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## Feelings of being disabled as a risk factor for mortality up to 8 years after acute myocardial infarction

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### Abstract

**Objective:** We examined the independent prognostic value of the four subscales of the Heart Patients Psychological Questionnaire (HPPQ) on mortality in acute myocardial infarction (AMI) survivors up to 8 years after the event. **Methods:** The HPPQ, which measures well-being, feelings of being disabled, despondency and social inhibition, was administered to 567 AMI patients during hospitalisation and at 3 months follow-up. The patients were followed for 8 years. **Results:** During follow-up, 157 patients (28%) died. Forty-one percent of the patients had a score indicating at least mild to moderate feelings of being disabled. Patients with feelings of being disabled were at increased risk of mortality compared with those having a low score, adjusted for other cardiac risk factors [hazard ratio (HR)=1.8, 95% confidence

interval (CI)=1.3–2.5]. There was no interaction between feelings of being disabled and gender. None of the other HPPQ subscales were related to mortality or recurrent myocardial infarction (MI). When the study population was stratified by low and high clinical risk (43% vs. 57%, respectively), feelings of being disabled was the most prominent predictor of mortality in the low-risk group (HR=3.5, 95% CI=1.4–8.8). **Conclusion:** Feelings of being disabled measured at baseline and at 3 months was the most prominent predictor of mortality in low-risk patients 8 years post-MI. This finding adds to the existing knowledge that psychosocial variables influence morbidity and mortality in cardiac patients.

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**Keywords:** Acute myocardial infarction (AMI); Coronary artery disease (CAD); Feelings of being disabled; Mortality; Prognosis; Psychosocial factors

### Introduction

The management of acute myocardial infarction (AMI) has changed considerably with the introduction of thrombolytic agents and immediate percutaneous interventions. Early reperfusion therapy limits infarct size, preserves left

ventricular function and improves early as well as long-term survival. The long-term outcome after AMI is related to the residual cardiac function, coronary anatomy and established biomedical risk factors. Furthermore, there is increasing evidence that psychosocial factors have prognostic value independent of disease severity and traditional risk factors [1–6]. Psychosocial factors have also been shown to impede the change of health-related behaviour and to moderate the effects of medical and invasive treatment [4,7].

Several instruments have been used to quantify the psychological functioning of cardiac patients, but few of these are disease specific. Disease-specific instruments are

*Abbreviations:* HPPQ, Heart Patients Psychological Questionnaire; AMI, acute myocardial infarction; HR, hazard ratio; CI, confidence interval.

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likely to be more sensitive and to cover dimensions that are relevant to cardiac patients, resulting in more valid results [8]. The Heart Patients Psychological Questionnaire (HPPQ) was developed in a heterogeneous group of cardiac patients and measures psychological functioning according to four subscales: well-being, feelings of being disabled, despondency and social inhibition [9]. There is a paucity of studies that have evaluated the prognostic value of the HPPQ. “Feelings of being disabled” measured 1 year after hospital discharge was a significant predictor of mortality 10 years in men after percutaneous coronary intervention (PCI) and in post-AMI patients [10,11].

The objectives of the current study were to investigate the impact of the HPPQ subscales in relation to subsequent major adverse cardiac events and to examine the prognostic value of the four HPPQ scales in low- and high-risk patients at 8 years follow-up in post-AMI patients.

## Methods

### Study population

The study population consisted of 567 AMI patients who completed the HPPQ during hospitalisation just prior to discharge from hospital. They were recruited from the Short Hospital Rehabilitation Trial (SHORT; [12]). The aim of the SHORT study was to develop and validate a decision-making strategy for early discharge after AMI in unselected patients. Between May 1993 and November 1995, 1472 patients were enrolled in four Dutch hospitals. Patients were excluded from the psychological study if they had died in-hospital ( $n=139$ ), were unable to fill in the questionnaire due to a serious clinical complication ( $n=199$ ), were suffering from other incapacitating diseases ( $n=114$ ) or had difficulty understanding and reading Dutch ( $n=212$ ). Seventy percent of the remaining 808 patients meeting the inclusion criteria agreed to take part and filled in the HPPQ in-hospital. Of these, 365 patients (64%) also filled in the HPPQ at 3 months.

No differences were found between responders and nonresponders on baseline characteristics [13]. Ethical approval was obtained from the hospital ethics committee, and the study was carried out in accordance with the Helsinki Declaration. Written informed consent was provided by every patient.

### Measures

The HPPQ was used to assess psychological functioning [9]. The HPPQ is a 52-item questionnaire that was developed and validated in a heterogeneous group of cardiac patients in the Netherlands. The scale consists of 52 items that are answered on a three-point scale (Correct/?/Incorrect), of which 40 items contribute to four subscales: *well-being* (“I feel happy”; 12 items; score range 12–36), *feelings of being disabled* (“I quickly feel tired even if I don’t do much”;

12 items; score range 12–36; Appendix A), *despondency* (“I am often in a bad mood without knowing why”; 10 items; score range 10–30) and *social inhibition* (“I feel shy in the company of people whom I don’t know”; 6 items; score range 6–18). The remaining 12 items are so-called buffer items. A high score on feelings of being disabled, despondency and social inhibition indicates psychological maladjustment, whereas a high score on well-being suggests adjustment. The internal consistency (Guttman’s lambda) of the subscales is good (well-being=.93; feelings of being disabled=.87; despondency=.80; and social inhibition=.64), and the test–retest reliability coefficients following 1–2 weeks range from .73 to .85 [9]. The HPPQ has been used to assess psychological functioning in patients with myocardial infarction (MI; [14]), chronic heart failure [15] and coronary artery bypass graft surgery [16]. The HPPQ has also been shown to distinguish between relatively small groups of patients with stroke ( $n=16$ ), MI ( $n=20$ ) and matched controls ( $n=17$ ; [17]).

### Follow-up

At the time of follow-up, May 1, 2002, clinical status was documented by approaching general practitioners by mail, review of hospital records and checking the civil registries. Information on follow-up survival, reinfarction and coronary interventions was obtained for all patients.

### Statistical analyses

The chi-square test (or Fisher’s Exact Test, when appropriate) was used to test the unadjusted association between the categorical variables. Continuous variables were compared by Student’s *t* test. The HPPQ subscales were mainly analysed as continuous variables. Cumulative survival curves were constructed using the Kaplan–Meier method. The log-rank test was used to compare survival curves. Univariate Cox regression analyses, adjusting only for the follow-up period, were used to evaluate the unadjusted relation between baseline characteristics and mortality. To adjust for baseline characteristics, a multivariate Cox proportional hazard regression model was used. In this multivariate model, the HPPQ scores were entered as dichotomised variables, with the highest tertile on the subscale indicating probable psychological morbidity. To investigate the relation between feelings of being disabled and gender, a test for interaction was performed. The clinical profile (demographic and procedural details), including complications, was recorded during the index AMI. The following variables were selected a priori and retained in the model irrespective of statistical significance: age, heart failure (as defined by Killip class >I), prior MI, treated diabetes (Type I or II), current smoking, treated hypertension, treated hypercholesterolemia and the angiographic parameters multivessel disease (at least two stenotic arteries  $\geq 50\%$ ) and impaired left ventricular function (ejection

fraction <50%). The primary endpoint was all cause mortality; the secondary endpoint was a major adverse cardiac event (death, recurrent MI or coronary revascularization). A decision rule classified patients into high- and low-risk patients [12]. Low risk was defined as free from major complications until Day 7 (43% of all patients), and these patients would qualify for discharge on Day 7. In-hospital complications were defined as death, cardiac arrest, recurrent MI or heart failure (defined as Killip Class II, III or IV).

## Results

### Sample characteristics

The study population consisted of 567 patients of whom 74% were male (Table 1). Mean age was 64 years. The mean in-hospital HPPQ subscales were similar to the subscale at 3 months. Median follow-up for the surviving patients was

Table 1  
Patient characteristics

	N	%	Mean	SD
Number of patients	567			
Age years $\pm$ SD	64	$\pm$ 11.4		
Male	418	74		
<i>History</i>				
Angina >4 weeks	136	24		
Progressive angina	74	13		
Heart failure (Killip >I)	112	20		
Prior myocardial infarction	124	22		
Prior CABG <sup>a</sup>	28	5		
Prior PCI <sup>b</sup>	21	4		
<i>Risk factors</i>				
Current smoking	247	44		
Dyslipidemia	142	25		
Diabetes	64	11		
Hypertension	179	32		
Familial	132	23		
<i>Hospitalisation</i>				
Treatment delay >3 hours	373	66		
Thrombolytic treatment	264	47		
Intravenous aortic balloon pump	58	10		
<i>Psychological HPPQ* factors</i>				
In-hospital (n=567)				
Feelings of being disabled			26.0	$\pm$ 6.2
Well-being			25.0	$\pm$ 7.7
Despondency			16.4	$\pm$ 4.8
Social inhibition			11.6	$\pm$ 3.1
At 3-months (n=365)				
Feelings of being disabled			26.0	$\pm$ 6.9
Well-being			26.9	$\pm$ 7.9
Despondency			15.8	$\pm$ 5.1
Social inhibition			11.6	$\pm$ 3.2

<sup>a</sup> CABG=Coronary bypass surgery.

<sup>b</sup> PCI=Prior percutaneous coronary intervention.

\* HPPQ=Heart patients psychological questionnaire.

Table 2  
Unadjusted predictors of mortality

	Feelings of being disabled		HR <sup>a</sup>	95%CI
	Yes (N=202) N (%)	No (N=365) N (%)		
Age yrs >70 years	83 (41%)	92 (25%)	3.0	2.3-3.9
Gender	124 (61%)	294 (81%)	0.9	0.7-1.2
Angina >4 weeks	75 (37%)	33 (9%)	0.8	0.5-1.3
Heart failure (Killip >I)	52 (26%)	60 (16%)	2.0	1.5-2.5
Prior myocardial infarction	65 (32%)	59 (16%)	1.8	1.4-2.4
Prior CABG	16 (8%)	12 (3%)	0.9	0.5-1.7
Prior PCI	13 (6%)	8 (2%)	1.2	0.6-2.3
Thrombolytic treatment	82 (41%)	182 (50%)	0.7	0.5-0.9
Treatment delay >3 hrs	143 (71%)	230 (63%)	1.6	1.1-2.2
<i>Risk factors%</i>				
Current smoking	76 (38%)	171 (47%)	0.7	0.5-0.9
Dyslipidemia <sup>b</sup>	53 (26%)	89 (24%)	0.7	0.5-0.9
Diabetes <sup>b</sup>	28 (14%)	3 (10%)	1.6	1.1-2.2
Hypertension <sup>b</sup>	76 (38%)	103 (28%)	1.1	0.9-1.5

### Psychological HPPQ<sup>c</sup>

In-hospital				
Feelings of being disabled			2.1	1.6-2.7
No well-being			1.0	0.8-1.4
Despondency			1.2	0.8-1.7
Social inhibition			0.9	0.6-1.2
At 3-months				
Feelings of being disabled			1.7	1.1-2.6
No well-being			1.3	0.8-2.0
Despondency			1.4	0.8-2.4
Social inhibition			1.1	0.7-1.8

<sup>a</sup> HR=Hazard ratio, 95%CI=95% Confidence interval.

<sup>b</sup> Treated risk factors

<sup>c</sup> Highest tertile vs. other tertiles.

8 years (range 6–9 years). During the follow-up period, 157 patients (28%) had died.

### Feelings of being disabled as a predictor of mortality

Patients scoring higher on feelings of being disabled at baseline were at increased risk of mortality at 8 years follow-up [hazard ratio (HR)=2.1, 95% confidence interval (CI)=1.6–2.7], as indicated by the univariate Cox regression analysis (Table 2). No significant relationships were found between the other HPPQ subscales and mortality. The predictive value of the 3-month HPPQ scores was not different from that of the baseline HPPQ scores (Table 2). Other univariate predictors were older age (HR=3.0, 95% CI=2.3–3.9), heart failure (HR=2.0, 95% CI=1.5–2.5), prior MI (HR=1.8, 95% CI=1.4–2.4) and diabetes (HR=1.6, 95% CI=1.1–2.2). However, smoking at the time of the event (HR=0.7, 95% CI=0.5–0.9), dyslipidemia (HR=0.7, 95% CI=0.5–0.9) and thrombolytic therapy (HR=0.7, 95% CI=0.5–0.9) were predictors of lower mortality. At the 3-, 5- and 8-year follow-up, feelings of being disabled remained

Table 3  
Adjusted<sup>a</sup> feelings of being disabled as a predictor of mortality

	3-years		5-years		8-years	
	HR <sup>a</sup>	95%CI <sup>b</sup>	HR <sup>b</sup>	95%CI <sup>b</sup>	HR <sup>b</sup>	95%CI <sup>b</sup>
Feelings of being disabled <sup>c</sup>	1.5	1.1-2.4	1.7	1.2-2.4	1.8	1.2-2.5
Age	1.06	1.04-1.09	1.07	1.05-1.09	1.07	1.05-1.09
Male	1.9	1.1-3.2	1.7	1.1-2.6	1.9	1.3-2.7
Heart failure (Killip>I)	2.3	1.4-3.6	2.1	1.4-3.1	1.8	1.3-2.5
Diabetes	2.1	1.3-3.6	1.9	1.2-3.1	1.7	1.1-2.6
Prior MI	1.4	0.9-2.3	1.5	1.0-2.3	1.5	1.1-2.1
Delay start treatment	1.7	1.1-2.8	1.6	1.0-2.5	1.6	1.1-2.3
In-hospital high risk <sup>d</sup>	1.2	0.6-2.5	1.4	0.4-1.2	1.3	0.8-2.0

<sup>a</sup> Adjusted for age, prior myocardial infarction, prior coronary intervention, prior angina, progressive angina, killip class, diabetes, smoking, hypertension, dyslipidemia, thrombolysis, delay start treatment >3 hours.

<sup>b</sup> HR=hazard ratio, 95%CI=95% Confidence interval.

<sup>c</sup> Highest tertile vs. other tertiles.

<sup>d</sup> In-hospital high risk=. In-hospital complications were defined as death, cardiac arrest, recurrent myocardial infarction, heart failure (defined as Killip class II, III or IV).

an independent predictor of mortality after adjustment for other baseline characteristics (8 years: HR=1.8, 95% CI=1.3–2.5; Table 3). The results did not change when using continuous scores on the HPPQ. We investigated the effect size of feelings of being disabled on mortality while entering covariates by performing a suppression analysis. The results were that only age had some nonsignificant effect on feelings of being disabled. The beta coefficient of feelings of being disabled decreased from .85 to .68 and the HR from 2.3 to 1.8. However, the effect of the other cofactors was much less. Furthermore, the correlations between the independent variables and mortality were very low and varied from .04 to .2.

Although women scored worse on feelings of being disabled, there was no interaction found. Other independent predictors of mortality were older age, heart failure, diabetes, prior MI and treatment delay >3 h. Cumulative survival rates among patients scoring high (highest tertile) versus those scoring low on feelings of being disabled were 91%, 80%,

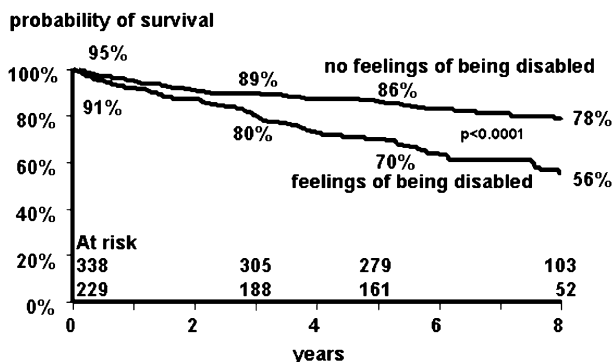


Fig. 1. Cumulative survival curves according to patients with and without feelings of being disabled in 356 post-MI patients.

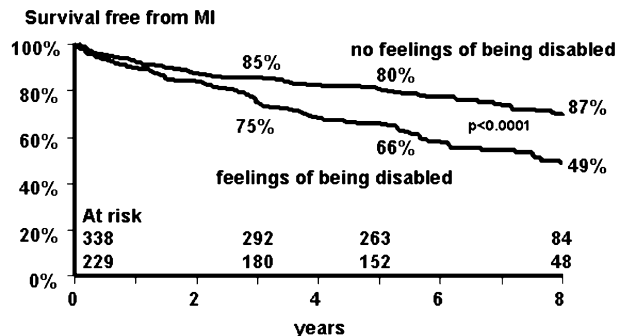


Fig. 2. Cumulative survival curves free from myocardial infarction according to patients with and without feelings of being disabled in 356 post-MI patients.

70% and 56% at 1, 3, 5 and 8 years, respectively (Fig. 1). By comparison, survival rates in patients scoring low on feelings of being disabled were 95%, 89%, 86% and 78%, respectively. This difference was significant (log-rank  $P$  value < .0001).

*The relation between feelings of being disabled and major adverse cardiac events*

During the 8-year follow-up period, 240 patients (38%) experienced one or more major adverse cardiac events. A recurrent infarct was experienced by 9.2% of the patients, 6.5% underwent coronary bypass surgery (CABG), and 5.5% percutaneous coronary angioplasty (PCI). By far, most of the events occurred in the first year. Adjusting for all known baseline characteristics, feelings of being disabled remained an independent predictor of death or recurrent MI (HR=1.8; 95% CI=1.3–2.4) and of any major adverse cardiac events (HR=1.4; 95% CI=1.1–1.8). In Figs. 2 and 3, the Kaplan–Meier survival curves of death or MI and of any cardiac event are shown for patients scoring high versus those scoring low on feelings of being disabled.

*Feelings of being disabled as a predictor of mortality stratified by clinical risk*

When the study population was stratified according to low and high clinical risk (43% and 57%, respectively; late

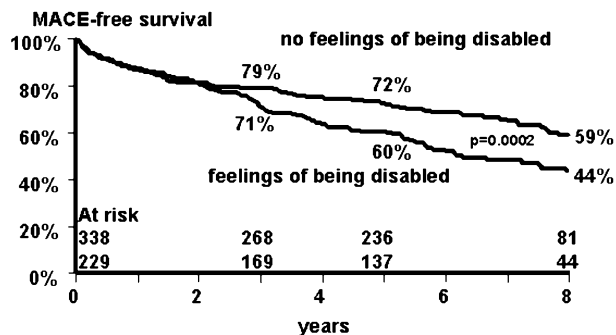


Fig. 3. Cumulative survival curves free from major adverse clinical events (MACE: death, myocardial infarction, revascularization) according to patients with and without feelings of being disabled.



mortality: 17% and 29%, respectively), feelings of being disabled was the most prominent independent predictor of mortality in the low-risk group (HR=3.5, 95% CI=1.4–8.8). In the high-risk group, feelings of being disabled was also an independent predictor of mortality, although less pronounced (HR=1.4, 95% CI=1.1–2.1).

## Discussion

In the current study, feelings of being disabled in post-MI patients was associated with an increased risk of mortality and of major adverse coronary events at 8-year follow-up, independent of established biomedical risk factors. In other words, the effect of feelings of being disabled could not be accounted for by somatic symptoms and clinical impairment, as indicated by heart failure, angina, prior MI, and a larger infarct size. Although we did not investigate its mechanisms, the effect size for feelings of being disabled actually increased substantially when these clinical factors were added to the Cox model. This increase might be the result of a statistical suppressor effect, in which the effect of feelings of being disabled on mortality was partly masked by the association of feelings of being disabled with the other established factors. However, we were not able to find any relation between feelings of being disabled and the other cofactors on mortality. In other words, the suppression effect was marginal.

In contrast to the current study, in which the HPPQ was administered at baseline and early thereafter, the HPPQ was administered much later in the post-PCI study (1–2 years following the procedure; [10]). Although we do not know whether feelings of being disabled in the post-PCI patients were present already early on, the findings of the current study suggest that, when present, feelings of being disabled may not remit spontaneously. The similarity in the mean HPPQ scores at baseline and at 3 months post-AMI and their respective prognostic impact, which were also of a similar magnitude, supports this notion. A recent study by Blumenthal et al. [1] also indicates that it is not the presence of psychological morbidity per se that renders patients at risk for adverse clinical outcome, but whether these symptoms become chronic. In addition, although it may seem puzzling that there was no decrease in the HPPQ scores between baseline and 3 months in the current study, others have also shown that symptoms such as depression and anxiety may persist up to at least 1 year in cardiac patients [1,18].

We were not able to find a relation between the other HPPQ subscales and mortality 8 years later. It may seem surprising that the HPPQ despondency subscale was not a predictor of mortality, given that it has an overlap with depression and that other studies have shown that depression has a prognostic role in patients with established CVD [19–22]. However, the shared variance between the HPPQ despondency and depression, as measured by Zung's Depression Scale, is only 40% [9], indicating that there is an overlap, but they do not measure the same construct.

In our opinion, feelings of being disabled may best be construed as a mental state rather than a proxy for clinical symptoms of disease. This can be substantiated by the fact that both in the current and our previous study [10], feelings of being disabled was a significant predictor of mortality despite adjustment for clinical symptoms. In other words, it is the patients' perception of the extent to which they are affected by the disease rather than clinical symptoms per se that predicts adverse clinical outcome. As such, feelings of being disabled may share some common features with vital exhaustion, another psychosocial risk factor for adverse clinical outcome [23,24]. Vital exhaustion also reflects a mental state rather than physical symptoms and is defined as unusual fatigue, demoralisation and increased irritability [23]. Although no studies to date have evaluated the overlap between feelings of being disabled and vital exhaustion, studies are now beginning to emerge that seek to disentangle the overlap between psychological constructs [25,26]. Two studies have shown that vital exhaustion and depression are moderately correlated, suggesting that, although there is an overlap, they comprise separate and distinct constructs [26,27]. An earlier study found that the shared variance between depression and feelings of being disabled is 15% [9]. Taken together, these findings suggest that feelings of being disabled comprises a different and distinct construct compared with vital exhaustion and depression.

The findings of the current study have implications for research and clinical practice. Further research is warranted that seeks to disentangle the overlap between psychological constructs to establish a core list of the most "toxic" risk factors. In addition, repeated rather than single assessments of psychological symptoms in research should become the preferred strategy to delineate the most optimal time point(s) to screen for psychological morbidity in clinical practice. The findings by Blumenthal et al. [1] and Poston et al. [28] support this notion. Of note, in the latter study, depression at 1-month postprocedure was a much stronger predictor (OR=27.2) of depression at 6 months than was baseline depression (OR=6.5; [28]). In turn, such knowledge would optimise risk stratification in clinical practice and help to identify patients most at need for psychosocial intervention. Finally, research into the mechanisms that may be responsible for the impact of feelings of being disabled on prognosis is required, as feelings of being disabled may only be a risk marker rather than a risk factor. Cytokines and altered hemostasis have been associated with increased symptoms of vital exhaustion [29,30] and may also provide mechanisms for feelings of being disabled. However, until such information is available, the results of the current study and those of our previous study suggest that feelings of being disabled in cardiac patients should be attended to, as they comprise a risk factor on par with diabetes and heart failure. This was especially the case in the low-risk population, i.e., those defined as free from major complications until Day 7 (43% of all patients). In other words, although screening on its own is not sufficient, "not enough" does not mean "not at all", as

pointed out in a recent editorial on the screening for depression [31].

### Limitations

Although psychosocial intervention programs would be warranted for patients scoring high on feelings of being disabled, its value is controversial. A trial comparing the effect of an outpatient rehabilitation program with standard medical care in patients with ischemic heart disease showed that rehabilitation patients displayed healthier behaviour than did the controls, as measured by the HPPQ [32]. In other words, the latter trial demonstrated that feelings of being disabled might be reduced through intervention. However, the important question is whether a reduction in psychological morbidity automatically leads to improved survival. The recent ENRICHD [33] and SADHART [34] trials showed a reduction in depressive symptoms and improvement in social support, but this did not lead to a concomitant increase in event-free survival. Furthermore, the poor prognosis of patients scoring high on feelings of being disabled may well partly be determined by other factors than pure psychosocial factors, such as differences in lifestyle (physical exercise and food habits) during follow-up, which were not assessed in the current study. Finally, other variables not assessed in the current study, such as socioeconomic status [35], may also serve as confounders on the relationship between feelings of being disabled and mortality.

### Conclusions

This is the first study to look at the prognostic value of the HPPQ on the long-term outcome following MI. The results showed that patients with a high score on feelings of being disabled who experience a MI are at increased risk of mortality and recurrent MI 8 years later. In particular, the subgroup of patients at low clinical risk, who score high on feelings of being disabled, might benefit from psychosocial intervention targeting feelings of being disabled in combination with optimal medical treatment with aspirin, beta-blockers, statins and ACE inhibitors. Thus, in clinical practice, it would be important to be aware of and intervene in those patients who feel most disabled by their cardiac disease.

### Acknowledgments

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### Appendix A. Feelings of being disabled

1. If it's cold and windy outside, I hardly ever leave the house.
2. I could do a lot more work formerly.

3. I don't have enough stamina.
4. I used to be capable of a lot more.
5. I fell tired quicker than I think is normal.
6. I feel tight in the chest quite often.
7. I still feel up to anything.
8. Things often go wrong if I have to do something quickly.
9. I quickly feel tired even if I don't do much.
10. I don't like the idea of doing heavy work.
11. I get out of breath quickly.
12. I still feel quite capable of taking parts in sports.

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