Type D personality and cardiovascular disease: evidence and clinical implications

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Despite significant reductions in morbidity and mortality in recent years due to improved treatment strategies, cardiovascular disease is the leading cause of death in the Western world. Psychosocial factors, such as depression, have been shown to impact adversely on the prognosis of patients with coronary artery disease, but personality factors have to a large extent been ignored since the controversial findings surrounding the Type A behaviour pattern. This review on Type D personality highlights the importance of including personality factors in research and clinical practice, as personality may be an important explanatory factor of individual differences in multiple clinical outcomes. Type D personality is defined as a high score on negative affectivity (a tendency to experience increased negative emotions) and social inhibition (a tendency not to express these emotions when together with others). Type D has been associated with increased depression, fatigue, poor health-related quality of life, and increased risk of cardiac morbidity and mortality independent of established biomedical risk factors. Type D personality can be assessed with the Type D 14-item Scale (DS14). The scale is a brief, valid and standardised instrument that comprises little burden to patients and to clinical practice. The DS14 has recently been validated in Italian cardiac patients.

Key words: Type D personality - Cardiovascular diseases - Psychiatry.

Several studies have shown that psychological distress is associated with the pathogenesis of cardiovascular disease (CVD), but a paucity of studies include an appraisal of the contribution of personality to the link between distress and CVD prognosis. Personality factors may have much explanatory power in terms of individual differences in psychological distress, morbidity and mortality following somatic disease such as CVD, as will be shown in this review. In part, the exclusion of personality factors in psychosomatic research can be attributed to inconsistent results on the Type A behaviour pattern (TABP) and CVD.

The Type D (distressed) personality construct, derived from theoretical and empirical research, is characterised by a high score on 2 stable personality traits, i.e. negative affectivity (NA) and social inhibition (SI). Negative affectivity denotes the tendency to experience negative emotions (such as anxiety, sadness, anger etc.) across time and situations with individuals high on this trait.
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scanning the world for signs of impending trouble.6, 7 SI refers to the tendency to inhibit the expression of these negative emotions in social interactions,8 i.e. individuals high on this trait fear the negative judgment of others and belittle or hide their difficulties thereby generating a condition of social isolation.7 In general, individuals with a Type D personality present with few positive emotions, have low self-esteem, and are generally dissatisfied with life.5 In addition, Type D persons are more likely to suffer from depression, chronic tension, anger, pessimism, poor social support, and low levels of perceived well-being.3-5, 9

The present review reports on research on Type D personality in relation to CVD conducted between 1995 and 2004. For clarity, the studies have been categorised according to the levels of evidence in medical experimentation proposed by the Italian National Program for Guidelines Ministry of Health (Table I).10 These levels range from I-V with level I (e.g. randomised controlled trials and meta-analysis) being the highest - i.e. the best level of evidence - and level V (e.g. case study without a control group) being the lowest. To date, no studies have looked at interventions targeting Type D personality. Therefore, evidence from level I and II studies is not available.

Evidence level III studies

The study that can be considered a precursor to the Type D personality construct was published in 1995.11 It was based on a small sample of 105 male survivors of myocardial infarction (MI), and investigated the association between personality and mortality. The results of the study showed that personality traits may play a role in the adverse effect of emotional distress on prognosis in patients surviving MI. Patients with a Type D personality had a six-fold increased risk of cardiac mortality compared with non-Type D patients adjusting for biomedical factors including low exercise tolerance, previous MI, smoking, and age. Furthermore, adding the personality variable to biomedical factors in a logistic regression model more than doubled the sensitivity of the model in terms of its ability to predict mortality. In the latter study, depression, social alienation, somatisation and the use of benzodiazepines were also related to prognosis in post-MI patients. The findings indicated a higher prevalence of the various psychosocial risk factors in the distressed than in the nondistressed. However, the factors did not add to the level of prediction of mortality above and beyond that of the distressed personality type.11

In 1996, an extension of the 1995 study was published.9 The number of patients included was increased in order to enhance the power of the study, and the follow-up was extended. Type D personality was associated with a significantly increased risk of mortality (Type Ds = 27% versus non-Type Ds = 7%; P < 0.00001). The influence of Type D on cardiac and noncardiac death remained substantial (OR = 4.1; 95%CI: 1.9-8.8) even after adjusting for left ventricular ejection fraction (LVEF), multivessel disease, low exercise tolerance, and lack of thrombolytic therapy after MI. As shown in Figure 1, Type D personality was a predictor of all-cause mortality independent of the 2 well known risk factors for coronary heart disease (CHD), i.e. LVEF and multivessel disease.9

Another important result of this (and the previous) study was that neither NA nor SI alone but the synergistic effect of these 2 traits had deleterious effects on cardiovascular health; death rates for patients scoring high on only one of these traits did not differ from patients scoring low on both traits.

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<tr>
<th>Levels of evidence as provided by the Italian Ministry of Health</th>
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<td>I) Randomised controlled trials (RCTs) and/or systematic reviews of RCTs</td>
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<td>II) One RCT</td>
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<td>III) Cohort non randomised studies with concurrent or historical controls or their meta-analyses</td>
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<td>IV) Retrospective studies (such as case control) or their meta-analyses</td>
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<td>V) Case series without control group</td>
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<td>VI) Expert opinion (such as guidelines or consensus conference)</td>
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In 2000, the above mentioned results were confirmed in a five-year follow-up study of 319 patients with established CHD.\textsuperscript{12} In a multivariate model, Type D personality (OR = 8.9; 95%CI: 3.2-24.7), LVEF<50% (OR = 3.9; 95%CI: 1.4-11.1) and age<55 (OR = 2.6; 95%CI: 1.1-6.6) were identified as independent predictors of cardiac mortality and nonfatal MI at 5 years follow-up. Type D personality was also a risk factor for a combined endpoint defined as cardiac mortality, nonfatal MI, coronary bypass graft surgery (CABG) and percutaneous transluminal coronary angioplasty (PTCA).

Two studies have investigated the relation between Type D and prognosis in special interest groups. The first study was undertaken in patients with poor LVEF;\textsuperscript{13} the second, in patients with established CHD who developed cancer.\textsuperscript{14} The first study focused on 87 patients with MI and LVEF ≤ 50%. Type D (RR = 4.7; 95%CI: 1.9-11.8) and LVEF ≤ 30% (RR = 3; 95%CI: 1.2-7.7) were identified as independent risk factors for cardiac events in a follow-up period of 6-10 years (mean 7.9 years).\textsuperscript{13} The second study that examined the association between Type D personality and the development of cancer in CHD patients found that 13% Type D patients developed cancer versus 2% non-Type D patients.\textsuperscript{14} Type D personality (OR = 7.2; 95%CI: 2.9-18.1) and age (OR = 4.6; 95%CI: 1.5-14.3) were identified as independent predictors of the development of cancer. There was no association between development of cancer and cardiac disease severity as measured by LVEF.\textsuperscript{14}

A recent substudy of the Rapamycin-Eluting Stent Evaluation At Rotterdam Cardiology Hospital (RESEARCH) registry evaluated the impact of Type D personality on prognosis at 9 months follow-up in 875 consecutive patients with ischemic heart disease (IHD) following percutaneous coronary intervention (PCI).\textsuperscript{15} The patients had either received a sirolimus-eluting stent (SES) or a conventional bare stent. In univariate analyses, patients with a Type D personality (5.6%) had a higher risk of a composite of death or MI compared with non-Type Ds (1.3%) (OR = 4.73; 95%CI: 1.87-12). Type D personality remained an independent risk factor for mortality or MI (OR = 5.31; 95%CI: 2.06-13.66) after adjusting for all other clinical variables, including stent type. The results of the above mentioned RESEARCH substudy suggest that Type D personality is an independent predictor of prognosis in CHD, even when patients are treated with the latest advent in interventional cardiology.

Taken together, the consistency of these results suggests that Type D personality is an independent risk factor for hard medical outcomes in patients with established CHD.

**Evidence IV studies**

A study by Appels \textit{et al.} in 2000 considered the association between vital exhaustion (VE) and the inhibition of emotions in patients having suffered a sudden cardiac arrest (SCA).\textsuperscript{16} This study, based on 99 patients with SCA and 119 controls, identified VE as an antecedent of SCA. Furthermore, the effect
of VE was modified by the inhibition of emotions, with patients who did not express their emotions being at an seven-fold increased risk of SCA. In 2001, a study of 171 patients with IHD focused on the relation between Type D personality, gender, VE and symptoms of angina. Patients scheduled for coronary angiography (CAG) completed a questionnaire at baseline and at 6 weeks following invasive or medical therapy. Univariate analyses yielded Type D as an independent predictor of VE at baseline and at follow-up. Compared with non-Type Ds, Type D patients were at increased risk of VE both at baseline (OR = 6.35; 95%CI: 3.01-9.69) and follow-up (OR = 4.74; 95%CI: 0.73-8.75). At follow-up, Type Ds also reported more symptoms of angina pectoris than non-Type Ds. These results suggest that Type D moderates the effect of medical therapy on VE.

A recent contribution to Type D research was conducted in Denmark. The objectives of this study were to investigate whether the Type D Personality Scale is a valid and reliable measure in other populations and to investigate whether individuals with a Type D personality may be at increased risk of developing post-traumatic stress disorder. The study was based on 112 first MI patients and 115 healthy controls selected at random from the general population. The study confirmed the validity of the DS16 and identified Type D (OR = 4.46; 95%CI: 1.36-14.64), neuroticism (OR = 1.32; 95%CI: 1.13-1.53) and diagnosis of MI (OR = 4.03; 95%CI: 1.43-11.35) as independent predictors of post-traumatic stress disorder adjusting for all other variables.

In another study, Pedersen et al. investigated the prevalence of symptoms of anxiety and depression and the association between Type D personality, social support and distress in patients with an implantable cardioverter defibrillator (ICD) (n=182) and their partners (n=144). The results showed a higher prevalence of anxiety symptoms in partners (42%) than in patients (31%), whereas levels of depression were similar (29% vs 28%). Both in patients (OR = 7.03; 95%CI: 2.32-21.32) and in partners (OR = 8.77; 95%CI: 3.19-24.14), Type D was an independent determinant of symptoms of anxiety. Type D was also independently associated with depressive symptoms in patients (OR = 7.40; 95%CI: 2.49-21.94) and partners (OR = 4.40; 95%CI: 1.76-11.01).

The results of the level IV studies indicate that the Type D construct also has value in arrhythmia research, and again support the notion that personality is an important explanatory factor of individual differences in distress.

**Evidence level V studies**

In 1998, the first level V study on Type D was published. The focus of the study was on the 2 traits that define Type D, i.e. NA and SI, and the development of a brief self-report measure for identifying Type Ds. The aim of the study was to replicate the 1996 finding that the synergistic effect of these 2 traits, i.e. Type D personality, is a risk factor for adverse prognosis in CHD patients. The results showed that the Type D Scale was a valid and reliable measure with Type Ds reporting more depressive feelings, lower self-esteem, and more dissatisfaction with life than non-Type Ds.

A study of 734 patients with hypertension focused on the synergetic effect of NA and SI that is known as a risk factor in CHD. First, the results showed that NA and SI and their lower order traits could be assessed reliably in this patient group. This means that the Type D construct is not only applicable in patients with established CHD. Furthermore, there was an association between Type D personality and depressive affect; 49% of the Type Ds scored high on depressive affect versus 23% of the non-Type Ds.

A preliminary cross-sectional study of 42 male patients with chronic heart failure (CHF) suggested that immune-activation may comprise one link between Type D personality and cardiac events. Denollet et al. found that Type D was independently associated with higher levels of the proinflammatory cytokine TNFα and its soluble receptors TNFR1 and TNFR2, which comprise important prognostic indicators in CHF. In the latter
study, Type D was as important as ischemic aetiology in immune activation. It has previously been shown that negative emotions are associated with increased levels of proinflammatory cytokines.22 The results of another study on healthy subjects (n=173) on the relationship between Type D personality and physiological indices indicated a relationship between increased blood pressure and SI, and between reduced heart rate and NA in male subjects.23 Furthermore, both NA and SI turned out to be correlated with increased cortisol levels as a result of stress. These results suggest that the sympathetic nervous system may comprise another pathway in the relationship between Type D and CVD.23

An American study took into consideration Type D personality and other psychosocial risk factors that have been associated with an increased risk of mortality in patients with CVD, using age at initial diagnosis as a proxy for prognosis in CVD. Type D personality was found not to be significantly correlated with age at initial diagnosis; however, Type D persons reported more symptoms of depression and anxiety compared to non-Type Ds.24 A sequel to the latter study which increased the number of participants by including more women identified a significant relation between Type D and younger age at initial diagnosis of CVD in men.25

Publications on Type D personality based on the level of evidence in medical experimentation as proposed by the Italian Ministry of Health are shown in Table II.

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**Type D personality, quality of Life and response to treatment**

**Quality of life**

Until now we have only considered the levels of evidence related to hard endpoints in CVD, i.e. morbidity and mortality, but response to treatment and quality of life (QoL) comprise other important endpoints. As emphasised by the World Health Organization (WHO), the target for the next millennium in terms of public health is a general improvement in QoL; all health-care professionals are required to devote attention to this aspect which to date only has been considered secondary.26 Furthermore, in medical research patients have rated QoL as more important than extended survival.27 As a consequence, QoL is an important outcome measure in medical research, also since impaired QoL has been associated with adverse prognosis.28, 29

Two studies have investigated the association between Type D personality and QoL in CHD patients. In the already cited study by Denollet et al., Type Ds reported poorer subjective health compared to non-Type Ds at 5 years follow-up.12 QoL was measured by the Health Complaints Scale (HCS) and the Global Mood Scale (GMS), 2 psychometrically sound and sensitive measures of QoL.30, 31 It must be emphasised, however, that the
above mentioned results are based on a relatively small sample (n=104) and that further studies are warranted to confirm these associations. A cross-sectional study of 84 patients with CHF also found an association between Type D personality and impaired health status. In univariate analyses, Type D was associated with impaired health status (OR = 2.8; 95%CI: 1.13-7.26). After adjusting for clinical and demographic variables Type D remained an independent risk factor for impaired health status (OR = 3; 95% CI: 1.12-7.78).32

Response to treatment

The already mentioned results of the Pedersen and Middel study on patients scheduled for CAG (n=171) showed that Type Ds reported more symptoms of angina pectoris than non-Type Ds following CABG/PTCA or conservative treatment, despite reduction in symptoms of angina.17 This means that Type D patients benefit from treatment, but not to the same extent as non-Type D patients as their levels of distress and somatic complaints remain significantly higher. Furthermore, another study showed that the convergence of decreased LVEF, younger age and Type D personality predicts absence of an expected therapeutic response.12

Taken together these results show that Type D personality is not only associated with an increase in emotional distress, more cardiac events and poor QoL, but also seems to moderate the effects of pharmacological and invasive treatment.17

Cross-cultural results on Type D personality: preliminary results on the DS14

During the third conference on the (Non)-Expression of Emotions in Health and Disease in Tilburg, the Netherlands (October 2003), a symposium was organised on the cross-cultural applicability of the Type D construct. Results of 4 studies on the validation of the Type D scale (DS14) in different countries, i.e. Hungary, Germany, Denmark, and Italy were presented.33,35,36 The fourteen-item Type D personality scale (DS14)33 comprises 2 subscales, i.e. NA and SI, containing 7 items respectively. Both subscales have good test-retest validity and high internal validity with Cronbach’s α of 0.88 and 0.86 for the NA and SI subscales. The items are answered on a five-point Likert scale from 0 (false) to 4 (true). A predetermined cut-off ?10 on both subscales is used to determine those with a Type D personality.33

The results of the Hungarian study34 in the general population (n=12 570) identified Type D personality as a risk factor for cardiovascular disorder, MI, and cardiovascular morbidity, especially in subgroups in whom more traditional risk factors were absent (i.e. hypertension, diabetes and smoking). The German study (n=2 417)35 confirmed the validity and reliability of the German DS14 in cardiac patients, psychosomatic patients and healthy factory workers (preliminary data). The prevalence of Type D in cardiac patients was 24%, in psychosomatic patients 62%, and in healthy factory workers 32%. The Danish study, which has been mentioned previously, was conducted in first MI patients (n=112) and healthy controls (n=115). The Type D scale was found to be a valid instrument in both MI patients and healthy persons. Type D also was associated with a four-fold increased risk of post-traumatic stress disorder in this population, confirming that it is a marker of general distress.18 The validation study of the Italian version of the DS14 included 145 cardiac patients.36 The study confirmed the validity of the Italian DS14 with Cronbach’s alpha 0.82 and 0.80 for the NA and SI subscales respectively, and found Type D to be a predictor of psychological distress.

Type D or not Type D: do we need another personality type?

The emergence of nonpsychopathological personality types and their association with somatic disease dates back to the 1950s when Friedman and Rosenman discovered that behavioural factors influenced serum cholesterol levels independent of diet.37 Their ob-
servations led to the derivation of the TABP or Type A as it is often referred to. TABP is probably the most well known personality construct, and is defined as competitive achievement orientation, a sense of urgency, and hostility; Type B typifies individuals with the absence of TABP. Following identification of TABP as an etiologic risk factor for CHD independent of established biomedical risk factors, TABP was formally recognised as a risk factor of CVD on par with traditional biomedical risk factors. However, later studies have shown mixed findings, and it seems that subcomponents of TABP (e.g. hostility) rather than global TABP have deleterious effects on health. The following personality taxonomy that emerged was Type C personality, or the cancer-prone personality. Type C defines those individuals who are cooperative, unassertive, and who suppress negative emotions. Type D personality is the most recent addition to these nonpsychopathological personality dispositions, and may revive research in personality factors per se.

As a final remark, it is important to note that, although TABP is often regarded as a personality type, it was defined so as to avoid any association with general and stable features of personality. Hence, it is particularly paradoxical that inconsistent results in relation to TABP has led to the general exclusion of personality factors in CVD. By contrast, Type D is a personality construct that is based on 2 stable traits, i.e. NA and SI. So far, this personality type has been related consistently to hard and soft endpoints in CVD and other chronic conditions, thereby identifying patients at risk for important events and impaired QoL.

**Conclusions**

The identification of cardiac patients at risk of recurrent cardiac events and impaired QoL and the modification of this risk comprise important targets for secondary prevention. Since psychosocial risk factors have shown to cluster together within individuals hence increasing the risk of adverse prognosis substantially, it is imperative to be able to identify this subgroup of patients. A recent review on the role of psychological factors in CVD has suggested that focus on chronic stress in research and in clinical practice may facilitate the identification of these patients. Chronic psychological risk factors are believed to promote the development of episodic and acute risk factors. Type D personality comprises a chronic psychological risk factor in so far as Type D individuals deal with stress in a particular way. As shown in this review, Type D has substantial explanatory power of individual differences in cardiac morbidity and mortality. It has been associated with increased morbidity and mortality in patients with established CVD, comprising a risk factor on par with traditional biomedical risk factors. Furthermore, it has been associated with increased psychological distress and impaired QoL, and it has been shown to moderate the effects of pharmacological and invasive treatment. Type D has also been shown to be important in other chronic conditions and diseases, including hypertension, cancer and arrhythmias.

An important question remains, however, namely whether it is at all possible to modify the impact of Type D personality given its stable effect on behaviour. Although 2 recent trials have produced mixed findings, psychosocial interventions successful at reducing emotional distress, depression, TABP and anger/hostility, have proven to reduce morbidity and mortality in patients with CVD. Type D patients match this psychological profile and may, therefore, also benefit from similar psychosocial interventions, even though this needs to be confirmed in future intervention studies.

In conclusion, the Type D Personality Scale (DS14) could be used in research and in clinical practice in order to identify patients at risk of future cardiovascular events. The scale is a brief and valid measure that comprises little burden to patients and to clinical practice. Although the scale was developed in Belgian cardiac patients, its applicability in other cultures has been demonstrated in recent studies in Denmark, Hungary, Germany, and Italy.
Riassunto

Personalità di Tipo D e malattie cardiovascolari: evidenza e implicazioni cliniche

Nonostante negli ultimi anni si sia verificata una notevole diminuzione di morbilità e mortalità, grazie anche al miglioramento nella diagnosi e nella cura, le malattie cardiovascolari rimangono la causa principale di morte nelle popolazioni occidentali.

Si è dimostrato che fattori psicosociali, come, ad esempio, la depressione, giocano un ruolo negativo nella prognosi delle malattie cardiovascolari; tuttavia, i fattori legati alla personalità, a causa dei risultati a volte contraddittori delle ricerche sul Tipo A (Type A behaviour pattern), sono stati trascurati.

Questa rassegna sulla personalità di Tipo D mette in luce l’importanza dell’inclusione dei fattori di personalità nella ricerca e nella pratica clinica, poiché la personalità può essere un importante fattore esplicativo di differenze individuali in molteplici esiti clinici.

La personalità di Tipo D è una combinazione di 2 dimensioni: affettività negativa (tendenza a esperire emozioni negative nel tempo e in diverse situazioni) e inibizione sociale (tendenza a inibire emozioni e comportamenti nelle interazioni sociali). La personalità di Tipo D è stata associata a un aumento di depressione, spostatezza cronica, insoddisfazione associata alla salute e aumentato rischio di morbidità e mortalità per malattie cardiovascolari, indipendentemente da altri fattori di rischio biomedici. La personalità di Tipo D è misurabile con la Scala DS-14 costituita da 14 item, uno strumento conciso, valido e standardizzato che richiede poco tempo a pazienti e operatori. La DS14 è stata recentemente validata anche in pazienti cardiopatici italiani.

Parole chiave: Personalità di Tipo D - Malattia cardiovascolare - Psichiatria.

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