

# Coping, uncertainty and health-related quality of life as determinants of anxiety and depression on a sample of hospitalized cardiac patients in Southern Italy

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## Abstract

**Objectives** Being hospitalized often causes psychological distress and compromises patients' psychological well-being, thereby augmenting the burden of illness. The aim of this paper is to investigate two possible determinants of anxiety and depression among hospitalized cardiac patients, namely uncertainty in illness, and coping strategies, controlling for the perceived health-related quality of life, and distinguishing between borderline and pathological levels of anxiety and depression.

**Methods** Data on anxiety, depression, coping style, uncertainty in illness and self-assessed quality of life concerning 200 cardiac inpatients from a university hospital were collected through validated questionnaires. A biprobit analysis, whose dependent variables are hospital anxiety and depression, was carried out.

**Results** Uncertainty in illness has a significant impact on the possibility of crossing the borderline level of both anxiety and depression. The coping strategy of Positive Reappraisal and Growth is inversely and significantly correlated to anxiety and depression, be it borderline or pathological; the Restraint Coping strategy is positively and significantly related to borderline anxiety.

**Conclusions** The reduction of uncertainty in illness and the development of adequate coping strategies should be

promoted in order to decrease the patients' risk of crossing the borderline threshold of anxiety and depression.

**Keywords** Hospital anxiety and depression · Uncertainty in illness · Coping strategies · Chronic cardiac illness

## Introduction

It is widely acknowledged that there is a higher occurrence of depression and anxiety in chronic patients, with a resulting impact on patients' quality of life [1]. Investigating the determinants of anxiety and depression in chronic cardiac patients may help to tailor interventions aimed at reducing their upsurge in these patients, thereby diminishing the global health burden.

The literature on this topic indicates the existence of higher anxiety and depression rates in cardiac patients [2–6]. Post-myocardial infarction patients exhibit a rate of depression of 24 %, while the rate of depression of the control population is 17.6 % [7]. A depression incidence rate of approximately 25 % has been found in coronary heart disease patients [8]; moreover, up to 26 % chronic heart failure patients suffer from major clinical depression [9]. Large existing evidence supports the prevalence of depression in chronic heart failure patients [10]. Anxiety rates range from 18.5 to 26 % among post-myocardial infarction patients [11] and are at 41.4 % in coronary disease patients [12].

The literature suggests the existence of a bidirectional link between anxiety/depression and cardiac patients health-related quality of life. On the one hand, the experience of chronic illness, accompanied by physical impairment and hospitalization, can be difficult to manage and can cause psychological distress in patients due to the

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changes and limitations it determines in their lifestyles. Hospitalization may compromise patients' psychological well-being, affecting their physical recovery and compliance to therapies. On the other hand, cardiac patients suffering from anxiety/depression will face adverse effects on cardiovascular health outcome [13–16].

In the following pages, evidence of both sides of this bidirectional link is presented.

First, the literature showing worse health conditions in cardiac patients caused by anxiety and depression is introduced. This branch of the literature explains the rationale for the interest in a second strand of research investigating the causes of the increase in anxiety and depression among cardiac hospitalized patients, and calls for additional efforts in isolating, and possibly controlling, any further booster of anxiety and depression in such chronic patients.

Knowing the causes of the arousal of anxiety and depression in the cardiac healthcare delivery service is the first step in an intervention aimed at reducing such negative psychological states and consequently the health burden of cardiac patients.

#### **From anxiety/depression to worse health conditions in cardiac patients**

Anxiety and depression are known to be potential risk factors for cardiovascular patients: They are related to the experience of recurrent events of hospitalization of coronary artery disease patients [16, 17] and affect the cardiovascular patient's Health-Related Quality of Life [18, 19].

Moreover, chronic patients who are also depressed record statistically significant lower mean health scores than chronic patient not experiencing depression [1]. The incidence rates of depressive symptoms in cardiac population are higher with respect to the lay population. Depression may fall into the category of both episodic psychological risk factors (lasting from several months to 2 years with a tendency to recur) and chronic psychological risk factor, promoting gradual progression of coronary artery disease for coronary syndromes. This may account for the observed long-term relationship between depression and cardiac episodes [7].

Depression in patients hospitalized for acute myocardial infarction significantly rise the 1-year cardiac mortality rate (8.3 % of the depressed women vs. 2.7 % of the non-depressed, and 7.0 % for depressed men vs. 2.4 % on non-depressed): Its influence is not affected by other post-myocardial infarction risks [13].

Evidence suggests that anxiety is among those acute psychological factors activating pathophysiological

mechanisms that trigger myocardial ischemia during daily life activities [20, 21].

#### **From chronic illness to anxiety/depression**

Evidence offered by the World Health Surveys data on worldwide prevalence of depression, asthma, angina, arthritis and diabetes shows that chronically ill people are significantly more likely to suffer from depression than those not suffering from any chronic condition [1]. Medical comorbidities and severe medical illness are among the mechanisms leading to depression for chronic cardiac patients [22]; a higher NYHA (New York Heart Association) class is associated with both depression and anxiety, while comorbid physical illness with anxiety [23].

Depression, which may occur as a reaction to acute myocardial infarction, is a major determinant of recovery. Patients showing depressive symptoms before admission may experience an intensification of such symptoms during hospitalization, while other patients, who are not depressed at admission, may experience depression in reaction to the hospitalization experience and the feeling of helplessness linked to the hospital experience [24]. Evidence on low-income heart failure patients showed the correlation between disease burden and major depressive disorder symptoms; disease burden mediates between post-traumatic stress disorder symptoms and major depressive disorder symptoms [25].

Living with coronary heart disease may trigger anxiety: Myocardial infarction patients can experience their sick conditions as a threat for themselves. The fear of death, lack of autonomy, poor sexuality and changes in family and social role can cause the arousal of anxiety in these patients [26].

#### **Uncertainty in illness and coping strategies as possible levers of anxiety and depression in hospitalized cardiac patients**

In cardiac patients, the hospitalization episode and the disease experience are significantly characterized by uncertainty in illness [27], which is a well-known lever for anxiety and depression in chronic hospitalized patients [28]. It also augments the negative impact of the state of chronic illness on patients' quality of life and obstacles patients' coping strategies [28–32].

Notwithstanding the above considerations, the investigation on the increase in anxiety and depression in cardiac patients and its relation to subjective well-being, uncertainty in illness and coping is still partial and fragmented. There is evidence of a positive relation between the subjective well-being of heart failure patients and task-focused

coping strategies, while a negative relation has been established between subjective well-being/maladaptive coping strategies and depressive symptoms [33]. In patients following an acute coronary syndrome event, the occurrence of a left ventricular ejection fraction (an index of prognostic severity) was predicted by emotion-focused coping strategies. Moreover, it has been shown that chronic cardiac patients adopting adaptive coping strategies are less exposed to depression [34]. The indirect effect of uncertainty as cause of depression in patients with atrial fibrillation has also been proven [35]. Finally, uncertainty and coping strategies have been found to explain a large part of variance in emotional distress prior to hospital discharge following myocardial infarction [30].

Some studies, focusing on different chronic patients, have jointly considered the correlations between anxious and depressive symptoms on the one hand, and global disability, psychological variables and uncertainty and coping strategies in hospital on the other hand [36–39]. However, to our knowledge, neither in Italy nor in an international context, have such correlations been investigated in cardiac patients.

The present contribution aims at filling this gap: It estimates the probability of cardiac patients developing anxiety and depression when hospitalized, and at verifying the impact of uncertainty, coping and quality of life on the aforementioned psychological conditions. The hypothesis tested is that, in hospitalized cardiac patients, uncertainty in illness may play a crucial part in the development of anxiety and depression, at both borderline and pathological levels. Coping strategies may help to contrast the negative effects of uncertainty.

Data collected have been employed within an econometric analysis, which applies statistical techniques to economic and social problems and theories. The probability of patients crossing the borderline threshold for both anxiety and depression has been estimated, along with the probability of such patients going beyond their pathological thresholds.

Results suggest that uncertainty in illness is associated with the probability of crossing the borderline threshold for both anxiety and depression and that the emotion-focused/Active Coping style, Positive Reinterpretation and Growth, are inversely related to anxiety and depression, while the problem-focused/passive coping style, Restraint Coping, are positively related to anxiety.

This study enriches the literature related to the burden of cardiac chronic illness. In fact, knowing more about the extent of such correlations may provide useful suggestions on how to better assist chronic cardiac patients and how to support them along their long-term care path.

## Methods

### Patients and tools employed

A convenience sample of 200 consecutive patients was recruited between January 2014 and March 2014 from the operative units of Cardiology, Cardiosurgery Angiology and Vascular Surgery of the university hospital *Azienda Policlinico Universitario “Vittorio Emanuele”* in Catania, Italy.

In order to be considered eligible for this study, patients had to satisfy the following criteria: Their cardiac disease had to be clinically defined, and they had to be aware of their diagnosis. Those who were unable to understand the questionnaire were excluded from the analysis. Overall, 97 % of the patients enrolled agreed to answer to the questionnaire.

Patients were asked to complete a test battery: The questions proposed asked for information on their clinical history, how they perceived their state of illness and the quality and quantity of information received from physicians.

Hence, patients answered the *Hospital Anxiety and Depression Scale* (HADS), the *Coping Orientation to Problems Experienced* (COPE) questionnaire and the *Mishel Uncertainty in Illness Scale* (MUIS), together with the *EuroQol-5D* (EQ-5D).

The HADS is composed of two scales, designed to measure anxiety and depression, each encompassing seven items on a four-point Likert scale, which ranges from 0 to 3. For each scale, scores less than or equal to 7 indicate *non-cases*, scores between 8 and 10 indicate *borderline cases*—which could potentially evolve in psychopathology—and scores greater than 11 indicate *pathological cases* [40]. The HADS is widely applied both in Italy and internationally and is considered a valid and reliable instrument [41–45]: It has been employed in the diagnosis of anxiety and depression in patients experiencing chest pain [46, 47], patients surviving recent myocardial infarction [48], patients in emergency departments suffering non-cardiac chest pain [49] and cardiac patients [50]. The HADS, initially designed to identify and quantify depression and anxiety in an outpatient hospital setting [51], has been validated and used in different inpatient settings too [52–54].

The COPE questionnaire [55] is aimed at analyzing the coping strategies adopted by patients as a result of their state of illness. Overall, it comprises 60 items and encompasses 15 dimensions, namely Active Coping, Planning, Seeking Instrumental Social Support, Seeking Emotional Social Support, Suppression of Competing Activities, Religion, Positive Reinterpretation and Growth, Restraint Coping, Acceptance, Focus on Emotions, Denial, Mental Disengagement, Behavioral Disengagement, Alcohol/Drug

Use, and Humor. Each dimension includes 4 items scoring between 1 and 4.

The COPE has been used with cardiac patients to assess their efforts in coping with coronary artery bypass surgery [56], to study the association between coping strategies and post-open-heart surgery levels of distress on the one hand and the recovering of functional capacity on the other [57], and to explain patients' attendance at cardiac rehabilitation [58]. The COPE has been translated and validated in different national contexts, including Estonia, Croatia, Germany, France, Spain and Italy [59, 60].

Uncertainty in Illness was assessed through a unidimensional uncertainty construct, recently validated in Italy [61], made up of eighteen items on a five-point Likert scale, between 1 and 5. It is the result of a confirmatory factor analysis performed for each of the four MUIS original dimensions, which validated three out of the four original dimensions: ambiguity (vagueness and indistinctness of the state of illness), inconsistency (contradictory information received) and complexity (cues about the treatment) [62, 63]. Nevertheless, as these dimensions were highly correlated, all their items were used to explain a new single factor called Uncertainty. This unidimensional construct exhibited positive and highly significant standardized regression weights, which can be interpreted as the correlations between the observed variables (the item scores) and the corresponding common construct (Uncertainty). It also showed satisfactory fit indexes, generally used to assess how well the model matches the observed data. The Uncertainty construct groups the great majority of the items encompassed by the three (out of the four) separate dimensions of the MUIS, which has been widely employed to measure the perception of uncertainty in illness in cardiac patients [27, 30, 64, 65].

Health-Related Quality of Life was measured by the EuroQoL-5D (EQ-5D), an extensively used multi-country, multi-attribute, non-disease-specific tool [66]. This short generic quality of life measure was chosen in order to make our results comparable with other studies tackling different chronic diseases.

The EQ-5D is based on five health attributes (mobility, self-care, usual activities, pain/discomfort and anxiety/depression), and each of them is rated according to its perceived level of severity (no problems/some or moderate problems/extreme problems). The individual assessment of the health state under consideration is then expressed by means of an index value, calculated attributing a particular set of weights to the scores of the five health dimensions. The EQ-5D worksheet also includes a Visual Analog Scale (VAS), which asks the respondents to assess their health state using a graduate interval scale: Its maximum value, 100, indicates perfect health, while its lowest value, 0, indicates the worst imaginable health [67].

## Statistical analysis: the bivariate probit model

The probabilities of experiencing anxiety and depression when hospitalized can be estimated using a bivariate probit model (biprobit). This model allows clarifying the causal relationship among the crucial variables that were considered in the analysis. It includes two latent variables,  $y_{n1}$  and  $y_{n2}$ , not directly observable and assumed to be a linear function of a set of explanatory variables, which might be or might not be the same for both of them [68, 69].

The biprobit model has been employed in studies concerning health care for example, in end-stage renal disease patients, to assess their probability of undergoing hemodialysis versus peritoneal dialysis at public or private centres [70], or in maternal care, to estimate the probability of delivering at healthcare facilities and the child probability of survival [71].

The system of equations to be estimated is the following:

$$y_{1i}^* = \beta'_1 x_{1i} + u_{1i} \quad (1)$$

$$y_{2i}^* = \beta'_2 x_{2i} + u_{2i} \quad (2)$$

where  $y_{1i}^*$  and  $y_{2i}^*$  are the latent variables, which, in this case, represent the probability of reporting anxiety and the probability of experiencing depression, respectively.

The coefficients represent the effect of changes in the values of the explanatory variables on these probabilities: In particular, a positive (negative) coefficient means that an increase (decrease) in the value of this variable leads to an increase (decrease) in the predicted probability of the dependent variable.

Two biprobit specifications were estimated.

The first model looked at the probability of crossing the *borderline threshold* of anxiety and depression; the second model estimated the probability of crossing the *pathological threshold* of anxiety and depression. The explanatory variables were the same for each model and related to the information collected through the COPE, MUIS and EQ-5D questionnaires. Other control variables were age and years of illness.

Estimations were carried out using the software package Stata 10.0 [72, 73].

## Results

### Descriptive analysis

Descriptive statistics can be seen in Table 1, which reports the mean scores for the HADS, COPE and MUIS questionnaires contained in the worksheet.

**Table 1** Descriptive statistics

Variable	Mean (or %)	SD	Min	Max
Age	65.77	10.61	19	87
Gender (1 = male; 0 = female)	53 %		0	100 %
Marital status (1 = married; 0 = single)	79 %		0	100 %
Education (1 = higher education; 0 = primary school)	40 %		0	100 %
Years of illness	6.60	7.10	0.8	40
Number of hospital admissions	1.98	2.98	0	15
Number of hospital visits	5.35	6.19	0	48
Assessment of health state before the diagnosis (0–100)	73.05	9.57	50	100
Assessment of health state today (VAS score)	50.71	21.57	0	100
Worse health state comparing to last year	34 %		0	100 %
HADS total score	14.59	5.87	2	33
HADS Anxiety score	6.58	3.17	0	17
HADS Depression score	8.00	3.28	0	18
HADS Anxiety (1 = yes; 0 = no)	0.39	0.49	0	1
HADS Depression (1 = yes; 0 = no)	0.53	0.50	0	1
HADS Pathologic anxiety (1 = yes; 0 = no)	0.10	0.31	0	1
HADS Pathologic depression (1 = yes; 0 = no)	0.24	0.43	0	1
EQ-5D score	0.64	0.22	−0.06	1
MUIS: Uncertainty	53.81	8.65	36	79
COPE: Active Coping	11.11	1.85	6	16
COPE: Planning	9.93	2.50	5	16
COPE: Suppression of Competing Activities	8.79	2.21	4	15
COPE: Restraint Coping	10.22	2.23	5	16
COPE: Seeking social support for instrumental reasons	11.01	2.74	4	16
COPE: Seeking social support for emotional reasons	12.12	2.95	4	16
COPE: Focusing on emotions	11.83	2.19	6	16
COPE: Behavioral disengagement	7.30	1.74	4	13
COPE: Positive Reinterpretation and Growth	10.39	3.16	4	16
COPE: Denial	7.99	2.40	4	16
COPE: Acceptance	13.14	1.72	7	16
COPE: Religion	13.55	2.67	4	16
COPE: Mental disengagement	9.62	2.13	4	16
COPE: Alcohol	4.12	0.65	4	8
COPE: Humor	5.20	2.25	4	16

Patients were on average 66 year old—their age ranging from 19 to 87; 53 % were male and 47 % female; most of them (79 %) were married or lived with someone and 60 % had completed higher education.

Patients had been in a state of illness for a period ranging from 9 months to 40 years (average of 6 years and 7 months). They were asked about their health state before being diagnosed with a chronic disease and, on a scale from 0 to 100, the mean assessment was 73. The subsequent assessment of health state, made through the VAS, on the other hand, showed an average value of 51. Approximately, one-third of the patients (34 %) declared that their health state had worsened during the past year. The average EQ-5D score was 0.64 in a range from −0.06

to 1 (maximum value); only one patient, in the sample, evaluated his/her health state as worse than death (whose corresponding EQ-5D score is 0). These results offer evidence of how the burden of a cardiac chronic illness impacts a patients' self assessment of his/her health-related quality of life.

As for the dependent variables of the analysis, i.e., the presence of anxiety and depression, 39 and 53 % of the patients were, respectively, clinically anxious and depressed, while 10 and 24 % of patients were pathologically anxious and depressed. This is consistent with the literature, which found high incidence rates of anxiety and depression in cardiac patients [22, 23, 26].

## Correlation analysis

The base hypothesis considered is that coping and uncertainty, controlling for quality of life, may have a relevant role in the development of anxiety and depression in hospitalized cardiac patients. Therefore, in order to check which items are significantly correlated with the dependent variables (i.e., the occurrence of anxiety and depression) and to select those ones that may be included as explanatory variables in the econometric analysis, different pairwise correlations were calculated. Specifically, the correlations between each of the four HADS threshold scores, detecting the presence of anxiety and depression at the borderline and pathological level and, respectively, each score referring to all the COPE dimensions, and to the MUIS were estimated. All these correlations are reported in Table 7 in “Appendix”.

Conversely, Table 2 shows only the correlations among the four HADS threshold scores and the variables employed in the biprobit analysis.

The COPE dimensions exhibiting statistically significant correlations with pathological or borderline anxiety and depression were Suppression of Competing Activities, Restraint Coping, Focus on Emotions and Positive Reinterpretation and Growth (Table 7). Restraint Coping and Positive Reinterpretation and Growth were chosen as regressors. As suggested by the literature [55], they may be considered “polar”: The former is a problem-

focused/passive strategy, the latter an emotion-focused/active strategy.

Restraint Coping is a problem-focused coping strategy as it is intended to impact the source of stress, and, at the same time, is a passive coping strategy as the individual waits for the right moment to do something so that he/she does not act. Positive Reinterpretation and Growth is an active coping strategy according to which the individual tries to manage the emotional consequences of the distress rather than dealing with the very source of stress.

As summarized in Table 2, Restraint Coping was inversely correlated with anxiety, be it borderline or pathological, and Positive Reinterpretation and Growth was inversely and significantly correlated with borderline and pathological anxiety and depression. The MUIS score was significantly and positively correlated with borderline anxiety and depression, and with pathological depression. These results are mainly confirmed by the two models tested by the biprobit analysis.

Moreover, age was significantly and inversely correlated with pathological depression. This reinforces its use as a control variable, in line with the literature suggesting that there might be an intrinsic reduction in susceptibility to anxiety and depression with age [74]. Experience in illness showed a negative though not statistically significant correlation with both levels of anxiety and depression. Nevertheless, the absolute magnitude of the correlation coefficient for anxiety and depression at borderline level

**Table 2** Correlations among the variables employed in the estimations

	Anxiety	Depression	Path. anxiety	Path. depression	Age	EQ-5D	Years since diagnosis	MUIS: Uncertainty	COPE: Restraint Coping	COPE: Positive Reinterpreta and Growth
Anxiety	1									
Depression	0.486*	1								
Pathologic anxiety	0.428*	0.290*	1							
Pathologic depression	0.462*	0.529*	0.419*	1						
Age	0.102	−0.117	0.068	−0.143*	1					
EQ-5D	−0.368*	−0.299*	−0.400*	−0.274*	−0.169*	1				
Years since diagnosis	−0.121	−0.119	−0.057	−0.097	0.149*	−0.058	1			
MUIS: Uncertainty	0.234*	0.281*	0.119	0.141*	−0.015	−0.133	−0.024	1		
COPE: Restraint Coping	0.214*	0.009	0.156*	0.059	0.154*	−0.056	−0.011	−0.041	1	
COPE: Positive Reinterpretation and Growth	−0.272*	−0.192*	−0.239*	−0.166*	−0.287*	0.270*	−0.042	−0.041	−0.330*	1

\*  $p < 0.05$

**Table 3** Biprobit model for borderline anxiety and depression

Variables	Borderline anxiety coefficient (SE)	Borderline depression coefficient (SE)
Age	0.003 (0.009)	-0.027** (0.009)
Years of illness	-0.028* (0.013)	-0.025(*) (0.013)
EQ-5D	-2.077** (0.464)	-2.049** (0.461)
MUIS: Uncertainty	0.035** (0.011)	0.039** (0.011)
COPE: Positive Reinterpretation and Growth	-0.064* (0.032)	-0.073* (0.033)
COPE: Restraint Coping	0.114** (0.042)	
Constant	-1.427 (1.199)	2.047* (1.051)

\*\*  $p < 0.01$ ; \*  $p < 0.05$ ; and (\*)  $p < 0.1$

Log pseudolikelihood = -206.042; Wald  $\chi^2$  (11) = 78.62  
Prob >  $\chi^2$  = 0.000

Ath  $\rho = 0.766^{**}$  (0.154);  $\rho = 0.645$  (0.090)

Wald test of  $\rho = 0$ :  $\chi^2$  (1) = 24.71 Prob >  $\chi^2$  = 0.000

The coefficient correlation  $\rho$  (rho) is a nonparametric measure of statistical dependence between two variables. It assesses how well the relationship between two variables can be described using a monotonic function. Higher values of  $\rho$  denote a closer relationship between the variables considered

suggests controlling for this variable as well. The EQ-5D score was significantly and inversely correlated with both anxiety and depression at borderline and pathological levels; the introduction of this variable in the following biprobit analysis allowed taking into account that the severity of patients' chronic cardiac conditions may increase the probability of them suffering from anxiety and depression too, as suggested by the relevant literature

#### *Biprobit analysis: first model*

Results of the first biprobit model, investigating the probability of crossing the borderline threshold of anxiety and depression, is shown in Table 3.

The EQ-5D, MUIS and the Positive Reinterpretation and Growth scores were the regressors considered in both equations. Restraint Coping was included only in the anxiety equation because of the low and nonsignificant correlation between Restraint Coping and depression, be it over the borderline or the pathological level.

While results of the biprobit analysis mainly confirm the findings of the correlation analysis, before commenting such results, it is worth noting that in the biprobit regressions, the interpretation of the coefficients is not as

straightforward as in linear regressions. This is because the increase in probability attributed to a one-unit increase in a given predictor depends both on its starting value and on the values of the other predictors. However, it can be said that a positive (negative) coefficient means that an increase (decrease) in the predictor leads to an increase (decrease) in the predicted probability.

Regarding the control variables, in line with the literature [74], age showed a positive although not significant correlation with anxiety, while it was significantly and inversely correlated with depression. This suggests that older hospitalized patients are generally less depressed than younger ones; this may be related with a higher acceptance of the deteriorated health conditions due to the illness state, as being older entails having as a reference group people with generally worse health conditions [75]. Consistent with this finding, the EQ-5D score was inversely correlated with both anxiety and depression, which may be envisaged as a reaction to a perceived deterioration in quality of life.<sup>1</sup> This is coherent with the evidence of the casual link offered by the relevant literature which goes from worst health conditions to anxiety and depression in chronic patients [22, 23].

Years of illness (time elapsed since the diagnosis) were inversely correlated with anxiety and, weakly, with depression: These results are consistent with the effect of the age variable. The more the years of illness, the more the patients get used to the chronic illness condition and become able to keep anxiety and depression under control during hospitalization. Moreover, this is also congruent with the extant literature claiming that the illness duration increases the knowledge of illness [76] and reduces uncertainty in illness which, as it will be shown, impacts positively on the reduction in both anxiety and depression. As regards to the crucial variables in our analysis, all the estimated coefficients were significant and confirmed the original hypothesis on uncertainty and coping.

Uncertainty was positively correlated with both the dependent variables, which were equally affected by it. This highlights how uncertainty during hospitalization negatively impacts patients' well-being, and calls for an adequate psychological assistance in this delicate acute phase of illness. For example, behavior therapy might be helpful for people manifesting anxiety, although this issue has not been frequently investigated in hospital care [77].

The negative sign of Positive Reinterpretation and Growth is in line with the cited literature [55], according to

<sup>1</sup> The strongest effect on the probability of reporting both anxiety and depression (or neither of them) might appear to result from the variable EQ-5D. However, this is due to the fact that the EQ-5D has a numerically small range from -0.06 to 1 while other variables, such as health uncertainty (MUIS), have, by definition, a much larger range.

which this coping style should be negatively correlated with both anxiety and depression, as it implies making the best of the situation and growing from it. This suggests that those patients who succeed in recognizing the positive aspects in an adverse situation report lower levels of anxiety and depression. On the other hand, Restraint Coping was positively related to anxiety. Restraint Coping is the attitude of coping passively by holding back one's coping attempts until they can be of use; hence, the patient elaborates his/her own coping strategies and then waits before using them, although waiting for the "right moment" to put such strategies in practice may increase the probability of reporting anxiety.

The biprobit analysis also allowed to calculate the marginal effects (see Table 4), which quantifies the effects of a unitary variation in each explanatory variable on the probability of experiencing both anxiety and depression; to report neither anxiety nor depression; to report anxiety but not depression; and to report depression but not anxiety.<sup>2</sup> Marginal effects reinforce the considerations made above on the determinants of anxiety and depression.

Within the four probabilities that were estimated,<sup>3</sup> the probability of reporting both anxiety and depression was 30.2 %. Each year elapsed from the diagnosis had the effect of lowering such probability by 1 %. Experience allows patients to better control and to understand the illness experience. In line with this result, a unitary positive increase in the uncertainty score increased the probability of reporting both anxiety and depression by 1.3 %.

An increase in the EQ-5D score had the effect of lowering the probability of reporting both anxiety and depression by a marginal value of 76.2 %, while coping strategies had an impact of -2.5 % (Positive Reinterpretation and Growth) and 2.8 % (Restraint Coping).

Considering the marginal effects of all the probabilities estimated, the highest value was obtained for the no anxiety/no depression circumstance, which means that a large number of the patients to whom the questionnaire was administered, about 39 % of the people interviewed, were non-cases.

Results show that being one year older increases the probability of reporting no anxiety and depression in

hospital by 0.7 %. The importance of health-related quality of life is confirmed by the evidence of an increase in the EQ-5D score, entailing a rise of 83.2 % in the joint probability of reporting no anxiety and no depression.

Each year of illness raises the joint probability of no anxiety/no depression by 10 %. A unitary reduction of the Uncertainty score lowers the joint probability of experiencing both anxiety/depression by 1.5 %, while coping strategies have an impact of 2.9 % (Positive Reinterpretation and Growth) and -1.4 % (Restraint Coping), respectively. Finally, the probabilities of reporting depression/no anxiety and anxiety/no depression were 24.2 and 6.6 %, respectively.

#### *Biprobit analysis: second model*

Table 5 shows the results of the second biprobit model which employed, as dependent variables, the probability of experiencing anxiety and depression at pathological levels.

Some explanatory variables, such as the years of illness, were not significant anymore, while Restraint Coping and Positive Reinterpretation and Growth were less significant than in first equation.

The fact that experience does not matter anymore when pathological specifications are considered suggests that when anxiety and depression are pathological, their upsurge is unlikely to represent a side effect of the hospitalization episode related to the cardiac illness, which can be better dealt with by the more experienced patients. This result is in line with the evidence that uncertainty loses significance when pathological states are considered. It might be concluded that although HADS has been designed to measure anxiety and depression during patients' hospital stay, when these states reach pathological levels, they have to be considered a major pathology, not explained through the uncertainty related to the contingency of the inpatient episode.

This line of reasoning helps to interpret the circumstance that the statistical significance relative to the EQ-5D coefficients is confirmed for both pathological anxiety and depression: In fact, these pathological states are not reactions to the hospitalization episode, but to a perceived deterioration in quality of life, be it stable or progressive. The negative significant coefficient estimated for age, in this specification, also reinforces the evidence that the younger the patients, the more prone they are to depression.

Marginal effects of the second specification of the analysis are shown in Table 6.

The four aforementioned joint probabilities that were estimated support the interpretation that anxiety and depression at pathological levels are mainly unrelated to hospitalization. The joint probability of reporting both pathological anxiety and pathological depression was only

<sup>2</sup> The marginal effects show the impact of the unit change of each covariate on the probability of reporting the outcome considered: for example, a unit change in the MUIS score (i.e. in the uncertainty measured with the MUIS scale) determines a higher probability of reporting both anxiety and depression (+1.3 in percentage terms). A unit change in the score for COPE positive interpretation item leads to a decrease in the probability of reporting anxiety and depression (-2.8 %).

<sup>3</sup> These are: the probability of experiencing anxiety and depression, only anxiety, only depression, no anxiety and no depression.



**Table 4** Marginal effects for borderline anxiety and depression

Variables	Anxiety: yes Depression: yes (SE) Probability = 0.302	Anxiety: no Depression: no (SE) Probability = 0.390	Anxiety: no Depression: yes (SE) Probability = 0.242	Anxiety: yes Depression: no (SE) Probability = 0.066
Age	−0.002 (0.002)	0.007* (0.003)	−0.008** (0.002)	0.003* (0.001)
Years of illness	−0.010* (0.004)	0.010* (0.004)	0.0001 (0.004)	−0.001 (0.001)
EQ-5D	−0.762** (0.151)	0.832** (0.163)	−0.049 (0.138)	−0.020 (0.063)
MUIS: Uncertainty	0.013** (0.003)	−0.015** (0.004)	0.002 (0.003)	−0.000 (0.001)
COPE: Positive Reinterpretation and Growth	−0.025* (0.010)	0.029* (0.011)	−0.004 (0.010)	0.000 (0.004)
COPE: Restraint Coping	0.028** (0.010)	−0.014* (0.005)	−0.029** (0.010)	0.014* (0.005)

\*\*  $p < 0.01$ ; \*  $p < 0.05$ ; and (\*)  $p < 0.1$

**Table 5** Biprobit model for pathological anxiety and depression

Variables	Pathological anxiety coefficient (SE)	Pathological depression coefficient (SE)
Age	0.008 (0.013)	−0.033** (0.009)
Years of illness	−0.021 (0.021)	−0.022 (0.016)
EQ-5D	−2.456** (0.515)	−1.604** (0.476)
MUIS: Uncertainty	0.032(*) (0.018)	0.019 (0.012)
COPE: Positive Reinterpretation and Growth	−0.091* (0.046)	−0.092** (0.012)
COPE: Restraint Coping	0.107(*) (0.042)	
Constant	−1.843 (1.748)	2.462* (1.041)

\*\*  $p < 0.01$ ; \*  $p < 0.05$ ; (\*)  $p < 0.1$

Log pseudolikelihood = 134.549; Wald  $\chi^2$  (11) = 57.89 Prob >  $\chi^2$  = 0.000

Ath  $\rho = 0.803^*$  (0.154);  $\rho = 0.666$  (0.090)

Wald test of  $\rho = 0$ :  $\chi^2$  (1) = 13.17 Prob >  $\chi^2$  = 0.003

The coefficient correlation  $\rho$  (rho) is a nonparametric measure of statistical dependence between two variables. It assesses how well the relationship between two variables can be described using a monotonic function. Higher values of  $\rho$  denote a closer relationship between the variables considered

3.7 %, while the highest joint probability was obtained for the no pathological anxiety/no pathological depression circumstance, approximately 78 %. The probabilities of reporting pathological depression/no pathological anxiety

and pathological anxiety/no pathological depression were, respectively, 1.7 and 1.2 %. While the marginal effects were consistent with the findings of the first model, they were generally weaker.

**Table 6** Marginal effects for pathological anxiety and depression

Variables	Path. anxiety: yes Path. Depr.: yes (SE) Probability = 0.037	Path. anxiety: no Path. Depr.: no (SE) Probability = 0.782	Path. anxiety: no Path. Depr.: yes (SE) Probability = 0.169	Path. anxiety: yes Path. Depr.: no (SE) Probability = 0.012
Age	−0.0005 (0.001)	0.009** (0.003)	−0.008** (0.002)	0.001 (0.000)
Years of illness	−0.002 (0.001)	0.007 (0.005)	−0.004 (0.004)	−0.000 (0.001)
EQ-5D	−0.192** (0.054)	0.513** (0.140)	−0.265** (0.122)	−0.056 (0.038)
MUIS: Uncertainty	0.002(*) (0.001)	−0.006(*) (0.003)	0.003 (0.002)	0.000(*) (0.000)
COPE: Positive Reinterpretation and Growth	−0.008** (0.003)	0.027** (0.010)	−0.018* (0.008)	−0.001 (0.001)
COPE: Restraint Coping	0.007(*) (0.004)	−0.004 (0.003)	−0.007(*) (0.003)	0.004* (0.003)

\*\*  $p < 0.01$ ; \*  $p < 0.05$ ; (\*)  $p < 0.1$

## Conclusions

This study, which deals with anxiety and depression in hospitalized patients, offers a contribution to the literature on the health burden of chronic cardiac patients and the psychological consequences of their illness, widely known to impact on health-related quality of life [19].

Through controlling for the patients' self-assessed quality of life, age and experience of illness, it investigates the impact of uncertainty in illness and coping strategies on the levels of anxiety and depression recorded during hospitalization.

Two bivariate probit models were estimated. Results showed that uncertainty in illness impacted on the probability of crossing the borderline level of both anxiety and depression but not on the probability of developing pathological anxiety and depression. Coping styles matter in the development of anxiety and depression too: A coping strategy based on Positive Reinterpretation and Growth was inversely related to both anxiety and depression, while Restraint Coping was positively related to anxiety.

The added value of the present study lies in the fact that it is the first to consider the concurrent impact of uncertainty and coping styles on the development of anxiety and depression in cardiac patients. A further novelty consists in the distinction between borderline and pathological levels of anxiety and depression. The former psychological states are contingent to the hospitalization episode and, hence, *can* and *must* be controlled in the delivery of hospital care; the latter are major pathologies and must be clinically treated as such.

A feasible approach aimed at reducing the patients' risk of crossing the borderline threshold for anxiety and depression could consist in providing high-quality information to patients. This should be done, not only during the hospitalization period, but within a global patient care management system, encompassing a tight interaction among clinicians of different specialties: Patients should receive not only better clinical integrated treatments, but also clearer and more consistent pieces of information. In line with the extant literature results [78], a better communication strategy, between clinical staff and patients, should be encouraged to let patients manifest their doubts and boost their active role in defining and personalizing their treatment, together with the physicians.

The need of a patient-centered care approach should be also advocated in helping patients to develop a positive coping style. The risk of indulging in Restraint Coping, which negatively affects anxiety and depression, would also be reduced, while, on the other hand, a Positive Reinterpretation and Growth coping strategy, which has an impact on reducing anxiety, would be encouraged.

These considerations are in line with the objectives sketched in the recent Italian National Health Plan (*Piano Sanitario Nazionale 2011–2013*) which stresses the need for more effective health services planning and calls for the design of specific assistance paths through which the care of the patient is followed over time, and the various stages of patient's transition between the various healthcare settings (hospital, long-term care structures, rehabilitation structures, etc.) are monitored [79]. The same approach is suggested at a European level too [80, 81].

The most significant limitation of the present contribution lies on the limited number of observations. For this reason, a development of the analysis should envisage the use of a larger sample of cardiac patients. In addition, the application of the same methodology could also be adopted for patients experiencing diverse chronic diseases, and in a broader perspective, it could be used to evaluate the experience of patients' relatives and caregivers.

Another limitation of this study lies in its cross-sectional nature, which suggests caution in advocating the existence of a casual relation between uncertainty in illness/coping strategies—the main explanatory variables included in the analysis—and anxiety/depression. Rather, this research should be seen as a first step toward a longitudinal analysis that would make its conclusions more robust. The study of a patients cohort allowing the collection of repeated observations not only would give strength to the results, but also would also track the evolution of anxiety and depression during the diverse stages of the chronic disease and would allow to highlight the aspects that need to be taken into account when planning an effective assistance aimed at reducing anxiety and depression both in the short and long run. It would also be interesting to distinguish between patients who are hospitalized for the first time due to their conditions and those who have already experienced a readmission, controlling for the disease stage. Such a

comprehensive analysis would allow to form a clear picture of the impact of illness on psychological states and of its indirect costs. In fact, although these costs represent the highest expenses in health care, their measurement is often neglected in economic evaluation studies on patients' quality of life.

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#### **Compliance with ethical standards**

**Conflict of interest** The authors declare that there are no conflicts of interest.

**Human and animal rights** All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

**Informed consent** Patients were asked to give their informed consent to the interview and the questionnaire administration for data collection.

## **Appendix**

See Table 7.

**Table 7** Correlations among anxiety, depression and all MUIS and COPE dimensions

	HADS: Anxiety	HADS: Depression	Pathologic anxiety	Pathologic depression	MUIS: Uncertainty	COPE: Active coping	COPE: Planning	COPE: Suppression of competing activities	COPE: Restraint Coping	COPE: Seeking social support for instrumental reasons	COPE: Seeking social support for emotional reasons
HADS: Anxiety	1										
HADS: Depression	0.486*	1									
HADS: Pathologic anxiety	0.428*	0.290*	1								
HADS: Pathologic depression	0.463*	0.529*	0.419*	1							
MUIS: Uncertainty	0.234*	0.281*	0.119	0.141*	1						
COPE: Active coping	0.072	-0.142*	-0.004	-0.067	-0.181*	1					
COPE: Planning	0.099	0.016	0.068	0.024	-0.139	0.579*	1				
COPE: Suppression of competing activities	0.160*	0.024	0.01	0.117	-0.004	0.377*	0.632*	1			
COPE: Restraint Coping	0.214*	0.010	0.156*	0.059	-0.040	0.519*	0.644*	0.570*	1		
COPE: Seeking instr. social support	0.029	-0.009	-0.085	0.074	0.064	0.157*	0.225*	0.273*	0.150*	1	
COPE: Seeking emotional social support	0.044	-0.006	-0.103	0.084	-0.002	0.172	0.157*	0.246*	0.205*	0.807*	1
COPE: Focus on and venting of Emotions	0.276*	0.199*	0.026	0.171*	0.114	0.121	0.150*	0.254*	0.272*	0.453*	0.512*
COPE: Behavioral disengagement	0.116	0.099	0.185*	0.173*	0.316*	-0.189*	-0.156*	0.043	0.036	0.004	0.020
COPE: Positive Reinterpretion and Growth	-0.272*	-0.192*	-0.239*	-0.166*	-0.041	-0.211*	-0.236*	-0.331*	-0.330*	0.242*	0.153*
COPE: Denial	-0.054	0.036	-0.061	0.006	0.254*	-0.298*	-0.412*	-0.241*	-0.275*	0.028	0.065

Table 7 continued

COPE: Acceptance	0.099	-0.06	0.028	0.027	-0.204*	0.407*	0.446*	0.182*	0.334*	0.120	0.084	
COPE: Religion	0.071	-0.089	0.039	0.085	-0.074	0.254*	0.287*	0.246*	0.253*	0.352*	0.401*	
COPE: Mental disengagement	-0.042	0.055	-0.116	-0.066	0.124	-0.297*	-0.136	-0.080	-0.124	0.278*	0.252*	
COPE: Alcohol/Drug Use	0.099	0.120	0.060	0.090	0.056	-0.159*	-0.091	0.011	-0.033	-0.103	-0.079	
COPE: Humor	-0.093	-0.13	-0.088	-0.133	-0.035	0.038	0.202*	0.124	0.037	0.319*	0.188*	
	COPE: Focus on and venting of Emotions		COPE: Behavioral disengagement		COPE: Positive Reinterpretation and Growth		COPE: Denial		COPE: Religion		COPE: Seeking social support for instrumental reasons	
	COPE: Focus on and venting of Emotions		COPE: Behavioral disengagement		COPE: Positive Reinterpretation and Growth		COPE: Denial		COPE: Religion		COPE: Seeking social support for instrumental reasons	
HADS: Anxiety												
HADS: Depression												
HADS: Pathologic anxiety												
HADS: Pathologic depression												
MUIS: Uncertainty												
COPE: Active coping												
COPE: Planning												
COPE: Suppression of competing activities												
COPE: Restraint Coping												
COPE: Seeking instr. social support												
COPE: Seeking emotional social support												
COPE: Focus on and venting of Emotions	1											
COPE: Behavioral disengagement	0.031			1								
COPE: Positive Reinterpretation and Growth	-0.138			0.023			1					
COPE: Denial	-0.030			0.395*			0.408*	1				
COPE: Acceptance	0.087			-0.307*			-0.043	-0.273*	1			
COPE: Religion	0.247*			-0.140*			0.048	-0.061	0.188*	1		

Table 7 continued

	COPE: Focus on and venting of Emotions	COPE: Behavioral disengagement	COPE: Positive Reinterpretation and Growth	COPE: Denial	COPE: Acceptance	COPE: Religion	COPE: Mental disengagement	COPE: Alcohol	COPE: Humor
COPE: Mental disengagement	0.084	0.117	0.294*	0.383*	-0.068	0.069	1		
COPE: Alcohol/Drug Use	0.046	0.145*	-0.164*	0.036	-0.124	-0.060	0.030	1	
COPE: Humor	-0.059	0.103	0.504*	0.229*	0.089	0.156*	0.347*	-0.027	1

\* Significant at 95 %

## References

- Moussavi, S., Chatterji, S., Verdes, E., Tandon, A., Patel, V., & Ustun, B. (2007). Depression, chronic diseases, and decrements in health: results from the World Health Surveys. *The Lancet*, 370(9590), 851–858.
- Miceli, M., & Castelfranchi, C. (2005). Anxiety as an “epistemic” emotion: An uncertainty theory of anxiety. *Anxiety, Stress, and Coping*, 18(4), 291–319.
- Katon, W., Lin, E. H., & Kroenke, K. (2007). The association of depression and anxiety with medical symptom burden in patients with chronic medical illness. *General Hospital Psychiatry*, 29(2), 147–155.
- Scott, K. M., Hwang, I., Chiu, W. T., Kessler, R. C., Sampson, N. A., Angermeyer, M., et al. (2010). Chronic physical conditions and their association with first onset of suicidal behavior in the world mental health surveys. *Psychosomatic Medicine*, 72(7), 712–719.
- de Voogd, J. N., Sanderman, R., Postema, K., van Sonderen, E., & Wempe, J. B. (2011). Relationship between anxiety and dyspnea on exertion in patients with chronic obstructive pulmonary disease. *Anxiety, Stress & Coping*, 24(4), 439–449.
- McInnis, O. A., Matheson, K., & Anisman, H. (2014). Living with the unexplained: coping, distress, and depression among women with chronic fatigue syndrome and/or fibromyalgia compared to an autoimmune disorder. *Anxiety, Stress, & Coping*, 27(6), 601–618.
- Barefoot, J. C., & Schroll, M. (1996). Symptoms of depression, acute myocardial infarction, and total mortality in a community sample. *Circulation*, 93(11), 1976–1980.
- Rosengren, A., Hawken, S., Ôunpuu, S., Sliwa, K., Zubaid, M., Almahmeed, W. A., & INTERHEART investigators. (2004). Association of psychosocial risk factors with risk of acute myocardial infarction in 11,119 cases and 13,648 controls from 52 countries (the INTERHEART study): case-control study. *The Lancet*, 364(9438), 953–962.
- Januzzi, J. L., Stern, T. A., Pasternak, R. C., & De Sanctis, R. W. (2000). The influence of anxiety and depression on outcomes of patients with coronary artery disease. *Archives of Internal Medicine*, 160(13), 1913–1921.
- Scherer, M., Himmel, W., Stanske, B., Scherer, F., Koschack, J., Kochen, M. M., & Herrmann-Lingen, C. (2007). Psychological distress in primary care patients with heart failure: A longitudinal study. *British Journal of General Practice*, 57(543), 801–807.
- Yohannes, A. M., Willgoss, T. G., Baldwin, R. C., & Connolly, M. J. (2010). Depression and anxiety in chronic heart failure and chronic obstructive pulmonary disease: prevalence, relevance, clinical implications and management principles. *International Journal of Geriatric Psychiatry*, 25(12), 1209–1221.
- Mayou, R. A., Gill, D., Thompson, D. R., Day, A., Hicks, N., Volmink, J., & Neil, A. (2000). Depression and anxiety as predictors of outcome after myocardial infarction. *Psychosomatic Medicine*, 62(2), 212–219.
- Frasure-Smith, N., Lespérance, F., & Talajic, M. (1995). Depression and 18-month prognosis after myocardial infarction. *Circulation*, 91(4), 999–1005.
- Frasure-Smith, N., & Lesperance, F. (2008). Depression and anxiety as predictors of 2-year cardiac events in patients with stable coronary artery disease. *Archives of General Psychiatry*, 65(1), 62–71.
- Carney, R. M., Saunders, R. D., Freedland, K. E., Stein, P., Rich, M. W., & Jaffe, A. S. (1995). Association of depression with reduced heart rate variability in coronary artery disease. *The American Journal of Cardiology*, 76(8), 562–564.

16. Grewal, K., Gravely-Witte, S., Stewart, D. E., & Grace, S. L. (2011). A simultaneous test of the relationship between identified psychosocial risk factors and recurrent events in coronary artery disease patients. *Anxiety, Stress & Coping*, 24(4), 463–475.
17. Nekouei, Z. K., Yousefy, A., Doost, H. T. N., Manshaee, G., & Sadeghei, M. (2014). Structural Model of psychological risk and protective factors affecting on quality of life in patients with coronary heart disease: A psychocardiology model. *Journal of Research in Medical Sciences: The Official Journal of Isfahan University of Medical Sciences*, 19(2), 90.
18. McCabe, P. J. (2010). Psychological distress in patients diagnosed with atrial fibrillation: the state of the science. *Journal of Cardiovascular Nursing*, 25(1), 40–51.
19. Ekici, B., Ercan, E. A., Cehreli, S., & Töre, H. F. (2013). The effect of emotional status and health-related quality of life on the severity of coronary artery disease. *Kardiologia Polska*, 72(7), 617–623.
20. Kop, W. J. (1997). Acute and chronic psychological risk factors for coronary syndromes: Moderating effects of coronary artery disease severity. *Journal of Psychosomatic Research*, 43(2), 167–181.
21. Kop, W. J. (1999). Chronic and acute psychological risk factors for clinical manifestations of coronary artery disease. *Psychosomatic Medicine*, 61(4), 476–487.
22. Koenig, H. G. (2006). Differences between depressed patients with heart failure and those with pulmonary disease. *The American Journal of Geriatric Psychiatry*, 14(3), 211–219.
23. Haworth, J. E., Moniz-Cook, E., Clark, A. L., Wang, M., Waddington, R., & Cleland, J. G. F. (2005). Prevalence and predictors of anxiety and depression in a sample of chronic heart failure patients with left ventricular systolic dysfunction. *European Journal of Heart Failure*, 7(5), 803–808.
24. Fielding, R. (1991). Depression and acute myocardial infarction: A review and reinterpretation. *Social Science and Medicine*, 32(9), 1017–1027.
25. Taylor-Clift, A., Hobfoll, S. E., Gerhart, J. I., Richardson, D., Calvin, J. E., & Powell, L. H. (2015). Posttraumatic stress and depression: Potential pathways to disease burden among heart failure patients. *Anxiety, Stress, & Coping*, (ahead-of-print), 1–14.
26. Hocaoglu, C., Yeloglu, C. H., & Polat, S. (2011). Cardiac diseases and anxiety disorders, anxiety and related disorders. In A. Szirmai (Ed.), ISBN: 978-953-307-254-8, In Tech. <http://www.intechopen.com/books/anxiety-and-related-disorders/cardiac-diseases-and-anxiety-disorders>. Accessed 25 October 2015.
27. Winters, C. A. (1999). Heart failure: Living with uncertainty. *Progress in Cardiovascular Nursing*, 14(3), 85.
28. Lazarus, R. S., & Folkman, S. (1984). *Stress appraisal and coping*. New York: Springer.
29. Hilton, B. A. (1989). The relationship of uncertainty, control, commitment, and threat of recurrence to coping strategies used by women diagnosed with breast cancer. *Journal of Behavioral Medicine*, 12(1), 39–54.
30. Christman, N. J., McConnell, E. A., Pfeiffer, C., Webster, K. K., Schmitt, M., & Ries, J. (1988). Uncertainty, coping, and distress following myocardial infarction: Transition from hospital to home. *Research in Nursing & Health*, 11(2), 71–82.
31. Christman, N. J. (1990). Uncertainty and adjustment during radiotherapy. *Nursing Research*, 39(1), 17–20.
32. Mishel, M. H., & Sorenson, D. S. (1991). Uncertainty in gynecological cancer: A test of the mediating functions of mastery and coping. *Nursing Research*, 40(3), 167–171.
33. Pérez-García, A. M., Oliván, S., & Bover, R. (2014). Subjective well-being in heart failure patients: Influence of coping and depressive symptoms. *International Journal of Behavioral Medicine*, 21(2), 258–265.
34. Holahan, C. J., Moos, R. H., Holahan, C. K., & Brennan, P. L. (1995). Social support, coping, and depressive symptoms in a late-middle-aged sample of patients reporting cardiac illness. *Health Psychology*, 14(2), 152.
35. Kang, Y. (2006). Effect of uncertainty on depression in patients with newly diagnosed atrial fibrillation. *Progress in Cardiovascular Nursing*, 21(2), 83–88.
36. Del Rosso, A., Mikhaylova, S., Baccini, M., Lupi, I., Maticci Cerinic, M., & Maddali Bonghi, S. (2013). In systemic sclerosis, anxiety and depression assessed by hospital anxiety depression scale are independently associated with disability and psychological factors. *BioMed Research International*. doi:10.1155/2013/507493
37. Mullins, L. L., Chaney, J. M., Balderson, B., & Hommel, K. A. (2000). The relationship of illness uncertainty, illness intrusiveness, and asthma severity to depression in young adults with long-standing asthma. *International Journal of Rehabilitation and Health*, 5(3), 177–186.
38. Lynch, S. G., Kroencke, D. C., & Denney, D. R. (2001). The relationship between disability and depression in multiple sclerosis: The role of uncertainty, coping, and hope. *Multiple Sclerosis*, 7(6), 411–416.
39. Jiang, X., & He, G. (2012). Effects of an uncertainty management intervention on uncertainty, anxiety, depression, and quality of life of chronic obstructive pulmonary disease outpatients. *Research in Nursing & Health*, 35(4), 409–418.
40. Mykletun, A., Stordal, E., & Dahl, A. A. (2001). Hospital Anxiety and Depression (HAD) scale: Factor structure, item analyses and internal consistency in a large population. *The British Journal of Psychiatry*, 179(6), 540–544.
41. Herrmann, C. (1997). International experiences with the Hospital Anxiety and Depression Scale—a review of validation data and clinical results. *Journal of Psychosomatic Research*, 42(1), 17–41.
42. Bjelland, I., Dahl, A. A., Haug, T. T., & Neckelmann, D. (2002). The validity of the Hospital Anxiety and Depression Scale: An updated literature review. *Journal of Psychosomatic Research*, 52(2), 69–77.
43. Costantini, M., Musso, M., Viterbori, P., Bonci, F., Del Mastro, L., Garrone, o, et al. (1999). Detecting psychological distress in cancer patients: Validity of the Italian version of the Hospital Anxiety and Depression Scale. *Supportive Care in Cancer*, 7(3), 121–127.
44. Vedana, L., Baiardi, P., Sommaruga, M., Galli, M., Neri, M., Pedretti, R. F., et al. (2002). Clinical validation of an anxiety and depression screening test for intensive in-hospital rehabilitation. *Monaldi Archives Chest Disease*, 58(2), 101–106.
45. Iani, L., Lauriola, M., & Costantini, M. (2014). A confirmatory bifactor analysis of the hospital anxiety and depression scale in an Italian community sample. *Health and Quality of Life Outcomes*, 12(1), 1–8.
46. Bass, C., Chambers, J. B., Kiff, P. J., Cooper, D., & Gardner, W. N. (1988). Panic anxiety and hyperventilation in patients with chest pain: A controlled study. *Quarterly Journal of Medicine*, 69(3), 949–959.
47. Goodacre, S., & Nicholl, J. (2004). A randomised controlled trial to measure the effect of chest pain unit care upon anxiety, depression, and health-related quality of life [ISRCTN85078221]. *Health and Quality of Life Outcomes*, 2(1), 39.
48. Bambauer, K. Z., Locke, S. E., Aupont, O., Mullan, M. G., & McLaughlin, T. J. (2005). Using the Hospital Anxiety and Depression Scale to screen for depression in cardiac patients. *General Hospital Psychiatry*, 27(4), 275–284.
49. Kuijpers, P. M., Denollet, J., Wellens, H. J., Crijns, H. M., & Honig, A. (2007). Noncardiac chest pain in the emergency department: the role of cardiac history, anxiety or depression and

- Type D personality. *European Journal of Cardiovascular Prevention & Rehabilitation*, 14(2), 273–279.
50. Bauer, L. K., Caro, M. A., Beach, S. R., Mastroiuro, C. A., Lenihan, E., Januzzi, J. L., & Huffman, J. C. (2012). Effects of depression and anxiety improvement on adherence to medication and health behaviors in recently hospitalized cardiac patients. *The American Journal of Cardiology*, 109(9), 1266–1271.
  51. Zigmond, A. S., & Snaith, R. P. (1983). The hospital anxiety and depression scale. *Acta Psychiatrica Scand.*, 67(6), 361–370.
  52. Hopwood, P., Howell, A., & Maguire, P. (1991). Screening for psychiatric morbidity in patients with advanced breast cancer: Validation of two self-report questionnaires. *British Journal of Cancer*, 64(2), 353.
  53. Le Fevre, P., Devereux, J., Smith, S., Lawrie, S. M., & Cornbleet, M. (1999). Screening for psychiatric illness in the palliative care inpatient setting: A comparison between the Hospital Anxiety and Depression Scale and the General Health Questionnaire-12. *Palliative Medicine*, 13(5), 399–407.
  54. Dowson, C., Laing, R., Barraclough, R., Town, I., Mulder, R., Norris, K., & Drennan, C. (2001). The use of the Hospital Anxiety and Depression Scale (HADS) in patients with chronic obstructive pulmonary disease: A pilot study. *The New Zealand Medical Journal*, 114(1141), 447–449.
  55. Carver, C. S., Scheier, M. F., & Weintraub, J. K. (1989). Assessing coping strategies: A theoretically based approach. *Journal of Personality and Social Psychology*, 56(2), 267.
  56. Scheier, M. F., Matthews, K. A., Owens, J. F., Magovern, G. J., Lefebvre, R. C., Abbott, R. A., & Carver, C. S. (1989). Dispositional optimism and recovery from coronary artery bypass surgery: The beneficial effects on physical and psychological well-being. *Journal of Personality and Social Psychology*, 57(6), 1024.
  57. Ben-Zur, H., Rappaport, B., Ammar, R., & Uretzky, G. (2000). Coping strategies, life style changes, and pessimism after open-heart surgery. *Health & Social Work*, 25(3), 201–209.
  58. Whitmarsh, A., Koutantji, M., & Sidell, K. (2003). Illness perceptions, mood and coping in predicting attendance at cardiac rehabilitation. *British Journal of Health Psychology*, 8(2), 209–221.
  59. Sica, C., Novara, C., Dorz, S., & Sanavio, E. (1997). Coping strategies: Evidence for cross-cultural differences? A preliminary study with the Italian version of coping orientations to problems experienced (COPE). *Personality and Individual Differences*, 23(6), 1025–1029.
  60. Sica, C., Magni, C., Ghisi, M., Altoè, G., Sighinolfi, C., Chiri, L. R., & Franceschini, S. (2008). Coping Orientation to Problems Experienced-Nuova Versione Italiana (COPE-NVI): Uno strumento per la misura degli stili di coping. *Psicoterapia Cognitiva e Comportamentale*, 14(1), 27.
  61. Giammanco, M. D., Gitto, L., Barberis, N., & Santoro, D. (2015). Adaptation of the Mishel Uncertainty of Illness Scale (MUIS) for chronic patients in Italy. *Journal of Evaluation in Clinical Practice*, 21(4), 649–655.
  62. Mishel, M. H. (1981). The measurement of uncertainty in illness. *Nursing Research*, 30(5), 258–263.
  63. Mishel, M. H. (1997). *Uncertainty in illness scales manual. Unpublished manual*. Chapel Hill, NC: University of North Carolina.
  64. Staples, P., & Jeffrey, J. (1996). Quality of life, hope, and uncertainty of cardiac patients and their spouses before coronary artery bypass surgery. *Canadian Journal of Cardiovascular = Journal canadien en soins infirmiers cardio-vasculaires*, 8(1), 7–16.
  65. Carroll, S. L., & Arthur, H. M. (2010). A comparative study of uncertainty, optimism and anxiety in patients receiving their first implantable defibrillator for primary or secondary prevention of sudden cardiac death. *International Journal of Nursing Studies*, 47(7), 836–845.
  66. Brooks, R., & Group, E. (1996). EuroQol: The current state of play. *Health Policy*, 37(1), 53–72.
  67. Parkin, D., Rice, N., Jacoby, A., & Doughty, J. (2004). Use of a visual analogue scale in a daily patient diary: Modelling cross-sectional time-series data on health-related quality of life. *Social Science and Medicine*, 59(2), 351–360.
  68. Heckman, J. (1978). Dummy endogenous variables in a simultaneous equation system. *Econometrica*, 46(4), 931–959.
  69. Maddala, G. S. (1986). *Limited-dependent and qualitative variables in econometrics (No. 3)*. Cambridge: Cambridge University Press.
  70. Gitto, L., Santoro, D., & Sobbrino, G. (2006). Choice of dialysis treatment and type of medical unit (private vs public): Application of a recursive bivariate probit. *Health Economics*, 15(11), 1251–1256.
  71. Habibov, N., & Fan, L. (2014). The effect of maternal healthcare on the probability of child survival in Azerbaijan. *Biomed Research International*, 2014, 317052. doi:10.1155/2014/317052.
  72. StataCorp. (2007). *Stata statistical software: Release 10*. College Station, TX: StataCorp LP.
  73. Hardin, J. W. (1996). Bivariate probit models. *Stata Technical Bulletin* 33, 15–20. Reprinted in *Stata Technical Bulletin Reprints*, vol. 6, pp. 152–158. College Station, TX: Stata Press.
  74. Jorm, A. F. (2000). Does old age reduce the risk of anxiety and depression? A review of epidemiological studies across the adult life span. *Psychological Medicine*, 30(01), 11–22.
  75. Groot, W. (2000). Adaptation and scale of reference bias in self-assessments of quality of life. *Journal of Health Economics*, 19(3), 403–420.
  76. Menzel, P., Dolan, P., Richardson, J., & Olsen, J. A. (2002). The role of adaptation to disability and disease in health state valuation: a preliminary normative analysis. *Social Science and Medicine*, 55(12), 2149–2158.
  77. Tyrer, P., Cooper, S., Salkovskis, P., Tyrer, H., Crawford, M., Byford, S., et al. (2014). Clinical and cost-effectiveness of cognitive behaviour therapy for health anxiety in medical patients: a multicentre randomised controlled trial. *The Lancet*, 383(9913), 219–225.
  78. Van der Zee, K. I., Huet, R. G., Cazemier, C., & Evers, K. (2002). The influence of the premedication consult and preparatory information about anesthesia on anxiety among patients undergoing cardiac surgery. *Anxiety, Stress & Coping*, 15(2), 123–133.
  79. Ministero della Salute, Piano Sanitario Nazionale 2011–2013, Jan 21st, 2011. [http://www.salute.gov.it/portale/documentazione/p6\\_2\\_2\\_1.jsp?lingua=italiano&id=1454](http://www.salute.gov.it/portale/documentazione/p6_2_2_1.jsp?lingua=italiano&id=1454).
  80. Thorne, B., & Lambers, E. (1999). *Person-centred therapy. A European perspective*. Thousand Oaks: Sage Publications.
  81. Ekman, I., Swedberg, K., Taft, C., Lindseth, A., Norberg, A., Brink, E., et al. (2011). Person-centered care—Ready for prime time. *European Journal of Cardiovascular Nursing*, 10(4), 248–251.