Personality and coronary heart disease

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Personality and Coronary Heart Disease:
The Type-*D* *S*cale-*16* (*DS16*)

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Abstract

Clinical diagnoses of depression, self-reported negative emotions, and personality traits have been associated with both the development and progression of coronary heart disease (CHD). This paper focusses on negative affectivity (the tendency to experience negative emotions) and social inhibition (the tendency to inhibit the expression of emotions) in CHD patients. Two independent samples of patients with CHD were included in this study. Both empirical and internal-structural criteria were used to devise a brief self-report measure comprising an 8-item negative affectivity and an 8-item social inhibition scale in sample 1 (N=400). These scales were internally consistent (á=.89 and .82), stable over time (3-month test-retest reliability= .78 and .87) and were validated against standard personality scales. CHD patients with a 'distressed' personality (type-D) report high levels of negative affectivity and social inhibition; accordingly, this self-report measure was termed type-D Scale-16 (DS16). Previous research showed that type-D was associated with cardiac events and incidence of cancer in patients with CHD. Type-D as measured by the DS16 was associated with depressive affect and symptoms, stress, poor self-esteem, dissatisfaction with life, and low positive affect in sample 2 (N=100) of the present paper. It is concluded that research on CHD should focus on affective disorder, specific negative emotions and global personality traits, and that the DS16 is a practical, sound research tool that can be used to assess type-D.

Introduction

There is now substantial evidence that psychosocial factors are associated with coronary heart disease (CHD) [1,3]. This research, however, is lagging in developing measurement tools that allow for adequate characterization of individual risk in studies of prevention and intervention [3]. For example, it is possible that discrepant findings of research on Type A behavior and CHD could be explained by different methods of diagnosing this behavior pattern [4]. Hence, a clearer understanding is needed about basic dimensions of negative psychosocial patterns that may matter in CHD and about reliable ways to measure them [2].

With reference to this issue, a diversity of self-report measures have yielded an association between negative emotions and CHD, including measures of state anxiety [5], trait anxiety [6], state anger [7], trait anger [8], depressive symptoms [9], worrying [10], psychological stress [11], vital exhaustion [12], and hopelessness [13]. Clinical diagnoses of affective disorder have also been associated with fatal and non-fatal CHD [14,15]. This observation suggests that the experience of emotional distress in general is related to CHD. Moreover, some of these reports have suggested the importance of examining broader [10] and more stable [9] constructs than have previously been considered, in relation to CHD risk.

In addition to clinical diagnoses of affective disorder and self-reports of negative emotions, personality test scores may also yield important information in this context. Personality refers to a complex organization of trait dispositions; it is well established that these traits can be linked to important life outcomes [16]. Negative affectivity and introversion are broad and stable personality traits that are relevant to physical and mental health [2,17]. Negative affectivity denotes the tendency to experience negative emotions across time and situations [18]. Introversion has been associated with less social support seeking, poor quality of social interactions and low self-esteem [19,20]. Individuals who are high in negative affectivity and introversion are at risk for depression, anxiety, and social phobia [17,21,22].

By analogy, CHD patients who are high in negative affectivity and social inhibition report high levels of distress [23,24]. Social inhibition denotes the stable tendency to inhibit the expression of emotions and behaviors in social interaction [25]. This trait focuses on the interpersonal dimension of introversion -i.e., withdrawal, subassertiveness, and low self-expression [25] but not the intrapsychic dimension of extraversion -i.e., positive affect, energy, and excitement seeking [16]. Hence, social inhibition refers to the avoidance of potential "dangers" involved in social interaction such as disapproval or nonreward by others.

A high score on both negative affectivity and social inhibition was used as a definition of the 'distressed' personality (type-D) in patients with CHD [26]; i.e., type-D patients simultaneously tend to experience negative emotions and tend to inhibit the expression of these emotions in social interaction. The findings of a 6 to 10-year follow-up study indicated that CHD patients with type-D had a four-fold mortality risk compared with non-type-D patients [27]. Moreover, type-D has been related to cardiac death and recurrent myocardial infarction (MI) in post-MI patients with a decreased left ventricular ejection fraction [28].

These findings need to be replicated but psychosomatic research still lacks a measure that allows for a quick assessment of type-D. Negative affectivity is assessed well by self-report distress scales [18]; however, these scales may be burdensome for CHD patients to complete and were originally designed to assess specific negative emotions. Social inhibition can be assessed by the inhibition subscale of the 52-item Heart Patients Psychological Questionnaire [29] but the reliability of this scale ($\ddot{e}$=.64) is rather poor. Hence, the purpose of this paper was (a) to report on a short, reliable self-report measure of type-D, and (b) to examine the notion that social inhibition may add a new dimension to research on emotion-related CHD.

Methods

Subjects. Two samples of CHD patients were included; all patients agreed to participate in this study and filled out questionnaires at 3-6 weeks after a myocardial infarction (MI), coronary bypass surgery (CABG) or coronary angioplasty (PTCA). Sample 1 comprised 400 men (mean age= 57.3 ± 9.2; MI=46%, CABG=49%, PTCA=5%) who were drawn from 4 hospitals in Belgium (the University, Middelheim, and Sint Jozef hospitals in Antwerp; Maria's Voorzienigheid hospital in Kortrijk) between January 1989 and March 1993. Sample 2 comprised 90 men and 10 women (mean age= 55.9 ± 9.1; MI=41%, CABG= 56%, PTCA=3%) from the University Hospital of Antwerp (October 1993-October 1994).

Item Selection. A pool of 66 statements was derived from an item-level factor analysis of the Minnesota Multiphasic Personality Inventory (MMPI) [30] and 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 5-point Likert scale (ranging from 0= False to 4= True). Statistical analyses were used to produce a short scale comprising 8 negative affectivity and 8 social inhibition items; selection of these items was based on external and internal criteria. The external-empirical criterion was the ability of items to discriminate between type-D and non-type-D patients. As described elsewhere [26,27], a median split on the Trait Scale of the State-Trait Anxiety Inventory [31] and the Social Inhibition Scale from Erdman [29] was used to classify patients as type-D. Internal-structural criteria were based on the ability of items to adequately reflect the personality traits that underpin the construct of type-D; principal components analysis [32] and internal consistency analysis were used for this purpose.

Construct Validity. A subset of 218 patients from sample 1 also filled out the 20-item form of the Taylor Manifest Anxiety scale (TMAS) [33], the short Neuroticism and Extraversion scales from the Eysenck Personality Questionnaire (EPQ) [34], the MMPI Extraversion scale [30], and the Marlowe-Crowne scale [35]. The TMAS and EPQ- Neuroticism scale are valid

measures of negative affectivity [18]; therefore, the 8 selected negative affectivity items were predicted to correlate positively with these scale scores. The 8 selected social inhibition items were predicted to correlate negatively with the MMPI- and EPQ- Extraversion scales. The Marlowe-Crowne scale measures a personality trait that is related to the domain of control, defensiveness and socialization; therefore, the negative affectivity and social inhibition items were predicted to be largely unrelated to this scale [36].

Cross-validation. Patients of sample 2 were not involved in scale construction; this sample was used to replicate and extend findings from sample 1. These patients filled out the final 16-item scale that resulted from the process of item selection in sample 1, as well as the 20-item TMAS [33], MMPI-Extraversion [30], and Marlowe Crowne [35] scales. A subset of 60 patients filled out this 16-item scale again at three months after the initial assessment to examine temporal stability. Median cut-off scores on the 8-item negative affectivity and social inhibition scales were used to classify patients of sample 2 as a) type-D, b) high negative affectivity/low inhibition, c) low negative affectivity/high inhibition, or d) low negative affectivity/low inhibition. Differences between these personality subtypes were analyzed with reference to negative and positive emotions, and depressive symptomatology.

Negative emotions included depressive symptoms as measured by the 13-item form of the Beck Depression Inventory (BDI) [37], psychological stress as measured by the 20-item form of the General Health Questionnaire (GHQ) [38] using a 5-point rating scale, and negative mood states as measured by the Global Mood Scale (GMS) [39]. High BDI and GHQ scores have been associated with post-MI mortality [11,40,41]; the negative affect subscale of the GMS is a valid measure of negative mood states. Positive emotions included self-esteem as measured by the Rosenberg Self-Esteem scale (RSE) [42], satisfaction with life as measured by the Life Satisfaction Index (LSI) [43], and positive affect as measured by the GMS [39]. Low levels of positive affect have been associated with post-MI mortality [40].

The relation between type-D and depressive symptoms was examined more in detail in two additional analyses. First, a cut-off score of 5 on the 13-item BDI was used to classify patients as scoring high in depressive symptomatology [37]. Second, depressive affect in particular, rather than depressive symptomatology in general, is a good predictor of mortality in CHD patients [44]. Depressive affect is characterized by the interaction of high negative affect and low positive affect [45]; hence, a median split on the GMS negative affect and positive affect scales [39] was used to classify patients as scoring high in depressive affect.

Statistical Analyses. Crosstabulation was used to examine the ability of the selected items to discriminate type-D and non-type-D patients. Principal components analysis (varimax rotation) was used to examine the internal-structural validity of the selected items [32]. Corrected item-total correlations and Cronbach's á were used to examine the internal consistency of the trait scales that emerged from these analyses. Pearson's correlations and principal components analysis of scale scores were used to examine the construct validity of the final 16-item measure. Multivariate analysis of variance (MANOVA) was used to examine the overall difference in negative and positive emotions between personality subtypes. Univariate analyses of variance (ANOVA), Student-Newman-Keuls procedure (SNK), and crosstabulation were used to further examine significant subtype differences.

Results

TABLE 1   The first step in data analysis focused on the selection of statements on the basis of an external criterion; i.e., their ability to differentiate among type-D and non-type-D patients. In sample 1, 95 patients were classified as type-D (i.e., Spielberger Trait Anxiety Score ≥ 40 and Erdman Social Inhibition score ≥ 12) and 305 as non-type-D personality. Consistent with the personality model under test, all of the negative affectivity items differentiated between type-D and non-type-D subjects at $p < 0.0001$; seven of the social inhibition items differentiated at

p<0.0001 and one item at p<0.05 (Table 1; "Item Mean / Personality"). These findings support the validity of the final 16 items against the diagnosis of type-D.

The second step in data analysis (principal components analysis) indicated that 8 items were clearly related to the negative affectivity and social inhibition domains, respectively (Table 1; "Item-Level Analysis"). Cronbach's á (=.89 and .82) and item-total correlations indicated a high level of internal consistency for these trait factors (Table 1, last column). Test-retest reliability (3-month interval) was .78 and .87 for negative affectivity and social inhibition items (N=60). These findings support the validity of the final 'type-D Scale-16' (DS16) against both external and internal criteria. The DS16 is presented in the appendix.

In order to examine the construct validity of the DS16, items were summed to comprise Negative Affectivity [= 12 + sum (items 2 +9 +10 +12 +16) - sum (items 1 +6 +15)] and Social Inhibition [=16 + sum (items 4 +5 +8 +14) - sum (items 3 +7 +11 +13)] scores. The mean scores were 9.6 (Sd=6.5) for Negative Affectivity and 14.4 (Sd=6.2) for Social Inhibition; the median scores of these scales were 10 and 15. Given the empirical criterion for item selection, the Negative Affectivity and Social Inhibition scales correlated highly with the Trait Anxiety (r= .81) and Erdman Inhibition (r= .73) scales, respectively.

TABLE 2   The DS16 scales were also closely related to standard personality scales that were not involved in the diagnosis of type-D (Table 2). The Negative Affectivity scale correlated positively with the TMAS (r=.62) and EPQ-Neuroticism (r=.64) scales, and the Social Inhibition scale negatively with the MMPI (r=-.61) and EPQ (r=-.65) Extraversion scales. The Negative Affectivity scale was unrelated to these extraversion scales (r=-.09/-.12), the Social Inhibition scale was unrelated to the TMAS (r=.15) and Neuroticism (r=.11) scales. The correlation between the Marlowe-Crowne and Negative Affectivity scales (r=-.38) yielded 14% shared variance; the Social Inhibition scale was unrelated to this scale (r=-.06). The scree

plot of a principal components analysis yielded 3 second-order factors (Table 2). Factor I (46% variance) loaded on the DS16 Negative Affectivity, Spielberger and TMAS Trait-Anxiety, and the EPQ-Neuroticism scales; factor II (30% variance) loaded on the DS16 and Erdman Social Inhibition scales, and the MMPI and EPQ Extraversion scales; factor III (8% variance) loaded on the Marlowe-Crowne scale but not on any of the DS16 scales. Hence, these factors clearly represented the personality domains of (a) negative affectivity/ neuroticism, (b) social inhibition/introversion, and (c) control/defensiveness, respectively.

In sample 2 ($N=100$), principal components analysis also yielded 3 second-order factors loading on the DS16 Negative Affectivity (.86) and TMAS (.84) scales, the DS16 Social Inhibition (.83) and MMPI-extraversion (-.78) scales, and the Marlowe Crowne scale (.96). The negative affect x social inhibition interaction was not significant in terms of emotional status ($p=.40$). Low negative affectivity/high inhibition and low negative affectivity/low inhibition patients did not differ in negative or positive emotions ($p=.45$) and, thus, were merged in further analyses focusing on the additive effects of high negative affectivity and high social inhibition. Using a median split on the Negative Affectivity and Social Inhibition scales, there were 29 type-D patients (≥10 and ≥15), 20 high negative affectivity/low inhibition patients (≥10 and ≤14) and 51 low negative affectivity patients (≤9), respectively.

TABLE 3 MANOVA indicated an overall difference among personality subtypes in negative and positive emotions (Wilk's ë=0.49, $p<.0001$); these differences occurred on the self-esteem, life satisfaction ($p<.0001$), depressive symptoms ($p=.0004$), stress, negative affect ($p<.05$), and positive affect ($p=.05$) scales (Table 3). Type-D patients displayed lower self-esteem and life satisfaction scores than both high negative affectivity/low inhibition and low negative affectivity patients ($p<.05$). They also reported more distress and less positive affect than low negative affectivity patients ($p<.05$). Using a cut-off of 5 on the 13-item BDI, 39 patients were high in depressive symptoms; using a median split on the GMS Negative Affect (≥12) and Positive

Affect ($\leq$19) scales, 38 patients were high in depressive affect. Of note, 62-69% type-D patients were high in depressive symptoms/affect as opposed to only 22-25% low negative affectivity patients (Table 3). High negative affectivity/low inhibition patients, however, did not differ significantly from low negative affectivity patients in this respect.

Discussion

The present findings suggested that the DS16 is not only a brief scale but also a reliable and valid measure of the two basic personality traits that define type-D. Three criteria were used for the selection of items comprising the DS16 scales: a) congruency with an explicit model of two broad and stable personality traits [18,25], b) their ability to discriminate between type-D and non-type-D CHD patients [26-28] and c) internal-structural validity [32]. Significant correlations with widely used personality measures revealed a consistent pattern of convergent and discriminant validity, and scale level principal components analysis confirmed that the DS16 comprised valid markers of negative affectivity and social inhibition. These findings were replicated in confirmatory research in an independent sample of patients.

It is well established that negative affectivity is associated with emotional distress, including anxiety and depression [46,47]. Some authors have argued that negative affectivity or neuroticism is related to symptom reports but not hard medical outcomes [48]; however, there is evidence to suggest that this personality trait is in fact associated with both valid and invalid reports of disease [49]. In a recent case-control study, for example, neuroticism significantly discriminated between healthy subjects and subjects with CHD [50]. Personality factors have also been related to the course of CHD [51]. Whether negative affectivity should be viewed only as a nuisance variable or as an actual risk factor remains unsolved; in the meantime, it is premature to write off associations between this trait and physical health [3].

The present findings suggest that the inclusion of social inhibition may benefit research on emotion-related CHD; i.e., type-D patients were likely to report more depressive symptoms, lower self-esteem and more dissatisfaction with life, than patients who were high in negative affectivity but low in social inhibition. Accordingly, the tendency to hide worries from one's spouse has been related to higher levels of distress among post-MI patients [52].

Although this is a speculative point, social inhibition may be associated with a poor prognosis in CHD through (a) lack of self-expression or (b) lack of social support. Only one of the 8 DS16 inhibition items (i.e., item 5) refers to self-expression per se; an extended version of this scale which contains "closeness", "withdrawal" and "non-expression" facet scales is currently being developed. Different schools of thought have examined the relation between physical health and various aspects of self-expression such as emotional expression [53] and disclosure of traumas [54]. Of note, emotional inhibition has been related to cardiovascular reactivity [55], hypertension [56], incidence of CHD [57], and mortality [58]. Regarding hypothesis (b), introversion measured at college entry has been associated with low perceived social support at midlife [59]. Social alienation [26] and lack of perceived social support [60], in turn, have been associated with an increased risk of post-MI mortality.

Repressive coping [61] has also been related to poor health; e.g., decreased immune efficiency [62] or hypertension [63]. However, repression refers to (a) <u>low negative affect</u>/ high defensiveness and (b) an <u>unconscious process</u> wherein negative emotions are excluded from awareness, whereas type-D refers to (a) <u>high negative affect</u>/high social inhibition and (b) the <u>conscious suppression</u> of emotions/behavior in order to avoid disapproval by others. Cluster analytic research showed that repressive CHD patients were <u>low</u> in social inhibition; i.e., repressive coping appeared to be the opponent of type-D in terms of personality [24]. Factor analytic research in the present study showed that defensiveness (Marlowe-Crowne scale) was unrelated to social inhibition (Table 2; eigenvalue of the "defensiveness" factor was <1.0 but

scree plot yielded 3 factors). Hence, type-D [27] and repression [47] are distinctly different constructs that both may yield important prognostic information in CHD.

Inclusion of personality scales in research on CHD is, however, not currently a common practice. Contradictory findings of Type A research [4] may have caused a prejudice against the role of personality in CHD (the construct of Type A behavior was designed to avoid association with global personality traits [49] but it is often mistaken for a personality type). In addition, most personality scales have a relatively long administration time which implies that these scales are burdensome for CHD patients to complete, and that researchers who are interested in a broad array of variables may be discouraged to include these scales in their study. Hence, the DS16 may benefit research on CHD because: (a) it is a sound personality scale with limited response-burden that can be easily used in combination with measures of other psychological constructs; (b) it includes a measure of the general distress factor that is shared by negative emotions such as anxiety, sadness and anger; (c) it includes a reliable measure of social inhibition that adds new information to the area of emotion-related CHD; and (d) it can be used in confirmatory research on type-D personality in patients with CHD.

Depression and anxiety have overlapping and distinct features [17]; i.e. a general distress factor that is shared by both negative emotions, a specific depression factor (anhedonia), and a specific anxiety factor (autonomic hyperarousal). Hence, the DS16 negative affectivity scale is not a proxy for depression or anxiety scales but can be used to assess the general distress factor as the temperamental core of negative affectivity [17]. Inclusion of this scale may help to distinguish general distress from distinct features of negative emotions in research on CHD; i.e., clinical diagnoses of affective disorder [15], self-reports of negative emotions [5-13] and personality test scores [26-28] may yield independent prognostic information. The relation between type-D and symptoms of depression (BDI) or stress (GHQ) calls for special attention; others have shown that these symptoms are associated with post-MI mortality [11,40,41].

The DS16 does not cover all global traits that are relevant to health [2]; however, type-D has been associated with mortality [27] and recurrent heart attack [28] in patients with CHD. The most powerful prediction scheme is likely to be one that incorporates specific and global psychosocial constructs but this line of research has been neglected too much in the past. The present findings suggest that, as a research tool, the DS16 may be an asset in this context.

DS16

Name: .... **Sex**: .... **Age**: .... **Date**: ....

Below are a number of statements that people often use to describe themselves. Read each   statement and then **circle** the appropriate **number** next to that statement to indicate your answer. There are no right or wrong answers; the only thing that matters is **how you generally feel**.

0 = FALSE   **1** = RATHER FALSE   **2** = NEUTRAL   **3** = RATHER TRUE   **4** = TRUE

_____

1 **I am happy most of the time** . . . . → 0 1 2 3 4

2 **I take a gloomy view of things** . . . . → 0 1 2 3 4

3 **I often talk to strangers** . . . . → 0 1 2 3 4

4 **I have little impact on other people** . . . . → 0 1 2 3 4

5 **I find it hard to express my opinions to others** . . → 0 1 2 3 4

6 **The future seems hopeful to me** . . . . → 0 1 2 3 4

7 **I often find myself taking charge in group** . . . . → 0 1 2 3 4
 situations

8 **I find it hard to make "small talk"** . . . . → 0 1 2 3 4

9 **I am often in a bad mood** . . . . → 0 1 2 3 4

10 **I often feel unhappy** . . . . → 0 1 2 3 4

11 **I make contact easily when I meet people** . . . . → 0 1 2 3 4

12 **I often find myself worrying about something** . . → 0 1 2 3 4

13 **I like to be in charge of things** . . . . → 0 1 2 3 4

14 **When socializing, I don't find the right things** . . → 0 1 2 3 4
 to talk about

15 **I feel at ease most of the time** . . . . → 0 1 2 3 4

[16] **I am often down in the dumps** . . . . → <u>0 1 2 3 4</u>

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Table 1 **DS16: External and Structural Validity, and Internal Consistency of Items (Sample 1; N=400)**

Items of the DS16	Item Mean / Personality		Item-Level Analysis		Internal
	non-type-D	type-D †	factor I	factor II	Consistency‡
Negative Affectivity items					
often feels unhappy	0.9	1.6***	**.80**	.05	.71
is often down in the dumps	0.8	1.9***	**.78**	.10	.72
often worries about something	1.5	2.6***	**.77**	.09	.69
takes a gloomy view of things	0.9	1.9***	**.72**	.10	.65
is often in a bad mood	0.9	1.7***	**.64**	.12	.55
feels at ease most of the time	3.0	2.2***	**-.70**	-.12	.62
is hopeful about the future	2.9	2.0***	**-.78**	-.04	.69
feels happy most of the time	3.1	2.3***	**-.79**	-.05	.70
			eigenvalue I= 5.17		á=.89
Social Inhibition items					
finds it hard to make "small talk"	1.5	2.3***	.14	**.78**	.67
doesn't find things to talk about	1.4	2.1***	.16	**.72**	.61
finds it hard to express opinions	1.3	2.0***	.16	**.66**	.55
has little impact on other people	1.7	2.2***	.09	**.65**	.54
likes to be in charge of things	2.2	1.5***	.03	**-.59**	.46
often talks to strangers	2.1	1.7*	-.08	**-.60**	.47
is often in charge in groups	1.9	1.2***	.02	**-.62**	.49
makes contact easily	2.5	2.0***	-.09	**-.70**	.58
			eigenvalue II= 3.03		á=.82

DS16 denotes type-D Scale-16.

*** p<.0001, * p<.05

† defined by a median split on the Trait Scale of the State-Trait Anxiety Inventory and the Inhibition Scale of the Heart Patients Psychological Questionnaire (type-D, n=95).

‡ corrected item-total correlations and Cronbach's á estimates of reliability.

Table 2   **Construct Validity of the DS16 Negative Affectivity and Social Inhibition Scales (Sample 1; N=218)**

		Intercorrelation Matrix *								Scale-Level Factor Analysis †		
		1.	2.	3.	4.	5.	6.	7.	8.	Factor I	Factor II	Factor III
1. DS16	Negative Affectivity	–								**.87**	.12	-.08
2. STAI	Trait-Anxiety	*.81*	–							**.89**	.06	-.06
3. TMAS	Trait-Anxiety	*.62*	*.66*	–						**.85**	.11	-.11
4. EPQN	Neuroticism	*.64*	*.66*	*.80*	–					**.84**	.06	-.27
5. DS16	Social Inhibition	.26	.16	.15	.11	–				.14	**.87**	.09
6. HPPQ	Social Inhibition	.23	.24	.21	.16	*.73*	–			.23	**.80**	.19
7. EXTR	Extraversion	-.09	-.08	-.17	-.15	*-.61*	*-.52*	–		.01	**-.84**	.26
8. EPQE	Extraversion	-.12	-.04	-.13	-.09	*-.65*	*-.57*	*.74*	–	.01	**-.88**	.08
9. MC Defensiveness		-.38	-.37	-.31	-.43	-.06	-.03	.13	-.32	-.02	**.89**	
									eigenvalue=	3.77	2.49	0.82

DS16 denotes type-D Scale-16; STAI: State-Trait Anxiety Inventory; TMAS: Taylor Manifest Anxiety Scale (20-item form); EPQN: Neuroticism Scale from the Eysenck Personality Questionnaire; HPPQ: Heart Patients Psychological Questionnaire; EXTR: extraversion scale from the Minnesota Multiphasic Personality Inventory (20 items); EPQE: Extraversion Scale from the Eysenck Personality Questionnaire; MC: Marlowe-Crowne Scale.
* correlations >.50 are presented in italics.

† loadings of scales that are assigned to a factor are presented in boldface.

Table 3 **External Correlates of Type-D Personality as Measured by the DS16 (Sample 2; N=100)**

External Correlates	Personality Type as Defined by NA and SI Scales *			Univariate Analysis
	type-D (n=29)	High NA / Low SI (n=20)	Low NA (n=51)	
Negative Emotions				
BDI Depressive symptoms	7.7 (6.7) [a]	4.7 (4.7)	3.2 (2.8) [a]	$E_{(2,97)}= 8.6$, p=.0004
GHQ Psychological stress	51.0 (11.0) [a]	47.7 (10.2)	44.4 (10.8) [a]	$E_{(2,97)}=3.5$, p=.034
GMS Negative affect	16.0 (9.2) [a]	13.8 (10.5)	10.7 (7.1) [a]	$E_{(2,97)}=3.8$, p=.027
Positive Emotions				
RSE Self-Esteem	24.1 (6.9) [a b]	31.3 (5.2) [a c]	34.3 (5.1) [b c]	$E_{(2,97)}=29.9$, p<.0001
LSI Life satisfaction	26.1 (8.6) [a b]	30.7 (9.7) [a c]	37.6 (6.6) [b c]	$E_{(2,97)}=20.6$, p<.0001
GMS Positive affect	15.4 (6.4) [a]	18.5 (7.0)	19.5 (7.7) [a]	$E_{(2,97)}=3.0$, p=.05

Depressive Symptomatology				type-D vs Low NA	High NA / Low SI vs Low NA
BDI Depressive Symptoms †	69 % (20)	40 % (8)	22 % (11)	$\div^2$=17.5, p=.00003	$\div^2$= 2.5, p=.11
GMS Depressive Affect ‡	62 % (18)	35 % (7)	25 % (13)	$\div^2$=10.4, p=.001	$\div^2$= 0.6, p=.42

Standard deviation (Negative and Positive Emotions) and number of subjects (Depressive Symptomatology) appear in parentheses.
NA and SI denote DS16 negative affectivity and social inhibition scales; DS16: type-D Scale-16; BDI: 13-item Beck Depression Inventory;
GHQ: 20-item General Health Questionnaire; GMS: Global Mood Scale; RSE: Rosenberg Self-Esteem Scale; LSI: Life Satisfaction Index Z.

∗ [a, b, c] denotes pairs of groups that are significantly different from each other ($p<.05$; Student-Newman-Keuls procedure)

† using a cut-off score of 5 on the 13-item Beck Depression Inventory

‡ using a median split on the Negative Affect (i.e., ≥ 12) and Positive Affect (i.e., ≤ 19) measures of the Global Mood Scale

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Dear Editor,

Please find enclosed four copies of a manuscript entitled: "Personality and Coronary Heart Disease: The Type-D Scale (DS16)." I would appreciate if you would be willing to consider this manuscript ("RAPID REVIEW" option) for publication in your Journal.

Previous research indicated that the interaction between two global personality traits -negative affectivity and social inhibition- was an independent predictor of mortality, cardiac events, and incidence of cancer in coronary patients (*Psychosom Med* 1995, 57:582-591; *Lancet* 1996, 347:417-421; *Circulation*, in press; *Psychol Med*, in press). Please find enclosed a copy of these papers. Unfortunately, research on emotion-related coronary heart disease (CHD) has largely ignored the role of global personality traits and inclusion of scales that measure these traits is not currently a common practice in this area.

The contradictory findings of research on Type A behavior may have caused a prejudice against the role of personality in CHD. In addition, most personality scales have a relatively long administration time; hence, these scales may be burdensome for CHD patients to complete, and researchers who are interested in a broad array of variables may be discouraged to include these scales in their study. Accordingly, this paper describes a brief and reliable personality scale that can be easily combined with measures of other psychosocial constructs in the study of emotion-related CHD. This scale a) includes a measure of the general distress factor that is shared by negative emotions such as anxiety, sadness and anger; b) includes a reliable measure of social inhibition that may add new information to the area of emotion-related CHD; and c) can be used in confirmatory research on type-D personality (characterized by high levels of negative affectivity and social inhibition) in patients with CHD. The findings of the present paper also showed that type-D, as measured by this new scale, was associated with depressive symptoms/affect, psychological stress, poor self-esteem, dissatisfaction with life, and low positive affect. It is concluded that the most powerful prediction scheme is likely to be one that incorporates measures of both specific psychosocial constructs and global personality traits.

The contents of this paper have not been published elsewhere and the paper is not being submitted elsewhere. I hope that you would be kindly willing to consider this paper for publication in *Annals of Behavioral Medicine*. I am convinced that the theoretical perspective and empirical findings of this paper will interest your readership.

Sincerely yours,

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Robert M. Kaplan, Ph.D.   March 9, 1998
Associate Editor *Annals of Behavioral Medicine*
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Re.: Manuscript #RK97-0050, "Personality and Coronary Heart Disease:
                            The Type-*D S*cale-*16* (*DS16*)"

Dear Editor,

Thank you for your letter of January 6 enclosing your reviewers' comments on the above
referenced manuscript. I am convinced that the manuscript is now markedly improved by
the revision you recommended.

I have tried to keep the paper as short and sharply focused as I could; the length of the
paper is expanded by one page. In response to the suggestions of both your reviewers, the
paper now includes a paragraph on type-D personality and repressive coping (page 10,
second paragraph). The theoretical reasoning for the type-D construct is now discussed
more in detail, including (a) the relationship between emotion, general distress and
personality; (b) the relationship between negative affectivity and symptom reports versus
hard coronary events; and (c) the health relevance of social inhibition. Reference 51 is now
deleted and the use of the Marlowe-Crowne scale in factor analysis is discussed more in
detail. Finally, the analysis of the interaction effect is now reported (page 8). My responses
to these and other comments are detailed in the attached sheets.

I am convinced that this revision may provide an appropriate answer to your reviewers'
comments and I hope that the revised manuscript meets the high standards of *Annals of
Behavioral Medicine*. Please find enclosed three copies of the revised manuscript.

Sincerely yours,

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<u>Responses to Comments of Reviewer 1</u>.

Thank you very much for your appreciation of my work.

Due to limited space in the journal, the editor asked me to keep the paper as short and sharply focused as possible. Although I was not able to expand much on important work of Friedman, Pennebaker and others, mention is now made of the fact that: "***Different schools of thought have examined the relation between physical health and various aspects of self-expression such as emotional expression [53] and disclosure of traumas [54].***" (page 10, first paragraph, lines 5-7). However, in response to your suggestion and to the comments of reviewer 2, the Discussion now includes a new paragraph that focuses on type-D and repressive coping. Hence, it is now stated that: "***Repressive coping [61] has also been related to poor health; e.g., decreased immune efficiency [62] or hypertension [63]. However, repression refers to (a) <u>low negative affect</u>/ high defensiveness and (b) an <u>unconscious process</u> wherein negative emotions are excluded from awareness, whereas type-D refers to (a) <u>high negative affect</u>/high social inhibition and (b) the <u>conscious suppression</u> of emotions/behavior in order to avoid disapproval by others. Cluster analytic research showed that repressive CHD patients were <u>low</u> in social inhibition; i.e., repressive coping appeared to be the opponent of type-D in terms of personality [24]. Factor analytic research in the present study showed that defensiveness (Marlowe-Crowne scale) was unrelated to social inhibition (Table 2; eigenvalue of the "defensiveness" factor was <1.0 but scree plot yielded 3 factors). Hence, type-D [27] and repression [47] are distinctly different constructs that both may yield important prognostic information in CHD.***" (page 10, second paragraph).

———————————

<u>Responses to Comments of Reviewer 2</u>.

1. The theoretical reasoning for the type-D construct is now discussed more in detail. With reference to the health relevance of social inhibition, it is now clearly stated in the Discussion Section that: "***Although this is a speculative point, social inhibition may be associated with a poor prognosis in CHD through (a) lack of self-expression or (b) lack of social support.***" (page 10, first paragraph, lines 1-2), and also that: "***Different schools of thought have examined the relation between physical health and various aspects of self-expression such as emotional expression [53] and disclosure of traumas [54]. Of note, emotional inhibition has been related to cardiovascular reactivity [55], hypertension [56], incidence of CHD [57], and mortality [58].***" (page 10, first paragraph, lines 5-8). With reference to the relationship between emotion, general distress and personality, it is now stated in the Discussion that: "***<u>Depression and anxiety have overlapping and distinct features [17]; i.e. a general distress</u> factor that is shared by both negative emotions, a specific depression factor (anhedonia), and a specific anxiety factor (autonomic hyperarousal). Hence, the DS16 negative affectivity scale is not a proxy for depression or anxiety scales but can be used to assess the general distress factor as the temperamental core of negative affectivity [17]. Inclusion of this scale may help to distinguish general distress from distinct features of negative emotions in research on CHD; i.e., clinical diagnoses of affective disorder [15], self-reports of negative emotions [5-13] and personality test scores [26-28] may yield independent prognostic information.***" (page 11, second paragraph, lines 1-6).

2. Up to now, little is known about the role of social inhibition as a potential CHD risk factor. The statement that socially inhibited individuals are low in emotional expressivity, is in keeping with the definition of social inhibition itself (see ref. #25). You are correct in pointing out the fact that the DS16 is not tapping emotional expressivity *per se*. Accordingly, mention is now made of the fact that: "***<u>Only one of the 8 DS16 inhibition items (i.e., item 5) refers to self-expression per se; an extended version of this scale which contains "closeness", "withdrawal" and "non-expression" facet scales is currently being developed</u>.***" (page 10, first paragraph, lines 2-5). Regarding evidence from past literature on the relation between expressivity and CHD, ref #51 of the initial version of the manuscript is deleted. The issue whether negative affectivity is only related to symptom reports or also to hard coronary events is now addressed extensively in the revised manuscript: "***Some authors have argued that negative affectivity or neuroticism is related to symptom reports but not hard medical outcomes [48]; however, there is evidence to suggest that this personality trait is in fact associated with both valid and invalid reports of disease [49]. In a recent case-control study, for example, neuroticism significantly discriminated between healthy subjects and subjects with CHD [50]. Personality factors have also been related to the course of CHD [51]. Whether negative***

affectivity should be viewed only as a nuisance variable or as an actual

risk factor remains unsolved; in the meantime, it is premature to write off associations between this trait and physical health [3]. " (page 9, second paragraph, lines 2-9).

3. The differences of type-D and repressive coping are now pointed out in a new paragraph of the Discussion section. Accordingly, it is stated that: "***Repressive coping [61] has also been related to poor health; e.g., decreased immune efficiency [62] or hypertension [63]. However, repression refers to (a) <u>low negative affect</u>/ high defensiveness and (b) an <u>unconscious process</u> wherein negative emotions are excluded from awareness, whereas type-D refers to (a) <u>high negative affect</u>/high social inhibition and (b) the <u>conscious suppression</u> of emotions/behavior in order to avoid disapproval by others. Cluster analytic research showed that repressive CHD patients were <u>low</u> in social inhibition; i.e., repressive coping appeared to be the opponent of type-D in terms of personality [24].*** " (page 10, second paragraph, lines 1-7); and also that: " ***... type-D [27] and repression [47] are distinctly different constructs that both may yield important prognostic information in CHD*** " (page 10, second paragraph, lines 10-11). With reference to this issue, the choice of the Marlowe-Crowne to establish discriminant validity is warranted; it is well established that negative affectivity and defensiveness are correlated in the range of -.30 to -.40 (e.g.; my own research in patients with CHD, *Psychosom Med 1991*, 53:538-56, Ref. #47) but it is important to examine the association between inhibition and defensiveness. Therefore, it is now stated in the Discussion section that: "***Factor analytic research in the present study showed that defensiveness (Marlowe-Crowne scale) was unrelated to social inhibition (Table 2; ...*** " (page 10, second paragraph, lines 8-9). Eigenvalue >1.0 is only one of the criteria for the extraction of factors; the scree plot is another commonly accepted criterion. Accordingly, mention is now made to the fact that: " ***... eigenvalue of the "defensiveness" factor was <1.0 but scree plot yielded 3 factors ...*** " (page 10, last paragraph, lines 9-10).

4. The negative affect x social inhibition interaction was not significant with reference to negative/positive emotions reported by patients in sample 2. Accordingly, it is now stated in the Results section that: "***The negative affect x social inhibition interaction was not significant in terms of emotional status ($\underline{p}$=.40). Low negative affectivity/high inhibition and low negative affectivity/low inhibition patients did not differ in negative or positive emotions ($\underline{p}$=.45) and, thus, were merged in further analyses focusing on the additive effects of high negative affectivity and high social inhibition.*** " (page 8, second paragraph, lines 4-8). However, previous research indicated that this interaction predicted hard coronary events in patients with CHD (e.g., Ref. #27). More research is needed to address this important issue.

Arthur A. Stone, Ph.D.   April 28, 1998
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Re.: Manuscript #RK97-0050-R1   "Personality and Coronary Heart Disease:
                                        The Type-*D S*cale-*16* (*DS16*)"

Dear Editor,

Thank you very much for giving me the opportunity to use your Journal as an outlet for my work. Please find enclosed my manuscript on disk (WP5.1) and the "assignment of copyright" form.

I hope you would be kindly willing to provide me more information about the expected date of publication.

Again, thank you for accepting my paper for publication in the *Annals of Behavioral Medicine*. I certainly will consider the *Annals* for publication of my future work.

Sincerely yours,

Johan Denollet, Ph.D.

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