Hostile Personality Traits and Coronary Artery Calcification in Middle-Aged and Older Married Couples: Different Effects for Self-Reports Versus Spouse Ratings

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Objective: To examine the association between hostile personality traits and coronary artery disease (CAD) and the role of aspects of hostility, method of assessment, and age as influences on its magnitude, as prior studies of hostility and coronary artery calcification (CAC) have produced conflicting findings. **Methods:** Participants included 300 married couples (mean age = 54.4 years) free from diagnosed CAD. Participants completed four measures of hostility—self-reports and spouse ratings of angry hostility (i.e., tendency to experience anger) and antagonism (i.e., argumentative, mistrusting, and cold interpersonal behavior). **Results:** In hierarchical random regression models accounting for dependency between husbands' and wives' observations, analyses of log-transformed Agatston scores indicated that self-reports of angry hostility and antagonism were not related to CAC. However, spouse ratings of both anger and antagonism were significantly associated with CAC severity. Interactions with age indicated that these associations occurred only among older participants. Control of behavioral and biomedical risk factors did not eliminate these effects. Antagonism but not anger was an independent predictor of CAC when considered simultaneously. **Conclusions:** Hostility is associated with concurrent asymptomatic CAD as assessed through CAC, but this effect is likely to be underestimated when hostility is assessed through self-reports rather than ratings by others and in samples with lower prevalence and severity of CAC. **Key words:** hostility, anger, antagonism, agreeableness, coronary artery calcification, coronary artery disease.

CAC = coronary artery calcification; **CAD** = coronary artery disease; **CHD** = coronary heart disease; **CT** = computed tomography.

INTRODUCTION

Individuals prone to anger, hostile attitudes, and antagonistic social behavior are at increased risk of cardiovascular disease (1,2). These hostile personality traits are associated with incident coronary artery disease (CAD) (3,4) and stroke (5). Such associations could reflect an influence on atherosclerosis, precipitation of acute events, or a combination of these processes. Hostile personality traits are associated with endothelial dysfunction (6) and carotid artery disease (7) among asymptomatic persons, suggesting a role in earlier disease stages. These traits have also been associated with CAD among patients referred for angiography and other diagnostic procedures (1,2). However, such patient samples have a high prevalence of CAD and include unrepresentative nondiseased controls. Further, associations of hostile traits with CAD in such samples could reflect emotional consequences of clinically apparent disease.

Computed tomography (CT) scans of coronary artery calcification (CAC) to assess CAD can provide more valid information, given that this procedure can be used with outwardly healthy nonclinical samples. CAC is concurrently related to angiographically determined CAD and prospectively associated with incident CAD events (8). However, of the five studies of this type to date, two studies have reported significant associations of self-reports of hostile personality traits with CAC (9,10) and two have not (11,12). The fifth study reported no association between self-reported hostility and CAC, but a significant association with aortic calcification (13). One of these studies is small (10), and two were conducted with samples of younger to middle-aged adults in which there was a low prevalence of detectable CAC (9,11). The most recent report found no association between self-reports of trait anger and CAC in a large sample of middle-aged and older adults with a relatively high prevalence of CAC (12), a result that has been interpreted as indicating that it is unlikely that hostile personality traits are associated with incident coronary heart disease (CHD) through atherogenesis (14). Because tests of the association of these traits with CAC in otherwise healthy samples can provide potentially important information about their role in early stages of CAD, further studies are needed.

The present study examined three possible contributions to the varying effects in prior studies. First, because the prevalence of detectable CAC increases with age (15), associations of hostile personality traits could be more apparent among older adults. Therefore, we tested the interactive association of these traits and age with CAC. Second, individuals may be limited in their ability or willingness to accurately describe their high levels of anger or antagonism because they lack awareness of these traits or are reluctant to admit undesirable characteristics (16). Hence, although self-reports are commonly used to assess hostile personality traits and were used in each of the prior studies of CAC, they may be less valid than ratings by significant others. We addressed this potential limitation of prior research by studying married couples and using parallel self-reports and spouse ratings of hostile personality. Third, it is possible that various aspects of hostile personality are not equally related to CAD (17). Although individual differences in both the tendency to experience anger and the tendency to display disagreeable attitudes and social behavior have been found to be related to CAD and incident CHD, across studies there is some indication that

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disagreeable or antagonistic behavior is more closely and consistently associated with these outcomes than is angry affect (1). Toward this end, we measured both the tendency to experience anger and antagonistic interpersonal behavior, and predicted that, although both trait anger and antagonism would be related to CAC, the latter trait would be more closely associated.

METHOD

Participants

The Utah Health and Aging Study enrolled 300 middle-aged and older couples during 2001 to 2005. The protocol was approved by the University of Utah Institutional Review Board. All participants gave informed consent. Couples from the Salt Lake City area were recruited through a) random telephone survey, b) advertisements in newspapers and newsletters, and c) community programs (e.g., "elder fairs"). Potential participants were screened for the following criteria: a) at least one member who was either between 40 and 50 years (middle-aged group) or between 60 and 70 years (older group); b) ≤10 year age difference; c) no cardiovascular disease history; and d) no cardiovascular medications (i.e., β blockers, calcium-blockers, anti-anginals). Mean length of marriage was 27.6 years (range = 3–53 years), and median household income was $50,000 to 75,000 per year. Additional demographics are presented in Table 1.

CT Scans of CAC

Participants underwent two coronary artery scans on a multidetector scanner (Phillips MX8000, Philips Medical Systems, Cleveland, OH), using 2.5-mm thick transverse slices obtained from approximately 2 cm inferior to the carina to the inferior margin of the heart. On this scanner, four 2.5-mm slices could be obtained with each gantry rotation. Scans were obtained in a single breath-hold, using 500-ms exposure and an axial (nonspiral) mode of imaging. Electrocardiogram (ECG) triggering was used to acquire images during diastole corresponding to 50% of the R-R interval. Image reconstruction was performed with a 220-mm field of view, using a 512 × 512 matrix with a standard reconstruction filter, to give a nominal pixel area of 0.18 mm^2 and voxel volume of 0.46 mm^3. To correlate CAC scores with those from the electron-beam CT scanners using the method of Agatston et al. (18), all scores from the multidetector imaging data were multiplied by a factor of 0.833 (2.5 mm/3.0 mm) to compensate for the smaller slice thickness.

TABLE 1. Demographic Characteristics and Behavioral Risk Factors

	Wives (n = 300)	Husbands (n = 300)
Mean age, years	53.3 ± 10.1[a]	55.5 ± 10.3[a]
Mean marital satisfaction	112.8 ± 26.2[a]	114.9 ± 24.1[a]
Employment, %		
Employed	60.5	68.8
Retired	19.9	26.9
Unemployed	19.6	4.3
Ethnicity, %		
White	94.1	95.1
Asian/Pacific Islander	1.3	2.0
Native American	1.3	0.3
African American	0.7	0.3
Hispanic	2.6	2.3
Smoking status, %		
Never	79.6	66.4
Former	18.7	30.2
Current	1.7	3.4
Alcohol use, %		
Rare or never	62.2	55.0
Low	18.7	13.6
Moderate to high	19.0	30.2
Exercise level, %		
Sedentary	7.1	6.1
Mild	28.2	30.2
Moderate	34.4	31.5
High	30.3	32.2
Self-rated health, %		
Excellent	22.5	26.7
Very good	43.0	43.7
Good	30.2	25.0
Fair/poor	4.4	4.7

[a] Mean ± standard deviation.

Risk Factor Assessment

A fasting blood sample was taken to measure glucose levels and plasma lipids through standard methods. Height, weight, and sitting blood pressure were recorded by trained personnel. Behavioral risk factors (i.e., smoking status, exercise/activity level) and general health ratings were assessed via self-report. Smoking status was categorized as current, former, or never. Exercise/activity level was rated as sedentary, mild (e.g., gardening ≥3 times per week), moderate (≥20 minutes walking, ≥3 times per week), or high (≥20 minutes vigorous activity, ≥3 times/week). Alcohol use was assessed as rare/never, low (1 oz./week), moderate (1 oz./day), or heavy (>1 oz. /day). Self-ratings of health were made on a Likert scale of 1 (poor) to 5 (excellent).

Psychosocial Assessment

Participants completed portions of two versions (i.e., self-report and spouse rating) of the Revised NEO Personality Inventory (NEO-PI-R) (19). There are many different measures of trait anger and antagonism and closely related characteristics used in the literature on psychosocial risk for CHD, several of which are used more commonly than the NEO-PI-R scales. The NEO-PI-R was selected because it contains well-validated measures of both individual differences in angry affect and disagreeable or antagonistic interpersonal behavior, and is available in parallel self-report and other-rating versions. This permitted the evaluation of these two aspects of the hostility personality domain and the method of assessment (i.e., self-report versus spouse ratings) as possible influences on the magnitude of association with CAD, at the same time using highly similar measures. Items administered here included the angry hostility scale (8 items) and five subscales (i.e., trust, straightforwardness, altruism, compliance, modesty) of the agreeableness (versus antagonism) domain scale (40 items). For the angry hostility scale, scores reflected the average item rating (possible range = 1–5). For ease of interpretation, the agreeableness scale was scored such that higher scores indicated more antagonism. Scores reflected the sum of the five average subscale scores (possible range = 5–25). Angry hostility items reflect the experience of anger, frustration, and related emotions in response to potentially upsetting events. Antagonism items reflect suspicious or cynical beliefs about others, and uncooperative, competitive, cold, quarrelsome, and argumentative responses during social interaction. The self-report and other rating versions of these scales have high levels of internal consistency (Cronbach's α values = 0.74–0.95) and substantial evidence of construct validity (19). The angry hostility and antagonism scales have been found to correlate highly with other measures of similar psychological constructs (16,17,19). Although both of these traits are also associated with other psychosocial risk factors such as anxiety and depressive symptoms, they are more closely correlated with other measures within the domain of anger, hostile attitudes, and aggressive behavior (16,17,19). Participants also completed the Marital Adjustment Test (MAT) (20), a widely used measure of marital satisfaction.

Overview of Statistical Analyses

Statistical tests of associations of angry hostility and antagonism with CAC were conducted so as to address two issues—the nonnormality of the distribution of CAC scores and the dependency of observations obtained from married couples. As per prior recommendations (21), Agatston scores were transformed as log (CAC + 1), but not further modified via cut-points or other restrictions of range. To address dependency in observations from couples, we

utilized Proc Mixed, which uses a random regression model to derive parameter estimates both within and across individuals (22). All factors in the model were treated as fixed, and Proc Mixed treats the unexplained variation within individuals as a random factor by default. In accordance with previous recommendations (23), we modeled individuals (i.e., husband, wife) within a dyad as a repeated factor using the compound symmetry covariance structure ("type = cs"). All measures were centered at their grand mean (22). The output of these random regression models was restricted maximum likelihood parameter estimates (*b*). As recommended (23), we used the Satterthwaite approximation to determine the appropriate degrees of freedom.

The authors had full access to the data and take responsibility for its integrity. All authors have read and agree to the manuscript as written.

RESULTS

Sample Description

Demographic and behavioral risk factor information is presented in Table 1, and traditional biomedical risk factors are presented in Table 2. The sample was predominantly White, consistent with the population of the Salt Lake City region. The risk factor information and self-ratings of health suggest a generally healthy sample.

The percentage of participants with Agatston scores in specific ranges is presented in Table 3. The modal score for both men and women is zero, with a pronounced positive skew. For comparison, the Multi-Ethnic Study of Atherosclerosis is the largest study of hostile personality and CAC (12), and the prevalence of detectable CAC in the present sample is similar for men (60%) but lower for women (29% versus 38%).

TABLE 2. Mean ± Standard Deviation Values for Biomedical Risk Factors

	Wives	Husbands
BMI	26.7 ± 4.9	27.8 ± 4.3
Total cholesterol	191.9 ± 34.4	184.5 ± 33.2
Triglycerides	122.3 ± 75.4	141.1 ± 117.2
HDL	59.8 ± 16.2	45.7 ± 12.1
LDL	110.5 ± 27.5	110.8 ± 29.3
VLDL	23.5 ± 14.5	28.4 ± 22.0
SBP, mm Hg	117.2 ± 19.2	123.6 ± 15.7
DBP, mm Hg	68.3 ± 10.8	78.8 ± 13.4
Glucose	87.5 ± 15.7	91.6 ± 14.8

BMI = body mass index; HDL = high-density lipoprotein; LDL = low-density lipoprotein; VLDL = very-low-density lipoprotein; SBP = systolic blood pressure; DBP = diastolic blood pressure.

TABLE 3. Distribution of Coronary Artery Calcification Scores

Agatston Score (%)	Wives	Husbands
0.0	72.2	40.5
0.1–10.0	11.1	16.5
10.1–20.0	3.3	3.3
20.1–30.0	1.5	3.3
30.1–40.0	1.2	0.9
40.1–50.0	0.9	2.1
50.1–100.0	2.4	5.7
100.1–200.0	2.1	7.5
200.1–400.0	1.8	6.9
400.1–1000.0	0.6	4.8
1000.1–2000.0	0.0	2.1
>2000	0.0	0.6

Convergence of Self-Reports and Spouse Ratings of Anger and Antagonism

Descriptive information for the angry hostility and antagonism scales is presented in Table 4. Correlations between the self-report and spouse ratings of the traits are presented in Table 5. For both the middle-aged and older groups, the convergence between two methods of measuring a given trait was significant and generally larger than the associations between anger and antagonism. Hence, consistent with prior research (19), the self-report and spouse-rating measures of anger and antagonism demonstrated convergent and discriminant validity in the present sample. However, it is important to note that the largest of these convergent associations were only moderate in magnitude, indicating that these two methods of assessing hostile personality traits could be differentially related to CAC.

Association of Angry Hostility and Antagonism With CAC

The primary analyses tested associations of angry hostility and antagonism with CAC scores, and their interactions with age. The first set of models examined the links between

TABLE 4. Descriptive Information for Angry Hostility and Antagonism Scores

	Mean ± SD	Observed Range
Wives' self-reports		
Angry hostility	2.49 ± 0.63	1.0–4.3
Antagonism	11.1 ± 1.70	7.0–16.7
Wives' ratings of husbands		
Angry hostility	2.78 ± 0.79	1.0–5.0
Antagonism	12.7 ± 2.73	6.7–20.4
Husbands' self-reports		
Angry hostility	2.49 ± 0.58	1.13–4.38
Antagonism	12.3 ± 1.78	7.8–17.1
Husbands' rating of wives		
Angry hostility	2.66 ± 0.65	1.0–4.38
Antagonism	11.7 ± 2.09	6.8–18.2

TABLE 5. Correlations Between Wives' and Husbands Self-Reports and Spouse Ratings of Angry Hostility and Antagonism

	Self-Reports			
	Wives		Husbands	
	Angry Hostility	Antagonism	Angry Hostility	Antagonism
Spouse ratings				
Angry Hostility	.50*	.33	.46*	.34
Antagonism	.33	.43*	.26	.46*

All $p < .001$; *convergent associations.

self-reports of these traits and CAC and at the same time controlling for age and gender. As expected (15), these models found main effects for age ($p < .001$) and gender ($p < .001$), such that older individuals and men had higher total CAC scores. However, husband and wife self-reports of their own angry hostility ($p > .88$) and antagonism ($p > .78$) did not predict CAC scores, nor was any interaction with age significant ($p > .87$).

The second set of models examined the associations of spouse ratings of angry hostility and antagonism with CAC. Again, older individuals ($p < .001$) and men ($p < .001$) had higher CAC scores. However, even when considering these covariates, spouse ratings of angry hostility were associated with higher CAC scores ($b = 0.23$; $p < .02$), as were spouse ratings of antagonism ($b = 0.07$; $p < .001$). In addition, both the age × angry hostility ($b = 0.03$; $p < .002$) and age × antagonism ($b = 0.007$; $p < .001$) interactions were significant. As depicted in Figure 1, subsequent analyses demonstrated that spouse ratings of angry hostility predicted higher CAC scores in the older ($b = 0.54$; $p < .002$) but not middle-aged individuals ($p > .28$). As shown in Figure 2, spouse ratings of antagonism were also more strongly related to CAC in the older ($b = 0.14$; $p < .001$) compared with the middle-aged group ($p > .75$). In both figures, predicted values for CAC are graphed for values of angry hostility or antagonism 1 standard deviation (SD) above and 1 SD below the sample mean. To estimate the magnitude of effects, partial correlations (controlling for age) between angry hostility and CAC and antagonism and CAC among older participants were r(150) = .19 and .22, respectively, indicating that the personality traits accounted for approximately 4% of the variance in log-transformed Agatston scores. None of the two- or three-way interactions between self-reports or spouse ratings of hostile personality and gender approached significance.

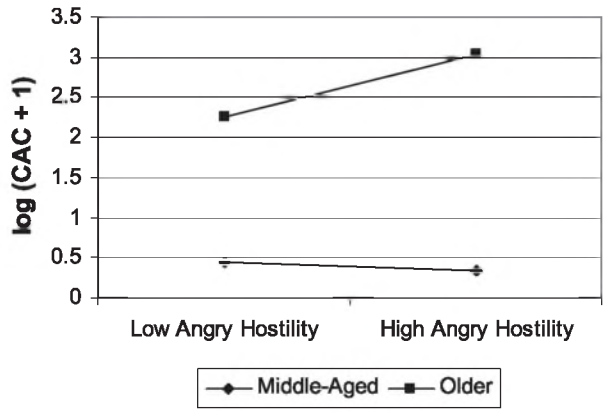

Figure 1. Association of spouse ratings of angry hostility with log-transformed CAC scores in middle-aged and older participants.

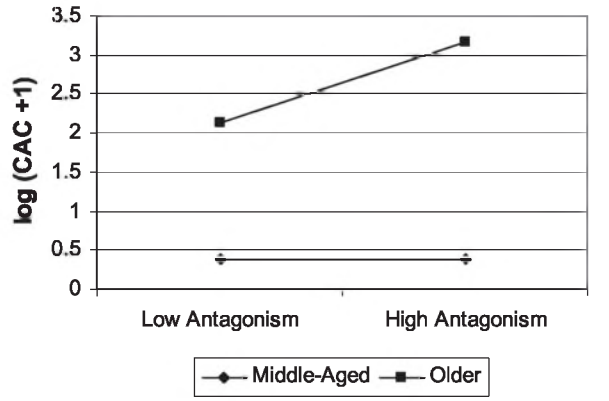

Figure 2. Association of spouse ratings of antagonism with log-transformed CAC scores in middle-aged and older participants.

Alternative Explanations/Mediational Pathways

We tested additional models to examine alternative explanations or potential statistical mediators of the associations between spouse ratings of their partners' personality and CAC. We focused these analyses on the older group because effects of hostile personality were significant effects only in this age range. In the first models, statistical control of age, gender, and the additional demographic factors of income and occupational status did not alter associations of spouse ratings of angry hostility ($b = 0.49$; $p < .004$) or antagonism ($b = 0.13$; $p < .001$) with CAC scores.

Biomedical and behavioral risk factors were similarly examined. Preliminary analyses tested the univariate association with CAC of biomedical risk factors listed in Table 2 and the behavioral risk factors (i.e., alcohol consumption, smoking status, exercise). We selected predictors of CAC with a $p < .10$. Of these, alcohol consumption ($p < .04$), smoking status ($p < .01$), resting diastolic blood pressure (DBP) ($p < .07$), triglycerides ($p < .001$), very-low-density lipoprotein cholesterol ($p < .02$), and fasting glucose levels ($p < .07$) were related to higher CAC scores, whereas high-density lipoprotein (HDL) cholesterol ($p < .07$) was related to lower CAC scores. Statistically controlling these risk factors in addition to age and gender did not appreciably alter the association of spouse ratings of angry hostility ($b = 0.40$; $p < .02$) or antagonism ($b = 0.11$; $p < .001$) with CAC scores.

It is important to note that hostile personality traits were associated with some unhealthy behaviors and biomedical risk factors. Husbands' ratings of their wives' angry hostility was associated with their wives' reports of lower weekly exercise levels, r(300) = −.13; $p < .03$, and husbands' ratings of their wives' antagonism was associated with wives' smoking, r(300) = .17; $p < .005$. Husbands' self-reports of angry hostility, as well as wives' ratings of husbands' angry hostility and antagonism, were related to husbands' smoking, rs(300) = .15, .14, and .15, respectively, all $p < .02$. Further, husbands' self-reports of antagonism were associated with greater alcohol intake, r(300) = .18; $p < .005$. Wives' ratings of their husbands' angry hostility were associated with husbands' triglyceride levels, r(300) = .12; $p < .05$, and husbands' self-reports of antagonism were associated with their resting DBP, r(300) = .15; $p < .02$. Husbands' ratings of their wives' angry hostility were inversely associated with wives' HDL, r(300) = −.12; $p < .04$. These associations were

similar for the middle-aged and older groups, and statistical control of these risk factors did not alter associations between hostile personality traits and CAC.

Finally, we examined if the associations between spouse ratings of hostile personality and CAC were due to differences in marital quality. Ratings of the spouse as hostile could reflect low-quality marriages, a possible cardiovascular risk factor (24). Spouse ratings of angry hostility ($b = 0.53$; $p < .003$) and antagonism ($b = 0.14$; $p < .001$) were significantly associated with CAC scores at the same time controlling MAT scores in addition to age and gender.

Independent Contributions of Angry Hostility and Antagonism

We also examined the independent contribution of spouse ratings of these personality factors. While statistically controlling both age and gender, we simultaneously modeled spouse ratings of angry hostility and antagonism, again focusing on the older group. Spouse ratings of angry hostility no longer predicted CAC scores ($b = 0.16$; $p > .46$), whereas spouse ratings of antagonism did ($b = 0.11$; $p < .01$). Hence, antagonism was related to CAC independently of trait anger, whereas the otherwise significant association between angry hostility and CAC reflected the overlap of anger and antagonism.

Exploratory Analyses of Potential Gender Differences

Although none of the associations of angry hostility or antagonism with CAC were moderated by gender (i.e., no interactions between gender and angry hostility or antagonism were significant), some prior research indicates that the greater predictive utility of spouse ratings of negative personality traits compared with self-reports in studies of CHD risk may be more characteristic of men than women (25). Therefore, again in the older group, we examined the associations of self-reports of angry hostility and antagonism with CAC in men and women separately. Men's self-reports of angry hostility and antagonism were nonsignificantly associated with CAC in an inverse direction, partial correlations controlling age, rs(152) = −.09 and −.02, respectively. In contrast, women's self-reports of angry hostility were positively associated with CAC, partial correlation controlling age, r(152) = .16; $p = .05$. Self-reports of antagonism were not related to CAC among women, partial r(152) = .02. Hence, there was some evidence that women's self-reports of trait anger were related to CAC, but no evidence that self-reported anger was related to CAC for men and no evidence that self-reported antagonism was related to CAC for either men or women.

Previous research has suggested that the discrepancy between self-reports of negative traits and ratings by others could reflect denial, and this index of denial has been associated with increased CHD risk among men but not women (25). To test this pattern, we examined the association of self-reports of angry hostility and antagonism with CAC before and after controlling for spouse ratings of the trait in multiple regression analyses, controlling age as before. When spouse ratings are controlled in this manner, self-reports of hostile personality represent the discrepancy between self-reports and spouse ratings; low scores reflect self-reports below what would be expected on the basis of their spouse's ratings—perhaps reflecting denial or minimization.

Among men, when controlling for the significant association between wives' ratings of their husbands' angry hostility and husbands' CAC, r(149) = .27; $p < .001$, husbands' self-reports of angry hostility were significantly and inversely associated with their CAC, r(149) = −.21; $p < .02$. Hence, the variance in husbands' self-reports of angry hostility that is independent of their spouses' ratings of this trait is inversely associated with CAC. A similar pattern emerged for husbands' self-reports of antagonism, although it was not significant, partial r(149) = −.14; $p = .12$. In parallel analyses for wives' self-reports, neither the association for wives' self-reports of angry hostility or antagonism approached significance when spouse ratings were controlled, both $p > .17$. When considering wives separately and while controlling the self-reported hostile personality traits, husbands' ratings of wives' angry hostility was marginally associated with CAC, r(149) = .15; $p < .07$, and husbands' ratings of wives' antagonism was significantly associated with CAC, r(149) = .21; $p < .02$. In the case of wives' angry hostility, control of self-reports of this trait reduced the otherwise significant association between their husbands' ratings of this trait with CAC, r(150) = 0.20; $p < .02$, to marginal significance as noted above. For husbands, the significant association between wives' ratings of husbands' angry hostility and CAC, r(150) = .19; $p < .02$, actually became stronger when husbands' self-reports of this trait were controlled, r(149) = .27; $p < .01$. This general pattern could indicate that wives' self-reports of angry hostility are less susceptible to denial or minimization than husbands' self-reports.

DISCUSSION

These results indicate that individual differences in angry hostility and antagonism, as assessed by spouse ratings, are associated with asymptomatic CAD, as measured by CAC. This association was significant among older (mean age = 63 years) but not middle-aged (mean age = 45 years) participants. Further, these effects were independent of other psychosocial and demographic factors (e.g., socioeconomic status, marital satisfaction, age, gender), behavioral risk factors (e.g., smoking, exercise, alcohol use), and biomedical risk factors. These results suggest that hostile personality traits may contribute to early stages of CAD. Hence, prospective associations of anger, hostility, and aggressiveness with CAD morbidity and mortality (1,2) could reflect influences on development and progression of atherosclerosis as well as on later stages of the disease.

These results also suggest three possible contributions to inconsistencies in prior studies of hostility and CAC. First, the association was significant among older but not middle-aged participants, perhaps due to the lower prevalence of detectable CAC in the middle-aged group. Low prevalence can reduce

the power of statistical tests of association, thereby increasing the chance of misleading null results (i.e., Type II errors).

Second, both angry hostility and antagonism were associated with CAC, but when considered together only antagonism was independently associated with CAC. Several interrelated aspects of anger, hostile cognition, and aggressive or disagreeable social behavior are associated with incident CHD (1,2,26), but the internal emotional experiences of anger proneness and related characteristics (e.g., irritability) might be less strongly related to cardiovascular disease than are cognitive and behavioral factors such as the tendency to be mistrusting, cold-hearted, abrasive, inconsiderate, and quarrelsome (17,27). Hence, studies assessing the latter components may be more likely to detect effects than those assessing only affective features.

Third, for both angry hostility and antagonism, spouse ratings were significantly associated with CAC, whereas self-reports were not. The effects for spouse ratings were significant even when levels of marital satisfaction were controlled. Hence, it is unlikely that spouse-reports of angry hostility or antagonism functioned as a marker for relationship distress. The greater predictive utility of spouse ratings could reflect the relative validity or accuracy of these methods. For negative traits such as anger and antagonism, individuals may be unable or unwilling to provide highly accurate self-reports (16). Spouse ratings are also potentially influenced by socially desirable response styles, but this may be a lesser concern than for self-reports. Consistent with this reasoning, interview-based behavioral ratings of hostility are generally better predictors of coronary vascular disease (CVD) than are self-reports (27). Further, studies of clinical CHD samples indicate that spouse ratings of patients' hostile personality traits are more closely related to manifestations of disease than are self-reports (25,28–30). Hence, the observed magnitude of the association of anger, hostility, or aggressiveness with CVD may be influenced by the method used to assess these traits; self-reports may provide smaller estimates of effect size, perhaps due to lower levels of validity. This lower validity may stem from the fact that self-reports are susceptible to denial or minimization.[1] It is important to note that self-reports of hostile personality traits have been significantly associated with CHD in prior studies (1,2,25) and that self-reports and spouse ratings of these traits are significantly associated in the current study and others (19). Hence, the limitations of self-reports of hostile personality traits might reduce the magnitude of observed associations with CHD but clearly do not preclude them.

Exploratory analyses suggested that the limitations of self-reports might differ for men and women. Self-reported angry hostility was marginally related to CAC in women, but not men. Further, when controlling for their spouses' ratings of husbands' angry hostility, husbands' self-reported angry hostility was inversely related to CAC. The variance in self-reports of anger that is independent of ratings by others could be seen as an index of denial or minimization, and the denial of anger and other negative affective traits has been previously found to be associated with CHD risk in men (25). Also, statistical control of self-reports of angry hostility tended to weaken the association of spouse ratings of this trait and women's CAC, whereas it tended to increase the association of spouse ratings of this trait and CAC among men. Hence, self-reports of anger may be more susceptible to the influence of denial or minimization among men than women.[1] However, it is important to note that these gender differences emerged in the context of exploratory analyses that considered men and women separately; in the primary analyses, there were no significant gender differences (i.e., gender by hostility interactions) in the associations between any measure of hostile personality and CAC.

Although these exploratory results should be interpreted with caution, they do suggest that self-reports of hostile personality traits might have lower predictive utility because they contain a systematic portion of variance that converges with ratings by others and another systematic component that could reflect the denial, minimization, or failure to fully appreciate a negative personality characteristic. Given that self-reports potentially capture both of these constructs, the simple association of scores on self-report measures of hostile personality with disease might underestimate the actual association between this personality construct and CHD. Further, when testing gender differences in the associations of these risk factors with CHD, the potential role of gender differences in the validity of assessment methods should also be considered.

Several limitations of this study should be noted. The sample is largely Caucasian, and middle and upper-middle socioeconomic status. Generalization to other demographic groups requires further research. The cross-sectional design precludes causal inferences, although the exclusion of individuals with diagnosed CAD reduces the likelihood that the concurrent association of angry hostility and antagonism with CAC reflects psychological reactions to disease. Spouse ratings of hostile personality were not related to CAC among younger participants, but these ratings might predict the later development of CAC in this group once they reach an age where this indication of CAD is more prevalent. Although the fact that hostile personality was associated with unhealthy behavior (e.g., smoking, drinking) in the middle-aged portion of the sample suggests this possibility, a prospective effect would represent much stronger evidence of hostile personality as a CAD risk factor. CAC provides a valid index of CAD (8), but it might not capture other features of CAD (e.g., plaque instability) that could be important in the association of hostility with CHD morbidity and mortality (31). The features of CAD captured by CAC also may be differentially related to subsequent CAD morbidity and mortality for men and women

[1]Consistent with this suggestion, repeated-measures analysis of variance indicated that participants' self-reports of angry hostility and antagonism were lower than the ratings by their spouses, $F(1,298) = 77.2$, $p < .001$; and $F(1,298) = 29.13$, $p < .001$, respectively (see mean values in Table 4). Although these differences were significant for both men and women when considered separately, in the case of angry hostility, this tendency for spouse ratings to exceed self-reports was stronger for men than women, gender by rating source interaction, $F(1,298) = 3.69$, $p < .06$.

(32). Within the associations between spouse ratings of hostile personality and CAC, the stronger effect for antagonism than angry hostility could be due to the fact that the former trait is more overt and perhaps therefore more amenable to ratings by others than is the subjective experience of anger. That is, a difference in how apparent these traits are to raters could account for the stronger association with CAC for antagonism than for angry hostility, rather than an actually more important role in atherogenesis. The associations between personality traits and CAC were small in magnitude, suggesting caution when considering their potential importance as influences on CHD. Also, the gender differences in the relative validity and predictive utility of self-reports of trait anger should be considered as tentative; although they are consistent with prior reports (25), these findings emerged from exploratory analyses. Finally, the present study does not identify mechanisms linking hostile personality traits and CAD. Several have been proposed (1,26), and some—such as more pronounced cardiovascular reactions to psychological stressors (33), inflammatory processes (34), and unhealthy behavior (35)—have been linked to both CAD and hostile personality. In the present study, the association between hostile personality traits and CAC was significant even when negative health behavior was statistically controlled. Nonetheless, this mechanism and others warrant future research.

Despite these limitations, the present results indicate that angry hostility and antagonism are associated with CAC in an otherwise healthy sample of married older adults. Inconsistencies in the prior literature may reflect sample age and the related prevalence of CAC, specific aspects of this personality domain assessed, and the methods used to measure these traits. Low CAC prevalence, assessment of primarily affective rather than behavioral aspects of these personality traits, and reliance on self-reports of personality could produce smaller observed associations between hostile personality traits and CAC—and perhaps other manifestations of CHD, as well. These considerations should inform the design and evaluation of future studies.

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