

Intimate Relationships, Individual Adjustment, and Coronary Heart Disease: Implications of Overlapping Associations in Psychosocial Risk

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Being married or involved in a similar intimate relationship is associated with reduced risk of coronary heart disease (CHD). However, the quality of these relationships matters, as strain and disruption are associated with increased risk. These effects are typically studied separately from well-established psychosocial factors for CHD that are aspects of personality and emotional adjustment, even though discord and disruption in intimate relationships are related to these same individual characteristics. Thus, research to date tends to parse correlated risks, often taking a piecemeal approach by focusing on intimate relationships without considering aspects of personality and emotional adjustment that contribute to risk and protection, or focusing on individual-level risks while largely ignoring closely related health-relevant relationships. As an alternative, this article describes an integrative approach, first reviewing associations of the quality of intimate relationships with personality characteristics and aspects of emotional adjustment that confer CHD risk, and then discussing conceptual models of these associations and the biobehavioral mechanisms linking them with CHD. Current approaches to couple interventions are then discussed, including those that have a combined focus on intimate relationship difficulties and emotional adjustment. An integrative agenda for future research emphasizes aggregated risks, combining concepts and methods in current relationship science with those in biobehavioral research on CHD, and including parallel disparities in relationship functioning, emotional adjustment, and CHD risk. Such efforts could ultimately inform empirically based assessments and interventions for interrelated aspects of individuals and their intimate relationships that influence the development and course of CHD.

Keywords: coronary heart disease, psychosocial risk, couples, intimate relationships

Coronary heart disease (CHD) is the leading cause of death globally, each year taking the lives of more men and women in the United States than any other cause (American Heart Association [AHA], 2015). Biologic and behavioral risk factors are key targets in addressing CHD, such as smoking, hypertension, elevated blood lipids and glucose, dietary fat and caloric intake, and inactivity. But a large body of research attests to the importance of psychosocial factors. Specifically, qualities of personal re-

lationships, features of social environments, and aspects of emotional adjustment and personality predict the development and course of CHD (Step toe & Kivimäki, 2013). This research has important applications, as psychosocial interventions are useful in the clinical management of CHD (Blumenthal et al., 2016; Rutledge, Redwine, Linke, & Mills, 2013).

Intimate relationships are a central element of psychosocial risk for CHD. Being married or involved in a similar relationship generally reduces risk (Eaker, Sullivan, Kelly-Hayes, D'Agostino, & Benjamin, 2007; Floud et al., 2014), but the quality of relationships also matters, as discord and disruption increase CHD risk (Robles, Slatcher, Trombello, & McGinn, 2014). In the current science of relationships and physical health more broadly, studies of associations of various aspects of intimate relationships with the development and course of CHD comprise a major portion of the available evidence.

This article discusses an important limitation in research on intimate relationships and CHD, one that is relevant to the current science of relationships and health generally.

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Intimate relationships as CHD risk factors are typically studied separately from the effects of personality and emotional adjustment on CHD incidence and course. Yet, relationship discord and disruption are closely related to these same aspects of personality and emotional adjustment (Proulx, Helms, & Buehler, 2007; Malouff, Thorsteinsson, Schutte, Bhullar, & Rooke, 2010; Roberts, Kuncel, Shiner, Caspi, & Goldberg, 2007). Thus, most approaches to intimate relationships as risk factors largely ignore aspects of personality and emotional adjustment that both influence this essential social context and confer CHD risk. Conversely, studies of personality and emotional adjustment as CHD risk factors generally ignore personal relationships. It is as if researchers represent separate schools of portrait and landscape painting. Some emphasize the relational landscape, paying little attention to the figure of individual personality and emotional adjustment. Others emphasize that often compelling figure, while paying scant attention to the surrounding landscape of intimate relationships. As a result, relationship studies that find associations of landscape features with CHD and individual-level studies that find associations involving emotional or personality characteristics may be unwittingly describing facets of the same larger, interconnected pattern and process of risk.

This article also outlines a more integrative approach. Theory, research, and interventions can address CHD risk more comprehensively by focusing on *both* the relational *landscape* and the *figure* comprising individual-level risk factors that this landscape surrounds. A previous presentation of this approach described how research on personality and emotional adjustment as CHD risk factors would benefit from considering overlapping aspects of intimate rela-

tionships (Smith, Baron, & Grove, 2014). This article presents the flip side of that argument; efforts to understand and alter effects of intimate relationships on CHD and physical health more broadly will benefit from consideration of correlated aspects of personality and emotional adjustment. These issues are important for researchers and clinicians working on the vast public health challenge posed by CHD. But given its prevalence, many other professional psychologists provide services to individuals or couples facing the risk or reality of CHD, as a quarter of Americans live with some form of cardiovascular disease and approximately half of middle-aged men and a third of middle-aged women will develop CHD in their lifetime (AHA, 2015).

Psychosocial Risk for Coronary Heart Disease

Clinically apparent CHD (e.g., myocardial infarction) reflects later stages of a decades-long progression of coronary atherosclerosis. First seen in childhood or adolescence, this disease begins at different ages and progresses at different rates depending on risk factors (Libby, Ridker, & Hansson, 2011), becoming clinically apparent when it disrupts blood flow to the heart (i.e., myocardial ischemia). Hence, risk factors can alter the development of atherosclerosis or later stages. Characteristics of intimate relationships, personality, and emotional adjustment can contribute to CHD through behaviors (e.g., smoking, physical activity), but current models emphasize physiological effects of stress, holding that psychosocial factors alter the frequency, magnitude and/or duration of such responses. These processes include sympathetic and parasympathetic cardiovascular responses, neuroendocrine reactivity, inflammation, mobilization of plasma lipids, and changes in blood platelet aggregation (Steptoe & Kivimäki, 2013). Here we emphasize psychosocial risk factors supported by systematic reviews and meta-analyses.

Social Support and the Special Case of Intimate Relationships

In quantitative reviews, isolation and low levels of social support predict development and adverse course of CHD (Barth, Schneider, & von Kanel, 2010; Valtorta, Kanaan, Gilbody, Ronzi, & Hanratty, 2016). Marriage and similar intimate relationships are a primary source of social connection and support, and in individual studies being married is associated with reduced risk of CHD development (e.g., Eaker et al., 2007; Floud et al., 2014) and better outcomes in established CHD (Dupre & Nelson, 2016; Floud et al., 2014; Idler, Boulifard, & Contrada, 2012; King & Reis, 2012).

Beyond low support, disruption of marriage and similar intimate relationships confers CHD risk. Divorce predicts all-cause mortality in quantitative reviews (Sbarra, Law, &



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Portley, 2011), and in individual studies divorce predicts asymptomatic coronary atherosclerosis (Smith, Uchino, et al., 2011), greater risk of emergence of clinically apparent CHD (Dupre, George, Liu, & Peterson, 2015; Matthews & Gump, 2002), and adverse medical course (e.g., reduced survival) in CHD patients (Dupre & Nelson, 2016; Kilpi, Kontinen, Silventoinen, & Martikainen, 2015).

Further, a systematic review and meta-analysis found that low marital quality confers increased risk of subsequent cardiovascular disease, primarily CHD (Robles et al., 2014). In individual studies, greater conflict, worries, and demands in cohabiting relationships (i.e., married and nonmarried couples) predict incident CHD (De Vogli, Chandola, & Marmot, 2007; Lund, Rod, Thielen, Nilsson, & Christensen, 2014), severity of atherosclerosis (Gallo et al., 2003; Joseph, Kamarck, Muldoon, & Manuck, 2014; Wang et al., 2007), and poor clinical outcomes (e.g., recurrent coronary events, reduced survival) in CHD patients (Idler et al., 2012; King & Reis, 2012; Orth-Gomer et al., 2000). Observer ratings of discordant behavior during marital conflicts predict coronary artery disease severity in healthy couples (Smith, Uchino, et al., 2011). Hence, the presence and quality of personal relationships in general predict CHD development and course, a pattern also evident in the specific context of intimate relationships.

Personality and Emotional Adjustment

In quantitative reviews trait anger and hostility predict CHD development and course (e.g., Chida & Steptoe, 2009). In individual studies a dominant and controlling interpersonal style predicts CHD, independently of anger

and hostility (e.g., Houston, Chesney, Black, Cates, & Hecker, 1992), and subsequent studies have replicated its independent association with CHD (Siegman et al., 2000) and coronary artery disease severity (Smith et al., 2008). In quantitative reviews depressive symptoms and disorders predict CHD development (Gan et al., 2014) and an adverse course (e.g., reduced survival) among CHD patients (Meijer et al., 2013), as do self-reported stress (Richardson et al., 2012) and anxiety symptoms and disorders (Edmondson, Kronish, Shaffer, Falzon, & Burg, 2013; Roest, Martens, de Jonge, & Denollet, 2010). However, effects of anxiety on CHD course are somewhat weaker (Celano et al., 2015). Such negative affective characteristics reflect the broad trait and symptom domain of neuroticism and distress disorders (Barlow, Sauer-Zavala, Carl, Bullis, & Ellard, 2014), consistent with the view that negative affectivity confers CHD risk (Suls & Bunde, 2005). Finally, optimism, subjective well-being, and conscientiousness confer reduced risk (Boehm & Kubzansky, 2012; Cohen, Bavishi, & Rozanski, 2016; Jokela, Pulkki-Råback, Elovainio, & Kivimäki, 2014).

The Social-Environmental Context of CHD Risk

These aspects of individuals and their relationships occur in a broader context that also confers risk. Low socioeconomic status (SES; Clark, DesMeules, Luo, Duncan, & Wielgosz, 2009) and job stress predict CHD (Kivimäki et al., 2013; Xu et al., 2015), and both correlate with lower marital quality (Neppl, Senia, & Donnellan, 2016; Repetti, Wang, & Saxbe, 2009; Roberts et al., 2007) and higher depression and hostility (Skodova et al., 2008; Theorell et al., 2015).

Association of Individual-Level CHD Risk Factors With Intimate Relationship Quality

Despite the typically separate examination of these CHD risk domains, qualities of intimate relationships and individual adjustment are interconnected. This general notion is supported in a substantial empirical literature and described in several conceptual models.

Empirical Evidence

In an extensive literature, depressive symptoms and disorders have a strong concurrent association with low marital quality, and initial marital conflict predicts later depression (Beach, 2014; Proulx et al., 2007). Anxiety symptoms and disorders (e.g., posttraumatic stress disorder) are also related to low marital quality (Pankiewicz, Majkovicz, & Krzykowski, 2012; Lambert, Engh, Hasbun, & Holzer, 2012). Further, the broader trait and symptom domain of negative affectivity or internalizing disorders predicts marital distress and divorce (Malouff et al., 2010; Roberts et al.,

2007). Anger, hostility, and related traits (e.g., antagonism) predict marital difficulties, as evident in self-reports of relationship quality (Baron et al., 2007; Malouff et al., 2010), divorce (Roberts et al., 2007), and behavior during marital conflict (Cundiff, Smith, & Frandsen, 2012).

Conversely, positive psychological attributes that confer reduced CHD risk are associated with higher quality intimate relationships. Optimism predicts lower conflict and higher support in intimate relationships (Assad, Donnellan, & Conger, 2007; Smith, Ruiz, Cundiff, Baron, & Nealey-Moore, 2013), and conscientiousness predicts better marital quality and a lower risk of divorce (Malouff et al., 2010; Roberts et al., 2007). Finally, life satisfaction and other aspects of subjective well-being are associated with better marital quality (Heller, Watson, & Hies, 2004).

Conceptual Models of Association and Risk

Several models describe associations of personality and adjustment with the quality of intimate relationships (e.g., Beach, 2014; Conway, Hammen, & Brennan, 2012; Hames, Hagan, & Joiner, 2013). Central among these is the

vulnerability-stress-adaptation model of marital adjustment (Karney & Bradbury, 1995), in which factors that are individual-level CHD risks (e.g., personality traits, emotional disorders) and others that are social-contextual risk factors (e.g., low SES, job strain) are seen as reciprocally related to intimate relationship processes.

The interpersonal perspective in personality and clinical psychology (Kiesler, 1996; Pincus & Ansell, 2013) provides the foundation for a detailed model of the interconnectedness of individual and relationship risk factors (Smith et al., 2014). In describing the association of emotional adjustment and personality with interaction patterns that give rise to marital quality, the transactional cycle (Kiesler, 1996) depicts covert or internal experiences as guiding overt behavior. Further, one actor's overt behavior influences the interaction partner's covert experience and subsequent overt behavior, in an ongoing cycle of mutual influence. An adaptation of this general view to risk for CHD is presented in Figure 1- the dyadic transactional cycle model (Smith et al., 2014). Characteristic internal experiences and overt behaviors are key

Dyadic Transactional Cycle and Coronary Risk

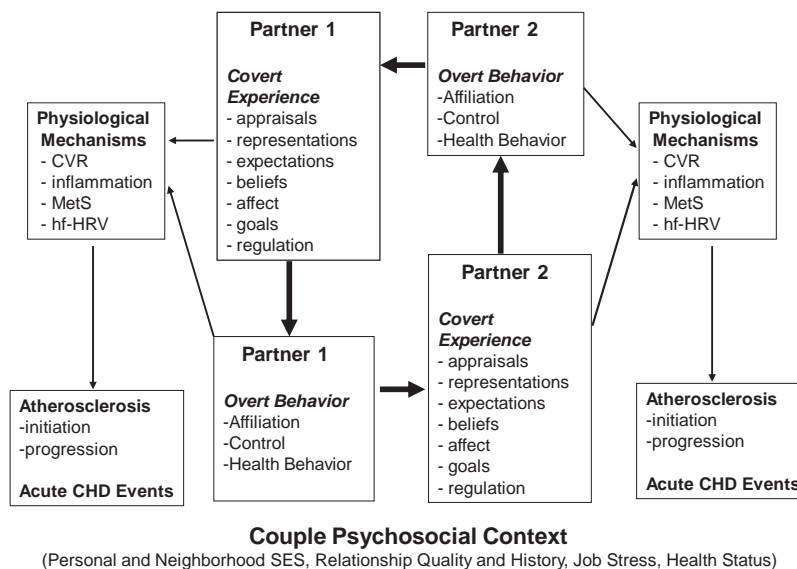


Figure 1. The dyadic transactional cycle model of individual-level and intimate relationship risk factors for coronary heart disease (CHD). Partners' internal or covert experiences and overt behavior, which are often reflections of personality and emotional adjustment, are reciprocally related, creating and maintaining positive (e.g., high warmth and support; low conflict, control, and neglect) or negative (e.g., high conflict, control, and neglect; low support and warmth) dyadic interactions and patterns of relationship quality. These behavioral patterns include health behaviors (e.g., diet, physical activity, sleep, adherence to medical regimens), and alter physiological processes (e.g., sympathetically mediated cardiovascular reactivity, parasympathetically mediated high-frequency heart rate variability) that influence the development and course of CHD. Recurring dyadic transactional patterns influence and are influenced by broader aspects of the couple psychosocial context that also influence CHD risk (e.g., socioeconomic status, job stress), and once developed, clinically apparent CHD becomes an important part of that potentially stressful couple context (adapted with permission from Smith, Baron, & Grove, 2014, Figure 4).

aspects of personality and emotional adjustment, and recurring patterns of couples' experience and behavior, in turn, are the immediate source or reflection of aspects relationship quality.

In interpersonal theory (Kiesler, 1996; Pincus & Ansell, 2013), behavior, appraisals, and motives vary along the dimensions of *affiliation* (i.e., warm and affectionate vs. cold and hostile) and *control* (i.e., dominant and directive vs. submissive and deferential). Both dimensions are included in relationship theory and research (e.g., Sanford & Wolfe, 2013), and blends of these dimensions are familiar in couples research, such as criticism and blame (i.e., hostile control), cooperation (warm deference), or supportive advice and encouragement (i.e., warm control). In interpersonal theory, variation in the initial actor's overt behavior along these dimensions tends to shape the other partner's reactions in specific ways. Warmth invites or evokes warmth in return, and hostility invites hostile partner responses. In this view, dominance invites deference, and deference invites dominance. Couple research confirms the prediction of reciprocity along the affiliation dimension, but dominance often evokes dominance in return, as in when control is contested (e.g., Cundiff, Smith, Butner, Critchfield, & Nealey-Moore, 2015). Given that individual-level CHD risk factors such as depression, anxiety, and anger are associated with hostile interpersonal behavior and protective factors such as optimism are associated with a warm style (Smith et al., 2013; Smith, Traupman, Uchino, & Berg, 2010), their associations with poor versus good intimate relationship quality are consistent with the theory.

As seen in Figure 1, one partner's behavior influences the internal experiences and overt actions of the other, with corresponding effects on the latter partner's physiology. For example, criticism and blame from a partner are typically experienced quite negatively, evoking defensive, angry, and quarrelsome responses, and increased physiological reactivity. In contrast, a partner's affection and warm support are experienced positively, evoking expression of warmth in return and reductions in unhealthy physiological responses and increases in protective physiological patterns. Experimental manipulations of marital conflict evoke physiological responses presumed to influence CHD (e.g., Nealey-Moore, Smith, Uchino, Hawkins, & Olson-Cerny, 2007; Smith et al., 2009), and measured marital quality predicts their magnitude (Robles et al., 2014). This research mostly examines sympathetically mediated cardiovascular and neuroendocrine responses, but negative marital interactions can also reduce salubrious parasympathetic responses (Smith, Cribbet, et al., 2011). Also, psychosocial risk factors such as posttraumatic stress disorder and trait hostility predict not only the individual's own physiological stress responses, but their partner's, as well (Caska et al., 2014; Smith, Uchino, Bosch, & Kent, 2014), consistent with the dyadic transactional cycle model in which one partner's personality

or emotional distress is a major component of the other's social context.

In the dyadic transactional model, couple processes also influence health behavior and adherence to medical regimens (e.g., Franks et al., 2006; Kronish, Rieckmann, Burg, Alcántara, & Davidson, 2014). Such mechanisms are important, given that exercise-based cardiac rehabilitation, adherence to prescribed medication, and changes in health behavior predict the course of CHD (Chow et al., 2010; Chowdhury et al., 2013; Rutledge et al., 2013). Finally, poor sleep predicts the development of CHD (Sofi et al., 2014), and the potentially dysfunctional couple processes depicted in the dyadic transactional model predict- and are predicted by- poor sleep (Hasler & Troxel, 2010).

Approaches to Interventions for Concurrent Intimate Relationship Difficulties and Emotional Distress

These transactional interconnections among relationship and individual-level risk factors raise the possibility of relationship-based interventions as a way to reduce broadly defined psychosocial risk for CHD. Such interventions could disrupt maladaptive transactional cycles and promote more adaptive patterns. There are a number of empirically supported interventions for intimate relationship difficulties generally, and for co-occurring couple and emotional distress (Baucom, Belus, Adelman, Fischer, & Paprocki, 2014). Despite differing theoretical underpinnings, these approaches generally include: changing partners' attributions for their relationship difficulties; reducing emotionally reactive, reciprocated hostility; decreasing emotion-based avoidance; enhancing positive behavioral cycles; and improving spouses' ability to use the preexisting relationship strengths (Benson, McGinn, & Christensen, 2012). Thus, effective couple therapy addresses key elements of maladaptive transactional cycles that can otherwise contribute to CHD.

Treatment for Couples With Co-Occurring Risks

There is considerable support for the efficacy of couple therapy approaches to treating depression and anxiety disorders (Baucom et al., 2014; Carr, 2014). Few couple approaches have specifically addressed personality factors that have been identified in CHD risk research. However, integrative behavioral couple therapy (Jacobson & Christensen, 1996) suggests that there are frequently sources of relationship distress, such as personality, where change may be limited. Integrative behavioral couple therapy includes acceptance-based strategies to help reduce emotional reactivity to these sources of distress and thereby interrupt and prevent maladaptive transactional cycles. Overall, the current general perspective of the couple intervention field is to

view relationship satisfaction, emotional adjustment, and personality as mutually influential, and, as a result, there are numerous interventions that could be adapted to address concurrent intimate relationship difficulties, emotional distress, and problematic personality processes.

Recent systematic reviews indicate that interventions for intimate partner involvement in medical care and health behavior change have beneficial effects on health, well-being, and adherence to medical regimens (Hartmann, Bätzner, Wild, Eisler, & Herzog, 2010; Martire, Schulz, Helgeson, Small, & Saghafi, 2010). Studies specifically focused on partner involvement in the care of CHD patients suggest that this approach improves exercise, medication adherence, and relationship quality, especially among more distressed couples (Sher et al., 2014). Although not directly focused on couple therapy interventions for relationship distress or its co-occurrence with individual-level risk factors (e.g., depression, anxiety), such studies underscore the potential value of such approaches. Evidence from meta-analyses (Rutledge et al., 2013) and subsequent randomized trials (e.g., Blumenthal et al., 2016) indicates that individually focused stress management and related interventions improve medical outcomes for CHD patients. Couple-focused treatments could be usefully adapted to address co-occurring individual-level and relationship risks in patient populations, as well as the physiologic and health behavior mechanisms underlying their associations with the course of CHD.

A Stepped Care Approach

Co-occurring individual-level and relationship risks are evident long before the clinical appearance of CHD, and the potential population for whom preventive services might be useful is vast. Traditional couple-based interventions are resource and time intensive, as clinicians treat one couple at a time over a period of weeks or months. Milder instances of co-occurring emotional and relationship distress could be addressed with less involved interventions, reserving traditional relationship therapy for more distressed couples in a stepped care approach.

Because they can be provided to larger populations, less involved approaches could have important public health effects. Prevention-focused relationship education (e.g., Halford, Markman, Kline, & Stanley, 2003) represents a scalable alternative for helping couples with low to moderate levels of distress prevent the decay of relationship quality. Relationship education teaches cognitive and behavioral skills similar in principle to those in couple therapies but through more flexible and less resource intensive formats, such as weekend workshops and self-directed approaches (e.g., Bodenmann, Hilpert, Nussbeck, & Bradbury, 2014). These lower cost, scalable approaches have not been specifically developed for co-occurring emotional and relation-

ship distress, but the cost-effectiveness of similar interventions for individual-level distress (Donker et al., 2015) suggests integrative scalable interventions may be feasible. An intermediate strategy in stepped care is the relationship check-up, a brief intervention for individual couples that includes assessment, feedback, and booster sessions, following principles of motivational interviewing and integrative behavioral couple therapy (Cordova et al., 2014; Fentz & Trillingsgaard, 2016).

An Agenda for Future Research

From this overview, it is evident that the integration of individual-level and couple approaches to identifying, explicating, and reducing psychosocial risk has considerable potential. However, many key research questions have not been addressed to date. Some new directions involve greater inclusion of concepts and methods of relationship science in research on CHD. Others involve greater use of current biobehavioral methods in studies of couples.

Using Methods From Relationship Science

Most research on relationships and CHD utilizes simple measures of this risk factor domain. Typical measures capture one dimension, contrasting high versus low relationship quality. Yet, in current relationship science, positive (e.g., warmth, support) and negative (e.g., conflict, criticism) factors are distinct constructs that have independent associations with overall relationship quality (Fincham & Rogge, 2010). These dimensions could have differing associations with CHD, or with underlying behavioral and physiological mechanisms. In the interpersonal perspective, this traditional one-dimension approach captures affiliation, largely ignoring control. However, control is also related to relationship quality (Cundiff et al., 2015; Sanford & Wolfe, 2013) and CHD risk. For example, high levels of controlling behavior in couple interactions predict men's coronary atherosclerosis but not women's, whereas the opposite sex difference occurs in the case of behavioral indications of affiliation (Smith, Uchino, et al., 2011). Thus, the single dimensional model in common use in psychosocial CHD risk research could underestimate the importance of this risk factor and fail to provide valuable specificity.

As in psychosocial research on CHD generally, relationship quality is routinely assessed through global self-reports. In current relationship science behavioral assessments and daily experience measures are increasingly utilized (Graber, Laurenceau, & Carver, 2011; Snyder, Heyman, & Haynes, 2005). Further, behavioral assessments in positive interaction contexts predict outcomes independently of conflict contexts (Graber, Laurenceau, Miga, Chango, & Coan, 2011). Both behavioral assessments and experience sampling predict atherosclerosis better than

commonly utilized self-reports of relationship quality (Joseph et al., 2014; Smith, Uchino, et al., 2011). Thus, the multimethod approach that characterizes relationship science could enhance CHD research.

Given the scale of well-powered epidemiological and clinical studies of psychosocial risk, it is unlikely that most future research will use resource intensive methods for all constructs of interest. But when possible, future research should go beyond the traditional reliance on global self-report measures. As a compromise approach, researchers can consider planned missingness designs that allow for the collection of intensive measures from a subsample of participants combined with economical measures from all participants to maximize measurement precision with limited resources (Graham, Taylor, Olchowski, and Cumsille (2006).

The dyadic approach in current relationship science provides additional methodological advances over traditional CHD research. Intimate partners can provide informant reports of individual-level risk factors (e.g., depression, hostility), which often have stronger predictive utility than self-reports for many outcomes (Connelly & Ones, 2010) including atherosclerosis (Smith et al., 2008). If this pattern is observed generally, then the bulk of the current evidence, because it uses self-reports, may underestimate CHD risks. Further, the actor-partner model (Kenny, Kashy, & Cook, 2006) that guides much couples research creates other opportunities. As seen in the dyadic transactional model (see Figure 1), one partner's personality or emotional adjustment is a key component of the other's social context. Hence, dyadic methods can determine if psychosocial risks operate not just within individuals, but between them, as well.

Testing Models of Overlapping Associations

An obvious initial direction for research is replication in high-risk and CHD patient populations of associations between individual-level risk and protective factors (e.g., depression, trait anger, optimism) with aspects of intimate relationship functioning that have been largely studied among healthy individuals. Beyond that, traditional epidemiological and clinical research predicting the development and course of CHD should be expanded to examine co-occurring individual-level and relationship risk factors (Gallo & Smith, 1999). In traditional psychosocial research on CHD, risk factors are most often studied one at a time. When multiple risks are considered, correlated predictors are addressed through statistical control, to identify their independent effects. This approach can provide valuable insights, but it also has drawbacks. Compared to separation of correlated risks through statistical control, natural aggregations of individual-level (e.g., depression, hostility) and relationship risk factors (e.g., social isolation, conflict) reflect individuals' lives more directly. These natural aggregations

may also correspond more closely to underlying transactional mechanisms responsible for effects on CHD, in which depression and chronic anger, for example, influence and are influenced by difficulties in intimate relationships. Hence, forced independence of inherently correlated risks may obscure the interpersonal patterns and processes through which risk and protection are conferred.

Familiar alternatives to the traditional approach include mediational and moderational models, in which individual-level and relationship risk factors are given distinct roles in the conceptually guided analyses. For example, intimate relationship quality could mediate the association of depression with CHD, or vice versa. Moderator effects could occur across the general classes of individual-level and relationship risk factors, such as where high conflict in intimate relationships is particularly unhealthy when one or more partner is high in trait hostility. Moderator effects could also occur within these classes of risk factors, as when unhealthy effects of divorce are potentiated by low levels of overall social support.

Less common alternatives capture directly the association between disease outcomes and risk shared among predictors, using two broad strategies. Dimensionality reduction techniques, such as factor analysis, principle components analysis, and structural equation modeling with latent variables, combine covariance shared across variables (e.g., multiple negative affective characteristics, multiple aspects of relationship functioning) to produce a composite. The association of this composite with a disease outcome represents risk associated with what is common to the set of predictors. The other alternative is a range of techniques, such as cluster analysis and latent class analysis, which divide samples into groups with different levels or patterns of risk across multiple risk factors as described above (cf., Gallo & Smith, 1999). The latter techniques group *participants* who share similar levels or patterns of risk, whereas the former group *variables* that share covariance. No one approach is preferable for all applications; a combination of approaches is most likely to advance understanding of combined cardiovascular disease risk (Kline, 2015). These approaches can also facilitate integration of relationship and individual-level risk factors with the broader social context (e.g., SES, job strain). These integrative methodologies are relevant to CHD development and course, and underlying mechanisms.

Evaluating Interventions

Research on associations among individual-level and relationship-based risk factors, and their combined effects on CHD and related biobehavioral mechanisms, is an essential guide to intervention research. Outside the context of health and illness, interventions for concurrent individual and relational distress have historically been evaluated in terms of effects on the primary and secondary outcomes considered separately. While this approach makes sense when the inter-

vention is intended to reduce a particular form of distress, it is less useful for evaluating interventions for reducing aggregated risk. The analytic methods that can be useful in this regard include assessment of outcomes identified through dimension reduction techniques described above, as well as latent transition analysis, growth mixture models, and multivariate multi-level models for evaluating treatment outcomes (Baldwin, Imel, Braithwaite, & Atkins, 2014).

The ultimate test of such interventions would be their efficacy in altering development and progression of atherosclerosis and the emergence and course of clinically apparent CHD. The scale and expense of adequately powered studies of this type will make them rare, but other studies could assess physiological mechanisms believed to link psychosocial risks with CHD, such as neuroendocrine and cardiovascular responses during marital conflict (Ditzen, Hahlweg, Fehm-Wolfsdorf, & Baucom, 2011; Ewart, Taylor, Kraemer, & Agras, 1984). Quality of life and adherence to medical regimens among CHD patients are also important outcomes. Finally, the evaluation of effects of traditional individual-based approaches to psychosocial risk reduction could be augmented by consideration of their effects on intimate relationship quality.

Diversity and Disparities

In this needed research on risk, mechanisms, and intervention, it is important to consider issues of diversity and health disparities, specifically potential differences across sex, sexual orientation, race and ethnicity, and socioeconomic position (SEP). The pathophysiology, clinical presentation, and optimal management of CHD often differs for men and women (Shaw, Bugiardini, & Merz, 2009), and few studies examine sex differences in psychosocial risk (Low, Thurston, & Matthews, 2010). For example, depression after coronary events is more common in women, but it predicts recurrent events and survival more strongly in men (Doyle et al., 2015). Patterns of risk aggregation could differ for men and women, as could underlying mechanisms. Some psychosocial interventions for CHD (e.g., stress management) have stronger effects for men than women (Linden, Phillips, & Leclerc, 2007), but approaches that address the unique psychosocial risks for women can have positive effects of the course of CHD (Orth-Gomer et al., 2009).

Preliminary evidence indicates that associations of relationship quality with individual-level CHD risk factors such as depression that are well-established in traditional couples are also apparent in same-sex couples (Whitton & Kuryluk, 2014). However, each of the major issues reviewed here requires research with same-sex couples, given health disparities associated with sexual orientation and the changing official status of same-sex marriage (Buffie, 2011), as well as challenges in adapting interventions for same-sex couples (Pepping & Halford, 2014). The difference between married

and nonmarried cohabiting intimate relationships also warrants further research, as they may be differentially related to CHD risk (e.g., Kilpi et al., 2015).

Associations of relationship quality with individual-level risk factors such as depression and anxiety are similar across racial and ethnic groups (McShall & Johnson, 2015). However, paralleling their greater risk of CHD (AHA, 2015), compared to Hispanics and non-Hispanic Whites, African Americans experience lower levels of relationship quality and greater risk of relationship dissolution (Bulanda & Brown, 2007). Despite SEP levels similar to African Americans, CHD incidence among Hispanics is equal to or even lower than non-Hispanic Whites (AHA, 2015). Labeled the Hispanic paradox (Ruiz, Steffen, & Smith, 2013), this pattern also occurs for Hispanics' better relationship quality and lower divorce rates (Bulanda & Brown, 2007). It is important to note that SEP has a robust inverse association not only with CHD, but also with relationship distress and dissolution (Conger, Conger, & Martin, 2010; Matthews & Gallo, 2011). These disparities have prompted relationship intervention programs for low-income groups and communities of color. However, results have been disappointing in many respects (Cowan & Cowan, 2014; Johnson, 2012), perhaps reflecting unique stresses in low-SEP environments (Jackson et al., 2016). Hence, the potential moderation of patterns of aggregated risk, mechanisms, and interventions by demographic factors should be a priority in research.

Conclusions

As noted at the outset, when studying psychosocial risk for CHD researchers tend to emphasize the often compelling figure of individual personality and emotional adjustment, while paying little attention to the surrounding context of intimate relationships. Or, they capture this relational landscape more fully, while considering that figure in little or no detail. A more integrated focus on individual-level risk factors *and* the surrounding relational ground could produce a more complete and useful depiction of psychosocial risk. The interpersonal perspective on psychosocial risk for CHD (Smith et al., 2014) provides such integration, and may be useful in the rapidly developing science of relationships and health more broadly.

To date, most adjunctive psychosocial interventions for managing CHD, though useful, follow the portrait artist's approach, focusing on the patient's depression, anger, or experience of stress. Interventions may be more useful if they considered the surrounding landscape of intimate relationships. It is important to note that there is little direct evidence that routine assessments of relationship functioning and related interventions improve medical outcomes for CHD patients or for individuals at high risk. Inclusion in routine services requires considerably more direct and compelling evidence, especially in a health care climate increasingly concerned with

costs. However, couple interventions show cost-offset in other contexts (Crane & Christensen, 2012), and suggestions for inclusion of assessment and management of relationship distress in other settings provide a guide to parallel issues in CHD (Foran, Whisman, & Beach, 2015).

Although considerable additional research is needed, it is important to be clear about the evidence that has accumulated to date; robust individual and couple risk factors are consistently related, interventions for co-occurring individual and relationship difficulties are efficacious in other domains, and couple-based interventions for chronic medical illness can be, as well. Placing the person in the intimate relationship context may eventually lead to a more complete and useful evidence-based model for the assessment, prevention, and management of CHD risk.

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