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BRIEF REPORT

Rumination, Fear, and Cortisol: An In Vivo Study of Interpersonal Transgressions

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The authors sought to examine whether rumination about psychologically painful, though nontraumatic, interpersonal transgressions is associated with increased salivary cortisol. They measured salivary cortisol, rumination about a transgression, fear and anger regarding the transgressor, perceived painfulness of the transgression, and positive and negative mood in 115 undergraduates who had experienced an interpersonal transgression during the previous 7 days. They obtained measurements on as many as 5 occasions separated by approximately 14 days each. On occasions when participants reported that they had been ruminating to a degree that was greater than was typical for them, they had higher levels of salivary cortisol than was typical for them. The rumination–cortisol association appeared to be mediated by fear of the transgressor. Rumination about even moderately painful but nontraumatic life events and associated emotions are related to biological changes that may subserve social goals such as avoiding social threats. Items from the rumination scale are appended.

Keywords: rumination, cortisol, hierarchical linear modeling, emotion, transgressions

Cortisol is a glucocorticoid that is involved in many biological functions, including growth, appetite, metabolism, and autonomic regulation (Lovallo & Thomas, 2000). In many species, cortisol is also sensitive to animals' social and emotional states: Stress, exposure to aggression, and competitions for dominance influence cortisol in many species (Abbott et al., 2003; Lovallo & Thomas, 2000; Overli, Harris, & Winberg, 1999). Among humans, psychological and social stressors can cause cortisol secretion, which is implicated in many of the psychological and physiological sequelae of chronic stress (Sapolsky, 1994). Cortisol is linked especially to social stressors that elicit fear or distress (Lovallo & Thomas, 2000).

Dickerson and Kemeny (2004) recently proposed that cortisol is a response to social–evaluative threat (i.e., concern that one is being evaluated negatively by other people). Moreover, van Honk et al. (1998) have shown that individual differences in basal cortisol are associated with avoidance of angry faces that are presented subliminally. In addition, van Honk et al. (2000) discovered that increases in cortisol after exposure to stimuli are positively associated with the allocation of attention to angry faces. Taken together, these data suggest robust and perhaps complex relationships between cortisol and exposure to threatening social stimuli.

Remembered Negative Life Events and Cortisol

One need not experience such threatening social stimuli in real time for them to elicit cortisol release: Activating autobiographical memories of such threats is apparently sufficient. Consistent with evidence that mental rehearsal of stressful memories elicits cardiovascular reactivity (McNally et al., 2004; Witvliet, Ludwig, & Vander Laan, 2001), people with high levels of ruminative thought about traumatic life events, including disasters (Aardal-Eriksson, Eriksson, & Thorell, 2001), motor vehicle accidents (Delahanty, Raimonde, Spoonster, & Cullado, 2003), and sexual abuse (Elzinga, Schmahl, Vermetten, van Dyck, & Bremner, 2003), experience increases in cortisol. The apparent link between rumination—a "passive and repetitive focus on the negative and damaging features of a stressful transaction" (Skinner, Edge, Altman, & Sherwood, 2003, p. 242)—and stress-related cortisol secretion led us to

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examine whether rumination about interpersonal transactions that are painful but by no means traumatic is also sufficient to elicit cortisol release. If someone begins ruminating about a romantic partner's recent sexual infidelity or an unfair reprimand she received from a work supervisor, would cortisol rise in response? Insofar as rumination leads to fear or worry (Dickerson & Kemeny, 2004; Lovallo & Thomas, 2000), the answer should be yes.

The Present Study

To test this hypothesis, we conducted an in vivo study to examine whether within-persons variations in rumination about nontraumatic social transactions that victims nonetheless perceive to be morally wrong and personally hurtful—interpersonal transgressions—are related to within-persons fluctuations in salivary cortisol. We hypothesized that on occasions when people's retrospective reports of how much they had ruminated during the previous 2 weeks about a recent interpersonal transgression were higher than was typical for them, they would also have cortisol concentrations that were higher than was typical for them. We also predicted that the entrainment of rumination and cortisol could be explained as a function of fluctuations in fear toward the transgressor (Dickerson & Kemeny, 2004; Lovallo & Thomas, 2000). In addition, we examined whether within-persons fluctuations in anger toward the transgressor, perceived transgression painfulness, and positive mood and negative mood were associated with within-persons fluctuations in cortisol.

Method

Participants

Participants were 115 undergraduate psychology students (91 women, 24 men; mean age = 19.76 years, *SD* = 2.61) at Southern Methodist University. Participants received extra course credit for enrolling and $20 if they completed five laboratory visits.

Participants had encountered interpersonal transgressions within the 7 days prior to recruitment (*M* = 4.04 days, *SD* = 1.82). Most transgressors were girlfriends/boyfriends (59%), friends of the same gender (19%), and friends of the other gender (11%). Some participants reported transgressions by relatives (10%), husbands/wives (3%), and others (9%). Transgressions included betrayals of a confidence or insults by a friend (28%); arguments with or neglect by a romantic partner, spouse, or ex-romantic partner (22%); romantic infidelity (19%); rejection, neglect, or insult by a family member (10%); termination of romantic relationship (11%); insults by people other than family or friends (3%); and rejection or abandonment by a friend or prospective romantic partner (2%). Five participants declined to describe their transgressions. On average, participants reported that these transgressions felt quite painful right after they occurred (mean level of subjective pain was 4.78, *SD* = 0.81, on a scale ranging from 0 = *not painful at all* to 6 = *worst pain I ever felt*).

Measures

Rumination about the transgression. We measured rumination about the transgression with the mean of eight items modeled after the Intrusiveness subscale of the Impact of Event Scale (Horowitz, Wilner, & Alvarez, 1979), which consists of items such as "I thought about it when I didn't mean to" and "I had waves of strong feelings about it." In writing our items (see Appendix), which were rated on a 6-point scale (ranging from 0 = *not at all true of me* to 5 = *extremely true of me*), we tried to reflect the fact that rumination has a passive, brooding, and typically intrusive quality (Skinner et al., 2003). Internal consistencies (α) exceeded .94 for all five measurement occasions. On the first measurement occasion, participants indicated the extent to which they had experienced the eight ruminative symptoms since the transgression had occurred; on the other four occasions, they indicated the extent to which they had experienced them during the previous 2 weeks.

Salivary cortisol. Participants provided two saliva samples during each laboratory visit. Salivary cortisol reliably reflects levels of plasma-free cortisol (Kirschbaum & Hellhammer, 1994). Samples were collected in 5-mL vials and then were frozen. In the laboratory, the cortisol concentration in each sample (measured in micrograms per deciliter) was established via enzyme-linked immunosorbent assay (ELISA) using a high-sensitivity salivary cortisol kit (Salimetrics, State College, PA). The cortisol values were positively skewed so we subjected them to a natural log transformation. The cortisol values obtained at the beginning and end of the laboratory sessions did not differ significantly, matched pairs, $t(505) = -1.01$, $p > .30$, and were highly correlated, $r(N = 505) = .91$, $p < .01$. Therefore, we averaged participants' two cortisol values from each session to enhance reliability.

Anger and fear regarding the transgressor. To measure participants' anger and fear regarding their transgressors, we asked the participants to complete adjectives to indicate how they felt about the person who had hurt them using a 6-point Likert-type scale (0 = *not at all*, 5 = *extremely*). We measured anger with the mean of three adjectives (*angry*, *mad*, and *enraged*) and fear with the mean of two adjectives (*afraid* and *fearful*). The range of internal consistencies (αs) was .85–.95 across the five measurement occasions.

Perceived painfulness of the transgression. On the five measurement occasions, participants completed a single item that read, "How painful is the offense to you right now?" using a 7-point Likert-type scale (0 = *not very painful at all*, 7 = *worst pain I ever felt*).

Positive and negative mood. We measured positive and negative mood states with the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988). This measure consists of 20 emotion words (e.g., *upset*, *proud*) that participants rated on a 5-point Likert-type scale to indicate the extent to which they had experienced each emotion over the previous 2 weeks, yielding a 10-item positive mood scale and a 10-item negative mood scale. Internal consistency reliability estimates were α = .78–.93 across five measurement occasions.

Procedure

Prospective participants were undergraduate psychology students who indicated that they had encountered a serious interpersonal transgression (something they considered "wrong" and "potentially hurtful" to them personally) during the previous 7 days. In soliciting participation, we indicated that we were interested in nontrivial events such as betrayals of confidence, romantic infidelity, property damage, and physical or emotional harm. We also indicated that we were not interested in petty arguments that were quickly resolved, misunderstandings that were easily cleared up, or participants' own harmful actions that they later regretted. After returning a preliminary screening questionnaire, eligible participants were scheduled for five laboratory visits spaced as closely as possible to 14 days apart. At each laboratory visit, participants first provided a saliva sample and then completed the self-report measures described herein. Afterward, they provided a second saliva sample. Participants returned every other week for up to four additional sessions. Approximately 99% of the laboratory sessions occurred between 10:00 a.m. and 4:00 p.m., thereby avoiding the very steep declines in serum cortisol that occur through the early morning for most people (Lovallo & Thomas, 2000). Even so, we included data from all laboratory sessions in our analyses.

We tried to limit nuisance variance in cortisol by holding constant the time of day and day of week for each participant's sessions (Lovallo & Thomas, 2000). Of the 115 participants, 96 completed five laboratory sessions, 5 completed four sessions, 5 completed three sessions, 5 com-

pleted only two sessions, and 4 completed only one session. Laboratory sessions lasted approximately 20 min.

Statistical Analyses

Because we measured cortisol and the self-report variables on as many as five occasions per individual, we analyzed the data with a two-level regression model (Nezlek, 2001). The Level-1 equation, describing how within-persons variation in a set of predictors was linked to within-persons variation in cortisol, was of the following form:

$$Cortisol_{ij} = \beta_{0j} + \beta_{1j}(rumination)_{ij} + r_{ij} \quad (1)$$

where $Cortisol_{ij}$ = person j's cortisol value on occasion i; β_{0j} = person j's mean cortisol value across the five measurement occasions, β_{1j} = the coefficient for the association of rumination and cortisol for person j, $(rumination)_{ij}$ = person j's rumination score on occasion i, and r_{ij} = a residual in person j's cortisol value on occasion i. We conducted within-persons models similar to the model in Equation 1 in which we substituted the measures of rumination for measures of anger and fear regarding the transgressor, perceived painfulness of the transgression, and positive and negative moods of the participant. These latter models enabled us to evaluate whether these latter variables might function as mediators or confounds of the rumination–cortisol association.

The equations in the Level-2 (or between-persons) models that described the between-persons differences in the Level-1 β parameters were as follows:

$$\beta_{0j} = \gamma_{00} + u_{0j} \quad (2)$$

$$\beta_{1j} = \gamma_{10} + u_{1j}. \quad (3)$$

In Equation 2, β_{0j} refers to person j's mean level of salivary cortisol across all laboratory sessions. This parameter is modeled as a function of γ_{00}, which is the expected mean level of cortisol across sessions for the entire sample (i.e., a grand mean), and u_{0j}, which is a residual in person j's mean level of cortisol that cannot be attributed to the grand mean. In Equation 3 above, β_{1j} refers to person j's within-persons association of rumination and salivary cortisol. This parameter is modeled as a function of γ_{10}, which represents the expected within-persons association between rumination and salivary cortisol for the entire sample, and u_{1j}, which represents the deviation of person j's within-persons association of rumination and cortisol from the expected within-persons association for the entire sample. Having conducted multilevel models in which the self-report variables were used to predict cortisol as in Equations 1–3 above, we examined mediational hypotheses (Krull & MacKinnon, 2001).

Because we had two measures of cortisol for each laboratory session—one before and one after participants completed the rumination scale—we also examined whether the amount of rumination participants reported during a given session was associated with their amount of pretest–posttest change (calculated as Δ) in cortisol during that session.

Results

Descriptive Statistics

Sample sizes, means, and standard deviations for major study variables, by measurement occasion, appear in Table 1. For the typical individual in the sample, all of the variables declined over time except for positive affect, which increased over time, and cortisol level, which did not change significantly as a function of time.

Within-Persons Correlates of Cortisol

Table 2 shows the unstandardized coefficients, standard errors, t values, p values, and effect size r statistics for the within-persons associations of cortisol with rumination and the other measures. Within-persons fluctuations in (a) rumination about the transgression and (b) fear of the transgressor were significantly associated with fluctuations in cortisol. For example, as Table 2 shows, each 1-unit increase in rumination was associated with a .037 log-unit increase in cortisol. This increase was significant ($p = .045$, two-tailed) albeit small in magnitude (effect size $r = .19$). The association of rumination with cortisol did not differ across persons (variance = .00731, $\chi^2(109, N = 110) = 127.16$, $p > .10$).

Similarly, the coefficient for fear of the transgressor (.074) indicates that a 1-unit increase in fear of the transgressor was associated with a .074 log-unit increase in the typical participant's salivary cortisol (effect size $r = .31$). None of the other variables were significantly associated with salivary cortisol at the within-persons level, ps $> .05$.

We looked for gender differences in the within-persons associations of the six self-report variables with cortisol. The only gender difference was in the association of fear with cortisol, for which the association was stronger in women than in men. The coefficient for the gender difference was −.105, $SE = .051$, $t = -2.039$, $p = .043$. When we controlled for gender (i.e., when the data were centered on the women), we found that the estimated association of fear and cortisol was .099, $SE = .020$, $t = 4.866$, $p < .001$, effect size $r = .42$. By adding the coefficient for gender (−.105) to the coefficient for the fear–cortisol association with the data centered on the women (.099), we could estimate that the association of fear and cortisol for men was .099 + (−.105) = −.006. Thus, fear was a stronger within-subjects predictor of cortisol for women than it was for men (for whom it was only trivially different from zero). However, the association of rumination and cortisol did not differ

Table 1
Sample Sizes, Means, and Standard Deviations for Major Study Variables by Measurement Occasion

	Occasion 1			Occasion 2			Occasion 3			Occasion 4			Occasion 5		
Psychological variable	*n*	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*
Rumination about the transgression	114	3.55	0.96	111	2.01	1.21	106	1.24	1.13	101	0.90	1.00	96	0.80	1.05
Salivary cortisol (μg/dL)	113	0.32	0.23	109	0.30	0.22	103	0.29	0.23	98	0.27	0.19	94	0.29	0.19
Anger toward transgressor	115	2.55	1.45	111	1.72	1.38	105	1.24	1.35	101	1.01	1.24	96	0.89	1.21
Fear of transgressor	115	1.33	1.56	111	0.77	1.13	105	0.50	0.88	101	0.47	0.93	96	0.54	0.95
Perceived painfulness of transgression	115	3.92	1.05	111	2.95	1.37	106	2.21	1.43	101	1.91	1.42	95	1.73	1.46
Positive affect (past 2 weeks)	115	2.80	0.81	111	3.01	0.82	106	3.12	0.82	101	3.09	1.05	95	3.02	1.07
Negative affect (past 2 weeks)	115	2.48	0.75	111	2.15	0.74	106	1.98	0.67	101	1.87	0.66	95	1.86	0.60

Table 2
Coefficients, Standard Errors, Significance Tests, and Effect Sizes for Within-Persons Associations of Six Psychological Variables With Salivary Cortisol

Psychological variable	Coefficient	*SE*	*t*	*p*	Effect size *r*
Rumination about transgression	0.037	0.018	2.025	.045	.19
Anger toward transgressor	0.025	0.020	1.248	.215	.12
Fear of transgressor	0.074	0.021	3.513	.001	.31
Painfulness of transgression	0.035	0.020	1.775	.078	.16
Positive affect (past 2 weeks)	−0.060	0.034	−1.743	.084	−.16
Negative affect (past 2 weeks)	0.044	0.050	0.873	.385	.08

Note. $N = 115$ for all t tests.

by gender, so we did not control for gender in our mediational models.

Mediation of the Rumination–Cortisol Association

We then examined whether rumination was associated with salivary cortisol by way of its ability to increase fear of one's transgressor. Krull and MacKinnon's (2001) method for examining Level-1 mediation in multilevel designs requires three equations. The first equation estimates the association of the presumed predictor (rumination) with the presumed outcome (cortisol). Table 2 shows that this condition of mediation was fulfilled. The second equation estimates whether the association between the presumed mediator (fear) and the presumed outcome (cortisol) is maintained even in cases in which the predictor (rumination) is controlled. In this equation, fear maintained a significant within-persons association with cortisol ($\beta = .047$, $p = .05$), but rumination did not ($\beta = .026$, $p = .20$). The third equation estimates the association of the predictor (rumination) and the presumed mediator (fear). This association was also significant ($\beta = .293$, $p < .001$). The result of a Sobel's test for mediation just barely missed conventional criteria for statistical significance, $z = 1.91$, $p = .056$, suggesting that fear of the transgressor may mediate the rumination–cortisol link (see Figure 1).

Association of Rumination With In-Session Cortisol Reactivity

Next, we examined whether the amount of rumination that participants reported in a given laboratory session was associated with the amount of pretest–posttest change in cortisol during that session. Although we found a significant within-persons association between rumination and cortisol reactivity ($p = .048$) such that cortisol increased to a greater extent on occasions when people reported a high degree of rumination, this association was reduced to a nonsignificant trend ($p = .091$) when we controlled for the amount of time since the transgression occurred. Thus, it appeared that the association of rumination and cortisol reactivity was, for the most part, a spurious result of the influence that the passage of time exerted on both rumination and in-session cortisol reactivity.

Discussion

Exposure to social threats such as an impending evaluation of one's performance (Dickerson & Kemeny, 2004) and the amount of attention allocated to angry faces (van Honk et al., 2000) has been linked to transient increases in cortisol. Moreover, mental rehearsal and intrusive imagery regarding painful life events are associated with physiological changes (Elzinga et al., 2003; Glynn, Christenfeld, & Gerin, 2002; McNally et al., 2004; Witvliet et al., 2001), including cortisol reactivity (Delahanty et al., 2003; Elzinga et al., 2003). The effect of such cognitive processes on cortisol levels might be due to the intermediate effects of those processes on subjective appraisals of pain, fear, distress, or the perceived disapproval of others (Dickerson & Kemeny, 2004; Lovallo & Thomas, 2000).

In the present study, we discovered that when people reported having ruminated a great deal during the previous 2 weeks about a recent interpersonal transgression—an interpersonal event that

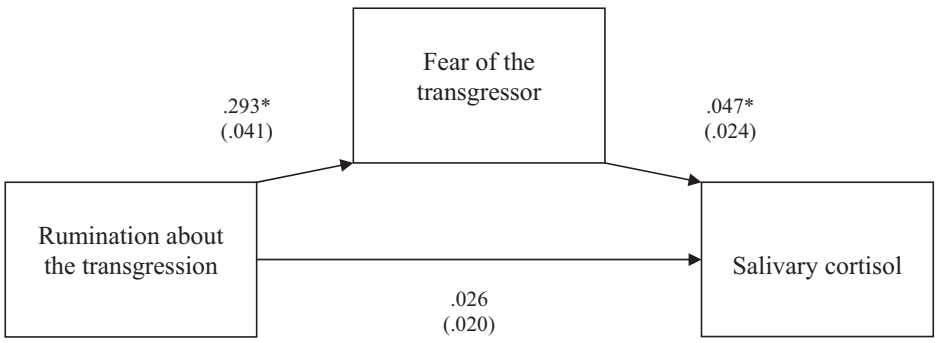

Figure 1. Unstandardized coefficients (standard errors in parentheses) for fear of the transgressor as a mediator of the rumination–cortisol relationship. Asterisks indicate $p < .05$.

was nontraumatic but nonetheless psychologically painful (recall that the mean degree of subjective painfulness right after the transgressions occurred was 4.78 on a 0–6 scale)—they experienced transient increases in cortisol. Although everyone dislikes being ridiculed, learning of a romantic partner's infidelity, or discovering that a friend in whom one confided has revealed an embarrassing secret, most would no doubt view such transgressions as qualitatively different from traumatic experiences like sexual abuse, natural disasters, and motor vehicle accidents. Nevertheless, our results indicate that insofar as people experience a "passive and repetitive focus on the negative and damaging features of a stressful transaction" (Skinner et al., 2003, p. 242), cortisol levels rise in response.

In addition, fear of the transgressor was associated with cortisol level, and analyses suggested that fear may mediate the rumination–cortisol association: On occasions when people reported having ruminated to a great extent during the previous 2 weeks, they tended to experience more fear of their transgressors, and this increased fear appeared responsible for cortisol level increases. Fear toward a transgressor might be higher on one occasion than on others if the transgression recipient is anticipating an upcoming negative interaction with the transgressor.

Fear—a basic emotion (Ekman, 1992)—is an adaptive biobehavioral response to threats (Korte, 2001) that is characterized by (a) subjective feelings of fear (in humans, at least), (b) behavioral responses such as fleeing or freezing, and (c) physiological responses (e.g., hypothalamic–pituitary–adrenal axis activation). Rumination may serve the adaptive function of activating these responses so that people maintain a vigilant posture toward threats from the past that could become threats again (Korte, 2001; van Honk et al., 2000). One should keep in mind, of course, that corticosteroids have also been implicated in causing fear and avoidant responses to social threats (Korte, 2001; Song, Phillips, & Leonard, 2003; van Honk et al., 1998). Thus, the causal relations among rumination, fear, and cortisol may be dynamic and reciprocal rather than unidirectional. Clearly, much more research remains to be done, but the present findings suggest that the top–down activation of thoughts, feelings, and images regarding a threatening social experience are sufficient to elicit increases in cortisol in humans.

Limitations and Directions for Future Research

Future researchers in this area might consider addressing the limitations of the present work. First, because our measure of rumination instructed participants to report on the extent to which they ruminated about a transgression during the previous 2 weeks, whereas the measure of fear instructed them to report their immediate feelings regarding their transgressors—and because the measures of cortisol assessed neuroendocrine activity at the beginnings and endings of the laboratory sessions themselves—our results do not present a clear picture of the temporal dynamics by which rumination might influence cortisol.

This dilemma is compounded by the fact that retrospective judgments of one's psychological or affective experience are unlikely to be simple arithmetic means or integrals of one's affective experience over the interval of time under consideration. For example, Redelmeier and Kahneman (1996) found that retrospective reports of pain during painful medical procedures were most highly correlated with the peak pain intensity that participants reported during the procedure and the pain intensity they reported during the final portion of the procedure. Similarly, our participants' reports of how much they ruminated about a transgression during the previous 2 weeks might have reflected their amount of rumination in the laboratory itself, plus their maximum amount of rumination during the previous 2 weeks.

However, it is noteworthy that the amount of rumination participants reported in the laboratory was not significantly related to increased cortisol during the laboratory sessions (after we controlled for the effects of the passage of time on both rumination and in-session cortisol reactivity, the association was reduced to a statistically nonsignificant trend). Therefore, the process of ruminating in the laboratory itself did not appear to be the major cause for the observed association of rumination with mean levels of cortisol in the laboratory. Instead, it seems likely that rumination outside the laboratory created more chronic elevations in cortisol that we were then able to detect once participants actually arrived in the laboratory. The exact time course of the relationship between rumination and cortisol level could be worked out more definitively through more frequent (e.g., daily) sampling of rumination and cortisol, the use of experience sampling methods to assess rumination as it occurs in people's daily lives, or use of experimental inductions of rumination in the laboratory.

A related limitation of the present study is that it was nonexperimental. As a result, the observed rumination–cortisol association might have been produced by unmeasured confounds (e.g., we did not measure life stress independently of the interpersonal transgressions that people encountered). This concern is mitigated by the fact that none of the other variables that we measured (i.e., transgression painfulness, anger toward the transgressor, or positive affect and negative affect during the previous 2 weeks) appeared to operate as confounds (because they were, for the most part, uncorrelated with cortisol level), but greater attention to possible confounding variables is warranted in future studies.

A third limitation emerges from the fact that although the association of rumination and cortisol did not differ by gender, fear of the transgressor was associated with cortisol only for women. This suggests that whereas self-reported fear of the transgressor may operate as a mediator of the rumination–cortisol relationship for women, more work must be done to examine psychological mediators of this association among men.

Fourth, and in a related vein, we hasten to note that we did not measure the full range of discrete negative emotions that could be examined in this context. Consideration of a broader range of negative emotions (e.g., disgust, contempt) might help to account more fully for the rumination–cortisol relationship, particularly in men.

Conclusion

Despite these limitations, the present study is the first of which we are aware to show that in vivo rumination about painful interpersonal transactions—even nontraumatic ones—has important neuroendocrine correlates. Given the link between rumination and health (Thomsen, Mehlsen, Hokland, et al., 2004; Thomsen, Mehlsen, Olesen, et al., 2004), research evaluating the health consequences of the rumination–cortisol link would be valuable.

The effects of rumination on emotion, social behavior, and health are quite undesirable (Bushman, 2002; Nolen-Hoeksema, 1998; Rusting & Nolen-Hoeksema, 1998; Thomsen, Mehlsen,

Hokland, et al., 2004; Thomsen, Mehlsen, Olesen, et al., 2004), so scientists have wondered why people ruminate at all (e.g., Martin & Tesser, 1996; Watkins & Baracaia, 2001). Although our results should be viewed as preliminary, they suggest that rumination may be a mental strategy for eliciting a complex of fear-related affective and physiological changes that constitute a vigilant, self-protective stance toward threats—including social ones. The adaptive benefits of fear are self-evident. Perhaps rumination is a cognitive mechanism for reactivating this adaptive, albeit unpleasant, emotion.

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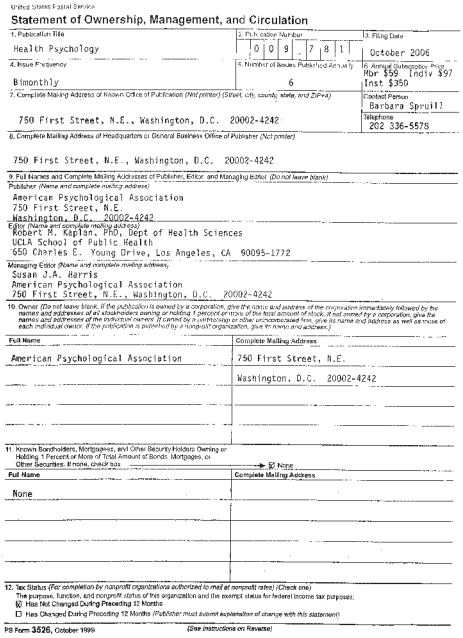
(*Appendix follows*)

Appendix

Items on the Rumination Scale

1. I couldn't stop thinking about what he/she did to me.
2. Thoughts and feelings about how he/she hurt me kept running through my head.
3. Strong feelings about what this person did to me kept bubbling up.
4. Images of the offense kept coming back to me.
5. I brooded about how he/she hurt me.
6. I found it difficult not to think about the hurt that he/she caused me.
7. I found myself playing the offense over and over in my mind.
8. Even when I was engaged in other tasks, I thought about how he/she hurt me.

Note. Participants were instructed to rate the frequency with which they had had each of these experiences in the previous 2 weeks (or in the case of the first measurement occasion, since the offense occurred) using a 6-point scale (0 = *not at all*, 1 = *very little*, 2 = *somewhat*, 3 = *moderately*, 4 = *considerably*, or 5 = *extremely*).



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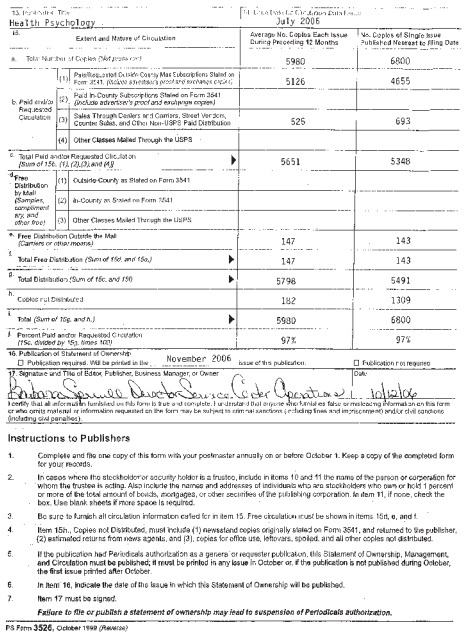

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