Inadequate Response to Treatment in Coronary Heart Disease

Denollet, J.K.L.; Vaes, J.; Brutsaert, D.L.

Published in:
Circulation

Publication date:
2000

Document Version
Publisher's PDF, also known as Version of record

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

Johan Denollet, Johan Vaes and Dirk L. Brutsaert

Circulation 2000;102;630-635
Circulation is published by the American Heart Association. 7272 Greenville Avenue, Dallas, TX 72514
 Print ISSN: 0009-7322. Online ISSN: 1524-4539

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

Johan Denollet, PhD; Johan Vaes, MD; Dirk L. Brutsaert, MD

Background—Improvement in treatment of patients with coronary heart disease (CHD) has caused longer survival but also an increase in the number of patients at risk for subsequent cardiac events and impaired quality of life (QOL). We hypothesized that chronic emotional distress confers an increased risk of poor outcome despite appropriate treatment.

Methods and Results—This prospective study examined the 5-year prognosis of 319 patients with CHD. Baseline assessment included symptoms of depression/anxiety and distressed personality type (type D—ie, high negative affectivity and social inhibition). The main end points were cardiac death or nonfatal myocardial infarction and impaired QOL. There were 22 cardiac events (16 nonfatal); they were related to left ventricular ejection fraction (LVEF) ≤50%, poor exercise tolerance, age ≤55 years, symptoms of depression, and type D personality. Multivariate analysis yielded LVEF ≤50% (OR, 3.9; $P=0.009$), type D personality (OR, 8.9; $P=0.0001$), and age ≤55 years (OR, 2.6; $P=0.05$) as independent predictors of cardiac events. Convergence of these risk factors predicted the absence of the expected therapeutic response that was observed in 10% of the patients. When 2 or 3 risk factors occurred together, the rate of poor outcome was 4-fold higher ($P=0.0001$). Estimates of medical costs increased progressively with an increasing number of risk factors. Smoking, symptoms of depression, and type D personality were independent predictors of impaired QOL.

Conclusions—Decreased LVEF, type D personality, and younger age increase the risk of cardiac events; convergence of these factors predicts nonresponse to treatment. Emotionally stressed and younger patients with CHD represent high-risk groups deserving of special study. **(*Circulation*. 2000;102:630-635.)**

Key Words: coronary disease ■ infarction ■ prognosis ■ quality of life ■ depression ■ psychosocial stress

Indexes of disease severity, such as decreased left ventricular function or exercise tolerance, are associated with poor prognosis in patients with coronary heart disease (CHD).[1] Emotional distress has, in addition to standard risk factors, been widely associated with CHD.[2–4] Whereas acute emotional stress may precipitate cardiac events in high-risk individuals,[3] chronic emotional stress increases susceptibility to the underlying pathophysiological processes.[4] Emotional stress may thus elicit coronary spasm, platelet activation, and decreased heart rate variability,[5–7] thereby leading to myocardial ischemia, thrombotic occlusion, cardiac arrhythmias, myocardial infarction, and sudden cardiac death.[2–4,8]

Chronic emotional stress is largely dependent on broad personality traits that refer to individual differences in emotions and behavior that are relatively stable across time.[9] Type A behavior has often been mistaken for a personality type, but type A was in fact designed to avoid association with broad personality traits.[10] Therefore, multivariate analyses were used in previous research to delineate the "distressed" personality (type D).[11] Type D patients simultaneously tend to experience negative emotions and inhibit the expression of emotion/behavior (Table 1). Type D personality is associated with vulnerability to chronic emotional distress[9] and an increased risk for cardiac events[11,12] in CHD patients.

Several issues need to be solved, however. First, because improvement in treatment and secondary prevention has caused a decline in mortality resulting from CHD,[13] it is unclear whether emotional distress has any prognostic value in CHD patients on appropriate treatment. Second, psychological risk factors often tend to converge within individuals. Because such convergence may, in turn, elevate the risk for adverse cardiac events,[2] CHD patients who are at risk for the convergence of psychological risk factors should therefore be identified. Third, although quality of life (QOL) is increasingly being acknowledged as an important outcome measure in cardiac patients,[14,15] little is known about its long-term determinants.[16]

Received November 18, 1999; revision received February 11, 2000; accepted March 2, 2000.

From the University Hospital of Antwerp (J.D., J.V., D.L.B.), Antwerp, Belgium, and the Department of Psychology, Tilburg University, the Netherlands (J.D.).

Correspondence to Johan Denollet, PhD, Clinical Health Psychology, Room P508, Tilburg University, PO Box 90153, Warandelaan 2, 5000 LE Tilburg, Netherlands. E-mail J.Denollet@kub.nl

Circulation **is available at http://www.circulationaha.org**

TABLE 1. Type D Personality

	Personality Trait	
	Negative Affectivity	Social Inhibition
Definition	Tendency to experience negative emotions across time/situations	Tendency to inhibit emotions and behaviors in social interaction
Clinical picture	Often feels unhappy, tends to worry; is pessimistic, easily irritated; lacks self-esteem/assertiveness; has symptoms of depression and anxiety	Feels insecure in social interaction; tends to keep others at distance; tends to be closed and reserved; reports low levels of social support
Diagnosis	DS16 negative affectivity scale (median split)	DS16 social inhibition scale (median split)
Prognosis	Type D, defined by high scores on negative affectivity and social inhibition: independent predictor of long-term mortality in patients with CHD[11]; associated with cardiac events in post-MI patients with LVEF≤50%[12]	

MI indicates myocardial infarction.

We report here on a prospective 5-year follow-up study designed to address these issues. Patients received thrombolysis (29%), β-blockers (54%), aspirin (72%), revascularization procedures (76%), and rehabilitation (100%), ie, interventions known to improve prognosis.[17] A new instrument[9] was used for a standardized diagnosis of patients at risk for the convergence of psychological stresses. End points included cardiac events and poor QOL. We hypothesized that both cardiac disorder and emotional distress confer an increased risk of cardiac events and impaired QOL despite appropriate cardiac treatment.

Methods

Subjects

Between January 1989 and December 1992, 322 patients with CHD (297 men, 25 women; age, 35 to 70 years; mean age, 56.7 years) were selected from a consecutive series of patients attending the Antwerp cardiac rehabilitation program. Patients were eligible for this study if they had experienced a myocardial infarction (n=162) or coronary bypass/angioplasty (n=160) within 2 months before entering the program. Patients with impaired left ventricular function were included; patients with major comorbidity (eg, cancer) were excluded. They all underwent a standardized treatment regimen, ie, an outpatient program comprising 36 sessions (3 sessions for 1 h/wk) of ECG-monitored, aerobic, and pulse-targeted exercise training, along with 6 psychosocial group sessions for patients and spouses. Individual medical, nutritional, and psychological counseling tailored the program to the needs of each patient. Medical care in the follow-up interval consisted of a cardiological check-up every 6 months. Three patients died of noncardiac causes during follow-up; the final sample consisted of 319 patients.

Prognostic Factors

Left ventricular function and exercise tolerance were included as indexes of disease severity. As suggested by others,[1] a decrease in left ventricular function was defined as a left ventricular ejection fraction (LVEF) ≤50% as calculated from ventricular angiography. Poor exercise tolerance was assessed with a symptom-limited exercise test 6 weeks after the coronary event (ie, peak workload ≤140 W for younger patients and ≤120 W for older patients). Other biomedical factors included thrombolysis after myocardial infarction; treatment with aspirin, β-blockers, or ACE inhibitors at discharge from the rehabilitation program; failure to quit smoking; and history of hyperlipidemia or hypertension. Demographic factors included sex and age (ie, ≤55 versus ≥56 years).

Emotional Distress

This study included measures of both episodic distress, lasting several months, and chronic distress, lasting several years.[4] Symptoms of depression/anxiety are markers of episodic distress most prominently linked to CHD.[2] Patients scoring in the upper tertile on the despondency scale (r=0.63 with the Zung Depression Scale)[18] and/or the state anxiety scale[19] were considered to report many symptoms of depression (≥19 symptoms) and/or anxiety (≥44 symptoms), respectively. Chronic emotional distress was assessed with the Type D Scale 16 (DS16)[9]; its validity and reliability are summarized in the Appendix. A median split on the DS16 negative affectivity and social inhibition scales was used to classify 99 patients as type D (≥9 and ≥15, respectively) and 220 patients as non–type D.

End Points

The main end points in this study were cardiac events (cardiac death or nonfatal myocardial infarction) and impaired QOL. Revascularization (coronary bypass or angioplasty) during follow-up was a secondary end point. The Health Complaints Scale (HCS) and the Global Mood Scale (GMS) are psychometrically sound and sensitive measures of QOL.[20] The HCS comprises 12 somatic items (eg, tightness of chest, shortness of breath, fatigue) and 12 items of perceived disability that are frequently reported by CHD patients[21]; these items are rated on a 5-point scale of distress. The GMS comprises 10 negative and 10 positive mood terms that are rated on a 5-point scale of intensity.[22] Depressive affect is characterized by the interaction of high negative and low positive mood[22]; a median split on the negative and positive mood scales was used to assess depressive affect at follow-up.

A multicategorical index[23] ranging from event-free survival with good QOL (rating=1) to cardiac death (rating=10) was used to summarize outcome data. Events were rated as 10 (cardiac death), 7 (myocardial infarction), 4 (revascularization), and 1 (event-free survival); poor perceived health was rated as 1 and depressive affect also as 1. For example, revascularization with poor perceived health and depressive affect was rated as 4+1+1=6. The economic impact of outcome was estimated with the use of data on the direct medical care costs of fatal ($17 532) and nonfatal ($15 540) cardiac events,[24] coronary bypass ($32 347), and angioplasty ($21 113)[14] and mild ($1820) to severe ($2100) depressive symptoms.[25]

Procedure and Analyses

At entry into the rehabilitation program, all patients filled out the emotional distress and type D scales. After 5 years, patients and their families were contacted by telephone and mail to determine the study end points. Mortality and infarction data were derived from hospital records and discussed with the patient's attending physician. The follow-up questionnaire contained the QOL scales; if patients failed to return the questionnaire, they were contacted again 4 and 8 weeks later to maximize outcome data on QOL. The χ^2 statistic was used to examine any changes in 5-year cardiac mortality between the 1985 to 1988 rehabilitation cohort[11] and the 1989 to 1992 cohort of the present study. Baseline measures were dichotomized, and the OR for cardiac

TABLE 2. Baseline Characteristics According to 5-Year Incidence of Cardiac Events and Revascularization Procedures

		Fatal and Nonfatal Cardiac Events at 5 Years			Cardiac Events and Revascularization at 5 Years		
Baseline Characteristics	Event Free (n=270), % (n)	Cardiac Events (n=22), % (n)	OR (95% CI)	*P**	Total Events (n=49), % (n)	OR (95% CI)	*P**
Demographic factors							
Male sex	92 (248)	95 (21)	0.5 (0.1–4.2)	NS	94 (46)	0.7 (0.2–2.6)	NS
Age≤55 y	38 (102)	59 (13)	2.4 (1.0–5.8)	0.049	53 (26)	1.9 (1.0–3.4)	0.045
Biomedical factors							
LVEF≤50%	16 (43)	36 (8)	3.0 (1.2–7.6)	0.015	33 (16)	2.6 (1.3–5.1)	0.006
Poor exercise tolerance	25 (68)	46 (10)	2.5 (1.0–5.6)	0.038	33 (16)	1.4 (0.8–2.8)	NS
Thrombolysis after MI	25 (45)	35 (6)	0.9 (0.4–2.2)	NS	34 (13)	0.9 (0.9–1.0)	NS
Aspirin therapy	79 (212)	73 (16)	0.7 (0.3–2.0)	NS	69 (34)	0.6 (0.3–1.2)	0.162
β-Blocker therapy	53 (143)	59 (13)	1.3 (0.5–3.1)	NS	61 (30)	1.4 (0.8–2.6)	NS
ACE inhibitor therapy	10 (28)	5 (1)	0.4 (0.1–3.2)	NS	10 (5)	1.0 (0.4–2.7)	NS
Failure to quit smoking	17 (45)	18 (4)	1.1 (0.4–3.4)	NS	20 (10)	1.3 (0.6–2.8)	NS
History of hyperlipidemia	38 (103)	36 (8)	0.9 (0.4–2.3)	NS	37 (18)	0.9 (0.5–1.8)	NS
History of hypertension	32 (85)	27 (6)	0.8 (0.3–2.2)	NS	29 (14)	0.9 (0.5–1.7)	NS
Episodic distress							
Symptoms of depression	32 (85)	55 (12)	2.6 (1.1–6.3)	0.027	51 (25)	2.3 (1.2–4.2)	0.008
Symptoms of anxiety	33 (90)	50 (11)	2.0 (0.8–4.8)	0.114	49 (24)	1.9 (1.0–3.6)	0.036
Chronic distress							
Type D personality	26 (70)	73 (16)	7.6 (2.9–20.2)	0.0001	59 (29)	4.1 (2.2–7.8)	0.0001

MI indicates myocardial infarction.
*Univariate analysis.

events for each pair of groups was assessed through logistic regression analysis and the χ^2 statistic. MANOVA and an unpaired *t* test were used to examine continuous scores of QOL. These scores were dichotomized to identify patients with impaired QOL, and ORs were calculated. Multiple logistic regression analyses were used to determine the best independent predictors of cardiac events and impaired QOL. Criteria for entry and removal were based on the likelihood ratio test with limits set at $P \leq 0.05$ and $P > 0.05$. Finally, patients were stratified by number of prognostic factors to examine the effect of convergence of risk factors on prognosis and direct medical care costs.

Results

No patients were lost to follow-up. Patients in the present study had a low rate of 5-year cardiac death (ie, 6/319=2%) compared with patients from the 1985 to 1988 rehabilitation cohort[11] (ie, 15/303=5%; $P=0.032$). This finding is consistent with the notion that the patients in the present study received appropriate treatment.[13] After 5 years, 22 patients had experienced a cardiac event; there were 16 nonfatal myocardial infarctions.

Cardiac Events

Cardiac events were significantly associated with LVEF ≤50%, poor exercise tolerance, symptoms of depression, type D personality, and age ≤55 years (Table 2). No drug treatment variables were related to outcome, suggesting an accurate pharmacological approach to the individual medical situation of patients in this study. Type D patients had a greater risk for both death and nonfatal myocardial infarction compared with non–type D patients—ie, 5/75=6% versus 1/200=0.5% cardiac deaths ($P=0.006$) and 11/81=13% versus 5/205=2% nonfatal infarctions ($P=0.007$), respectively. Including revascularization as an end point in secondary analyses also yielded significant associations with LVEF ≤50%, symptoms of depression, type D personality, and age ≤55 years. Poor exercise tolerance did no longer reach statistical significance, whereas symptoms of anxiety were significant ($P=0.036$).

To determine whether disease severity and emotional distress were independent predictors of adverse cardiac events, we entered these factors in a stepwise logistic regression model. This model included LVEF ≤50% (OR, 3.9), type D personality (OR, 8.9), and age ≤55 years (OR, 2.6) but not poor exercise tolerance or symptoms of depression/anxiety (Table 3). Accordingly, secondary analyses indicated that LVEF ≤50% and type D personality were retained as independent predictors of total events, including revascularization procedures.

Quality of Life

Of the 313 surviving patients, 299 (95%) completed and returned the follow-up questionnaire, 11 (4%) failed to return

TABLE 3. Independent Predictors of 5-Year Prognosis

Variable	OR	95% CI	*P*
Cardiac events*			
LVEF≤50%	3.9	1.4–11.1	0.009
Type D personality	8.9	3.2–24.7	0.0001
Age≤55 y	2.6	1.0–6.6	0.05
Total events†			
LVEF≤50%	2.9	1.4–6.0	0.004
Type D personality	4.5	2.3–8.5	0.0001

*Fatal and nonfatal cardiac events (n=22).
†Cardiac events plus revascularization procedures (n=49).

TABLE 4. Independent Predictors of Impaired QOL

Variable	OR	95% CI	*P*
Poor perceived health*			
Failure to quit smoking	2.3	1.2–4.5	0.014
Symptoms of depression	3.3	1.9–5.8	0.0001
Type D personality	2.2	1.2–3.8	0.007
LVEF≤50%	2.0	1.0–3.9	0.049
History of hyperlipidemia	2.0	1.1–3.4	0.016
Depressive affect†			
Failure to quit smoking	2.6	1.3–5.1	0.009
Symptoms of depression	2.7	1.5–5.2	0.002
Type D personality	2.6	1.4–4.8	0.002
Female sex	3.0	1.1–8.1	0.032
Symptoms of anxiety	2.5	1.3–4.6	0.005

*n=104 of 299 patients.
†n=82 of 299 patients.

the questionnaire, and 3 (1%) provided incomplete data. Nonresponders did not differ significantly from responders on any of the baseline measures. With continuous scores of somatic complaints, perceived disability, and negative and positive mood as an outcome measure, MANOVA indicated that poor QOL after 5 years of follow-up was associated with female sex ($P=0.004$), age ≤55 years at baseline ($P=0.05$), poor exercise tolerance at baseline ($P=0.003$), failure to quit smoking ($P=0.02$), symptoms of depression ($P=0.0001$) and anxiety ($P=0.0001$) at baseline, type D personality ($P=0.0001$), and nonfatal myocardial infarction ($P=0.003$) or revascularization ($P=0.0001$) during follow-up.

Using median splits at follow-up, 104 patients were classified as reporting poor perceived health (ie, HCS somatic complaints >6 and HCS feelings of disability >8) and 82 patients as reporting depressive affect (ie, GMS negative mood >6 and GMS positive mood <24). A stepwise logistic regression model yielded failure to quit smoking (OR, 2.3 and 2.6), symptoms of depression (OR, 3.3 and 2.7), and type D personality (OR, 2.2 and 2.6) as independent prognostic factors for both poor perceived health and depressive affect (Table 4). Poor health was also predicted by LVEF ≤50% and hyperlipidemia, and depressive affect was predicted by female sex and symptoms of anxiety. Accordingly, psychosocial factors had a prognostic power above and beyond that of standard biomedical factors in the prediction of poor QOL.

On a Scale From 1 to 10

Next, all patients were rated in terms of their outcome ranging from event-free survival with good QOL (rating=1) to cardiac death (rating=10). Most patients were rated 1 or 2; 10% of patients were rated ≥6 (Table 5). There were 4 independent prognostic factors for poor outcome (categories 6 through 10) as opposed to good outcome (categories 1 to 2); ie, LVEF ≤50% (OR, 4.7; 95% CI, 1.8 to 12.4; $P=0.002$), type D personality (OR, 8.3; 95% CI, 3.4 to 20.4; $P=0.0001$), age ≤55 years (OR, 2.6; 95% CI, 1.1 to 6.1; $P=0.024$), and symptoms of depression at baseline (OR, 2.4; 95% CI, 1.0 to 5.6; $P=0.042$). Hence, cardiac disorder, emotional distress, and younger age provided additional prognostic information.

TABLE 5. Overall Rating of Adverse Health Outcomes According to Medical Events and QOL

Rating	Percent of patients (n)	Criteria	Outcome Category*
1	54 (173)	Event-free survival, good QOL	Good
2	16 (50)	Event-free survival, poor perceived health or depressive affect only	Good
3	15 (47)	Event-free survival, poor perceived health, and depressive affect	Intermediate
4	3 (10)	Revascularization during follow-up, good QOL	Intermediate
5	2 (6)	Revascularization during follow-up, poor perceived health or depressive affect only	Intermediate
6	3 (11)	Revascularization during follow-up, poor perceived health, and depressive affect	Poor
7	2 (7)	Nonfatal myocardial infarction, good QOL	Poor
8	1 (4)	Nonfatal myocardial infarction, poor perceived health or depressive affect only	Poor
9	2 (5)	Nonfatal myocardial infarction, poor perceived health, and depressive affect	Poor
10	2 (6)	Cardiac death	Poor

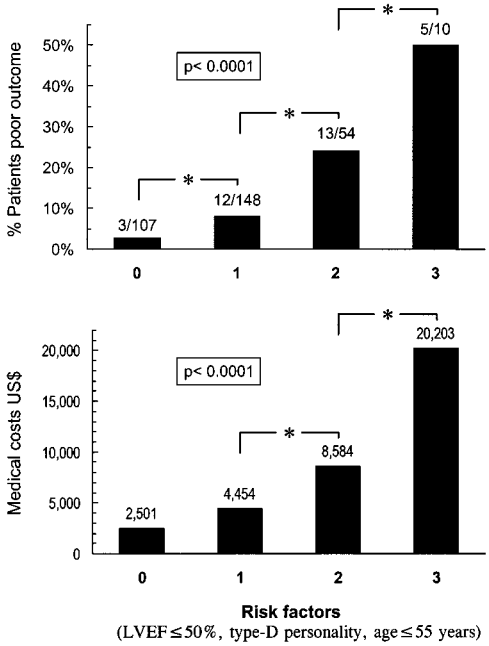
*For outcome categories, 70% (n=223) were good, 20% (n=63) were intermediate, and 10% (n=33) were poor.

Convergence of Risk Factors

To examine the effect of convergence of risk factors, patients were stratified according to LVEF ≤50%, type D personality, and age ≤55 years. Only 3 of 107 patients without any of these prognostic factors had a poor outcome; in contrast, prognostic factors occurring in combination significantly magnified the risk for poor outcome (the Figure, top). Of 10 patients combining 3 risk factors (LVEF≤50% plus type D plus ≤55 years), 5 had a poor outcome. Convergence of risk factors was paralleled by an increase in estimated medical costs (the Figure, bottom). Overall, patients with 2 or 3 prognostic factors had 4 times the risk for poor outcome compared with patients with either 0 or 1 prognostic factor; ie, the rate for poor outcome was 18/64=28% versus 15/255=6% ($P<0.0001$). Accordingly, mean estimated medical costs were $10 400 and $3600 for both groups, respectively ($P<0.0001$).

Discussion

Cardiac disorder (decreased LVEF), emotional distress (type D personality), and premature onset of CHD (younger age at index event) were independent predictors of poor prognosis. Convergence of these distinctly different factors heightened the risk for poor outcome; when 2 or 3 factors occurred together, the rate of adverse health outcome was 4-fold higher. Estimates of direct medical costs increased progres-



Convergence of risk factors: adverse effect on prognosis (top) and medical costs (bottom). Patients were stratified by number of independent prognostic factors that emerged from logistic regression model (ie, LVEF ≤50%, type D personality, and age ≤55 years). Top, Poor outcome of patients as function of convergence of risk factors. Poor outcome was defined as cardiac death, nonfatal myocardial infarction, or revascularization with poor QOL. Number of patients are presented on top of each bar. Bottom, Increase in estimated medical costs as function of convergence of risk factors. Mean estimated medical costs are presented on top of each bar. *$P<0.05$.

sively with increasing number of factors. Examination of the QOL end points revealed that behavioral/psychological indexes (smoking, depressive symptomatology, type D personality) outweighed biomedical indexes in the long-term prediction of physical and emotional well-being. Overall, these findings provide clinical evidence that CHD patients constitute a heterogeneous group and that failure to account for emotional distress and age at disease onset may lead to inaccurate risk estimates.

In line with epidemiological data in the United States,[13] we observed a significant decrease in 5-year cardiac mortality. Aspirin and β-blockers improve survival in CHD patients[17]; in the present study, 72% and 54% of patients were treated with these drugs, respectively. Cardiac rehabilitation also improves survival[17] and decreases the incidence of ventricular arrhythmias[26] and cardiac death[27] in patients with left ventricular dysfunction. However, despite appropriate medical treatment and a low mortality rate, younger age and emotional distress still emerged as independent predictors of cardiac events.

In the present sample of middle-aged and predominantly male subjects, patients ≤55 years of age had a greater risk of cardiac events than patients ≥56 years of age. This finding may indicate that younger men with CHD represent a distinct group in terms of risk factors and prognosis. Consistent with previous findings,[2] episodic distress (symptoms of depression and anxiety) was associated with an increased risk for cardiac events. This risk, however, was accounted for by individual differences in chronic emotional distress (ie, type D personality). Hence, the present study confirms and expands previous findings[11,12] by showing that type D personality was still a predictor of cardiac events despite appropriate treatment. The adverse effect of type D personality may, in fact, extend beyond cardiac events to include impaired QOL.

Little is known about the long-term determinants of QOL in cardiac patients. The present findings suggest that QOL is a complex phenomenon explained by multiple factors. Failure to quit smoking emerged as a major predictor of poor QOL. In addition, symptoms of depression and type D personality were independent predictors of QOL. The fact that baseline levels of depressive symptomatology predicted depressive affect 5 years later supports the notion that the relation between depressive symptoms and CHD implies an element of chronicity.[28] Poor perceived health was also predicted by a decreased LVEF, and depressive affect was predicted by female sex and anxiety. Hence, apart from disease severity, research needs to focus on smoking, chronic negative emotions, and personality as determinants of poor QOL in CHD.

Using a composite end point, we found that 10% of patients experienced a deterioration in health status within the first 5 years of the index event. Biomedical and psychosocial factors predicted this absence of the expected therapeutic response to medical/surgical intervention and rehabilitation. Although the generalizability of these findings is limited by the small number of women[29] and the exclusion of elderly patients,[30] they do suggest that we need to identify ways to optimize treatment for certain subgroups of high-risk patients. Conversely, non–type D patients who were >55 years of age and had an LVEF >50% had an excellent prognosis, suggesting that the present treatment regimen did meet the needs of this subgroup.

These findings have implications for clinical research and practice. First, outcome research in CHD has focused largely on the role of disease severity[1] and sex- and age-based differences[29,30]; it is time now to also account for psychological factors.[2] Second, the identification of CHD patients who experience emotional distress may lead to more accurate risk estimates in clinical practice. The DS16[9] is a brief, sound measure that allows rapid screening of chronic emotional distress among patients with CHD. Third, emotional distress as a risk factor is subject to clinical modification.[31] Patient-specific interventions[2] targeting specific risk factors may include stress management.[32]

In conclusion, we found that 10% of patients with CHD did not display the expected therapeutic response to cardiac treatment and secondary prevention. A decreased LVEF, chronic emotional distress, and younger age at disease onset accounted for their susceptibility to cardiac events and impaired QOL 5 years after the index event. When 2 or 3 risk factors occurred together, the rate of adverse health outcomes was 4-fold higher. The longer survival of patients with CHD will lead to a growing group of patients at risk of subsequent cardiac events and chronic conditions.[15] In addition to cardiac disorder, patients' ages and levels of emotional distress must be considered to optimize this risk stratification.

Appendix

Validity of the DS16 in CHD Patients

	Factor Analysis	
Internal validity (n=400)	Factor I	Factor II
Negative affectivity		
Often feels unhappy	0.80	0.05
Is often down in the dumps	0.78	0.10
Often worries about something	0.77	0.09
Takes a gloomy view of things	0.72	0.10
Is often in a bad mood	0.64	0.12
Feels at ease most of the time (R)	−0.70	−0.12
Is hopeful about the future (R)	−0.78	−0.04
Feels happy most of the time (R)	−0.79	−0.05
	α=0.89	
Social inhibition		
Finds it hard to make "small talk"	0.14	0.78
Doesn't find things to talk about	0.16	0.72
Finds it hard to express opinions	0.16	0.66
Has little impact on other people	0.09	0.65
Likes to be in charge of things (R)	0.03	−0.59
Often talks to strangers (R)	−0.08	−0.60
Is often in charge in groups (R)	0.02	−0.62
Makes contact easily (R)	−0.09	−0.70
		α=0.82

External validity (n=100)	Non–type D	Type D*
Symptoms of depression (BDI)	3.6 (3.6)	8.4 (6.5)†
Symptoms of anxiety (MAS)	4.4 (4.0)	9.8 (4.6)†
Symptoms of stress (GHQ)	45.2 (10.9)	52.0 (10.1)‡
Satisfaction with life (LSI)	35.8 (8.2)	24.6 (7.1)†
Global self-esteem (RSE)	33.1 (5.5)	24.0 (7.1)†
Extraversion (EXT)	12.7 (4.3)	6.9 (4.6)†

α indicates Cronbach's estimate of internal consistency; R, reverse keyed; BDI, 13-item Beck Depression Inventory; MAS, 20-item Manifest Anxiety Scale from the Minnesota Multiphasic Personality Inventory (MMPI); GHQ, 20-item General Health Questionnaire; LSI, Life Satisfaction Index Z; RSE, Rosenberg Self-Esteem Scale; and EXT, 20-item Extraversion Scale from the MMPI.

*Twenty-six type D vs 74 non–type D patients.

†$P<0.0001$; ‡$P<0.01$.

Adapted from Denollet.[9]

References

1. Emond M, Mock MB, Davis KB, et al, for the Participants in the Coronary Artery Surgery Study (CASS). Long-term survival of medically treated patients in the Coronary Artery Surgery Study (CASS) registry. *Circulation*. 1994;90:2645–2657.
2. Rozanski A, Blumenthal JA, Kaplan J. Impact of psychological factors on the pathogenesis of cardiovascular disease and implications for therapy. *Circulation*. 1999;99:2192–2217.
3. Mittleman MA, Maclure M, Sherwood JB, et al. Triggering of acute myocardial infarction onset by episodes of anger. *Circulation*. 1995;92:1720–1725.
4. Kop WJ. Chronic and acute psychological risk factors for clinical manifestations of coronary artery disease. *Psychosom Med*. 1999;61:476–487.
5. Yeung AC, Vekshtein VI, Krantz DS, et al. The effect of atherosclerosis on the vasomotor response of coronary arteries to mental stress. *N Engl J Med*. 1991;325:1551–1556.
6. Grignani G, Soffiantino F, Zucchella M, et al. Platelet activation by emotional stress in patients with coronary artery disease. *Circulation*. 1991;83(suppl II):II-128–II-136.
7. Carney RM, Saunders RD, Freedland KE, et al. Association of depression with reduced heart rate variability in coronary artery disease. *Am J Cardiol*. 1995;76:562–564.
8. Blumenthal JA, Jiang W, Waugh RA, et al. Mental stress-induced ischemia in the laboratory and ambulatory ischemia during daily life: association and hemodynamic features. *Circulation*. 1995;92:2102–2108.
9. Denollet J. Personality and coronary heart disease: the Type D Scale-16 (DS16). *Ann Behav Med*. 1998;20:209–215.
10. Dimsdale JE. A perspective on type A behavior and coronary disease. *N Engl J Med*. 1988;318:110–112.
11. Denollet J, Sys SU, Stroobant N, et al. Personality as independent predictor of long-term mortality in patients with coronary heart disease. *Lancet*. 1996;347:417–421.
12. Denollet J, Brutsaert DL. Personality, disease severity, and the risk of long-term cardiac events in patients with a decreased ejection fraction after myocardial infarction. *Circulation*. 1998;97:167–173.
13. Rosamond WD, Chambless LE, Folsom AR, et al. Trends in the incidence of myocardial infarction and in mortality due to coronary heart disease, 1987 to 1994. *N Engl J Med*. 1998;339:861–867.
14. Hlatky MA, Rogers WJ, Johnstone I, et al. Medical care costs and quality of life after randomization to coronary angioplasty or coronary bypass surgery. *N Engl J Med*. 1997;336:92–99.
15. Cohn JA, Goldstein SO, Greenberg BH, et al, for the Vesnarinone Trial Investigators. A dose-dependent increase in mortality with vesnarinone among patients with severe heart failure. *N Engl J Med*. 1998;339:1810–1816.
16. Pignalberi C, Patti G, Chimenti C, et al. Role of different determinants of psychological distress in acute coronary syndromes. *J Am Coll Cardiol*. 1998;32:613–619.
17. Lau J, Antman EM, Jimenez-Silva J, et al. Cumulative meta-analysis of therapeutic trials for myocardial infarction. *N Engl J Med*. 1992;327:248–254.
18. Erdman RA, Duivenvoorden HJ, Verhage F, et al. Predictability of beneficial effects in cardiac rehabilitation: a randomized clinical trial of psychosocial variables. *J Cardiopulm Rehabil*. 1986;6:206–213.
19. Van Der Ploeg HM, Defares PB, Spielberger CD. *ZBV: A Dutch-language adaptation of the Spielberger State-Trait Anxiety Inventory*. Lisse, Netherlands: Swets & Zeitlinger; 1980.
20. McGee HM, Hevey D, Horgan JH. Psychosocial outcome assessment for use in cardiac rehabilitation service evaluation: a 10-year systematic review. *Soc Sci Med*. 1999;48:1373–1393.
21. Denollet J. Health complaints and outcome assessment in coronary heart disease. *Psychosom Med*. 1994;56:463–474.
22. Denollet J. Emotional distress and fatigue in coronary heart disease: the Global Mood Scale (GMS). *Psychol Med*. 1993;23:111–121.
23. Ormel J, Oldehinkel T, Brilman E, et al. Outcome of depression and anxiety in primary care: a three-wave 3½-year study of psychopathology and disability. *Arch Gen Psychiatry*. 1993;50:759–766.
24. Russell MW, Huse DM, Drowns S, et al. Direct medical costs of coronary artery disease in the United States. *Am J Cardiol*. 1998;81:1110–1115.
25. Unützer J, Patrick DL, Simon G, et al. Depressive symptoms and the cost of health services in HMO patients aged 65 years and older: a 4-year prospective study. *JAMA*. 1997;277:1618–1623.
26. Hertzeanu HL, Shemesh J, Aron LA, et al. Ventricular arrhythmias in rehabilitated and nonrehabilitated post-myocardial infarction patients with left ventricular dysfunction. *Am J Cardiol*. 1993;71:24–27.
27. Specchia G, De Servi S, Scirè A, et al. Interaction between exercise training and ejection fraction in predicting prognosis after a first myocardial infarction. *Circulation*. 1996;94:978–982.
28. Barefoot JC, Schroll M. Symptoms of depression, acute myocardial infarction, and total mortality in a community sample. *Circulation*. 1996;93:1976–1980.
29. Vaccarino V, Parsons L, Every NR, et al, for the National Registry of Myocardial Infarction 2 Participants. Sex-based differences in early mortality after myocardial infarction. *N Engl J Med*. 1999;341:217–225.
30. Ahnve S, Gilpin E, Dittrich H, et al. First myocardial infarction: age and ejection fraction identify a low-risk group. *Am Heart J*. 1988;116:925–932.
31. Linden W, Stossel C, Maurice J. Psychosocial interventions for patients with coronary artery disease: a meta-analysis. *Arch Intern Med*. 1996;156:745–752.
32. Blumenthal JA, Jiang W, Babyak M, et al. Stress management and exercise training in cardiac patients with myocardial ischemia: effects on prognosis and evaluation of mechanisms. *Arch Intern Med*. 1997;157:2213–2223.