

Marriage and Health: His and Hers

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This review focuses on the pathway leading from the marital relationship to physical health. Evidence from 64 articles published in the past decade, particularly marital interaction studies, suggests that marital functioning is consequential for health; negative dimensions of marital functioning have indirect influences on health outcomes through depression and health habits, and direct influences on cardiovascular, endocrine, immune, neurosensory, and other physiological mechanisms. Moreover, individual difference variables such as trait hostility augment the impact of marital processes on biological systems. Emerging themes in the past decade include the importance of differentiating positive and negative dimensions of marital functioning, the explanatory power of behavioral data, and gender differences in the pathways from the marital relationship to physiological functioning. Contemporary models of gender that emphasize self-processes, traits, and roles furnish alternative perspectives on the differential costs and benefits of marriage for men's and women's health.

The health-enhancing properties of personal relationships have been repeatedly documented. Data from well-controlled epidemiological studies suggest that social isolation constitutes a major risk factor for morbidity and mortality, with statistical effect sizes comparable to those of such well-established health risk factors as smoking, blood pressure, blood lipids, obesity, and physical activity (House, Landis, & Umberson, 1988). Marriage is the central relationship for a majority of adults, and morbidity and mortality are reliably lower for the married than the unmarried across a variety of acute and chronic conditions, including such diverse health threats as cancer, heart attacks, and surgery (Chandra, Szklo, Goldberg, & Tonascia, 1983; J. S. Goodwin, Hunt, Key, & Samet, 1987; Gordon & Rosenthal, 1995; House et al., 1988). The two major hypotheses for these disparities are selection and protection, that is, healthier individuals are more likely to marry and to stay married, and/or they have more material resources, less stress, more social support, and less risky health habits than their unmarried counterparts (Umberson, 1992).

Despite the fact that married people, on average, enjoy better mental and physical health than the unmarried, marriage's protective effects are notably stronger for men than women (Berkman & Breslow, 1983; Litwak & Messeri, 1989). In contrast to their married counterparts, nonmarried women have 50% greater mortality, compared with 250% for men (C. E. Ross, Mirowsky, & Goldsteen, 1990). Gender differences in social control of health-

related behavior appear to be one operative factor in this mortality differential, because women are more likely than men to attempt to control others' health; thus, when marriage promotes better health habits, these effects are relatively larger for men than women (Umberson, 1992). In addition, social integration is inversely related to negative health habits (Berkman & Breslow, 1983), and there are also gender differences in this regard; women's support networks often include close friends and relatives as confidantes, whereas men typically name their wives as their main source of support and the only person in whom they confide personal problems or difficulties (Phillipson, 1997). Accordingly, even though both bereavement and divorce contribute to poorer health and increased mortality, marital disruption appears to be more detrimental for men than for women (House et al., 1988).

Although loss of a spouse can provoke adverse mental and physical health changes, the simple presence of a spouse is not necessarily protective; a troubled marriage is itself a prime source of stress, while simultaneously limiting the partner's ability to seek support in other relationships (Coyne & DeLongis, 1986). Troubled marriages are reliably associated with increased distress, and unmarried people are happier, on the average, than unhappily married people (Glenn & Weaver, 1981). In fact, both syndromal depression and depressive symptoms are strongly associated with marital discord (Beach, Fincham, & Katz, 1998; Fincham & Beach, 1999). Given the centrality of the relationship, it seems likely that marital functioning would have consequences for physical health as well. However, on the basis of the evidence available at the time, Burman and Margolin (1992) concluded that although marital variables affected health, the effects of marital relationships on health status were indirect and nonspecific. Evidence from 64 journal articles published since their seminal review furnishes a reason for revisiting this area, particularly in view of the growth in one key aspect of this literature, marital interaction studies; prior work in this domain was limited to four publications that described autonomic activity in samples of 2 to 19 couples (Burman & Margolin, 1992). In contrast, in the past decade re-

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searchers have documented a broad array of autonomic, endocrine, and immune alterations as couples interact; these data provide a critical context for understanding the interplay between interpersonal processes and biological states (Ewart, 1993).

Overview

Drawing from empirical research conducted during the past decade, the present review refines and amplifies particular aspects of the more comprehensive biopsychosocial "blueprint" for marriage and health proposed by Burman and Margolin (1992) in their seminal review. Specifically, the present review focuses on physiological pathways leading from the marital relationship to physical health outcomes, along with the roles of depression, health habits, and trait hostility (see Figure 1).

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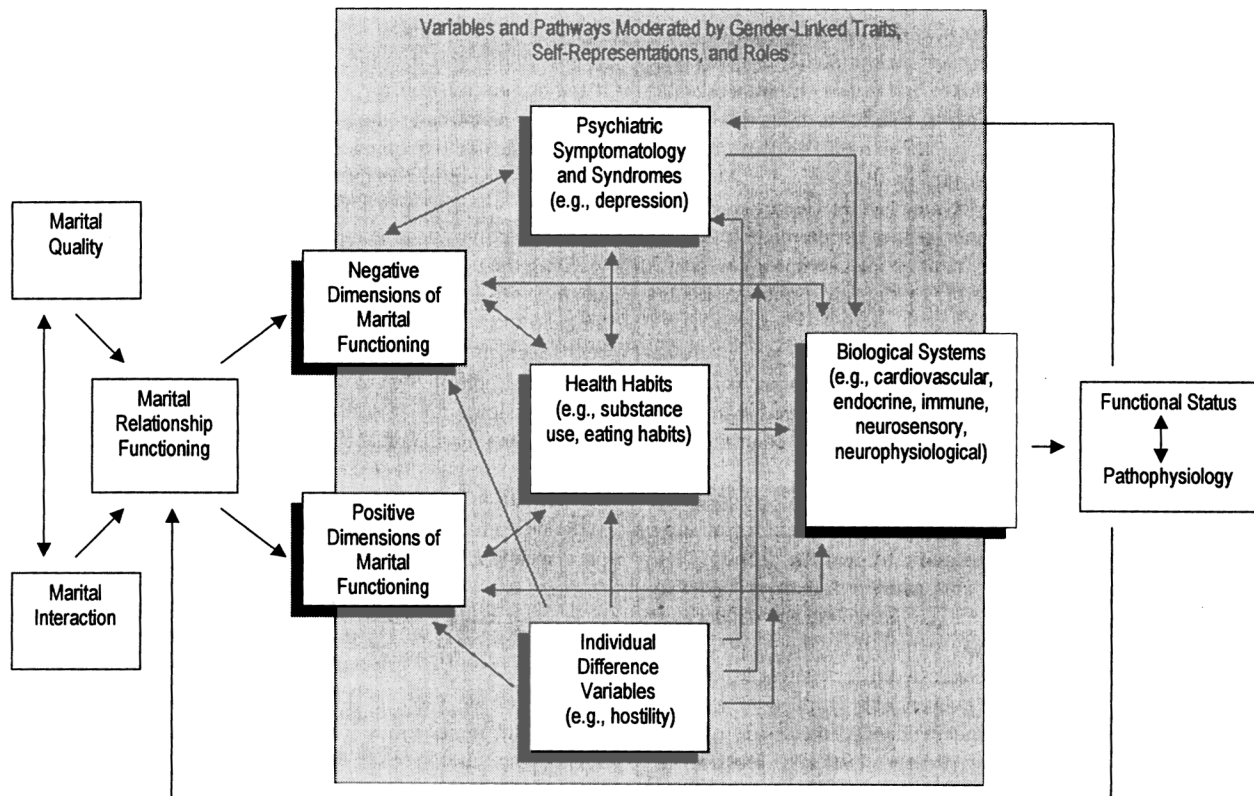


Figure 1. Conceptual framework for organizing associations among marital functioning, biological systems, and physical health. Note that although this figure summarizes data that form the focus of this review (i.e., those that pertain to the direct and indirect pathways leading from the marital relationship to physiological functioning and physical health), it also illustrates hypothesized pathways along with bidirectional associations that are outside the scope of this article (see Burman & Margolin, 1992). Marital quality and marital interaction are the two aspects of marital functioning that have been examined with regard to physiological functioning and physical health. Positive and negative dimensions of marital functioning are composed of communication behaviors, emotional states, and cognitions (e.g., attributions and expectations) that are activated within specific marital interactions, along with spouses' evaluations of the overall marital relationship and of specific marital domains (e.g., satisfaction–dissatisfaction, companionship, equality in decision making). Following the pathways that are the focus of the present review—those leading from marital functioning to physiological functioning and physical health—the figure illustrates direct links from negative and positive marital dimensions to biological systems. In the domain of marital communication, direct links from negative behaviors to physiological functioning are supported; direct links involving positive behaviors are less evident, perhaps because paradigms that might best demonstrate these links have not been routinely used. Indirect pathways from the marital relationship to biological systems are mediated by health habits and psychiatric symptomatology that are affected by marital functioning and that in turn impact biological systems (Whisman, 1999). Also shown are individual differences variables that affect marital functioning and its associations with biological systems. Finally, the shaded background represents a triad of gender-linked factors that influence behavior, cognition, and emotion in close relationships. It is proposed that this triad helps explain gender differences in pathways leading from marital functioning to biological systems and physical health.

ingly, considerable attention is devoted to evaluating studies of physiological responses to marital interaction, including a discussion of the potential significance of these physiological changes for subsequent morbidity and mortality.

The second theme concerns gender differences. As discussed below, in studies of physiological correlates of marital interaction, gender differences are robust and salient. In contrast, in research on marital functioning and physical health outcomes, gender has not received consistent and systematic attention. Accordingly, we review the past decade of studies on marriage and physical health outcomes with an eye toward gender-related differences, highlighting emerging patterns that suggest areas for future research. In addition, we consider conceptual perspectives on gendered patterns of physiological functioning and health status in marriage. Drawing on models of gender-linked individual differences, one perspective considers how women's relational traits and self-processes could conceivably render them more responsive than men, psychologically and physiologically, to the emotional tone of marital relationships (Cross & Madson, 1997b; Helgeson, 1994). Another perspective considers how gender differentials in stress exposure that occur within the context of marital roles (e.g., responsibility for and participation in domestic chores) might contribute to certain pathways leading from marital functioning to deleterious health outcomes (Glass & Fujimoto, 1994). As illustrated in Figure 1, it is proposed that these gender-linked factors have a pervasive influence on all pathways connecting marital functioning with physiological mechanisms that contribute to health outcomes.

The third theme of the present review concerns the stress-social support hypothesis or, alternatively, the social strain-social support hypothesis, the major explanatory framework proposed by Burman and Margolin (1992). This aspect of their model was proposed in order to account for both the protective and deleterious health correlates of marriage. Consistent with this explanatory model, a growing literature has suggested that negative aspects of social relationships are often independent of positive aspects (Rook, 1998) and are important independent predictors of psychological and physical functioning (Bolger, DeLongis, Kessler, & Schilling, 1989; Stansfeld, Bosma, Hemingway, & Marmot, 1998). Moreover, research emerging in the past decade permits the supposition that these two aspects of marriage may merit independent assessment in order to best understand links between marriage and health, for example, evidence that socially supportive behaviors, assessed prospectively, are associated with marital outcomes (Pasch & Bradbury, 1998). Accordingly, throughout this review, we highlight findings that speak to the possible independent effects of positive and negative aspects of marital relationships, and we return to this theme when we discuss methodological implications.

Scope and Organization of Review

The literature search made use of the ancestry approach after Medline and PsycINFO were surveyed using the terms *marital interaction*, *marital adjustment*, *marital quality*, *marital conflict*, and *marital satisfaction*; it spans 1990 through December 1999, beginning where Burman and Margolin (1992) ended their literature review. For inclusion, researchers must have reported data on some dimension of physical health and/or physiological function. Studies are clustered based on whether the dependent measures

were (a) objective physical health status or physiological data, (b) self-reported physical health, (c) pain outcomes, or (d) physiological assessments collected during or following marital interaction. Because this review focuses on the pathway leading from the marital relationship to physiological functioning and physical health, studies in which marital quality was the dependent variable were excluded; thus, for example, the effects of alcohol use on marital functioning are not addressed (Jacob & Leonard, 1988, 1992). Similarly, although there are obvious mutual influences, studies that simply used an illness as a stressor, without attempting to relate changes in marital functioning to physical health, were not considered, for example, the literature on caregiver burden (Kiecolt-Glaser, Glaser, Gravenstein, Malarkey, & Sheridan, 1996). Studies that examined family functioning were not included if the marital relationship was not assessed separately.

Studies examining the link between marital functioning and physical health outcomes are considered first. This part of the review is organized into three sections, according to the dependent measure: objective physical health status or physiological data, self-reported physical health, or pain outcomes. For each of these sections, the corresponding table provides a comprehensive list of all studies that were located in the literature review. The discussion for each section is designed to highlight salient themes, rather than be all-inclusive. Afterward, we review marital interaction studies that include physiological assessments and then address the roles of depression, trait hostility, and health habits in the pathway leading from marital relationship factors to physiological functioning and health outcomes. Finally, conceptual perspectives on gender are discussed. The review concludes with a summary of methodological recommendations for the next decade of research on marriage and health.

Marital Studies With Objective Physical Health Status Measures or Physiological Data

A survey of Table 1 reveals that marital relationship factors have health implications for diverse medical conditions. For example, two studies observed relationships between marital variables and immunologically mediated disease outcomes. The first of these addressed oral health, an arena in which the immune system plays a key role. Both men and women who reported low marital quality were more likely to have periodontal disease and dental caries than those who reported high marital quality (Marcenes & Sheiham, 1996).

The second study addressed rheumatoid arthritis, another condition in which the immune system plays a central role. Differences in the marital relationship were used to predict the impact of interpersonal stressors in the women's network on rheumatoid arthritis disease activity (Zautra et al., 1998). Although both immune function and clinician's ratings changed during a week of increased interpersonal stress, women who reported either more positive spousal interaction patterns or less spouse criticism or negativity did not show as large an increase in disease activity. These benefits were not found among women who reported only that their husbands were highly supportive during disease flare-ups. As the authors noted, this is the first study to successfully predict changes in rheumatoid arthritis disease states using a priori decision rules; the study's notable strengths include its prospective design and objective assessment of disease activity. In addition, by

differentiating positive spousal interaction patterns and general spousal support expressed during symptom flares, two different and modestly correlated aspects of positive marital quality, the investigators revealed an important specificity with regard to marriage–disease linkages in rheumatoid arthritis. Because specific positive interactions, but not support, were implicated in disease activity, the authors recommended that future studies differentiate and assess various components of marital quality.

Other work underscored the impact of marital distress on cardiovascular function. Data from one innovative study of married women suggest that recollection of conflict is sufficient to alter blood pressure (Carels, Sherwood, & Blumenthal, 1998). Women who reported lower marital satisfaction exhibited higher systolic blood pressure and heart rate responses during marital conflict recall than women with high marital satisfaction, after controlling for reactivity in two nonmarital tasks. In a related domain, lower scores on the Cohesion scale of the Dyadic Adjustment Scale (DAS) were related to elevated nighttime blood pressure and 24-hr diastolic blood pressure among a population of early hypertensive men and women (Baker et al., 1999). Gender was included as a covariate, making it unclear whether these associations held for men and women separately. In addition, among the participants who scored below the group mean on Cohesion, more spousal contact was associated with elevated evening blood pressure.

The spouse's behavior also appears to influence behavioral symptomatology in neurological disorders. In a longitudinal study of spouse pairs in which one member of the couple had Alzheimer's disease (AD), the caregiver's *expressed emotion* (EE), defined as expressions of criticism and/or overinvolvement toward the care recipient, was predictive of increased negative behaviors (symptom manifestations of the underlying AD neuropathophysiology) in the impaired spouse (Vitaliano, Young, Russo, Romano, & Magana-Amato, 1993). In related work, behavioral symptoms of Parkinson's disease were coded from a videotaped interaction of the patient and spouse as they discussed changes in their lives since the patient's diagnosis (Greene & Griffin, 1998); patients in distressed relationships blinked less frequently and had longer blink durations than their nondistressed counterparts. Because spontaneous eye-blink rate and duration can be affected by dopamine availability and thus can serve as quantitative correlates of neurophysiological status among individuals with Parkinson's disease, the investigators interpreted these results as evidence for neurophysiological symptom exacerbation among patients with Parkinson's disease in distressed marriages. Taken together, the results of these two studies indicate that marital distress and specific negative spousal behaviors contribute to the worsening of behavioral symptomatology in two different neurological disorders. Analyses were not conducted by gender in either study, and thus no conclusions can be drawn about the role of gender in these results.

Of the studies reviewed so far, the only one that tested gender differences observed similar associations between marital functioning and health status for men and women (Marcenes & Sheiham, 1996). However, two additional studies showed that marital functioning had a stronger impact on women than on men. One such study used a substantial follow-up period, rather than a cross-sectional design, in order to establish a stronger and less ambiguous basis for links between marital processes and the development of important health outcomes such as cancer or heart

disease (Hibbard & Pope, 1993). Using medical records from women and men randomly selected from among members of a large HMO, the investigators found that health data from a 15-year follow-up were related to social role measures (Hibbard & Pope, 1993). For women, companionship in marriage and equality in decision making were associated with a lower risk of death. Men's morbidity and mortality were unrelated to marital role characteristics. Data from another large longitudinal study reflect a similar gender disparity (Appelberg, Romanov, Heikkila, Honkasaari, & Koskenvuo, 1996). Women who reported that they had "considerable conflicts" with their husband and who also reported work conflicts had a 2.54-fold risk of physician-certified work disability related to a variety of health problems in the ensuing 6 years. Neither work nor marital conflict was a risk factor for men.

In contrast, in two other studies, aspects of the marital relationship had a larger impact on men than women. In the first of these, mood self-ratings made while a couple watched the videotape of their conflict session that had taken place several days earlier were modestly correlated with husbands' (but not wives') autonomic responses recorded previously during conflict (Levenson, Carstensen, & Gottman, 1994). These data stand in contrast to the evidence that simple recall of marital conflict can heighten cardiovascular responses in maritally distressed women (Carels et al., 1998). However, unlike the procedure in Carels et al., the mood ratings and the physiological data were collected at different time points, making interpretation problematic.

Apparent gender differences in a second study may have been an artifact of statistical power. Husbands who reported that they disclosed to their wives were less likely to die and/or be rehospitalized within the next year following a myocardial infarction (Helgeson, 1991). This association held after controlling for an empirically derived biomedical index that is highly predictive of medical prognosis following a heart attack. With regard to gender differences, the beneficial effects of disclosure to one's spouse were significant for men ($n = 63$) but not women, but the small number of married women ($n = 14$) precluded firm conclusions.

Taken together, the studies in Table 1 suggest that marital dimensions other than global marital quality may contribute to health outcomes, including spousal conflict and overinvolvement, inequality in decision making, disclosure, and companionship (Appelberg et al., 1996; Helgeson, 1991; Hibbard & Pope, 1993; Vitaliano et al., 1993). Because few studies assessed multiple marital factors, it is unclear whether other aspects of the marital relationship make unique contributions to health outcomes or whether they reflect the effect of a more global, underlying marital quality dimension. One study that did evaluate two different aspects of positive marital quality revealed novel evidence for specificity with regard to marriage–disease linkages in rheumatoid arthritis (Zautra et al., 1998), thus highlighting the potential importance of disaggregating marital quality.

At the same time, global measures of marital satisfaction provide critical information, and many of the studies in Table 1 either did not assess marital adjustment or provided no data from scales with known norms that would allow inferences about the range and variability of marital happiness in the sample. Given the lower participation of dissatisfied couples in marital studies (Bradbury & Karney, 1993), truncation of range may lead to underestimates of the effect of marital unhappiness. Restriction of range is also an

Table 1
Marital Studies With Objective Health or Physiological Data

Study	Participants (age) and marital adjustment	Design and independent measures	Dependent measures	Relevant findings
Helgeson, 1991	63 male and 14 female patients who were post-MI ($Mdn = 60$, 37-70); no marital adjustment data	Longitudinal; spouse disclosure, rated on a 6-point scale	Rehospitalization and/or death, post-MI chest pain, and perceived health 1 year following post-MI	Lack of spouse disclosure predicted poorer recovery on all three indices. Men who disclosed were rehospitalized less often than women, but only 14 wives were included.
Hibbard & Pope, 1993	980 women and 896 men (18-65) randomly selected from members of a large HMO; no standardized marital adjustment data	Longitudinal; ratings of satisfaction with marriage, equality in decision making, and companionship	Medical records; mortality data through 15 years postinterview for the entire cohort and morbidity for a subset	Women: Companionship in marriage and equality in decision making were associated with a lower risk of death. Men: None of the marriage characteristics were related to morbidity or mortality.
Vitaliano, Young, Russo, Romano, & Magana-Amato, 1993	79 couples (patient with Alzheimer's and spousal caregiver); 68% of patients were men ($M = 71$); no marital adjustment data	Longitudinal; EE ratings	Care recipients' decline in cognitive abilities (Mini-Mental State Exam), ADL, and Negative Care Recipient Behaviors	Caregiver EE was not predictive of care recipient cognitive or ADL decline as hypothesized; however, EE was predictive of increased negative behaviors over a 15- to 18-month interval.
Levenson, Carstensen, & Gottman, 1994	151 couples in long-term marriages; MAT = 115	Cross-sectional; BS factors: age (40-50 or 60-70) and MAT group (satisfied or dissatisfied); affect self-ratings made while couples watched a videotape of their conflict session that had taken place several days earlier	IBI, somatic activity, skin conductance, finger pulse transmission time, FPA, ear pulse transmission time, finger temperature	Wives: No significant correlation between physiology and affect ratings. Husbands: Rating of negativity was associated with higher somatic activity and smaller FPAs. Pleasant topic conversation was correlated with higher HR.
Appelberg, Romanov, Heikkila, Honkasalo, & Koskenvuo, 1996	8,021 male and 7,327 female Finnish employees (24-65); average marital adjustment not reported	Longitudinal, 6-year follow-up; response to a single question about "considerable conflicts" with spouse	Risk for work disability, related to a variety of health problems, based on a physician's certificate	Women who reported both work and marital conflicts had a 2.54 risk ratio of becoming disabled. Neither work nor marital conflict was a risk factor for men.
Marcenes & Sheiham, 1996	164 men (35-44); no standardized marital adjustment data	Cross-sectional; marital quality (five questions taken from several inventories)	Periodontal health status and dental caries status	Higher marital quality was associated with better periodontal health status, as well as better dental caries status for both men and women.
Baker et al., 1998	113 men and 63 women ($M = 46$), all with mild hypertension; average marital adjustment not reported	Cross-sectional; DAS and Areas of Change Questionnaire	Cardiac morphology measures: Variability in left ventricular mass and relative wall thickness	No relationships between marital and cardiac morphology measures.
Carels, Sherwood, & Blumenthal, 1998	50 women (25-45); DAS: high satisfaction = 116, low satisfaction = 78	Cross-sectional; WS factor: three laboratory tasks (marital conflict recall, work conflict recall, serial subtraction); BS factor: DAS groups	BP and HR	Women low on marital adjustment had higher SBP and HR than more maritally satisfied women during marital conflict recall.
Greene & Griffin, 1998	17 couples with one spouse with Parkinson's disease ($M = 72$); 15 of 17 patients were male; MAT: high satisfaction = 122, low satisfaction = 87	Cross-sectional; MAT	Rate and duration of spontaneous eye blink and rate of speech during a 10-min spousal discussion	Patients in distressed relationships blinked less frequently and had longer blink durations than their nondistressed counterparts.

Table 1 (continued)

Study	Participants (age) and marital adjustment	Design and independent measures	Dependent measures	Relevant findings
Zautra et al., 1998	20 women with rheumatoid arthritis ($M = 53$); no standardized marital adjustment data	Prospective, data collected at baseline and during a stressful week; self-reports of spouse criticism, spouse support, and frequency of positive spouse interactions	Immunological assays; clinician's global ratings of disease activity (completed by rheumatologists and nurses)	Although immune function and clinician's ratings showed significant change during a week of significant stress in their interpersonal network, women with more positive spousal interaction patterns and less spouse criticism or negativity did not show increases in disease activity.
Baker et al., 1999	113 men and 63 women ($M = 46$), all with mild hypertension; average marital adjustment not reported	Cross-sectional, 24-hr data collection; Cohesion scale of the DAS	24-hr ambulatory BP	Lower Cohesion scores were related to higher nighttime BP and 24-hr DBP. For low Cohesion participants, more spousal contact was associated with elevated evening BP. No Gender $\times$ Cohesion analyses.
Tuschen-Caffier, Florin, Krause, & Pook, 1999	17 couples with infertility ($M = 31, 24-39$); no standardized marital adjustment data	Couples in CBT to improve communication skills were compared with two nonrandomized control groups	Sperm concentration and marital distress rated 1-100	Pre- to posttreatment improvement in sperm concentration and marital distress.

Note. MI = myocardial infarction; EE = expressed emotion; ADL = activities of daily living; MAT = Marital Adjustment Test; BS = between subjects; IBI = interbeat interval; FPA = finger pulse amplitude; HR = heart rate; DAS = Dyadic Adjustment Scale; WS = within subjects; BP = blood pressure; SBP = systolic blood pressure; DBP = diastolic blood pressure; CBT = cognitive-behavioral therapy.

obvious problem when single items are used as the basis for evaluation of marital adjustment.

With regard to gender, some studies in Table 1 suggested sex differences in links between marital functioning and health status, whereas others did not. Although comparisons were hampered by the fact that a number of the studies did not report analyses by gender or included only one gender, it is notable that the two large longitudinal studies—some of the strongest empirical evidence because of the predictive designs and sizable samples—showed differences in disability and mortality for women, but not men (Appelberg et al., 1996; Hibbard & Pope, 1993).

Finally, the studies in Table 1 indicate that marital relationship factors bear significant relationships with physiological and objective health status indicators. The broad influence of marital factors is revealed by the number of different biological systems implicated (e.g., immunological, cardiovascular, neurophysiological) and by the number of distinct points in the disease trajectory at which marital factors appear to play a prominent role, including possible etiology (Hibbard & Pope, 1993); symptom exacerbation in chronic, degenerative illnesses (Vitaliano et al., 1993; Zautra et al., 1998); and prognosis-recovery following a life-threatening medical event (Helgeson, 1991).

Marital Studies With Self-Reported Health

Self-reported health took two forms in the studies listed in Table 2. In the first, global perceptions of health or frequencies of nonspecific health complaints served as the dependent variable. In the second, data were collected in regard to particular illnesses, syndromes, or disorders (e.g., ulcers, premenstrual syndrome, disability associated with tinnitus).

Linkages between self-rated health and marital functioning were reported in a number of cross-sectional studies. In two studies that included women only, married women who described their relationships with their partners as more rewarding reported fewer medical symptoms and rated their health as better than those who were less satisfied (Barnett, Davidson, & Marshall, 1991; Thomas, 1995). In addition to these cross-sectional data, one longitudinal study of married women showed that marital harmony was associated with better sleep and fewer physician visits (Prigerson, Maciejewski, & Rosenheck, 1999). In two studies that included men and women, higher marital satisfaction was associated with higher self-rated health for both men and women (Ganong & Coleman, 1991; Ren, 1997). In contrast, among couples in long-term marriages, the relationship between marital distress and health was stronger for women than men (Levenson, Carstensen, & Gottman, 1993). In satisfied marriages, the health of wives and husbands was equivalent (based on a health symptom checklist); in dissatisfied marriages, husbands reported fewer mental and physical health problems than their wives. Overall, these studies reveal clear links between self-rated health and marital functioning for men and women, with one study revealing a gender disparity.

Among spousal pairs in which one partner had chronic tinnitus, patients' scores from the DAS Cohesion scale, along with their interaction with depressive symptoms, accounted for 15% of the variance in disability ratings beyond gender, tinnitus characteristics, and depression (Sullivan, Katon, Russo, Dobie, & Sakai, 1994). Patients whose high levels of depression were accompanied by low marital cohesion reported the most tinnitus-related role

Table 2
Marital Studies With Self-Reported Health

Study	Participants (age) and marital adjustment	Design and independent measures	Dependent measures	Relevant findings
Coughlin, 1990	150 married women (21–49); Marital Satisfaction Inventory = 558	Cross-sectional; Marital Satisfaction Inventory	Menstrual Distress Questionnaire	Higher marital satisfaction was associated with fewer premenstrual syndrome symptoms.
Barnett, Davidson, & Marshall, 1991	403 women ($M = 40$), 248 social workers and 155 nurses; no standardized marital adjustment data	Cross-sectional; partner role quality (difference between reward and concern scores)	Medical Symptom Checklist	Women who had more rewarding relationships with partners reported lower levels of physical symptoms.
Ganong & Coleman, 1991	105 women and 100 men ($M = 37$) from 105 stepfamilies (one or both partners previously married); DAS = 119	Cross-sectional; DAS and Inventory of Family Feelings	Health Complaint Frequency Index, and general health assessment ratings (1–4)	For men, fewer health complaints and higher health ratings were associated with greater marital satisfaction. Wives who had more positive feelings for their husbands reported fewer health complaints, and women with lower marital satisfaction rated their health more poorly.
Fisher, Nakell, Terry, & Ransom, 1992	225 families ($M = 42$); no standardized marital adjustment data	Cross-sectional; behavioral ratings made during three interaction tasks	Fourteen scales from the RAND that assessed global perceptions of health and health behaviors	For wives, couple emotional avoidance–distance was associated with poorer health. For husbands, couple overt emotional aversiveness was associated with poorer health.
Medalie, Stange, Zyanski, & Goldbourn, 1992	8,548 Israeli men (40+) who were ulcer-free at baseline; no standardized marital adjustment data	Longitudinal (5-year follow-up); one question, frequency of wife showing love	Participants reported a duodenal ulcer that had been confirmed by a radiologic examination	Low levels of marital love and support were associated with the development of duodenal ulcer.
Levenson, Carstensen, & Gottman, 1993	156 couples in long-term marriages (40–50 or 60–70); MAT = 115	Cross-sectional; BS factors: age (40–50 or 60–70) and MAT group (satisfied or dissatisfied)	Cornell Medical Index	In dissatisfied marriages, wives reported more health problems than husbands, with no difference between the two in satisfied marriages.
Sullivan, Katon, Russo, Dobie, & Sakai, 1994	49 spousal pairs in which one partner had chronic tinnitus, 48% female ($M = 62$); average marital adjustment not reported	Cross-sectional; DAS and WHYMPI (adapted for tinnitus)	Disability assessed with three Likert-type scales evaluating tinnitus interference with role performance in work, social, and home-family	Patient ratings: DAS Cohesion scale and its interaction with depressive symptoms accounted for 15% of the variance in disability ratings beyond gender, tinnitus characteristics, and depression. Spouse-rated punishing responses and their interaction with depression explained an additional 15% of the variance beyond gender, tinnitus characteristics, and depression.
Levenstein, Kaplan, & Smith, 1995	6,928 adults (18+) in the Alameda county study; no marital adjustment data	Longitudinal (8- to 9-year follow-up); marital strain assessed by eight questions	Reporting current ulcer	Cross-sectional data showed an increased prevalence of ulcers associated with marital strain among men, but not women; longitudinal data linked marital strain with incidence of ulcers for women, but not men.
Thomas, 1995	141 married midlife women; no standardized marital adjustment data	Cross-sectional; partner role quality; secondary analyses used extreme groups design based on health perceptions	Three items aggregated into index of health perceptions	Partner role quality was associated with better health perceptions. Women in the upper quartile on health perceptions reported higher partner role quality and fewer marital concerns (marital conflicts about children and housework) than women in the lower quartile.

Table 2 (continued)

Study	Participants (age) and marital adjustment	Design and independent measures	Dependent measures	Relevant findings
Roth-Roemer & Kurpius, 1996	172 women ($M = 51$) with rheumatoid arthritis; DAS: high adjustment ≥ 126 , low adjustment ≤ 103	Cross-sectional; extreme groups design based on DAS	z-score composite from subscales of the AIMS and the ADL subscale of the Modified Health Assessment Questionnaire	Happily married women reported better health than unhappily married women.
S. Goodwin, 1997	131 women ($M = 43$, 24–75) diagnosed with CFIDS and their husbands; DAS = 129	Cross-sectional; DAS, Interpersonal Relationship Inventory	DeGroot Chronic Fatigue Syndrome Symptom Scale	Women with higher DAS scores and lower conflict scores reported fewer CFIDS symptoms.
Ren, 1997	7,156 respondents (men and women) to the National Survey of Families and Households; no standardized marital adjustment data	Cross-sectional; ratings of relationship dimensions	Response to question, "Compared with other people your age, how would you describe your health?" coded as a dichotomous variable	Individuals who were happy with their relationships, who always discussed disagreements in a peaceful manner, who never resorted to violence, and who were optimistic about the future of their relationships were more likely to report good health than those who reported the obverse.
Wickrama, Lorenz, & Conger, 1997	364 wives and husbands ($M = 40$); no standardized marital adjustment data	Longitudinal, four annual assessments; marital quality (summed responses to seven questions)	Illness Index (weighted scores from list of 56 self-reported symptoms or diseases)	Both initial level of and change in marital quality of both spouses correlated with initial levels and changes in physical health.
Prigerson, Maciejewski, & Rosenheck, 1999	927 married women ($M = 52.3$); no standardized marital adjustment data	Longitudinal; marital satisfaction index	Self-reported health services use	Women higher in marital satisfaction reported better sleep, fewer depressive symptoms, and fewer physician visits than women who were less satisfied.

Note. DAS = Dyadic Adjustment Scale; MAT = Marital Adjustment Test; BS = between subjects; WHYMPI = West Haven–Yale Multidimensional Pain Inventory; AIMS = Arthritis Impact Measurement Scales; ADL = activities of daily living; CFIDS = Chronic Fatigue and Immune Dysfunction Syndrome.

disability. In addition, spouse-related punishing responses and their interaction with depression explained an additional 15% of the variance in disability beyond gender, tinnitus characteristics, and depression. Although both male and female patients were included, gender differences were not assessed.

The validity of self-reported health data has been questioned because of correlations with psychological distress (Mechanic, 1980); this argument assumes that distress leads to spurious over-reporting of symptoms, one important methodological consideration regarding studies in this section. Indeed, when respondents rate diffuse symptoms such as fatigue, correlations with depressive symptoms are often high, an unsurprising finding because of the overlap in symptomatology. Nonetheless, global self-rated health is a robust independent predictor of mortality (Idler & Benyamini, 1997). In addition, self-report methods that focus on very specific, well-operationalized symptom clusters can show reliable associations with physicians' diagnoses (Jenkins, Kraeger, Rose, & Hurst, 1980; Orts et al., 1995).

Longitudinal designs enhance researchers' ability to control for distress-related variance in self-reported health. One of the most intensive assessments involved couples who provided data on marital quality and illness symptoms annually (Wickrama, Lorenz, & Conger, 1997). Participants with higher initial levels of marital quality reported fewer physical illness symptoms at study entry. Moreover, improvements in marital quality over the 4-year period were accompanied by decreases in self-reported physical illness symptoms.

Another study also highlighted the value of longitudinal assessment. Among adults in the Alameda county study, the associations between peptic ulcer and marital strain were greater among men than women in cross-sectional data (Levenstein, Kaplan, & Smith, 1995); however, these findings contrasted with data from the 8- to 9-year follow-up in which the prospective associations, with the greater control afforded by the longitudinal design, were actually stronger among women than men. Of importance, these longitudinal effects were significant after controlling for chronic diseases and health risk behaviors that are key risk factors for ulcers (Levenstein, Ackerman, Kiecolt-Glaser, & Dubois, 1999).

With regard to gender differences, some studies revealed gender parity in marriage-health linkages (Fisher, Nakell, Terry, & Ransom, 1992; Ganong & Coleman, 1991; Ren, 1997; Wickrama et al., 1997), whereas two suggested stronger links for women (Levenson et al., 1993; Levenstein et al., 1995). Although the small number of studies that included both men and women and assessed sex differences hampers strong conclusions about gender from this set of self-report studies, none provided stronger evidence for men.

Some of the same methodological issues that characterized studies of objective health status indicators remain problematic in studies of self-reported health (e.g., absence of normative data from marital adjustment scales), but the evidence nonetheless consistently suggests that marital functioning is reliably related to health. Clearly apparent in cross-sectional studies, such associations also held in longitudinal studies that provided greater methodological safeguards for the potential impact of psychological distress on self-reported health. Overall, the studies in Table 2 reveal that self-reported health is associated with marital quality and cohesion, and also with spousal behaviors that are perceived as unsupportive and punishing.

Pain

Pain is a pervasive medical problem, accounting for substantial levels of disability and contributing greatly to the overall burden of illness (Turk & Melzack, 1992). Pain can be accompanied by notable changes in physiological functioning. For example, dysfunctional alterations in stress hormones and/or endocrine stress responses have been linked to some chronic pain syndromes (Geiss, Varadi, Steinbach, Bauer, & Anton, 1997; Jones, Rollman, & Brooke, 1997; Lentjes, Griep, Boersma, Romijn, & de Kloet, 1997). Moreover, pain can provoke increases in heart rate and blood pressure, enhance secretion of stress-related hormones including catecholamines and cortisol, and suppress a range of immunological activities (Kiecolt-Glaser, Page, Marucha, MacCallum, & Glaser, 1998; Liebeskind, 1991; Pezzone, Dohanics, & Rabin, 1994); indeed, acute pain is used as a stressor in both animal and human studies for this reason (Greisen et al., 1999; Page, McDonald, & Ben-Eliyahu, 1998; Santos et al., 1998). Not surprisingly, anesthetic techniques that block transmission of nociceptive impulses can significantly reduce neuroendocrine or immune responses prompted by extreme physical stressors such as surgery (Kiecolt-Glaser, Page, et al., 1998), as well as mild acute experimental pain (Greisen et al., 1999).

The studies presented in Table 3 provide evidence that marital functioning is associated with pain and pain-related disability assessed by self-report, performance on physically taxing tasks, and objectively coded pain behaviors (e.g., verbal, nonverbal, and functional expressions of pain experience). These pain indices may directly reflect nociception triggered by underlying pathophysiological processes as outlined above. Thus, the marital relationship may provide one direct route for maladaptive physiological changes that contribute to pain outcomes. In addition, to varying degrees, pain outcome indicators may simultaneously reflect motivational factors or social contingencies. For example, spousal behaviors such as pain-related solicitedness can reinforce maladaptive pain behaviors, thereby promoting disability (Turk, Kerns, & Rosenberg, 1992). Compared with the objective and self-reported health outcome indicators reviewed in the prior sections, pain outcome indicators reflect a unique interdependence of pathophysiology and motivational effects, and thus we chose to review these studies in this separate section.

According to social support models, encouragement and other positive, attentive marital interactions are typically viewed as facilitating adaptation and enhancing health outcomes. In contrast, a number of pain studies based on an operant model have provided evidence that such spousal behaviors, particularly pain-related solicitedness, contribute to maladaptive outcomes (Turk et al., 1992).

In a comprehensive study of patients with chronic back pain that included relevant physiological variables and a group of control couples, Flor, Breitenstein, Birbaumer, and Furst (1995; see Table 4) contrasted pain perceptions and attendant physiological responses to cold pressor tests when the spouse was present or absent. In accord with the operant paradigm, greater spouse solicitedness was related to higher pain perceptions in the spouse-present condition for patients but not control participants, and the former also reported fewer positive coping self-statements. The heightened systolic blood pressure responses that characterized patients' responses to a cold pressor test while alone were not

exhibited when the test was repeated in the presence of more solicitous spouses (Flor et al., 1995). However, increased blood pressure, a hemostatic response, is associated with reductions in pain. Thus, the authors suggested that the absence of blood pressure increases in the spouse's presence indicated a maladaptive physiological response.

In another study of patients with chronic back pain, higher spousal ratings of solicitousness were associated with less time spent walking on a treadmill in the partner's presence than when alone (Lousberg, Schmidt, & Groenman, 1992). The perception of patients with rheumatoid arthritis of overall spouse responsiveness (including solicitous, distracting, and punishing responses to pain displays) were significant predictors of pain intensity and pain behavior assessed during a standardized battery of physical tasks (Williamson, Robinson, & Melamed, 1997).

Certainly it seems reasonable to assume that marital adjustment would influence pain outcomes and spouses' responses to pain behaviors. Indeed, associations between pain outcomes and marital adjustment may be moderated by gender, and these linkages may be masked when analyses are conducted across gender in mixed patient samples. For example, among patients with chronic low-back pain, marital dissatisfaction was associated with greater self-reported pain and disability among female patients, but not males (Saarijarvi, Rytokoski, & Karppi, 1990).

Alternatively, marital adjustment and spouse responsiveness to pain behaviors may represent partially independent components of the marital relationship that bear unique associations with pain outcomes. Indeed, Turk and colleagues (Turk et al., 1992) offered a reformulated cognitive-behavioral model in which they suggested that marital satisfaction moderates linkages between spouse responsiveness and pain outcomes by altering patients' appraisals and interpretations of their spouses' responses to communications of pain. On the basis of the evidence that relationships between spouses' responses to pain and key aspects of the pain experience are prominent only among satisfied couples, these authors argued that it is only in the context of global marital happiness that solicitous behaviors are perceived as such. In contrast, in the context of a dissatisfied marriage, patients may question the motivation of their spouses' behaviors or appraise and interpret them as unhelpful. Indeed, their own and others' data support this conceptualization. For example, in a sample of female patients with chronic pain, higher marital quality was associated with perceptions of the spouse as more solicitous and distracting, and less punishing, in response to pain behaviors (Kerns, Haythornthwaite, Southwick, & Giller, 1990).

In addition to the role of spouse solicitousness-responsiveness in increased functional impairment and higher self-reported pain, the management of marital disagreement may play a role in pain outcomes. For example, premature termination of a physically demanding bicycling task was more likely among male patients with chronic back pain who first discussed a conflictual marital topic with their spouses, as opposed to those who discussed a neutral topic (Schwartz, Slater, & Birchler, 1994; see Table 4). In addition, marital conflict between male patients with chronic back pain and spouses was associated with subsequent increases in pain behaviors, which, in turn, appeared to promote more punitive responses by the spouse (Schwartz, Slater, & Birchler, 1996). In longitudinal analyses of a predominantly female sample of patients with rheumatoid arthritis, negative spouse behaviors such as crit-

ical remarks predicted greater future pain even after controlling for baseline pain (Waltz, Kriegel, & Bosch, 1998).

Finally, three studies have examined marriage and pain outcomes in the context of psychological interventions. One series of studies examined the impact of participation in a couple's therapy group in which five sessions focused on communication (Saarijarvi, Rytokoski, & Alanen, 1991; Saarijarvi et al., 1990). Among the 63 patients with chronic low-back pain who took part (35 couples refused participation), there were no significant changes in pain, disability, or clinical assessments. Of importance, however, there were also no significant changes in marital satisfaction, a perhaps unsurprising finding when the intervention was relatively brief and couples had not been selected on the basis of marital distress.

In contrast, results of a more intensive spouse-assisted coping skills intervention administered to a group of male and female patients with osteoarthritic knee pain showed that patients who reported increased marital adjustment from pre- to posttreatment were characterized by less physical disability and less pain behavior on completion of treatment (Keefe et al., 1996). In data from the 12-month follow-up of this intervention, patients in the spouse-assisted coping skills training (CST) condition who reported enhanced marital adjustment from pre- to posttreatment also had lower levels of physical disability and pain behaviors at follow-up (Keefe et al., 1999). However, higher marital adjustment was associated with increased pain and poorer coping among patients assigned either to CST without spouse involvement or to an arthritis education-spousal support control condition. The authors speculated that individuals receiving CST might have initiated more candid discussions with their spouses about pain and coping, whereas spouses who were not included in the training might simply have increased solicitous attention to pain symptoms, inadvertently reinforcing pain behaviors. In addition, participants on average were not maritally distressed prior to treatment, thus limiting their range for improvement in marital adjustment.

In summary, the studies reviewed in this section provoke novel questions about the role of marital functioning in physical health outcomes generally, and in pain, a costly and prevalent health problem, specifically. For example, spousal behaviors that appear supportive on the surface (and that therefore might be assumed to lead to positive health outcomes) may actually culminate in compromised functional status and more physical disability. In addition, pain outcome studies provide conceptual clues as to how researchers might meaningfully model the multiple facets of marital functioning. For example, global marital satisfaction may serve as an interpretive backdrop, altering patients' appraisals of specific spousal behaviors and, thereby, their functional significance for disability (Turk et al., 1992). These data suggest that if models of marital functioning and pain, or perhaps other health outcomes, exclude either global marital quality or specific spousal behaviors, their explanatory power will be compromised. Beyond these novel contributions, many of the pain outcome studies reviewed here reveal methodological limitations described in earlier sections, namely, (a) the inclusion of only one gender or lack of attention to gender differences and (b) the paucity of dissatisfied couples.

Although there are not compelling gender differences in the literature on marriage and pain to date with few studies making explicit comparisons, there are consistent and notable gender associations in both acute and chronic pain; these pervasive patterns

Table 3
Marital Studies With Pain Outcomes

Study	Participants (age) and marital adjustment	Design and independent measures	Dependent measures	Relevant findings
Saarijari, Rytokoski, & Karppi, 1990	31 male and 32 female patients with low-back pain ($M = 47$); average marital adjustment not reported	Cross-sectional; Marital Questionnaire (14 DAS items and 6 MCI items)	Standardized Nordic Questionnaire, clinical examinations by a physiatrist and a physiotherapist	Marital dissatisfaction was associated with greater self-rated pain and resultant disability in women, but not men. Marital dissatisfaction was unrelated to clinical examination findings. No significant changes in pain, disability, or clinical assessments.
Saarijari, Rytokoski, & Alanen, 1991	31 male and 32 female patients with low-back pain ($M = 47$); average marital adjustment not reported	Longitudinal, experimental; 5 monthly sessions in a couples therapy group, with a 6-month follow-up	Standardized Nordic Questionnaire, clinical examinations by a physiatrist and a physiotherapist	
Lousberg, Schmidt, & Groenman, 1992	42 patients with chronic back pain (32 men and 10 women; $M = 46$); no marital adjustment data	Cross-sectional; WS factor: spouse present or absent during treadmill test; WHYMPI, completed by both patient and spouse	HR, pain behaviors, and distance walked during a treadmill test	Patients with pain whose spouses were more solicitous reported more pain and walked less in the presence of the spouse than those with less solicitous spouses. Spousal reports of solicitedness were more predictive than those of patients.
Turk, Kerns, & Rosenberg, 1992	148 patients with chronic pain (65 men and 83 women; $M = 46$); average marital adjustment not reported	Cross-sectional; MAT, spouse and patient versions of the WHYMPI	Pain Behavior Checklist, a clinician-based behavioral rating; Oswestry Disability Scale	Positive attention from spouses was associated with higher self-reported pain, greater behavioral communication of pain, and greater disability among those patients who were happier in their marriages; among dissatisfied couples, solicitedness had little relationship.
Paulsen & Altmaier, 1995	110 patients with chronic pain (75 men and 35 women; $M = 47$); no marital adjustment data	Cross-sectional; WS factor: spouse present or absent as patients engaged in routine daily activities; WHYMPI, Social Provisions Scale	Behaviorally coded pain behaviors during a simulation of routine daily activities	Patients reporting more solicitous responses (enacted support) displayed more pain behaviors than those who described the spouse as less solicitous. Patients reporting more perceived support displayed more pain behaviors in the spouse's absence than when the spouse was present.
Romano et al., 1995	25 female and 25 male patients with chronic pain ($M = 40$, 24-64) and their spouses; DAS = 112	Cross-sectional; Pain Behavior Checklist, Pain Rating Index of the McGill Pain Questionnaire	Sickness Impact Profile; nonverbal pain behaviors and spouse's solicitous behaviors were coded by the LIFE	Spouse solicitous responses were associated with greater pain behaviors among patients reporting higher pain severity. Spouse solicitous responses to patient pain behaviors were associated with greater disability among patients reporting greater depression. Relationships between solicitous spouse responses and pain behaviors were stronger for more satisfied couples.
Weiss & Kerns, 1995	96 male patients with chronic pain ($M = 54$); average marital adjustment not reported	Cross-sectional; MAT	WHYMPI, Pain Behavior Checklist, Pain Behavior Scale	Maritally dissatisfied patients who described their wives as engaging in high levels of negative and distracting responses to pain and low levels of solicitedness reported greater pain severity and pain behaviors. Among maritally satisfied patients, the same behaviors were associated with lower pain responses.

Table 3 (continued)

Study	Participants (age) and marital adjustment	Design and independent measures	Dependent measures	Relevant findings
J. W. Burns, Johnson, Mahoney, Devine, & Pawl, 1996	54 female ($M = 43$) and 73 male ($M = 42$) patients with chronic pain; no marital adjustment data	Cross-sectional; WHYMPI-rated spouse behaviors	WHYMPI-rated pain severity, and interference, and ability to perform everyday activities	Patients who described their spouses as more punishing in response to pain behaviors reported greater pain severity, greater interference with daily activities, and lower ability to perform everyday activities.
Keefe et al., 1996	34 male and 54 female patients with osteoarthritis ($M = 63$); baseline DAS = 117	Patients were assigned to spouse-assisted CST, CST with no spouse involvement, or ARE-SS control condition	DAS, pain coping, and pain behavior (coded from a videotape)	Patients who reported increased marital adjustment from pre- to posttreatment were more likely to report less physical disability and show less pain behavior at completion of treatment.
Schwartz, Slater, & Birchler, 1996	61 male patients with chronic back pain ($M = 52$, 30–68) and their spouses; no marital adjustment data	Cross-sectional; Conflict Scale, with questions added regarding pain behaviors; WHYMPI	Pain intensity rated on a numeric analog scale; Sickness Impact Profile to measure functional impairment related to back pain	Both patients and spouses reported that patients responded to conflict with pain behaviors more often than with active or passive responses. Spouse punishing responses were the strongest predictors of patients' pain intensity and functional impairment; spouse solicitousness made an additional contribution to pain intensity, but not functional impairment.
Romano, Turner, & Jensen, 1997	25 female and 25 male patients with chronic pain ($M = 40$, 24–64) and their spouses; DAS = 112	Cross-sectional; FES, DAS	Sickness Impact Profile, Pain Behavior Checklist, Pain Questionnaire; nonverbal pain behaviors and spouse's solicitous behaviors were coded by the LIFE	Marital adjustment was not significantly correlated with self-rated disability or pain behaviors. Greater conflict was associated with patient-reported disability.
Williamson, Robinson, & Melamed, 1997	22 men and 30 women diagnosed with rheumatoid arthritis ($M = 57$, 28–76); MAT = 121	Cross-sectional; WS factor: presence of spouse or neutral observer as patients performed a standardized 10-min movement sequence; WHYMPI, MAT	Pain behavior data collected in two observational conditions; pain intensity and unpleasantness ratings	No differences in pain behavior or patients' report of pain intensity or unpleasantness between conditions. MAT scores were not correlated with patients' or spouses' rating of spouses' solicitous, distracting, and punishing responses to pain behaviors. Patients' ratings of spouses' responsiveness were associated with greater disease impact, pain severity, and interference; spouses' ratings were not associated. No gender differences.
Menna, Binick, Khalife, & Cohen, 1998	76 women ($M = 40$) with dyspareunia; MAT = 96	Cross-sectional; MAT	McGill-Melzack Pain Questionnaire	Higher anxiety and lower marital quality accounted for 21% of the variance in women's pain ratings.
Waltz, Krieger, & Bosch, 1998	165 patients with rheumatoid arthritis ($M = 57$), 70% female; no standardized marital adjustment data	Longitudinal; disease-related ratings of positive and negative spouse interactions	Nottingham Health Profile, Arthritis Impact Measurement Scales, McGill Pain Questionnaire, and a specialized pain scale	Relatively consistent correlations between pain measures and negative (but not positive) spouse behavior. In longitudinal analyses, negative spouse behavior predicted worse pain outcome even after controlling for baseline pain. No gender analyses.
Keefe et al., 1999	34 male and 54 female patients with osteoarthritis ($M = 63$); baseline DAS = 117	Follow-up study of patients assigned to spouse-assisted CST, CST with no spouse involvement, or ARE-SS control condition	DAS, pain coping, pain behavior (coded from a videotape), arthritis self-efficacy	Patients in spouse-assisted CST with pre- to posttreatment DAS increases had lower levels of physical disability and pain behavior at follow-up. Patients in conventional CST and ARE-SS with DAS increases showed greater pain.

Note. DAS = Dyadic Adjustment Scale; MCI = Marital Communication Inventory; MAT = Marital Adjustment Test; WHYMPI = West Haven–Yale Multidimensional Pain Inventory; WS = within subjects; HR = heart rate; LIFE = Living in Family Environments; CST = coping skills training; ARE-SS = arthritis education–spousal support; FES = Family Environment Scale.

Table 4
Marital Interaction Studies With Physiological Data

Study	Participants (age) and marital adjustment	Design and independent measures	Dependent measures	Relevant findings
Group 1: Conflict interactions—Discussions of couples' relationship problems				
Morell & Apple, 1990	24 couples ($M = 47$, 39–60); MSI scores in nondistressed range	Cross-sectional; WS factor: epoch (baseline, 10-min conflict, recovery); Family and Marital Interaction Scoring System	Women's HR and BP	Negative affect accounted for 20% of the variance in women's SBP; women with higher negative affect had elevated SBP during recovery period (HR = +6.6 BPM; SBP = +7.3 mmHg).
Ewart, Taylor, Kraemer, & Agras, 1991	24 women and 19 men with hypertension ($M = 57$, 32–73) and spouses; MAT: wives = 103, husbands = 115	Cross-sectional; WS factor: epoch (before, during, and after a 10-min problem-solving discussion); MICS, MAT	BP	During problem solving, wives' SBP increased more than husbands' ($M = 7.8$ vs. 3.1 mmHg; maximal differences = 20.3 vs. 14.2 mmHg). In women, hostile interactions and marital dissatisfaction accounted for 50% of the variance in SBP with no significant contributions from supportive or neutral behaviors. For men, only speech rate was associated with BP fluctuations.
Kiecolt-Glaser et al., 1993	90 newlywed couples ($M = 26$, 20–37); MAT = 127	Cross-sectional; BS factor: MICS negative behavior (high vs. low); WS factor: epoch (immune assessments at the beginning and end of 24-hr hospitalization; BP and HR before and after 30-min conflict, and after a 30-min break)	A battery of functional and quantitative immune assays; BP and HR	Participants high in negative behavior had larger increases in BP that remained elevated longer (changes from baseline to end of conflict and to 30-min break, SBP = -0.67 vs. $+0.3$; DBP = -1.60 vs. $+3.10$). Participants exhibiting more negative behaviors during marital problem discussion showed greater immunological change over 24 hr than those low in negative behavior. Women were more likely to show immunological changes than men. Positive or supportive problem-solving behaviors were not related to immune or BP changes.
Schwartz, Slater, & Birchler, 1994	34 male patients with chronic back pain ($M = 51$, 30–68) and their spouses; DAS scores ≥ 100	Experimental; BS factor: 20-min marital discussion of disagreements versus neutral talking task	BP, persistence on a stationary bicycle task, and self-reported pain	Marital interviews produced significantly greater increases in SBP (+19 mmHg) and DBP (+7 mmHg) than the neutral task. More patients in the marital discussion group terminated the bicycling task prematurely than those in the neutral condition. Pain ratings did not differ between groups.
Jacobson et al., 1994	60 couples experiencing domestic violence and 32 maritally distressed but nonviolent couples ($M = 38$); DAS = 89	Cross-sectional; BS factor: domestic violence versus distressed groups, 15-min conflict discussion	IBI, FPA, pulse transmission time to the finger	Wives in physically violent marriages had larger FPAs and faster finger pulse transit times during problem-solving discussion than wives in distressed but nonviolent marriages. Cardiovascular data did not discriminate husbands.
Malarkey, Kiecolt-Glaser, Pearl, & Glaser, 1994	90 newlywed couples ($M = 26$, 20–37); MAT = 127	Cross-sectional; WS factor: epoch (5 endocrine assessments before, during, and after 30-min conflict); MICS	Levels of 6 hormones: EPI, NEPI, ACTH, cortisol, PRL, GH, BP, HR, SCL, lumbar EMG, Pain-Related Self-Statements Scale, KPI-coded	Negative behavior was associated with decreased levels of PRL and increases in EPI, NEPI, ACTH, and GH; the gender by time interaction was significant for EPI and ACTH, with women showing more persistent elevations than men.
Flor, Breitenstein, Birbaumer, & Furst, 1995	17 patients with chronic back pain (13 female and 4 male, $M = 42$) and 15 control couples; no marital adjustment data	Experimental; BS factor: pain patients versus controls; WS factors: type of 10-min interaction (neutral vs. conflictual) and cold pressor test (spouse present or absent); WHYMPI, Terman Rating Scale	BP, HR, SCL, lumbar EMG, Pain-Related Self-Statements Scale, KPI-coded	Patients' lumbar muscular reactivity was elevated during the conflictual interaction. SCL and SBP (+11 mmHg) were elevated during the conflict interaction compared with the neutral discussion. Greater solicitedness was associated with lower HR responses during marital interactions; solicitedness also was related to higher pain perception in the spouse-present condition for patients but not control participants, and the former also reported fewer positive coping self-statements

Table 4 (continued)

Study	Participants (age) and marital adjustment	Design and independent measures	Dependent measures	Relevant findings
Kelly & Halford, 1995	5 couples (30-57) reporting marital distress; DAS = 87	Longitudinal; WS factor: epoch (repeated assessments); KPI; cognitions assessed by thought-listing	Maximum HR	No consistent CBMT effects on maximum HR, no consistent significant correlations between negativity or cognitions and HR.
Frankish & Linden, 1996	40 couples ($M = 41.8$, 30-64); DAS = 132	Cross-sectional; BS factors: Type A versus Type B men married to women with high versus low education; WS factor: responses during mental arithmetic versus 5-min conflict	HR, BP	Husbands: Type A men with highly educated wives exhibited greater DBP reactivity to the dyadic task than men in the other three groups (HR = 6 BPM; SBP = +6.3 mmHg; DBP = +6.9 mmHg). Wives: No physiological data were collected.
Kiecolt-Glaser, Newton, et al., 1996	90 newlywed couples ($M = 26$, 20-37); MAT = 127	Cross-sectional; blood samples acquired hourly from 8 a.m. through 10 p.m. were pooled to provide composite daytime values, after 30-min conflict early in the day; MICS	EPI, NEPI, ACTH, cortisol, PRL, GH	Wives: Marital behavior accounted for 24% of the variance in EPI and cortisol and 29% of the variance in NEPI; higher frequencies of positive behaviors were associated with lower EPI and higher PRL. Husbands: Endocrine data were not associated with behavioral data.
Schmaling et al., 1996	4 female and 2 male patients with asthma ($M = 45$, 28-64) and their spouses; DAS = 110	Cross-sectional; WS factors: task (problem discussion vs. recent asthma attack discussion); epoch (before and after each task), affect ratings, and LIFE videotape coding	Peak expiratory flow-rate measurements	Two patients' pulmonary function improved over tasks, and 4 patients' deteriorated. Decreased function was associated with more self-rated hostility and depression. The 4 women appeared to have more reactive function than the 2 men.
Kiecolt-Glaser et al., 1997	31 couples ($M = 67$, 55-75), marital length = 42 years; MAT = 122	Cross-sectional; WS factor: epoch (5 endocrine assessments before, during, and after 30-min conflict)	EPI, NEPI, ACTH, and cortisol; three functional immunological assays	Wives: Escalation of negative behavior during conflict and marital adjustment accounted for 16%-21% of the variance in rates of change in cortisol, ACTH, and NEPI. Husbands: Endocrine data did not show relationships to behavior or marital adjustment. Both men and women who showed a pattern of poorer immune function displayed more negative behavior during conflict and characterized marital disagreements as more negative than did individuals with better immune function.
Mayne, O'Leary, McCrady, Contrada, & Labouvie, 1997	10 couples who reported marital distress ($M = 38$, 26-61); DAS = 95	Cross-sectional; WS factor: epoch (assessments before, during, and after 40-min conflict)	BP, HR, PHA	Following conflict, women became more depressed and hostile, in contrast to men's more positive affect. Wives also responded with increases in both SBP and DBP (maximal changes = +17 and +7 mmHg, respectively); husbands showed increased SBP (+7 mmHg). Women's PHA responses decreased after conflict, whereas those of men increased. Decreases in PHA were significantly correlated with increased hostility.
Thomsen & Gilbert, 1998	32 couples ($M = 26$, 20-35); DAS = 114	Cross-sectional, with measurements before and during a 15-min conflict task; DAS	HR, SCL	Factor analysis with 13 variables produced six factors; participants with higher marital adjustment showed greater synchrony in the activation of HR and SCL, whereas more dissatisfied couples tended to have asynchronous patterns. Marital adjustment was higher for wives with extremely high or low "physiological arousal" (factor score) relative to baseline.
Broadwell & Light, 1999	45 couples ($M = 35$, 24-50); DAS = 108 for men, 105 for women	Cross-sectional; BS factors: SSQ6 family support (high vs. low), husband versus wife; WS factor: epoch (baseline, reading control, events of the day, 15-min conflict)	Cardiovascular measures	Of the four conditions, conflict produced the greatest increases in BP (SBP = +10 mmHg; DBP = +228 mmHg), with no gender by epoch interactions. Men with low "family support" had higher BP than high-support men at baseline, and during all three tasks. Both men and women with low family support had higher VRI than those with high support across all four epochs.

Table 4 (continued)

Study	Participants (age) and marital adjustment	Design and independent measures	Dependent measures	Relevant findings
Fehm-Wolfsdorf, Groh, Kaiser, & Hahlweg, 1999	80 couples ($M = 38$, 23-62); Partnership Questionnaire = 48 (70% maritally distressed)	Cross-sectional; BS factors: couples displaying predominantly positive, negative, or asymmetric behavior; husband versus wife; WS factor: epoch (five assessments before and after 15-min conflict, including 30-min follow-up)	BP and cortisol	Conflict produced higher cortisol responses in women than men, and women had elevated values 30 min after conflict. Cortisol increased during conflict in couples with positive behavior and in wives of asymmetric couples and decreased in couples with negative behavior. BP did not change in men or women in response to conflict.
G. E. Miller, Dopp, Myers, Felten, & Fahey, 1999	41 couples ($M = 31$); no marital adjustment data	Cross-sectional; BS factors: Cook-Medley Hostility (high vs. low), husband versus wife; WS factor: epoch (baseline, 15-min conflict, recovery)	HR, BP, cortisol, NK cell cytotoxicity and numbers	Among men high in cynical hostility, anger displayed during the conflict was associated with greater elevations in BP, cortisol, and NK cell cytotoxicity and numbers.
Group 2: Neutral or impersonal spousal disagreements				
Smith & Brown, 1991	45 couples (22-40); MAT = 115	Experimental; BS factors: social influence condition (influence vs. discuss), role (husband vs. wife), Cook-Medley Hostility scores; WS factor: epoch (4-min preparation, 8-min structured talk alternating speaker every minute, and 4-min free talk)	HR and BP	Higher cynical hostility in husbands was associated with greater SBP reactivity in their wives, accounting for 9% of the variance. Wives' hostility was not related to their husbands' reactivity.
Brown & Smith, 1992	45 couples (22-40); MAT = 115	Experimental; BS factors: social influence condition (influence vs. discuss), and role (husband vs. wife); WS factor: epoch (4-min preparation, 8-min structured talk alternating speaker every minute, and 4-min free talk)	HR and BP	Compared with husbands who discussed a topical issue with wives, those attempting to influence their wives had larger SBP increases before and during the task (+6.4 vs. +13.1 mmHg, respectively). Wives did not show elevated SBP.
Brown, Smith, & Benjamin, 1998	45 couples (22-40); MAT = 115	Experimental; BS factors: social influence condition (influence vs. discuss), and role (husband vs. wife); WS factor: epoch (4-min preparation, 8-min structured talk alternating speaker every minute, and 4-min free talk); SASB to assess dominance	HR and BP	Greater BP reactivity was associated with perceptions of the spouse as dominant, except at the highest level of dominance, where reactivity was attenuated. The incentive to influence the spouse eliminated the decrease in reactivity among participants who had the highest perceptions of spouse dominance.
Smith, Gallo, Goble, Ngu, & Stark, 1998	60 couples ($M = 25$); no marital adjustment data	Experimental; BS factors: achievement challenge (high vs. low), agree versus disagree, husband versus wife; WS factor: epoch (4-min preparation, 4-min listening, 4-min speaking)	HR, BP	Compared with agreement, disagreement elicited heightened HR (+3.3 vs. +7.4 BPM), SBP (+8.2 vs. +12.6 mmHg), and DBP (+7.1 vs. +10.7 mmHg) among wives, but not husbands (HR = +4 vs. +4.3 BPM; SBP = +12 vs. +13.5 mmHg). Husbands in the high-achievement-challenge condition displayed larger increases in HR and BP than those in the low-challenge condition; the achievement challenge manipulation had no effects on wives' HR or BP. For men, hostility was associated with higher SBP under high (but not low) threat, and this appeared to be related to attempts to assert dominance. Women did not show a relationship between hostility and cardiovascular reactivity; however, wives interacting with husbands high in hostility displayed heightened cardiovascular responses, but only when disagreeing.
Smith & Gallo, 1999	60 couples ($M = 25$); no marital adjustment data	Experimental; BS factors: achievement challenge (high vs. low), agree versus disagree, husband versus wife; hostility assessed with the AQ; WS factor: epoch (4-min preparation, 4-min listening, 4-min speaking)	HR, BP	

Note. MSI = Marital Satisfaction Inventory; WS = within subjects; HR = heart rate; BP = blood pressure; SBP = systolic blood pressure; BPM = beats per minute; MAT = Marital Adjustment Test; MICS = Marital Interaction Coding System; BS = between subjects; DBP = diastolic blood pressure; DAS = Dyadic Adjustment Scale; BI = interbeat interval; FPA = finger pulse amplitude; EPI = epinephrine; NEPI = norepinephrine; PRL = prolactin; GH = growth hormone; WHYMPI = West Haven-Yale Multidimensional Pain Inventory; SCL = skin conductance level; EMG = electromyogram; KPI = Katagorientsystem für Partnerschaftliche Interaktion; CBMT = Cognitive-Behavioral Marital Therapy; LIFE = Living in Family Environments; PHA = phytohemagglutinin; SSQ6 = Social Support Questionnaire, six items; VRI = vascular resistance index; NK = natural killer; SASB = Structural Analysis of Social Behavior; AQ = Buss-Perry Aggression Questionnaire.

strongly suggest that when marital relationships influence pain outcomes, the effects are likely to be more consequential for the health of wives than husbands. For example, compared with women, men have higher pain thresholds and tolerance for acute experimental pain, men are less likely to experience a spectrum of recurrent pains, and men report less severe and less frequent pain (LeResche, 1995; Unruh, 1996). Women may also be at greater risk for pain-related disability than men (Unruh, 1996). Furthermore, as discussed earlier, these gender differences in pain perception and tolerance have to be placed in the context of the multiple adverse physiological changes that pain can provoke (Kiecolt-Glaser, Page, et al., 1998). Accordingly, any contributions that the marital relationship makes to pain outcomes could have a greater impact on the overall burden of illness among wives than husbands.

Pathways From Marital Functioning to Health Outcomes

There is ample evidence that intimate relationships can impact illness processes or outcomes indirectly through alterations in mood, as well as through their influence on health habits (Burman & Margolin, 1992; Kiecolt-Glaser & Glaser, 1988). In addition, marital interaction studies that include physiological assessments provide solid, mechanistic evidence of how marital functioning can have direct consequences for cardiovascular, endocrine, and immune function. We next consider evidence for these pathways, including the role of trait hostility in biological responses to marital interaction.

The two groups of interaction studies in Table 4 assessed physiological changes during and/or following a marital interaction. The first set provided data on physiological changes associated with "conflict" interactions—discussion of couples' relationship problems. The specific topics were typically chosen by the experimenter, based on each spouse's ratings of common relationship problems. In the second set of studies, couples were asked to discuss and resolve impersonal topics on which they had been assigned opposing positions, for example, layoffs in a hypothetical school district (Brown & Smith, 1992).

Marital Problem Discussions

When we reviewed findings from couples' discussions of relationship issues, several obvious themes emerged. First, conflict clearly alters physiological functioning; data collected during the problem-solving discussions differed reliably from those gathered during noninteractive baselines, and/or nonconflictual discussions. Most studies included cardiovascular data, and marital disagreement was reliably associated with heightened blood pressure and heart rates (Broadwell & Light, 1999; Ewart, Taylor, Kraemer, & Agras, 1991; Flor et al., 1995; Frankish & Linden, 1996; Kiecolt-Glaser et al., 1993; Mayne, O'Leary, McCrady, Contrada, & Labouvie, 1997; Morell & Apple, 1990; Schwartz et al., 1994; Thomsen & Gilbert, 1998), with one exception (Fehm-Wolfsdorf, Groth, Kaiser, & Hahlweg, 1999). Patients with chronic back pain showed elevated lumbar muscular reactivity during a conflict interaction, compared with a neutral discussion (Flor et al., 1995). Conflict was also associated with alterations in both endocrine and immune function (Kiecolt-Glaser et al., 1993, 1997; Kiecolt-

Glaser, Newton, et al., 1996; Malarkey, Kiecolt-Glaser, Pearl, & Glaser, 1994; Mayne et al., 1997).

Second, negative or hostile behavior during conflict markedly enhanced physiological change. For example, a marital problem-solving task produced clinically significant increases in blood pressure among patients with hypertension that were specifically associated with hostile marital interactions; neither supportive nor neutral behavior was significantly associated with change (Ewart et al., 1991). Indeed, the effects were sizable: Hostile interactions and marital dissatisfaction accounted for 50% of the variance in women's systolic blood pressure. The authors summarized the findings in their subtitle: "Not Being Nasty Matters More Than Being Nice" (p. 155).

Paralleling the link between hostile behaviors and elevated blood pressure reported by Ewart et al. (1991), analyses of immune and blood pressure data from newlywed couples suggested that physiological changes were significantly related to hostile behavior only, not to avoidant, positive, or problem-solving behaviors (Kiecolt-Glaser et al., 1993). Similarly, endocrine data from these newlyweds demonstrated the significant impact of hostile behaviors during marital conflict on changes in serum levels of epinephrine, norepinephrine, ACTH, growth hormone, and prolactin (Malarkey et al., 1994). Moreover, differences in the pattern of change were apparent between behaviorally defined groups, with more negative or hostile couples showing more persistent elevations on epinephrine, norepinephrine, ACTH, and growth hormone during the conflict discussion and for 15 min after the end of the discussion. Consistent with these data from newlyweds, endocrine data also evidenced significant relationships to negative behavior during marital conflict among older couples in long-term marriages (Kiecolt-Glaser et al., 1997). Both men and women who demonstrated a pattern of relatively poorer immunological responses displayed more negative behavior during conflict; they also characterized their usual marital disagreements as more negative than did individuals who showed better immune responses across assays.

A third key theme among the interaction studies is the relatively greater physiological change shown in women; gender disparities were most obvious in relation to negative behavior. In data from a sample of patients with hypertension, wives showed larger blood pressure increases than husbands during marital conflict, and women's blood pressure changes were specifically related to both hostile behaviors and marital quality, with these two variables accounting for 50% of the variance; in contrast, only speech rate predicted men's blood pressure increases (Ewart et al., 1991).

Similarly, behaviorally coded negative affect accounted for 20% of the variance in women's systolic blood pressure during a marital conflict discussion and 53% of the variance in self-reported marital distress (Morell & Apple, 1990); although cardiovascular data were not obtained from husbands, behaviorally coded negative affect and marital distress were unrelated for men. Differences in cardiovascular arousal during conflict discriminated wives (but not husbands) in physically violent marriages from those in distressed but nonviolent marriages (Jacobson et al., 1994).

Among distressed couples who participated in a marital interaction study in exchange for marital therapy, wives responded to the task with greater increases in depression, hostility, and systolic blood pressure than husbands; in addition, women's lymphocyte proliferative responses to phytohemagglutinin (PHA) decreased

following conflict, whereas those of the men increased (Mayne et al., 1997). Following conflict, decreases in PHA were significantly correlated with increases in self-reported hostility (Mayne et al., 1997).

In further data from the newlywed couples described earlier, blood samples acquired hourly from 8 a.m. through 10 p.m. were pooled to provide composite daytime values for six hormones; these data provided a way to examine relationships between conflict behaviors observed during the morning's discussion and more enduring or persistent endocrine changes (Kiecolt-Glaser, Newton, et al., 1996). Consistent with the gender differences in immune function, there were stronger and more reproducible links between behavior and endocrine function among women than men. For wives, higher probabilities of husbands' withdrawal in response to wives' negative behavior were associated with higher norepinephrine and cortisol levels; this *demand-withdraw* sequence has been associated with greater marital distress in a number of marital studies (Christensen, 1987; Heavey, Layne, & Christensen, 1993). In addition, wives who showed higher frequencies of positive behaviors during conflict had lower epinephrine levels. Moreover, the magnitude of the relationships was noteworthy: Among women, behavior accounted for 24% of the variance in epinephrine and cortisol, 29% of the variance in norepinephrine, and 37% of the variance in prolactin (Kiecolt-Glaser, Newton, et al., 1996). In contrast, none of the six hormones were significantly associated with husbands' behavioral data.

The generalizability of physiological changes observed with these younger couples was assessed using a similar laboratory paradigm to study endocrinologic and immunological responses to marital conflict in older couples who had been married an average of 42 years (Kiecolt-Glaser et al., 1997). Among wives, escalation of negative behavior during conflict and marital adjustment showed strong relationships to hormones, accounting for 16% to 21% of the variance in the rates of change of cortisol, ACTH, and norepinephrine measured serially across the interaction. In contrast, husbands' endocrine data was not significantly related to negative behavior or marital quality.

Across these studies, the relationships between physiological change and negative behaviors have typically been stronger for women than for men, and women's physiological changes following marital conflict show greater persistence than men's (Ewart et al., 1991; Fehm-Wolfsdorf et al., 1999; Kiecolt-Glaser et al., 1993, 1997; Kiecolt-Glaser, Newton, et al., 1996; Malarkey et al., 1994; Mayne et al., 1997). Moreover, wives' physiological changes were more closely linked to conflict behavior and marital adjustment than husbands' (Ewart et al., 1991; Jacobson et al., 1994; Kiecolt-Glaser et al., 1993, 1997; Kiecolt-Glaser, Newton, et al., 1996; Malarkey et al., 1994; Morell & Apple, 1990).

Might women's greater physiological responsiveness to marital conflict simply reflect broader patterns of response to acute stressors? In fact, the gender differences observed in the marital interaction studies are particularly noteworthy because men appear to show larger cortisol and catecholamine responses to a range of laboratory stressors than do women. For example, comparison of effect sizes in response to harassment revealed that cortisol reactivity in men was twice that of women (Earle, Linden, & Weinberg, 1999). Similarly, women's cortisol levels decreased when anticipating the stress of public speaking, whereas men's cortisol increased, and although both sexes responded with cortisol in-

creases to speaking and performing mental arithmetic in front of an audience, men's responses were 1.5- to 2-fold higher than those of women (Kirschbaum, Wust, & Hellhammer, 1992). Moreover, the fact that wives displayed larger blood pressure changes than husbands in two studies (Ewart et al., 1991; Mayne et al., 1997), as well as greater increments in epinephrine in response to conflict (Malarkey et al., 1994), is particularly interesting because men typically show larger blood pressure and epinephrine increases in response to most laboratory stressors than do women, although the "gender relevance" of a stressor may modulate responsivity (Smith, Gallo, Goble, Ngu, & Stark, 1998; Stoney, Davis, & Matthews, 1987). Thus, the sex differences observed during marital conflict are at variance with broader physiological patterns of responding to acute stressors.

Alternatively, might women's greater physiological responsiveness to marital conflict reflect gender differences in physiological self-monitoring? For example, if males show greater accuracy than females at detecting physiological signals, men might be more aware of the relationships between conflict and arousal, and thus might make greater efforts to decrease this arousal; women, not self-monitoring as carefully, might not decrease their arousal during conflict, to the detriment of their health. Moreover, women might be socialized to regulate themselves based on others' behavior (Cross & Madson, 1997b). Consistent with this interpretation, Levenson et al. (1994) reported that mood self-ratings made while a couple watched the videotape of their conflict session "several days earlier" were correlated with husbands' (but not wives') autonomic responses recorded previously during conflict. As these authors noted, a number of laboratory signal-detection studies have demonstrated that males show greater accuracy than females at detecting physiological signals when situational cues such as the presence of fear-producing stimuli are experimentally controlled, similar to their data (Pennebaker & Roberts, 1992).

However, in naturalistic settings that provide multiple cues (including data from several large field studies), women and men show equal accuracy at detection of blood pressure, heart rate, or blood glucose (reviewed in Pennebaker & Roberts, 1992), in contrast to laboratory studies such as that of Levenson et al. (1994). Thus, the sex differences observed during marital conflict are at variance with broader physiological patterns of responding to laboratory stressors, and relevant data do not suggest that these differences are due to gender discrepancies in the ability to use self-monitoring to moderate physiological arousal.

Among the first set of studies in Table 4, only two of those that analyzed data by gender reported significantly greater responses in men than women on any physiological parameter. In the first of these, discussion of marital problems produced significant increases in blood pressure for both men and women, as well as changes in a number of other cardiovascular parameters (Broadwell & Light, 1999). Subsequent median splits on a measure of family support suggested that both men and women who reported high family support had lower vascular resistance indexes than those low on support across all four tasks. In addition, men who reported high support had lower blood pressure than those with less support, and these differences were observable across all four experimental periods (baseline, discussion of events of the day, conflict, and recovery). However, the fact that these latter analyses were not limited to perceptions of spousal support makes interpretation difficult, particularly in view of the absence of significant

group by experimental period interactions that would suggest greater specificity for the marital relationship.

One other study found no relationships between behaviorally coded affect during conflict and cardiovascular, immune, or cortisol data among wives; however, although there were no significant findings for women, there were also none for men, unless the husband was high on cynical hostility (G. E. Miller, Dopp, Myers, Felten, & Fahey, 1999). Anger displayed during the conflict was associated with greater elevations in blood pressure, cortisol, and natural killer (NK) cell cytotoxicity and numbers among men high in cynical hostility (but not among those who were low). Why might this study differ from related work?

Methodological differences among the studies in Table 4 provide one explanation. The length of the conflict discussions varied from 10 to 40 min, and the strategies (and time allotted) to prepare couples for the task also differed. For example, G. E. Miller et al. (1999) simply asked couples to spend 15 min attempting to resolve an issue previously identified as problematic. In contrast, in a related set of endocrine-immune studies, the experimenter first talked with couples for 10 to 20 min to help identify the best topics for discussion among issues previously identified as problematic, and then the conflict discussion lasted 30 min (Kiecolt-Glaser et al., 1993, 1997; Kiecolt-Glaser, Newton, et al., 1996; Malarkey et al., 1994). Similarly, in an immunological project from another laboratory, the researcher sat with couples and facilitated the 40-min conflict interactions when they slowed (Mayne et al., 1997).

The length of the problem discussion and the type or intensity of preparation are likely to be most critical when the marital adjustment of the sample is average or higher; in nondistressed marriages, the kinds of negative behaviors that magnify physiological change during conflict occur at lower frequencies (Fincham & Beach, 1999). In addition, as noted previously, unhappy couples are less likely to volunteer for marital research projects than those who are more satisfied with their spouse (Bradbury & Karney, 1993); indeed, G. E. Miller et al. (1999) reported that 14 couples who had initially responded to their newspaper advertisement declined to participate after learning that they would be asked to discuss a disagreement in their marriage. Thus, demonstrating physiological consequences of marital problem discussions requires particular effort in selecting distressed couples and maximizing the involvement of couples in conflict discussions.

Physiological Reactivity to Neutral or Impersonal Spousal Disagreements

Unlike the participants in the conflict interaction studies in Table 4, the couples studied by Smith and his colleagues discussed impersonal topics, not relationship issues (Brown & Smith, 1992; Smith & Brown, 1991; Smith et al., 1998). In the first of this series, couples were given an incentive to influence the spouse (Brown & Smith, 1992; Smith & Brown, 1991). Although both spouses were given the same inducement, each was led to believe that he or she alone had an incentive. Under these conditions, husbands showed greater elevations in systolic blood pressure than wives, and these elevations were correlated with husbands' hostile and controlling behavior (Brown & Smith, 1992). However, further analyses from this project showed that higher cynical hostility in husbands was associated with greater blood pressure reactivity in their wives,

whereas wives' hostility was not related to either their own or their husbands' reactivity (Smith & Brown, 1991). Among husbands, only their own hostility predicted their blood pressure changes.

Results of a subsequent study suggest that the type of interpersonal demand might contribute to differences in husbands' and wives' cardiovascular responses to impersonal interactions. In this study, couples in a high-challenge condition were told that their audiotaped discussion of two community issues would be rated for verbal competence, whereas low-challenge participants were told only to speak audibly and clearly (Smith et al., 1998). In contrast, to manipulate disagreement, the experimenters randomly assigned spouses to either the same or opposing sides for discussion of community issues. Thus, the authors manipulated disagreement (a communion stressor) and an achievement challenge (an agency stressor) to assess whether men and women would be differentially reactive to stressors that embody gender role characteristics.

As predicted, disagreement elicited heightened heart rates and blood pressure among wives, but not husbands (Smith et al., 1998). In contrast, the achievement challenge had no effects on women's cardiovascular responses, whereas men in the high-achievement-challenge condition displayed larger heart rate and blood pressure increases than those in the low-challenge condition, consistent with earlier findings on men's greater response to incentives (Brown & Smith, 1992). Of importance, these differences were also observed while couples were preparing for the discussion, not just during the time when they were actually talking.

These data suggest that qualitatively different interpersonal demands may differentially activate husbands' and wives' cardiovascular responses. As reviewed in the prior section, studies in which spouses discuss areas of marital disagreement showed that negative or hostile behavior during conflict was clearly associated with physiological alterations, with larger differences among women than men. The fact that wives respond to spousal disagreements, even on impersonal topics, with larger cardiovascular responses than husbands (Smith et al., 1998) is consistent with those studies.

Depression

Both syndromal depression and depressive symptoms are strongly associated with marital distress (Beach et al., 1998; Fincham & Beach, 1999). The strength of the tie is sizable—for example, one study found a 10-fold increase in risk for depressive symptomatology associated with marital discord (O'Leary, Christian, & Mendell, 1994); similarly, data from a large epidemiological study demonstrated that unhappy marriages were a potent risk factor for major depressive disorder for both men and women, associated with a 25-fold increase over untroubled marriages (Weissman, 1987). The relationship appears to be bidirectional, with poor marriages enhancing depressive symptoms, and depression promoting poorer marital quality (Beach et al., 1998; Fincham & Beach, 1999).

The magnitude of the relationship between marital distress and depressive symptomatology is similar for women and men (O'Leary et al., 1994), a surprising finding because of the evidence that relationships are more important for women (Cross & Madison, 1997b), as well as the fact that women are twice as likely to be clinically depressed as men (Weissman, 1987). However, recent work suggests that marital adjustment and depression show differ-

ent relationships for men and women; among a sample of recently married couples who provided marital adjustment and depressive symptom data at two time points, the path for men emerged from depressive symptoms to marital adjustment, whereas data for women showed a stronger prospective association in the path from adjustment to depression (Fincham, Beach, Harold, & Osborne, 1997).

Marital disagreements appear to contribute to poorer mental health after considering the contribution of marital quality (McGonagle & Schilling, 1992), paralleling the evidence from marital interaction studies that marital conflict behaviors predict physiological change after controlling for marital adjustment (Kiecolt-Glaser et al., 1993, 1997; Kiecolt-Glaser, Newton, et al., 1996). Indeed, day-to-day marital disagreements were better predictors of daily mood variation among married individuals than any other common stress experiences (Bolger, DeLongis, Kessler, & Wethington, 1989). In fact, among individuals with remitted depression, expressed emotion and marital adjustment predicted the same proportion of variance in patients' outcomes (Hooley & Teasdale, 1989); however, the single best predictor of relapse was a patient's response to one question: "How critical is your spouse of you?" (p. 229).

The association of marital distress with higher rates of both syndromal depression and depressive symptoms has important implications for physical functioning. For example, data from 11,242 outpatients in the Medical Outcomes Study showed that patients with either a current depressive disorder or depressive symptoms in the absence of a syndromal disorder had worse physical, social, and role function; worse perceived current health; and greater bodily pain than patients with no chronic conditions (Wells et al., 1989). The poorer functioning that was uniquely associated with depressive symptoms was comparable to—or even worse than—that uniquely associated with eight chronic medical conditions.

Depression alters cardiovascular, immune, and endocrine function, and these alterations are sufficient to enhance a variety of health threats (Glassman & Shapiro, 1998; Herrmann et al., 1998; Kiecolt-Glaser, Page, et al., 1998; Penninx, Guralnik, Ferrucci, et al., 1998; Penninx, Guralnik, Pahor, et al., 1998; Simonsick, Wallace, Blazer, & Berkman, 1995). In addition to physiological alterations, distressed individuals are also more likely to have poorer health habits including a greater propensity for alcohol and drug abuse, inadequate sleep and nutrition, and less exercise (Kiecolt-Glaser & Glaser, 1988), all of which have negative health influences in their own right.

Trait Hostility

Hostility refers to a constellation of cognitive, affective, and behavioral features including interpersonal mistrust and suspiciousness and cynicism about human nature, along with tendencies to experience anger and resentment and to behave uncooperatively and aggressively (Smith, 1992). Identified as an independent risk factor for premature mortality and morbidity, particularly coronary heart disease (T. Q. Miller, Smith, Turner, Guijarro, & Hallet, 1996), hostility could contribute to poorer health outcomes by eroding social relationship quality, heightening physiological responses to stressful social interactions, and increasing unhealthy

behaviors such as cigarette smoking and alcohol use (Scherwitz & Rugulies, 1992; Smith, 1992).

Compared with their low-hostile counterparts, individuals who are high in hostility show more negative conflict behaviors during marital interaction, an association that is more prominent among hostile husbands than among hostile wives (Newton, Kiecolt-Glaser, Glaser, & Malarkey, 1995; Smith, Sanders, & Alexander, 1990). Similarly, hostile husbands, but not wives, report lower levels of marital satisfaction in cross-sectional studies (Houston & Kelly, 1989; Smith, Pope, Sanders, Allred, & O'Keefe, 1988). Further, in one prospective study of newlywed couples married an average of 5 months at initial assessment, hostile husbands showed significant linear decreases in marital satisfaction over the first 3 years of marriage (Newton & Kiecolt-Glaser, 1995). The wives of hostile husbands showed similar significant linear decreases in marital satisfaction. In contrast, wives' trait hostility was not associated with changes in their own, or their husbands', marital satisfaction. Trait hostility also is related to depressive symptomatology in married couples (Brummett et al., 2000). Hostile husbands and wives report higher levels of depressive symptoms, and, for wives, being married to a hostile spouse adds to depression.

Trait hostility contributes to negative marital interaction and erodes marital quality, and it also heightens the physiological consequences of marital conflict. It is well documented that hostile individuals show cardiovascular hyperreactivity in interpersonal contexts characterized by harassment or provocation, presumably because their psychological characteristics predispose them to perceive, and react strongly to, interpersonal threats (Suls & Wan, 1993). Predictably, trait hostility heightens blood pressure and heart rate responses to impersonal marital discussions (Smith & Brown, 1991; Smith & Gallo, 1999) and also amplifies cardiovascular and cortisol responses that accompany angry marital conflict (G. E. Miller et al., 1999). These responses are uniformly apparent for hostile husbands. In contrast, hostile wives do not exhibit heightened physiological reactivity during marital conflict, but wives in general show heightened systolic blood pressure when interacting with hostile husbands (Smith & Brown, 1991).

In sum, hostile characteristics are positively associated with marital dissatisfaction and conflict behaviors, and several studies suggest they contribute to heightened physiological reactivity during marital discussions and conflict interactions. Preliminary evidence shows that hostility contributes to depression in married couples. There is a fairly uniform gender disparity across these observations, with hostile husbands, more so than hostile wives, showing greater dissatisfaction, conflict, and hyperreactivity; in contrast, wives' social, emotional, and physiological functioning are all negatively affected by their husbands' trait hostility.

Health Habits

Supportive relationships can directly influence health by facilitating health-promoting behaviors and decreasing maladaptive coping behaviors (Lewis, Rook, & Schwarzer, 1994). For example, higher marital adjustment was associated with better compliance with a blood pressure medication regimen (Trevino, Young, Groff, & Jono, 1990). Among women who underwent gastric restriction surgery for the treatment of morbid obesity, marital dissatisfaction was associated with weight gain a year later (Hafner, Rogers, & Watts, 1990). In longitudinal data from men, positive marital

interaction (assessed by both self-report and behavioral indices) reduced the probability of risky health habits (poor eating habits, substance use, and inadequate sleep); moreover, risky lifestyles contributed to poorer health after controlling for initial health status (Wickrama, Conger, & Lorenz, 1995).

Some of the strongest data indicate that marital conflict may be both a precursor and a consequence of alcohol and drug abuse (O'Farrell, Hooley, Fals-Stewart, & Cutter, 1998). Among individuals who underwent behavioral marital therapy (BMT) for alcoholism, patients with high-EE spouses were more likely to relapse, had a shorter time to relapse, and drank on a greater percentage of days in the year after starting BMT than patients with low-EE spouses (O'Farrell et al., 1998). A longitudinal study assessed the frequency of negative consequences from alcohol use (Horwitz & White, 1991); after controlling for alcohol problems at baseline, participants' responses to a single question about how often serious conflicts arose within the marriage were associated with problem drinking for men, but not women, 3 years later. Similarly, among middle-aged couples, unhappy husbands consumed more alcohol than happy husbands, with no differences for wives (Levenson et al., 1993). In contrast to the results of these two studies, when predisposing factors and mental health status were statistically controlled, women who reported greater marital conflict were more likely to smoke and to drink a moderate to heavy amount of alcohol; marital stress was not associated with health practices among men (Cohen, Schwartz, Bromet, & Parkinson, 1991). Recent spousal conflict was associated with greater tranquilizer use for both genders in a nationwide sample of Finnish men and women (Appelberg, Romanov, Honkasalo, & Koskenvuo, 1993). Data such as these suggest that interpersonal conflict in close relationships intensifies maladaptive health practices. Could health habits and/or depression-related marital distress account for the physiological differences observed in marital interaction?

This issue was addressed in a series of articles that reported data from newlywed couples who were selected on the basis of extremely stringent mental and physical health criteria (Kiecolt-Glaser et al., 1993; Kiecolt-Glaser, Newton, et al., 1996; Malarkey et al., 1994). Couples were eliminated from consideration during an initial phone interview if either spouse reported a previous marriage or children, any acute or chronic health problems that might have immunological or endocrinologic consequences, if they took any medications except birth control pills, if they drank more than 10 alcoholic drinks per week or used any street drugs, if they smoked, if they used caffeine excessively, or if they were not within 20% of their ideal weight for their height. A second set of phone interviews assessed both current and lifetime psychiatric disorder data as well as a detailed medical history. Participants were excluded who had met *Diagnostic and Statistical Manual of Mental Disorders* (3rd ed., rev.; American Psychiatric Association, 1987) criteria for any psychotic diagnosis, any depressive or anxiety disorder other than simple phobia, or substance abuse. Among participants selected on the basis of these stringent criteria, those who exhibited more hostile or negative behaviors during a marital problem discussion showed greater immunological, endocrinologic, and cardiovascular alterations relative to low-negative-behavior participants.

Subsequent analyses of couples who were high or low on hostile behavior during conflict showed no differences on age, education,

income, social support in other relationships, social desirability, negative or positive mood, depressive or anxiety symptoms, Axis II personality dimensions, parental history of hypertension or heart disease, length of marriage or how long they had dated before marriage, or health habits. Baseline heart rate and blood pressure did not diverge before the conflict discussion, and the two groups did not differ in cardiovascular reactivity to a mental arithmetic task in the afternoon; this latter similarity between groups was especially important in light of data linking cardiovascular reactivity with short-term endocrinologic and immunological changes (Kiecolt-Glaser, Cacioppo, Malarkey, & Glaser, 1992). Admission to a hospital research unit provided a uniform environment, simultaneously controlling factors such as physical activity, diet, and caffeine intake (Kiecolt-Glaser & Glaser, 1988). Accordingly, it seems reasonable to conclude that the behavior of the couples during their 24 hr together, rather than extraneous factors, produced the observed cardiovascular, endocrine, and immunological changes.

On the basis of the evidence available at the time, Burman and Margolin (1992) concluded that "marital variables affect health, but the effect is indirect and nonspecific" (p. 39). Although marital functioning undoubtedly influences health indirectly by means of modulation of mood and health habits, the marital interaction studies published in the decade since their review have demonstrated direct and specific influences on key physiological mechanisms.

Health Consequences: Linking Physiological Changes to Morbidity and Mortality

Burman and Margolin (1992) argued that the most convincing way to document a causal relationship between marital functioning and health status would be first to confirm that marital interaction had direct effects on physiological processes and then to show that individuals who exhibited physiological changes were more likely to develop health problems; this is certainly the most stringent test, and none of the studies reviewed here have all of these components. Indeed, the links between autonomic, endocrine, and immune responses to challenge and health are tenuous, with responses to laboratory challenge typically returning to resting levels within 1 to 2 hr after cessation of the stressor (Kiecolt-Glaser et al., 1992). Although data from some of the marital interaction studies are consistent with evidence from this "challenge" paradigm, others are particularly provocative precisely because they deviate from this pattern—for example, among newlyweds immunological differences endured for 22 hr across 10 different assays after a marital conflict, consistent with persistent endocrinologic alterations (Kiecolt-Glaser et al., 1993; Kiecolt-Glaser, Newton, et al., 1996). Moreover, although direct effects on etiology have yet to be demonstrated, marital functioning unquestionably has consequential influences on symptom expression (a key component of disability). In addition, the marital interaction literature may be examined with an alternative question: Are the physiological alterations that have been demonstrated to date large enough to have clinical significance? Evidence from each of these vantage points is evaluated below.

The best evidence relating marital functioning to health status comes from illnesses that have immunological or cardiovascular components or mediators. The endocrine system serves as one

important gateway for both; stressors can provoke the release of pituitary and adrenal hormones that have multiple effects, including alterations in cardiovascular and immune function (Dhabhar & McEwen, 1997; Glaser & Kiecolt-Glaser, 1994; Kuhn, 1989). The endocrine system's involvement in the pathogenesis of stress-related disease processes is probably mediated through frequent small daily excursions in hormonal levels following stressful events. For example, chronic stimulation of cortisol and catecholamine secretion at lower levels has been linked to cardiovascular pathology (Kuhn, 1989) and immunological dysregulation (Dhabhar & McEwen, 1997; Glaser & Kiecolt-Glaser, 1994). Cortisol facilitates the vasoconstrictive effects of catecholamines; accordingly, the combination of catecholamine and cortisol responses is important for pathogenesis in cardiovascular disease (Fredrikson, Tuomisto, & Bergman-Losman, 1991). Furthermore, both catecholamines and cortisol are associated with immunological dysregulation (Glaser & Kiecolt-Glaser, 1994). The ability to unwind after stressful encounters (i.e., quicker return to one's neuroendocrine baseline) influences the total burden that stressors place on an individual (Frankenhaeuser, 1986). Stressors that are resistant to behavioral coping, particularly stressors perceived as unpredictable and uncontrollable, may continue to be associated with elevated stress hormones even after repeated exposure (Baum, Cohen, & Hall, 1993).

Dhabhar and McEwen (1997) speculated that chronic stress dysregulates immune function in part by means of disruption of circadian rhythms, leading to elevated cortisol at the time of day when levels are normally low. Newlyweds' cortisol data are provocative in this context. Hours after a laboratory conflict task had ended, negative behaviors accounted for 24% of the variance in "daytime" cortisol, that is, pooled samples collected hourly from 8 a.m. through 10 p.m. (Kiecolt-Glaser, Newton, et al., 1996). As an illustration of the biological implications of these data, a wife who fell 1.5 standard deviations above the mean for the demand-withdraw behavioral sequence and at the mean on all other predictors (i.e., holding other values constant) would show a predicted cortisol level of 15.28 ng/ml, whereas a woman 1.5 standard deviations below the mean would have a predicted cortisol level of only 7.71 ng/ml—about half as large. Similarly, among older women in long-term marriages, multilevel modeling of cortisol change showed a mean slope of .04 and variance of .70 in those slopes. A model for prediction of that variation in slopes showed that conflict behavior accounted for 21% of the variance in the rate that cortisol changed when measured serially across the problem resolution task (Kiecolt-Glaser et al., 1997). These data are likely to underestimate the actual physiological impact of marital discord, because both the younger and older couples were generally quite happy; only 3% of newlyweds and 13% of the older sample had marital adjustment scores in the distressed range. Thus, negative or hostile marital conflict behaviors were linked to biologically relevant elevations in cortisol even in relatively nondistressed couples.

For what kinds of health outcomes might such changes have relevance? Recent studies have demonstrated substantial relationships between stress and wound healing, a process in which the immune system plays a key role (Kiecolt-Glaser, Marucha, Malarkey, Mercado, & Glaser, 1995; Kiecolt-Glaser, Page, et al., 1998). Even a transient, commonplace stressor, academic examinations, can substantially delay wound repair: Oral wounds

placed 3 days before an exam healed an average of 40% more slowly than those made in the same individuals during summer vacation (Marucha, Kiecolt-Glaser, & Favagehi, 1998). Stress-induced elevations in cortisol can alter the carefully regulated dynamic system that controls development of the immune response at the wound site, suppressing production of cytokines, key messenger molecules that help cells communicate (DeRijk et al., 1997; Hübner et al., 1996). Indeed, in a study that measured immune function at the site of blister wounds, low cytokine producers reported more stress and more negative mood than high producers, and the former also had higher levels of salivary cortisol (Glaser et al., 1999). Consistent with these data, male coronary artery bypass patients who received greater spousal support used less pain medication, had a more rapid discharge from the surgical intensive care unit, and spent fewer total days in the hospital (Kulik & Mahler, 1989).

Six studies have demonstrated an association between marital quality or marital interaction and immune function (Kiecolt-Glaser et al., 1987, 1988, 1993, 1997; Mayne et al., 1997; G. E. Miller et al., 1999). A central question throughout much of the psychoneuroimmunology literature has been the extent to which stress-induced immune changes have consequences for morbidity and mortality (Kiecolt-Glaser, 1999). The data on wound repair provide clear evidence of important health effects in one domain. In addition, several studies have demonstrated stress-related modulation of vaccine responses in both younger and older participants, including alterations in response to a mild stressor, academic exams (Glaser, Kiecolt-Glaser, Bonneau, Malarkey, & Hughes, 1992; Kiecolt-Glaser, Glaser, et al., 1996; Vedhara et al., 1999). Vaccine responses provide an excellent proxy for infectious illness risk because they demonstrate clinically relevant alterations in immune responses to challenge under well-controlled conditions; adults who show poorer responses to vaccines and other antigenic challenges also experience higher rates of clinical illness (E. A. Burns & Goodwin, 1990; Hobson, Curry, & Beare, 1972; Patriarca, 1994). Thus, these data provide a window on the body's response to other pathogens. In accord with these findings, individuals who reported enduring interpersonal difficulties with family or friends were significantly more likely to develop a cold following inoculation with a cold virus than those who were not experiencing interpersonal strains (Cohen et al., 1998). Thus, there is good evidence (albeit indirect) to suggest that the immune and endocrine dysregulation associated with marital discord is likely to be consequential for two broad health outcomes, wound healing and infectious disease risk.

Stress-related immune dysregulation is also a catalyst for clinical change in rheumatoid arthritis, an autoimmune disease. Using a prospective design, Zautra and colleagues (Zautra et al., 1998) linked interpersonal stress with changes in clinician-rated disease activity as well as immune function, a notable addition to the rheumatoid arthritis literature; in addition, they found that women with better spousal relationships appeared to be protected—that is, they did not show increases in disease activity. In related work with patients with rheumatoid arthritis, the immune-stimulating hormones prolactin and estradiol were significantly positively correlated with interpersonal conflicts, depression, coping inefficacy, and clinician ratings of disease activity; for systemic autoimmune diseases such as rheumatoid arthritis, increases in aspects of immune function are maladaptive, because they are associated with

disease flare-ups (Zautra, Burleson, Matt, Roth, & Burrows, 1994). Thus, interpersonal stress was linked to both endocrine and immune alterations, and these changes were also associated with clinician-rated disease activity as well as self-reported joint tenderness in well-designed prospective studies. Similarly, other data from patients with rheumatoid arthritis showed that negative spouse behavior predicted poorer pain outcomes longitudinally with controls for baseline pain (Waltz et al., 1998). The potential long-term significance of such changes is suggested by data from a community cohort of patients with rheumatoid arthritis who were assessed every 6 months for up to 9.5 years; married patients had a slower progression of functional disability than the unmarried (Ward & Leigh, 1993).

Considerable research on cardiovascular disease has been guided by the *reactivity hypothesis*, the premise that excessive cardiovascular reactivity to stress is a risk factor for the development of hypertension and cardiovascular disease, particularly if responses occur relatively frequently and at high intensity (Carels et al., 1998; Smith et al., 1998). In the studies reviewed above, marital conflict was reliably associated with heightened blood pressure and heart rates (Broadwell & Light, 1999; Ewart et al., 1991; Flor et al., 1995; Kiecolt-Glaser et al., 1993; Mayne et al., 1997; Morell & Apple, 1990; Schwartz et al., 1994; Thomsen & Gilbert, 1998). Of importance, among a sample of 43 patients with essential hypertension, a 10-min marital problem-solving task produced clinically significant increases in blood pressure, with participants reaching a mean of 160/100 mmHg. Twenty of these couples subsequently completed marital communications training, and their blood pressure reactivity to marital arguments was reduced compared with those who did not undergo training (Ewart, Taylor, Kraemer, & Agras, 1984), a notable demonstration of the linkage between marital factors and clinically relevant physiological responses.

When a marriage becomes sufficiently abrasive, a bona fide disagreement is not essential to promote heightened cardiovascular responses; marital conflict recall in the absence of the spouse was sufficient to elevate blood pressure among women low on marital adjustment (Carels et al., 1998). More spousal contact was associated with elevated evening blood pressure among individuals with mild hypertension who reported lower marital cohesion (Baker et al., 1999). In addition to these direct pathways, there are also important indirect routes; higher marital adjustment was associated with better compliance with a blood pressure medication regimen (Trevino et al., 1990), and depressive affect has been linked to cardiovascular morbidity and mortality (Glassman & Shapiro, 1998; Simonsick et al., 1995). A meta-analysis suggested that familial sources of social support are associated with reliable positive effects on blood pressure regulation (Uchino, Cacioppo, & Kiecolt-Glaser, 1996). Finally, lack of disclosure to one's spouse predicted poorer recovery on three indices 1 year after a myocardial infarction: rehospitalization and/or death, post-myocardial-infarction chest pain, and perceived health (Helgeson, 1991). Thus, marital functioning has obvious negative influences on hypertension and cardiovascular disease through both direct and indirect routes.

Marital interaction unquestionably alters symptom expression in a number of chronic conditions. Spousal reinforcement of pain behaviors has been associated with subsequent illness chronicity (Paulsen & Altmaier, 1995; Romano et al., 1995; Turk et al.,

1992); hence, the finding that patients who reported increased marital adjustment following a spouse-assisted coping skills intervention were more likely to report less physical disability and show less pain behavior is particularly provocative (Keefe et al., 1996). In this context, the evidence that women may be at greater risk for pain-related disability than men (Unruh, 1996) may have been a factor in a large longitudinal study that found greater physician-certified disability related to marital conflict for women, but not men (Appelberg et al., 1996).

Two large prospective epidemiological studies implicated marital strain as a factor in the development of ulcers (Levenstein et al., 1999; Medalie, Stange, Zyanski, & Goldbourt, 1992), findings that echo earlier cross-sectional work (Alp, Court, & Grant, 1970; Gillies & Skyring, 1968). Although the data were based on self-reports, one of the studies assessed the accuracy of participants' recall by requesting medical records for 25% of all ulcer cases (Medalie et al., 1992). Definite confirmatory evidence was found in 77% of these cases; false positives included patients who were being treated by their physician with an ulcer diet despite negative radiological findings and cases in which the radiologist examining the radiographic data disagreed with the original interpretation. Endocrine and immune dysregulation play a role in addition to health habits (smoking, alcohol use, and lack of sleep), and stress also alters key gastrointestinal processes such as blood flow and gastric acid secretion (Levenstein et al., 1999). Thus, marital functioning could play a role in ulcers' multifactorial origin and course through a number of routes.

If abrasive relationships provoke larger and more frequent immunological, endocrinologic, and cardiovascular changes, then individuals in troubled relationships could be at greater risk for a variety of health problems over time. Distressed families experience roughly twice as many tensions per day as nondistressed families (Christensen & Margolin, 1988; Margolin, Christensen, & John, 1996). There is also greater spillover of conflict from one topic to another and greater "contagion" between marital and child-related tensions among unhappy couples than those who are more satisfied (Margolin et al., 1996). Moreover, distressed couples are more likely to experience continuance of tensions, particularly those that repeat in ritualized patterns at the same time on subsequent days (Margolin et al., 1996). In contrast to stressors without an interpersonal component, those that involve conflict have an increasing emotional impact as stressors occur over days, and they account for a large portion of the variance in daily mood (Bolger, DeLongis, Kessler, & Schilling, 1989). Older adults are likely to be at greatest risk, related to the greater physical vulnerability that accompanies aging. For example, age and distress appear to interact to promote immune regulation: Older adults show greater immunological impairments related to stress or depression than young adults (Kiecolt-Glaser, Glaser, et al., 1996; Schleifer, Keller, Bond, Cohen, & Stein, 1989). Accordingly, troubled marriages are likely to be more consequential for the health of older couples.

Conceptual Perspectives on Gender Differences

The physiological studies of marital interaction from the past decade provide convergent evidence that gender is an important moderator of the pathway from negative marital conflict behaviors to physiological functioning; this pathway is stronger for women

than for men, and women's physiological changes following marital conflict show greater persistence than men's (Ewart et al., 1991; Jacobson et al., 1994; Kiecolt-Glaser et al., 1993, 1997; Kiecolt-Glaser, Newton, et al., 1996; Malarkey et al., 1994; Mayne et al., 1997). As noted earlier, this gender pattern stands in contrast to broader patterns of responding to acute stressors in which men show larger physiological responses than women (Earle et al., 1999; Kirschbaum et al., 1992). In this section we consider evidence that a triad of loosely integrated gender-linked factors—self-representations, traits, and roles—contributes to gender differences in the pathways leading from the marital relationship to physiological functioning and health outcomes. This perspective furnishes a preliminary working model of the origins of these gender differences, and provides a framework to guide research on marital functioning, gender, and health.

It is generally accepted that gender is a multidimensional construct composed of biological, cognitive, affective, and behavioral features that are loosely integrated (Ashmore, 1990). Self-representations have emerged as one key dimension of gender. Self-representations, or self-construals, are central to social information processing. They guide social cognition by directing attention to information that is emotionally salient to the self and by facilitating recall of self-relevant life experiences. Moreover, they serve motivational and regulatory functions, promoting, or sometimes hampering, short- and long-term efforts to achieve valued goals (Cross & Madson, 1997b).

Recent theoretical and empirical developments suggest there are fundamental differences in the content and structure of men's and women's self-representations, perhaps as a result of socialization and cultural influences (Cross & Madson, 1997a, 1997b). Specifically, women's self-construals, compared with men's, are characterized by relational interdependence (Acitelli & Young, 1996; Cross & Madson, 1997a, 1997b). Self-construals characterized by relational interdependence incorporate representations of close and significant others (e.g., a spouse), so that self-attributes, characteristics, and preferences are represented within the context of close, often dyadic, relationships. Individual goals, strivings, and regulatory functions are influenced by valued personal relationships that are represented hand-in-hand with the self. In marriage, wives' interdependent self-systems will include representations of their husbands, and their thoughts and feelings in marriage will be partially regulated by and responsive to not only their own behavior, but also that of their husbands. In contrast, men's self-construals are less relational than are women's. Although men clearly have, value, and strive for close relationships, having self-construals that are less relational means that their social information processing and self-regulation are less influenced by close, dyadic relationships (Cross & Madson, 1997a, 1997b). Instead, evidence suggests that men's self-construals are characterized by collective interdependence, or representations of group memberships and affiliations that occur at a broader social sphere (Baumeister & Sommer, 1997; Gabriel & Gardner, 1999).

This perspective predicts that wives, by virtue of their more relationally interdependent self-representations, should be more attuned to (and less insulated from) the emotional quality of marital interactions compared with husbands. Extensive empirical research on gender, emotion, and social relationships is consistent with this notion. Wives function as the "barometers" of distressed marriages (Floyd & Markman, 1983), in part because women are

more sensitive to negative marital interactions than are men. Wives are better than husbands at interpreting their spouse's emotional messages (Noller & Fitzpatrick, 1990); distressed wives can more accurately decode their husbands' negative messages than the reverse (Notarius, Benson, Sloane, Vanzetti, & Hornyak, 1989). Maladaptive attributions for events in the marital relationship are associated with less positive behavior and more negative behavior among wives, whereas husbands' attributions and behavior are unrelated (Bradbury, Beach, Fincham, & Nelson, 1996). Women are more adversely affected than men by overt expressions of hostility in marital interactions (Gaelick, Bodenhausen, & Wyer, 1985). In the emotional transmission literature, several studies have provided evidence that husbands' negative emotions predict wives' negative emotions more reliably than the converse (Notarius & Johnson, 1982; Roberts & Krokoff, 1990), particularly among distressed couples (Larson & Almeida, 1999). The fact that negative emotions are more contagious than positive emotions may lead to increased vulnerability in wives, who are more likely to be receivers than senders (Larson & Almeida, 1999).

Women also report that they reminisce more frequently about important relationship events and spend more time thinking about their marital relationships than do men (Burnett, 1987; M. Ross & Holmberg, 1990). Arguments with the spouse are more upsetting to women than to men (Almeida & Kessler, 1998; Bolger, DeLongis, Kessler, & Wethington, 1989), and wives demonstrate more detailed and vivid memories of marital disagreements than do their husbands (M. Ross & Holmberg, 1990).

These data are consistent in showing that women are more attuned than men to the emotional quality of marital functioning. This perspective suggests that the observed differences in husbands' and wives' physiological responses to negative aspects of marital interaction may reflect a biological consequence of gendered self-processes; a relational self-construal may increase psychological and physiological vulnerability to abrasive interpersonal relationships. For example, because memories of stressful experiences can themselves continue to evoke stress-related physiological changes (Baum et al., 1993; Carels et al., 1998), women's stronger and more enduring memories of marital disagreements are likely to sustain maladaptive physiological changes such as heightened cardiovascular responses and elevated stress hormones. In contrast, husbands' less relational self-representations should insulate them from the psychological and physiological consequences of marital conflict.

Wives' greater cognitive and emotional sensitivity to marital distress and their associated physiological arousal may also be tied to their greater propensity to mend or end their marriages. Wives are more likely to voice their discontent with their marriages, and to do so earlier than their husbands (Hagestad & Smyer, 1982; Harvey, Wells, & Alvarez, 1978). Longitudinal data indicate that wives' autonomic and immunological responses to conflict may have greater predictive power than husbands' responses for assessing risk for marital discord and dissolution (Gottman & Levenson, 1992; Kiecolt-Glaser, Glaser, Cacioppo, & Malarkey, 1998). In addition, precisely because they strive for close relationships with others, wives may be more likely to end a troubled marriage when they see their efforts at reparation as failed (Cross & Madson, 1997a). Only a quarter to a third of marital separations are directly prompted by the husband's decision (Kitson, 1982).

A corollary prediction of this conceptual perspective is that relational interdependence will render wives more responsive than husbands to the positive aspects of marital interactions, not just to the abrasive qualities (Cross & Madson, 1997b). In contrast, husbands' less relational self-representations should provide them with fewer benefits of positive marital interactions (Cross & Madson, 1997b). Although the physiological consequences of positive marital interactions have not been adequately tested for either men or women, the results of one study reviewed above are consistent with this proposition (Kiecolt-Glaser, Newton, et al., 1996); wives, but not husbands, who showed higher frequencies of positive behaviors during marital conflict had lower epinephrine levels throughout the day.

A recent trait-based approach to gender differences draws on reminiscent themes and has received preliminary empirical support in the health arena (Helgeson, 1994). According to this trait-based model, women, compared with men, are more characterized by communion, a trait that motivates attention to and focus on others. In contrast, men, compared with women, are more characterized by agency, a personality trait that motivates separating from others and focusing on the self. This model posits that communion reliably increases vulnerability to relationship stressors when it occurs in its extreme form and is unmitigated by agency—that is, when an individual is characterized by a focus on others to the exclusion of the self. In fact, there are supportive data; unmitigated communion was correlated with stronger adverse effects from stressful interpersonal events, and these stressors accounted for the associations between unmitigated communion and both psychological distress and poorer metabolic control among adolescents with diabetes (Helgeson & Fritz, 1996).

Self-representations and the personality traits of agency and communion may also affect indirect pathways leading from marital functioning to health outcomes by increasing vulnerability to depression and compromised health habits. Women's greater sensitivity to relationship events has been implicated in their heightened risk for depression (Cross & Madson, 1997b). Similarly, in the context of social challenges such as those posed by marriage, risk for depression may be increased by the communal personality orientation that so often characterizes women, whereas agentic personality characteristics may decrease the risk of depression (Nolen-Hoeksema & Girgus, 1994). Among couples adjusting to a first coronary event in the husband, the most distressed wives were those who were high in unmitigated communion with spouses high in unmitigated agency (Helgeson, 1993). However, in its less extreme form, communion's positive focus on relationships has a number of beneficial features, including greater marital satisfaction for both the spouse and partner (Bradbury & Fincham, 1988). With regard to health habits, it has been proposed that the extreme or unmitigated forms of communion and agency both contribute to poorer self-care (Helgeson, 1994). Individuals characterized by unmitigated communion, the extreme focus on others that is more likely to occur among women than men, may prioritize others' needs above their own, thereby neglecting their own health habits. Individuals characterized by unmitigated agency, an extreme focus on the self that is more likely to occur among men than women, may not reliably seek health care because help seeking is viewed as inconsistent with autonomy (Helgeson, 1994).

In sum, convergent evidence suggests that observed gender differences in the pathway from negative marital interactions to

physiological responses could be partially driven by self-processes and traits that increase women's vulnerability to abrasive marital interactions. In addition, these and other gender-linked self-processes and traits have implications for indirect pathways involving depression and health habits and for the impact of positive marital functioning. Although direct tests are needed, this perspective provides a viable and testable starting point from which to examine gender differences in pathways from marital functioning to physical health outcomes. Moreover, because marriage occupies a privileged place among relationships that affect well-being (Glenn & Weaver, 1981), gender-linked traits and self-processes that operate within marriage may be particularly salient to health outcomes. Social conventions and gender-typed marital roles (e.g., "homemaker," "breadwinner") that continue to characterize many marriages may buttress the gender typing of self-processes (Cross & Madson, 1997b).

Gender differences in stress exposure that occur within the context of marital roles may also contribute to pathways leading from marital functioning to health outcomes. Marital roles refer to the concrete ways in which time and daily behavior are structured within the context of marriage. In contemporary marriage, particularly salient roles are those that revolve around contributions to paid employment and performance of domestic chores (Glass & Fujimoto, 1994). After controlling for prior reports of mental distress, Bird (1999) found that among men and women employed outside the home, contributing more than 46% of the total domestic labor accelerated increases in depressive symptoms. On average, wives contribute up to 53% beyond this threshold, whereas husbands' contributions fall below this threshold; normative inequities in marital roles may contribute to depressive symptoms among employed wives. The chronic strain of domestic chores also contributes to women's tendencies to ruminate or dwell passively on their negative emotional states, a response style that increases vulnerability for later depressive symptoms and disorders (Nolen-Hoeksema & Girgus, 1994; Nolen-Hoeksema, Larson, & Grayson, 1999). In reciprocal feedback fashion, rumination in turn has been linked to higher levels of domestic role strain, perhaps by dampening motivation and vitality to overcome negative situations (Nolen-Hoeksema et al., 1999).

Participation in domestic labor after a day at work also has been proposed to impair working women's ability to physiologically "unwind" in the evening hours (Frankenhauser, Lundberg, Fredrikson, Melin, & Tuomisto, 1989); this process has potentially powerful implications for the disruption of biological circadian rhythms, a proposed mediator of the health consequences of chronic stress, discussed above. Although more data are needed to directly test this proposition, indirect indicators of women's participation in domestic labor (i.e., marital and parental status) have been linked with physiological parameters assessed during workdays, nonworkdays, and sleep. For example, compared with unmarried female nurses, married nurses showed significantly higher levels of nighttime urinary cortisol, and their urinary norepinephrine levels showed no reduction from workdays to days off (Goldstein, Shapiro, Chicz-DeMet, & Guthrie, 1999). In addition, although all nurses showed reductions in heart rate from daytime working hours to evening hours, those with children living at home showed significantly smaller reductions than did nurses without children at home (Goldstein et al., 1999). Similarly, compared with working women without children at home, those with children at

home showed more pronounced elevations in 24-hr cortisol excretion during the workday (Luecken et al., 1997), and number of children living at home was positively associated with working women's diastolic blood pressure levels during sleep (James, Cates, Pickering, & Laragh, 1989). In one study that assessed family responsibilities, working women's aggregate 24-hr blood pressure levels were highest among women who had obtained a college degree and also reported high levels of family responsibility (i.e., having more and younger children, and performing a greater percentage of domestic work; Brisson, Laflamme, Moisan, Milot, Masse, & Vezina, 1999). On the other hand, in one study of men and women schoolteachers, individuals with children showed greater reductions in systolic and diastolic blood pressure from the workday to the evening compared with individuals without children (Steptoe, Lundwall, & Cropley, 2000).

With one exception, the indirect evidence provided by these studies is consistent with the notion that stress exposure accompanying marital and parental roles contributes to alterations in women's circadian physiological levels, including degree of physiological unwinding from workday to nighttime and from workdays to nonworkdays. Future research should include direct measurements of role stress and should examine the intra- and interpersonal processes involved in evening and nonworkday physiological unwinding. Reciprocal feedback cycles involving domestic role strain and rumination may be particularly problematic intrapersonal processes for women (Nolen-Hoeksema et al., 1999); likely interpersonal contributors to degree of physiological unwinding include the quality of spouses' marital interactions during evenings and nonworkdays (Baker et al., 1999; Repetti, 1989). In addition, because the role stress of dual-earner marriages has consequences for husbands, too, studies should include husbands and wives. For example, the spillover of interpersonal conflict from workplace to home, and from home to workplace, is stronger among husbands than wives (Bolger, DeLongis, Kessler, & Wethington, 1989); the physiological correlates of such spillover await investigation.

Overall, what general conclusions can be drawn about gender, physical health, and marital functioning? As described in the introduction, married people have reliably better physical health profiles than unmarried people. At the same time, epidemiological studies of marital status show that being married, as compared with being unmarried, is more beneficial for men's health than women's (House et al., 1988; Umberson, 1992). Also, physiological studies of marital interaction from the past decade provide convergent evidence that marital conflict is likely to have a greater negative impact on the health of women than men. In contrast to these clear gender patterns, in the studies reviewed that did not assess physiological changes during marital interactions, we did not observe such strong or uniform gender patterns in associations between marital functioning and physical health outcomes. What might account for the discrepancy? The explanatory power of behavioral data may be one key factor; within the few marital interaction studies that made explicit contrasts, objectively measured behaviors explained considerably more of the variance than self-report data among women compared with men (Ewart et al., 1991; Kiecolt-Glaser et al., 1993, 1997; Kiecolt-Glaser, Newton, et al., 1996). In addition, the health outcome studies as a whole assessed many different aspects of marital functioning (not only marital conflict per se, which presumably might have revealed consistently

poorer health outcomes for wives), and most did not assess or control for factors such as depression and health habits. Thus, the health outcome studies reviewed here reflect the contribution of multiple aspects of marital functioning (positive and negative), and multiple direct and indirect pathways, each with costs that are differentially weighted by a host of gender-linked factors. The conceptual models discussed in this section provide a starting point for a more focused and comprehensive exploration of the differential costs and benefits the marital relationship offers men and women (House et al., 1988).

Recommendations for the Next Decade of Research on Marriage and Health

To maximize the chances of demonstrating linkages between marital functioning and health, how should researchers assess marital relationships? Behavioral data appear to enhance prediction (Ewart et al., 1991; Kiecolt-Glaser et al., 1993, 1997; Kiecolt-Glaser, Newton, et al., 1996); in addition, the importance of assessing both positive and negative aspects of relationships is highlighted by data from the Whitehall II study, which examined the relative impact of three types of support provided by the person that the respondent named as his or her closest relationship (Stansfeld et al., 1998). When researchers contrasted the effects of confiding-emotional support, practical support, and negative aspects of the relationship (negative interaction and conflict), they found that the negative effects of close relationships were independent and powerful predictors of poor health functioning (both physical and psychological), after adjustment for age, employment grade, baseline ill health, and negative affect. Moreover, these effects did not appear to be mediated through health practices. These data suggested that negative aspects of close relationships have an etiological role that is independent of baseline illness. Although the relationships assessed were not exclusively marital, the findings are notable because they demonstrate that conflicts and negative interactions are more than simply the absence of support (Berkman, 1998).

Within the few marital interaction studies that have made explicit contrasts, negative behavior appears to be more closely tied to physiological changes than positive behavior (Ewart et al., 1991; Kiecolt-Glaser et al., 1993, 1997; Kiecolt-Glaser, Newton, et al., 1996). Moreover, longitudinal data suggest that negative communication indices provide much more discriminative and predictive power for marital distress and dissolution than positive behaviors (Markman, 1991). However, it should be noted that in each case the experimental task involved resolving a disagreement, a paradigm that promotes negativity and simultaneously provides limited opportunities to display supportive behavior. Recent data emphasize the importance of assessing both conflict and support behaviors (Bradbury, Cohan, & Karney, 1998). For example, the socially supportive behaviors displayed by newlywed spouses as the partner discussed a personal issue were associated with marital outcome 24 months later after controlling for initial levels of marital adjustment (Pasch & Bradbury, 1998). By assessing both conflictual and supportive behaviors, it may be possible to determine whether behavioral problems are unique to conflictual interactions or whether they reflect other interpersonal deficits (Bradbury et al., 1998). In particular, the impact of conflict behaviors might be buffered in more supportive marriages but exacerbated in

those where support is low (Bradbury et al., 1998). Bolstering this view, the strongest cross-sectional predictor of marital disagreement frequency was the extent to which one's spouse was perceived as supportive (McGonagle & Schilling, 1992).

The Marital Adjustment Test and the DAS, the two most commonly used marital scales (Locke & Wallace, 1959; Spanier, 1976), offer obvious advantages for research on marriage and health. They can serve as sensitive and specific measures of marital distress (Eddy, Heyman, & Weiss, 1991), and they provide normative data about a sample's marital adjustment. However, their multidimensional nature (both tap several relationship dimensions, including satisfaction and disagreement) is problematic, in that marital quality is not distinguished from related concepts (Eddy et al., 1991). Moreover, conceptualizing marital satisfaction as bidimensional has been criticized, and the need to disaggregate the assessment of both positive and negative aspects of marital functioning appears to be particularly important; the separability of positive and negative components is an important theme in related areas of psychological inquiry (Fincham & Beach, 1999). Data from the marital interaction studies discussed earlier suggest that hostile or negative behaviors markedly enhance physiological change, particularly among women. Although marital adjustment data provide one indirect link, more focused assessments of marital strain, conflict, or upset would be useful, particularly in view of the gender differences that may be most obvious when observed in the context of the frequency or intensity of marital conflict (Helgeson, 1994; Smith et al., 1998).

Relatedly, preliminary evidence supports the value of disaggregating positive aspects of marital functioning, particularly in the study of health outcomes. For example, specific positive spousal interactions, but not spousal support, were implicated in disease activity of women with rheumatoid arthritis (Zautra et al., 1998). Without measuring specific positive interactions in this study, the results may have generated the erroneous conclusion that positive marital factors were not related to disease activity. In addition, the literature on marriage and pain outcomes suggests that measuring specific spousal behaviors along with global marital quality, and assessing the interaction of these two factors, can increase explanatory power. Levels of global marital satisfaction may moderate patients' appraisals of specific spousal behaviors, thereby altering their functional significance for health outcomes.

Another recurrent theme in many of the studies reviewed above was the importance of including a sufficient number of distressed couples in study samples; truncation of range may lead to underestimates of the effect of marital unhappiness. Similarly, routine assessment of marital adjustment, particularly by using scales with known norms, will enable investigators to assess the extent to which reductions in range could affect results.

With regard to the two most commonly used approaches to studying the psychophysiology of marriage (conflict interactions vs. experimental-impersonal discussions), the former has the advantage of lending greater ecological validity, as couples discuss topics that are of personal relevance and importance to them and that presumably provoke conflict discussions in their day-to-day interactions outside the laboratory (Smith & Gallo, 1999). Experimental approaches, although providing less ecological validity, enable greater and more precise control over specific aspects of marital interaction (e.g., level of disagreement) that may be important to isolate. Ultimately, the most solid empirical founda-

tion for understanding the psychophysiology of marriage will develop from the convergence of multiple methods, including laboratory conflict resolution tasks, supportive interactions, and experimental-impersonal discussions, along with ambulatory studies that examine marital functioning within the context of daily life.

Concerning gender differences, this review of the past decade of marriage and health research suggests that future research in this arena might profitably adopt approaches that are increasingly prominent in biobehavioral research more broadly: Conduct gender comparisons with regard to health outcomes and with regard to biobehavioral processes that contribute to physical health status (Blanchard, Griebel, & Blanchard, 1995; Legato, 1997). It seems likely that to have the strongest explanatory power, models of marital functioning and health will have to include factors that can account for gender differences in biopsychosocial pathways and health outcomes. Data from physiological correlates of marital conflict support this recommendation, and it is strongly suggested by contemporary psychological models of gender that reveal prominent differences in the way relationships affect men's and women's self-representations, social interactions, health habits, and risk for depression. Contemporary conceptual approaches to gendered traits, self-processes, and marital roles will provide marital researchers with useful starting points for gender-specific assessment, model building, and hypothesis testing.

Finally, considering evidence that marital distress has the potential to generate substantial health challenges, can this risk factor be effectively modified? Although couples therapy reliably increases marital satisfaction above that of couples in no-treatment control groups, some evidence suggests that treatment moves couples from a distressed to a nondistressed range in less than half the cases (Christensen & Heavey, 1999). Because significant and lasting endocrine alterations subsequent to a period of conflict occur even among healthy couples who are predominantly not distressed (Kiecolt-Glaser, Newton, et al., 1996), many couples who participate in marital therapy could continue to experience levels of distress that could conceivably contribute to health risk. This seems particularly likely given the chronicity of exposure to marital distress and conflict, and because improvements in marital satisfaction may decay within a few years following termination of treatment (Christensen & Heavey, 1999). In addition, intervention programs designed to prevent marital distress have not consistently been interpreted as efficacious (Christensen & Heavey, 1999). Even with an optimistic interpretation of these outcome data, some evidence reveals that married couples with the greatest need of prevention programs are also the least likely to participate in them (Fincham & Beach, 1999). Nevertheless, precisely because marital distress appears to be a potent correlate of health risk factors, the couples that do benefit substantially from marital therapy might also experience notable reductions in health risks; the alcohol literature has provided some suggestive data in this regard (Shoham, Rohrbach, Stickle, & Jacob, 1998). Thus, continued efforts at developing efficacious interventions have the potential for sizable yields in the arena of physical health.

Conclusion

Although both the quality and quantity of social ties have been related to morbidity and mortality (House et al., 1988), the support

provided by certain key relationships is obviously more important than others. Indeed, data from national surveys suggest that marital happiness contributes far more to global happiness than any other variable, including satisfaction with work and friendships; however, the relationship is (once again) stronger for wives than husbands (Glenn & Weaver, 1981). Although this literature review has emphasized the costs of marital discord, Glenn and Weaver framed the issue somewhat differently and suggested a provocative and important hypothesis for future studies on marriage and health; they suggested that if women, on average, experience more stress from marriage than do men, then the happiness data also suggest that men derive a lesser benefit from a satisfying relationship—that is, women surpass men in both the stress and satisfactions gleaned from marriage.

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