Journal of Behavioral Medicine, Vol. 29, No. 4, August 2006 (© 2006)
DOI: 10.1007/s10865-006-9058-3

Older Spouses' Cortisol Responses to Marital Conflict: Associations With Demand/Withdraw Communication Patterns

Kathi L. Heffner,[1,6] Timothy J. Loving,[2] Janice K. Kiecolt-Glaser,[3] Lina K. Himawan,[1] Ronald Glaser,[4] and William B. Malarkey[5]

Accepted for publication: May 2, 2006
Published online: June 20, 2006

We examined 31 older couples' wife demand/husband withdraw communication patterns and cortisol responses to marital conflict. Regression analyses indicated that wife demand/husband withdraw sequences during conflict related to cortisol responses only for wives. Based on a mixed model that accounted for the interdependence of spouses' perceptions of communication patterns and outcomes, older spouses who reported greater wife demand/husband withdraw patterns in their marriage had greater cortisol responses during a conflict discussion; actual demand-withdraw did not relate to cortisol responses in this model. Findings suggest that perceived communication patterns contribute to neuroendocrine responses to marital conflict, and implications for marriage and health research with older couples are discussed.

KEY WORDS: older couples; marital conflict; cortisol; demand/withdraw; communication; psychophysiology.

Married couples' communication patterns during conflict relate strongly to marital quality (Weiss and Heyman, 1990), as well as physiological function (Denton *et al.*, 2001; Kiecolt-Glaser *et al.*, 1996). In light of suggested ties between short-term physiological stress responses and long-term health outcomes (Cacioppo *et al.*, 1998), and the impact of marital quality on health (Coyne *et al.*, 2001; Gallo *et al.*, 2003), spouses' communication patterns and their physiological correlates merit significant attention to understand the role of marriage in physical well-being.

[1]Department of Psychology, Ohio University.
[2]Department of Human Ecology, The University of Texas, Austin.
[3]Department of Psychiatry, The Ohio State University.
[4]Department of Molecular Virology, Immunology, and Medical Genetics, The Ohio State University.
[5]Department of Internal Medicine, The Ohio State University.
[6]To whom correspondence should be addressed at Department of Psychology, Ohio University, 209 Porter Hall, Athens, OH, 45701; e-mail: heffner@ohio.edu.

The demand/withdraw communication pattern (Christensen, 1987), characterized by communication of criticism, blame, and threats by one partner and concomitant withdrawal or avoidance by the other partner, is tied to marital dissatisfaction and divorce (Caughlin and Huston, 2002; Heavey *et al.*, 1995; Noller *et al.*, 1994). Wives are reported to enact the demander role more often than husbands, whereas husbands are more likely to avoid or withdraw (Caughlin and Vangelisti, 1999; Christensen and Heavey, 1990; Gottman and Levenson, 1988). These roles are, however, contingent upon contextual characteristics of relationship conflict (for example, who is initiating discussion about a problem), rather than gender-based (Caughlin and Vangelisti, 1999), and husband demand/wife withdraw is a dysfunctional communication style as well (Caughlin and Huston, 2002; Denton *et al.*, 2001). Importantly, demand/withdraw is highly resistant to change (Jacobson *et al.*, 1986), underscoring the importance of studying demand/withdraw in long-married older couples for

whom current communication patterns may mirror years of marital functioning.

There are indeed neuroendocrine correlates of demand/withdraw sequences. Newlywed wives' daytime levels of stress hormones, including cortisol levels, were related to wife demand/husband withdraw sequences enacted during a conflict discussion; husbands' endocrine data were not associated with behaviors during conflict (Kiecolt-Glaser *et al.*, 1996). Interestingly, in a longitudinal study of these same newlyweds, wives' stress hormone levels during marital conflict and throughout the day predicted marital dissolution and dissatisfaction 10 years later (Kiecolt-Glaser *et al.*, 2003). Whether demand/withdraw has implications for longer-married, older couples' neuroendocrine responses to conflict remains to be determined.

The findings from newlyweds suggest that physiological correlates of couples' communication patterns can provide a window into spouses' marital quality and long-term relationship outcomes. Importantly, these neuroendocrine outcomes also suggest potential pathways to spouses' long-term physical health via conflict communication patterns. Cortisol is important for maintaining normal metabolic function; however, excessive cortisol secretion is implicated in the dysregulation of immune function (Lovallo, 1997), as well as memory and learning deficits, osteoporosis, abdominal obesity, and delayed wound healing (Malarkey *et al.*, 2001). Aging increases cortisol response to both physical and psychological challenges (Otte *et al.*, 2005). Such increases to environmental demands may underpin age-related disease risks given cortisol's contribution to cognitive and physical pathology (Meites *et al.*, 1987; Seeman *et al.*, 1995). Thus, couples' dysfunctional communication patterns and the pernicious physiological correlates of those patterns, if persisting throughout the lifespan, may increase spouses' vulnerability to poor health outcomes at older ages.

Although observing couples' behaviors-and physiological correlates of those behaviors-provides valuable information about current marital quality and outcomes (Gottman and Levenson, 1988; Kiecolt-Glaser *et al.*, 1996), spouses' *perceptions* of their own marital functioning, including their perceptions about their communication patterns, might contribute considerably to their physiological responses during marital interactions. Indeed, spouses' self-reported perceptions of communication provide valuable information about the quality of relationships (Noller and Guthrie, 1989). Further, spouses' general sentiment toward their partner is an important contributor to spouse behaviors and judgments (Fincham *et al.*, 1995; Hawkins *et al.*, 2002), and can take precedence over the immediate affective tone or communication quality of the partner's behaviors (Weiss, 1980). For instance, wives in distressed marriages, when observing their own pre-recorded marital interaction, were more likely to interpret their husbands' neutral and negative behaviors as negative compared to distressed husbands and spouses in non-distressed marriages. These wives were also more apt to *respond* negatively to their husbands' messages that they evaluated negatively (Notarius *et al.*, 1989). In light of such "sentiment override" (Weiss, 1980), spouses' perceptions about the nature of their conflict interactions in general could be strong predictors of their physiological responses during isolated conflicts. We suggest that spouses who judge their usual marital conflicts to be characterized by demand/withdraw have more negative sentiments about their *conflicts*, and approach these conflicts with more negative expectations about the course of the discussion. In turn, they will likely respond with greater physiological arousal during actual marital conflict relative to those who perceive less demand/withdraw, despite the extent to which demand/withdraw patterns are actually enacted.

Finally, communication patterns in marriage may impact husbands and wives differently. Considering the etiology of demand/withdraw, long-married men report feeling more negative when more physiologically aroused during conflict compared to women (Levenson *et al.*, 1994), and it has been suggested that physiological arousal leads to withdrawal, especially in men (Gottman and Levenson, 1988). More recently, however, husbands *and* wives who were classified as avoiders evidenced heightened blood pressure responses during a conflict discussion (Denton *et al.*, 2001), suggesting that withdrawal is associated with physiological responses to conflict regardless of gender. Further, as discussed elsewhere (see Kiecolt-Glaser *et al.*, 1996), cumulative evidence calls into question the validity of models positing general physiological arousal as an elicitor of husbands' behavioral withdrawal: Wives appear to respond to marital conflict with greater physiological change (Ewart *et al.*, 1991; Malarkey *et al.*, 1994), and have stronger associations among physiological responses and conflict behavior than do husbands (Ewart *et al.*, 1991; Jacobson *et al.*, 1994; Smith *et al.*, 1998). Neuroendocrine studies of marital conflict in particular indicate greater effects of negative

conflict behavior for wives than for husbands, including stronger cortisol effects of wife demand/husband withdraw for younger wives than husbands (Kiecolt-Glaser *et al.*, 1996), and associations among older wives', but not older husbands', negative conflict behaviors and heightened cortisol responses (Kiecolt-Glaser *et al.*, 1997).

As noted above, spouses' sentiments about their marriage play an important role in their judgments and behaviors, and here, too, gender differences have emerged. Notarius *et al.* (1989) observed sentiment override among wives, but not husbands, in distressed marriages. In contrast, Floyd (1988) found that among premarital couples, men displayed greater sentiment override when evaluating the impact of their partners' statements during a problem solving interaction compared to women. In addition, marital satisfaction, a global sentiment about marriage, appears important for wives' physiological responding during marital conflict but not husbands' (for example, Ewart *et al.*, 1991), but marital quality reported by husbands does have important ties to their physical well-being (Coyne *et al.*, 2001). We addressed in the current study the extent to which older husbands' and wives' physiological responses are differentially influenced by their marital sentiments as indicated by their *beliefs* about demand/withdraw during usual marital conflicts.

Specifically, we examined associations among older spouses' perceptions of wife demand/husband withdrawal in their marital conflicts more generally, coded instances of this communication pattern during an observed marital conflict, and cortisol responses during that conflict. We focused on wife demand/husband withdraw because of the prior associations reported between this pattern and newlyweds' endocrine function (Kiecolt-Glaser *et al.*, 1996).

In light of findings from the young newlyweds study (Kiecolt-Glaser *et al.*, 1996) and other psychophysiological studies of marital conflict (for example, Jacobson *et al.*, 1994; Smith *et al.*, 1998), we hypothesized that wife demand/husband withdraw behaviors observed during a marital conflict of older, long-married couples would relate to wives' but not husbands' increased cortisol responses during conflict. In light of the influence spouses' marital sentiment has on marital functioning, we also predicted that spouses' general perceptions of wife demand/husband withdraw would be important predictors of their stress hormone responses, independent of coded wife demand/husband withdraw behaviors during a marital conflict. In light of inconclusive evidence for specific gender differences in the role of marital sentiments in spouses' functioning, no predictions were made regarding the differential impact of demand/withdraw perceptions on cortisol responses to conflict for husbands versus wives, though we explored this potential difference.

METHOD

Participants

The participants, 32 older couples (mean age: 66.75 years; $SD = 4.96$; range: 55–77 years) were recruited from newspaper advertisements, notices posted in senior citizen centers, and referrals from other participants (for details, see (Kiecolt-Glaser *et al.*, 1997). Twenty-nine couples were composed of spouses who were both White and three couples were composed of spouses who were both African American. Couples had been married an average 42.28 years ($SEM = 1.67$), and had 11.26 years ($SEM = 0.85$) of education. One couple was excluded from the analyses due to missing questionnaire data and outlying physiological data; thus, the final sample for the analyses contained 31 older couples.

Participants were not eligible for the study if they were taking beta-blockers or calcium channel blockers because they could interfere with sympathetic nervous system responses to conflict. Eighteen of the women in the final sample of 31 were taking estrogen and/or Provera supplements; therefore, these women on supplements were evaluated during the estrogen only phase of their cycle. Other prescription medications taken by older adult participants included diuretics (2 women, 2 men), thyroid supplements (2 women), nonsteroidal anti-inflammatory medication for arthritis (3 women, 3 men), and antacids (2 women, 2 men).

Procedure

Participants were admitted to the clinical research center, a hospital research unit, at 7:00 AM, and a heparin well was inserted in each participant's arm. Participants then completed a battery of questionnaires. After a 1 1/2 hr adaptation period following insertion of the heparin well, participants were positioned in chairs facing each other in front of a curtain. The couples completed several questionnaires and then sat quietly for 10 min.

At the end of the baseline period a psychology graduate student or postdoctoral fellow conducted a brief interview (10–20 min) to help identify the best topics for the problem discussion. Based on this interview and the couples' independent ratings of their disagreements about common relationship issues (e.g., in-laws, finances, leisure time), couples were asked to discuss and try to resolve the two or three marital issues that the interviewer judged to be the most conflict-producing. The research team remained out of sight behind a curtain during the 30-min problem discussion that immediately followed.

Self-Report Measures

The short form of the Communication Patterns Questionnaire was used to assess spouses' perception of their typical communication patterns during relationship problem discussions (Christensen and Heavey, 1990). This instrument was among the initial battery of questionnaires spouses completed after admission to the clinical research center. Three items are conventionally summed to produce a score reflecting the likelihood of wife demand/husband withdraw when relationship problems arise and when they are discussed (Christensen and Heavey, 1990). However, we summed only the two items that assessed wife demand/husband withdraw communication during "the discussion of a relationship problem." The third item, assessing wife demand/husband withdraw "when some problem in the relationship arises," was not included in our calculation. We were interested in spouses' expectations of demand/withdraw *during* discussion about a current relationship issue that was identified through our interview procedure, and thus, the third item was not relevant to our context. Each item was rated from 0 (very unlikely) to 9 (very likely). In accordance with prior reliability analyses of the Communication Patterns Questionnaire subscales (e.g. (Heavey *et al*., 1993), we computed Cronbach's (Cronbach, 1951) alpha to determine the internal consistency of the two-item subscale based on wives' and husbands' responses. Alpha was .76, similar to previous reports of alphas computed for the three-item subscale (e.g., (Heavey *et al*., 1993) reported an $\alpha = 71$), and demonstrated an adequate degree of internal consistency.

The Marital Adjustment Test (Locke and Wallace, 1959), used to assess marital satisfaction, was administered during an initial telephone screening interview. Marital satisfaction plays a pivotal role in determining spouses' behaviors and judgments (Gove *et al*., 1983; Pasch *et al*., 1997) and was included in analyses to rule out the possibility that any observed relationships were primarily driven by marital satisfaction. The Marital Adjustment Test is widely used in marital research because of its reliability and validity in discriminating satisfied and dissatisfied couples (Krokoff, 1989). Lower scores indicate lower marital satisfaction. The mean for our sample of 62 spouses was 122.61 ($SD = 21.22$), with only 13% scoring below 100, the mean population score for this measure (Locke and Wallace, 1959).

Behavioral Coding and Sequential Analysis

The Marital Interaction Coding System-IV, the most widely used marital behavioral coding system, provided data on problem solving behaviors during the 30-minute marital conflict resolution task (Heyman *et al*., 1995). The videotapes were coded by the Oregon Marital Studies Program under the direction of Robert L. Weiss. The Marital Interaction Coding System is designed to describe couples' behaviors, through continuous coding of wives and husbands' concurrent behaviors (called dual-stream coding), as they attempt to resolve a relationship issue. A number of studies have shown that the Marital Interaction Coding System (MICS) discriminates well between happy and unhappy couples, and marital therapy studies show changes in MICS-coded behaviors from pre-to post-treatment (Floyd *et al*., 1987). Following Oregon Marital Studies Program coding conventions, each coder maintained code-by-code agreement with a master coder of at least 70% on a random sample of 20% of the tapes. Tapes were recoded when agreement fell below this criterion. One study that used generalizability theory as a method for evaluating the dependability of the Marital Interaction Coding System produced impressive evidence supporting its reliability (Wieder and Weiss, 1980).

We used the results of factor analyses as well as the conventional groupings from our prior work (for details, see (Kiecolt-Glaser *et al*., 1993); see also (Kiecolt-Glaser *et al*., 1996)) and others' (Weiss and Summers, 1983) to help determine the final clustering of Marital Interaction Coding System codes. Fifteen negative behavior codes constituted two clusters; the first cluster included eleven active negative behaviors (criticize, disagree, deny responsibility, excuse, interrupt, negative mind reading,

noncompliance, put down, turn off, disapprove, dysphoric affect), and composed our demand category. Our second negative dimension included four avoidance or withdrawal behaviors: not tracking, withdrawal, off-topic, and disengage (Weiss and Heyman, 1990), and constituted our withdraw category. These clusters resulted in behavioral categories consistent with those used in prior studies (Ewart *et al*, 1991; Weiss and Summers, 1983; Jacob and Krahn, 1987; Weider and Weiss, 1980; see also Jacob and Krahn, 1987 for a discussion of classification strategies).

Bakeman's (Bakeman, 1983) lag sequential analysis program, ELAG, was used to assess wife demand/husband withdraw sequences across the conflict task. In such analyses, the base rate or unconditional probability of a target behavior is compared to its conditional probability, i.e., the probability of the target behavior given the occurrence of a particular criterion behavior. This difference is then divided by an estimate of the standard error of the difference, thereby expressing the relationship between the conditional and unconditional probabilities as a z-statistic. Positive z statistics indicate wife demand increases the likelihood of husband withdraw. Negative z scores signify that wife demand decreases the likelihood that husband withdraw will follow. We used lag 1 data (the immediate response of one spouse to the other) for our analyses.

Endocrine Measures

For frequent, unobtrusive cortisol sampling during the interaction task, a long polyethylene tube was attached to the heparin well, allowing nurses to draw blood samples at set intervals, out of participants' sight. During the marital interaction tasks the couples were seated facing each other in front of a curtain, with the polyethylene tubes easily accessible to two nurses who sat behind the curtain. Two psychology team members were also seated behind the curtain during the interviews, monitoring the videotaping and adjusting the remote-controlled cameras.

Approximately 90 min after the heparin well had been inserted, the baseline blood samples were drawn. At the end of the interview and immediately before the conflict task, the second blood sample was drawn; the third and fourth samples were drawn 15 min after conflict began and again at the end of the 30-minute conflict task. Measurable increases in cortisol appear in the plasma approximately 15 minutes after the start of a stressor. The half-life of cortisol is 60–90 min; because we were interested in the cumulative effect of the conflict discussion on spouses' physiological response, cortisol analyses focused on cortisol at the end of conflict, controlling for baseline cortisol levels. Cortisol assays were performed with well-established methods, described in detail elsewhere (Malarkey *et al*., 1994).

RESULTS

Spouses' Communication Patterns and Associations with Marital Satisfaction

Communication Patterns Questionnaire Scores

Wives' and husbands' Communication Patterns Questionnaire scores did not differ significantly, indicating similar perceptions of the likelihood of wife demand/husband withdraw during their conflicts (wives' perceived likelihood: $M = 6.68$, $SD = 3.98$; husbands' perceived likelihood: $M = 4.90$, $SD = 2.81$; paired $t(30) = 1.07$, *ns*).

Marital Interaction Coding System (MICS): Coded Behaviors of Wife Demand/Husband Withdraw

Z statistics greater than ± 1.96, computed from the sequential analysis of wife demand/husband withdraw, would indicate that husbands' withdraw was significantly influenced by wives' demanding behavior. The mean z score was $-.89$ ($SD = .55$), indicating, on average, no significant influence of wife demand on husband withdraw at lag 1 (the immediate response of husbands to their wives' behavior).

Self-Reports, Behavioral Coding, and Marital Satisfaction

Correlations among spouses' Communication Patterns Questionnaire scores of wife demand/husband withdraw (self-reports), z statistics for Marital Interaction Coding System-coded wife demand/husband withdraw during the marital conflict, and marital satisfaction are depicted in Table I. The only significant correlation was among wives' and husbands' marital satisfaction.

Spouses' Cortisol Effects of Demand/Withdraw

We conducted separate regression analyses for wives and husbands, as in our prior work, to determine whether, like newlyweds, coded wife

Table I. Correlations Among Perceptions of Wife Demand/Husband Withdraw, MICS Wife Demand/Husband Withdraw Sequences (z Scores), and Marital Satisfaction

Variable	1	2	3	4	5
1. Wives' perceived wife demand/husband withdraw	—	− .07	.24	.08	− .03
2. Husbands' perceived wife demand/husband withdraw		—	.05	− .23	− .18
3. MICS wife demand/husband withdraw sequences			—	− .09	− .01
4. Wives' marital satisfaction				—	.66**
5. Husbands' marital satisfaction					—

Note. $N = 31$ couples. MICS, Marital Interaction Coding System.
**$p < .001$.

demand/husband withdraw during the conflict related to older wives' cortisol responses. Included in the model were baseline cortisol levels and coded wife demand/husband withdraw. Older wives' cortisol during conflict (model: $R^2 = .70$, $F(2,27) = 28.45$, $p < .001$), after controlling for baseline cortisol levels ($\beta = .87$, $p < .05$), was indeed higher with greater wife demand/husband withdraw ($\beta = .30$, $p < .05$). Just as we found for newlyweds, older husbands' cortisol responses were not a function wife demand/husband withdraw during the conflict (model: $R^2 = .08$, $F(2,27) = 1.14$, *ns*).

To assess the contribution of spouses' wife demand/husband withdraw perceptions and actual demand/withdraw to explaining cortisol responses during the conflict, we implemented the Actor-Partner Interdependence Model (Campbell and Kashy, 2002). This analytic strategy takes into account spouses' mutual influence on their outcomes by incorporating into a mixed effects model the individual's own impact on his or her outcomes (actor effects), as well as the individual's impact on his or her partner's outcomes (partner effects). We used PROC MIXED in SAS to simultaneously estimate actor and partner effects of spouses' self-reports of wife demand/husband withdraw on cortisol responses during the conflict. We included sex in our model and its interactions with the wife demand/husband withdraw self-reports and coded sequences to determine if effects differed for men and women. We also included actor and partner Marital Adjustment Test scores given marital satisfaction's pivotal role in determining spouses' behaviors and judgments (Pasch *et al.*, 1997).

Results from the mixed model analysis are presented in Table II. After controlling for baseline cortisol levels, spouses' own self-reports of wife demand/husband withdraw were positively associated with their cortisol responses during conflict. No partner effects emerged, and sex was not a moderator in this model.

DISCUSSION

We examined associations among older couples' perceptions about their communication patterns, the enactment of wife demand/husband withdraw communication, and cortisol responses to marital conflict. Wife demand/husband withdraw coded behaviors were associated with wives', but not husbands', cortisol responses to a problem

Table II. Summary of Actor-Partner Interdependence Model of Spouses' Cortisol During Conflict

	Estimate	Error	*df*	*T*	*p*
Baseline cortisol	*0.49*	*0.08*	*45.5*	*5.84*	*.00*
Own marital satisfaction	0.01	0.02	36.9	0.60	.55
Spouse's marital satisfaction	− 0.01	0.02	36.8	− 0.60	.55
Own self-reported wife demand/husband withdraw	*0.31*	*0.11*	*46*	*2.87*	*.01*
Spouse's self-reported wife demand/husband withdraw	0.09	0.11	46	0.86	.40
Sex	1.40	1.02	32.2	1.37	.18
MICS wife demand/husband withdraw sequences	0.61	0.76	24.6	0.80	.43
Own self-reported wife demand/husband withdraw X sex	− 0.04	0.10	41.3	− 0.40	.69
MICS wife demand/husband withdraw X sex	0.76	0.71	24.7	1.08	.29

Note. $N = 62$ spouses. Variables in *italic* signify significant effects. MICS, Marital Interaction Coding System. Self-reported wife demand/husband withdraw assessed via Communication Pattern Questionnaire. Convergence criterion = 0.00000000.

solving discussion. This pattern is consistent with our previous work involving primarily younger, newlywed couples (Kiecolt-Glaser *et al*., 1996). This is an important replication given the limited marital behavior research utilizing samples of spouses married over 10 years (Matthews *et al*., 1996), and supports prior evidence for the greater impact of negative conflict behaviors on wives' physiological responses during marital conflict compared to husbands' (Kiecolt-Glaser and Newton, 2001).

More intriguing, however, were results from the mixed-model analysis indicating that perceived wife demand/husband withdraw, for both wives *and* husbands, was positively associated with cortisol responses to conflict. This model produced no effect for coded behaviors when considering them simultaneously with spouses' perceptions of demand/withdraw, as well as when also taking into considering the contribution of the couple unit on spouses' individual cortisol outcomes . Why might older spouses' perceptions be more strongly related to spouses' physiological responses to conflict than their actual behaviors? Perhaps long-married spouses' history together has a greater physiological impact than their immediate interactions observed by third parties. This perspective is consistent with the psychological construct of sentiment override (Baucom *et al*., 1989; Weiss, 1980), and research on older couples' stress responses to conflict would benefit from greater attention to such processes. Spouses, particularly those with a long history together, likely perceive and interpret marital interactions as a function of their general feelings towards, and expectations of, their partner, rather than via specific behaviors displayed during a given interaction (Weiss, 1980). Among younger couples, the stress of demand/withdraw is denoted by increased stress hormone responses to conflict, especially for wives (Kiecolt-Glaser *et al*., 1996). Although couples may engage in fewer negative conflict behaviors as they age (Carstensen *et al*., 1995), perceptions and expectations of dysfunctional behavior may endure and maintain stressful responses to conflict.

Our findings are also consistent with recent calls to consider multi-method assessments of marital function (Heyman, 2001). Using both observational coding and self-reports conjointly can shed light on the ways couples' communication pattern perceptions are formed and influence marital and physiological outcomes over time. For instance, repeated assessments of both perceptions and actual communication patterns during conflict might reveal the processes by which spouses form their perceptions and how these perceptions influence subsequent interaction and concomitant physiological responses. Given the correlational nature of the present study, we cannot rule out the possibility that individuals more threatened by conflict, and thus more prone to heightened cortisol responses, come to develop dysfunctional communication patterns. Only longitudinal studies of stress appraisals and behavioral and physiological assessments can reveal such cause-effect relationships.

The absence of associations among our older couples' demand/withdraw and marital satisfaction may seem surprising in the face of much research linking demand/withdraw to marital distress. The small sample of couples employed in the study may have contributed to the null findings reported here. However, idiosyncratic characteristics of our sample perhaps played a role. Our couples were extraordinarily satisfied with their marriages. We have previously noted that these same older couples were highly satisfied with the support they receive from their spouses in general (Heffner *et al*., 2004). Further, high levels of affection, a characteristic of more satisfying marriages, may reduce the inverse association between marital satisfaction and demand/withdraw (Caughlin and Huston, 2002). A less homogeneous sample, representing the spectrum of marital satisfaction and associated characteristics, is needed to clarify the role of demand/withdraw in marital satisfaction.

In addition to sample size limitations, the lack of association between actual demand/withdraw during conflict and older spouses' perceptions might alternatively suggest that the conflict discussion in the laboratory was not representative of these spouses' conflicts in their natural environments. Indeed, couples' arguments in the home last longer and are more negative than those observed in a laboratory setting (Margolin *et al*., 1989). Importantly, even in our contrived laboratory setting, where wife demand/husband withdraw was observed only minimally, there emerged demand/withdraw associations with wives' cortisol responses. We believe the degree of stress hormone change is likely greater in response to more realistic, more intense naturalistic interactions involving demand/withdraw. Further, if indeed the disparity between observed behaviors and perception of demand/withdraw indicates an inhibition or modification of these specific marital communication patterns in the laboratory, our findings suggest that self-reported perceptions are certainly useful in studies of couples' physiological responding in such

contrived settings. Current methodological advances in field assessment will be invaluable for determining the degree of physiological impact of marital discord, as well as influence of the environment on marital interactions. In a related vein, and as mentioned earlier, our couples were quite happy in their marriages and physically healthy in light of our stringent inclusion criteria. These characteristics limit the generalizability of our findings while concurrently highlighting the prospect that individuals in more distressed marriages might experience pernicious physiological responses during relationship conflict.

In conclusion, these findings suggest that among older adults, wife demand/husband withdraw plays a role in stress hormone responses during marital conflict, especially for wives. For both wives and husbands, perceiving greater wife demand/husband withdraw during conflicts more generally is associated with greater cortisol responses during an actual conflict, and these perceptions appear to be more important to physiological responding than the immediate enactment of demand/withdraw during a given conflict. The present findings underscore the need for greater exploration of marital dynamics among older couples with careful consideration given to life-course models of relationship and individual development. In light of accumulating evidence linking stress hormones with age-related health processes (Malarkey *et al*., 2001), spouses' perceptions of marital characteristics may reveal pathways to older spouses' health and illness. Longitudinal studies of communication patterns, endocrine-immune interactions and health outcomes would clearly be worthwhile.

ACKNOWLEDGMENTS

Work on this article was supported in part by NIH Grant P50 DE13749, NIA Program Project Grant AG16321, NIH General Clinical Research Center Grant M01-RR-0034, NIH Independent Scientist Award MH01467, The Ohio State University Comprehensive Cancer Center Core Grant CA-16058-09, and NIH Psychoneuroimmunology Training Grant MH18831.

REFERENCES

Bakeman, R. (1983). Computing lag sequential statistics: The ELAG program. *Behav. Res. Methods Instrum* 15(5): 530–535.

Baucom, D. H., Sayers, S. L., and Duhe, A. (1989). Attributional style and attributional patterns among married couples. *J. Pers. Soc. Psychol.* 56(4): 596–607.

Cacioppo, J. T., Berntson, G. G., Malarkey, W. B., Kiecolt-Glaser, J. K., Sheridan, J. F., Poehlmann, K. M., *et al.* (1998). Autonomic, neuroendocrine, and immune responses to psychological stress: the reactivity hypothesis. *Ann. NY Acad. Sci.* 840: 664–673.

Campbell, L., and Kashy, D. A. (2002). Estimating actor, partner, and interaction effects for dyadic data using PROC MIXED and HLM: A user-friendly guide. *Pers. Relationships* 9(3): 327–342.

Carstensen, L. L., Gottman, J. M., and Levenson, R. W. (1995). Emotional behavior in long-term marriage. *Psychol. Aging* 10(1): 140–149.

Caughlin, J. P., and Huston, T. L. (2002). A contextual analysis of the association between demand/withdraw and marital satisfaction. *Pers. Relationships* 9(1): 95–119.

Caughlin, J. P., and Vangelisti, A. L. (1999). Desire for change in one's partner as a predictor of the demand/withdraw pattern of marital communication. *Commun Monogr.* 66(1): 66–89.

Christensen, A. (1987). Detection of conflict patterns in couples. In Hahlweg, K., and Goldstein, M. (Eds.), *Understanding major mental disorder*, Family Process, New York, pp. 250–265.

Christensen, A., and Heavey, C. L. (1990). Gender and social structure in the demand/withdraw pattern of marital conflict. *J. Pers. Soc. Psychol.* 59(1): 73–81.

Coyne, J. C., Rohrbaugh, M. J., Shoham, V., Sonnega, J. S., NIcklas, J. M., and Cranford, J. A. (2001). Prognostic importance of marital quality for survival of congestive heart failure. *Am. J. Cardiol.* 88: 526–529.

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika* 16: 297–334.

Denton, W. H., Burleson, B. R., Hobbs, B. V., Von Stein, M., and Rodriguez, C. P. (2001). Cardiovascular reactivity and initiate/avoid patterns of marital communication: A test of Gottman's psychophysiologic model of marital interaction. *J. Behav. Med.* 24(5): 401–421.

Ewart, C. K., Taylor, C. B., Kraemer, H. C., and Agras, W. S. (1991). High blood pressure and marital discord: Not being nasty matters more than being nice. *Health Psychol.* 10(3): 155–163.

Fincham, F. D., Garnier, P. C., Gano-Phillips, S., and Osborne, L. N. (1995). Preinteraction expectations, marital satisfaction, and accessibility: A new look at sentiment override. *J. Fam. Psychol.* 9(1): 3–14.

Floyd, F. J. (1988). Couples' cognitive/affective reactions to communication behaviors. *J. Marriage Fam.* 50(2), 523–532.

Floyd, F. J., O'Farrell, T. J., and Goldberg, M. (1987). Comparison of marital observational measures: The Marital Interaction Coding System and the Communication Skills Test. *J. Consult. Clin. Psychol.* 55(3): 2200.

Gallo, L. C., Troxel, W. M., Matthews, K. A., and Kuller, L. H. (2003). Marital status and quality in middle-aged women: Associations with levels and trajectories of cardiovascular risk factors. *Health Psychol.* 22(5): 453–463.

Gottman, J. M., and Levenson, R. W. (1988). The social psychophysiology of marriage. In Noller, P., and Fitzpatrick, M. A. (Eds.), *Perspectives on marital interaction. Monographs in social psychology of language, No. 1.*, Multilingual Matters, Ltd, Clevedon, England, pp. 182–200.

Gove, W. R., Hughes, M., and Style, C. B. (1983). Does marriage have positive effects on the psychological well-being of the individual? *J. Health Soc. Behav.* 24(2): 122–131.

Hawkins, M. W., Carrere, S., and Gottman, J. M. (2002). Marital sentiment override: Does it influence couples' perceptions? *J. Marriage Fam.* 64(1): 193–201.

Heavey, C. L., Christensen, A., and Malamuth, N. M. (1995). The longitudinal impact of demand and withdrawal during marital conflict. *J. Consult. Clin. Psychol.* 63(5), 797–801.

Heavey, C. L., Layne, C., and Christensen, A. (1993). Gender and conflict structure in marital interaction: A replication and extension. *J. Consult. Clin. Psychol.* 61(1): 16–27.

Heffner, K. L., Kiecolt-Glaser, J. K., Loving, T. J., Glaser, R., and Malarkey, W. B. (2004). Spousal support satisfaction as a modifier of physiological responses to marital conflict in younger and older couples. *J. Behav. Med.* 27(3): 233–254.

Heyman, R. E. (2001). Observation of couple conflicts: Clinical assessment applications, stubborn truths, and shaky foundations. *Psychol. Assess.* 13(1): 5–35.

Heyman, R. E., Weiss, R. L., and Eddy, J. M. (1995). Marital Interaction Coding System: Revision and empirical evaluation. *Behav. Res. Ther.* 33(6): 737–746.

Jacob, T., and Krahn, G. (1987). The classification of behavioral observation codes in studies of family interaction. *J. Marriage Fam.* 49(3): 677–687.

Jacobson, N. S., Follette, W. C., and Pagel, M. (1986). Predicting who will benefit from behavioral marital therapy. *J. Consult. Clin. Psychol.* 54(4): 518–522.

Jacobson, N. S., Gottman, J. M., Waltz, J., Rushe, R., and Babcock, J. M. (1994). Affect, verbal content, and psychophysiology in the arguments of couples with a violent husband. *J. Consult. Clin. Psychol.* 62(5): 982–988.

Kiecolt-Glaser, J. K., Bane, C., Glaser, R., and Malarkey, W. B. (2003). Love, marriage, and divorce: Newlyweds' stress hormones foreshadow relationship changes. *J. Consult. Clin. Psychol.* 71(1): 176–188.

Kiecolt-Glaser, J. K., Glaser, R., Cacioppo, J. T., MacCallum, R. C., *et al.* (1997). Marital conflict in older adults: Endocrinological and immunological correlates. *Psychosom. Med.* 59(4): 339–349.

Kiecolt-Glaser, J. K., Malarkey, W. B., Chee, M., Newton, T., Cacioppo, J. T., Mao, H.-Y., *et al.* (1993). Negative behavior during marital conflict is associated with immunological down-regulation. *Psychosom. Med.* 55(5): 395–409.

Kiecolt-Glaser, J. K., and Newton, T. L. (2001). Marriage and health: His and hers. *Psychol. Bull.* 127(4): 472–503.

Kiecolt-Glaser, J. K., Newton, T., Cacioppo, J. T., MacCallum, R. C., Glaser, R., and Malarkey, W. B. (1996). Marital conflict and endocrine function: Are men really more physiologically affected than women? *J. Consult. Clin. Psychol.* 64(2): 324–332.

Krokoff, L. J. (1989). Predictive validation of a telephone version of the Locke-Wallace Marital Adjustment Test. *J. Marriage Fam.* 51(3): 767–775.

Levenson, R. W., Carstensen, L. L., and Gottman, J. M. (1994). Influence of age and gender on affect, physiology, and their interrelations: A study of long-term marriages. *J. Pers. Soc. Psychol.* 67(1): 56–68.

Locke, H. J., and Wallace, K. M. (1959). Short marital-adjustment and prediction tests: Their reliability and validity. *Marriage Fam. Living* 21: 251–255.

Lovallo, W. R. (1997). *Stress & health: Biological and psychological interactions*.

Malarkey, W. B., Glaser, R., Kiecolt-Glaser, J. K., and Marucha, P. T. (2001). Behavior: the endocrine-immune interface and health outcomes. *Adv. Psychosom. Med.* 22: 104–115.

Malarkey, W. B., Kiecolt-Glaser, J. K., Pearl, D., and Glaser, R. (1994). Hostile behavior during marital conflict alters pituitary and adrenal hormones. *Psychosom. Med.* 56(1): 41–51.

Margolin, G., Burman, B., and John, R. S. (1989). Home observations of married couples reenacting naturalistic conflicts. *Behav. Assess.* 11(1): 101–118.

Matthews, L. S., Wickrama, K. A. S., and Conger, R. D. (1996). Predicting marital instability from spouse and observer reports of marital interaction. *J. Marriage Fam.* 58(3): 641–655.

Meites, J., Goya, R., and Takahashi, S. (1987). Why the neuroendocrine system is important in aging processes. *Exp. Gerontol.* 22(1): 1–15.

Noller, P., Feeney, J. A., Bonnell, D., and Callan, V. J. (1994). A longitudinal study of conflict in early marriage. *J. Soc. Pers. Relationships* 11(2): 233–252.

Noller, P., and Guthrie, D. (1989). Assessment and modification of marital communication. *Behav. Change* 6(3–4): 124–136.

Notarius, C. I., Benson, P. R., Sloane, D., Vanzetti, N. A., and Hornyak, L. (1989). Exploring the interface between perception and behavior: An analysis of marital interaction in distressed and nondistressed couples. *Behav. Assess.* 11(1): 39–64.

Otte, C., Hart, S., Neylan, T. C., Marmar, C. R., Yaffe, K., and Mohr, D. C. (2005). A meta-analysis of cortisol response to challenge in human aging: Importance of gender. *Psychoneuroendocrinology* 30(1): 80–91.

Pasch, L. A., Bradbury, T. N., and Sullivan, K. T. (1997). Social support in marriage: An analysis of intraindividual and interpersonal components. In Pierce, G. R., Lakey, B., *et al.* (Eds.), *Sourcebook of social support and personality*, pp. 229–256.

Seeman, T. E., Berkman, L. F., Gulanski, B. I., Robbins, R. J., *et al.* (1995). Self-esteem and neuroendocrine response to challenge: MacArthur studies of successful aging. *J. Psychosom. Res.* 39(1): 69–84.

Smith, T. W., Gallo, L. C., Goble, L., Ngu, L. Q., and Stark, K. A. (1998). Agency, communion, and cardiovascular reactivity during marital interaction. *Health Psychol.* 17(6): 537–545.

Wieder, G. B., and Weiss, R. L. (1980). Generalizability theory and the coding of marital interactions. *J. Consul. Clin. Psychol.* 48(4): 469–477.

Weiss, R. L. (1980). Strategic behavioral marital therapy: Toward a model for assessment and intervention. In Vincent, J. P. (Ed.), *Advances in Family Intervention, Assessment and Theory*, Vol. 1, JAI Press, Greenwich, CT, pp. 229–271.

Weiss, R. L., and Heyman, R. E. (1990). Observation of marital interaction. In Fincham, F. D., and Bradbury, T. N. (Eds.), *The psychology of marriage: Basic issues and applications*, pp. 87–117.

Weiss, R. L., and Summers, K. (1983). The Marital Interaction Coding System-III. In Filsinger, E. E. (Ed.), *A sourcebook of marriage and family assessment*, Sage, Beverly Hills, CA, pp. 85–115.

Wieder, G. B., and Weiss, R. L. (1980). Generalizability theory and the coding of marital interactions. *J. Consult. Clin. Psychol.* 48: 469–477.