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Type D personality
A potential risk factor refined

Johan Denollet*

Department of Clinical Health Psychology, Tilburg University, The Netherlands

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Abstract

Objective: Acute and chronic psychological distress have been associated with coronary heart disease (CHD) but little is known about the determinants of distress as a coronary risk factor. Broad and stable personality traits may have much explanatory power; this article selectively focuses on negative affectivity (NA; tendency to experience negative emotions) and social inhibition (SI; tendency to inhibit self-expression in social interaction) in the context of CHD. **Methods:** The first part of this article reviews research on NA and SI in patients with CHD. The second part presents new findings on NA and SI in 734 patients with hypertension. **Results:** Accumulating evidence suggests that the combination of high NA and high SI designates a personality subtype (''distressed'' type or type D) of coronary patients who are at risk for clustering of psychosocial risk factors and incidence of long-term cardiac events. Type D and its contributing low-order traits (dysphoria/tension and reticence/withdrawal) could also be reliably assessed in a community-based sample of patients with hypertension. This finding was replicated in men and women, and in Dutch- and French-speaking subjects. Type D hypertensives reported more depressive affect than their non type D counterparts. **Conclusions:** There is an urgent need to adopt a personality approach in the identification of patients at risk for cardiac events. NA and SI are broad and stable personality traits that may be of special interest not only in CHD, but in other chronic medical conditions as well. © 2000 Elsevier Science Inc. All rights reserved.

Keywords: Coronary heart disease; Hypertension; Personality; Depression; Prognosis

Introduction

In recent years, a wide variety of psychosocial factors has been associated with the incidence and progression of coronary heart disease (CHD). Most of this research focused on affective disorder [1–4], negative emotions [5–19], and social isolation [20–23] as risk factors. Hence, depression and low perceived social support are often considered to be the psychosocial features that are most prominently linked to CHD morbidity and mortality [24].

One generally assumes that depression is *the* psychosocial factor that should be accounted for in the prognosis of patients with CHD, at the risk of ignoring other psychosocial variables that may be of equal importance. Many negative affective states other than depressed affect (e.g., anxiety, anger, hostility, vital exhaustion) have been associated with CHD as well [25–28]. In addition, the specificity of the relationship between clinical depression and CHD may be limited, e.g., only 7 out of 19 patients who died from cardiac causes at 18 months follow-up in the Frasure-Smith et al. study (a frequently cited study in favor of the depression — CHD hypothesis) were classified as clinically depressed [29], implying that 63% of the cardiac deaths were not diagnosed with a depression at baseline. The findings of this study also indicated that clinical depression, as opposed to self-reported depressive symptoms, did *not* improve the predictive ability of the standard risk factors. Others have shown that depressive symptoms as a risk factor for CHD may reflect a chronic psychological characteristic rather than a discrete, transient psychiatric condition [6,30,31].

These observations do not refute the notion that clinical depression [32–34] and depressive symptoms [5–9,29] are important risk factors in the context of CHD. Rather they point out the importance of examining multiple psychosocial factors — both acute and chronic — in the evaluation of

* Department of Clinical Health Psychology, Room P508, Tilburg University, PO Box 90153, 5000 LE Tilburg, The Netherlands. Tel.: +31-13-466-2390; fax: +31-13-466-2370.

E-mail address: j.denollet@kub.nl (J. Denollet).

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individuals at risk of coronary events [35–37]. In addition, there is an urgent need to document the determinants of depression [38] and psychological distress [39,40] in CHD patients. In nonclinical populations, evidence suggests that broad and stable personality traits represent major determinants of depression [41], psychological distress [42], life stress [43], and subjective mood [44] and well-being [45]. Individual differences in personality and coping have also been associated with psychological distress in CHD [39,40].

Hence, in addition to focusing on specific psychological risk factors, there is a need to adopt a personality approach in the early identification of those coronary patients who are at risk for emotional stress-related cardiac events. Evidence suggests that psychological risk factors tend to cluster together and that clustering of these factors, in turn, substantially elevates the risk for cardiac events [37]. Broad and stable personality traits may have much predictive value regarding this clustering of risk factors in patients with CHD [39,46].

Therefore, the present article emphasizes the potential role of personality as determinant of emotional distress in patients with CHD. More specifically, this article will selectively focus on the "distressed" personality type or "type D," i.e., those individuals who simultaneously tend to (a) experience negative emotions and (b) inhibit self-expression [47]. The present article is organized in two separate parts, each with its own specific perspective on type D. The first part focuses on the conceptual framework that guided research on type D personality and CHD, and briefly reviews some of the empirical findings. The second part presents new findings on the structural validity of the type D construct and its relationship with depressive affect in a hypertensive population. This article concludes with some observations about the role of type D personality in clinical research and practice.

Yet another personality construct?

In the past decade, there was a resurgence of interest in the role of personality in health and disease [48,49]. Personality refers to a complex organization of trait dispositions [41]; these traits reflect consistencies in the general affective level and behavior of individuals. Hence, personality is conceived as a complex system of structures and processes that underlie these consistencies in human affect and behavior [50]. Different models of personality have identified two [51], three [52,53], or five [54,55] global traits that are relevant in a large number of situations. This paper is based on the notion that negative affectivity and social inhibition are two global traits that can be linked to important health outcomes in CHD.

Negative affectivity and social inhibition

Negative affectivity (NA) denotes the stable tendency to experience negative emotions [56,57], i.e., high-NA individuals are more likely to experience negative affect across time and regardless of the situation. This trait has also been conceptualized as neuroticism [53,54]. NA correlates 0.68 with the neuroticism scale from the NEO-FFI in healthy subjects [58] and 0.64 with the neuroticism scale from the Eysenck Personality Questionnaire in patients with CHD [59]. Hence, these personality constructs share about 40–50% common variance, implying that they are closely related but not identical. Neuroticism may have negative connotations (i.e., "neurotic" disorder) that I prefer to avoid. Because both NA and neuroticism are centrally defined by the tendency to experience negative affect [57], the label NA is used here to designate dysphoric individual differences that are stable over time.

High-NA individuals not only experience more feelings of dysphoria and tension, but have a negative view of self, report more somatic symptoms, and have an attention bias towards adverse stimuli [57]. Overall, they seem to scan the world for signs of impending trouble: neuroticism or NA has been associated with more *exposure* to and *reactivity* to stressful events [60] and with more negative appraisals of interpersonal stressors [61]. In women with breast cancer, for example, NA is associated with heightened sensitivity to treatment-induced symptoms [62] and a self-defeating way of comparing one's own situation with that of other breast cancer patients [63]. Likewise, evidence suggests that NA is an important determinant of subjective well-being and emotional distress in CHD patients [64].

NA has been associated with chest pain in the absence of CHD [65] but also with actual CHD [66]. Hence, NA may act both as a nuisance variable and as an actual risk factor. In any case, it is premature to write off associations between NA and physical health [67]. NA is assessed well by the Trait Anxiety Inventory [68]; therefore, the Dutch form of this scale [69] was used to assess dysphoric individual differences in previous research on type D.

Social inhibition (SI) denotes the stable tendency to inhibit the expression of emotions and behaviors in social interaction [70], i.e., high-SI individuals are more likely to feel inhibited, tense and insecure when with others. SI correlates -0.52 with the extraversion scale from the NEO-FFI in healthy subjects [58] and -0.65 with the extraversion scale from the Eysenck Personality Questionnaire in patients with CHD [59]. Hence, these personality constructs share about 25–45% common variance, implying that they are closely related but not identical. SI is more closely related to the interpersonal than to the intrapsychic (i.e., positive affect, energy, excitement seeking) dimension of introversion/extraversion [59].

SI has in fact been related to the avoidance of potential "dangers" involved in social interaction such as disapproval or nonreward by others [70]. Although inhibited individuals are quiet on the surface, they may actually avoid interpersonal conflict through excessive control over self-expression [71]. Hence, SI refers to pervasive individual differences in reticence, withdrawal, nonexpression, and discomfort in

encounters with other people. As a result, SI has been associated with high negative emotionality and personal distress [72,73].

What SI adds to research on stress-related CHD is the notion that how people cope with negative emotions may be as important as the experience of negative emotion per se. However, SI clearly differs from other emotional coping styles, such as repression [64], defensiveness [74,75], denial [76] and alexithymia [77]. Repression and defensiveness refer to *low distress* and the *unconscious* exclusion of negative emotions from awareness whereas SI refers to *high interpersonal distress* and the *conscious* suppression of emotions [59]. SI correlates −0.06 with the Marlowe–Crowne measure of defensiveness in patients with CHD [59], indicating that these constructs are not related at all. Likewise, denial implies the underreporting of emotional distress [76] whereas high-SI individuals readily acknowledge high levels of distress [72,73]. Finally, there is no reason to assume that high-SI individuals have a deficit in their ability to recognize emotional stimuli — a key feature of alexithymia [78].

The inhibition of emotions has been associated with increased cardiovascular reactivity [79], decreased cardiovascular recovery [80], decreased heart rate variability [81], and, in the long term, carotid atherosclerosis [82], incidence of CHD [83] and cardiac mortality [84]. Moreover, introversion is a determinant of low perceived social support [85] which, in turn, has been associated with an increased risk of post-MI mortality [21–23]. Since inhibition, disengagement and insecurity when with others may represent coronary prone aspects of interpersonal behavior, the Social Inhibition subscale of the Heart Patients Psychological Questionnaire [86] was used to assess this personality trait in previous research on type D.

Delineation of type D personality

NA and SI do not cover the entire range of individual differences in personality but these global traits do represent major domains of personality, are theoretically sound, and may be immediately relevant to patients with CHD [39]. One issue that has been overlooked, however, is the delineation of personality subtypes of patients with CHD. A type refers to a subset of entities each member of which is more like every other member than it is like entities in any other type [87]. The delineation of personality subtypes may help to identify groups of patients who share a set of relevant characteristics in terms of prognosis and treatment [88]. In other words, research should look beyond the traditional question of how single traits affect disease, to the way traits combine in the determination of disease [89].

In my own research, I addressed this issue by jointly using NA and SI as determinants of health outcomes in patients with CHD. In order to examine the combination of these traits, I used both empirical induction (relying on statistical procedures) and theoretical deduction (relying on specific assumptions). The *empirical induction* of an "NA + SI" model in coronary patients was derived from research that used cluster analysis (i.e., a statistical procedure that is designed to classify subjects into homogeneous subtypes). These studies yielded a small number of homogeneous personality subtypes in patients with CHD [39,46].

More specifically, this approach yielded a discrete personality type — which I termed at that time "high-NA" subtype — that was characterized by the combination of high NA and high SI: "High-NA individuals (characterized by high levels of negative affectivity and social inhibition...) reported high levels of transient distress, disability, chronic tension and anger, and a low level of well-being" [39, p. 679]. The reliability of this personality subtype was demonstrated across parallel data sets, and these patients still experienced substantial emotional distress at fifteen months after the initial assessment.

The *theoretical deduction* of an "NA + SI" model in coronary patients was derived from this empirically generated personality profile, i.e., a median split of scores on self-report measures of NA and SI was used as an operational definition of the "distressed" personality type or type D [47,90]. Hence, CHD patients with a type D personality tend simultaneously to experience negative emotions (as indicated by a high NA score) and to inhibit self-expression in social interaction (as indicated by a high SI score).

The choice of median cut-off points to classify patients was derived from the model of anxiety and repression that was developed by Weinberger et al. [91]. In this model, "defensive high-anxious" individuals were defined as those individuals with a trait-anxiety score above the median and a defensiveness score above the median. In my own research on personality and CHD, trait-anxiety was more broadly conceptualized as NA [64], and defensiveness was replaced by SI because these global personality traits represent the major dimensions in the two-dimensional personality/mood space [44].

Type D as a determinant of psychological distress

As noted earlier, research needs to identify the determinants of psychological distress in CHD patients [38–40]. I hypothesized that NA and SI may be important determinants, but what evidence is there to support this proposition? With reference to this issue, evidence indicated that coronary patients with type D reported high levels of emotional stress, chronic tension and anger, and a low level of subjective well-being [39,46]. Pessimism, depressive symptoms, general negative affect, and lack of perceived social support were also found to be more prevalent in coronary patients with type D than in non type D patients [47,59,64]. Finally, type D patients displayed a relative absence of positive emotions as indicated by low levels of

self-esteem, dissatisfaction with life in general, and low positive affect [59].

In other words, empirical research suggests that type D personality may be an important determinant of difficulties in the area of emotional and social health. These difficulties not only result in psychological distress, but also in nontest behaviors such as persistent chest pain, failure to return to work, and chronic (ab)use of benzodiazepines [39,90]. Eventually, the emotional and social difficulties of type D patients may result in hard medical endpoints.

Type D and the prediction of health outcomes

Preliminary evidence for the notion that type D may predict adverse health outcomes was found in a study of 105 men who completed the Trait Anxiety Inventory [69] and the Social Inhibition Scale [86] after they survived a myocardial infarction [90]. A median split on these measures was used to classify 28 patients as type D (trait anxiety $\geq$40 and social inhibition $\geq$12) and 77 patients as non type D. After 2–5 years of follow-up, the rate of death was much higher for type D patients (11/28 = 39%) than for non type D patients (4/77 = 5%), $P<.0001$. A regression model including standard risk factors had a sensitivity for mortality of only 27%; the addition of type D in this model more than doubled its sensitivity.

In a second study, 268 men and 35 women with CHD, aged 31–79 years, completed the Trait Anxiety Inventory [69] and the Social Inhibition Scale [86] at baseline [47]. Once again, a median split was used to classify 85 patients as type D (i.e., trait anxiety $\geq$43 and social inhibition $\geq$12) and 218 patients as not type D. Consistent with the findings of the initial study, the rate of death after 6–10 years of follow-up was significantly higher for type D patients (23/85 = 27%) than for non type D patients (15/218 = 7%), $P < .00001$. This association was still evident more than 5 years after the coronary event, was found with reference to cardiac and noncardiac death, and was found in both men and women. When we controlled for disease severity and other biomedical risk factors, the impact of type D personality on prognosis remained significant (odds ratio 4.1 [95% CI 1.9–8.8]; $P = .0004$).

Type D reflects the joint effects of the tendency to experience negative emotions and the tendency to inhibit self-expression; in this study, the presence of only one of these tendencies had no effect. The death rate (6%) of patients scoring high on NA *but low* on SI did not differ significantly from that for low-NA patients (7%), and the death rate (6%) of patients scoring high on SI *but low* on NA did not differ significantly from that for low-SI (7%). Hence, it was the combination of high NA/SI that had an adverse effect on prognosis.

Type D personality may also predict the clinical course of myocardial infarction patients with a serious cardiac condition as indicated by a decreased left ventricular ejection fraction (LVEF) [92]. In a study of 87 of these patients with a decreased LVEF, 21 patients had experienced a cardiac event (13 fatal events) after an average follow-up of 8 years. These events were related to an LVEF $\leq$30%, a poor exercise tolerance, and history of a previous myocardial infarction (all P's $\leq .02$) but also to type D personality ($P = .00005$). Cox proportional hazards analysis yielded LVEF $\leq$30% (relative risk, 3.0; 95% CI, 1.2–7.7; $P = .02$) and type D (relative risk, 4.7; 95% CI, 1.9–11.8; $P = .001$) as independent predictors.

Finally, a 5-year prospective follow-up study in a new sample of 319 patients with CHD confirmed that type D represents a high-risk category deserving of special care [93]. This study examined the prognosis of patients who received optimal treatment in terms of medication, surgery and rehabilitation. At baseline, a median split on the type D Scale-16 (DS16) "negative affectivity" and "social inhibition" scales [59] was used to classify 99 patients as type D ($\geq$9 and $\geq$15, respectively) and 220 as non type D. The main end point was cardiac death or nonfatal myocardial infarction. At follow-up, there were 22 cardiac events (16 nonfatal); multivariate analysis yielded LVEF $\leq$50% (OR 3.9; $P = .009$), type D (OR 8.9; $P = .0001$) and age $\leq$55 years (OR 2.6; $P = .05$) as independent predictors. When two or three of these risk factors occurred together, the rate of poor outcome was fourfold higher ($P = .0001$). Estimates of direct medical costs increased progressively with increasing number of risk factors in this study. In addition, failure to quit smoking, symptoms of depression, and type D were independent predictors of impaired quality of life after 5 years of follow-up.

"D" as in "distressed"

The review of empirical findings and theoretical considerations presented above is consistent with the notion that the combination of high NA and high SI identifies a subgroup of patients with CHD who are at risk for adverse emotional and physical health outcomes. Nevertheless, why should patients with this combination of high NA/high SI be labeled as "distressed"? As noted by an anonymous reviewer of the present paper, the utility of treating "negative affectivity" and "distressed" as separate constructs may be questioned. So, what rationale is there for making a difference between these constructs? It should be noted from the outset that, within the type D framework, NA refers to a continuous personality *trait* of the 3–5–16 factor personality space [58] while "distressed" refers to a discrete personality *configuration* designating patients who are inclined to experience emotional and interpersonal difficulties.

Theoretical justification why this personality configuration is considered a "distressed" type was provided in our 1995 paper: "We hypothesized that it is not the experience of negative emotions per se, but rather the chronic psychological distress that results from holding back negative

emotions, that is likely to affect physical health'' [90, p. 583]. Empirical justification for this distinction was provided in a study showing that ''distressed'' or type ''D'' patients reported significantly more depressive symptoms and significantly lower self-esteem and life satisfaction as compared to high NA/low SI patients [59]. As noted above, the rate of death after 6–10 years of follow-up was also significantly higher for type D than for high NA/low SI patients, i.e., 27% versus 6%, respectively [47]. Finally, regarding depressive symptoms after 5 years of follow-up [93], negative affect and type D retained unique predictive value after the other had been controlled in regression equation.

These findings corroborate the utility of treating ''negative affect'' and psychological ''distressed'' as separate constructs. However, a number of issues still remain to be resolved. The mechanisms that account for the synergetic effect of NA and SI in relation to prognosis in CHD remain unexplained. Failure to adapt to stressful events [94] and emotion suppression [95] have been suggested as mechanisms that may impact on the cardiovascular system. Preliminary findings of a Japanese study also suggest that both NA and introversion are associated with a dysfunctional immune response in CHD patients [96]. Future research needs to identify the role of these mechanisms in the synergetic effect of NA and SI.

NA and SI were conceptualized as dimensions reflecting individual differences in relatively normal variations in emotional and behavioral tendencies. NA is associated with vulnerability to anxiety and depression [41], and SI with interpersonal stress and failure to adapt [73], however. Type D may predispose to psychopathology but this personality configuration is not pathological by itself. As noted by an anonymous reviewer, some type D individuals will cross the threshold for diagnosis of psychiatric disorder, while others will do so only during times of elevated stress, and still others will display subclinical levels of emotional distress all their lives. Hence, more research is needed to refine the construct of type D personality, and its overlap with various manifestations of emotional distress.

Refining the construct of type D personality

If the assumption that research on CHD should also focus on NA and SI as potential determinants of health outcomes is correct, than this research may benefit from a measure that allows for a quick assessment of these traits. Standard self-report distress scales may be burdensome for CHD patients to complete, and the internal consistency of the Social Inhibition scale from Erdman [86] is rather poor (i.e., λ = 0.64). Therefore, empirical and structural criteria were used to devise the DS16, a brief self-report measure comprising an eight-item NA and an eight-item SI scale [59]. These scales were found to be reliable (α = 0.89 and 0.82; test–retest = 0.78 and 0.87) and were validated against standard personality scales. Type D as measured by the DS16 was associated with depressive symptoms and lack of positive emotions [59] and increased risk for cardiac events [93] in patients with CHD.

These findings are promising but more research is needed to refine the construct of type D and its assessment. First, previous research on type D personality largely focused on CHD populations; additional research is needed to document the validity of type D in other populations as well. Second, identifying the relevant low-order traits within the broad personality domains of NA and SI may enhance the validity of type D as a personality construct [97–99]. Third, the relation between type D personality and depressive affect calls for special attention [59]. Hence, the second part of the present article focuses on the refinement of the NA and SI low-order traits in a sample of patients with hypertension. In addition, the association between type D personality and depressive affect will be examined.

Adding tension and withdrawal

For the purpose of this paper, the DS16 was revised to include the two most prominent low-order traits corresponding to the NA and SI personality dimensions, respectively. A pool of 24 items was derived from 13 items of the DS16 [59] and 11 items that were specifically written for the purpose of this study. Subjects were asked to rate the extent to which they agreed with each item on a five-point Likert scale (from 0 = false to 4 = true). Statistical analyses were used to produce a self-report scale comprising 12 NA and 12 SI items. Classification of these items was based on internal structural criteria, i.e., the ability of the items to adequately reflect the low-order traits that underpin the personality dimensions of NA and SI in individuals with a type D personality. Principal components analysis and internal consistency analysis were both used for this purpose [100].

NA is centrally defined by the tendency to experience aversive emotional states with, on the one hand, feelings of *dysphoria* and, on the other hand, feelings of *tension and worry* [56]. In the present article, I refer to the first NA low-order trait as ''dysphoria'' rather than ''depression'' because the term ''depression'' should be reserved for individuals with a clinical diagnosis of affective disorder whereas individuals scoring high on self-report measures of depressive symptoms should be referred to as ''dysphoric'' [101,102].

Six out of eight NA items of the DS16 were related to dysphoria, i.e., ''I often feel unhappy,'' ''I am often down in the dumps,'' ''I take a gloomy view of things,'' ''I am happy most of the time'' (reverse-keyed), ''The future seems hopeful to me'' (reverse-keyed) and ''I feel at ease most of the time'' (reverse-keyed). Only two DS16 items were related to ''tension/worry,'' i.e., ''I am often in a bad mood'' and ''I often find myself worrying about something.'' Four

new items were added to better reflect this lower-order trait, i.e., "feelings of tension," "easily irritated," "nervous" and "makes a fuss about details." Hence, the resulting NA scale reflected the low-order traits of dysthymia and tension by six items each.

SI is centrally defined by the tendency to avoid potential dangers involved in social interaction such as disapproval by others [70]. High-SI individuals may avoid interpersonal conflict through excessive control over the expression of emotions and behaviors [70,71]. This first low-order trait of SI refers to individual differences in *reticence* and nonexpression. High-SI individuals may also keep other people at a distance in order to avoid negative reactions and may be less likely to seek social support [72,103,104]. Accordingly, this second low-order trait of SI refers to individual differences in *withdrawal*.

Five out of eight SI items of the DS16 were related to reticence and nonexpression, i.e., "I often talk to strangers" (reverse-keyed), "I make contact easily when I meet people" (reverse-keyed), "I find it hard to make 'small talk,'" "I find it hard to express my opinions to others" and "When socializing, I don't find the right things to talk about." The remaining three SI items of the DS16 were related to dominance; these items were deleted and replaced by a new item (i.e., "closed kind of person") to enhance the first low-order trait. Next, six new items were written to adequately reflect the low-order trait of withdrawal, i.e., "keeps others at a distance," "keeps in the background," "doesn't like many people around," "reserved kind of person," "inhibited kind of person" and "nervous when meeting people." Hence, the resulting SI scale contained 12 items that were selected on an a priori basis to reflect the low-order traits of reticence/nonexpression and withdrawal by six items each.

Subjects and methods

Subjects in this study were drawn from the "3P Study — Psychological Profile in High Blood Pressure." The main purpose of the 3P study is to identify personality subtypes for patients with hypertension based on the combination of three global traits that have been associated with hypertension: negative affectivity, social inhibition, and defensiveness [105]. The original database included 784 patients with hypertension. Thirty-four subjects had to be excluded because they did not meet the inclusion criteria or had too much missing values; 16 subjects had to be excluded because they failed to fill out the NA and SI scales. Hence, the final sample in the study includes 734 patients who were seeing their general practitioner for hypertension. This sample included 380 men (52%) and 354 women (48 %); 410 subjects were drawn from the northern Dutch-speaking part and 324 from the southern French-speaking part of Belgium. The mean age of this sample was 61.7 years (range 45–75 years).

These subjects also filled out an abbreviated version of the Global Mood Scale (GMS) to assess negative and positive affective mood states [106]. In a recent review of outcome measures, the GMS was identified as a measure with significant potential for monitoring emotional well-being in the context of cardiovascular disorder [107]. Evidence suggests that depressive affect in particular may be a good predictor of adverse health outcomes [108]. Since depressive affect is characterized by the interaction of high negative affect and low positive affect [109], a median split on the GMS negative affect and positive affect scales [106] was used to classify hypertensive patients as scoring high or low in depressive affect.

Principal components analysis (varimax rotation) was used to examine the structural validity of the items that were selected to cover the low-order traits of NA and SI, respectively. Corrected item-total correlations and Cronbach's α were used to examine the internal consistency of the corresponding personality scales. Unpaired *t* test and cross tabulation were used to examine the difference between type D and non type D individuals in both continuous scores and categorical classifications of affective mood states.

Results and discussion

Principal components analysis indicated that all of the 12 NA items were clearly related to their corresponding personality domain (Table 1). Inclusion of the four new items (i.e., "easily irritated," "makes a fuss about details,"

Table 1
Facets of the negative affectivity domain in hypertensives (N = 734)

	Personality domain		
	Factor analysis[a]		Internal
Item	NA	SI	consistency[b]
Dysphoria			
Down in the dumps[c]	**0.82**	0.18	0.76
Feels unhappy[c]	**0.78**	0.18	0.71
Gloomy view of things[c]	**0.75**	0.26	0.70
Happy most of the time[c] (R)	**−0.67**	−0.12	0.60
Hopeful about future[c] (R)	**−0.61**	−0.15	0.55
At ease most of the time[c] (R)	**−0.54**	−0.30	0.54
Tension/worry			
Tends to worry[c]	**0.63**	0.12	0.64
In a bad mood[c]	**0.59**	0.17	0.59
Easily irritated	**0.50**	0.06	0.51
Makes a fuss about details	**0.48**	0.11	0.52
Nervous kind of person	**0.48**	0.06	0.50
Feelings of tension	**0.40**	0.06	0.41
	Eigenvalue I = 7.59		α = 0.89

R denotes reverse-keyed; items assigned to a factor are in boldface.

[a] Principal components analysis of the 24 items; NA: negative affectivity; SI: social inhibition.

[b] Corrected item-total correlations; α: Cronbach's α.

[c] Items that were retained from the DS16.

"nervous," "feelings of tension") adequately reflected the low-order trait of tension/worry; these items loaded 0.40 or more on the NA factor and correlated significantly with the initial DS16 items. Cronbach's α (=0.89) and item-total correlations yielded a high level of internal consistency (Table 1, last column).

Similarly, all of the 12 SI items were clearly related to their corresponding personality domain (Table 2). Of note, the new item "closed kind of person" loaded 0.70 on the SI factor, while the other six new items (i.e., "inhibited," "others at a distance," "in the background," "nervous meeting people," "reserved," "doesn't like people around") adequately reflected the low-order trait of withdrawal that was added to the initial low-order trait of reticence. The loadings of each of the 12 items on the SI factor were greater than 0.50, and Cronbach's α yielded a substantial increase in internal consistency from 0.82 as reported for the initial DS16 SI scale [59] to 0.88 in the present study (Table 2, last column). Overall, these findings indicate a high level of internal structural validity of the newly added type D items.

Secondary analyses showed that these findings could be replicated in both men and women (Table 3), as well as in the Dutch- and French-speaking subsamples (Table 4). Hence, these analyses indicated that the broad personality domains of NA and SI and their corresponding low-order traits could be reliably assessed in hypertensive patients, and that these personality correlates of type D were not a function of gender or cultural background.

Table 2
Facets of the social inhibition domain in hypertensives (N = 734)

	Personality domain		
	Factor analysis[a]		Internal
Item	NA	SI	consistency[b]
Reticence			
Closed kind of person	0.19	**0.70**	0.67
Hard to make "small talk"[c]	0.15	**0.67**	0.64
Doesn't find things to talk about[c]	0.16	**0.61**	0.58
Hard to express opinions[c]	0.22	**0.54**	0.53
Makes contact easily[c] (R)	−0.18	−**0.66**	0.63
Talks to strangers[c] (R)	0.00	−**0.53**	0.47
Withdrawal			
Inhibited kind of person	0.22	**0.67**	0.65
Keeps others at distance	0.08	**0.65**	0.62
Keeps in the background	0.18	**0.58**	0.58
Nervous when meeting people	0.32	**0.53**	0.56
Reserved kind of person	0.02	**0.51**	0.47
Doesn't like many people around	0.10	**0.51**	0.50
		Eigenvalue II = 3.17	α = 0.88

R denotes reverse-keyed; items assigned to a factor are in boldface.

[a] Principal components analysis of the 24 items; NA: negative affectivity; SI: social inhibition.

[b] Corrected item-total correlations; α: Cronbach's α.

[c] Items that were retained from the DS16.

To obtain scores for NA and SI, the negatively stated items were reversed before adding them to the corresponding trait score. Using a median split on these scale scores, 207 subjects were identified as type D (i.e.; high NA and high SI) and 521 as non type D. Type D subjects reported more negative mood states ($P < .0001$) and less positive mood states ($P < .0001$) than non type D subjects (Table 5). Subjects scoring high on the negative affect and low on the positive affect scales of the GMS [106] are prone to depressive affect [109]; 49% type D patients were high in depressive affect as opposed to 23% non type D patients.

Hence, the present findings indicated that it was possible to reliable capture the broader, more general personality traits of NA and SI by focusing on their contributing low-order traits of dysphoria and tension, and reticence and withdrawal, respectively. The resulting personality scales were found to be psychometrically sound, thereby providing a solid basis for research in the area of type D personality. Hence, the present findings suggest that type D represents a broad and general construct that is not necessarily restricted to coronary patients [47] but that can also be assessed reliably in noncardiac populations.

While previous research on type D mainly focused on Dutch-speaking men, the present research documented the validity of the personality model underpinning type D in different populations, i.e. women and French-speaking subjects. Moreover, the association between type D and depressive symptoms that was reported in patients with CHD [59,93] could be replicated in a sample of patients that were seeing their GP for high blood pressure. These findings indicate that NA and SI are traits that can be reliably assessed in patients with a somatic condition, in order to identify those patients who are at risk for emotional distress.

Clinical implications

Thus far, this article focused on evidence linking type D and the clinical course of CHD and new evidence for the validity of the type D construct in different populations. However, what is the role of this new personality construct in clinical research and practice? Rozanski et al. [37] recently reviewed evidence for the role of psychological factors in cardiovascular disease. Among other things, they concluded (a) that psychosocial risk factors tend to cluster together and that clustering of these factors substantially elevates the risk for cardiac events, and (b) that research should focus on the clinical modification of chronic stress as a potential risk factor. Hence, it is important to (a) *diagnose those patients who are at risk for clustering* of psychosocial risk factors, and (b) *reliably predict which patients are at greater risk for cardiac events* due to chronic stress.

It is argued here that *broad and stable* personality traits carry with them much potential for these diagnostic and prognostic purposes. *Broad* personality traits have many

Table 3
Negative affectivity and social inhibition domains stratified by gender

Item	Men (N = 380)			Women (N = 354)		
	Factor[a]		Internal	Factor[a]		Internal
	NA	SI	consistency[b]	NA	SI	consistency[b]
Negative affectivity						
Down in the dumps	**0.84**	0.19	0.77	**0.80**	0.16	0.75
Feels unhappy	**0.78**	0.18	0.70	**0.79**	0.17	0.72
Gloomy view of things	**0.77**	0.28	0.70	**0.73**	0.24	0.70
Happy most of the time (R)	**−0.59**	−0.13	0.54	**−0.74**	−0.10	0.66
Hopeful about future (R)	**−0.62**	−0.15	0.56	**−0.59**	−0.13	0.54
At ease most of the time (R)	**−0.50**	−0.28	0.51	**−0.58**	−0.30	0.57
Tends to worry	**0.67**	0.05	0.67	**0.56**	0.17	0.61
In a bad mood	**0.60**	0.23	0.62	**0.60**	0.10	0.56
Easily irritated	**0.49**	0.10	0.53	**0.54**	0.02	0.53
Makes a fuss about details	**0.53**	0.08	0.58	**0.43**	0.15	0.46
Nervous kind of person	**0.43**	0.05	0.46	**0.51**	0.07	0.53
Feelings of tension	**0.43**	0.03	0.43	**0.36**	0.09	0.39
	I = 7.69		α = 0.89	I = 7.40		α = 0.89
Social inhibition						
Closed kind of person	0.21	**0.71**	0.69	0.18	**0.69**	0.65
Hard to make "small talk"	0.17	**0.68**	0.65	0.15	**0.67**	0.63
Doesn't find things to talk about	0.18	**0.67**	0.64	0.15	**0.55**	0.52
Hard to express opinions	0.20	**0.51**	0.49	0.22	**0.56**	0.55
Makes contact easily (R)	−0.14	**−0.65**	0.62	−0.21	**−0.66**	0.63
Talks to strangers (R)	0.03	**−0.55**	0.49	0.02	**−0.50**	0.44
Inhibited kind of person	0.22	**0.66**	0.66	0.19	**0.67**	0.64
Keeps others at distance	0.03	**0.66**	0.62	0.12	**0.63**	0.62
Keeps in the background	0.19	**0.60**	0.60	0.16	**0.57**	0.55
Nervous when meeting people	0.30	**0.55**	0.57	0.33	**0.52**	0.55
Reserved kind of person	0.04	**0.51**	0.48	−0.02	**0.50**	0.45
Doesn't like many people around	0.12	**0.59**	0.57	0.10	**0.43**	0.43
		II = 3.30	α = 0.89		II = 3.14	α = 0.87

R denotes reverse-keyed; items assigned to a factor are in boldface.
[a] Principal components analysis; NA: negative affectivity; SI: social inhibition; I: eigenvalue factor 1; II: eigenvalue factor 2.
[b] Corrected item-total correlations; α: Cronbach's α.

referent attributes and therefore have much explanatory power. NA, for example, has been associated with affective disorder [41], chronic disturbance in coping with life stress [43], symptoms of emotional [56] and somatic [57] distress, and hostility [110]. Introversion has been associated with low self-esteem [103], poor social interactions [73] and poor emotional well-being [111]. *Stable* personality traits tap into chronic attributes of individuals and thus have much predictive power. Of note, research in both CHD [6] and cancer [112] indicates that chronically depressed mood is a more viable risk factor than episodic depression. NA has been shown to reliably predict long-term emotional distress [42] while introversion seems to predict poor social support [85] and the experience of less positive life events [113].

Overall, these findings suggest that NA and SI are both broad *and* stable personality traits. It follows that these traits may be of great benefit in the process of diagnosing patients who are at risk for clustering of psychosocial risk factors and predicting which patients are at risk for long-term incidence of emotional stress-related cardiac events. In keeping with this proposition, the evidence reviewed in the first part of this article indicated that type D patients display high levels of psychosocial stress and are at risk for adverse cardiac events. The second part of this article elucidated somewhat more in detail the very nature of NA and SI and their corresponding low-order traits. So what is the clinical picture of type D patients that emerged from these analyses? In brief, this picture can be summarized as follows.

On an *intrapsychic* level, type D patients tend to experience difficulties in the area of emotional well-being. That is, individuals high in NA are more likely to experience emotional problems across time and situations. From a cognitive point of view, type D patients are inclined to be worrying a lot and to take a gloomy view of things. From an affective point of view, symptoms of depressed mood are often accompanied by other negative emotions like anxiety and anger. Type D patients are more likely to feel unhappy and to be tensed or easily irritated and less likely to experience positive mood states. They sometimes live under a considerable amount of pressure and may be unable to cope effectively with stressful events. However, given their inhibited behavior and low

Table 4
Negative affectivity and social inhibition domains stratified by language

Item	Dutch (N = 410)			French (N = 324)		
	Factor[a]		Internal	Factor[a]		Internal
	NA	SI	consistency[b]	NA	SI	consistency[b]
Negative affectivity						
Down in the dumps	**0.81**	0.15	0.75	**0.83**	0.22	0.78
Feels unhappy	**0.76**	0.15	0.69	**0.82**	0.22	0.74
Gloomy view of things	**0.72**	0.26	0.69	**0.84**	0.27	0.77
Happy most of the time (R)	**−0.68**	−0.15	0.64	**−0.66**	−0.08	0.57
Hopeful about future (R)	**−0.60**	−0.12	0.56	**−0.61**	−0.17	0.55
At ease most of the time (R)	**−0.57**	−0.28	0.56	**−0.51**	−0.31	0.52
Tends to worry	**0.68**	0.12	0.69	**0.56**	0.09	0.58
In a bad mood	**0.58**	0.17	0.57	**0.60**	0.17	0.61
Easily irritated	**0.51**	0.02	0.50	**0.47**	0.09	0.51
Makes a fuss about details	**0.53**	0.12	0.54	**0.43**	0.09	0.49
Nervous kind of person	**0.53**	0.12	0.54	**0.40**	−0.03	0.44
Feelings of tension	**0.41**	0.05	0.41	**0.39**	0.06	0.41
	I = 7.65		α = 0.89	I = 7.70		α = 0.88
Social inhibition						
Closed kind of person	0.13	**0.69**	0.64	0.28	**0.72**	0.70
Hard to make "small talk"	0.10	**0.68**	0.63	0.20	**0.67**	0.65
Doesn't find things to talk about	0.14	**0.61**	0.58	0.19	**0.61**	0.59
Hard to express opinions	0.27	**0.55**	0.55	0.19	**0.53**	0.50
Makes contact easily (R)	−0.14	**−0.65**	0.60	−0.24	**−0.69**	0.67
Talks to strangers (R)	0.02	**−0.59**	0.52	−0.02	**−0.46**	0.42
Inhibited kind of person	0.33	**0.65**	0.66	0.08	**0.71**	0.66
Keeps others at distance	0.11	**0.62**	0.60	0.04	**0.70**	0.66
Keeps in the background	0.18	**0.58**	0.58	0.20	**0.61**	0.59
Nervous when meeting people	0.32	**0.51**	0.54	0.32	**0.55**	0.59
Reserved kind of person	0.07	**0.57**	0.54	−0.04	**0.44**	0.39
Doesn't like many people around	0.09	**0.51**	0.50	0.10	**0.50**	0.49
		II = 3.26	α = 0.88		II = 3.19	α = 0.88

R denotes reverse-keyed; items assigned to a factor are in boldface.
[a] Principal components analysis; NA: negative affectivity; SI: social inhibition; I: eigenvalue factor 1; II: eigenvalue factor 2.
[b] Corrected item-total correlations; α: Cronbach's α.

self-disclosure, these intrapsychic phenomena may not be readily acknowledged by others.

On an *interpersonal* level, type D patients tend to experience difficulties in the area of social interaction. That is, individuals high in SI are more likely to perceive the social world as "threatening" in the sense that they anticipate negative reactions from others such as disapproval. To avoid these reactions, type D patients adopt self-enhancing strategies such as inhibition of self-expression and withdrawal. They are less likely to be disclosive and tend to inhibit the expression of their true thoughts and feelings. Type D patients often feel uncomfortable with strangers, and may be unable to display assertive behaviors. They may have few personal ties with other people and tend to keep other people at a distance.

Table 5
Relationship between type D personality and depressive affect in hypertensives (N = 728)

Affective mood state	Type D as defined by NA and SI scales[a]		
	non type D (n = 521)	type D (n = 207)	Significance
Continuous score			
GMS negative affect	7.4 (5.6)	11.1 (6.2)	$t(1,726) = -7.77$, $P < .0001$
GMS positive affect	10.9 (4.4)	7.7 (4.4)	$t(1,726) = 8.71$, $P < .0001$
Categorical classification			
Depressive affect[b]	23% (121)	49% (101)	$\chi^2(1,726) = 45.7$, $P < .0001$

Standard deviation (continuous score) and number of subjects (categorical classification) appear in parentheses.
GMS denotes abbreviated global mood scale.
[a] NA denotes negative affectivity; SI: social inhibition.
[b] Using a median split on the negative affect and positive affect scales.

Of course, the picture provided by the type D model is incomplete since it neither specifies all health-related personality dimensions [114] nor takes into account dynamic interactions between person and environmental situations [115]. Still this model may have substantial predictive power; e.g., Appels et al. [116] recently observed a significant interaction between vital exhaustion and inhibition of emotions as antecedent of sudden cardiac arrest. The notion that type D patients may use a characteristic coping style does not entail that their health risk is unmodifiable. It would be interesting to see if psychopharmacological [117] and behavioral [118] interventions would help to improve their prognosis. Inclusion of type D as an individual difference variable in outcome research is indicated to address this issue.

In their editorial comment on our Lancet paper, Lespérance and Frasure-Smith [119] stated that the concept of type D further congests the field and that the bottom line is far from clear. Therefore, I would like to end by summarizing the bottom line of type D. First, the inclusion of NA in the definition of type D summarizes this field rather than congesting it further. Abundant evidence suggests that negative emotions in general are associated with CHD, and that NA is a broad personality trait that predisposes to clustering of these negative emotions within an individual. Second, the inclusion of SI in the definition of type D may add new explanatory and predictive power, i.e., the joint effects of NA and SI may increase the risk for emotional distress and adverse cardiac events. Third, type D entails that clinical trials should take a broad enough view of the problem areas of emotional distress and inhibition that may be relevant to a substantial number of patients with CHD.

Type D personality is not a concurrent of well-known psychosocial risk factors (e.g., depressive symptomatology, vital exhaustion, anxiety, low social support) but rather aims at the early identification of patients who are inclined to experience these manifestations of psychosocial stress over a longer period of time. Last but not least, the delineation of a new personality construct is just the beginning of a research process, not the end. To be continued.

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