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Marital Discord and Coronary Artery Disease: A Comparison of Behaviorally Defined Discrete Groups

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Objective: Marital difficulties can confer risk of coronary heart disease, as in a study of outwardly healthy couples (T. W. Smith et al., 2011) where behavioral ratings of low affiliation and high control during marital disagreements were associated with asymptomatic coronary artery disease (CAD). However, taxometric studies suggest that marital discord is more accurately represented by discrete groups, rather than continuous dimensions. To determine if a categorical representation of marital discord was also related to CAD, discordant and nondiscordant groups were identified via cluster analysis in further analyses of the T. W. Smith et al. (2011) study. ***Method:*** One hundred fifty healthy couples (*M* age = 63.5) completed a marital disagreement discussion, self-reports of anxiety and anger during the disagreement, and self-report measures of marital adjustment. CAD was measured as coronary artery calcification (CAC) via computed tomography scans. ***Results:*** In a 2-group cluster solution, 31% of couples were characterized as discordant, with higher levels of hostility and dominance and lower levels of warmth compared with the nondiscordant group. Discordant couples reported lower marital adjustment and greater negative affect during the discussion. Controlling biomedical and behavioral risk factors, discordant couples had greater CAC ($p = .029$, $\eta^2 = .035$). Discordant and nondiscordant groups defined via self-reported marital adjustment did not differ in CAC ($p = .17$, $\eta^2 = .014$). ***Conclusions:*** Marital discord defined categorically and with behavioral observations was associated with greater levels of asymptomatic CAD. Marital discord is associated with higher risk at early stages of coronary heart disease, but commonly used self-reports may underestimate this risk.

Keywords: marital discord, coronary artery disease, affiliation, dominance

The quality of marriage and similar close relationships is related to risk of coronary heart disease (CHD). Marital disruption (i.e., separation, divorce) and strain (i.e., conflict, dissatisfaction) predict the development of CHD (De Vogli, Chandola, & Marmot, 2007; Matthews & Gump, 2002) and poor prognosis for heart patients (Rohrbaugh, Shoham, & Coyne, 2006). Yet the association of marital quality with asymptomatic atherosclerosis in otherwise healthy individuals is inconsistent. In the relevant studies to date, low marital quality has been related to more severe atherosclerosis in some sites (e.g., carotid arteries, aorta) but not in the coronary arteries (Gallo et al., 2003; Janicki, Kamarck, Shiffman, Sutton-Tyrrell, & Gwaltney, 2005). The uncertain role of marital quality in early stages of coronary artery disease (CAD) before the onset of clinically apparent CHD complicates the design of CHD risk assessments and risk-reducing interventions.

Conceptual and measurement issues may contribute to this ambiguity. Prior studies have relied on self-reports of marital quality. Such measures are generally valid, but behavioral observation of marital interactions captures aspects of marital quality that self-reports sometimes do not (Snyder, Heyman, & Haynes, 2005). Also, studies of CHD conceptualize marital quality as a single dimension—labeled *affiliation* in interpersonal theories (Horowitz & Strack, 2011) —varying from friendliness and warmth to hostility and quarrelsomeness. A second major dimension in interpersonal theories, *control*, describes behavior as dominant and directive versus submissive and yielding and is also important, as excessive or unfair control by a spouse contributes to low marital quality and increased conflict (Ehrensaft, Langhinrichsen-Rohling, Heyman, O'Leary, & Lawrence, 1999; Sanford, 2010; Smith, Traupman, Uchino, & Berg, 2010). Further, dominant interpersonal behavior is implicated in CHD development (Smith & Cundiff, 2011).

Measurement of both the affiliation and control dimensions of marital functioning could also clarify sex differences in the health effects of marital factors. Women are sometimes more distressed by low affiliation in close relationships than are men, whereas men are often more troubled by concerns involving status or control (Smith, Gallo, Goble, Ngu, & Stark, 1998). When marital quality is more closely associated with women's health than men's (Kiecolt-Glaser & Newton, 2001), this could be due to the relative emphasis on affiliation rather than control in most measures of relationship quality used in this research.

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To address these issues, Smith et al. (2011) examined associations of behavioral ratings of affiliation and control during marital disagreement with coronary artery calcification (CAC), a noninvasive measure of CAD, in outwardly healthy couples. Low affiliation was associated with more severe CAC in women but not men, whereas high control was associated with CAC in men but not women. Further, self-reports of marital quality were unrelated to CAC. Hence, behavioral measures of these two dimensions of marital functioning identified specific relationship risk factors for early stages of CAD.

However, taxometric studies (Ruscio, Haslam, & Ruscio, 2006) have challenged such dimensional models of marital quality. Marital discord may be more accurately represented as a discrete category, rather than the extreme of a continuous dimension, with an approximate prevalence of .20 among newlyweds (Beach, Fincham, Amir, & Leonard, 2005) and .30 among married persons more generally (Whisman, Beach, & Snyder, 2008). Hence, the association of behavioral measures of marital quality with early stages of CAD reported by Smith et al. (2011) might be limited to a somewhat artificial circumstance in which a dimensional structure is imposed on the categorical reality of marital discord. The association of early CAD with more naturally occurring, discrete groups of discordant and nondiscordant couples has not been tested to date.

Here, we report further analyses of the Smith et al. (2011) study to address this issue. Because the sample size of the study is too small for taxometric analyses (Ruscio et al., 2006), we used cluster analysis to identify discordant and nondiscordant groups. After establishing that the behaviorally defined groups represented discordant and nondiscordant couples as intended, we tested the prediction that the discordant (i.e., low affiliation, high control) couples would evidence more severe asymptomatic CAD than the nondiscordant (i.e., high affiliation, low control) couples.

Method

Participants

The Utah Health and Aging Study (Smith et al., 2007, 2009), approved by the University of Utah Institutional Review Board, enrolled married couples with no history of cardiovascular disease from the Salt Lake City, Utah, area. The Smith et al. (2011) report and present report are based on 150 older couples, because detectable CAC was uncommon in middle-aged couples. In the older couples, women averaged 62.2 years of age (range = 50–71) and men 64.7 (range = 52–76). Mean length of marriage was 36.4 years (range = 5–53). Median household income was $50,000–$75,000 per year, and 95.4% were non-Hispanic White.

Measures

Marital adjustment and psychological responses during disagreement. Participants completed the Locke-Wallace Marital Adjustment Test (MAT; Locke & Wallace, 1959), the support from spouse and conflict scales of the Quality of Relationship Inventory (QRI; Pierce, Sarason, & Sarason, 1991), the Areas of Disagreement Questionnaire (ADQ: Fincham, 1985), and the Impact Message Inventory (IMI; Wagner, Kiesler, & Schmidt, 1995), in which participants rated their spouses' levels of affiliation and control during typical marital interactions. They completed a measure of state anxiety and anger before and after the disagreement task and completed another IMI asking about their spouse's behavior during the disagreement task. Evidence of the reliability and validity of these scales as used in the present sample can be found in Smith et al. (2009, 2010).

Behavioral assessments. Videotaped disagreements were coded using the Structural Analysis of Social Behavior (SASB; Benjamin, Rothweiler, & Critchfield, 2006). Codes were combined to form four components: dominance, submissiveness, warmth, and hostility. Details of the coding are presented elsewhere, as is evidence of the reliability and validity of these measures in this sample (Smith et al., 2009, 2011).

Risk factors and coronary artery calcification. Glucose and plasma lipids were measured via fasting blood draws. Behavioral risk factors (i.e., smoking, alcohol use, activity level) were assessed via self-report. Participants underwent coronary artery scans, producing CAC scores equivalent to the method of Agatston et al. (1990). Details are presented elsewhere (Smith et al., 2007, 2011). For women and men, respectively, 51.3% and 81% had detectable CAC (i.e., nonzero Agatston scores). The presence and degree of CAC are well-established predictors of CAD and future CHD events (i.e., myocardial infarction, coronary death; Pletcher, Tice, Pignone, & Browner, 2004).

Procedures

Participants completed marital quality questionnaires independently. A laboratory session included a disagreement discussion, videotaped for behavioral coding. Spouses rated their level of disagreement on 13 topics (e.g., money, household duties) listed on the ADQ. The specific topic with the greatest combined rating by husbands and wives was used for discussion. Couples were informed that "we are not expecting you to solve the particular issue right now; you can think of this as an opportunity to work toward making progress on the issue." They engaged in an initial 6-min conversation, used for coding. Participants underwent medical clinic visits for biomedical risk factors and CAC measurement approximately 1 week later.

Statistical Analyses

CAC scores were transformed as nlog (CAC + 1; Reilly, Wolfe, Localio, & Rader, 2004). To control CAD risk factors, CAC scores were regressed, separately for men and women, on age, biomedical risk factors (i.e., body mass index, mean arterial blood pressure, fasting glucose, total cholesterol, triglycerides, high-density lipoprotein, low-density lipoprotein), and behavioral risk factors (i.e., smoking, exercise, alcohol use, household income). Residual CAC scores were added to means for men and women, considered separately. We performed a two-step cluster analysis (SPSS Version 16.0) on eight variables: husbands' and wives' friendliness, hostility, dominance, and submissiveness. Corresponding to results of taxometric studies (Beach et al., 2005; Whisman et al., 2008), a two-cluster solution was specified. multivariate analyses of variance (MANOVAs) grouped dependent variables to correspond to specific a priori conceptual questions. Residualized CAC scores were then analyzed in a 2 (clusters) × 2 (husbands vs

wives) mixed analysis of variance (ANOVA), treating husbands and wives as a repeated factor.[1]

Results

Cluster Analysis of Marital Disagreement Behavior

Table 1 presents means for disagreement behavior. In a MANOVA of eight behavioral variables, the smaller, discordant group (31% of the sample) displayed lower affiliation and generally higher control than the nondiscordant group, $F(8, 141) = 37.1$, $p < .001$, $\eta^2 = .68$. Discordant husbands displayed more hostility and dominance and less friendliness and submissiveness than those in the nondiscordant group; discordant wives displayed more hostility, dominance, and submissiveness and less friendliness. It should be emphasized that cluster analysis maximized differences on these variables; group comparisons are presented simply to describe the resulting cluster solution.[2]

Validity of Group Classification

A MANOVA of IMI spouse ratings of affiliation and control during the laboratory disagreement (see Table 2) indicated that discordant couples rated spouses as lower in affiliation and higher in control than nondiscordant couples, $F(4, 140) = 9.47$, $p < .001$, $\eta^2 = .21$. In a MANOVA of negative affect (see Table 2), discordant couples reported larger increases in anxiety and anger during this task than the nondiscordant group, $F(4, 140) = 4.66$, $p = .001$, $\eta^2 = .12$. In a MANOVA of IMI spouse ratings of affiliation and control during marital interactions in general (see Table 3), discordant couples rated their spouses as lower in affiliation and somewhat higher in control, compared with nondiscordant couples, $F(4, 144) = 5.34$, $p < .001$, $\eta^2 = .13$. A MANOVA indicated that discordant couples reported lower marital satisfaction and spouse support, and higher levels of marital conflict, $F(6, 141) = 5.11$, $p < .001$, $\eta^2 = .18$ (see Table 3).

Associations With Coronary Artery Calcification

In a 2 (husband vs. wife) × 2 (couple type) mixed ANOVA, husbands displayed significantly greater CAC than wives, $F(1, 137) = 94.31$, $p < .001$, $\eta^2 = .41$. The discordant group displayed significantly greater CAC (2.91; $SE = 0.22$) than did the nondiscordant group (2.33; $SE = 0.14$), $F(1, 137) = 4.90$, $p = .029$, $\eta^2 = .035$ (see Figure 1). The Group × Gender interaction did not approach significance, $F(1, 137) = 0.03$, $p = .86$, $\eta^2 = .00$.

Ancillary Analysis of Groups Defined by Self-Reported Marital Adjustment

A cluster analysis of husbands' and wives' self-reported marital satisfaction, conflict, and support identified a discordant cluster characterized by low satisfaction, high conflict, and low support compared with a nondiscordant cluster. This grouping was associated with the behaviorally defined grouping ($\chi^2 = 20.7$, $p < .001$) but was unrelated to husbands' and wives' CAC scores, $F(1, 137) = 1.91$, $p = .17$, $\eta^2 = .014$.

Discussion

Cluster analysis of behavioral observations of affiliation and control during a marital disagreement identified approximately 30% of the present sample as belonging to a discordant group, characterized by low warmth and high hostility and dominance. This prevalence is quite similar to a recent taxometric study of self-reported marital discord (Whisman et al., 2008). During the disagreement, discordant couples reported a larger increase in negative affect—especially anger—and perceived their spouses as displaying less affiliation and more control. Discordant couples also rated their spouses as generally lower in affiliation and somewhat higher in control during marital interactions and reported lower marital satisfaction, higher marital conflict, and less support from their spouse. Hence, the grouping solution obtained here had an expected frequency of discord, behavioral differences consistent with predictions, and independent evidence of validity as indicated by subjective responses during disagreement and general marital processes.

As predicted, the discordant group had higher levels of CAC, independent of demographic characteristics, and biomedical and behavioral risk factors. Hence, the association of behavior during marital disagreement with early, asymptomatic CAD was evident in discrete couple groups similar to those identified in taxometric studies of marital discord. Therefore, the association between marital interaction behavior and early CAD we identified previously (Smith et al., 2011) is not limited to potentially artificial dimensional approaches to marital discord but is also evident in a categorical grouping that may resemble more closely the naturally occurring structure of marital discord.

Couple groups defined by cluster analysis of self-reported marital discord did not differ in CAD severity, perhaps because some individuals are unable or unwilling to provide highly accurate reports of undesirable characteristics. Many self-report measures of marital dysfunction, including those used here, have substantial evidence of construct validity and predictive utility, and couples are often willing to report highly dysfunctional behavior, such as violence and infidelity (Snyder et al., 2005). However, self-presentational concerns, a lack of awareness of dysfunctional behavior, or a failure to identify such patterns as problematic could all contribute to weaker associations of self-reports with health outcomes. As a result, studies using only self-reports of marital quality might underestimate the role of this risk factor in the development of CAD.

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[1] Degrees of freedom vary across analyses because of missing data.

[2] K-means cluster analysis specifying a two group solution produced highly similar groups, with 29% in the discordant group. Concurrence of group membership (i.e., discordant vs. nondiscordant) was 97% across the two methods ($\chi^2 = 126.7$, $p < .001$, $\kappa = .92$). When a three-group solution was specified, a small group ($n = 3$) was split off from the discordant group, characterized by very high levels of wives' submissive behavior. When a four-group solution was specified, this small group was retained, and the remaining discordant couples were split into two equal sized groups, differing mostly on the relative degrees of wives' and husbands' dominant behavior. Thus, the two-group cluster solution not only corresponds to prior taxometric studies but it also was more interpretable and parsimonious than three- and four-cluster solutions.

Table 1
Differences Between Discordant and Nondiscordant Groups in Levels of Warm, Hostile, Dominant, and Submissive Behavior During the Disagreement Discussion

	Discordant		Nondiscordant				
Dependent variable	*M*	*SE*	*M*	*SE*	*F*(1, 141)	*p*	η^2
Wives' behavior							
Warmth	28.97	1.67	46.02	1.07	74.03	<.001	.33
Hostility	19.67	0.91	11.32	0.58	60.11	<.001	.29
Dominance	20.23	1.45	7.23	0.93	109.41	<.001	.43
Submissiveness	13.04	1.16	4.03	0.74	47.60	<.001	.24
Husbands' behavior							
Warmth	29.43	1.70	45.57	1.09	63.86	<.001	.30
Hostility	14.89	0.58	10.34	0.38	43.10	<.001	.23
Dominance	13.46	1.15	5.09	0.73	106.05	<.001	.42
Submissiveness	2.11	1.17	10.08	0.75	34.21	<.001	.19

Several limitations of these analyses must be noted. Couples in the present sample were mostly White and middle class, and all were married. Generalization to other groups requires further research. Noninvasive CAC scans permit tests of psychosocial risks for CAD without selection artifacts inherent in clinical samples referred for invasive tests (e.g., angiography) but may not capture some features of CAD (e.g., unstable plaque), through which relationships could influence CHD (Fuster, Moreno, Fayad, Corti, & Badimon, 2005). The cross-sectional design precludes causal inferences, but the healthy sample free from symptomatic CHD reduces the likelihood that associations between marital groups and CAD reflect reactions to disease. The prevalence of marital dysfunction obtained here is high, and this group reported levels of marital quality that were on average within the range for satisfied marriages (i.e., MAT > 100), perhaps raising concerns about the extent to which this group represents typical, clinically significant marital distress. However, the prevalence is consistent with recent evidence (Whisman et al., 2008). Further, cut-points for self-reported marital distress are somewhat arbitrary (Snyder et al., 2005), and taxometrically defined marital distress groups in prior studies include couples with self-report marital quality scores well within the normal range (cf. Beach et al., 2005). Finally, although the prevalence and features of the marital discord group were consistent with prior theory and research, the results do not address directly the structure of marital discord because cluster analysis imposes rather than detects a discrete group structure.

These limitations notwithstanding, our results indicate that marital discord is associated with early CAD when this risk factor is represented by discrete groups, by "carving nature at its joints" rather than using continuous dimensions. However, the effect size for this association (i.e., 3.5% of variance in CAC) was somewhat smaller than those obtained with continuous measures of affiliation and control in their specific associations among women and men (6%; Smith et al., 2011). Hence, marital discord seems to be associated with increased risk of early CAD for both men and women, but the affiliation and control dimensions of problematic marital interaction patterns may be important in the identification of more specific CHD risks. That is, strained marriages may threaten heart health for both genders, but low affiliation and high control during marital interactions may underlie this risk for women and men, respectively. As noted by others (e.g., Whisman et al., 2008), evidence that marital quality is most accurately represented as having a categorical, rather than dimensional, structure does not

Table 2
Differences Between Discordant and Nondiscordant Groups on Ratings of Spouse Affiliation and Control and Self-Reported Negative Affect During Disagreement Discussion

	Discordant		Nondiscordant				
Dependent variable	*M*	*SE*	*M*	*SE*	*F*(1, 144)	*p*	η^2
Wives' reports							
Husbands' affiliation	1.92	0.35	3.79	0.22	24.72	<.001	.15
Husbands' control	0.92	0.19	−0.27	0.12	25.83	<.001	.16
Change in anxiety	3.74	0.61	1.85	0.40	6.23	.014	.04
Change in anger	3.77	0.60	1.23	0.39	9.32	.003	.06
Husbands' reports							
Wives' affiliation	2.82	0.27	3.83	0.17	10.86	.001	.07
Wives' control	0.24	0.17	−0.18	0.11	5.84	.017	.04
Change in anxiety	2.54	0.51	1.36	0.33	2.90	.091	.02
Change in anger	2.37	0.47	0.68	0.31	8.20	.005	.06

Table 3
Differences Between Discordant and Nondiscordant Groups on Ratings of Spouse Affiliation and Control During Typical Marital Interactions and Self-Reports of Marital Satisfaction, Conflict, and Support From the Spouse

	Discordant		Nondiscordant				
Dependent variable	*M*	*SE*	*M*	*SE*	*F*(1, 141)	*p*	η^2
Wives' report							
Husbands' affiliation	2.56	0.28	3.67	0.18	17.72	<.001	.11
Husbands' control	0.13	0.19	−0.25	0.12	2.69	.103	.02
Marital adjustment	106.2	3.7	122.1	2.4	12.79	<.001	.08
Conflict	28.5	0.98	23.7	0.64	17.12	<.001	.11
Support from spouse	22.4	0.53	25.2	0.35	19.50	<.001	.12
Husbands' report							
Wives' affiliation	3.24	0.22	3.97	0.14	7.85	.006	.05
Wives' control	0.08	0.17	−0.43	0.11	5.96	.016	.04
Marital adjustment	112.2	3.1	126.3	2.1	14.10	<.001	.09
Conflict	27.9	0.86	23.7	0.56	17.59	<.001	.11
Support from spouse	24.4	0.37	25.9	0.24	11.50	.001	.07

indicate that dimensional analyses are inappropriate or uninformative. Rather, the continuous and dimensional approaches may complement one another, as there may be meaningful variation in levels or aspects of marital quality within discrete groups.

These results have other implications for research and clinical applications. Despite the added difficulty and expense, behavioral observations of couple interactions may be an important methodological approach in studying the association of relationship quality with cardiovascular health. As noted above, reliance on self-reports alone could contribute to an underestimate of the importance of this risk factor. Finally, the affiliation and control dimensions of social behavior define the interpersonal circumplex (IPC), a key component of the interpersonal psychology tradition (Horowitz & Strack, 2011). By providing a common conceptual and methodological framework, the IPC and other aspects of this tradition can facilitate an integrative understanding of psychosocial risk factors for CHD (Smith & Cundiff, 2011; Smith & Traupman, 2012; Smith et al., 2004) and, ultimately, could guide the design and implementation of approaches to risk assessment and reduction.

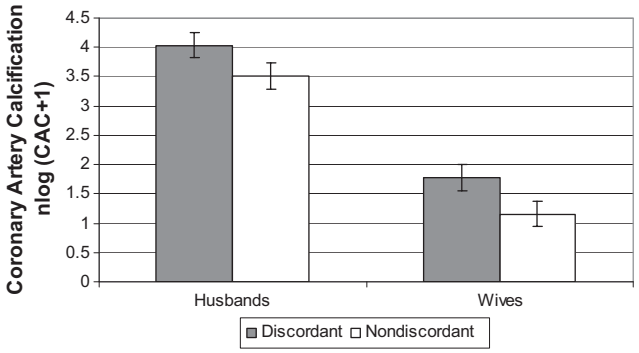

Figure 1. Mean levels (and standard errors) of coronary artery calcification (CAC) in discordant and nondiscordant couples.

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