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Increased emotional distress in type-D cardiac patients without a partner

Krista C. van den Broek[a,*], Elisabeth J. Martens[a], Ivan Nyklíček[a], Pepijn H. van der Voort[b], Susanne S. Pedersen[a]

[a]*CoRPS—Center of Research on Psychology in Somatic diseases, Tilburg University, Tilburg, The Netherlands*
[b]*Department of Cardiology, Catharina Hospital Eindhoven, Eindhoven, The Netherlands*

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Abstract

Objective: The distressed (type-D) personality is an emerging risk factor in coronary artery disease that has been associated with adverse prognosis, impaired health status, and emotional distress. Little is known about factors that may influence the impact of type-D personality on health outcomes. Therefore, the aim of this study was to determine the combined effect of type-D and not having a partner on symptoms of anxiety and depression. **Methods:** Patients (n=554) hospitalized for acute myocardial infarction or implantable cardioverter defibrillator implantation completed the 14-item type-D Scale (DS14) during hospitalization and the State–Trait Anxiety Inventory and Beck Depression Inventory at 2 months follow-up. **Results:** Stratifying by personality and partner status showed that type-D patients without a partner had a higher risk of both anxiety [odds ratio (OR)=8.27; 95% confidence interval (CI)=2.50–27.32] and depressive symptoms (OR=6.74; 95% CI=2.19–20.76) followed by type-D patients with a partner (OR=3.73; 95% CI=2.16–6.45 and OR=3.81; 95% CI=2.08–6.99, respectively) and non-type-D patients without a partner (OR=2.04; 95% CI=1.05–3.96 and OR=3.03; 95% CI=1.46–6.31, respectively) compared to non-type-D patients with a partner, adjusting for demographic and clinical baseline characteristics, indicating a dose–response relationship. **Conclusion:** Lack of a partner further exacerbated the risk of symptoms of anxiety and depression in the already distressed type-D patients. In clinical practice, it is important to identify type-D patients without a partner and carefully monitor them, as they may be less likely to alter health-related behaviors due to their increased levels of distress.

Keywords: Type-D personality; Depression; Anxiety; Partner; Myocardial infarction; Implantable cardioverter defibrillator

Introduction

There is increasing emphasis on patient-centered outcomes in cardiovascular disease (CVD), such as quality of life and emotional distress [1]. Knowledge of the determinants of these outcomes is also important in order to facilitate identification of high-risk patients in clinical practice [1]. The distressed (type-D) personality may be an important determinant of individual differences in outcomes, as this personality disposition has been associated with an increased risk of adverse prognosis [2–5], impaired quality of life and health status [6,7], exhaustion and fatigue [8], and a wide range of emotional distress, including anxiety [9], depressive symptoms [9,10], and posttraumatic stress disorder [11]. Type-D has been shown to be a risk factor for adverse health outcomes across different types of CVD, including peripheral arterial disease [6], coronary artery disease (CAD) [12], chronic heart failure [10], arrhythmias [9], and heart transplantation [13,14]. The risk associated with type-D in relation to clinical outcome is on par with established biomedical risk factors such as left ventricular dysfunction [3,4,15].

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* Corresponding author. CoRPS, Department of Medical Psychology, Tilburg University, Room P612, PO Box 90153, 5000 LE Tilburg, The Netherlands. Tel.: +31 13 466 8169/2175; fax: +31 13 466 2370.

E-mail address: c.c.l.t.vdnbroek@uvt.nl (K.C. van den Broek).

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Type-D personality is characterized by the two stable personality traits negative affectivity (the tendency to experience negative emotions across time and situations) [16] and social inhibition (the tendency to inhibit the expression of emotions and behaviors in social interactions to avoid disapproval by others) [17]. The prevalence of type-D ranges from 24–34% in patients with CAD [3,4] and arrhythmias [9] to 33–53% in patients with hypertension [18], peripheral arterial disease [6], and chronic heart failure [10,19].

Little is known about factors that may influence the impact of type-D personality on prognosis, quality of life, and emotional distress. Knowledge of these factors is important for optimizing risk stratification in clinical practice and may also point to targets for intervention. There are several pathways that may link type-D to adverse health outcomes, including physiological and behavioral pathways. As for physiological pathways, they may comprise inflammation [19,20], blood pressure reactivity to stress [21], and hyperactivity of the hypothalamic–pituitary–adrenal axis, including increased levels of cortisol [21,22]. Potential behavioral pathways comprise health-related behaviors, including failure to change risk factors, such as smoking, and poor treatment adherence [3,23]. In addition, because type-D patients inhibit behavior in social interactions, it is likely that communication with doctors is impaired, which may also hinder effective treatment [24]. However, to date, these potential mechanisms have not been examined in type-D patients.

A potentially important behavioral factor influencing the relationship between type-D and health outcomes is social support. Since social support has been shown to buffer the effects of stress on both well-being [25] and cardiovascular function [26,27], lack of support may enhance the adverse effects of type-D personality on health outcomes, including emotional distress. By analogy, since type-D patients have been shown to have fewer social ties and to experience less social support than non-type-D patients [3], type-D patients who have a fulfilling relationship with a partner may be at less risk for adverse health outcomes than patients without a partner.

Therefore, the aim of this study was to determine the combined effect of type-D personality and not having a partner on symptoms of anxiety and depression across different CVD treatment groups, that is, in patients with acute myocardial infarction (MI) or patients who received an implantable cardioverter defibrillator (ICD). An additional advantage of pooling data was to enhance the statistical power of the study, which has also been advocated by others [28].

Methods

Patient population and design

Patients hospitalized for acute MI or ICD implantation between May 2003 and December 2005 were included from five hospitals in the Netherlands (Catharina Hospital, Eindhoven; Amphia Hospital, Breda; St. Elisabeth Hospital, Tilburg; TweeSteden Hospital, Tilburg; and St. Anna Hospital, Geldrop). Inclusion criteria were hospitalization for acute MI (n=452) or ICD implantation (n=210). Exclusion criteria were significant cognitive impairments (e.g., dementia) and severe life-threatening comorbidities (e.g., cancer). Criteria for diagnosis of acute MI were troponin I levels that are more than twice the upper limit, typical ischemic symptoms (e.g., chest pain) lasting for more than 10 min, and ECG evidence of ST segment elevation or new pathological Q waves. ICDs were implanted for primary or secondary prevention of ventricular arrhythmias, according to accepted criteria [29].

Patients completed self-report measures on type-D personality at baseline as well as measures on anxiety and depressive symptoms at 2 months follow-up. The 2-month follow-up period was adopted due to logistic reasons. Two months after acute MI or ICD implantation, patients visited the outpatient clinic for a routine control. To minimize patient burden, we combined our study with these visits to the hospital. Demographic and clinical variables were obtained from the medical records. Of the original 662 patients, 554 patients were included in the final analyses (i.e., 390 MI patients and 164 ICD patients; see Fig. 1). The 108 patients who were excluded comprised 62 MI patients and 46 ICD patients. Excluded patients differed signifi-

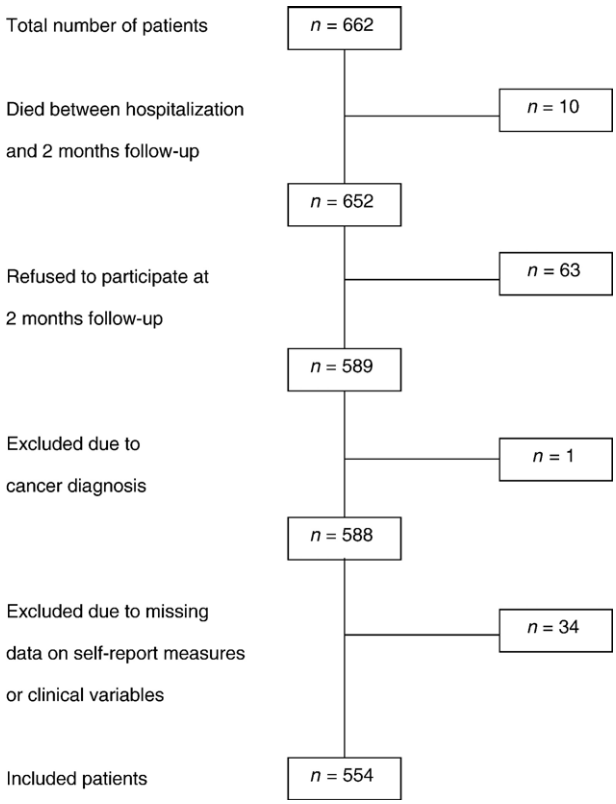

Fig. 1. Flowchart of patient selection.

cantly from included patients regarding type-D/no partner [9.2% vs. 3.6%, $\chi^2(1)=6.01$, $P=.014$], female gender [28.0% vs. 18.2%, $\chi^2(1)=5.43$, $P=.020$], history of ischemic heart disease [47.9% vs. 34.1%, $\chi^2(1)=6.52$, $P=.011$], treatment [ICD implantation; 43.0% vs. 29.6%, $\chi^2(1)=7.42$, $P=.006$], diabetes [23.2% vs. 13.2%, $\chi^2(1)=6.35$, $P=.012$], use of anticoagulants [62.8% vs. 75.9%, $\chi^2(1)=7.14$, $P=.008$], and use of psychotropics [25.2% vs. 13.6%, $\chi^2(1)=9.35$, $P=.002$].

The study was approved by the ethics committees of the participating hospitals. The study was conducted in accordance with the Helsinki Declaration, and all patients provided written informed consent.

Measures

Demographic and clinical characteristics

Demographic variables included partner status (i.e., not having a partner), gender, age, and educational level. Clinical variables included comorbidity (arthritis, renal insufficiency, or chronic obstructive pulmonary disease), history of ischemic heart disease [previous MI, percutaneous coronary intervention (PCI), or coronary artery bypass graft (CABG) surgery], multivessel disease and left ventricular ejection fraction (for MI patients), ICD indication and history of shocks (for ICD patients), diabetes mellitus, smoking (self-report), cardiac medication (beta-blockers, anticoagulants, statins, and aspirin), and psychotropic medication (self-report).

Personality

The 14-item Type-D Scale (DS14) was used to assess type-D personality [18]. Items are answered on a 5-point Likert scale from 0 to 4. The scale consists of two 7-item subscales: negative affectivity (e.g., "I often feel unhappy") and social inhibition (e.g., "I am a closed person"). Only patients scoring high on both subscales according to a standardized score $\geq$10 are categorized as type-D [18]. The DS14 is a valid and reliable scale with Cronbach's α of .88 and .86 and a test–retest reliability over a 3-month period of $r=.72$ and $r=.82$ for the two subscales, respectively [18]. It is important to note that in addition to negative affectivity, social inhibition is crucial in defining type-D personality, as it is the interaction of negative affectivity and social inhibition, and not the single traits, that is related to cardiac prognosis, independent of concurrent symptoms of anxiety and depression [30].

Symptoms of anxiety and depression

The State–Trait Anxiety Inventory (STAI) was used to assess symptoms of anxiety [31]. The STAI is a self-report measure consisting of two 20-item scales developed to measure the level of general state and trait anxiety [31]. In the current study, we only used the state measure, as the objective was to assess the current presence of anxiety symptoms at 2 months follow-up, rather than anxiety as a stable trait. Each item is rated on a 4-point Likert scale from 1 to 4. We used the cutoff $\geq$39, which represents clinical levels of anxiety [31]. The STAI has been demonstrated to have adequate validity and reliability, with a Cronbach's α of .92 [32]. Elevated scores on the STAI have been associated with poor prognosis in patients with CAD [33].

The Beck Depression Inventory (BDI) is a 21-item self-report measure developed to assess the presence and severity of depressive symptoms [34]. Each item is rated on a Guttmann scale from 0 to 3. The BDI is a reliable and validated measure of depressive symptomatology [35,36], with a Cronbach's α of .81 in non-psychiatric samples [35], and the most frequently used self-report measure of depressive symptomatology in cardiac patients. We used the standardized cutoff $\geq$10, indicative of at least mild to moderate symptoms of depression, which has also been associated with poor prognosis in patients with CAD [37–39]. In addition, this cutoff has good sensitivity and specificity to screen for major depression, that is, 81.8% and 78.7%, respectively [40].

Scores on anxiety and depression measures were dichotomized in order to enhance clinical interpretability, which is also advocated by others [41].

Statistical analysis

To examine differences in baseline characteristics stratified by personality type (type-D vs. non-type-D) and partner status (partner vs. single), we used the chi-square test (Fisher's Exact Test when appropriate) for nominal variables and analysis of variance (ANOVA) for continuous variables. In the ANOVA, we used Tukey's test for post hoc comparisons. The impact of type-D personality and partner status on symptoms of anxiety and depression was examined by means of logistic regression analysis with non-type-D/partner as the reference category. In multivariable analysis, we adjusted for gender, age, educational level, smoking status, cardiac history, treatment (MI vs. ICD implantation), days between MI or ICD implantation and completion of baseline questionnaires, comorbidity, diabetes, dyslipidemia, hypertension, beta-blockers, aspirin, anticoagulants, statins, and psychotropic medication. A P value $<.05$ was considered to be statistically significant. Odds ratios (ORs) with 95% confidence intervals (CIs) are reported. All statistical analyses were performed using SPSS 12.0.1 for Windows.

Results

Patient characteristics

No significant differences between ICD patients and MI patients were found for either type-D personality or partner status, although type-D personality was slightly more

Table 1
Patient characteristics stratified by type-D personality and partner status

	Non-type-D/partner (*n*=364)	Non-type-D/no partner (*n*=69)	Type-D/partner (*n*=101)	Type-D/no partner (*n*=20)	*P*
Demographics					
Female	14	28	19	55	<.0001
Age, mean (S.D.)	61 (10)	61 (14)	60 (11)	60 (11)	.91
Low education[a]	43	50	53	70	.06
Clinical variables					
History of ischemic heart disease[b]	33	33	39	40	.65
Treatment[c]	71	78	61	75	.10
Days[d], mean (S.D.)	7 (9)	9 (8)	8 (10)	10 (12)	.44
Comorbidity[e]	20	18	22	25	.86
Diabetes	13	19	10	10	.46
Dyslipidemia	39	40	39	25	.65
Hypertension	39	43	33	35	.64
Current smoking	29	40	36	45	.17
Invasive treatment MI[f]	65	41	61	67	.01
Multivessel disease[g]	42	32	26	47	.13
LVEF[h], mean (S.D.)	52 (13)	50 (13)	52 (13)	55 (12)	.48
Shocks[i]	5	7	3	0	.76
Secondary indication for ICD implantation[i]	65	53	54	40	.44
Medication					
Beta-blockers	85	84	86	85	.99
Aspirin	67	78	69	60	.32
Anticoagulants	78	68	72	75	.28
Statins	85	81	88	75	.42
Psychotropics	9	13	22	35	<.0001

Data are presented as percentages (χ^2 test), unless specified as mean (S.D.) (ANOVA).
[a] No education completed, first level (primary school), or secondary level (first phase).
[b] Previous MI, PCI, or CABG.
[c] MI versus ICD implantation, MI=reference category.
[d] Days between MI or ICD implantation and completion of baseline questionnaire.
[e] Lung, renal, or rheumatic disease.
[f] MI patients (*n*=389).
[g] MI patients (*n*=318).
[h] LVEF, left ventricular ejection fraction (*n*=309 MI patients).
[i] ICD patients (*n*=164).

prevalent in ICD patients than in MI patients [27% vs. 20%, $\chi^2(3)=3.40$, $P=.07$]. In the total patient group, 121 patients (22%) were classified as type-D and 89 patients (16%) had no partner. Partner status did not differ in type-D versus non-type-D patients [17% vs. 16%, $\chi^2(1)=0.25$, $P=.88$].

Patient characteristics stratified by personality and partner status are presented in Table 1. The groups differed significantly with respect to female gender [14%, 28%, 19%, and 55%; $\chi^2(3)=25.97$, $P<.0001$] and current use of psychotropic medication [9%, 13%, 22%, and 35%; $\chi^2(3)=20.85$, $P<.0001$]. Type-D patients without a partner were more likely to be female, to have had an invasive treatment for MI, and to use psychotropic medication compared with the other three groups. No other significant differences were found between groups on baseline characteristics.

In the ICD group, seven patients received a shock, but this number did not differ significantly between groups (Fisher's Exact Test=1.12, $P=.76$). Likewise, no significant differences were found for secondary indication for ICD implantation [$\chi^2(3)=2.72$, $P=.44$]. In MI patients, multivessel disease [$\chi^2(3)=5.59$, $P=.13$] and left ventricular ejection fraction [$F(3, 305)=0.83$, $P=.48$] did not differ significantly between groups, whereas invasive treatment did [$\chi^2(3)=11.37$, $P=.01$]. However, because invasive treatment and the other four group-specific indices were not significantly related to anxiety and depression (all P values >.10), they were omitted from further analyses.

Group differences on anxiety and depressive symptoms

Both type-D personality and partner status had main effects on anxiety (OR=4.01; 95% CI=2.63–6.11 and OR=1.88; 95% CI=1.19–2.97, respectively) and depressive symptoms (OR=3.91; 95% CI=2.53–6.05 and OR=2.44; 95% CI=1.50–3.96, respectively) in unadjusted analyses.

When stratifying by personality type and partner status, statistically significant differences were found between the four groups on anxiety [$\chi^2(3)=52.92$, $P<.0001$] and depression scores [$\chi^2(3)=53.67$, $P<.0001$] (Fig. 2). Type-D patients without a partner had the highest prevalence of symptoms of anxiety and depression compared to the other three groups.

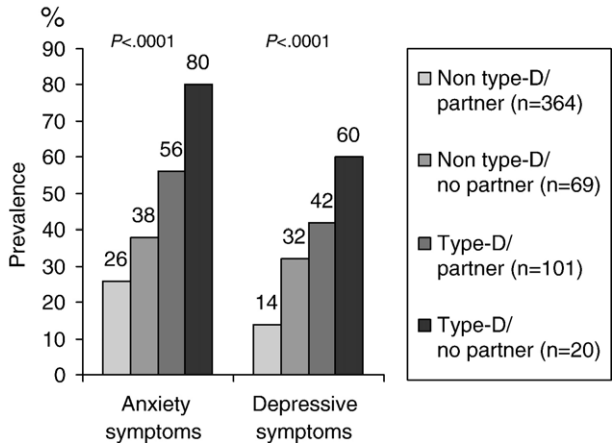

Fig. 2. Prevalence of anxiety and depressive symptoms at 2 months stratified by type-D personality and partner status (chi-square test was used).

Univariable predictors of anxiety and depressive symptoms

In univariable logistic regression analysis, non-type-D/no partner (OR=1.76; 95% CI=1.03–3.03), type-D/partner (OR=3.78; 95% CI=2.39–5.97), and particularly type-D/no partner (OR=11.66; 95% CI=3.80–35.75) had an increased risk of anxiety at 2 months follow-up compared with non-type-D/partner patients (Table 2, left). Other significant predictors were female gender, low level of education, comorbidity, and the use of psychotropic medication.

Similarly, non-type-D/no partner (OR=2.81; 95% CI=1.56–5.04), type-D/partner (OR=4.27; 95% CI=2.61–6.99), and type-D/no-partner patients (OR=9.00; 95% CI=3.51–23.08) had an increased risk of depressive symptoms compared to non-type-D/partner patients (Table 2, right). Female gender, current smoking, comorbidity, and psychotropic medication were also significantly related to an increased risk of depressive symptoms in univariable logistic regression analysis. For both anxiety and depressive symptoms, type-D/no partner patients had the highest risk followed by type-D/partner patients and non-type-D/no-partner patients.

When analyzing the data separately for the two treatment groups, the results remained the same, with non-type-D/partner having the lowest risk and type-D/no partner having the highest risk.

Multivariable predictors of anxiety and depressive symptoms

In multivariable analysis, non-type-D/no partner (OR=2.04; 95% CI=1.05–3.96), type-D/partner (OR=3.73; 95% CI=2.16–6.45), and type-D/no partner (OR=8.27;

Table 2
Univariable predictors of anxiety and depressive symptoms (logistic regression analysis)

	Anxiety symptoms			Depressive symptoms		
	OR	95% CI	*P*	OR	95% CI	*P*
Groups						
Non-type-D/partner	1.00	–	–	1.00	–	–
Non-type-D/no partner	1.76	1.03–3.03	.04	2.81	1.56–5.04	.001
Type-D/partner	3.78	2.39–5.97	<.0001	4.27	2.61–6.99	<.0001
Type-D/no partner	11.66	3.80–35.75	<.0001	9.00	3.51–23.08	<.0001
Demographics						
Female	2.15	1.39–3.33	.001	2.30	1.44–3.66	<.0001
Age	1.00	0.98–1.02	.99	1.01	0.99–1.02	.59
Low education[a]	2.12	1.48–3.02	<.0001	1.36	0.92–2.03	.13
Clinical variables						
History of ischemic heart disease[b]	1.24	0.85–1.80	.26	1.32	0.87–2.00	.19
Treatment[c]	0.76	0.52–1.11	.16	1.00	0.65–1.53	.98
Days[d]	1.01	1.00–1.03	.13	1.00	0.98–1.02	.88
Comorbidity[e]	1.72	1.11–2.66	.01	2.19	1.38–3.48	.001
Diabetes	1.46	0.87–2.43	.15	1.25	0.71–2.12	.44
Dyslipidemia	1.25	0.86–1.83	.25	1.52	1.00–2.31	.05
Hypertension	0.94	0.64–1.36	.74	1.05	0.69–1.60	.84
Current smoking	1.38	0.95–1.99	.09	1.61	1.07–2.42	.02
Medication						
Beta-blockers	1.18	0.71–1.96	.52	1.08	0.61–1.91	.79
Aspirin	0.89	0.61–1.30	.55	0.72	0.47–1.10	.13
Anticoagulants	0.88	0.88–1.33	.55	0.72	0.46–1.13	.15
Statins	1.26	0.76–2.10	.37	1.08	0.61–1.91	.79
Psychotropics	4.89	2.87–8.34	<.0001	5.40	3.21–9.10	<.0001

[a] No education completed, first level (primary school), or secondary school (first phase).
[b] Previous MI, PCI, or CABG.
[c] MI versus ICD implantation, MI=reference category.
[d] Days between MI or ICD implantation and completion of baseline questionnaire.
[e] Lung, renal, or rheumatic disease.

Table 3
Multivariable predictors of anxiety and depressive symptoms (logistic regression analysis)

	Anxiety symptoms			Depressive symptoms		
	OR	95% CI	*P*	OR	95% CI	*P*
Groups						
Non-type-D/partner	1.00	–	–	1.00	–	–
Non-type-D/no partner	2.04	1.05–3.96	.04	3.03	1.46–6.31	.003
Type-D/partner	3.73	2.16–6.45	<.0001	3.81	2.08–6.99	<.0001
Type-D/no partner	8.27	2.50–27.32	.001	6.74	2.19–20.76	.001
Demographics						
Female	1.79	1.01–3.17	.05	1.92	1.02–3.62	.05
Age	0.99	0.97–1.02	.61	1.00	0.97–1.02	.85
Low education[a]	1.79	1.14–2.81	.01	0.97	0.58–1.65	.92
Clinical variables						
History of ischemic heart disease[b]	0.88	0.47–1.63	.68	1.75	0.87–3.53	.12
Treatment[c]	0.62	0.31–1.25	.18	2.50	1.13–5.53	.02
Days[d]	1.01	0.99–1.03	.26	0.99	0.97–1.02	.60
Comorbidity[e]	1.57	0.90–2.74	.12	1.96	1.06–3.60	.03
Diabetes	1.51	0.82–2.79	.19	1.34	0.65–2.73	.43
Dyslipidemia	1.21	0.75–1.95	.44	1.58	0.91–2.74	.10
Hypertension	0.91	0.57–1.47	.70	0.90	0.52–1.56	.70
Current smoking	1.57	0.95–2.60	.08	1.72	0.98–3.02	.06
Medication						
Beta-blockers	1.23	0.67–2.28	.51	1.13	0.56–2.28	.74
Aspirin	1.10	0.61–1.98	.76	0.46	0.23–0.90	.02
Anticoagulants	1.11	0.64–1.92	.72	0.61	0.33–1.15	.13
Statins	1.57	0.76–3.24	.22	1.30	0.56–3.01	.55
Psychotropics	3.06	1.64–5.70	<.0001	4.54	2.40–8.57	<.0001

[a] No education completed, first level (primary school), or secondary school (first phase).
[b] Previous MI, PCI, or CABG.
[c] MI versus ICD implantation, MI=reference category.
[d] Days between MI or ICD implantation and completion of baseline questionnaire.
[e] Lung, renal, or rheumatic disease.

95% CI=2.50–27.32) remained significant predictors of anxiety symptoms, adjusting for all other variables (Table 3, left). Other independent variables related to anxiety symptoms were female gender, low education, and use of psychotropic medication.

Similar results were found for depressive symptoms, where non-type-D/no partner (OR=3.03; 95% CI=1.46–6.31), type-D/partner (OR=3.81; 95% CI=2.08–6.99), and type-D/no partner (OR=6.74; 95% CI=2.19–20.76) remained as significant predictors, adjusting for all other variables (Table 3, right). Other independent variables associated with depressive symptoms were female gender, treatment, comorbidity, use of aspirin, and psychotropic medication. For both anxiety and depressive symptoms, there was a dose–response relationship, with the presence of both risk factors (type-D and no partner) incurring the highest risk.

Discussion

This is the first study to examine the combined effect of type-D personality and not having a partner on emotional distress in cardiac patients. Stratifying by personality and partner status showed that non-type-D patients without a partner had a twofold increased risk of both anxiety and depressive symptoms followed by type-D patients with a partner with a threefold risk and, most importantly, type-D patients without a partner having a six- to eightfold risk compared to non-type-D patients with a partner, adjusting for demographic and clinical baseline characteristics. This shows that there was a dose–response relationship between the two risk factors (type-D personality and having no partner) and emotional distress, with type-D patients without a partner having the highest risk. It is important to note that the effect of the two risk factors on emotional distress was consistent across treatment group (i.e., MI vs. ICD).

Previous research has demonstrated that type-D personality is a *cardiotoxic* factor that is associated not only with adverse prognosis [2–5] and impaired health status [6–8] but also with increased levels of emotional distress [9–11]. It is important to include indices of emotional distress, such as symptoms of anxiety and depression, as outcome measures since these symptoms are associated with adverse prognosis [42], impaired health-related quality of life [43], increased health care consumption [42,44], and reduced compliance [45,46].

Traditionally, depression but not anxiety has been studied as an important psychosocial risk factor for adverse outcomes in CVD, despite the co-occurrence of anxiety and depression [42,47,48]. Recent studies have demonstrated the detrimental effect of anxiety for adverse outcomes in

CVD over and above the effect of depression [42,47,48]. Our results also show that anxiety may be an important person-centered outcome; the dose–response relationship of the combination of type-D personality and having no partner was found for both depressive and anxiety symptoms. In this context, it is important to note that type-D personality is not equivalent to anxiety or depressive symptoms. This was verified in a recent prospective study of patients treated with PCI who were all anxious at 6 months [49]. Another study of PCI patients showed that type-D personality predicted adverse prognosis above and beyond symptoms of anxiety and depression, which was due to the combined effect of high negativity and social inhibition and not to the main effects of anxiety and depressive symptoms [30].

As shown in the current study, not all type-D patients experience similar levels of risk, suggesting that within the group of type-D patients, there is some heterogeneity. This heterogeneity is also supported in a recent study of PCI patients, which showed that type-D patients with diabetes were at increased risk of onset of depressive symptoms at 12 months when compared to patients with a type-D personality or diabetes alone [50].

Although our findings indicate the importance of having a partner, the results also suggest that partner status does not completely buffer the effects of type-D on distress since type-D patients with a partner still had a significantly higher risk compared to non-type-D patients with or without a partner. In a recent study of ICD patients, type-D personality was also shown to have a larger impact on distress than shocks [9], emphasizing the importance of personality as an independent determinant of distress. In the present study, lack of a partner showed a further elevated risk of emotional distress in the already distressed type-D patients.

It is important to note that in the current study, disease severity was not related to emotional distress at 2 months follow-up, indicating that emotional distress is not just a consequence of disease severity, which is in line with some [51,52] but not all [53] studies.

In view of our results, in clinical practice, it is important to screen for and identify patients with a type-D personality, particularly those type-D patients who do not have a partner. Type-D personality has been associated with adverse prognosis [2–5], and other studies have shown that patients without a partner are less compliant [54,55], less physically active [56], and at increased risk of CVD mortality [57,58]. Cardiologists and nurses should therefore carefully monitor type-D patients without a partner, as they may be less likely to adhere to medication, participate in cardiac rehabilitation, and attend regular checkups. In this context, nurses could serve as an important source of support. In addition, these patients may benefit from psychosocial intervention in order to prevent the development of anxiety and depressive symptoms, as these symptoms are associated not only with reduced compliance [44,45] and impaired health-related quality of life [42] but also with worse prognosis [33].

This study has some limitations. First, the number of patients in the type-D/no partner group was relatively small, which may have led to reduced power. Therefore, replication of these results is warranted in future studies. Nevertheless, we still found significant and consistent results across patient groups and psychological symptomatology. Second, the 2-month follow-up period was relatively short. Future studies need to replicate our findings using a longer follow-up period. Third, we had no information on the psychological and physical status of the partner or on marital quality or marital satisfaction. Marital status may have an impact on quality of life. Nevertheless, we were able to show that not having a partner was associated with increased risk of anxiety and depressive symptoms in both non-type-D and type-D patients. Fourth, we had no information on behavioral risk factors and compliance with medical regiments, which may serve as confounders. Fifth, excluded patients differed from included patients with respect to several demographic and clinical indices, which may result in limited generalizability of the findings. However, since excluded patients appeared to be more ill, the adverse effect of type-D personality and having no partner found in this study is more likely to be an underestimation rather than an overestimation. Finally, the two pooled cardiac patient groups differed on indices of disease severity. However, disease severity was not associated with either the independent or the outcome variables.

Despite these limitations, this study also has several strengths. This is the first study to examine partner status as a potentially important factor in the link between type-D personality and anxiety and depressive symptoms. In addition, results are based on a heterogeneous patient group with acute MI or ICD implantation, showing that results are generalizable across CVD patient groups.

In conclusion, these results show that there was a dose–response relationship between the two risk factors (type-D personality and having no partner) in relation to anxiety and depressive symptoms, with type-D patients without a partner having the highest risk 2 months after hospitalization for acute MI or ICD implantation. Given the fact that this is the first study to show that lack of a partner in patients with a type-D personality is associated with a particularly high risk of emotional distress, future studies that replicate these findings are warranted. In clinical practice, it is important to screen for type-D personality to monitor type-D patients without a partner particularly carefully. These patients may be less likely to comply with medication, take part in cardiac rehabilitation, and change health-related behaviors that are detrimental to their health due to their increased levels of emotional distress.

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References

[1] Krumholz HM, Peterson ED, Ayanian JZ, Chin MH, DeBusk RF, Goldman L, Kiefe CI, Powe NR, Rumsfeld JS, Spertus JA, Weintraub WS, National Heart, Lung, and Blood Institute working group. Report of the National Heart, Lung, and Blood Institute working group on outcomes research in cardiovascular disease. Circulation 2005; 111:3158–66.
[2] Denollet J, Sys SU, Brutsaert DL. Personality and mortality after myocardial infarction. Psychosom Med 1995;57:582–91.
[3] Denollet J, Sys SU, Stroobant N, Rombouts H, Gillebert TC, Brutsaert DL. Personality as independent predictor of long-term mortality in patients with coronary heart disease. Lancet 1996;347:417–21.
[4] Denollet J, Vaes J, Brutsaert DL. Inadequate response to treatment in coronary heart disease. Adverse effects of Type-D personality and younger age on 5-year prognosis and quality of life. Circulation 2000; 102:630–5.
[5] Denollet J. Personality and risk of cancer in men with coronary heart disease. Psychol Med 1998;28:991–5.
[6] Aquarius AE, Denollet J, Hamming JF, De Vries J. Role of disease status and type-D personality in outcomes in patients with peripheral arterial disease. Am J Cardiol 2005;96:996–1001.
[7] Al-Ruzzeh S, Athanasiou T, Mangoush O, Wray J, Modine T, George S, Amrani M. Predictors of poor mid-term health related quality of life after primary isolated coronary artery bypass grafting surgery. Heart 2005;91:1557–62.
[8] Pedersen SS, Middel B. Increased vital exhaustion among type-D patients with ischemic heart disease. J Psychosom Res 2001; 51:443–9.
[9] Pedersen SS, Van Domburg RT, Theuns DAMJ, Jordaens L, Erdman RAM. Type-D personality: a determinant of anxiety and depressive symptoms in patients with an implantable cardioverter defibrillator and their partners. Psychosom Med 2004;66:714–9.
[10] Schiffer AA, Pedersen SS, Widdershoven JW, Hendriks EH, Winter JB, Denollet J. The distressed (type-D) personality is independently associated with impaired health status and increased depressive symptoms in chronic heart failure. Eur J Cardiovasc Prev Rehabil 2005;12:341–6.
[11] Pedersen SS, Denollet J. Validity of the type-D personality construct in Danish post-MI patients and healthy controls. J Psychosom Res 2004;57:265–72.
[12] Pedersen SS, Denollet J. Type-D personality, cardiac events, and impaired quality of life: a review. Eur J Cardiovasc Prev Rehabil 2003;10:241–8.
[13] Pedersen SS, Holkamp PG, Caliskan K, Van Domburg RT, Erdman RAM, Balk AHMM. Type-D personality is associated with impaired health-related quality of life 7 years following heart transplantation. J Psychosom Res 2006;61:791–5.
[14] Denollet J, Holmes RVF, Vrints CJ, Conraads VM. Unfavorable outcome of heart transplantation in recipients with type-D personality. J Heart Lung Transplant 2007;26:152–8.
[15] Denollet J, Brusaert DL. Personality, disease severity, and the risk of long-term cardiac events in patients with decreased ejection fraction after myocardial infarction. Circulation 1998;97:167–73.
[16] Watson D, Pennebaker JW. Health complaints, stress, and distress: exploring the central role of negative affectivity. Psychol Rev 1989; 96:234–54.
[17] Asendorpf JB. Social inhibition: a general–developmental perspective. In: Traue HC, Pennebaker JW, editors. Emotion, inhibition, and health. Seattle: Hogrefe & Huber Publisher, 1993. p. 80–99.
[18] Denollet J. DS14: standard assessment of negative affectivity, social inhibition, and type-D personality. Psychosom Med 2005;67:89–97.
[19] Denollet J, Conraads VM, Brutsaert DL, De Clerck LS, Stevens W, Vrints CJ. Cytokines and immune activation in systolic heart failure: the role of type-D personality. Brain Behav Immun 2003;17:304–9.
[20] Conraads VM, Denollet J, De Clerck LS, Stevens WJ, Bridts C, Vrints CJ. Type-D personality is associated with increased levels of tumour necrosis factor (TNF)-α and TNF-α receptors in chronic heart failure. Int J Cardiol 2006;113:34–8.
[21] Habra ME, Linden W, Anderson JC, Weinberg J. Type-D personality is related to cardiovascular and neuroendocrine reactivity to acute stress. J Psychosom Res 2003;55:235–45.
[22] Sher L. Type-D personality: the heart, stress, and cortisol. Q J Med 2005;98:323–9.
[23] Horwitz RI, Viscoli CM, Berkman L, Donaldson RM, Horwitz SM, Murray CJ, Ransohoff DF, Sindelar J. Treatment adherence and risk of death after a myocardial infarction. Lancet 1990;336:542–5.
[24] Roter DL, Ewart CK. Emotional inhibition in essential hypertension: obstacle to communication during medical visits? Health Psychol 1992;11:163–9.
[25] Fontana AF, Kerns RD, Rosenberg RL, Colonese KL. Support, stress, and recovery from coronary heart disease: a longitudinal causal model. Health Psychol 1989;8:175–93.
[26] Gerin W, Pieper C, Levy R, Pickering TG. Social support in social interaction: a moderator of cardiovascular reactivity. Psychosom Med 1992;54:324–36.
[27] Fontana AM, Diegnan T, Villeneuve A, Lepore SJ. Nonevaluative social support reduces cardiovascular reactivity in young women during acutely stressful performance situations. J Behav Med 1999; 22:75–91.
[28] Suls J, Bunde J. Anger, anxiety, and depression as risk factors for cardiovascular disease: the problems and implications of overlapping affective dispositions. Psychol Bull 2005;131:260–300.
[29] Gregoratos G, Abrams J, Epstein AE, Freedman RA, Hayes DL, Hlatky MA, Kerber RE, Naccarelli GV, Schoenfeld MH, Silka MJ, Winters SL. ACC/AHA/NASPE 2002 guideline update for implantation of cardiac pacemakers and antiarrhythmia devices: summary article: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (ACC/AHA/NASPE Committee to Update the 1998 Pacemaker Guidelines). Circulation 2002;106:2145–61.
[30] Denollet J, Pedersen SS, Ong ATL, Erdman RAM, Serruys PW, Van Domburg RT. Social inhibition modulates the effect of negative emotions on cardiac prognosis following percutaneous coronary intervention in the drug-eluting stent era. Eur Heart J 2006;27:171–7.
[31] Spielberger CD. Manual for the state–trait anxiety inventory (Form Y). Palo Alto (CA): Consulting Psychologists Press, 1983.
[32] Knight RG, Waal-Manning HJ, Spears GF. Some norms and reliability data for the state–trait anxiety inventory and the Zung self-rating depression scale. Br J Clin Psychol 1983;22:245–9.
[33] Frasure-Smith N, Lespérance F, Talajic M. The impact of negative emotions on prognosis following myocardial infarction: is it more than depression? Health Psychol 1995;14:388–98.
[34] Beck AT, Steer RA. Manual for the revised Beck Depression Inventory. San Antonio: Psychological Corporation, 1993.
[35] Beck AT, Steer RA, Garbin MC. Psychometric properties of the Beck Depression Inventory: twenty-five years of evaluation. Clin Psychol Rev 1988;8:77–100.
[36] Welch G, Hall A, Walkey F. The replicable dimensions of the Beck Depression Inventory. J Clin Psychol 1990;46:817–27.
[37] Frasure-Smith N, Lespérance F, Talajic M. Depression and 18-month prognosis after myocardial infarction. Circulation 1995;91:999–1005.
[38] Frasure-Smith N, Lespérance F, Juneau M, Talajic M, Bourassa MG. Gender, depression, and one-year prognosis after myocardial infarction. Psychosom Med 1999;61:26–37.
[39] Lespérance F, Frasure-Smith N, Talajic M, Bourassa MG. Five-year risk of cardiac mortality in relation to initial severity and one-year

changes in depression symptoms after myocardial infarction. Circulation 2002;105:1049–53.
[40] Strik JJMH, Honig A, Lousberg R, Denollet J. Sensitivity and specificity of observer and self-report questionnaires in major and minor depression following myocardial infarction. Psychosomatics 2001;42:423–8.
[41] Spertus JA, Jones P, McDonell M, Fan V, Fihn SD. Health status predicts long-term outcome in outpatients with coronary disease. Circulation 2002;106:43–9.
[42] Strik JJMH, Denollet J, Lousberg R, Honig A. Comparing symptoms of depression and anxiety as predictors of cardiac events and increased health care consumption after myocardial infarction. J Am Coll Cardiol 2003;42:1801–7.
[43] Lane D, Carroll D, Ring C, Beevers DG, Lip GY. Mortality and quality of life 12 months after myocardial infarction: effects of depression and anxiety. Psychosom Med 2001;63:221–30.
[44] Strik JJMH, Lousberg R, Cheriex EC, Honig A. One year cumulative incidence of depression following myocardial infarction and impact on cardiac outcome. J Psychosom Res 2004;56:59–66.
[45] Glazer KM, Emery CF, Frid DJ, Banyasz RE. Psychological predictors of adherence and outcomes among patients in cardiac rehabilitation. J Cardiopulm Rehabil 2002;22:40–6.
[46] Gehi A, Haas D, Pipkin S, Whooley MA. Depression and medical adherence in outpatients with coronary heart disease Findings from the Heart and Soul study. Arch Intern Med 2005; 165:2508–13.
[47] Grace SL, Abbey SE, Irvine J, Shnek ZM, Stewart DE. Prospective examination of anxiety persistence and its relationship to cardiac symptoms and recurrent cardiac events. Psychother Psychosom 2004;73:344–52.
[48] Pedersen SS, Denollet J, Spindler H, Ong ATL, Serruys PW, Erdman RAM, Van Domburg RT. Anxiety enhances the detrimental effect of depressive symptoms on health status following percutaneous coronary intervention. J Psychosom Res 2006;61:783–9.
[49] Spindler H, Pedersen SS, Serruys PW, Serruys PW, Erdman RA, Van Domburg RT. Type-D personality predicts chronic anxiety following percutaneous coronary intervention in the drug-eluting stent era. J Affect Disord 2007;99:173–9.
[50] Pedersen SS, Ong ATL, Sonnenschein K, Serruys PW, Erdman RA, Van Domburg RT. Type-D personality and diabetes predict the onset of depressive symptoms in patients following percutaneous coronary intervention. Am Heart J 2006;151:367e1–6.
[51] Ruo B, Rumsfeld JS, Hlatky MA, Liu H, Browner WS, Whooley MA. Depressive symptoms and health-related quality of life: the Heart and Soul study. JAMA 2003;290:215–21.
[52] Rumsfeld JS, Havranek E, Masoudi FA, Peterson ED, Jones P, Tooley JF, Krumholz HM, Spertus JA. Depressive symptoms are the strongest predictors of short-term declines in health status in patients with heart failure. J Am Coll Cardiol 2003;42:1811–7.
[53] Van Melle JP, De Jonge P, Ormel J, Crijns HJ, Van Veldhuisen DJ, Honig A, Schene AH, Van den Berg MP. Relationship between left ventricular dysfunction and depression following myocardial infarction: data from the MIND-IT. Eur Heart J 2005;26:2650–6.
[54] Spertus JA, Kettelkamp R, Vance C, Decker C, Jones PG, Rumsfeld JS, Messenger JC, Khanal S, Peterson ED, Bach RG, Krumholz HM, Cohen DJ. Prevalence, predictors, and outcomes of premature discontinuation of thienopyridine therapy after drug-eluting stent placement. Results from the PREMIER registry. Circulation 2006;113:2803–9.
[55] De Geest S, Borgermans L, Gemoets H, Abraham I, Vlaminck H, Evers G, Vanrenterghem Y. Incidence, determinants, and consequences of subclinical noncompliance with immunosuppressive therapy in renal transplant recipients. Transplantation 1995;59:340–7.
[56] Pettee KK, Brach JS, Kriska AM, Boudreau R, Richardson CR, Colbert LH, Satterfield S, Visser M, Harris TB, Ayonayon HN, Newman AB. Influence of marital status on physical activity levels among older adults. Med Sci Sports Exerc 2006;38:541–6.
[57] Rutledge T, Matthews K, Lui LY, Stone KL, Cauley JA. Social networks and marital status predict mortality in older women: prospective evidence from the Study of Osteoporotic Fractures (SOF). Psychosom Med 2003;65:688–94.
[58] Williams RB, Barefoot JC, Califf RM, Haney TL, Saunders WB, Pryor DB, Hlatky MA, Siegler IC, Mark DB. Prognostic importance of social and economic resources among medically treated patients with angiographically documented coronary artery disease. JAMA 1992;267:520–4.