.010	.009		
	Attachment Anxiety								.095 *	.045		
	Attachment Avoidance								.017	.058		
Instantaneous Rate of Change	Intercept	-.131	.021		-.131	.021	-.131	.021	-.130	.021		
	<i>Blood Contamination</i>				.103	.058	.153	.078	.111	.077		
	Rejection Sensitivity						-.002	.004	-.004	.004		
	Attachment Anxiety								.037 ***	.022		
	Attachment Avoidance								-.046	.028		
Curvature Across Trajectory	Intercept	-.209	.030		-.210	.030	-.210	.029	-.210	.029		
	<i>Antibiotics</i>				-.367	.212	-.368	.171	-.375	.169		
	<i>Allergy Medication</i>				.212	.134	-.222	.162	-.190	.155		
	Rejection Sensitivity						-.002	.006	.002	.006		
	Attachment Anxiety								.008	.031		
	Attachment Avoidance								-.020	.038		

Note: * $p < .05$, ** $p < .01$, *** trend

Figure 1. Male Rejection Sensitivity and Cortisol Level



T₁ T₂ T₃ T₄ T₅ T₆ T₇

T1 (-.88) = First sample taken at entry

T2 (-.53) = Second sample taken at anticipation point

T3 (.00) = Third sample taken at discussion point

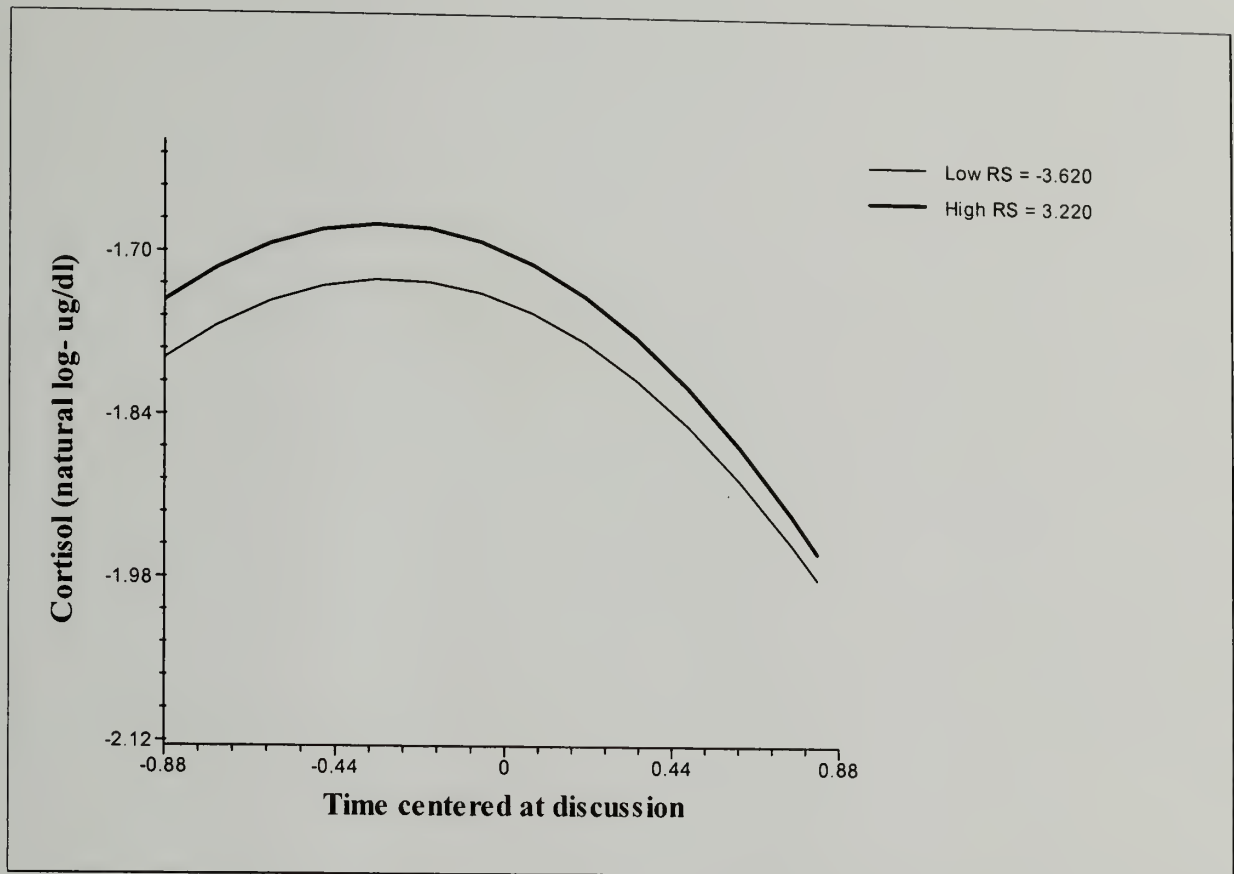
T4 (.17) = Fourth sample taken at completion of discussion

T5 (.34) = Fifth sample taken during recovery

T6 (.59) = Sixth sample taken during recovery

T7 (.84) = Seventh sample taken during recovery

Figure 2. Female Rejection Sensitivity and Cortisol Level



T₁ T₂ T₃ T₄ T₅ T₆ T₇

T₁ (-.88) = First sample taken at entry

T₂ (-.53) = Second sample taken at anticipation point

T₃ (.00) = Third sample taken at discussion point

T₄ (.17) = Fourth sample taken at completion of discussion

T₅ (.34) = Fifth sample taken during recovery

T₆ (.59) = Sixth sample taken during recovery

T₇ (.84) = Seventh sample taken during recovery

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