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**BIOBEHAVIORAL RESEARCH ON CORONARY HEART DISEASE :  
WHERE IS THE PERSON ?**

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by

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Running head : PERSONALITY AND CHD

## ABSTRACT

This study examined the thesis that patients with coronary heart disease (CHD) comprise discrete personality subtypes, and that identification of these subtypes may benefit biobehavioral research on CHD. Measures of Negative Affectivity, Social Inhibition, and Self-Deception were used to generate a personality taxonomy through cluster analysis in a sample of 405 men with CHD. This empirical taxonomy served as a basis for the development of a conceptual model which delineates *hardy*, *distressed*, *inhibited*, and *repressive* subtypes. Coronary proneness may differ across these subtypes to the extent that potential behavioral correlates of CHD were associated with subtype membership. Distressed individuals (characterized by elevated levels of Type A behavior, anger, hostility, and life stress) and inhibited individuals (characterized by the nonexpression of anger) may be particularly coronary prone. It is concluded that research should focus on the interaction of global traits that may define subtypes of patients with CHD.

**Key Words:** coronary heart disease; personality; Type A behavior; hostility; coping

## INTRODUCTION

*"The chief danger in the concept of trait is that, through habitual and careless use, it may come to stand for an assembly of separate and self-active faculties, thought to govern behavior all by themselves, without interference."* (G.W. Allport, 1937, p 312)

Biobehavioral research on coronary heart disease (CHD) has received impetus from the inability to identify 50% of the new cases of CHD based on standard risk factors such as hypertension, hyperlipidemia, and smoking (Krantz et al., 1988). This research has mainly focused on Type A behavior, a behavior pattern characterized by a sense of time-urgency and hostility. While some prospective studies found that Type A behavior was associated with the incidence of CHD (Rosenman et al., 1975; Haynes et al., 1980; Kornitzer et al., 1981), others failed to replicate this association (Shekelle et al., 1985b). Likewise, studies of Type A behavior as a risk factor for progression of CHD have produced inconsistent findings (Barefoot et al., 1989; Case et al., 1985; Jenkins et al., 1976; Ragland & Brand, 1988; Shekelle et al., 1985a).

These contradictory findings stimulated the search for specific risk factors such as potential for hostility and anger-in (e.g., Barefoot et al. 1983; Dembroski et al., 1985; R. Williams, 1987). In fact, reanalyses of data from the Western Collaborative Group Study (the first prospective study that identified Type A as a risk factor) and the Multiple Risk Factor Intervention Trial (a frequently cited study questioning the role of behavioral risk factors) indicated that ratings of hostility were associated with CHD incidence (Hecker et al., 1988; Dembroski et al., 1989). Other follow-up studies, however, failed to replicate the hostility-CHD association (McCranie et al., 1986; Leon et al., 1988; Hearn et al., 1989). Although the Structured Interview assessment of Type A behavior predicts actual CHD (H. Friedman & Booth-Kewley, 1988; Matthews 1988), the nature of that relationship is far more complex than is conveyed by the simple assertion that Type A is a risk factor for CHD (Dimsdale, 1988). Rather, the substantial variation of findings in this area suggests that important moderating variables are involved.

### Personality and Health

A major problem with attempts to find the behavioral pathogen (such as Type A behavior or hostility) leading to CHD is that emotional and behavioral reaction patterns do not occur outside a context. Since the human body is a complex system comprised of many subsystems, it is likely that a variety of different influences are at work in the relationship between personality and health (H. Friedman, 1990; H. Friedman & DiMatteo, 1989). Accordingly, it is *not* being suggested that biological or environmental factors are any less important, merely that personality factors may as well have a moderating effect on health and therefore should be studied in their own right. In contrast to this proposition, surprisingly little attention has been paid to the role of personality in CHD. Personality refers to structures and processes that underlie regularities in human experience and behavior (Gangestad & Snyder, 1985). Although Type A represents itself an emotional and behavioral style, this construct was specifically designed, however, to avoid association with

broader psychological constructs such as chronic emotional distress or repressive coping. This absence of conceptual basis in psychological theory has substantially hampered a more comprehensive understanding of the health consequences of Type A behavior and hostility (Emmons, 1992; H. Friedman, 1990). Therefore, these constructs should be placed in a theoretical framework of regularities in human behavior (Denollet, 1991).

With reference to this issue, the theoretical framework of this paper is based on the assumption that coping styles can moderate the stress-health relationship (Krantz & Hedges, 1987). This approach places importance on the individual's coping abilities in the face of life stress. Coping is a dynamic and ongoing process of constantly changing cognitive and behavioral efforts to manage challenge (Folkman & Lazarus, 1985; Lazarus 1990). However, psychological research on disease proneness needs to take a broad enough view through the investigation of coping styles that persist across time and a variety of situations (e.g., Ouellette Kobasa, 1990). That is, depending on a person's view of the world and psychological resources, he or she is more or less likely to experience certain emotional and physiological responses when confronted by environmental stressors (H. Friedman & DiMatteo, 1989). Particular coping styles, then, may lead to adverse physiological and behavioral responses that have consequences for health. Consistent with this proposition, accumulating evidence suggests that something is going on in terms of the relation between personality and CHD (e.g., Dimsdale, 1988; H. Friedman, 1991; H. Friedman & Booth-Kewley, 1987a). However, an important unsolved conceptual issue is determining the best way to think about personality in the context of health (H. Friedman, 1990).

### **Toward a Taxonomic Model**

Across the sciences, taxonomy precedes causal analysis. That is, the entities in the field of study must be analyzed and classified before meaningful theories concerning their behavior can be framed (Eysenck, 1991). The chemist therefore classifies elements, the botanist plants, and the zoologist animals. Likewise, it is essential that some consensually validated criteria be used to identify groups of individuals who share a set of relevant personality characteristics. Such a classification scheme may facilitate communication and research, thereby stimulating the advancement of knowledge and, consequently, treatment of patients (e.g., Turk & Rudy, 1990). Since personality is often loosely defined, it is, however, not clear whether research should focus on cognitive styles, defense mechanisms, interpersonal orientations, or basic traits as potential psychological correlates of health and disease (H. Friedman, 1990). Therefore, this paper concerns the relations among the various personality characteristics relevant to CHD and describes a new way to think about this matter. Basically, this approach focuses on the place of potential psychological correlates of CHD in an appropriate taxonomic model of *personality subtypes*. Most important, these subtypes are defined by the interaction of global personality traits that (a) are theoretically sound, (b) are relevant to behavior in a large number of situations, and (c) have much explanatory power (Denollet & De Potter, 1992; Weinberger & Schwartz, 1990). Two major

principles undergird the development of this taxonomic model.

First, different models of personality all have identified a small set (i.e., 2 to 5) of global traits that reflect one's general approach to life and summarize the tendencies of individuals (e.g., Eysenck, 1991; McCrae & Costa, 1987; Tellegen, 1985; Weinberger & Schwartz, 1990). This paper focuses on three global traits. *Negative Affectivity* (or neuroticism) reflects the tendency to experience emotional distress and the inability to cope effectively with stress. Although emotional distress is associated with invalid health complaints such as chest pain in the absence of CHD (Costa & McCrae, 1987), evidence suggests that emotional distress is associated with actual CHD as well (H. Friedman, 1990). *Positive Affectivity* (or extraversion) reflects general levels of enthusiasm and engagement with the environment. Inhibition when with others (i.e., shyness) and preference for being with others (i.e., sociability) are two related components of extraversion (Cheek & Buss, 1981). Submissive/self-minimizing (and conversely assertive/outspoken) behavior is in fact closely related to introversion-extraversion (e.g., Digman & Inouye, 1986). Evidence suggests that inhibition (e.g., H. Friedman & Booth-Kewley, 1987b; Gross, 1989; Pennebaker, 1992) and anger-in (e.g., Dembroski et al., 1985; Haynes et al., 1980; MacDougall et al., 1985) are potential behavioral correlates of cancer and CHD. *Self-Deception* is a third global trait which reflects the tendency to remain unaware of unpleasant emotional realities (Gur & Sackeim, 1979). Previous studies suggest that research on CHD may benefit from the assessment of this unconscious form of defensiveness (e.g., Denollet, 1991).

Second, research should move its focus from isolated dimensions to the interplay of dimensions that determines the structure of complex systems (Weinberger & Schwartz, 1990). Since personality is conceived as a complex system that underlies regularities in human behavior (Gangestad & Snyder, 1985), personality research should look beyond the traditional question of how single traits affect single behaviors, to the way traits combine in the determination of behavior. However, research on personality and health is largely limited to studies of only one personality variable at a time in relationship to health (Ouellette Kobasa, 1990). Studies that look at the patterns of relationships between several aspects of personality at a time (entailing emotional/cognitive/behavioral styles, temperament, and learned expectancies) may help illuminate the relevance of psychosocial factors to health and disease. Across the sciences, categorical presentations are in fact more efficacious than dimensional ones when one is interested in complex systems that differ on a large number of attributes (Weinberger & Schwarz, 1990).

As noted earlier, the purpose of this study was to devise a classification scheme for CHD patients that is based on the interaction of three global personality traits. Deductive strategies (relying on specific assumptions about the characteristics forming the basis for assignment to categories) as well as inductive strategies (relying on statistical procedures whereby individuals are grouped quantitatively according to characteristics that they share) can be used to classify patients (Turk & Rudy, 1990). In a previous study, a deductive approach was used to define three coping

subtypes of CHD patients (Denollet, 1991). Since an infinite number of classification systems can be developed deductively, a subsequent study used an inductive approach which identified four coping subtypes (Denollet & De Potter, 1992). There is of course a mutual interaction between empirical induction and theoretical deduction, to the advantage of both sides of the scientific enterprise (e.g., Eysenck, 1991). The current study therefore used a combined inductive-deductive approach in the study of personality and CHD. For this purpose, a sample of patients with well established CHD was used because identification of discrete personality subtypes in this population (a) may help to explain mixed findings in biobehavioral research on CHD, and (b) makes it possible to examine the relationship between subtype and long-term health outcomes in later prospective designs. Since evidence suggests that personality plays a role in both the development and progression of disease (H. Friedman, 1991), the conceptual understanding of this relationship should focus on the likelihood of recovery as well.

## METHODS

### Subjects

The subjects were 405 male CHD patients admitted to the cardiac rehabilitation program of the University Hospital of Antwerp between June 1985 - November 1989. The mean age was 55.2 years (*SD* 8.4). Outpatient rehabilitation was started  $\pm$  3 weeks following acute myocardial infarction (AMI, *N*=106), coronary artery bypass graft surgery (CABG, *N*=164), AMI & CABG (*N*=83), or percutaneous transluminal coronary angioplasty (PTCA, *N*=52). All subjects agreed to participate in the study. On admission to the rehabilitation program, they filled out psychological questionnaires and underwent an interview as well as an exercise test.

### Measures

The selected measures have been extensively validated and have adequate levels of reliability. The following measures of global traits were used to develop a personality taxonomy.

**Negative Affectivity.** This global trait is assessed well by measures of dysphoric individual differences (Watson & Pennebaker, 1989). Therefore, the Dutch trait form of the State Trait Anxiety Inventory was used as a measure of Negative Affectivity (Van Der Ploeg et al., 1980).

**Social Inhibition.** Positive Affectivity is assessed well by introversion-extraversion scales (Watson & Pennebaker, 1989). Since the focus was on potential coronary prone aspects of interpersonal behavior such as inhibition of emotional expression and anger-in, a scale that measures inhibition and insecurity when with others was used to assess this global trait. Shyness and self-consciousness can reliably be assessed by, for instance, the Cheek and Buss (1981) scale, or by a subscale of the revised MMPI Social Introversion scale (Ben-Porath et al., 1989). In this study, the Social Inhibition scale of the Heart Patients Psychological Questionnaire (Erdman et al., 1986) was used because this scale was designed specifically for cardiac patients.

**Self-Deception.** The Marlowe-Crowne scale (Crowne & Marlowe, 1960) was used to assess the

self-deceptive factor that underlies defensiveness (Denollet, 1991). Although the Marlowe-Crowne scale was originally developed as a measure of social desirability, abundant later evidence indicates that this scale measures itself an individual difference variable which is related to constructs such as defensiveness and approval dependence (Evans, 1982). High Marlowe-Crowne scorers are in fact highly conscientious, well-adjusted to the rules of society, and cooperative (McCrae & Costa, 1983). This scale thus measures a "need for approval" or "social adjustment" dimension of defensiveness that may be important in predicting real-life outcomes. Albeit originally described as the strategic counterpart of self-deception, impression management may also be unintentional defensiveness elicited by threat (Paulhus & Levitt, 1987). The Marlowe-Crowne therefore was conceptualized as a measure of unconscious defensiveness. Three items were omitted because they were judged to be typical of an American population.

The following behavioral variables that have been related to the development of CHD were used to validate the devised taxonomy. Some scales were completed by subsets of patients.

**Ratings of Type A Behavior & Anger-In.** All subjects underwent an interview in order to rate Type A behavior (M. Friedman & Powell, 1984) and anger-in (MacDougall et al., 1985) based on reported symptoms and observed signs. Anger-in refers to the inability to express anger and is associated with the avoidance of interpersonal conflict (MacDougall et al., 1985). This interview was audiotaped and quantified for the intensity of Type A and anger-in manifestations; using a check list, these manifestations were rated as 0,1,2, or 3 (Denollet, 1991).

**Chronic Tension.** All subjects completed the Chronic Tension scale of the Millon Behavioral Health Inventory (MBHI; Millon et al., 1982). The MBHI Chronic Tension scale taps the level of perceived chronic stress and the tendency to live under considerable self-imposed pressure.

**Trait Anger.** All subjects completed the trait form of the State Trait Anger Scale. This scale taps the tendency to experience a lot of situations as frustrating and to react in those situations with anger (Van Der Ploeg et al., 1982) and is therefore closely related to potential for hostility.

**Hostility.** A subset of 288 subjects completed the Cook-Medley Hostility scale (Cook & Medley, 1954), which measures cynical hostility (Smith & Frohm, 1985). This scale has produced mixed findings regarding prediction of CHD incidence (e.g., Barefoot et al., 1983; Hearn et al., 1989).

**Self-Report of Type A behavior.** A subset of 259 subjects completed the Jenkins Activity Survey (JAS, Dutch adaptation), which produces a global Type A score (Appels, 1985). Despite its limited predictive value (e.g., Matthews, 1988), the JAS was used to validate Type A ratings.

The following variables that have been related to deterioration of health in CHD patients were used to validate the devised taxonomy. Some measures were completed by subsamples.

**Life Stress.** Evidence suggests that following AMI, male patients classified as having a high degree of life stress and being socially isolated have an increased long-term mortality risk (Ruberman et al., 1984). All subjects therefore completed the MBHI scales (Millon et al., 1982) Recent Stress (which taps the perception of recent marked changes in one's life) and Social Alienation (which taps the perception of -lack of- support from others), and were then classified in one of three different



categories of life stress: high, intermediate, or low.

**Depression.** Depression has been associated with development of CHD (Booth-Kewley & H. Friedman, 1987), as well as increased long-term risk for reinfarction and cardiac mortality among patients with CHD (Ahern et al., 1990; Carney et al., 1988; Ladwig et al., 1991). Depressive symptomatology therefore was assessed in a subset of 240 patients with the Dutch adaptation of the SCL90 depression subscale (Arrindell & Ettema, 1986), which consists of 16 self-report items concerning depressive behavior, cognition, and affect during the past week.

**Physical Fitness.** Six weeks after the cardiac event ( $\pm$  3 weeks after admission to the program), 362 subjects underwent a sign- or symptom limited bicycle exercise test. Cardiorespiratory fitness (measured in WATT) was conceptualized as an objective measure of health status.

### Statistical Analyses

Pearson correlations were calculated in order to examine the relationships among independent and dependent measures. Since cluster analysis is designed to find natural subtypes that are categorical, this multivariate procedure was used to generate an empirically based taxonomy of personality subtypes (Lorr & Suziedelis, 1982). Ward's minimum variance method was used because this method is clearly preferable if one wishes to generate a classification (Blashfield, 1976). The cubic clustering criterion was used to decide on the optimum number of clusters to retain: a sharp increase in the within-group sum of squares indicates that a great deal of accuracy has been lost by reducing the number of clusters. To examine the reliability of the generated cluster solution, the study population was randomly divided into 2 samples: once homogeneous clusters were identified in sample 1 ( $N=202$ ), the same clustering procedure was used in sample 2 ( $N=203$ ). This empirical taxonomy served as a basis for the development of a personality model. Following discriminant analyses, a median split of the trait measures that best described the identified clusters was used to classify subjects into discrete personality subtypes. The resulting model was then tested against the purpose for which it was generated: its predictive validity regarding behavioral variables that have been associated with CHD in previous research. MANOVAs, ANOVAs, and post hoc analyses were performed to detect the significant subtype differences on Type A, anger-in, tension, anger, hostility, and depression measures. Crosstabulation was used to examine the relationship between subtypes and life stress.

## RESULTS

### Relationships Among Measures

**TABLE 1** There was no overall difference in trait scores among AMI, CABG, and PTCA patients [ $Wilk's \lambda=0.98, F(9,969)=1.08, p=.38$ ], which justified pooling of subjects in one CHD category for classification purposes. Correlations among measures of Negative Affectivity, Social Inhibition and, Self-Deception were sufficiently low (i.e., 0 - 12 % shared variance) to justify jointly using these global traits for classification purposes (Table 1). Significant correlations in the range of .50 to

.60 (Negative Affectivity) and in the range of .30 to .40 (Self-Deception) emerged with reference to self-reports of chronic tension, anger and life stress. Likewise, global traits correlated significantly in the range of .20 with ratings of Type A behavior (Negative Affectivity / Self-Deception) and anger-in (Social Inhibition). Furthermore, significant correlations were found among ratings of Type A behavior and self-reports of chronic tension and anger (in the range of .30 to .40), and among self-reports of chronic tension, anger, and life stress (in the range of .40 to .50). Regarding measures that were completed by subsets of patients, significant correlations were found among Self-Deception and Ho self-reports of hostility ( $r=-.46$ ); among interview ratings and JAS self-reports of Type A behavior ( $r=.54$ ); among JAS self-reports of Type A behavior and self-reports of chronic tension ( $r=.68$ ) and trait anger ( $r=.42$ ); and among Ho self-reports of hostility and self-reports of chronic tension ( $r=.47$ ), trait anger ( $r=.54$ ), and social alienation ( $r=.50$ ) (all correlations:  $p<.001$ ). Finally, a high correlation among Negative Affectivity and SCL90 scores of depressive symptomatology ( $r=.73, p<.001$ ) indicated a substantial overlap of more than 50 % shared variance.

### Development of a Four-Group Classification Scheme

**FIGURE 1** The left side of figure 1 shows the four clusters that were identified through cluster analysis using Ward's method and the cubic clustering criterion. Since similar clusters were found in sample 1 (full line) and sample 2 (dotted line), the corresponding clusters of both samples were combined and their characteristics investigated. Not surprisingly given the type of classification used, significant differences among clusters emerged on the three global traits [Wilk's  $\lambda=0.23, F(9,971)=88.56, p<.0001$ ]. Post hoc analyses indicated that cluster 1 ( $N=81$ ) comprised *hardy* subjects with adequate coping and social skills; cluster 2 ( $N=100$ ) comprised *distressed* subjects who tend to be dissatisfied with life in general; cluster 3 ( $N=145$ ) comprised *inhibited* subjects who tend to be shy/tense when with others; and cluster 4 ( $N=79$ ) comprised *repressive* subjects who tend to repress negative affect. A 2-cluster solution maintained the distinction between *low-defensive* (1 & 2) and *high-defensive* (3 & 4) clusters; a discriminant function determined by Self-Deception (.81) correctly classified 84% of the subjects. A 3-cluster solution sorted low-defensive subjects into hardy and distressed clusters; a discriminant function determined by Negative Affectivity (.85) correctly classified 89% of these subjects. Finally, high-defensive subjects were sorted into inhibited and repressive clusters; a discriminant function determined by Social Inhibition (.91) correctly classified 85% of these subjects.

Next, this empirical model was formalized in an a priori personality model. By analogy with cluster analysis, subjects were first classified as *low-* or *high-defensive* using a median split on the Marlowe-Crowne scale ( $<20/\geq 20$ ). Low-defensive subjects were then classified as *hardy* ( $N=90$ ) or *distressed* ( $N=92$ ) using a median split on their Trait-Anxiety scores ( $<44/\geq 44$ ), while high-defensive subjects were classified as *inhibited* ( $N=116$ ) or *repressive* ( $N=107$ ) using a median split on their Social Inhibition scores ( $\geq 12/<12$ ). The right side of figure 1 shows the mean standardized

T scores for the four subtypes of this a priori model. This figure indicates that the a priori personality subtypes closely resembled those identified through cluster analysis.

### Validity of the Classification Scheme

**FIGURE 2** Figure 2 shows the group differences on measures of Type A behavior, chronic tension, anger, anger-in, and hostility that were used to evaluate the validity of the classification scheme. MANOVA indicated an overall difference among subtypes on ratings of Type A and anger-in and self-reports of chronic tension and anger [Wilk's  $\lambda=0.69, F(12,1053)=12.97, p<.0001$ ]. ANOVAs confirmed that these differences occurred on measures of Type A ( $F=8.43$ ), anger-in ( $F=7.25$ ), chronic tension ( $F=35.00$ ), and trait-anger ( $F=31.09$ ) [all  $dfs=3,401, p<.0001$ ]. Post hoc analyses indicated that distressed subjects displayed significantly higher Type A ratings, and inhibited subjects significantly higher anger-in ratings, than the other 3 subtypes ( $p<.05$ ). Distressed subjects also reported the highest levels of tension and anger, hardy subjects the next highest, and inhibited subjects the lowest levels of tension and anger ( $p<.05$ ). Repressive subjects reported an intermediate tension level and the lowest anger level. Significant differences among subtypes also emerged on the JAS Type A scale [ $F(3,255)=13.21, p<.0001$ ] and the Ho hostility scale [ $F(3,284)=25.47, p<.0001$ ] in subsets of 259 and 288 subjects, respectively. Post hoc analyses indicated that distressed subjects displayed the highest JAS Type A scores, hardy and repressive subjects the next highest, and inhibited subjects the lowest JAS scores ( $p<.05$ ). All subtypes displayed significantly different Ho hostility scores, with distressed subjects reporting the highest levels and repressive subjects the lowest levels of hostility ( $p<.05$ ).

**FIGURE 3** To examine the association between subtype and life stress, all subjects were classified in one of three categories: the *high*-life stress category with scores above the median of the Recent Stress and Social Alienation scales ( $N=130$ ), the *low*-life stress category with scores below the median of both scales ( $N=130$ ), or the *intermediate*-life stress category with scores above the median of one of these scales ( $N=145$ ). As figure 3 shows, a significant association between subtype and stress emerged [ $\chi^2(6)=110.69, p<.0001$ ]: 74% of the distressed subjects reported *high* life stress, whereas 52% of the repressive subjects reported *low* life stress.

**FIGURE 4** Figure 4 shows the mean depression scores in a subset of 240 subjects: distressed subjects reported significantly more depressive complaints than the other subtypes [ $F(3,236)=34.10, p<.0001$ ]. On the whole, a consistent association emerged between the a priori defined personality subtypes and a large number of potential psychosocial correlates of CHD. In contrast, these subtypes were neither related to medical category [ $\chi^2(9)=4.91, p=.84$ ], nor to cardiorespiratory fitness as measured by exercise stress testing [ $F(3,358)=1.33, p=.26$ ].

### DISCUSSION

This study indicates that the population of male CHD patients comprises distinctive personality subtypes and that these subtypes have a significant impact on potential psychosocial

correlates of CHD. Global traits were used to generate a personality taxonomy through cluster analysis (a statistical procedure that classifies entities on the basis of their similarity across a set of attributes into homogeneous subtypes). A 4-cluster solution was adopted since it maintained clinical distinctiveness lost in a 3-cluster solution, and the accuracy of the 4-cluster solution was demonstrated across parallel data sets. This empirical taxonomy served as a basis for the delineation of four personality subtypes on a priori grounds. Most important, the resulting model was validated against behavioral variables that have been related to CHD in previous research. These findings therefore suggest the moderating role of personality in biobehavioral research on CHD. Although this finding may not seem novel from a common sense point of view, it should be remembered that personality traits have been in considerable dispute during the past twenty years. The current findings support, however, the potential value of global traits.

Before discussing the implications of these findings, it should be noted that the current research has a number of limitations. (a) The generalizability of this study is limited because only males were included, and the results need to be cross-validated and replicated with other assessment instruments. (b) Selection bias may have inflated the findings of this study because all subjects were rehabilitation candidates. This artifact occurs if certain types of patients are more likely than others to enter the program (H. Friedman & DiMatteo, 1989). The factors that determine the presence of CHD patients in the Antwerp rehabilitation program are, however, largely a function of the attitude of cardiologists and general practitioners towards rehabilitation. (c) Since the association between personality subtype and behavioral correlates of CHD was examined at the same point in time, cause and effect relationships cannot be reliably determined. This cross-sectional bias does not explain away the overall conclusion, but instead appears to strengthen it: despite the fact that all subjects experienced similar major life stress (i.e., the occurrence of a coronary event), a clear relationship between personality subtype and psychological functioning was found. Thus, people are likely to display their usual coping style when they are diagnosed with a disease (e.g., Temoshok, 1990). Accordingly, subtype membership was not related to cardiorespiratory fitness as an objective measure of health status. (d) The substantial overlap of the Negative Affectivity and depression scales indicates that they both measured the same nonspecific component of affective distress. Depression is, however, distinguished from anxiety by the relative absence of positive affect (Clark & Watson, 1991).

### **The Four-Group Conceptual Scheme**

Using the Marlowe-Crowne and Trait-Anxiety scales, two subtypes of *low-defensive* subjects were defined. *Hardy subjects*, who are low in defensiveness and distress, may use an adaptive style of coping with stress and therefore are expected to be particularly well-adjusted. Hardiness as originally defined by Kobasa (1979) is characterized by the belief that life experiences are controllable, the belief that change is normal in life and represents a challenge, and the belief that life experiences are meaningful. These beliefs underlie the individual's tendency to make

adaptive interpretations when encountering a stressful event. Since hardiness is likely to be associated with both higher levels of active coping (which entails low levels of defensiveness; see also Denollet, 1991) and lower levels of distress (Allred & Smith, 1989), subjects scoring low on both the Marlowe-Crowne and Trait-Anxiety scales were conceptualized to comprise a hardy or resilient personality subtype. Individuals who are low in distress but moderate in restraint are in fact likely to be self-assured in that they can meet their own personal needs without excessive conflict with the needs of others (Weinberger & Schwartz, 1990). *Distressed subjects*, who are low in defensiveness but high in distress, may be unable to cope effectively with the ongoing events of life and therefore are expected to be particularly prone to adjustment difficulties (McCrae & Costa, 1986; Tellegen, 1985). Accordingly, they tend to be dissatisfied with themselves, others, and the world in general (Watson & Pennebaker, 1989).

In contrast to the hardy and distressed subtypes, high Marlowe-Crowne scorers display higher levels of approval dependence and lower levels of self-disclosure (e.g., Evans, 1982). Using the Marlowe-Crowne and Social Inhibition scales, two subtypes of *high-defensive* subjects were defined. *Inhibited subjects*, who are high in defensiveness and social inhibition, may use avoidant and dependent style of coping and therefore are expected to be insecure and low in self-expression (Cheek & Buss, 1981). Usually, the processes of inhibition are highly adaptive because individuals must learn to behave in socially defined ways in order to function well in the society (Pennebaker, 1992). However, inhibition can have potential drawbacks as well. Regarding this issue, the "Type C" coping style has been described as being cooperative and compliant with external authorities, but also as being unassertive and unexpressive of negative emotions, particularly anger (e.g., Temoshok, 1990). Given their desire to avoid disapproval, inhibited individuals are particularly concerned with doing what others want and consequently may adopt self-enhancing strategies such as conformity or withdrawal (Alden & Wallace, 1991). As such, the inhibited subtype appears to be the opponent of the hardy subtype (cf. figure 1). *Repressive subjects*, who are high in defensiveness but low in social inhibition, may use a repressive style of coping and therefore are expected to avoid threatening cognitions and emotions (Denollet, 1991). While inhibited subjects exhibit extensive control over the expression of negative emotions, repressive subjects are likely to remain unaware of these emotions in order to enhance their self-esteem. Accordingly, they tend to deny experiencing distress even in the presence of objective signs indicating that they actually are distressed (Emmons, 1992). As such, the repressive subtype appears to be the opponent of the distressed subtype (cf. figure 1).

Recently, a four-group conceptual scheme with interesting analogies to the current scheme has been described by H. Friedman (1991) in his book "The Self-Healing Personality". By analogy with the Greek physicians Hippocrates and Galen, H. Friedman delineates four personality subtypes that may be related to disease and health. *Hostile* people are grouchy and resentful, have a pessimistic, quarrelsome view of life, and are not trusting, helpful, or forgiving. *Depressed* people generally feel sad, tired, indecisive, and worthless, and tend to be alert to problems. They are likely

to be prone to excessive stress which manifests itself in a disruption of hormonal systems that are used to maintain internal homeostasis. *Apathetic* people may appear cooperative, compliant, and unassertive, and tend to be out of touch with their own emotions. Since apathy is characterized by the suppression or repression (i.e., the conscious or unconscious pushing back) of threatening cognitions and emotions, apathetic people often do not react with any overt emotions when they experience challenges or disruptions in their lives. However, they still may be stressed when challenged by happenings in their environment. *Enthusiastic* people are low on neuroticism and social inhibition. They are relaxed and secure, and tend to be outgoing, spontaneous, and warm. As a consequence, enthusiastic people are likely to cope well with challenging events and are often successful in accomplishing things. Apparently, the distressed subtype of the current scheme comprises hostile and depressed people, while the inhibited/repressive subtypes are characterized by the suppression/repression of negative emotions, and the hardy subtype comprises people that are low on neuroticism and inhibition. Most important, these subtypes are likely to affect health (H. Friedman, 1991).

### **Personality Subtypes in the Context of Health**

One might expect coronary proneness to differ across subtypes to the extent that different behavioral correlates were associated with membership in those subtypes. Since a maladapted personality may actually be the one that is particularly prone to CHD, distressed subjects did emerge as potential risk category in the current study: they displayed high levels of Type A behavior, anger, hostility, and life stress. Regarding this issue, some authors have described a neuroticism artifact in the sense that emotional distress is related to health complaints (such as chest pain) but not actual cardiac disease (Stone & Costa, 1990). Although self-reported illness is in fact not synonymous with the presence of organic disease (Costa & McCrae, 1987; Watson & Pennebaker, 1989), this phenomenon does not mean that emotional distress cannot also play a true causal role in CHD (H. Friedman, 1990). Rather, evidence suggests that emotional distress is associated with both invalid health complaints and actual coronary proneness. In the general population, emotional distress has been associated with the incidence of CHD (e.g., Booth-Kewley & H. Friedman, 1987; Crisp et al., 1984; Rosengren et al., 1991) as well as increased mortality risks (e.g., Murphy et al., 1987; Somervell et al., 1989). Likewise, emotional distress has been associated with reinfarction and long-term mortality among patients with CHD (Ahern et al., 1990; Carney et al., 1988; Frasure-Smith, 1991; Ladwig et al., 1991; Ruberman et al., 1984). Recent studies suggest that psychological stress may in fact cause platelet activation and coronary vasoconstriction in CHD patients (Grignani et al., 1991; Krantz et al., 1991; Yeung et al., 1991; J. Williams et al., 1991). Since these physiological mechanisms may play a key role in the progression of CHD (Nobuyoshi et al., 1991; Thaulow et al., 1991), the thesis that distress is related to CHD warrants further consideration.

Apart from the clinically prominent emotional distress dimension, psychological research

on disease has also focused on inhibition and repressive coping. In this study, inhibited subjects displayed low levels of Type A behavior, anger, and hostility, but also significantly higher ratings of anger-in. While these individuals are quiet and unaggressive on the surface, they may actually avoid interpersonal conflict through excessive control over the expression of emotions (e.g., H. Friedman & Booth-Kewley, 1987b). Albeit adaptive in nature, inhibition or "Type C" coping (i.e., focusing on others, minimizing one's own needs, and not expressing one's true emotions) will probably result in the maintenance of social equilibrium at the expense of biological homeostasis if it is applied inflexibly to all situations (Temoshok, 1990). That is, long-term inhibition may cause health problems because restraining ongoing thoughts, feelings, and behaviors requires physiological work and impedes cognitive processes that promote health (Pennebaker, 1992). Evidence in fact suggests that over time, the work of inhibition can be viewed as a form of disease promoting stress. Inhibited children, for example, appear to have an increased risk for health problems and physiological disorder (Kagan et al., 1988). In adult populations, inhibition and nonexpression of emotion has been associated with the incidence and progression of CHD (Dembroski et al., 1985; Haynes et al., 1980; MacDougall et al., 1985) and cancer (Gross, 1989; Kune et al., 1991; Temoshok, 1990), as well as all-cause mortality (Julius et al., 1986). Likewise, individuals who do not talk about their personal traumas are more prone to disease (Pennebaker & Susman, 1988). In this study, repressive subjects displayed a moderate level of Type A behavior, and the lowest levels of anger, hostility, and life stress. Although defensiveness may in fact protect against lifetime prevalence of emotional disorder (e.g., Lane et al., 1990), evidence also suggests that repressive coping may promote health-related problems. For example, repressive coping has been associated with hypertension (King et al., 1990) and cancer progression (Jensen, 1987). Accordingly, several mechanisms have been proposed to explain why repressive individuals may be more susceptible to disease, including psychophysiological factors, differences in health-related behaviors and social support, and the tendency to ignore threatening information about somatic malfunctioning (Emmons, 1992; Esterling et al., 1990; Jamner et al., 1988; Schwartz, 1983).

Research has also identified personality characteristics such as hardiness (Kobasa, 1979), and the dispositional sense of coherence (Antonovsky, 1990) that appear to be health promoting. That is, their characteristic way of coping with stress may help to explain the capacity of some people not to become ill when they are confronted with stressful situations. Accordingly, it has been suggested that hardy individuals are more likely to maintain health because their coping style probably reduces the stressfulness of aversive events (Kobasa, 1979). For example, high hardy men may appraise an aversive task as less threatening and more controllable, and consequently may respond to this task with less negative affect, more positive affect, and lower physiological arousal than low hardy men (Wiebe, 1991). Likewise, individuals with a strong sense of coherence have an integrated view of the world as more or less comprehensible, manageable, and meaningful, which enables them to select the particular coping strategy that seems most appropriate to deal with the stressor being confronted (Antonovsky, 1990). Since this ability to cope successfully with stress

may help to maintain homeostasis among bodily systems, it can be viewed as health promoting disposition. In fact, self-healing personalities have an inherent resilience and an emotional equilibrium that comes from doing the right combination of activities appropriate for the individual. Apparently, there are two major types of self-healing personalities, of which one is characterized by high sociability and need for stimulation, and the other by the tendency to be calm or relaxed (H. Friedman, 1991). In this study, hardy subjects displayed moderate levels of Type A behavior, anger, hostility, and life stress. Given their active expressive style, some of these subjects may be misidentified because of gross similarities with Type A individuals who are coronary prone (H. Friedman & Booth-Kewley, 1987b).

On the whole, it is hard to believe that personality is *not* related to the development and progression of disease. A major difficulty, however, concerns the definition and measurement of personality. Until these problems are resolved, inconsistent outcomes are likely to persist in this area. The current findings suggests that the focus of research should move from the traditional strategy of dividing subjects into two subtypes along a single trait, to a new strategy of defining subtypes in terms of interactions of traits (e.g., Weinberger & Schwartz, 1990). Negative Affectivity, for example, may fail to predict CHD if solely this trait is taken into account (Stone & Costa, 1990). However, actual associations between Negative Affectivity and CHD may be masked since both distressed and inhibited individuals are potentially coronary prone despite the fact that the former are *high* and the latter *low* in Negative Affectivity. Likewise, discrepant findings across studies of depression as a risk factor for cancer (Zonderman et al., 1989) could reflect the finding that individuals who avoid expression of negative affect may as well be cancer prone (Gross, 1989; Kune et al., 1991). Research also suggests that hardy individuals with Type A behavior may cope well with stress and thus are not coronary prone (H. Friedman & Booth-Kewley, 1987b). These propositions are speculative, but they also are consistent with the idea that certain units of personality are differently distributed into discrete categories (Gangestad & Snyder, 1985). That is, these propositions run counter the widespread assumption that differences between people are differences in degree, not in kind.

### **Personality and Health Revisited**

Clearly, this paper leaves a number of important issues unanswered. Although the current taxonomic model may predict nontest behaviors such as work resumption and tranquilizer use (Denollet & De Potter, 1992), a prospective study is needed in order to evaluate the ability of this model to predict health outcomes. Another issue concerns the mechanisms that account for the links between personality and disease (H. Friedman, 1992; Suls & Rittenhouse, 1990). Psychosocial factors may promote CHD directly through physiological effects, or indirectly through health-related behaviors such as smoking and adherence to treatment. A third possible mechanism is that personality may be related to CHD through an underlying biological variable which leads to the likelihood of both a certain type of personality and coronary proneness. That is, the personality



style may itself be harmless; it may merely be a marker of a biological third variable that increases CHD susceptibility. Constitutional hyperreactivity of the nervous system has been proposed as an underlying factor in the development of both Type A behavior and CHD (e.g., Krantz & Durel, 1983). In this model, Type A behavior is a marker of a biological variable which predisposes one to coronary atherosclerosis. Likewise, links among the nervous system and inhibition/introversion have been proposed as possible causes of poor health (H. Friedman & Booth-Kewley, 1987a; Pennebaker, 1992). Evidence in fact suggests that global traits such as the tendencies to experience distress or to rely on inhibitory processes (Pennebaker, 1992; Tellegen et al., 1988), as well as coronary prone factors such as cynicism and hostility (Carmelli et al., 1988; Matthews et al., 1984) may have a genetic component. These findings suggest the search for a biological basis of behavior (e.g., Eysenck, 1990).

Consistencies in behavior are also accounted for by the way individuals are socialized. The actualization of inhibited behavior in children, for example, probably requires some form of chronic environmental stress acting upon the underlying temperamental disposition (Kagan et al., 1988). Most important, a number of models that focus on the person-environment match as a determinant of disease have recently been developed (e.g., Revenson, 1990). Accordingly, the interactional model of hostility and CHD (Smith & Christensen, 1992) is based on the reciprocal relationship between the cognitive/behavioral correlates of hostility and the social environment. This model posits that (a) given their beliefs and expectations, hostile individuals are likely to behave in an antagonistic way, (b) which, in turn, is likely to elicit similar antagonistic behavior from others, (c) thereby confirming the hostile individual's cynical view of the world and decreasing social support. Likewise, recurrent anger or anxiety can indicate a troubled relationship with the world since the environment is frequently viewed as assaultive or threatening (Lazarus, 1990). Another example concerns evidence that defensive individuals, given their tendency to avoid disapproval and self-disclosure, may experience interpersonal difficulties in the areas of conflict resolution and social support (e.g., Emmons, 1992). In fact, the functional value of a coping strategy depends on its fit with the situational and intrapsychic requirements of the context in which a stressor occurs. Thus, it is not stressful environments per se but rather the chronic negative emotions that results from placing certain people into certain environments that is a contributor to illness (e.g., H. Friedman, 1991; Lazarus, 1990). Consequently, the individual's life circumstances and position in the social world, as well as other coping resources that he or she may use, can moderate the impact of Type A behavior and hostility on health (Blumenthal et al., 1987; Jamner et al., 1991; Smith & Christensen, 1992).

All of this complexity does not mean, however, that research should ignore the fact that personality plays a key role in disease (H. Friedman, 1990). This paper therefore proposes a new conceptual approach which focuses on the interaction of global traits that defines distinct personality subtypes of CHD patients. First, subtype membership may have a direct influence on the incidence of CHD. For example, distressed as well as inhibited individuals who, through a

combination of personal vulnerability and situational stressors, experience difficulties to maintain homeostasis among bodily systems may be at risk for CHD. Second, subtype membership may have a moderating effect on other risk factors. For example, Type A behavior may be a risk factor in the context of a distressed personality, but not in the context of a hardy personality (H. Friedman & Booth-Kewley, 1987b). Likewise, the adverse effects of hostility on health may be potentiated by other individual psychological characteristics such as defensiveness (Jamner et al., 1991). Third, subtype membership may be a marker of an underlying biological basis which predisposes one to CHD (e.g., Suls & Rittenhouse, 1990). Fourth, subtype membership may have implications with reference to intervention strategies. The proposition that individuals use characteristic styles to cope with stress does *not* entail that coping processes are fixed or unmodifiable (e.g., Pennebaker et al., 1990). However, distressed individuals may need psychological intervention, while hardy subjects may neither need nor seek psychological treatment. Furthermore, inhibited and repressive individuals are less likely to be diagnosed as being in need of professional support because of their low level of self-disclosure.

Admittedly, it still remains to be seen what, if any, potential value this conceptual scheme has for the study of personality and CHD. Future research therefore should focus on the ability of the taxonomic model to predict health outcome and well-being in the current sample. Meanwhile, the fact that diverse groups of CHD patients (infarction, bypass, and angioplasty) could be classified within a common taxonomy and that the derived personality subtypes were unrelated to physical fitness provided support for the generalizability of the classification system. However, the major purpose of this paper was to propose a new way to think about personality and disease. As pointed out by H. Friedman (1992), the emotional/motivational perspective (focusing on Type A, hostility, physiological reactivity, etc.) and the coping perspective (focusing on cognitive processes, self-disclosure, social support, etc.) overlap and have implications for each other. The conceptual approach of this paper may provide an appropriate framework to integrate findings of both perspectives since the defined personality subtypes summarize the emotional/cognitive/behavioral styles, temperamental dispositions, and learned expectancies of individuals. That is, this approach is not a concurrent of Type A, hostility, or coping research, but instead is proposed as an adjunct to these lines of research. Undoubtedly, the picture provided by this taxonomic model is incomplete since it neither specifies biological or environmental components, nor takes into account dynamic or interactional processes that may moderate the personality-disease relationship. Therefore, it is concluded that:

*"You can make your model more complex and more faithful to reality, or you can make it simpler and easier to handle. Only the most naive scientist believes that the perfect model is the one that perfectly represents reality."* (J. Gleick, 1987, p 278)

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Table 1. Intercorrelation matrix of independent and dependent measures that were completed by all subjects (N=405).

	<i>Social Inhibition</i>	<i>Self-Deception</i>	<i>Type A Rating</i>	<i>Anger-In Tension</i>	<i>Chronic Anger</i>	<i>Trait Stress</i>	<i>Recent Alienation</i>	<i>Social</i>
<i>Negative Affectivity</i> (STAI)	.25 *	-.35 *	.23 *	.04	.52 *	.49 *	.56 *	.61 *
<i>Social Inhibition</i> (HPPQ)		.00	-.11	.24 *	-.14 †	.01	.07	.29 *
<i>Self-Deception</i> (MC)		-	-.22 *	.15 †	-.38 *	-.44 *	-.34 *	-.34 *
<i>Type A Rating</i> (INT)			-	-.19 *	.40 *	.32 *	.22 *	.13 †
<i>Anger-In Rating</i> (INT)				-	-.13 †	-.13 †	-.03	.03
<i>Chronic Tension</i> (MBHI)					-	.55 *	.55 *	.42 *
<i>Trait Anger</i> (STAS)						-	.46 *	.39 *
<i>Recent Stress</i> (MBHI)							-	.54 *

Note. STAI denotes State-Trait Anxiety Inventory (Trait form); HPPQ: Heart Patients Psychological Questionnaire; MC: Marlowe-Crowne scale; INT:

audiotaped interview; MBHI: Millon Behavioral Health Inventory; STAS: State-Trait Anger Scale (Trait form).

\*  $p < .001$ , †  $p < .01$ .

## LEGENDS

### *Legend to Figure 1*

**Mean standardized T scores on the global trait measures for the four personality subtypes identified through cluster analysis (left side) and the a priori model (right side) (N=405).**

Note. NA denotes Negative Affectivity; SD: Self-Deception; IN: Social Inhibition.

Sample 1: N= 33, 53, 67, and 49 for clusters 1 to 4, respectively; Sample 2: N= 48, 47, 78, and 30 for clusters 1 to 4, respectively.

### *Legend to Figure 2*

**Mean Type A behavior, chronic tension, trait-anger, anger-in, and hostility scores for the four personality subtypes of the a priori model.** Note. TABP denotes Type A behavior pattern.

### *Legend to Figure 3*

**Proportion of subjects that were classified as being high, intermediate, or low in life stress for each of the four personality subtypes (N=405).**

### *Legend to Figure 4*

**Association between personality subtype and depressive complaints (N=240).**

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March 26, 1992

Dear Dr. Gentry,

Thank you for your letter of March 16, 1992 which informed me about the acceptance of my manuscript #910056-R "*Biobehavioral Research on Coronary Heart Disease: Where is the person?*" for publication in the *Journal of Behavioral Medicine*. I greatly appreciate your interest in my work and your decision to offer me the opportunity to publish my manuscript in your Journal.

Enclosed please find the signed statement concerning the transfer of copyright of my article.

Of course, I would greatly appreciate if you would be willing to consider my future work for publication in your Journal.

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## Responses to Comments of Reviewer # 1.

I am indebted for your many helpful comments and suggestions that enabled me to further strengthen the paper. The three books that you have recently completed are in fact most interesting and contain several relevant theoretical and conceptual points that are directly relevant to the thesis of my paper.

On the basis of your suggestions, I have decided to revise my paper to be mostly conceptual by focusing on a new way to think about personality in the context of coronary heart disease. I agree that it would be interesting to use the proposed classification scheme to predict disease outcome in this sample. At present, I am examining this issue in an ongoing follow-up study, but it will take some time to complete the gathering of data. Interestingly, preliminary findings seem to indicate that distressed subjects may have the highest mortality ratio, and hardy subjects the lowest mortality ratio. However, at this very moment, these are only speculations and much more work is needed before any firm conclusions can be drawn. With reference to the current paper, my responses to your comments and suggestions are detailed in the following sections.

In the current study, a sample of patients with well established coronary heart disease was used because identification of subtypes in this sample may help to explain the mixed findings in psychological research on coronary heart disease and makes it possible to examine the association with long-term health outcomes in future research. This is now mentioned in the Introduction section (page 6, last paragraph).

The study now includes an intercorrelation table of independent and dependent measures (see table 1), and the relationships among the measures used in the study are highlighted in the first paragraph of the Results section on page 8.

Furthermore, reference is made to your four-group conceptual scheme in the Discussion section on page 12, last paragraph: "Recently, a four-group conceptual scheme with interesting analogies to the current scheme has been described by H. Friedman (1991) ... ". In fact, it would be great to examine the extent to which both classification schemes corroborate each other.

Reference is also made to possible biological bases of behavioral tendencies and personality-disease associations in the Discussion section on page 15, last paragraph: "A third possible mechanism is that personality may be related to coronary heart disease through an underlying biological variable ... ".

The statement on page 3 that associations between behavior and coronary heart disease remain elusive is now deleted and is replaced by the statement that " ... the Structured Interview assessment of Type A behavior predicts actual CHD (H. Friedman & Booth-Kewley, 1988; Matthews, 1988), ..." (line 17 of the first paragraph).

Finally, the last line of the second paragraph on page 7 states that the JAS, despite its limited predictive validity, was used to validate Type A ratings.

## Responses to Comments of Reviewer 2.

Your point regarding the conceptualization and measurement of negative affectivity, self-deception, and social inhibition is well taken. Accordingly, the revised manuscript comprises a clear rationale for the selection of these global personality traits that were used to delineate personality subtypes.

The Introduction section incorporates an entire paragraph that addresses the conceptualization of the selected personality traits (see first paragraph on page 5). In fact, independent and dependent variables were significantly correlated (see also table 1 and the first paragraph of the Results section on page 8). However, these significant correlations are theoretically sound since they confirm the basic assumption that global traits " ... reflect one's general approach to life and summarize the tendencies of individuals ... " (second line on page 5).

Nevertheless, I agree that the high correlation among the STAI trait scale and the SCL90 depression scale is problematic, and probably reflects the fact that both scales measured the same underlying component of affective distress. This is now clearly stated on page 11, point (d) of the Discussion section.

Although earlier research of Paulhus suggests that the Marlowe-Crowne may measure both self-deception and impression management, later work of the same author indicates that under some conditions, impression management may in fact be unintentional and unconscious defensiveness as well (Paulhus & Levitt, 1987). This is now stated in the Methods section on page 7, lines 6 to 8. Moreover, evidence for the conceptualization of the Marlowe-Crowne scale as a measure of unconscious defensiveness can also be found in, for example, the articles of Denollet (1991) and Lane et al. (1990).

With reference to the use of the Social Inhibition scale of the Heart Patients Psychological Questionnaire, accumulating evidence suggests that the inhibition component of introversion-extraversion is a potential behavioral correlate of coronary heart disease, cancer, and all-cause mortality (Dembroski et al., 1985; H. Friedman & Booth-Kewley 1987b; Gross, 1989; Haynes et al., 1980; Kune et al., 1991; Julius et al., 1986; MacDougall et al., 1985; Pennebaker, 1992; Pennebaker & Susman, 1988; Temoshok, 1990). To my knowledge, evidence for these associations with measures of sociability is lacking. Moreover, H. Friedman (1991) suggests that there are two major types of health promoting personalities that are low on neuroticism and high on extraversion, of which one is apparently characterized by high sociability and the other by rather *low* sociability (i.e., quiet, relaxed, and likely to prefer a small number of good friends). For these reasons, a measure of social inhibition was used instead of more traditional measures of extraversion. Accordingly, reference is now made to the rationale for using the inhibition scale in the Introduction section (first paragraph on page 5, lines 9 to 15) and the Method section (third paragraph on page 6, lines 7 to 13), while the health consequences of inhibition are described in the Discussion section (third paragraph on page 13).

I hope that these modifications may provide an appropriate answer to the important issues that you have indicated.