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**Conflict and Cortisol in Newlyweds' Natural Environments:  
The Stress-Buffering Role of Perceived Network Support**

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**Conflict and Cortisol in Newlyweds' Natural Environments:  
The Stress-Buffering Role of Perceived Network Support**

**by**

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**Thesis**

Presented to the Faculty of the Graduate School of

The University of Texas at Austin

in Partial Fulfillment

of the Requirements

for the Degree of

**Master of Arts**

**The University of Texas at Austin**

**December 2013**

## **Acknowledgements**

I first thank my adviser, Timothy Loving, for his patient and constructive guidance throughout this project and throughout each of my professional endeavors. I thank Lisa Neff for providing me with the invaluable experience of managing the Austin Marriage Project and for all her theoretical and statistical guidance thereafter, and Paul Eastwick for his thoughtful feedback on this project. Additionally, I thank my lab mates, April Allen Buck and Taylor Anne Morgan, for their constant support as my friends and colleagues as well as their tireless work on the Austin Marriage Project. Lastly, I thank the sources of my highly satisfying social network support, including Chase Fleming, Susan Shellhammer, Carla Smith, Maggie Kane, and Tara Clark.

## **Abstract**

### **Conflict and Cortisol in Newlyweds' Natural Environments: The Stress-Buffering Role of Perceived Network Support**

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Relationship conflict is robustly linked to negative physiological responses that have serious implications for partners' overall physical health. The link between relationship conflict and physiological reactivity, however, has been studied almost exclusively in a laboratory setting. The first aim of this study was to assess the link between conflict and physiological function in couples' home environments. Newlywed spouses reported occurrences of marital conflict in a daily diary and concurrently provided morning and evening saliva samples for the calculation of daily diurnal cortisol slopes. Spouses experienced less steep (i.e., less healthy) diurnal cortisol slopes on days of greater marital conflict. The second aim of this study was to examine whether spouses' connections with close others outside their marriages (i.e., quantity and quality of perceived network support) moderate physiological responses to marital conflict. Whereas the quantity of network support did not influence spouses' responses to conflict, the quality of spouses' network support attenuated the association between daily marital

conflict and diurnal cortisol. Specifically, whereas those spouses who were less satisfied with their network support experienced less steep diurnal cortisol on days of greater marital conflict, those spouses who were more satisfied with their network support exhibited no effects of daily marital conflict on diurnal cortisol. Implications for maintaining quality social relationships outside a marriage are discussed.

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## INTRODUCTION

Disagreements naturally occur in any relationship when two individuals' lives are intertwined (Cupach, 2000). Despite its ubiquity, however, relationship conflict is not innocuous. Conflict is robustly linked to negative physiological responses that have serious implications for partners' overall physical health (for review, see Wright & Loving, 2011). Importantly, the vast majority of research on relationship conflict and physiological outcomes has been conducted in the laboratory. On the one hand, studying the effects of relationship conflict in laboratory environments provides researchers with the control that allows for a careful examination of the links between micro-level biological processes and specific behavioral sequences. On the other hand, however, the constraints of the empirical setting unnaturally isolate participants from their real-life interaction contexts. Thus, the extent to which associations observed in the laboratory can be generalized to couples' natural environments is not fully understood.

Isolating participants from their natural social environments may particularly limit the generalizability of laboratory-based conflict studies. Specifically, couples are embedded within social networks comprised of friends and family members. These close others provide important sources of relationship support (e.g., Bryant & Conger, 1999), including a shoulder to cry on during times of relationship strain as well as a sounding board to process relationship events when couples members are trying to work through specific issues (e.g., Klein & Milardo, 2000). Furthermore, network members provide a general sense of connectedness to others outside couple members' romantic relationships (Voss, Markiewicz, & Doyle, 1999).

This sense of belonging outside the dyad may have important implications for how couple members function within their relationships. Consistent with themes in the networks literature that suggest a relationship partner, though important, is not a ‘one and only’ (e.g., DePaulo & Morris, 2005), friends and family members play an important role in shaping well-being. Although relationships researchers often assert that “no couple is an island” (Felmlee, 2001), couple members do *vary* in the extent to which they are connected to others outside their romantic relationships (Voss, Markiewicz, & Doyle, 1999). This variation in the extent to which couple members feel they have others to turn to may influence how partners respond to events in their relationships.

I propose that feelings of belonging and support external to a romantic relationship may buffer partners from any negative effects resulting from intimate relationship conflict. Below, I briefly review the literature on the link between relationship conflict and physiological outcomes. I then highlight how partners may draw on perceptions of social network support to fulfill their need to belong—a need that is inherently threatened when partners experience conflict in their romantic relationships. Finally, I outline the current study in which I test whether day-to-day relationship conflict in partners’ home environments is associated with negative physiological outcomes and whether this physiological stress is moderated by partners’ perceptions of the quantity and quality of support available from their social networks.

## **RELATIONSHIP CONFLICT AND PHYSICAL OUTCOMES**

Conflicts are a natural part of any relationship as two individuals’ needs and wants will not always be in line (Thibaut & Kelley, 1959; Kelley & Thibaut, 1978). Even

the most minor disagreements require one individual to accommodate another, and these negotiations can take a mental and physical toll. Negative interactions between intimates are associated with a variety of detrimental individual and dyadic outcomes (e.g., greater depressive symptoms and greater risk for divorce, respectively; Choi & Marks, 2008; Kiecolt-Glaser, Bane, Glaser, & Malarkey, 2003). Moreover, relationship conflict induces shifts in cardiovascular, endocrine, and immune function, and this dysregulation of key body systems has implications for objective health outcomes (Wright & Loving, 2011). For example, conflict reliably activates the hypothalamic-pituitary-adrenocortical (HPA) axis of the endocrine system, resulting in the release of cortisol, one of the human body's primary stress hormones (e.g., Kiecolt-Glaser et al., 1996; Heffner et al., 2006). Furthermore, conflict, particularly conflict characterized by negativity or hostility, predicts delayed wound healing (Kiecolt-Glaser et al., 2005), decreased immunity to latent viruses, and decreased immune cell counts (Kiecolt-Glaser et al., 1993; Kiecolt-Glaser et al., 1997). Over time, elevations in cortisol associated with chronic relationship strain result in a host of negative physical outcomes, including poor cardiovascular and immune function (Robles & Kiecolt-Glaser, 2003), increased likelihood of illness, and early mortality (McEwen, 1998).

As noted above, the vast majority of research on physiological responses to relationship conflict has been conducted in the laboratory. During these laboratory studies, couples are instructed to sit in chairs facing one another, directed to discuss a specific relationship issue (sometimes chosen from a list), timed while they engage in the conflict discussion, and interrupted by a researcher to end the discussion. It is also

commonplace to, for example, isolate couples from their social networks during these laboratory studies (i.e., ask them not to make phone calls). These protocols *necessarily* standardize the study procedures across couples. Although couple members report that their laboratory-based conflicts reflect their real-life dynamics (Heyman, 2001), very few studies have observed the physical consequences of naturally occurring conflict in couples' natural worlds. A number of environmental factors influence couples' day-to-day relationship dynamics. One such factor, and the focus of this investigation, is the extent to which couple members rely on social connections and know they can turn to close others outside their relationships during relationship conflict.

## **THE NEED TO BELONG AND SOCIAL NETWORKS**

Humans are characterized by a fundamental need to belong (Baumeister & Leary, 1995)—individuals must maintain a minimum quantity and quality of social contacts in order to feel connected to others. When feelings of belonging are lacking, such as in the contexts of social rejection or loneliness, individuals experience a range of negative mental and physical consequences (for reviews, see Hawkey & Cacioppo, 2010; Williams, 2007). Given the negative consequences of deficits in social connection, humans are keenly aware of threats to belonging (Baumeister & Leary, 1995). According to the *substitution hypothesis*, deficits in feelings of belonging resulting from the loss of one social relationship can be replaced by forming another social connection (Baumeister & Leary, 1995). The idea of substitution highlights the fundamental nature of the need to belong as a human drive for survival—the need must be fulfilled elsewhere when at a deficit to avoid a prolonged threat to well-being. Although the original formulation of the

substitution hypothesis focused on the formation of new social connections, it has become clear that individuals can seek connection in existing social relationships when experiencing a void in belonging, such as when relationship quality with a current romantic partner suffers (Spielmann, Joel, MacDonald, & Kogan, 2013). In other words, humans seek out others when they feel a threat to connectedness, including when the deficit is in one's romantic relationship.

Interestingly, even “*potential threats* to social bonds generate a variety of unpleasant emotional states” (Baumeister & Leary, 2005, p. 520; emphasis added). For example, attachment insecurity vignettes (e.g., “recall a person that abandoned you when you really needed them...”) are often used to prime feelings of social detachment or loss (Sakaluk, in press). Given humans' attunement to social connection, people are wired with a number of information-processing mechanisms that alert them to potential social threats and regulate responses to correct social deficits. According to the Risk Regulation Model (Murray, Holmes, & Collins, 2006), for instance, partners must assess ‘risk’, or feelings of rejection when experiencing conflict, and thereby activate social behaviors that promote connectedness goals (Murray, Derrick, Leder, & Holmes, 2008). Similarly, empirical support for Sociometer Theory (Leary, 2005) provides evidence that decreases in self-esteem following social exclusion alert individuals to a lack of social connection and subsequently motivate them to seek out connectedness with others (Denissen, Penke, Schmitt, & van Aken, 2008). Across these lines of work, it is clear that individuals are equipped with innate mechanisms designed to sense deficits in social connection.

Conflict represents one relationship context in which individuals are especially

likely to perceive potential threats to their connection with partners. Specifically, relationship conflict is associated with partners' perceptions of greater relationship instability (Loving et al., 2004)—couple members feel less certain about their relationship lasting relative to when there is no conflict. As conflict activates a perceived threat in partners' social regulation systems, couple members should also be motivated to seek connectedness elsewhere. Importantly, it is not the case that a friend can simply replace a romantic partner (Coyne & DeLongis, 1986); rather, *fluctuations* in feelings of connectedness with one's romantic partner can be temporarily compensated for by feeling connected in other relationships.

## **SOCIAL CONNECTION AND STRESS BUFFERING**

According to the stress-buffering model of social support, perceptions of connectedness to others mitigate negative consequences associated with life stressors (Cohen & Wills, 1985). Support for the stress-buffering model has been obtained in a variety of samples and in a variety of stress-related contexts. For example, college students who are currently experiencing loneliness and who also perceive greater available network support at their universities experience lower pulse pressure during a laboratory stress task than lonely students who perceive less network support (O'Donovan & Hughes, 2007). Whereas students exhibited physical stress in response to a lack of connectedness, those that knew they had others that they could potentially form social connections with were buffered from the negative physical consequences of loneliness. Perceptions of greater social network support also improve average diurnal cortisol for parents of children with autism or ADHD (Lovell, Moss, & Wetherell, 2012).



Collectively, these and similar studies provide evidence that feeling more (versus less) connected to others, as evidenced by perceptions of greater social network support, can guard against both psychological *and physical* stress. Over time, this physiological buffering may manifest in improved health outcomes by slowing the accumulation of the negative consequences typically associated with unabated stress.

I propose that perceptions of social network support buffer individuals from the negative physiological effects of relationship conflict. Empirical evidence in support of this hypothesis would have important implications. Relationship conflict is a unique stressor in that the source of stress is, generally, one's primary support provider. In other words, the person who partners would naturally turn to during times of need is the cause of (or associated with) the problem. Studies on social support, however, most often include perceptions of available spousal support under the 'umbrella' of overall social network support availability (e.g., House, Landis, & Umberson, 1988), confounding perceived support from one's social network with perceived support from one's spouse. Therefore, the context of relationship conflict exclusively allows for an examination of the stress-buffering effects of perceived social support, *excluding* support from one's partner. An analysis of available and satisfying support outside of a relationship provides a test of the impact of perceived social support when, as is unavoidable, one's relationship is a cause of stress.

## **OVERVIEW OF THE CURRENT STUDY**

The primary goals of this study were to clarify the biological responses to naturally occurring relationship conflict and to test whether perceived social network

support might buffer partners from the physiological strain of relationship conflict. Studying couples in their natural environments provides a much-needed test of whether the association between conflict and cortisol extends beyond the walls of the laboratory into daily relationship interactions. To achieve these aims, I examined whether the physiological stress of day-to-day marital conflict is lessened when spouses perceive available and satisfying social network support outside their marriages.

Extending prior work on the physiological consequences of relationship conflict, a daily diary and at-home saliva collection study design was used to assess the link between everyday conflict and diurnal cortisol slopes. The assessment of cortisol in couple members' natural environments provides important information about individuals' day-to-day physical function. The slope of the change in cortisol throughout the course of a day (i.e., its diurnal pattern) is a critical marker of a healthy HPA axis, which regulates numerous body functions and responses. Additionally, diurnal cortisol is a more robust predictor of health outcomes than absolute levels of cortisol (Adam & Kumari, 2009). Individuals with normally functioning endocrine systems begin each day with peaking levels of cortisol within the first thirty minutes of waking and experience a steady decline in cortisol throughout the day. A slower rate of decline in cortisol over the course of the day, or flatter diurnal cortisol slopes, are associated with chronic and acute psychosocial stress (Adam, Hawkley, Kudielka, & Cacioppo, 2006), impaired immune functioning (Uchino, Cacioppo, & Kiecolt-Glaser, 1996), and early mortality (e.g., Sephton, Sapolsky, Kraemer, & Spiegel, 2000). Consequently, flattened cortisol slopes are considered an important indicator of accumulated stress, or what is commonly referred to

as allostatic load (McEwen, 1998). The HPA axis is especially sensitive to socially threatening situations (Dickerson & Kemeny, 2004) and perceptions of social support (Sjögren, Leanderson, & Kristenson, 2006), making diurnal cortisol an excellent biological marker of daily physiological health for the current study.

Extant research on perceived social network support has unfortunately suffered from a lack of clarity in the conceptualization and measurement of support (for review, see Uchino, 2004). The umbrella term “perceived social support” has included assessments of the size of one’s social network (e.g., number of friends), levels of social integration and diversity (e.g., the number of different types of relationships one engages in—spouse, family, friends, coworkers, acquaintances), perceived availability of network members for a future time of need (e.g., “I have people I can count on for help;” Wethington & Kessler, 1986), and the quality of the relationships within the network (e.g., satisfaction with the support offered by network members). The inconsistency in how perceived social support is measured makes it difficult to determine the precise mechanisms by which specific characteristics of perceived support improve health (Thoits, 2011; Uchino, 2004). In the current study, we assessed both the quantity and quality of perceived social support in order to contribute to a better understanding of how these different aspects of perceived support operate to influence health outcomes.

Analyses addressed two primary research questions:

**Is Daily Marital Conflict Linked to Less Steep Diurnal Cortisol Slopes?**

Based on prior work demonstrating a reliable connection between relationship conflict and elevated stress hormone levels in the laboratory (e.g., Malarkey, Kiecolt-

Glaser, Pearl, & Glaser, 1994), it was expected that on days on which couple members reported greater marital conflict, they would also exhibit less steep diurnal cortisol slopes. Although naturally occurring marital conflict has been previously examined in conjunction with the diurnal cortisol of children who observe the disagreements (Slatcher & Robles, 2012), this is the first study to examine the association between couple members' daily relationship conflict and their own cortisol responses in a non-laboratory setting.

### **Does Perceived Social Network Support Moderate the Association between Daily Marital Conflict and Diurnal Cortisol?**

Perceived social network support provides one metric of individuals' level of connectedness and has the capacity to protect individuals from a variety of life stressors (e.g., Uchino, 2004), including, potentially, relationship conflict. Thus, it was predicted that perceptions of more available social support network support and greater satisfaction with the availability of that network support would ameliorate the hypothesized association between daily relationship conflict and diurnal cortisol.

## METHOD

### PARTICIPANTS

The current study drew from a sample of 171 newlywed couples who participated in a broader longitudinal study of marital development. Couples were recruited using several methods. Advertisements were placed in community newspapers and with local wedding vendors (e.g., bridal shops, floral shops, etc.) and premarital counselors. Additional advertisements were placed on websites such as TheKnot.com and on *Facebook*. Interested couples were screened in a telephone interview to determine whether they met the following eligibility requirements: (a) this was the first marriage for each partner, (b) the couple had been married less than six months, and (c) neither spouse had any children.

On average, husbands were 29.1 ( $SD = 5.3$ ) years old and had received 16.0 ( $SD = 2.3$ ) years of education. Seventy-seven percent were employed full-time and 14% were full-time students. Seventy-seven percent of husbands identified themselves as White, 15.8% as Hispanic/Latino, 1.8% as Asian American, and 2.3% as African American. Wives were an average of 27.2 ( $SD = 4.9$ ) years old and had received 16.3 ( $SD = 1.9$ ) years of education. Sixty-eight percent were employed full-time and 13.5% were full-time students. Seventy-five percent of wives identified themselves as White, 15.2% as Hispanic/Latino, 2.3% as Asian American, and 3.5% as African American. Approximately 50% of spouses identified themselves as Christian. The median combined income of couples was between \$60,000 and \$65,000.

## **PROCEDURE**

Within the first six months of their marriages, couples completed two tasks relevant to the current study. First, couples were mailed a packet of questionnaires that included self-report measures of availability of social network support and satisfaction with that social network support. Couples were instructed to complete all questionnaires independently of one another and were paid \$50 for completing this part of the study.

Second, couples were asked to complete a 14-day daily diary task, which assessed spouses' experiences with daily marital conflict. Spouses were given two options for completing the diaries: online or paper. Spouses opting to complete their diaries online were given a participant identification number which they used to login to a website every evening to access and submit their diaries. Spouses who chose the paper version were given all days of the paper diaries along with a set of pre-addressed and -stamped envelopes. Spouses were instructed to independently fill out one diary each night before going to bed and to mail the diary the next morning. Couples were paid \$30 for completing this part of the study.

As part of the diary task, all spouses were also asked to provide two saliva samples for the assessment of diurnal cortisol slopes on each of the first six days of the diary. Consenting spouses were provided with 12 salivettes (i.e., a small piece of sterile dental cotton in a plastic collection tube) and given specific instructions as to how to provide the samples correctly. Specifically, spouses were asked to provide one sample immediately upon waking and one sample in the evening before going to bed at the same time each night. Change in cortisol values from morning to evening (e.g., change based

on two data points) is reliably associated with health outcomes (Adam & Kumari, 2009). Mean collection times were 7:53 a.m. ( $SD = 96$  min) and 10:05 p.m. ( $SD = 95$  min). Spouses also were instructed not to eat, drink, brush their teeth, or smoke in the hour prior to providing the samples, as these behaviors can affect HPA-axis function. At each collection time, spouses recorded the time and date of the sample, as well as any irregular circumstances that occurred around the time they provided the sample (e.g., if they recently ate, drank, brushed their teeth, took medication, etc.; see Appendix A). Spouses included detailed notes for each sampling time, suggesting that they were highly compliant with the study protocol. Spouses were then asked to store their saliva vials in the refrigerator until the end of the six-day period, at which point they returned the vials in a pre-addressed and -stamped priority mail box provided by the researchers. Couples were paid an additional \$10 for providing and sending their saliva samples.

As the purpose of the current investigation was to examine links between daily marital conflict and diurnal cortisol slopes, all analyses are based on data collected during the first six days of the diary task. Overall, 147 couples (86%) agreed to participate in the diary task and provide saliva samples. Importantly, spouses who participated in this part of the study did not differ from those who did not participate on any demographic or other variables of interest with one exception: husbands who provided saliva reported lower social network support satisfaction ( $M = 6.21$ ,  $SD = 1.11$ ) than did those who did not ( $M = 6.64$ ,  $SD = .63$ ;  $t(169) = 2.69$ ,  $p = .01$ , 95% CI [.11, .76]). Saliva samples from 80 individuals were discarded prior to assay because these individuals reported health conditions or other circumstances known to affect HPA-axis functioning (i.e., 5 were

pregnant, 9 were on medications that affect the HPA axis, 14 reported anxiety, 15 reported depression, 31 smoked, and 6 reported working nightshifts). Thus, 109 husbands and 105 wives provided eligible saliva samples. Of the possible 2,568 samples, 148 samples (5.50%) were returned with insufficient saliva to determine cortisol levels. If participants indicated that they did eat, drink, or brush their teeth an hour before providing saliva, their samples were not included in analyses. A total of 231 samples (9.00%) were excluded for this reason. After removing these saliva samples, there were 985 days for which participants provided both morning and evening samples that were eligible for analysis (an average of 4.60 days per person). Following assay of the saliva samples, diurnal slopes that were three standard deviations from sample means (e.g., steeply positive slopes very likely indicative of participants inadvertently switching their “A.M. sample” and “P.M. sample” salivettes) were excluded from analyses for five spouses ( $n = 10$  samples; 2 per spouse). Notably, participants who did not provide all days of saliva data could be included in the analyses because multilevel modeling techniques were used.

## **MATERIALS**

### **Perceived social network support**

At the beginning of their marriages, spouses reported the number of people they could turn to, other than their spouse, for support in times of need and how satisfied they were with that available network support. Example items included, “If you were to have a marital difficulty or personal problem, how many people do you know, other than your spouse, who you would you feel comfortable talking to about your problem?” (rating



scale: 0 = “No one” to 5 = “5 or more”) and “How satisfied are you with this?” (7-point Likert-type scale: 1 = “dissatisfied” to 7 = “satisfied”; see Appendix B). An average score for each subscale (i.e., one subscale indicating the size of the perceived available support network and one subscale indicating satisfaction with that available network) was calculated. Internal consistency among the items that assessed the size of network was high ( $\alpha = .79$  for husbands;  $\alpha = .79$  for wives); likewise, the internal consistency among the items that assessed spouses’ satisfaction with the availability of their social networks was high ( $\alpha = .83$  for husbands;  $\alpha = .84$  for wives). Size of the available network and satisfaction with the availability of the network were moderately correlated ( $r = .59, p < .001$  for husbands and  $r = .62, p < .01$  for wives).

### **Daily marital conflict**

As a part of the daily diary task, spouses completed a checklist indicating whether they had experienced any of five marital conflict behaviors that day (e.g., “spouse and I had an argument,” “spouse criticized me”; see Appendix C). The number of marital conflict behaviors spouses reported was summed for each day of the diary.

### **Daily overall stress**

To ensure that any association between diurnal cortisol slopes and daily marital conflict was not driven by a spurious association with spouses’ levels of general stress caused by factors outside their marriages (e.g., work stress), spouses’ daily stress was assessed to be used as a covariate. Spouses indicated how stressful their day was on a seven-point Likert-type scale (1 = “not at all stressful” to 7 = “extremely stressful”; see Appendix D).

### **Cortisol-relevant health conditions and behaviors: Exclusionary criteria**

As was indicated previously, spouses reported whether they were currently diagnosed with depression or anxiety, taking any medications, smoking or regularly using tobacco products, or working night shifts (see Appendix E). Consistent with prior work, this information was used to determine eligible saliva samples (Adam & Kumari, 2009).

### **Cortisol-relevant health conditions and behaviors: Covariates**

Spouses provided their age and their height and weight for Body Mass Index (BMI) calculations to be used as covariates (e.g., Adam & Kumari, 2009). Furthermore, as birth control use can influence cortisol levels (Kirschbaum, Kudielka, Gaab, Schommer, & Hellhammer, 1999), women were asked to indicate whether they were currently using hormonal contraception. Finally, spouses recorded saliva collection times due to the strong diurnal rhythms of cortisol (Adam & Kumari, 2009).

### **Diurnal cortisol**

Spouses' morning and evening saliva samples were assayed for cortisol as an indicator of physiological stress and overall physiological function. Cortisol concentrations, reported in  $\mu\text{g}/\text{dL}$  (microgram per deciliter), were determined via Salimetrics<sub>LLC</sub> expanded range high sensitivity salivary cortisol enzyme immunoassay kits for research. As per kit instructions, all samples were frozen at  $-20^{\circ}\text{C}$  until assayed. Each participant's samples were assayed in duplicate (25  $\mu\text{g}$  per well) in the same batch with high and low control samples provided by Salimetrics<sub>LLC</sub> included to ensure reliability. The assays had an average intra-assay coefficient of variation of 7.74% and an inter-assay coefficient of variation of 8.20%. The average of the two duplicate assays was used in all analyses. As

is standard practice, obtained cortisol values were subjected to a natural log transformation before statistical analysis to correct for positive skewness (e.g., Loving, Crockett, & Paxson, 2006). To create a daily index of spouses' cortisol slopes, the difference between morning and evening cortisol values were calculated. Thus, lower values for diurnal cortisol slope indicate less steep declines in daily cortisol.

## **DATA ANALYSIS**

Exploring spouses' physiological reactivity to marital conflict, as well as potential moderators of that reactivity, requires both within-subjects and between-subjects analyses. The within-subjects approach allows for the examination of the daily covariation between spouses' reports of marital conflict and diurnal cortisol slopes, controlling for spouses' idiosyncratic levels of both variables. Between-subjects analyses allow for a test of whether spouses' overall perceptions of available and satisfying social network support moderate the strength of this covariation.

To address both the within-subjects and between-subjects hypotheses, data were examined using Hierarchical Linear Modeling (HLM; Bryk & Raudenbush, 1992; Bryk, Raudenbush, Congdon, 1994). This approach was adopted for several reasons. First, in contrast to other approaches for analyzing multilevel models (e.g., structural equation modeling), HLM provides reliable estimates of within-subject parameters even when sample sizes are relatively small. Second, HLM provides maximally efficient estimates of these parameters by weighting individual estimates according to empirical Bayes theory. When the within-subject parameter for an individual can be estimated precisely, the final estimate relies heavily on the individual data. When the parameter cannot be estimated

precisely (e.g., because of missing data), the final estimate relies more heavily on the mean of the sample. Because the most precise estimates therefore contribute more to the final estimated variance of the sample, variances estimated in this way tend to be more conservative than those obtained through traditional ordinary-least-squares methods.

To account for interdependence within couples, the procedures described by Laurenceau and Bolger (2005) for analyzing dyadic diary and longitudinal data were followed. Specifically, husbands' and wives' effects were estimated simultaneously for all analyses and dummy variables were used to nest husband and wife data within each couple. This approach allows for straightforward tests of gender differences in coefficients of interest (a 1-*df*  $\chi^2$  test). As no significant gender differences were found in the current study, coefficients were constrained to be equal for husbands and for wives, according to procedures outlined by Barnett, Marshall, Raudenbush, and Brennan (1993; see also Murray, Griffin, Rose, & Bellavia, 2006). The significance test of such a constrained coefficient is more powerful than tests for gender-specific coefficients (Barnett, et al., 1993).

## RESULTS

### DESCRIPTIVE STATISTICS AND CORRELATIONS

Means and standard deviations for all variables of interest are provided in Table 1. On average, spouses reported that they had approximately four network members to turn to for support and were generally highly satisfied with the availability of their social network support. Spouses reported experiencing marital conflict on 1 to 2 days of the 6-day daily diary. Evening cortisol levels were negatively associated with evening sample time, such that cortisol levels were higher the earlier the sample was provided ( $r = -.20, p = .04$  for husbands;  $r = -.32, p < .001$  for wives); there were no associations between morning sample time and morning cortisol levels ( $r = .05, p = .63$  for husbands;  $r = .07, p = .49$  for wives). To test for possible gender differences on all variables of interest, paired-sample *t* tests were conducted. Consistent with some prior work (see Kirschbaum & Hellhammer, 1989, for a review), men had higher morning cortisol values than did women ( $t(80) = 2.21, p = .03, 95\% CI [0.01, 0.25]$ ). Additionally, wives reported fewer daily marital conflict across the daily diary ( $t(78) = 2.27, p < .01, 95\% CI [.02, .24]$ ). No other gender differences emerged.

Within-spouse and between-spouse correlations for all measures are provided in Table 2. Husbands' and wives' reports of the number of network members they felt they could turn to when in need were moderately correlated with their reports of how satisfied they were with the availability of that support. Further, there was a trend to suggest that husbands' and wives' reports of the size of each of their individual support networks

were somewhat related. Wives' reports of daily marital conflict interactions were inversely associated with their reports of support network size and satisfaction with available support.

### **Is Daily Marital Conflict Linked to Less Steep Diurnal Cortisol Slopes?**

It was hypothesized that spouses' reports of daily marital conflict would be related to their diurnal cortisol slopes such that spouses reporting greater marital conflict on a given day would exhibit less steep cortisol declines on that day. To test this hypothesis, the within-person association between daily marital conflict and daily diurnal cortisol slopes was modeled, controlling for saliva sampling times, using the following HLM equation:

*Within-subjects level:*

$$\begin{aligned} \text{Daily Cortisol Slope} = & \beta_0(\text{Wives}) + \beta_1(\text{Husbands}) \\ & + \beta_2(\text{Wives' Diary Day}) \\ & + \beta_3(\text{Husbands' Diary Day}) \\ & + \beta_4(\text{Wives' A.M. Sampling Time}) \\ & + \beta_5(\text{Husbands' A.M. Sampling Time}) \\ & + \beta_6(\text{Wives' P.M. Sampling Time}) \\ & + \beta_7(\text{Husbands' P.M. Sampling Time}) \\ & + \beta_8(\text{Wives' A.M. Cortisol Level}) \\ & + \beta_9(\text{Husbands' A.M. Cortisol Level}) \\ & + \beta_{10}(\text{Wives' Reported Marital Conflict}) \\ & + \beta_{11}(\text{Husbands' Reported Marital Conflict}) \\ & + \text{error} \end{aligned}$$

[Equation 1]

in which day, A.M. and P.M. sampling time, A.M. cortisol level, and reported marital conflict were centered within persons for each spouse. Importantly, centering conflict in this way allowed for the examination of whether reporting more or less conflict on a

given day relative to the spouse's mean level of reported conflict was associated with corresponding changes in the spouse's daily cortisol slope. In other words, this centering strategy accounts for individual differences in the amount of conflict reported across the daily diary. Day was included as a predictor in the model to control for potential linear changes in daily marital conflict or diurnal cortisol over the course of the diary (for participant habituation effects in daily dairies, cf. Bolger, Davis, & Rafaeli, 2003). As no gender differences emerged for any of the parameters in this model, all results presented are pooled across gender.

As seen in Table 3, on days when spouses reported experiencing greater marital conflict interactions than usual, they exhibited less steep cortisol slopes compared to an average day. In order to test the robustness of this effect, further analyses were conducted to ensure that results held when controlling for health factors previously linked to diurnal cortisol (i.e., BMI, age, wives' use of birth control). To do so, these control variables were centered on the grand mean of the sample and were added to predict the intercept of cortisol (i.e.,  $\alpha$  and  $\beta$ ) at the between-subjects level of the model. Age marginally predicted spouses' diurnal cortisol ( $\beta = -.01$ ,  $SE = .007$ ,  $t(72) = -1.98$ ,  $p = .05$ ,  $95\% CI [-.03, 0.004]$ ) such that older participants exhibited less steep diurnal cortisol slopes. BMI and wives' use of birth control did not influence diurnal cortisol slopes (BMI,  $\beta = .004$ ,  $SE = .006$ ,  $t(72) = 0.69$ ,  $p = .35$ ,  $95\% CI [-.008, 0.02]$ ; birth control,  $\beta = .04$ ,  $SE = .06$ ,  $t(74) = 0.60$ ,  $p = .55$ ,  $95\% CI [-.08, 0.16]$ ). Importantly, the effects of daily marital conflict on diurnal cortisol remained significant when including these control variables ( $\beta = -.04$ ,  $SE = .02$ ,  $t(74) = -2.34$ ,  $p = .02$ ,  $95\% CI [-.08, -0.00003]$ ).

As an even more stringent test of this effect, spouses' reports of overall daily stress were added to the within-subjects level of the model in order to ensure that changes in spouses' diurnal cortisol slopes were not a function of experiencing more stress than usual outside the marriage (e.g., work stress). Daily stress did not significantly influence spouses' diurnal cortisol ( $\beta = -.004$ ,  $SE = .02$ ,  $t(74) = -0.21$ ,  $p = .96$ , 95%  $CI [-.04, 0.04]$ ), and its inclusion in the model did not impact the effect of daily marital conflict on diurnal cortisol ( $\beta = -.03$ ,  $SE = .02$ ,  $t(74) = -2.04$ ,  $p = .04$ , 95%  $CI [-.07, 0.01]$ ). In other words, spouses' experienced physiological stress as a result of marital conflict above and beyond what was caused by stress outside their marriages. Collectively, these results indicate that experiences of daily marital conflict are strongly linked to spouses' exhibition of less steep declines in cortisol.

### **Does Perceived Social Network Support Moderate the Association between Daily Marital Conflict and Diurnal Cortisol?**

It was hypothesized that spouses' perceptions of available and satisfying social network support would moderate the daily association between marital conflict and diurnal cortisol such that spouses who perceived greater available and more satisfying social network support would experience steeper cortisol slopes on days of greater marital conflict. To test this hypothesis, the main effects of each type of social network support, grand centered around the sample means, as well as the interaction of each type of perceived social network support and daily marital conflict were individually added at the between-subjects level of analysis to predict the intercept and slope of daily diurnal cortisol (see Equation 2; "perceived network support" includes both size of the network



and satisfaction with available support). As no gender differences emerged for any of the variables in this model, all results presented are pooled across gender.

*Between-subjects level (see Equation 1 for within-subjects level):*

$$\begin{aligned} \beta_0(\text{Wives' Average Cortisol Slope}) &= \gamma_{00} \\ &+ \gamma_{01}(\text{Wives' Perceived Network Support}) \\ &+ \text{error} \end{aligned}$$

$$\begin{aligned} \beta_1(\text{Husbands' Average Cortisol Slope}) &= \gamma_{10} \\ &+ \gamma_{11}(\text{Husbands' Perceived Network Support}) \\ &+ \text{error} \end{aligned}$$

$$\begin{aligned} \beta_{10}(\text{Wives' Daily Covariation between Marital Conflict \& Diurnal Cortisol}) &= \gamma_{100} \\ &+ \gamma_{101}(\text{Wives' Perceived Network Support}) \\ &+ \text{error} \end{aligned}$$

$$\begin{aligned} \beta_{11}(\text{Husbands' Daily Covariation between Marital Conflict \& Diurnal Cortisol}) &= \gamma_{110} \\ &+ \gamma_{111}(\text{Husbands' Perceived Network Support}) \\ &+ \text{error} \end{aligned}$$

[Equation 2]

As seen in Table 4, availability of social network support marginally moderated the effect of daily marital conflict on diurnal cortisol. However, when additional covariates were added to the model (i.e., BMI, age, wives' use of birth control, daily overall stress), the interaction of available social network support and daily marital conflict to predict diurnal cortisol was no longer significant ( $b = .002$ ,  $SE = .02$ ,  $t(73) = 0.15$ ,  $p = .88$ ,  $95\% CI [-0.04, 0.04]$ ). Thus, the number of network members spouses reported being able to turn to was not a robust buffer from the physiological stress of daily marital conflict.

As seen in Table 5, satisfaction with social network support significantly

moderated the effect of daily marital conflict on diurnal cortisol. The findings above held when all additional covariates were added to the model (i.e., BMI, age, wives' use of birth control, daily overall stress; the interaction of satisfaction with social network support and daily marital conflict,  $b = .03$ ,  $SE = .02$ ,  $t(72) = 1.98$ ,  $p = .05$ , 95% CI [-0.0003, 0.06]). Predicted means for spouses with higher (+1 SD) and lower (-1 SD) levels of satisfaction with social network support are plotted across the full range of daily conflict scores reported by participants (i.e., 0 –5 instances) in Figure 1. Simple slope analyses revealed no difference in spouses' diurnal cortisol slopes on days they reported no marital conflict regardless of their level of satisfaction with their perceived social network support ( $b = -.02$ ,  $SE = .02$ ,  $t(129) = 1.09$ ,  $p = .32$ , 95% CI [-0.06, .02]). However, on days of greater marital conflict, spouses who reported being more satisfied with their social network support exhibited significantly steeper declines in cortisol than spouses who reported being less satisfied with their social network support ( $b = .17$ ,  $SE = .06$ ,  $t(129) = 2.68$ ,  $p < .01$ , 95% CI [.05, .29]). Additional simple slopes analyses confirmed that spouses who reported low satisfaction with social network support were especially likely to exhibit flatter cortisol slopes on days of greater marital conflict ( $b = -.05$ ,  $SE = .02$ ,  $t(129) = -2.04$ ,  $p = .04$ , 95% CI [-0.09, -.01]). Among spouses who were highly satisfied with their social network support, conflict was not significantly associated with daily cortisol slopes ( $b = .02$ ,  $SE = .02$ ,  $t(129) = 0.93$ ,  $p = .36$ , 95% CI [-0.02, .06]). These results indicate that marital conflict may be particularly threatening for spouses who do not feel satisfied with their external network of close others to turn to in times of need.

## **DISCUSSION**

The first aim of this study was to assess the link between conflict and physiological function in couples' home environments. Newlywed spouses reported daily occurrences of marital conflict and provided morning and evening saliva samples for the determination of diurnal cortisol slopes. As predicted, spouses experienced less steep (i.e., less healthy) diurnal cortisol slopes on those days that they experienced greater marital conflict. The second aim of this study was to examine whether spouses procure physiological benefits from perceived social network support from friends and family members. The extent to which spouses were satisfied with the availability of network members to provide support if needed moderated the association between daily conflict and diurnal cortisol. Whereas those spouses who reported less satisfying social network support experienced less steep diurnal cortisol on days of greater marital conflict, those spouses who perceived more satisfying network support exhibited no effect of daily marital conflict on diurnal cortisol. The sheer number of network members spouses reported being able to turn to in times of need, on the other hand, did not affect physiological function on days of greater marital conflict. Thus, the quality of spouses' connections to those in their support networks, and not just the presence or quantity of those close others, influences the way spouses respond physiologically to day-to-day marital conflict.

### **MOVING COUPLES OUT OF THE LABORATORY**

Whereas relationship conflict in the laboratory has been reliably linked to

negative physiological outcomes (e.g., increased cortisol reactivity; Kiecolt-Glaser et al., 1996), the current study is the first to examine the link between naturally occurring conflict and couple members' cortisol in their home environments. In line with laboratory investigations, natural occurrences of relationship conflict influenced day-to-day physiological function. This study provides ecological validity to the conflict and health literature because it removes couples from a controlled environment (i.e., specified discussion topics, isolation from the outside world). Couples experience conflict in their daily lives in the context of numerous environmental factors. Couple members are not 'alone' when they experience relationship conflicts; to a varying degree, partners feel contentment with the availability of close others they can turn to during times of need. The findings that day-to-day marital conflict does, in fact, negatively affect spouses' daily diurnal cortisol, but that more satisfying network support eliminates this negative consequence, highlights the value of examining relationship conflict in couples' natural settings.

In addition to underscoring the importance of considering couples' natural social contexts, the at-home saliva samples taken in this study also allowed for an assessment of daily rather than acute biological outcomes. Despite the utility of examining micro-level biological processes during in-lab couple conflict, researchers can only speculate as to the long-term health implications of heightened acute cortisol reactivity (Keneski, Schoenfeld, & Loving, in press; Loving & Keneski, in press). Participants' provision of morning and evening saliva samples allowed for the calculation of diurnal cortisol slopes, or the degree to which cortisol declines throughout the day. Diurnal cortisol has proven to

be a powerful predictor of objective health outcomes (Adam & Kumari, 2009), especially when examined over the course of several days. Thus, an examination of health-relevant physiological processes in individuals' natural environments provides insight into how day-to-day physical function affects health over time.

Additionally, whereas women typically exhibit more pronounced physiological reactivity during relationship conflict in the laboratory (e.g., Kiecolt-Glaser et al., 1993; Kiecolt-Glaser et al., 1996), no gender differences were found in the current study. It could be that aspects of a lab environment induce greater physiological reactivity in women above and beyond responses to relationship conflict. For example, a primary argument for why women exhibit greater physiological reactivity in the lab is because women's self-construals are based on their romantic relationships more so than are men's (Acitelli & Young, 1996; Cross & Madson, 1997), and women are therefore more affected by relationship conflicts. However, women's relationship-based self-construals may also cause them to be more concerned about others' perceptions of their relationships. Because women engage in more relationship impression management in public settings than do men (Loving & Agnew, 2001), women may experience added physiological stress in response to knowing researchers will view (and presumably judge) the quality of the couple's relationship following an in-lab relationship conflict. Examining couple members' physiological responses to relationship conflict in couples' natural settings eliminates factors in laboratory studies that may more strongly influence women's perceptions of and responses to conflict.

## THE PROTECTION OF SATISFYING NETWORK SUPPORT

Although spouses' reports of daily marital conflict were associated with less steep diurnal cortisol declines overall, this association was not present for those spouses that perceived highly satisfying available social network support. One explanation for this attenuation is that individuals can draw from alternative sources of belonging when their connections to their romantic partners are threatened. That is, perhaps spouses who have more satisfying relationships with the friends and family members experience relationship conflict as being less psychologically, and thus less physiologically, stressful. The current results are consistent with this explanation and, therefore, support a conceptual extension of the substitution hypothesis of belonging. In addition to forming new relationships when one important relationship is lost (Baumeister & Leary, 1995), it is plausible that *perceived connections* to others may compensate for detriments to belonging when they occur in one social domain (e.g., marriage). In order to maintain non-threatening levels of belonging and avoid the psychological discomfort of feeling disconnected, spouses' feelings of connectedness to social network members can be substituted when connectedness within romantic relationships is compromised. Substituting perceptions of connectedness to social network members when there is strain in a marital relationship subsequently lessens the physiological stress of marital conflict.

To illustrate this idea, the need to belong can be conceptualized as a metaphorical bank account—one needs a minimum quantity and quality of social connections in order to maintain one's ideal 'balance'. After experiencing a significant 'withdrawal' from a primary 'account', such as when couple members experience relationship conflict,

partners should need not take the time and energy to make an entirely new ‘deposit’ (i.e., form a new relationship). Rather, simply knowing one has a solid ‘savings account’ of social network support should be sufficient to make partners feel they can make it through the inevitable hard times any relationship faces.

In many respects, the stress-buffering effects in the current study mirror those in the social capital literature. Similar to the metaphor of a bank account, social capital has been likened to a reservoir of social and community resources. Individuals derive feelings of trust and social cohesion from their social and civic participation and are able to draw on those resources when needed (Kawachi et al., 1997). For example, a mother’s sense of community in her neighborhood reduces her level of worry about her child walking home alone from school. This sense of community, one aspect of social capital, is the result of the mother’s numerous experiences as a neighborhood resident that have built up her confidence in her family’s surroundings. As individuals encounter stressors over time, social capital serves as buffer that guards against the negative consequences of stress, and those individuals that have greater levels of social capital experience more positive mental and physical health outcomes (Kawachi et al., 1997).

Similarly, perceiving that one has supportive family members, friends, and acquaintances is robustly linked to a variety of positive health outcomes, including longer life and lower rates of disease (e.g., Uchino et al., 1996). One well-supported explanation for the perceived social support-health link is the stress-buffering model—that perceived availability of social network support protects individuals from the negative effects of stress (e.g., Wethington & Kessler, 1986). In other words, believing that one has a

network of supportive others to turn to in times of need results in less distress when life stressors occur (Cohen & Wills, 1985). Despite decades of research focused on the consequences of perceived social network support, however, the mechanisms underlying exactly how buffering procures health benefits remain unclear (e.g., Thoits, 2011). The findings from the current study provide evidence that stress buffering may ‘work its magic’ on long-term health outcomes by attenuating negative physiological responses to stressors. Satisfying social network support protected spouses from the negative physiological consequences (i.e., less steep diurnal cortisol slopes) of marital conflict. Over time, buffering should manifest in improved health and mortality outcomes by slowing the accumulation of the negative health consequences typically associated with unabated physiological stress.

The results of the current study indicate that spouses’ *satisfaction* with available network support, and not just the number of available support network members, affects physiological responses to marital conflict. These results provide insight into a body of work in the social support literature that demonstrates differential effects of social network structure versus function on health. Specifically, structural aspects of social networks (e.g., network size) are stronger direct predictors of *long-term* health outcomes than are functional aspects (e.g., satisfying perceived support; Holt-Lunstad, 2012). Although physical health outcomes were not measured in the current study, satisfying social network support, and not network size, improve *daily* physiological function, which has implications for long-term health. That is, whereas the structural facets of social relationships are tied *directly* to health, functional social network support may



positively influence health slowly *over time*. Further, these findings are consistent with another overarching theme in the support literature—the *quality*, and not just the quantity, of social ties greatly matters for individuals’ well-being (e.g., VanderVoort, 1999).

One potential alternative explanation for the current findings could be that those spouses who reported greater satisfaction with their social network support and experienced no effects of marital conflict on diurnal cortisol are less physiologically reactive to stress in general. In other words, it is possible that an individual difference may be responsible for individuals both maintaining better relationships with their social network members and being better able to regulate their physiological responses to marital conflict. This explanation is unlikely, however, because spouses’ diurnal cortisol slopes were influenced by daily marital conflict, even after controlling for spouses’ reports of overall daily stress outside their marriages. Additionally, the current results are consistent with recent work that demonstrates that day-to-day marital conflict is associated with less steep diurnal cortisol slopes in couples’ children (Slatcher & Robles, 2012). Together, this study and the current study provide concurrent evidence that marital conflict, as experienced by both couple members and children, affects the daily physiological function of all those exposed.

## **STRENGTHS AND LIMITATIONS**

The current study has several notable strengths. First, spouses’ completion of daily diaries allowed for an assessment of naturalistic conflict—the characteristics and frequency of which are representative of couples’ typical interaction patterns—over the span of several days. Additionally, the assessment of morning and evening saliva samples

in couples' home environments for cortisol analysis allowed for a highly ecologically valid assessment of day-to-day physiological function. Diurnal cortisol slopes are also reliably linked to long-term health outcomes, and thus provide an objective marker of potential future health risks. Finally, within-subjects analyses of both daily marital conflict and daily diurnal cortisol slopes allowed for a test of the effects of daily conflict, controlling for couples' general inclinations towards conflict, for spouses' idiosyncratic tendencies in reporting conflict, and for spouses' average cortisol slopes.

Whereas the use of daily diaries to assess naturally occurring marital conflict and diurnal cortisol as a marker of daily physiological function was a study strength, it also represents a limitation. Because the data are correlational, clear causal inferences cannot be made, and it is possible that a third variable influenced both marital conflict and diurnal cortisol.

The assessment of diurnal cortisol with only two measurement time points (i.e., morning and evening) versus three or more time points (e.g., waking, 30 minutes post-waking, and evening) also represents a possible limitation. Specifically, the cortisol awakening responses (CAR), or the slight increase in cortisol from waking to 30 minutes post-waking, is associated with a number of health-relevant outcomes (Fries, Dettenborn, & Kirschbaum, 2009). Therefore, it is not uncommon for researchers to ask participants to complete three or more saliva samples per day for the assessment of cortisol (e.g., Liu, Rovine, Cousino Klein, & Almeida, 2013). Given the theoretical consistency of the current results, however, two saliva assessments were sufficient to capture spouses' daily physiological function in relation to marital conflict. Further, given there is no consensus

within and across the fields of psychoneuroendocrinology and social psychology as to how best to assess diurnal cortisol, two saliva samples per day constitutes a balance between a sufficient test of hypotheses regarding daily physiological function, cost-effectiveness, and overall participant burden.

We argue that the threat of relationship conflict motivates spouses to draw upon their perceptions of social network support. However, the extent to which relationship conflict threatened spouses' feelings of connectedness was not assessed in the current study. It could be that newlywed spouses, who have recently made a lifelong commitment to their partners, do not experience day-to-day marital conflict as 'threatening' per se. However, the ways in which individuals attend to and experience the threat of conflict are not necessarily conscious; feeling like the world is ending every time one has a disagreement with one's partner would not be very adaptive to relationship function. At the same time, few would argue that conflict is not stressful to some degree. Given the evidence that humans have fine-tuned information-processing systems to attend to and correct detriments in feeling connected to others (e.g., need to belong, Baumeister & Leary, 1995; Risk Regulation Model, Murray, Derrick, Leder, & Holmes, 2008; Sociometer Theory; Leary 2005), it seems unlikely that newlyweds are able to simply override their attunements to connectedness.

Additionally, spouses' actual solicitation or receipt of support from their network members was not assessed in the current study. Given that support receipt is associated with negative outcomes (e.g., decreased feelings of esteem or independence, Bolger, Zuckerman, & Kessler, 2000; heightened emotional reactivity, Bolger & Amarel, 2007;

more negative mood, Gleason et al., 2008), spouses getting support for marital conflicts could actually function to exacerbate negative physiological responses to conflict. An examination of the physiological effects of both perceived support and received support would provide a more nuanced understanding of how social support influences couple members' health. These concerns notwithstanding, the current study contributes to extant work that demonstrates the benefits of *perceived* social support—simply knowing one could turn to close others if needed is associated with a number of positive health outcomes (e.g., Uchino et al., 1996), including, as shown here, more functional daily diurnal cortisol slopes.

The characteristics of the current sample also constitute strengths and weaknesses. First, the empirical focus on newlyweds, who are generally quite satisfied with their marriages (Karney & Bradbury, 1995), limits generalizability from the current sample to other relationship forms. However, the use of this sample also provides an especially stringent test of the first hypothesis. That is, it would be expected that the association between marital conflict and diurnal cortisol would become stronger as the 'glow' of being recently married wanes; couples that are together longer, some of which inevitably become distressed, might experience especially strong physiological reactions to more severe conflict. The current hypotheses should be tested with couples in various relationship stages.

Second, only heterosexual couples were recruited for the current study, and it is possible that individuals in same-sex relationships have different physiological reactions to day-to-day relationship conflict. Same-sex couples' conflict interactions are less

intense than the conflict of heterosexual couples (Gottman et al., 2003); therefore, same-sex couple members may also be less physiologically responsive to relationship conflict. However, the current finding regarding the protective effect of satisfying social network support on couple members' diurnal cortisol has important implications for same-sex couple members regardless of the intensity of their general physiological responses to relationship conflict. Same-sex couples perceive less overall support for their relationships (Kurdek, 2004) and more marginalization (Lehmiller & Agnew, 2006). As such, same-sex couple members may not be as satisfied, on average, with the network of close others they could turn to in times of need in comparison to heterosexual couples and may experience more pronounced negative physiological consequences of relationship conflict. It will be important for future research to examine the association between naturally occurring relationship conflict and diurnal cortisol slopes for same-sex couple members as well as the effect of perceptions of social network support.

## **FUTURE DIRECTIONS**

The stress-buffering effect of satisfying available social network support in the current study opens the door to very interesting support-related experimental manipulations. For example, priming individuals with an awareness of their social network support before or after in-lab conflict interactions would provide a stringent test of the substitution hypothesis. Additionally, it would be both theoretically and empirically useful to test the hypothesis that isolating participants from their networks during laboratory interaction studies changes their responses to conflict. Manipulating whether couple members can or cannot reach out to their network members during

conflict interaction studies would clarify the extent to which isolation affects couple members' experiences of in-lab conflict.

The measurement of diurnal cortisol slopes in the current study was a response to calls in the field to assess physiological markers that are relevant to objective health outcomes (i.e., Loving & Keneski, in press; Uchino, 2013). However, both the micro-level biological mechanisms of the impact of day-to-day conflict on diurnal cortisol as well as the long-term health outcomes of this association should be further investigated. For instance, it remains to be seen whether other hormones are activated by social network support that suppress cortisol production. Further, a direct test of the long-term impact of stress buffering on spouses' overall physical health is needed.

Finally, the psychological mechanisms underlying the protective effect of perceived social network support should be explored further. For example, do couple members' perceptions of support vary *between* network members? It has been argued that friends serve as 'sounding boards' for couple members to discuss relationship ups and downs whereas family members serve as 'final stamps of approval (or disapproval)' when couple members are more clear on their desired relationship trajectories (Keneski & Loving, in press). Given that couple members disclose different amounts and types of relationship-related information to different network members (Boelter et al., in preparation), it may be that friends and family members satisfy different functions in fulfilling one's need for external connectedness during relationship conflict. Identifying more proximal predictors of the positive effects of social network support, such as these, will contribute to a more holistic understanding of stress buffering.

## CONCLUSION

Whereas the link between relationship conflict and physiological reactivity has been well supported in laboratory studies (Wright & Loving, 2011), this was the first study to test this link in couples' natural environments with a consideration of their broader social contexts. Overall, naturally occurring marital conflict was associated with less steep (i.e., less healthy) declines in cortisol throughout the day. Spouses' who were highly satisfied with their perceived social network support, however, did not experience the negative physiological consequences of daily marital conflict. I argue that spouses were able to substitute feelings of connectedness to their social network members when feelings of connectedness to their partners were suffering during marital conflict. Thus, it may be that "no couple is an island" (Felmlee, 2001)—relationships do not unfold in isolation—but also that some couple members are (or feel) more isolated from the outside world than others. Couple members who have satisfying social network support, in essence, know that 'supplies are on the way'; thus, they can weather the storm when there is trouble in paradise.

**Table 1***Within-Spouse and Between-Spouse Descriptive Statistics*

	Husbands		Wives	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Size of available support network	4.04	0.98	3.89	1.08
Satisfaction with available social network support	6.41	0.96	6.18	1.14
Frequency of daily conflict	1.71	1.54	1.59	1.29
Average raw waking cortisol	0.30	0.12	0.26	0.09
Average raw evening cortisol	0.05	0.03	0.05	0.02

*Note.* Size of the available social network could range from 0 to 5 persons. Satisfaction with the available social network could range from 1 (dissatisfied) to 7 (satisfied). Daily conflict is scored from 0 to 6 here representing how many days out of 6 spouses reported any marital conflict. Raw cortisol levels (measured in ug/dL) typically range from < .01 to 1.3 in women and < .01 to .7 in men. Waking levels of cortisol are higher than evening levels of cortisol, as cortisol levels peak approximately 30 minutes after waking and steadily decline throughout the day (Kirschbaum & Hellhammer, 1989).



**Table 2***Within-Spouse and Between-Spouse Correlations*

	1	2	3	4
<b>(1)</b> Social network support size	<b>.16<sup>++</sup></b>	.62**	-.25*	-.14 <sup>++</sup>
<b>(2)</b> Social network support satisfaction	.59***	<b>.04</b>	-.15 <sup>++</sup>	-.08
<b>(3)</b> Average daily marital conflict	.01	-.02	<b>.59***</b>	-.03
<b>(4)</b> Average daily diurnal cortisol slope	.02	-.01	.06	<b>.20<sup>+</sup></b>

*Note.* Husbands' correlations appear below the diagonal and wives' correlations appear above the diagonal. The diagonal (in bold) contains between-spouse correlations. <sup>++</sup> $p \leq .15$ , <sup>+</sup> $p < .10$ , \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ .

**Table 3***Within-Spouses' Association between Daily Marital Conflict and Daily Diurnal Cortisol Slopes*

	$\beta$	<i>SE</i>	<i>t</i>	95% CI	
				<i>UL</i>	<i>LL</i>
Average daily cortisol slope (Intercept)	1.81	.04			
Diary day	.00	.01	0.02	-0.02	0.02
A.M. time	.11	.29	0.38	-0.46	0.68
P.M. time	.52	.16	3.30***	0.20	0.84
Morning cortisol	.94	.03	27.46***	0.88	1.00
Daily conflict	-.04	.02	-2.79**	-0.08	-0.00

*Note.* All effects are reported as unstandardized coefficients. All coefficients presented are pooled across gender. CI = confidence interval; LL = lower limit; UL = upper limit. *df* = 130. \*\**p* < .01. \*\*\**p* < .001.

**Table 4**

*Effect of Available Social Network Support on the Within-Spouse Association between Daily Marital Conflict and Daily Diurnal Cortisol Slopes*

	$\beta$	<i>SE</i>	<i>t</i>	95% CI	
				<i>UL</i>	<i>LL</i>
Average daily cortisol slope (Intercept)	1.80	.04			
Intercept*Available social network support	-.02	.03	-0.56	-0.08	0.04
Diary day	-.002	.01	-0.17	-0.02	0.02
A.M. time	.31	.31	1.00	-0.30	0.92
P.M. time	.54	.25	2.14*	0.05	1.03
Morning cortisol	.96	.04	25.20***	0.88	1.04
Daily conflict	-.04	.02	-2.08*	-0.08	-0.00
Daily conflict*Available social network support	.03	.02	1.79 <sup>+</sup>	-0.003	0.06

*Note.* All effects are reported as unstandardized coefficients. All coefficients presented are pooled across gender. CI = confidence interval; LL = lower limit; UL = upper limit.  $df = 129$ . <sup>+</sup> $p < .10$ . \* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

**Table 5**

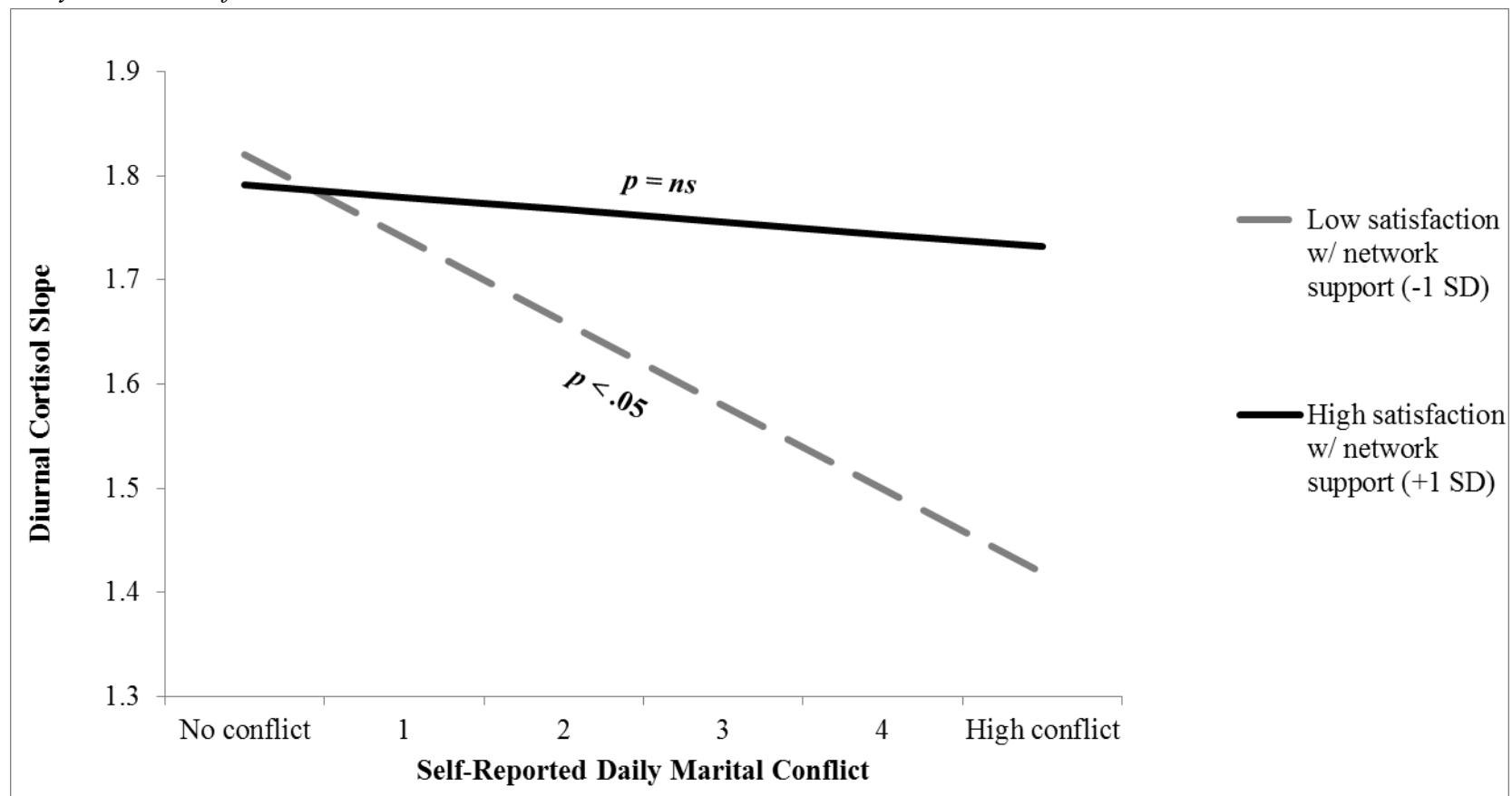
*Effect of Satisfaction with Social Network Support on Within-Spouses' Association between Daily Marital Conflict and Daily Diurnal Cortisol Slopes*

	$\beta$	<i>SE</i>	<i>t</i>	95% CI	
				<i>UL</i>	<i>LL</i>
Average daily cortisol slope (Intercept)	1.81	.04			
Intercept*Satisfaction w/ social network support	-.01	.02	-0.59	-0.07	0.04
Diary day	-.00	.01	-0.08	-0.02	0.02
A.M. time	.15	.29	0.51	-0.42	0.72
P.M. time	.50	.15	3.25***	0.15	0.91
Morning cortisol	.95	.03	27.55***	0.88	1.04
Daily conflict	-.05	.01	-3.13**	-0.06	-0.02
Daily conflict*Satisfaction w/ social network support	.03	.01	2.45*	0.02	0.06

*Note.* All effects are reported as unstandardized coefficients. All coefficients presented are pooled across gender. CI = confidence interval; LL = lower limit; UL = upper limit.  $df = 129$ . <sup>+</sup> $p < .10$ . \* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

**Figure 1**

*Spouses' Daily Diurnal Cortisol as a Function of the Interaction between Satisfaction with Available Social Network Support and Daily Marital Conflict*



*Note.* The interaction of satisfaction with social network support and daily marital conflict predicting spouses' daily diurnal cortisol slopes. Less steep diurnal cortisol slopes (smaller values on the y-axis) have been previously demonstrated to be associated with poorer health outcomes (e.g., Adam & Kumari, 2009). To produce these predicted means, satisfaction with social network support was standardized. Daily marital conflict was left on its original metric (actual range of scores is 0 – 5 in this sample).

## Appendix A: Saliva Sample Log

Participant ID number: \_\_\_\_\_ Height: \_\_\_\_\_ Weight: \_\_\_\_\_ Age: \_\_\_\_\_

Day	Sample	Date	Time	# of alcoholic drinks in last 24 hrs	Did you brush your teeth 1 hr before sample?	Did you eat or drink 1 hr before sample?	Did you smoke 1 hr before sample?	Notes
1	Waking							
1	PM							
2	Waking							
2	PM							
3	Waking							
3	PM							
4	Waking							
4	PM							
5	Waking							
5	PM							
6	Waking							
6	PM							

Please list any medications you have taken in the last 6 days (including birth control).

\_\_\_\_\_

## Appendix B: Perceived Social Network Support

1. Besides your spouse, how many people in your life can you relax and be yourself around?

No one   1 person   2 people   3 people   4 people   5 or more  
              

2. How satisfied are you with this?

DISSATISFIED        SATISFIED

3. Besides your spouse, how many people in your life could you count on to help you if you needed it?

No one   1 person   2 people   3 people   4 people   5 or more  
              

4. How satisfied are you with this?

DISSATISFIED        SATISFIED

5. If you were to have a marital difficulty or personal problem, how many people do you know, other than your spouse, who you would you feel comfortable talking to about your problem?

No one   1 person   2 people   3 people   4 people   5 or more  
              

6. How satisfied are you with this?

DISSATISFIED        SATISFIED

7. Besides your spouse, how many people can you really count on to help you feel better when you are feeling either very upset or generally "down in the dumps"?

No one   1 person   2 people   3 people   4 people   5 or more  
              

8. How satisfied are you with this level of support?

DISSATISFIED        SATISFIED

## **Appendix C: Daily Marital Conflict**

Please indicate whether any of the following events occurred for you within the last 24 hours:  
(You may mark more than one event.)

- You had an argument with spouse
- Spouse let you down or broke a promise
- Spouse criticized you
- Spouse withdrew from a conversation
- Spouse showed anger or impatience toward you



**Appendix D: Daily Overall Stress**

Overall, how stressful was your day today?

Not at all      Extremely

## Appendix E: Cortisol-Relevant Health Conditions and Behaviors

	Yes	No
Are you currently diagnosed with depression?	<input type="radio"/>	<input type="radio"/>
Are you currently diagnosed with anxiety?	<input type="radio"/>	<input type="radio"/>
Do you work night shifts?	<input type="radio"/>	<input type="radio"/>
Do you smoke?	<input type="radio"/>	<input type="radio"/>
Do you regularly use other tobacco products (i.e., dip, chew, patch, etc.)?	<input type="radio"/>	<input type="radio"/>

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