Lovesick: How Couples' Relationships Influence Health

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Annu. Rev. Clin. Psychol. 2017. 13:421–43

First published online as a Review in Advance on March 16, 2017

The *Annual Review of Clinical Psychology* is online at clinpsy.annualreviews.org

https://doi.org/10.1146/annurev-clinpsy-032816-045111

Keywords

marriage, depression, convergence, interdependence, sleep, metabolism

Abstract

This review highlights recent advances in research addressing intimate partner relationships and health. Consideration of the strong mutual influences that the members of a couple have on each other's mental and physical health trajectories provides a new way to view the health implications of couples' convergence or interdependence; marital closeness can have a clear downside when one partner has mental or physical health problems. Couples' interconnectedness can also be leveraged to promote better treatment outcomes. Major themes include the pivotal role of depression and the importance of gender differences in the pathways from the marital relationship to physiological functioning and health. The health risks and benefits of support are weighed. Additionally, two prominent emerging paths from marital distress to poor health are emphasized: sleep problems and metabolic alterations that promote obesity and its comorbidities.

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INTRODUCTION

Married people have better mental and physical health than unmarried people, on average (Kiecolt-Glaser & Newton 2001, Robles et al. 2014). 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 (Aizer et al. 2013, Engstrom et al. 2006, Neuman & Werner 2015).

However, the simple presence of a spouse is not necessarily protective; a troubled marriage is itself a prime source of stress and simultaneously limits the partner's ability to seek support in other relationships (Coyne & DeLongis 1986). Indeed, the relationship between life satisfaction and marital quality is stronger than life satisfaction's ties to either one's job or one's health (Heller et al. 2004). Marital quality clearly colors one's overall sense of well-being, and marital distress elevates health risks (Kiecolt-Glaser & Newton 2001, Robles et al. 2014).

A recent meta-analysis reported that the relationships between marital quality and various health outcomes had effect sizes similar in magnitude to the reported effects of diet and exercise on clinical health end points (Robles et al. 2014). Although the number of studies for specific health problems limited the conclusions that could be drawn, a notable finding was the lower risk for mortality associated with better marital quality, with the largest relationships found in studies addressing chronic illnesses (Robles et al. 2014).

In this article we highlight advances in research addressing intimate partner relationships and health. To complement and extend the extensive reviews that have documented marital discord's negative health consequences (Kiecolt-Glaser & Newton 2001, Robles et al. 2014), we discuss how couples mutually influence each other's mental and physical health trajectories, and we consider the health and treatment implications of couples' convergence or interdependence in mental and physical health. We consider marital functioning's indirect influences on health outcomes through depression and health behaviors. Following up on major themes that we have addressed

previously, we emphasize the importance of differentiating positive and negative dimensions of marital functioning, specifically examining the health risks and benefits of support, as well as gender differences in the pathways from the marital relationship to physiological functioning and health (Kiecolt-Glaser & Newton 2001). We highlight two prominent emerging paths from marital distress to poor health: sleep problems and metabolic alterations that promote obesity, metabolic syndrome, and diabetes. Additionally, we focus on evidence that more satisfying or closer marital relationships also increase health risks; marital closeness can have a clear downside when one spouse has mental or physical health problems.

DEPRESSION: A FOUNDATIONAL RISK FACTOR

Distressed marital relationships and depression often travel in tandem. Both syndromal depression and depressive symptoms are strongly associated with marital distress (Beach 2014). The strength of the tie is sizable. For example, O'Leary et al. (1994) found a tenfold increase in risk for depressive symptomatology associated with marital discord; similarly, data from a large epidemiological study (Weissman 1987) 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. The relationship is bidirectional: Distressed marriages enhance depressive symptoms, and depression promotes poorer marital quality (Beach 2014). The stress generation model illustrates how this association emerges: Depression contributes to marital discord, which enhances other stressors and serves to maintain or exacerbate symptoms (Foran et al. 2015).

The association of marital distress with depression has important implications for physical functioning. Depression alters multiple biological systems (e.g., endocrine, immune, cardiovascular, metabolic, neurocognitive), and these alterations are sufficient to enhance a variety of health threats, including premature mortality (Jaremka et al. 2013, Hughes et al. 2016). Depression promotes inflammation, one central pathway to poor health (Kiecolt-Glaser et al. 2015a). Heightened inflammation characterizes a number of disorders and systemic diseases, including cardiovascular disease, diabetes, metabolic syndrome, rheumatoid arthritis, asthma, multiple sclerosis, chronic pain, and psoriasis; each of these also features an elevated risk for depression (Shelton & Miller 2010, Slavich & Irwin 2014). In addition to experiencing these physiological alterations, depressed individuals are more likely to have poorer health habits, such as abusing alcohol and drugs, sleeping inadequately, eating less nutritiously, and exercising less, all of which have negative health influences in their own right (Kiecolt-Glaser et al. 2010).

Furthermore, depression can sensitize the inflammatory response, thus effectively promoting larger cytokine increases in response to stressors or pathogens (Glaser et al. 2003, Fagundes et al. 2013). Together, depression and stress contribute to a greater risk for infection, prolonged infectious episodes, and delayed wound healing—all processes that can fuel sustained proinflammatory cytokine production (Glaser & Kiecolt-Glaser 2005).

By promoting depression and emotional stress responses, marital distress can effectively modulate secretion of proinflammatory cytokines both directly, via central nervous system/neural/endocrine/immune biobehavioral pathways, and indirectly, via behavioral changes. Through these pathways, depression and stressful marital experiences contribute to both acute and chronic proinflammatory cytokine production (Kiecolt-Glaser et al. 2003, 2005).

COUPLES' HEALTH CONCORDANCE, FOR GOOD OR ILL

A growing literature addresses how couples mutually influence each other's mental and physical health trajectories (Hoppmann et al. 2011a). As depicted in **Figure 1**, couples' health and health

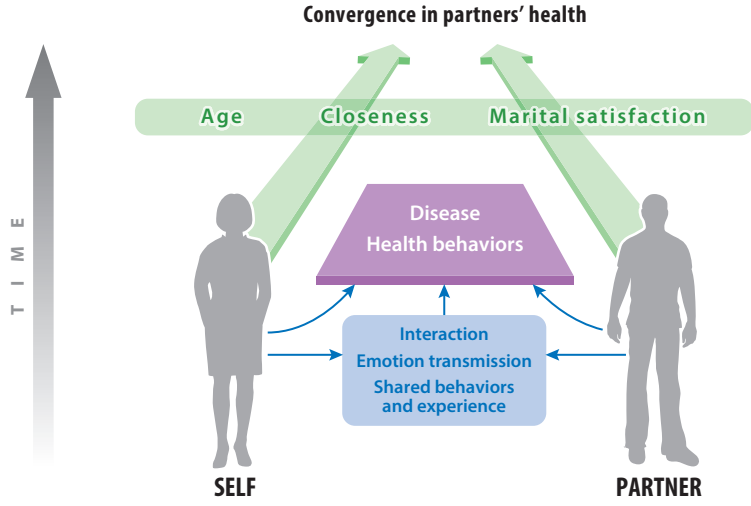

Figure 1

Conceptual framework summarizing the pathways by which partners' health may converge over time. Partners influence each other's health behaviors and eventual development of disease directly through interaction, emotion transmission, and shared behavior and experience. Partners' level of closeness, their marital satisfaction, and age may modify their degree of convergence.

behaviors are often similar and tend to converge over time (Leong et al. 2014). This occurs in part because of assortative mating: People typically choose a partner who is similar in terms of attitudes, demographics, and health-related behaviors, such as diet, physical activity, smoking, and alcohol consumption (Jackson et al. 2015, Leong et al. 2014). The shared resources hypothesis speculates that concordance may be a function of the fact that couples share a lifestyle as well as common stressors; spouses typically have a common living environment, pool resources, eat together, and share a social network. Shared major and minor life events contribute to behavioral convergence. Spouses' daily life activities are intertwined, and each partner's personal attributes—mood, attitudes, behavior, health, stresses, and lifestyle—affect both spouses. Thus, couples' mutual influence can be beneficial or harmful to health behaviors and health (Meyler et al. 2007).

In accord with lifespan theories, the links between partners' happiness trajectories across 35 years were substantially stronger than those observed in random pairs of women and men (Hoppmann et al. 2011b). Furthermore, spouses' joint happiness explained much of the interindividual differences in happiness.

Survey data from aging adults showed that wives' and husbands' quality of life traveled together over time; furthermore, each partner's self-reported physical health and cognition predicted their spouses' baseline quality of life, even after controlling for their own health and cognition (Bourassa et al. 2015b). In turn, better quality of life scores were related to longer-term health outcomes, including better cardiovascular health, better sleep, and lower all-cause mortality (Bourassa et al. 2015b). Indeed, interdependence in couples' quality of life can persist even after a partner's death; among couples in which one spouse had died, the surviving partner's later quality of life was associated with the deceased's prior life quality (Bourassa et al. 2015a).

Researchers have documented strong spousal associations in their exercise, smoking, alcohol consumption, and diet (Jackson et al. 2015). For example, a diary study showed that on days when spouses took more steps, osteoarthritis patients were more physically active as well (Martire et al.

2013b). Convergence on such key health behaviors has implications for other health indices; a systematic review reported positive spousal concordance for major coronary risk factors, including diastolic blood pressure, triglycerides, total and low-density lipoprotein cholesterol, smoking, body mass index, and waist-to-hip ratio (Di Castelnuovo et al. 2009).

In addition, changes in one spouse's behavior can prompt change in their partner. Couples in the English Longitudinal Study of Ageing, a population-based study of middle-aged and older adults in the United Kingdom, were more likely to stop smoking, increase physical activity, and lose 5% or more of their weight if their partner made the same positive change (Jackson et al. 2015). The impact on health behaviors can be substantial; longitudinal data show that when one spouse becomes obese, their partner's risk for obesity almost doubles (Cobb et al. 2015). In fact, couples who live together for longer time periods become more similar in obesity-related behaviors, including low levels of physical activity and high rates of sedentary behavior (The & Gordon-Larsen 2009).

Moreover, one spouse can benefit from an intervention delivered to their partner via a ripple effect (Gorin et al. 2008). For example, in a trial that evaluated how intentional weight loss affected cardiovascular outcomes in overweight people with type 2 diabetes, spouses of intervention group participants lost more weight than the partners of usual care condition participants, and the spouses' weight loss was significantly correlated (Gorin et al. 2008). Similarly, husbands of women in the low-fat intervention arm of the Women's Health Trial reduced their body fat and weight more than the husbands of control-arm women (White et al. 1991).

Not surprisingly, spouses' health behavior concordance can translate into disease risks (Gerstorf et al. 2009, Hoppmann et al. 2011a, Monserud & Peek 2014). When one partner has a history of diabetes, spousal risk for diabetes is increased 26%; a spousal history of either diabetes or prediabetes confers a twofold risk for the partner (Leong et al. 2014). When one spouse has metabolic syndrome, his or her spouse has roughly a 30% greater chance of also having metabolic syndrome (Kim et al. 2006). Among older Mexican American couples, a history of hypertension, arthritis, or cancer was associated with higher odds that the spouse would have the same condition. For example, having a partner with arthritis almost tripled the spouse's odds for arthritis (Stimpson & Peek 2005). People whose partners have asthma, peptic ulcer disease, or depression have a 70% or greater increased risk themselves for these conditions, even after controlling for partners' age, smoking, and obesity (Hippisley-Cox et al. 2002). Spouses of hypertensive patients have a twofold increased risk of hypertension even when age, BMI, and diabetes are controlled (Hippisley-Cox & Pringle 1998).

A large population-based, nested case-control study showed that the risk for developing physician-diagnosed hay fever was more than twice as great in people who lived with a partner with hay fever compared to people living with an unaffected partner. Furthermore, the longer the partners lived together, the greater the risk: Compared to couples who had lived together for 1–11 years, the odds ratio for those who were together 12–23 years rose to 1.8, increasing to 7.4 for 24–35 years, and then rapidly escalating to 13.7 for those in the longest term relationships, 36–54 years (Schafer et al. 2004).

Married couples' behavior patterns influence both spouses, a key assumption of interdependence theory, and one partner's functioning can influence both spouses (Kelly & Thibaut 1978). Crossover or spillover effects can arise in one partner following a spouse's negative experience, particularly when one member of the couple is experiencing health problems (Bourassa et al. 2015b). In a diary study, patients diagnosed with both diabetes and osteoarthritis had heightened blood glucose problems and arthritis severity on days when their disease-free spouses reported worse physical symptoms (Yorgason et al. 2012). Relatedly, emotional transmission occurs when a partner's own personal experiences provoke emotional responses and behaviors, which, in turn, affect

the spouse (Larson & Almeida 1999). Indeed, both mood convergence and emotional contagion hypotheses suggest that the interdependence of life with a partner promotes shared emotions.

Marital contagion of depressive symptoms and distress has been extensively documented. Living with a depressed spouse clearly alters the partner's mood. Higher levels of depressive symptoms in one spouse are associated with higher levels of depressive symptoms in his or her partner; this reciprocal relationship has been a consistent theme throughout a number of studies. Furthermore, longitudinal studies suggest that increases in one partner's depressive symptoms over time are associated with increments in the spouse's symptoms (Monin et al. 2016, Pruchno et al. 2009). Diary studies suggest that negative and high-arousal emotions are particularly contagious between partners (Saxbe & Repetti 2010, Schoebi 2008).

Major and minor life events that happen to one spouse can influence the mental health of both partners; for example, research has confirmed convergence following such health events as a cancer diagnosis and treatment, cardiomyopathy, heart failure, coronary heart disease, erectile dysfunction, and infertility, as well as nonhealth events such as job loss (Meyler et al. 2007). Data from both cross-sectional and longitudinal studies show that depressive symptoms among older adults experiencing vision loss (Strawbridge et al. 2007), prostate cancer (Berg et al. 2011), and arthritis (Stephenson et al. 2014) are also experienced by their spouse. Lung cancer patients' declining physical function predicted increases in spouse depressive symptoms over one year (Lyons et al. 2014). Similarly, longitudinal data from the National Survey of Families and Households addressed the effects of a spouse's illness on depressive symptoms in middle-aged and older married adults. People whose spouse had become ill or stayed ill because of a chronic disease or physical disability reported higher levels of depressive symptoms at the 10-year follow-up; in contrast, depressive symptoms were lower at follow-up than at baseline among those whose spouses' health improved (Bookwala 2014).

Depressive symptoms and the ability to perform activities of daily living have reciprocal influences between older partners; functional limitations increase risk for depression, and depression increases the risk for functional limitations (Hoppmann et al. 2011a). For example, frailty, characterized by weakness, slowness, and exhaustion, presages elevated risks for depression, disability, falls, hospitalization, and early mortality (Monin et al. 2016). Over time, people's depression predicted their own later frailty, and frailty predicted subsequent depression (Monin et al. 2016). In couples, frailty in one spouse predicted frailty in their partner; moreover, higher levels of depressive symptoms in one spouse predicted greater depressive symptoms in the partner (Monin et al. 2016). Similarly, longitudinal data from older Mexican American couples showed that functional limitations in one spouse were linked with higher levels of depressive symptoms in their partner (Monserud & Peek 2014). Mechanistically, both depression and frailty have inflammatory correlates, and chronic inflammation may be a key biological mechanism that fuels declines in physical function that lead to frailty, disability, and, ultimately, death (Ershler & Keller 2000).

Self-rated health—how healthy one feels—predicts physical disability, inflammation, and mortality (Christian et al. 2011, Pruchno et al. 2009). In a longitudinal study of self-rated health and depressive symptoms in patients with end-stage renal disease, changes in the patient's self-rated health increased the spouse's depressive symptoms, and these effects were greater for the spouse than changes in his or her own self-rated health (Pruchno et al. 2009).

MARITAL SATISFACTION, RELATIONSHIP CLOSENESS, AND AGE INFLUENCE CONVERGENCE-RELATED RISK

Surprisingly, little of the research has addressed how either marital satisfaction or relationship closeness impacts convergence-related risk. The limited data described below speak to their importance.

Marital satisfaction moderates the dynamic links between partners' health. The health of people in higher-quality marriages may be at greater risk when their partner is suffering (Hoppmann & Gerstorf 2009). In longitudinal data from community-dwelling older couples, husbands' cognitive impairment was associated with subsequent poorer health and well-being among their wives, but only for the 52% of wives who reported few or no marital problems (Strawbridge et al. 2009). Global marital satisfaction may serve as an interpretive backdrop, altering the partner's appraisals of the impaired spouse's behaviors and, thereby, their functional significance for the partner's health (Turk et al. 1992).

Marital satisfaction is moderately correlated with relationship closeness (Aron et al. 1992), another important relational dimension that may alter spillover and health convergence. Closer relationships may involve greater involvement in the spouse's daily activities compared to relationships that are not as close. Also, feeling close to one's partner can promote more empathic responses as well as greater contagion of negative affect (Berg et al. 2008, Cialdini et al. 1997); consequently, adverse health changes in one spouse may have a particularly strong impact on close partners. For example, in a sample of osteoarthritis patients and their spouses, the patient's greater knee pain during the day predicted the partner's poorer sleep quality that night, and these effects were strongest among couples in closer relationships (Martire et al. 2013a). Other data from this cohort showed that greater relationship closeness exacerbated the impact of a patient's increased severity of illness on their partner's positive affect and depressive symptoms over six months (Polenick et al. 2015), consistent with previous studies that showed stronger transmission of depressive symptoms in closer couples (Tower & Kasl 1995, 1996).

Exposure to a partner's disease-related pain can function as a potent stressor, influencing the spouse's physical and psychological health (Schulz et al. 2009). For example, spouses were adversely affected by witnessing their partner's pain; the spouse's blood pressure increased more in response to their arthritic partner's suffering than to a stranger's pain (Monin et al. 2010).

These studies illustrate how even close and satisfying relationships can have a clear downside. The very fact that spouses are close and happy means that one spouse's mental or physical health problems are more likely to impact their partner, perhaps because they spend more time together, the spouse engages their ill partner more willingly despite stressors, and the spouse connects more to their ill partner's suffering. Among prostate cancer patients and their wives, negative affect was heightened when couples managed daily stressors together, which underscores the risk of negative emotion transmission when both partners are closely involved (Berg et al. 2011). The closer the relationship, the greater the potential loss, and the greater the risk for the unimpaired partner's mental and physical health.

For many reasons, older adults are at greatest risk when a spouse is ill. Older adults typically put more time and energy into close personal relationships rather than broader social networks (Charles & Carstensen 2010), and thus, partner functioning has a greater impact than among younger people. Among older couples, trajectories of social activity are interrelated, strengthened by the partner's cognitive, physical, and affective resources (Hoppmann et al. 2008). Concordance is likely to be greater in longer-term marriages; couples have learned to function as a team throughout their history of joint experiences (Gerstorf et al. 2009). Compared to younger adults, older adults' marriages are typically closer (Hoppmann & Gerstorf 2009). Older couples in longer-term marriages have survived many challenges during their decades-long history of shared experiences and joint roles, such as parenthood (Hoppmann & Gerstorf 2009). This interdependence can be problematic when adverse changes arise for one partner (Gerstorf et al. 2009). Greater spousal closeness when facing one partner's health crisis may thus spread poorer health, particularly among older couples.

MARITAL SUPPORT AND CAPITALIZATION

Certainly, the pathways linking marital processes to health are complex. Although partners may expose each other to health risks via shared health behaviors and emotion transmission, they may also positively influence health outcomes by exchanging support.

On one hand, a spouse's support and encouragement may lessen symptoms in their partner. Arthritis patients whose partners had more confidence in their illness management improved more in their physical function, disease severity, and activity levels compared with those with less confident spouses, in part through increases in partners' empathic responses to patient pain (Gere et al. 2014, Hemphill et al. 2016). Arthritis patients who were more satisfied with their spouse's behavior had lower pain ratings than patients whose spouses offered less satisfying support (Holtzman & Delongis 2007).

On the other hand, support that inadvertently undermines independence and self-efficacy to maintain healthy behaviors can have poor health consequences. For example, male osteoarthritis patients reduced their physical activity on days when wives pressured them to be more active (Martire et al. 2013b). Patients who received more unwanted spouse support reported worse arthritis management (Martire et al. 2002). Support delivered in a critical, controlling, or coercive way can also have negative results: A diary study found that on days when spouses used coercion in the absence of encouragement, type 2 diabetes patients were less physically active (Khan et al. 2013).

In addition to influencing health behaviors, partner support may directly alter physiological reactivity to stressors. For instance, people who received more encouragement and validation from their partner after a stressor experienced faster reductions in cortisol levels than those who were met with less sensitive and more hostile responses (Meuwly et al. 2012). In a neuroimaging study, neural reactions to a painful stimulus were less pronounced when participants held their spouse's hand instead of a stranger's, and maritally satisfied wives who held their husband's hand reacted even less than dissatisfied wives (Coan et al. 2006).

Beyond the effects of discrete support behaviors, perceiving one's spouse as generally responsive may confer health benefits. Perceived partner responsiveness—the extent to which people feel that their partner understands, cares for, and validates them—has emerged as a predictor of health in recent studies. For example, higher mortality rates were associated with having received more emotional support from the partner among those who described their partner as low on responsiveness (Selcuk & Ong 2013). Conversely, when patients described their partner as very responsive, they were protected from the mortality risk associated with higher levels of support from their partners. Likewise, in a representative sample of 1,078 married or cohabiting adults, greater perceived partner responsiveness at baseline was related to higher awakening cortisol and steeper diurnal cortisol slopes, but not to total cortisol production 10 years later (Slatcher et al. 2015). However, a prospective study of osteoarthritis patients found that perceived partner responsiveness did not explain improvements in postsurgical knee recovery associated with partner support (Khan et al. 2009). Understanding the interplay of support behaviors and the general impressions that shape their interpretation represents a promising avenue for future work.

Spouses' responses to positive events, or capitalization support, should also be further examined as a candidate mechanism of marriage's health effects. Among romantic partners in a lab study, partners' supportive responses increased positive emotions and facial expressions but not skin conductance responses (Monfort et al. 2014). Future studies might expand the range of physiological outcomes to determine the scope of capitalization's effects.

GENDER INFLUENCES

We have focused on depression as a key pathway between marital distress and health. In this context, the consistent finding that women have higher rates of depression than men has multiple

implications for marriage-related health outcomes. As described earlier, depression has close ties to inflammation (Kiecolt-Glaser et al. 2015a); this link may be particularly relevant to women for several reasons. First, inflammation-induced mood and behavior changes appear to be more prominent among women than men. For example, women respond to transient elevations in inflammation with stronger feelings of loneliness and social disconnection than men do, a characteristic that likely contributes to the 2:1 ratio of women to men in depressive disorders (Moieni et al. 2015). Additionally, prior depression, somatic symptomatology, interpersonal stressors, childhood adversity, obesity, and physical inactivity are all factors that elevate inflammation, and women have disproportionately higher representation than men have in each of these domains (Derry et al. 2015). Relationship-related distress has stronger ties to inflammation among women than men (Derry et al. 2015), and the relationship between depression and marital quality is stronger among women than men (Whisman 2001). Accordingly, there are multiple reasons to believe that these gender-related differences in depression lead to greater health risks for women than for men in marriage.

Some evidence suggests that husbands' cognitive functioning can predict changes in wives' cognition, but not the reverse (Gerstorf et al. 2009, Strawbridge et al. 2009). One hypothesis used to explain this unidirectional effect suggests that the wife's greater time demands would lead her to curtail activities that provide cognitive stimulation in favor of more time at home (Gerstorf et al. 2009).

Auditory and visual impairments become increasingly prevalent with age. Hearing impairments in one spouse also affect the partner's health and well-being. Spouses experienced hearing loss like they experienced cognitive decline: Wives were more negatively affected by their husbands' hearing loss than vice versa (Wallhagen et al. 2004).

Vision impairments can lead to communication problems and, more broadly, difficulties with psychosocial functioning (Strawbridge et al. 2007). In longitudinal data with older adults from the Alameda County Study, impaired vision in one spouse adversely impacted his or her own depression, physical functioning, and well-being, and the partner's data showed negative changes on these same dimensions. After adjusting for the impact of one's own visual impairment, the spousal consequences for physical functioning, depression, and well-being were greater among wives than husbands (Strawbridge et al. 2007).

Within the dementia caregiving literature, spousal caregivers' stress has been well documented. Women suffer greater adverse effects when caregiving for a husband with dementia than men experience when they become caregivers (Hagedoorn et al. 2001). Although such intensive caregiving substantially increases health risks (Glaser & Kiecolt-Glaser 2005), the data reviewed above suggest that even nondisabling conditions can raise the stakes.

A meta-analysis of distress in couples coping with cancer reported a moderate correlation of 0.29 between patients and partners. Nonetheless, regardless of whether they were the person with cancer or the person's partner, women consistently reported greater distress than men (Hagedoorn et al. 2008).

Husbands' high blood pressure and stroke history were related to higher levels of depressive symptoms among their wives; however, wives' health problems were not related to husbands' depressive symptoms (Ayotte et al. 2010).

Similarly, among a community-based sample of 995 older couples in which neither, one, or both partners had a chronic disease, a woman's psychological distress was linked with both her own and her husband's condition, whereas a man's distress was related only to his own health (Hagedoorn et al. 2001). Moreover, even though male patients reported fewer physical problems than female patients, husbands' health status augmented wives' distress, but wives' health problems did not increase husbands' distress.

Individuals with chronic pain often rate their pain and disability differently than their partners do. Women's perceptions of their husbands' thoughts and feelings better matched husbands' responses compared to husbands' ratings of wives' thoughts and feelings (Cano et al. 2005).

These findings echo the gender differences we have highlighted previously (Kiecolt-Glaser & Newton 2001). As discussed elsewhere, past studies show that a wife responds more to her husband's chronic illness than vice versa, and this greater influence means that wives are also more likely to be affected (Berg & Upchurch 2007). However, the origin of this gender-based vulnerability is unclear; this area of research must continue to be reevaluated as new cohorts of couples marry and divorce and as the demographic face of marriage evolves (Amato et al. 2007, Cherlin 2010).

EMERGING PATHS FROM MARITAL DISTRESS TO HEALTH: SLEEP AND METABOLIC CHANGES

Marital Discord and Sleep

Poor sleep contributes to cardiovascular disease, cancer, obesity, diabetes, and premature death (Cappuccio et al. 2010, Consens. Conf. Panel et al. 2015) (**Figure 2**). Though married people sleep better than single people on average (Chen et al. 2015), marital discord jeopardizes sleep quality and quantity (Chen et al. 2015, Troxel et al. 2009). Those in more strained marriages report greater insomnia than their happily married counterparts report (Chen et al. 2015, Troxel et al. 2009), and they experience increased sleep disturbance over time. For instance, unhappily married older adults' sleep problems worsened across four years (Yang et al. 2013). More destructive and less constructive conflict spurred declines in actigraphy-assessed sleep quality and duration over one year (El-Sheikh et al. 2015). These deficits also emerge in daily life: On days when couple interactions were more negative, women experienced worse actigraphy-assessed sleep that night (Hasler & Troxel 2010). Moreover, the sleep-disruptive effects of marital discord are contagious; husbands' poorer sleep also followed wives' reports of greater marital tension (Hasler & Troxel 2010).

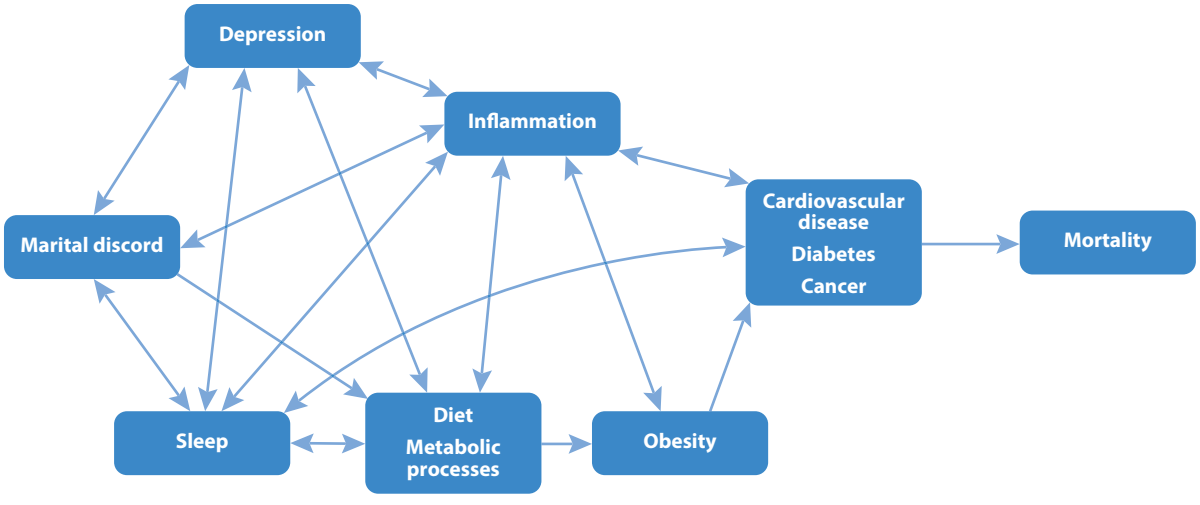

Figure 2

Model that links marital discord to chronic illness and mortality through emerging mechanisms, including sleep, diet, metabolic processes, and obesity.

The link between marital discord and sleep exhibits a dose-response relationship: More pernicious conflict elevates the risk for sleep disturbance. Divorced victims of intimate partner violence suffered worse lingering sleep problems than did unvictimized divorcees, and those who experienced prolonged aggression slept even worse than women subjected to less frequent violence (Newton et al. 2016).

A marital therapy intervention produced mixed effects for couples' insomnia symptoms (Troxel et al. 2016). Though therapy improved marital satisfaction in both partners compared to no-treatment controls, only husbands' risk for insomnia lessened three months later, and this satisfaction-related sleep benefit arose irrespective of treatment. Thus, marital discord is strongly established as a predictor of sleep, but no clear evidence shows that relieving discord resolves sleep problems.

Beyond direct conflict and discord, exposure to one's partner's stressors impacts sleep. As described earlier, partners slept worse on days when osteoarthritis patients had more severe pain, particularly those who felt close in the relationship (Martire et al. 2013a). For patients, negative mood led to worse sleep when partners responded to pain in hostile or overzealous ways (Song et al. 2015). On the other hand, leveraging relationship resources may protect against stress-related sleep problems. For instance, on days when couples disclosed their feelings they enjoyed better sleep and fewer negative-mood-related sleep disruptions at night (Kane et al. 2014).

Bidirectional Exacerbation: Poor Sleep Induces Conflict

Sleep loss and poor sleep intensify conflict. In a diary study, when men slept more poorly they reported more negative partner interactions the next day (Hasler & Troxel 2010). Likewise, couples who slept poorly over 14 nights reported more daily conflict with their partners than those with better sleep quality (Gordon & Chen 2014). Worse sleep also translated into more negative affect and less positive affect during a marital problem discussion; moreover, partners were less able to accurately assess their emotions or those of their partner. These data show that one partner's poor sleep affects not only their own mood and empathic accuracy but also the partner's affect and empathic accuracy. Yang et al. (2013) found that more sleep problems at baseline related to lower marital quality four years later. Thus, the bidirectional links between marital discord and sleep disturbance foster a positive feedback loop wherein discord-induced sleep problems exacerbate conflict that can lead to longer-term marital dysfunction.

Depression as a Key Sleep Pathway

Marital distress elevates risk for depression (Whisman 1999) and predicts increased symptomatology over time (Whisman & Uebelacker 2009). Accordingly, depression represents a key pathway from marital conflict and distress to disturbed sleep, a cardinal symptom of depression. In a longitudinal study, depressive symptoms explained conflict-related declines in sleep quality and duration (El-Sheikh et al. 2015). A known risk to partners' psychological well-being (Benazon & Coyne 2000), depression also predicted worse sleep problems for partners one year later (El-Sheikh et al. 2015, Revenson et al. 2016).

In turn, sleep loss stimulates production of proinflammatory cytokines and cellular inflammatory signaling, thus facilitating depression (Irwin 2015). Heightened inflammation feeds back to dysregulate sleep (Lopresti et al. 2013). In this way, marital discord activates a synergistic cascade of depression, sleep disturbance, and inflammation that heightens risk for comorbidities and death.

In addition to its important inflammatory consequences, insufficient sleep also alters appetite regulation and food choice (Bayon et al. 2014). Thus, it is not surprising that poor sleep has also been associated with obesity and the metabolic syndrome (Bayon et al. 2014).

MARITAL PATHS TO OBESITY AND ITS COMORBIDITIES

Depression and stress promote obesity (Raikkonen et al. 2007, Williams et al. 2009, Luppino et al. 2010). Depressed people have a 58% increased risk of becoming obese (Luppino et al. 2010). In addition, a large prospective study showed that older depressed adults gained visceral fat over five years, while nondepressed adults lost visceral fat (Vogelzangs et al. 2008). Stressful events have also been associated with weight gain and adiposity (Block et al. 2009, Sinha & Jastreboff 2013); longitudinal studies suggest that chronic stress and stressful life events enhance the development of the metabolic syndrome, which has central obesity as its cornerstone (Chandola et al. 2006, Kyrou et al. 2006, Raikkonen et al. 2007, Troxel et al. 2005). These data have clear implications for people in troubled marriages because of the strong ties between marital discord and depression (Beach 2014).

Marital distress and depression can alter neurochemistry, neurobiology, and behavior, providing multiple pathways for obesity-related metabolic alterations. For example, both depression and marital distress can elevate cortisol production (Kiecolt-Glaser et al. 1996). Higher cortisol fosters increased intake of calorie-dense comfort foods, and insulin secretion rises as cortisol increases (Dallman 2010). Persistent hypercortisolemia and higher insulin enhance visceral fat accumulation (Dallman 2010, Vogelzangs et al. 2008). Furthermore, marital distress can alter production of ghrelin, an appetite-stimulating hormone that promotes food intake (Jaremka et al. 2015).

A recent study from our lab examined the impact of marital conflict on couples' metabolic responses to high-fat meals (Kiecolt-Glaser et al. 2015c). Metabolic processes that influence weight regulation and fat storage were a central focus. Resting energy expenditure plays a key role in energy balance and weight control, accounting for 65% to 75% of total daily energy expenditure; lower daily energy expenditure increases risk for weight gain (Lara et al. 2010). Higher levels of insulin stimulate food intake and visceral fat accumulation (Dallman 2010).

Our double-blind, randomized crossover study included serial assessments of resting energy expenditure, insulin, and glucose before and after two high-fat meals during two separate 9.5-h visits. Couples discussed a marital disagreement during both visits; behavioral coding of these interactions provided data on hostile marital behaviors.

When combined with a mood disorder history, men and women who had more hostile marital interactions had lower postmeal energy expenditure, and this disparity was clinically meaningful: The cumulative 6.75-h total translates into 128 kcal, a difference that could add 7.6 pounds/year for women and 7.7 for men, based on weight change prediction models that incorporate metabolic adaptation. In addition to energy expenditure, higher levels of hostile behaviors among those who had a mood disorder history were also associated with higher postmeal insulin compared with other participants. Higher insulin levels stimulate food intake and visceral fat accumulation (Dallman 2010), and thus can act in tandem with lower energy expenditure to promote obesity. These data complemented and extended an earlier study in which women who reported more recent stressors had lower energy expenditure and fat metabolism and greater insulin production following the same high-fat, fast-food-type meals (Kiecolt-Glaser et al. 2015b). Our data also dovetail with a recent paper showing that chronic stress was associated with diet-related abdominal fat and insulin resistance in postmenopausal women (Aschbacher et al. 2014).

Dining with one's partner is a common daily event, and marital discord and other stressors contribute to poorer diet quality because they enhance the likelihood that people will turn to

calorie-dense, high-fat comfort food (Jaremka et al. 2015, Kiecolt-Glaser 2010, Tomiyama et al. 2011). Prospective studies have linked healthier diets (typically Mediterranean-style) with a lower risk for depression as well as lower inflammation, compared to less healthy, Western diets (Kiecolt-Glaser et al. 2015a). Both of our study meals had 930 kcal and 60 g fat, as they were designed to mimic common fast food options. For example, a Burger King Double Whopper with cheese has 990 kcal and 64 g fat, and a Big Mac cheeseburger and medium French fries together contain 930 kcal and 58 g fat. Thus, the metabolic changes that we observed likely occur with high frequency in response to common meal choices.

The marital relationship is typically a person's most significant adult relationship, and thus a troubled marriage is uniquely stressful, providing regular acute stressors, such as disagreements, that heighten chronic relationship stress. Distressed families experience roughly twice as many tensions per day as nondistressed families (Margolin et al. 1996). Moreover, distressed couples are more likely to have continuing conflicts that recur in well-established patterns at the same time on subsequent days—and meals provide prime opportunities for these ongoing disagreements (Margolin et al. 1996).

Metabolic Syndrome

Metabolic syndrome, diagnosed using the National Cholesterol Education Program criteria, includes mild dyslipidemia, central adiposity, hypertension, and insulin resistance/hyperglycemia (Troxel et al. 2005). This cluster represents characteristics that, individually, have associations with increased cardiovascular disease and diabetes risk (Whisman & Uebelacker 2012).

Women who reported greater marital satisfaction were at significantly lower risk for developing metabolic syndrome over a period of 11.5 years, compared to women who were maritally dissatisfied or those who were unpartnered (single, widowed, or divorced) (Troxel et al. 2005). Indeed, maritally dissatisfied women were more than three times as likely to develop metabolic syndrome compared to those women who were in higher-quality marriages, even after controlling for age, demographic characteristics, and psychosocial and behavioral risk factors.

Subsequent work in a cross-sectional sample confirmed that marital distress was associated with a greater likelihood for meeting metabolic syndrome criteria in women but not men (Whisman et al. 2010). When these authors examined four-year follow-up data, they found that the magnitude of the association between marital distress and a metabolic syndrome diagnosis was substantially greater for women than men; additionally, when husbands reported marital distress at baseline, wives were more likely to meet criteria for metabolic syndrome four years later (Whisman & Uebelacker 2012).

Further work that used a couples structural equation model with metabolic syndrome components concluded that marital quality for both husbands and wives was associated with metabolic syndrome only through depressive symptoms, not by itself directly (Henry et al. 2015). These data contrast with the earlier work showing that marital distress independently predicted metabolic syndrome in women but not men (Troxel et al. 2005, Whisman et al. 2010, Whisman & Uebelacker 2012). However, the prior studies used a dichotomous metabolic syndrome classification, as well as different measures for depressive symptoms, and these factors could have accounted for the differences in the findings.

Diabetes

Diabetes is the fastest-growing chronic health problem in the United States and is the seventh leading cause of death (Liu et al. 2016). Diabetes care requires daily management, and thus, adherence may be affected by the spouse's behavior, either directly, through encouragement of

a healthier diet and exercise, or indirectly, through interdependent couple behaviors, such as sharing meals. Marital discord can heighten important risk factors for diabetes, including metabolic syndrome and inflammation.

Two studies have addressed marital quality and diabetes prevalence in population-based samples, and they arrived at divergent conclusions. Using data from the Health and Retirement Study, Whisman et al. (2014) reported that husbands' decreased frequency of positive marital interactions and increased frequency of negative exchanges were linked with a higher prevalence of diabetes, but no effects were found for wives. In contrast, Liu et al. (2016) found that women who reported increased positive marital quality over time had a reduced risk for diabetes; however, men who reported increased negative marital quality over time had better outcomes. For the latter study, which used two waves of data from the National Social Life, Health, and Aging Project, the authors suggested that the somewhat counterintuitive data from men might reflect wives' attempts to regulate husbands' health behaviors.

When one spouse has metabolic syndrome, his or her spouse has roughly a 30% greater chance of also having metabolic syndrome (Kim et al. 2006). When one partner has a history of diabetes or prediabetes, the other's risk for diabetes increases twofold (Leong et al. 2014). Future work that addresses marital quality and marital closeness could provide more nuanced information about convergence that would enhance treatment recommendations to lower partners' risks for diseases such as diabetes and metabolic syndrome.

TREATMENT IMPLICATIONS

Just as one partner's health problems risk the other's health and well-being, leveraging couples' interconnectedness stands to promote both partners' health. This so-called relative benefit (Martire 2005) has been demonstrated for psychological and medical diagnoses and across intervention techniques.

As noted earlier, marital distress has strong ties with depression, both cross-sectionally and longitudinally. An excellent literature review (Whisman & Baucom 2012) describes how depressed people in distressed relationships have poorer outcomes following both psychopharmacological and individual-based treatments than those in nondistressed marriages, and relationship distress predicts depression relapse. Additionally, individual-based treatments typically do not lessen marital distress, leading to poorer outcomes than couple-based treatments.

Precisely because marital distress appears to be a potent correlate of health risk factors, the couples who do benefit substantially from marital therapy might also experience notable reductions in health risks. Importantly, treating marital distress can lower healthcare service utilization and associated costs. A comparison of healthcare utilization patterns before and after marital or family therapy showed a 21.5% reduction in medical visits; in contrast, people who received individual therapy had a 10% decrease, and comparison group participants who received no therapy increased utilization by 12.2% (Law & Crane 2000). Diminished reactivity to couple conflict may be one biological mechanism that leads to a reduced need for medical services. For example, two effective couple therapies downregulated arousal to couple conflict via vocal stress (Baucom et al. 2015). Also, enhancing positive communication through preventive relationship education reduced cortisol reactivity to couple conflict but not to an individual stress task (Ditzen et al. 2011).

A meta-analysis of couple-based interventions for chronic illness concluded that couple interventions improved marital functioning and reduced patient depressive symptoms and pain to a greater extent than either patient-based psychosocial interventions or usual care (Martire et al. 2010). Although all effect sizes were small, none of the reviewed studies used spouse support or distress as a criterion for treatment, and this likely attenuated the effect sizes.

CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE WORK

Intimate relationships play a central role in most people's lives. Spouses influence each other's developmental trajectories and outcomes. As a consequence, health-related marital processes can be conceptualized as mutual influences on health behaviors, stress reactivity, happiness, and depression. Future research that addresses links between spouses' well-being and morbidity and mortality would profit from a greater emphasis on partner associations (Hoppmann et al. 2011a).

The greater risk associated with marital distress among women compared to men is a clear and compelling theme in concordance studies, just as it is in marital interaction studies (Kiecolt-Glaser & Newton 2001), but a meta-analysis did not find gender differences (Robles et al. 2014). At a demographic level, cohabiting same-sex couples have reported poorer health than their different-sex married counterparts and, after adjusting for socioeconomic status, also fared worse than different-sex cohabitors (Liu et al. 2013). It remains unknown whether marital processes for same-sex couples are similar and if they confer similar health risks and benefits. Studies of men and women in same-sex and different-sex couples will help to untangle the roles of gender and sexual orientation in relationships' health effects (Umberson & Kroeger 2016).

One partner's distress or depression can provoke similar emotional responses in their partner as a function of their shared environment and history, interaction patterns, and emotional contagion (Schulz et al. 2009). People with a history of depression experience more major and minor stressors than those without a similar history, and past depression can also boost emotional reactivity to stressors, including relationship stressors (Hammen 1991, Husky et al. 2009). Both currently and formerly depressed men and women had poorer family functioning than those who had no depression history, even years after their depression had remitted (Herr et al. 2007). A history of depression may index a high-risk phenotype, and marital conflict is a stressful context that provokes a coordinated physiological response. Accordingly, a past or current mood disorder could act synergistically with marital stress through multiple pathways. Indeed, depression alters inflammation-relevant health behaviors, including sleep, physical activity, alcohol and drug use, smoking, and diet (Kiecolt-Glaser et al. 2015a).

In addition to mood contagion, couples also transmit health behaviors, including sleep, exercise, and diet quality, to one another, and these can converge in a common path to promote shared risks for obesity, metabolic syndrome, and diabetes (Franks et al. 2002, Meyler et al. 2007). When marital stressors worsen sleep, they also dysregulate leptin and ghrelin, key appetite hormones that regulate energy balance and food intake (Spiegel et al. 2004). In turn, alterations in leptin and ghrelin stimulate interest in unhealthy foods, and they can induce overeating (Spiegel et al. 2004). Poor sleep has also been associated with obesity and metabolic syndrome (Bayon et al. 2014). Thus, how couples' mutual influences spur synergistic relationships between sleep and metabolic processes warrants further study.

Obesity has been characterized as a state of chronic inflammation. What is more, the pathways are bidirectional; visceral adipose tissue's secretion of proinflammatory cytokines can function as a stimulus for hypothalamic–pituitary–adrenal axis activation, such that hypercortisolemia enhances adipocyte accumulation, and vice versa (Kyrou et al. 2006). Inflammation is a robust and reliable predictor of all-cause mortality in older adults, in addition to its association with multiple diseases of aging (Ershler & Keller 2000, Kiecolt-Glaser et al. 2002).

Stronger parasympathetic function has been linked with lower inflammation, and one novel study showed that more satisfied couples had stronger parasympathetic coregulation during structured lab tasks than less satisfied couples; this intriguing study suggests another potential route to marriage-related health benefits (Helm et al. 2014). Marital interaction studies with physiological assessments have provided solid, mechanistic evidence of how marital functioning can have direct

consequences for cardiovascular, metabolic, endocrine, and immune function, but few have looked at coregulation across various physiological indices, a promising future direction.

Considerable evidence has linked the quality of the marital relationship to health outcomes ranging from intracellular signaling to mortality (Kiecolt-Glaser et al. 2010). Marriage can protect and promote health by buffering stress reactivity and encouraging healthy behavior. However, closer relationships also facilitate stress transmission (Larson & Almeida 1999), and thus marital satisfaction and closeness can have a clear downside when one partner has mental or physical health problems. In higher-quality marriages, a partner's illness may put the spouse at risk for accelerated aging (Hoppmann & Gerstorf 2009). A better understanding of how interdependent development provides both gains and losses will help illuminate the risks and benefits of couples' relationships.

SUMMARY POINTS

1. There is considerable interdependence between partners' health.
2. Partners' mutual influences may introduce health risks or benefits.
3. The physiological cascade from marriage to health consists of bidirectional mechanisms; therefore, couples' health risks can be synergistic.

FUTURE ISSUES

1. Thoughtfully designed studies should reconcile the risks of convergence with health benefits of a good relationship.
2. Research must further investigate the processes by which couples are buffered from convergence-related decline.
3. How couples' mutual influences spur synergistic relationships between sleep and metabolic processes warrants further study.
4. Few studies have looked at coregulation across various physiological indices, a promising future direction.
5. The roles of gender and sexual orientation in relationship processes and health convergence must be better understood.
6. Further empirical work must determine the best methodological practices for estimating partners' trajectories of interdependence on different time scales.

DISCLOSURE STATEMENT

The authors are not aware of any affiliations, memberships, funding, or financial holdings that might be perceived as affecting the objectivity of this review.

ACKNOWLEDGMENTS

Work on this review was supported in part by National Institutes of Health grants K05 CA172296, R01 CA186720, R01 CA186251, and T32 DE014320, as well as a Pelotonia Postdoctoral Fellowship from the Ohio State University Comprehensive Cancer Center.

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