Anger Expression and Sleep Quality in Patients With Coronary Heart Disease: Findings From the Heart and Soul Study

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Objective: To evaluate if anger expression affects sleep quality in patients with coronary heart disease (CHD). Research has indicated that poor sleep quality independently predicts adverse outcomes in patients with CHD. Risk factors for poor sleep quality include older age, socioeconomic factors, medical comorbidities, lack of exercise, and depression. **Methods:** We sought to examine the association of anger expression with sleep quality in 1020 outpatients with CHD from the Heart and Soul Study. We assessed anger-in, anger-out, and anger temperament, using the Spielberger State-Trait Anger Expression Inventory 2, and measured sleep quality, using items from the Cardiovascular Health Study and Pittsburgh Sleep Quality Index. We used multivariate analysis of variance to examine the association between anger expression and sleep quality, adjusting for potential confounding variables. **Results:** Each standard deviation (SD) increase in anger-in was associated with an 80% greater odds of poor sleep quality (odds ratio (OR) = 1.8, 95% Confidence Interval (CI) = 1.6–2.1; $p < .0001$). This association remained strong after adjusting for demographics, comorbidities, lifestyle factors, medications, cardiac function, depressive symptoms, anger-out, and anger temperament (adjusted OR = 1.4, 95% CI = 1.5–1.7; $p = .001$). In the same model, each SD increase in anger-out was associated with a 21% decreased odds of poor sleep quality (OR = 0.79, 95% CI = 0.64–0.98; $p = .03$). Anger temperament was not independently associated with sleep quality. **Conclusions:** Anger suppression is associated with poor sleep quality in patients with CHD. Whether modifying anger expression can improve sleep quality or reduce cardiovascular morbidity and mortality deserves further study. **Key words:** anger expression, sleep quality, coronary heart disease.

BMI = body mass index; **CHD** = coronary heart disease; **DSM-IV-TR** = Diagnostic and Statistical Manual of Mental Disorders-IV-Text Revision; **MI** = myocardial infarction; **REM** = rapid eye movement; **STAXI-2** = Spielberger State-Trait Anger Expression Inventory 2; **BP** = blood pressure; **HR** = heart rate; **SD** = standard deviation; **ANOVA** = analysis of variance; **CI** = confidence interval; **OR** = odds ratio; **PHQ** = Patient Health Questionnaire; **COPD** = chronic obstructive pulmonary disease.

INTRODUCTION

Poor sleep quality predicts adverse outcomes in patients with coronary heart disease (CHD) (1–7). Understanding and modifying risk factors for poor sleep quality may decrease morbidity and mortality in patients with CHD. Known demographic risk factors for poor sleep include older age, female sex, non-White race, less education, low income, and being unmarried. Medical and psychological risk factors include cardiac problems (myocardial infarction (MI), congestive heart failure, and angina), use of certain medications, physical inactivity, depression, and anxiety (2,6,8). The potential effects of anger expression on sleep quality have not been evaluated in patients with CHD.

Research has indicated that anger expression and trait anger are risk factors for a number of negative consequences, including verbal and physical altercations, interpersonal problems, increase in negative emotions, and physical injury, for example (9). Other investigations have indicated that individuals who suppress their anger experience elevated physiological arousal and are at an increased risk for high blood pressure (BP) and hypertension (10–12). Furthermore, anger suppression has shown to be associated with slower recovery on a variety of cardiovascular indices, whereas outward anger expression was more beneficial (13–16). Although Dorr and colleagues found similar results with regard to anger suppression, their data indicated the outward expression of anger interacted with race to have differential effects on BP, cardiac output, and heart rate (HR) recovery in a sample of African and European Americans participating in a series of verbal debates (17). Other investigations have also provided evidence that trait anger and possessing an angry temperament leave individuals at risk for experiencing adverse cardiovascular events (18–20).

Further research has also suggested that angry feelings are associated with sleep quality in patients who do not have CHD. Pilcher, Ginter, and Sadowsky found that feelings of anger and tension were associated with poor sleep quality among college students (21). Ireland and Culpin found that hostility was a risk factor for poor sleep in juvenile offenders but that the experience of anger was not predictive of poor sleep quality in this population (22). Bardwell and colleagues found that anger was associated with reduced total sleep time (23). However, the association between anger expression and sleep quality has not been examined in patients with CHD. We sought to evaluate the association of anger expression with sleep quality in a cross-sectional study of 1020 outpatients with stable CHD.

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METHODS

Participants

The Heart and Soul Study is a prospective cohort study of psychosocial factors and health outcomes in patients with CHD. Methods have been described previously (24–26). Patients with CHD were recruited, using administrative databases from two Department of Veterans Affairs Medical Centers (San Francisco, California; and Palo Alto, California), one university medical center (University of California, San Francisco), and nine public health clinics in the Community Health Network of San Francisco. Patients were eligible to participate if they had a history of the following: MI, angiographic evidence of ≥50% stenosis in one or more coronary vessels, prior evidence of exercise-induced ischemia by treadmill or nuclear testing, or coronary revascularization. Patients were not eligible for the study if they had an acute coronary syndrome within the past 6 months, could not walk one block, or were planning to move out of the local area within 3 years.

Between September 2000 and December 2002, a total of 1024 participants enrolled and completed a daylong study protocol at the San Francisco Veterans Affairs Medical Center. Of these, four participants were excluded due to incomplete answers to the anger expression questionnaire, leaving a total of 1020 for analysis. The Heart and Soul Study protocol was approved by the appropriate Institutional Review Boards, and all participants provided their written informed consent.

Anger

We administered the trait anger temperament, anger-in, and anger-out subscales of the Spielberger State-Trait Anger Expression Inventory 2 (STAXI-2). The STAXI-2 is used to evaluate the various components of anger expression and has been used to measure the roles that anger plays in the development of a variety of medical conditions, including hypertension, coronary heart disease, and cancer (Psychological Assessment Resources, Inc., Odessa, Florida). Individuals were asked to rate the intensity of anger they generally feel and how often they experience angry feelings. Each of 20 questions was answered on a scale of 1 to 4 (almost never, sometimes, often, almost always) with higher scores indicating more anger. The anger temperament subscale included four items scored 1 to 4 (total subscale range = 4–16) to assess individual differences in disposition to experience anger (27). An example of an item from this scale reads: "I am a hotheaded person." The anger-in subscale included eight items scored 1 to 4 (total subscale range = 8–32) to assess experienced but suppressed anger. An example of an item from this scale reads: "I boil inside but don't show it." The anger-out subscale included eight items scored 1 to 4 (total subscale range = 8–32) to assess the frequency that angry feelings were outwardly expressed in a verbally or physically aggressive manner. An example of an item from this scale reads: "I strike out at whatever infuriates me."

Sleep

Our primary outcome variable was a single question on overall sleep quality from the Pittsburgh Sleep Quality Index, a self-rated questionnaire which assesses sleep quality and disturbances. Participants were asked: "During the past month, how would you rate your overall sleep quality?" and indicated: "very good," "fairly good," "good," "fairly bad," or "very bad." For analysis purposes, we coded sleep as "good" if participants answered: "very good," "good," or "fairly good," and we coded sleep as "poor" if they answered: "very bad," or "fairly bad" (28). As secondary outcome variables, we administered modified items from the Cardiovascular Health Study to assess difficulty initiating and maintaining sleep, including difficulty falling asleep, frequent awakenings, and waking up too early (29). We also asked: "Have you ever snored?" and (if yes) "How often do you snore now? (none, a little, some, much, or all of the time)." Snoring was defined as much or all of the time.

Other Participant Characteristics

Age, sex, ethnicity, medical history, and current smoking status were determined by the self-report questionnaire. Regular alcohol consumption was measured, using the AUDIT-C questionnaire, with a score of ≥4 used to define regular alcohol use (30). We measured height and weight and calculated body mass index (BMI) (weight in kilograms divided by the square of height in meters). Physical activity was determined using the multiple-choice question, "Which of the following statements best describes how physically active you have been during the past month, that is, done activities such as 15 to 20 minutes of brisk walking, swimming, general conditioning, or recreational sports?" Participants who answered fairly, quite, very, or extremely active (versus not at all or a little active) were considered physically active. Participants were instructed to bring all of their medication bottles to the study appointment, and trained research assistants recorded all current medications.

We assessed left ventricular ejection fraction, using a resting echocardiogram. To measure ischemia, we performed a symptom-limited, graded exercise treadmill test according to a standard Bruce protocol and defined ischemia as the presence of new wall motion abnormalities at peak exercise that were not present at rest. BP was measured with standard sphygmomanometry.

We assessed depressive symptoms, using the 9-item Patient Health Questionnaire. Participants were asked how often they were bothered by each of nine depressive symptoms during the past 2 weeks, with four multiple choice response options ranging from "not at all (0)" to "nearly every day (3)." This measure is often used in medical settings and has been shown to have excellent reliability and validity (31).

Statistical Analysis

The goal of this study was to examine the association between anger and sleep quality. Differences in characteristics between participants with good sleep quality and those with poor sleep quality were compared, using Student's t test for continuous variables and χ^2 test for dichotomous variables. Mean anger scores were compared across sleep quality categories, using analysis of variance. We used logistic regression to evaluate the association of anger-in, anger-out, and anger temperament (as continuous variables and divided into quartiles) with sleep quality, adjusted for potential confounding variables. These results were reported as odds ratios (ORs) with 95% Confidence Intervals (CIs). We also tested for interactions between anger variables and depression. Analyses were performed with SAS 9.1 (SAS Institute, Cary, North Carolina).

RESULTS

Of the 1020 participants, 284 (28%) had poor (bad or fairly bad) sleep quality. Compared with participants who had good, fairly good, or very good sleep quality, participants with poor sleep quality were younger, less likely to be male, less likely to be married, more likely to have hypertension, more likely to be depressed, and less physically active (Table 1). Higher anger-in, anger-out, and anger temperament scores were associated with worse sleep quality (Table 2). Mean ± standard deviation (SD) scores on the anger scales were 14.5 ± 4.0 for anger-in, 13.3 ± 3.3 for anger-out, and 6.0 ± 2.2 for anger temperament. These scores are comparable to, although slightly lower than, those reported by Spielberger and colleagues for college students (32) and to those reported in a previous study of anger and hypertension among otherwise healthy individuals (33). t Tests comparing men versus women and Whites versus non-Whites revealed no significant gender or race differences. However, older age was associated with lower scores on all three anger scales ($p < .0001$). Correlations among anger scales were 0.32 for anger-in and anger-out, 0.34 for anger-in and anger-temperament, and 0.63 for anger-out and anger temperament.

Each SD (4-point) increase of anger-in score was associated with an 80% greater odds of poor sleep quality ($p < .0001$) (Table 3), adjusting for the other two anger variables. After further adjustment for demographics, comorbidities,

TABLE 1. Characteristics of 1020 Participants With Stable Coronary Heart Disease

	Good Sleep Quality $n = 736$	Poor Sleep Quality $n = 284$	p
Demographic			
Age (mean)	67 ± 10	65 ± 12	.01
White race	444 (60)	170 (60)	.94
Sex (male)	615 (84)	221 (78)	.03
High school graduate	640 (87)	248 (88)	.81
Married	336 (46)	97 (34)	.001
Comorbidities			
HTN	507 (69)	215 (76)	.03
MI	391 (53)	155 (55)	.70
CHF	127 (17)	52 (18)	.72
COPD	117 (16)	46 (16)	.89
Diabetes	190 (26)	75 (26)	.85
Snoring	127 (17)	62 (22)	.09
Lifestyle			
Smoking	134 (18)	67 (24)	.05
Regular alcohol use	207 (28)	85 (30)	.59
Physically active	497 (68)	151 (53)	<.0001
Mean BMI (k/m^2)	28 ± 5	29 ± 5	.06
Medications			
β blockers	423 (57)	168 (59)	.63
Aspirin	567 (77)	223 (79)	.61
Statins	479 (65)	176 (62)	.35
Ace/ARBs (angiotensin)	385 (52)	138 (49)	.29
Cardiac function			
Ejection fraction	0.62 ± 0.10	0.62 ± 0.09	.64
Inducible ischemia	170 (25)	58 (23)	.53
Systolic blood pressure	132 ± 20	134 ± 22	.26
Mean PHQ	3.8 ± 4.5	8.8 ± 6	<.0001

Values are represented as n (%) or means +/− (SD).
HTN = hypertension; MI = myocardial infarction; CHF = congestive heart failure; COPD = chronic obstructive pulmonary disease; BMI = body mass index; PHQ = Patient Health Questionnaire.

TABLE 2. Mean (±SD) Anger-In, Anger-Out, and Anger Temperament Scores by Self-Reported Sleep Quality

Sleep Quality	Anger-In	Anger-Out	Anger Temperament
Very good ($n = 130$)	12.3 ± 3.6	12.7 ± 3.1	5.6 ± 1.9
Fairly good ($n = 270$)	13.7 ± 3.4	13 ± 3	5.6 ± 2
Good ($n = 336$)	14.5 ± 3.7	13.5 ± 3.2	6.1 ± 2.2
Fairly bad ($n = 215$)	15.9 ± 4	13.8 ± 3.5	6.3 ± 2.3
Very bad ($n = 69$)	17.3 ± 4.9	13.4 ± 4.8	6.5 ± 2.9
p (ANOVA)	<.0001	.008	.0004

SD = standard deviation; ANOVA = analysis of variance.

lifestyle factors, medications, cardiac function, and depressive symptoms, each 4-point increase of anger-in score remained associated with a 40% greater odds of poor sleep quality (OR = 1.4, 95% CI = 1.5–1.7; $p = .001$). Each SD (3.3 point) increase in anger-out was independently associated with a 21% decreased odds of poor sleep quality (adjusted OR = 0.79, 95% CI = 0.64–0.98; $p = .03$). Anger temperament was not independently associated with sleep quality after adjusting for all relevant variables (Table 3). We found no evidence for an interaction of depressive symptoms with anger-in ($p = .50$), anger-out ($p = .59$), or anger temperament ($p = .99$).

The single sleep item was strongly correlated with the other sleep measures we administered ($p < .0001$ for correlations with trouble falling asleep, sleeping in daytime, waking up several times at night, and waking up too early). After sequentially adjusting for all variables in Table 1, each 4-point increase of anger-in score was associated with a 30% greater odds of waking up several times at night and of waking up far too early (Table 4). Each 2.2-point increase of anger temperament score was also associated with a 30% greater odds of waking up far too early. Each 3.3-point increase in anger-out score was associated with an 18% decreased odds of waking up far too early, but not with other sleep problems.

DISCUSSION

We found that anger suppression (anger-in) was associated with poor sleep quality in 1020 outpatients with stable CHD. Each SD increase on the anger-in scale was associated with a 40% greater odds of poor sleep quality. In contrast, outward anger expression (anger-out) was associated with a 21% decreased odds of poor sleep quality per SD increase. Each of these findings was independent of age, sex, marital status, medical comorbidities, depressive symptoms, physical activity, and each of the other anger variables. These results suggest that anger suppression may be a risk factor for poor sleep quality in patients with CHD, and raise the possibility that poor sleep may contribute to the association of anger suppression with adverse cardiovascular outcomes.

Several studies have found that anger is associated with adverse cardiovascular outcomes (34–36). However, results have been inconsistent as to whether the increased risk of cardiovascular disease is associated with having an angry temperament or with the relative suppression (34–36) versus outward expression (37–42) of angry feelings (43). Our findings raise the possibility that poor sleep quality, itself a risk factor for cardiovascular events (1–7), may mediate the association between anger suppression and adverse cardiovascular outcomes.

The anger-in construct can be defined as anger that is experienced, yet suppressed, or an unwillingness to outwardly express anger (27,35). In a study of sleep problems in juvenile offenders, Ireland and Culpin suggested that cognitive rumination may be a possible mechanism by which anger influences sleep (22). Rumination is characterized by persistent negative thoughts and memories about past events, current mood states, and personal failure to achieve goals. Linden and colleagues illustrated the relationship between rumination and anger expression by reporting on statistically significant, moderate correlations between the rumination scale of their Behavioral Anger Response Questionnaire and Spielberger's indices of

TABLE 3. Association of Each SD Increase in Anger Temperament, Anger-In, or Anger-Out With Poor Sleep Quality (Bad or Very Bad) Versus Good Sleep Quality (Good, Fairly Good, or Very Good)

Model	Anger-In		Anger-Out		Anger Temperament	
	OR (95% CI)	*p*	OR (95% CI)	*p*	OR (95% CI)	*p*
Adjusted for other 2 anger variables	1.8 (1.6–2.1)	<.0001	0.91 (0.76–1.1)	.29	1.1 (0.94–1.3)	.22
Adjusted for above plus demographics	1.8 (1.6–2.1)	<.0001	0.90 (0.75–1.1)	.28	1.2 (0.96–1.4)	.12
Adjusted for above plus comorbidities	1.8 (1.5–2.1)	<.0001	0.91 (0.76–1.1)	.35	1.2 (0.96–1.4)	.12
Adjusted for above plus lifestyle	1.8 (1.5–2.1)	<.0001	0.88 (0.73–1.1)	.20	1.2 (0.98–1.4)	.09
Adjusted for above plus medications	1.8 (1.5–2.1)	<.0001	0.88 (0.73–1.1)	.19	1.2 (0.97–1.4)	.09
Adjusted for above plus cardiac function[a]	1.8 (1.5–2.1)	<.0001	0.83 (0.68–1)	.07	1.3 (1.04–1.5)	.02
Adjusted for above plus continuous PHQ score[b]	1.4 (1.5–1.7)	.001	0.79 (0.64–0.98)	.03	1.2 (0.97–1.5)	.09

SD = standard deviation; OR = odds ratio; CI = Confidence Interval; PHQ = Patient Health Questionnaire.
[a] Other variables associated with poor sleep quality ($p < .05$) were being unmarried and physical inactivity.
[b] Other variables associated with poor sleep quality ($p < .05$) were being unmarried and depressive symptoms.

TABLE 4. Association of Each Standard Deviation Increase in Anger Temperament, Anger-In, or Anger-Out With Other Sleep Problems in 1020 Participants, Adjusted for the Other Two Anger Measurements and All Table 1 Variables

Sleep Problem (number of participants endorsing)	Anger-In		Anger-Out		Anger Temperament	
	OR (95% CI)	*p*	OR (95% CI)	*p*	OR (95% CI)	*p*
Sleepy in daytime ($n = 324$)	1.1 (0.92–1.3)	.31	1.1 (0.91–1.3)	.32	0.86 (0.70–1.1)	.16
Trouble falling asleep ($n = 357$)	1.2 (0.99–1.4)	.07	0.92 (0.75–1.1)	.41	1.1 (0.92–1.4)	.26
Snoring much or all of the time ($n = 189$)	1 (0.82–1.2)	.95	1.1 (0.90–1.4)	.31	1.1 (0.86–1.3)	.50
Wake up several times at night ($n = 794$)	1.3 (1.1–1.6)	.01	1.1 (0.85–1.3)	.59	1.1 (0.87–1.4)	.41
Wake up far too early ($n = 436$)	1.3 (1.1–1.5)	.01	0.82 (0.68–0.99)	.04	1.3 (1.1–1.6)	.007

anger-in ($r = .42$) and trait anger ($r = .44$) (44). Rusting and Nolen-Hoeksema also found that ruminating after a procedure intended to create angry feelings significantly increased the ratings and intensity of anger (45). Cognitive rumination may be an associated symptom or characteristic of anger suppression and could play a role in sleep quality.

There could also be biological mechanisms that explain the association between anger suppression and sleep quality. Rapid eye movement (REM) sleep is a stage of the sleep cycle when the brain transitions into a period where cerebral metabolic rate and electrical output resemble being awake and people report the experience of dreaming. During REM sleep, the limbic system is highly activated and the frontal cortex is deactivated (46). The limbic system is primarily responsible for emotion regulation and the frontal cortex is involved in the development of rational thought and memory formation (46). One potential explanation for the association between anger and sleep is that anger suppression may activate the limbic system, which may have a disruptive effect on REM sleep. Emotional arousal related to anger suppression could also affect the depth and quality of non-REM sleep as it may be related to both limbic activation and stress-related peptides released from the hypothalamus (46,47). Madigan, Dale, and Cross conducted an investigation on HR reactivity and REM sleep in male college students who endorsed Type A behavior and scored above the 70th percentile on the anxiety-expression scale of the STAXI. Results indicated that Type A, angry, participants had increased HR reactivity moving from periods of non-REM sleep to REM sleep. Furthermore, these individuals also showed the same HR during periods of stress and REM sleep, whereas their nonangry counterparts exhibited a significant decrease in HR during this sleep cycle (48). Furthermore, Bardwell and colleagues (23) conducted an investigation looking at correlates of sleep quality and architecture in participants with and without sleep apnea. Results indicated that, after controlling for age, BMI, and hypertension, anger—as measured using the Profile of Mood States anger scale (49)—was positively correlated with total time in REM sleep (23). Although these studies look at variables that are not directly consistent with this investigation, they provide support for the relationship between anger and REM sleep. Further research utilizing polysomnography should be conducted to evaluate fully the relationship between anger expression and REM sleep as a pathway by which sleep quality is affected.

There are a number of physiological changes associated with anger that may also account for these associations. For example, stress hormones associated with anger expression may also have an impact on sleep quality. A study of sleep disturbances and stress hormones in posttraumatic stress disorder found an increase in stress hormones during periods of lighter sleep shifting from the REM sleep stages (50). This finding may support the hypothesis that anger suppression (which may be associated with an increase in stress levels) affects REM sleep and subsequently sleep quality. Furthermore, research has found that an increase in the stress hormone corticotropin-releasing factor is associated with a decrease in delta sleep, which is a characteristic of slow-wave sleep (51–55). Delta sleep is most active in the early hours of sleep and is thought to

be a marker of sleep homeostasis and the restorative function of sleep (56). Furthermore, several investigations have found that anger-out, anger temperament, and overall anger expression are associated with increased cortisol levels (57–59). Although these investigations provide broad support for this hypothesis, an investigation by Steptoe and colleagues found that anger-in and anger-out were not directly related to cortisol increases. Their data indicated that anger-out interacted with time of day and job strain to have an effect on cortisol concentrations, whereas anger-in scores did not (59).

Although some investigations have found evidence toward the relationship between anger-out and risk of cardiovascular reactivity and possible changes in cortisol concentrations, other investigations have illustrated that overt anger expression may have positive effects on the individual. Hokanson and Shetler presented evidence that individuals who were given the opportunity to show aggression toward an individual who caused them frustration had significantly lower BP at the end of the experiment as compared with those participants who were not given the opportunity to express their anger (15). Engebretson and colleagues found similar results in that participants who were given the opportunity to express anger toward their antagonist experienced a quicker decline in cardiovascular reactivity than their counterparts who were not awarded such an opportunity (14). Although our investigation did not address the associations between anger expression and physiological changes, these results may provide support for the mechanisms by which anger-out decreases the risk of poor sleep quality. Further research needs to be conducted in this area to investigate more specifically types of anger expression and their relationships to stress hormones and other physiological changes.

Research into anger expression, angry rumination, and their influence on the sympathetic nervous system also provides potential explanations for the relationship between anger expression and sleep quality. Several studies have indicated that anger suppression and angry rumination work to heighten sympathetic nervous system activity by increasing systolic BP and HR and at the same time decreasing parasympathetic activity. This leads to low vagal tone and subsequently places an individual at risk for increased BP variability, decreased HR variability, and slower cardiovascular recovery (17,60–63). This increased activation may play a key role in the relationship between anger suppression and poor sleep quality. Brosschot and Thayer further suggested that anger suppression and rumination may place individuals at a greater risk for experiencing anger-inducing situations because their interactions with the environment are likely to change as a result of their emotional state (13).

The highly significant association found between anger and poor sleep quality has several clinical implications. This information could be used to improve anger management programs to evaluate and address sleep quality, which has various health consequences, including increasing risk for CHD. It would also be important to test the effectiveness of these programs on modifying sleep and cardiovascular risk as a whole. Additionally, physicians could use this research to support anger management and expression screenings when trying to address sleep problems.

Strengths of our study include its large sample of outpatients with CHD and comprehensive measurement of potential confounding variables. However, several limitations must be considered in interpreting our results. First, there are always limitations when using self-report measures because inconsistencies or difficulties with recall may arise. Second, we did not administer the full version of the STAXI-2, which could have been helpful in differentiating between the effects of anger-in (suppression) and anger-control, or angry-reaction, for example. Third, we did not specifically account for sleep apnea, and greater sleep apnea could lead to both anger and poor sleep quality. However, anger was not associated with snoring in our sample, and adjustment for snoring, BMI, and systolic BP did not affect the association between anger and sleep quality. Fourth, the self-report measure of sleep quality used in this study prohibited us from evaluating the potential physiological causes for the relationships we found. Finally, because our study population consisted of mostly older male veterans, our results may not generalize to all populations.

In summary, our results indicate that suppressing anger is associated with poor sleep quality in patients with CHD. These results suggest that anger suppression may be a risk factor for poor sleep quality in patients with CHD, and they raise the possibility that modifying anger expression may improve sleep quality and possibly cardiovascular outcomes in patients with CHD.

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