



Illness beliefs before cardiac surgery predict disability, quality of life, and depression 3 months later

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Abstract

Objective: The purpose of this study was to examine the influence of patients' presurgery illness beliefs and cardiac risk factors on health-related outcomes 3 months following cardiac surgery. **Methods:** In a prospective design, 56 patients undergoing elective cardiac surgery (coronary artery bypass grafting (CABG), heart valve surgery, or a combined procedure) were approached on admission to hospital and reassessed 3 months after surgery. Presurgery assessment included cardiac risk factors and measures of illness severity. Illness beliefs were assessed using the Illness Perception Questionnaire–Revised (IPQ-R). Outcome measures included levels of illness-related disability, physical functioning, psychological well-being, and depressive symptoms. **Results:** Physical functioning of patients improved 3 months after surgery, while disability and psychological well-being did not change

significantly. Cardiac risk factors prior to surgery were unrelated to the outcomes 3 months later. With the use of hierarchical multiple regression analyses, after controlling for demographic variables and baseline scores of outcome variables, patients' beliefs about their illness predicted disability (adjusted $R^2=.350$, $P<.01$), physical functioning (adjusted $R^2=.283$, $P<.01$), and depressive symptoms (adjusted $R^2=.302$, $P<.01$). Illness severity measures did not mediate the association between illness beliefs and outcomes. **Conclusion:** Patients' beliefs about their illness before surgery strongly influence recovery from cardiac surgery. The results suggest that patients could benefit from presurgery cognitive interventions aimed at changing maladaptive illness beliefs to improve physical functioning and disability following cardiac surgery.

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Keywords: Illness beliefs; Illness perceptions; Cardiac surgery; Disability; Quality of life; Depression

Introduction

The aim of cardiac surgery is to prolong life and to reduce illness-associated disability of heart disease patients. Important outcomes from surgery include additional life years and symptom reduction as well as improvements in the patient's quality of life [1,2]. However, identifying which patients

benefit most from surgery is not accurately predicted from objective measures of cardiac functioning [3–5]. An alternative approach focuses on patients' perceptions about their illness [6,7]. Patients form beliefs about the identity, time course, possible causes, consequences, and the controllability of their illness [8]. These beliefs provide a framework for patients to make sense of their symptoms and guide subsequent coping strategies. Patients' illness beliefs are closely tied to emotional reactions such as fear, anger, and distress [9]. An increasing number of studies have demonstrated the importance of illness beliefs for health-related outcomes in several chronic illnesses [10–13].

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Several studies in patients with coronary artery disease have shown that certain illness beliefs, such as the expectation of severe consequences and long duration, are related to maladaptive outcomes such as higher illness-related disability [14], lower quality of life [15,16], higher levels of depression [16], a later return to work [15,17], and a poorer attendance at cardiac rehabilitation programs [18,19]. Furthermore, illness beliefs have shown to be a better predictor of disability than medical variables [17]. It should be noted that illness beliefs are lay beliefs that can be highly discrepant from expert opinions about the severity of the patient's condition and do not show strong relationships to objective measures of illness severity [10,14,17]. These findings are of particular importance, given that interventions by Petrie et al. [20] and recently by Broadbent et al. [21] have shown that it is possible to improve functional outcome by changing illness beliefs of myocardial infarction patients, thus suggesting a method for improving recovery and return to work in cardiac patients.

So far, most studies have evaluated illness beliefs in relatively stable medical conditions. It could be argued that the relationship between psychological factors and outcome is not surprising. However, heart surgery can be considered as causing a more dramatic change in the health of the patient, which might be accompanied by a rapid cognitive reappraisal and reduction of the influence of presurgery beliefs the patients hold about their illness. Therefore, it is still unknown whether illness beliefs before a critical medical intervention predict the outcome of cardiac rehabilitation months later, or whether objective measures of illness severity or changes in clinical variables due to the surgery are principal determinants of future functioning. It could be assumed that clinical measures of illness severity such as heart functioning, course of surgery, or risk factors account for the variance in health-related outcomes after surgery. It needs to be controlled whether common variance in illness beliefs and surgery outcome is mainly explained by clinical measures of illness severity, or whether illness beliefs predict outcome even after controlling for medical severity. Previous studies have shown that illness beliefs explain a moderate amount of variance after clinical variables are controlled [14,22]. This suggests that presurgery illness beliefs might already influence health-related outcomes independent of clinical measures of illness severity or the course of surgery.

The aim of the present study was to examine the relationship between presurgery illness beliefs and later illness-related disability, health-related quality of life, and depression. First of all, our major hypothesis was that illness beliefs assessed before scheduled heart surgery would predict disability, health-related quality of life, and depressive symptoms 3 months later. Second, we hypothesized that objective medical measures of illness severity would not mediate the association between illness beliefs and disability, quality of life, and depressive symptoms after surgery.

Method

Participants

Patients were recruited from an open heart surgery unit at the Marburg University Hospital, Germany. Patients aged between 18 and 80 years who were receiving coronary artery bypass graft surgery (CABG), heart valve surgery, or combined surgery were invited to participate in the study. A total of 96 patients were informed about the study and 66 agreed to participate. Three patients subsequently withdrew their agreement, one person died, and seven patients were not able to fill in the first questionnaire because of medical problems (two patients) or language problems (five patients). Thus the final sample consisted of 56 patients.

Procedure

The present study was approved by the ethics committee for medical research at the University of Marburg. With the use of a longitudinal design, patients completed informed consent procedures and the first questionnaire after admission to the unit and before undergoing surgery. Additional medical data was taken from the patient file. Three months following surgery, patients were mailed a follow-up questionnaire and responses were received from 42 patients (75% response rate). The flow of the patients through the study is shown in Fig. 1.

Assessment

Illness severity

Illness severity was assessed by three different indices before surgery: First, left ventricular ejection fraction was

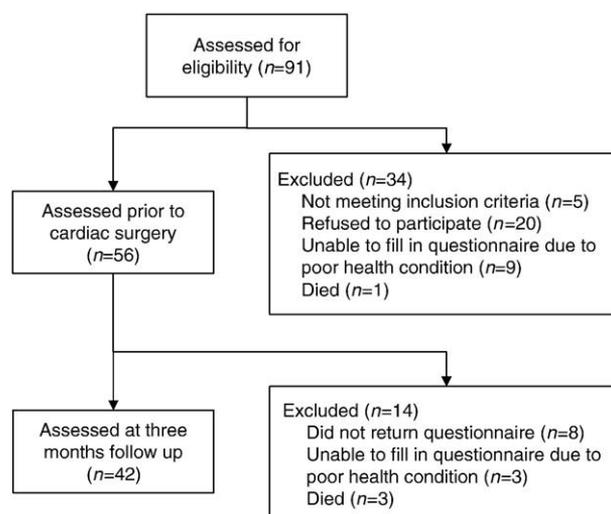


Fig. 1. Flowchart of patients through the study.

used to estimate heart function. Second, the European System for Cardiac Operative Risk Evaluation (EuroSCORE) [23], a widely used and validated risk score in heart surgery, was used to identify morbidity and mortality risk levels in patients. The EuroSCORE comprises 17 risk factors concerning patient-related factors (e.g., extracardiac arteriopathy), heart-related factors (e.g., recent myocardial infarct), and surgery-related factors (e.g., emergency) which are included in a weighted sum score. Patients are classified into three different risk groups according to the EuroSCORE points (for details see Ref. [23]). Also, following surgery, surgeons were asked to rate the severity of the patients' cardiac condition and the complexity of surgery on two 11-point Likert scales with higher scores indicating higher severity and complexity, respectively.

Illness beliefs

The Illness Perception Questionnaire–Revised (IPQ-R) [24] was administered to assess the patients' beliefs of their illness before surgery. The term 'illness' was modified to 'heart condition.' The IPQ-R comprises nine subscales: chronic time course (e.g., "My heart condition is likely to be permanent rather than temporary"), cyclical time course (e.g., "My symptoms come and go in cycles"), consequences (e.g., "My heart condition has major consequences on my life"), personal control (e.g., "The course of my heart condition depends on me"), treatment control (e.g., "My treatment can control my heart condition"), illness coherence (e.g., "My heart condition is a mystery for me"), emotional representations (e.g., "My heart condition makes me feel afraid"), identity, and cause. The identity subscale is measured by the number of symptoms patients endorse as being part of their illness from a 14-item symptom checklist (e.g., breathlessness, fatigue). The other subscales are measured by 56 five-point Likert scale items. Mean subscale scores were computed with higher scores indicating greater endorsement of the given construct. The cause subscale was not included in the current analyses as the authors suggest a minimum of 81 subjects to validly analyze this subscale [24]. The treatment control subscale showed low internal consistency of Cronbach's alpha (.20) and was not included in any further analyses. For the other subscales Cronbach's alpha ranged from .68 to .89, demonstrating adequate levels of reliability.

Disability

Patients completed the Pain Disability Index (PDI) [25] in an adapted version for heart disease patients to assess the effect of the illness on their functioning before and after surgery. The PDI is a brief self-rating scale with seven 11-point Likert scale items to assess the level of illness-related disability in the following areas of daily life: family and home, responsibilities, recreation, social activity, occupation, sexual behavior, self-care, and life-support activity. A sum score was built with higher scores

indicating higher levels of disability. Cronbach's alpha was .89 in the current sample.

Health-related quality of life

Patients completed the SF-12 questionnaire [26] pre- and postsurgery, a 12-item scale that generates scores for physical functioning and psychological well-being. Higher scores indicate a better health status. Cronbach's alpha values in the current sample were .69 and .72, respectively.

Depression

Depressive symptoms were assessed before and after surgery using the depression scale of the Hospital Anxiety and Depression Scale (HADS) [27], a validated seven-item rating scale specifically designed for the detection and assessment of mood disorders in medical outpatient population [28]. Higher scores reflect more depressive symptoms. Cronbach's alpha was .82 in the current sample.

Statistical analysis

SPSS version 11.5 was used for all statistical analyses. The χ^2 test and independent samples *t* test, respectively, were used to compare proportions and means between respondents and nonrespondents and between the three groups of patients with different surgery indications. The relations between the independent variables and outcome measures were examined using Pearson correlation coefficients. Hierarchical multiple linear regression was used in order to examine whether presurgery illness beliefs predicted disability, quality of life, and depression at 3 months' follow-up over and above demographic data and illness severity. To deal with missing data, single missing values were imputed using multiple imputation with NORM version 2.03 for Windows, a simulation-based software for the statistical analysis of incomplete data.

Results

Thirty-eight patients in the study underwent a CABG procedure, 16 had valve surgery, and two had combined procedures. There were no significant demographic differences between the patients undergoing the different surgical procedures. However, CABG patients were more likely to have experienced a previous myocardial infarction ($\chi^2=6.79$, $P<.05$) and have a greater level of obesity ($\chi^2=8.93$, $P<.05$). Both factors are inherent risk factors of coronary artery disease which lead to the necessity of undergoing CABG. Since no other differences were found, the three groups were merged together and evaluated as one single group of surgery patients. In this group, the average age was 63.6 years (S.D.=11.6) and there were 44 males and 12 females. Most of the patients were married (44) with the remainder widowed (2), divorced (5), or single (5). The majority were retired or unable to work due to their illness (31) and the

Table 1
Clinical characteristics of study sample

Variables	Numbers
<i>n</i>	56
Previous myocardial infarction	23 (41.1%)
Ejection fraction	58.0%
EuroSCORE	4.45
Class 1 (low risk)	12 (21.4%)
Class 2 (medium risk)	27 (48.2%)
Class 3 (high risk)	17 (30.4%)
Other noncardiac illnesses	23 (41.1%)
Diabetes	14 (25.0%)
Obesity	24 (42.9%)
Peripheral arterial disease	18 (32.1%)

remainder were working in part- or full-time jobs (19) or unemployed (6). There were no group differences between patients reassessed at follow-up and patients who dropped out regarding age, gender, ejection fraction, and EuroSCORE. The study sample was similar to other European cardiac surgery patients as regards age, gender, EuroSCORE classes, and cardiac-related risk factors [29] (see Table 1).

Functioning at 3 months

Patients reported higher physical functioning 3 months after surgery compared to presurgery ($T=-3.88$, $P<.001$). However, there were no significant changes in reported levels of disability ($T=0.76$, ns), psychological well-being ($T=-0.68$, ns), or depression ($T=1.66$, ns). Men and women did not differ in any of the outcomes.

To examine the association between illness beliefs, illness severity, and surgeon's ratings with patient functioning, Pearson correlations were computed with these variables (Table 2). The pattern of relationships shows that illness-related disability was higher in patients who associated more symptoms with their condition (identity), were more

distressed by their illness, saw their illness as having a chronic or cyclical timeline, and perceived their illness as having serious consequences. In contrast, higher levels of physical functioning were associated with the presurgery belief that the heart disease would be of short duration and would not be related to serious consequences. Higher levels of depression 3 months after surgery were related to the beliefs of chronic illness duration, severe consequences, and low illness coherence at baseline. All relations showed medium effect sizes as defined by convention [30]. Psychological well-being was unrelated to any of the predictor variables and therefore was not included in any further analyses. There was no relationship between age, left ventricular ejection fraction, EuroSCORE, surgeons' ratings of illness severity, and complexity of surgery and the outcome variables.

Association between illness beliefs and health-related outcomes

In order to estimate the contribution of presurgery illness beliefs to the prediction of disability, physical functioning, and depressive symptoms 3 months later, three hierarchical multiple regression analyses were conducted. For all regression models, data were entered in three steps. To control for demographic variables and baseline levels, Step 1 contained age (as a potentially confounding demographic variable) and presurgery baseline scores (of disability, physical functioning, or depressive symptoms, respectively). In Step 2, the IPQ-R sum score was entered. We chose to include the sum score due to the high collinearity between the IPQ-R subscales, as applied elsewhere [22,31]. The IPQ-R sum score was computed after reversing the control and coherence scales, with higher scores indicating a more negative perception of the illness (i.e., long timeline, severe consequences, low control, etc.). In order to test our second hypothesis that objective medical measures of illness

Table 2
Correlations between predictor variables and outcomes at the 3-month follow-up

	Disability (PDI)	Physical functioning (SF-12)	Psychological well-being (SF-12)	Depression (HADS)
1. Identity	.445 **	-.236	-.018	.232
2. Chronic time course	.472 **	-.428 *	-.165	.360 *
3. Cyclical time course	.481 **	-.525 **	-.318	.326 *
4. Consequences	.431 **	-.418 *	-.245	.342 *
5. Personal control	-.041	-.077	-.082	-.045
6. Illness coherence	-.127	-.057	.062	-.322 *
7. Emotional representation	.359 *	-.246	-.311	.299
8. Age	.062	-.152	-.143	.148
9. Ejection fraction	-.089	.097	.021	-.125
10. EuroSCORE	.000	-.206	-.088	.061
11. Illness severity ^a	.119	-.279	-.017	.252
12. Complexity of surgery ^a	-.050	-.029	.080	.082

* $P<.05$.

** $P<.01$.

^a Surgeons' ratings.

Table 3
Summary of hierarchical multiple regression analyses

Model	Predictors	Outcome variables 3 months later											
		Disability (PDI)				Physical functioning (SF-12)				Depressive symptoms (HADS)			
		β	R^2	R^2 adjusted	ΔR^2	β	R^2	R^2 adjusted	ΔR^2	β	R^2	R^2 adjusted	ΔR^2
Step 1			.211 *	.171 *	.211 *		.232 **	.192 **	.232 **		.228 **	.189 **	.228 **
	Age	.166				-.082				.192			
	Presurgery level ^a	.467 **				.462 **				.456 **			
Step 2			.427 **	.381 **	.215 **		.356 **	.304 **	.124 *		.371 **	.321 **	.142 **
	Age	.021				-.068				.108			
	Presurgery level ^a	.225				.200				.319 *			
	IPQ-R sum score	.529 **				-.441 *				.407 **			
Step 3			.430 **	.350 **	.003		.373 **	.283 **	.017		.387 **	.302 **	.016
	Age	.061				-.005				.169			
	Presurgery level ^a	.217				.189				.317 *			
	IPQ-R sum score	.534 **				-.437 *				.396 **			
	Ejection fraction	-.007				.056				-.134			
	EuroSCORE	-.069				-.136				-.042			

* $P < .05$.

** $P < .01$.

^a Presurgery level of disability, physical functioning, or depressive symptoms, respectively.

severity would not mediate the association between illness beliefs and outcomes, the variables left ventricular ejection fraction and the EuroSCORE were entered in Step 3. Mediation can be assumed if the mediator is related to both the predictor and the outcome in the affected relationship, and if the presence of the mediator reduces the effect of the predictor on the outcome [32]. A summary of the regression analyses is shown in Table 3.

Disability

In the first step, baseline disability status was the only significant predictor of postsurgery disability, explaining 21% of the variance in outcome ($\beta = .467$, $R^2 = .211$, $P < .05$). The IPQ-R sum score added 22% of the variance ($\beta = .529$, $R^2 = .427$, $P < .01$). In other words, negative beliefs about patients' illness were associated with higher reported illness-related disability 3 months later. Including ejection fraction and the EuroSCORE as measures of patients' illness severity did not explain additional variance in disability ($\Delta R^2 = .003$,

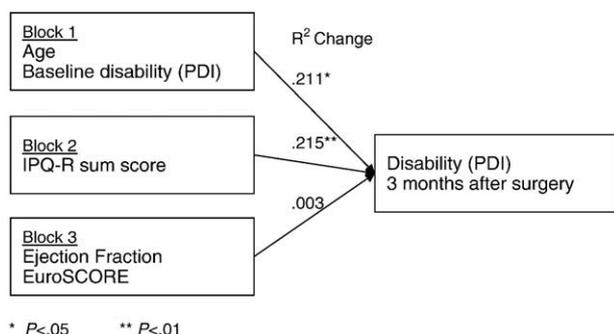
$P > .05$) (Fig. 2). Presurgery cardiac illness severity did not have an impact on posttreatment disability status. It did not mediate the influence of illness beliefs on disability.

Physical functioning

In the first step, presurgery levels of physical functioning explained 23% of the variance in physical functioning after surgery ($\beta = .462$, $R^2 = .232$, $P < .01$). Including the IPQ-R sum score in the second step added a small amount of 12% of variance ($\beta = -.441$, $R^2 = .356$, $P < .01$). In other words, patients' beliefs about a negative impact of their illness were related to poorer physical functioning 3 months after cardiac surgery. Ejection fraction and EuroSCORE as measures of illness severity did not predict physical functioning at 3 months ($\Delta R^2 = .017$, $P > .05$). Illness severity did not mediate the influence of illness beliefs on physical functioning 3 months after cardiac surgery. In other words, illness beliefs but not illness severity measures before surgery predicted poorer physical functioning 3 months after cardiac surgery.

Depression

The pattern of results was similar for depression. Only presurgery depression level predicted postsurgery depressive symptoms, explaining 23% of the variance in the first step ($\beta = .456$, $R^2 = .228$, $P < .01$). Including the IPQ-R sum score in the regression analysis added a small but significant amount of 14% of variance, explaining an overall 37% of the variance in depression at 3 months ($\beta = .407$, $R^2 = .371$, $P < .01$). Thus, patients who reported negative beliefs about their heart disease reported higher levels of depression 3 months after surgery. Measures of illness severity did not contribute additional variance to the equation, nor did they



* $P < .05$ ** $P < .01$

Fig. 2. Hierarchical multiple regression analysis predicting postsurgery disability.

mediate the influence of illness beliefs on depression. ($\Delta R^2=.016$, $P>.05$).

In sum, in line with our main hypothesis, the present results suggest that illness beliefs predict disability, physical functioning, and depression 3 months after cardiac surgery. In contrast, psychological well-being was unrelated to any of the illness beliefs. In line with our second hypothesis, the EuroSCORE and left ventricular ejection fraction as measures of illness severity were unrelated to disability, health-related quality of life, and depressive symptoms after surgery. They did not mediate the relationship between illness beliefs and health-related outcomes.

Discussion

The purpose of the present study was to evaluate the relevance of presurgery illness beliefs as a predictor of health-related functioning following cardiac surgery. Our results show that patients' views about their illness play an important role in recovery after cardiac surgery. Consistent with our hypothesis, illness beliefs predicted disability, physical functioning, and depression. Psychological well-being was not related to illness beliefs. Illness beliefs assessed prior to surgery predicted later disability, physical functioning, and depressive symptoms even after controlling for cardiac variables of illness severity and the baseline levels of these variables, thus confirming our second hypothesis.

The contribution of variance made by illness beliefs was moderate; however, illness beliefs emerged as the strongest predictor of health-related outcomes in the final regression models. Our findings are consistent with previous studies [14–16] that found illness beliefs to be predictive of disability, quality of life, depression, and return to work after myocardial infarction and in the course of coronary artery disease. In this study as well as in previous studies, illness beliefs add a small but consistent amount of variance to the prediction of health-related outcomes after controlling for demographic and clinical variables.

Correlational analyses revealed that patients' beliefs about the timeline and consequences of their condition appeared to be particularly important factors influencing recovery following surgery. Patients who perceived their illness to have a chronic or cyclical time course and who perceived their illness to have severe consequences on their lives reported higher levels of disability, depressive symptoms, and lower levels of physical functioning 3 months after surgery. The strength of the relationships was only medium sized, but underlines the existing data confirming the impact of illness beliefs on health-related outcomes [15,22,33].

However, in our study, illness beliefs were assessed prospectively before the scheduled cardiac surgery. Undoubtedly, cardiac surgery changes the patient's health condition dramatically, but presurgery illness representations continue to be an important determinant of recovery. These findings are consistent with McCarthy et al. [34] who

showed that patients' expectations before oral surgery are also associated with different aspects of the recovery process. We can conclude that the predictive value of illness beliefs is relatively stable over time. They seem to be formed by information during the development of illness [14], and they are less influenced by medical changes. Therefore, the influence of illness beliefs on surgery outcome is independent from the course of surgery.

It remains unclear why psychological well-being was unrelated to any of the outcomes. In a meta-analytic review, Hager and Orbell [10] reported psychological well-being to be related to various illness beliefs. The lack of statistically significant relations is most likely due to the small sample size which does not provide sufficient statistical power to detect small relationships.

Furthermore, illness beliefs were largely unrelated to objective measures and surgeons' ratings of illness severity. Patients' views can differ largely from their objective medical state. Despite the information offered by health professionals, patients frequently seem to develop inaccurate and often unhelpful concepts about the symptoms, duration, consequences, and controllability of their illness. Since these aspects strongly influence recovery they are important determinants that should be addressed in the treatment of cardiac patients.

Finally, many patients showed improved physical functioning after recovery from surgery but did not report reduced levels of disability, psychological well-being, and depression. This is unexpected since surgery aims at reducing illness-related disability. It may be that our reassessment period of 3 months has not been long enough for changes in disability to occur. This might be of particular importance given that our sample of surgery patients was rather old and could have required more than 3 months to fully recover from surgery. Besides, considering the multimorbidity of this patient group, the deceleration of the worsening can also be an important treatment goal.

Limitations

When interpreting the results of the current study, some issues should be considered. First of all, the use of correlational data to test for relationships limits the validity of causal inferences. The study was conducted in a single setting and included only a moderate number of participants. High dropout rates at baseline might be due to the time of our first assessment which was after admission on the day before surgery. Patients might have felt too distressed to complete questionnaires. Similar rates have been reported in comparable study designs [35,36]. Due to our small sample size, we merged the different surgery indications as one group. While the groups were highly comparable, and surgery procedures were similar in terms of impact for the patients, different illness beliefs might apply for different surgery types.

Furthermore, we did not assess measures of coping behaviors. We exclusively focused on the association

between illness beliefs and outcomes since there is only limited support for mediation of coping in the literature [12,37]. However, coping procedures might be an important link between illness beliefs and health outcomes and should be considered in future studies. Another critical aspect of our study was the absence of any objective assessment of health outcome such as heart functioning or exercise tolerance testing. It would be important to investigate the influence of illness beliefs on these outcomes in the future. However, patients' own rating of their health status is in itself an important measure of disease severity and will influence health-related behaviors.

Clinical implications

Our findings have important implications for the treatment of cardiac surgery patients. First, the extent to which patients benefit from surgery depends not only on the medical intervention, but also on patients' view about their illness. Therefore it is important to identify maladaptive illness beliefs as early as possible. Petrie et al. [20] and a recent study of Broadbent et al. [21] have shown that illness beliefs are amenable to change which results in improved recovery after myocardial infarction. Changing maladaptive illness beliefs before scheduled heart surgery may lead to an improved outcome of surgery in terms of less disability and a higher health-related quality of life. Since illness representations already influence in-hospital recovery as Cherrington et al. [22] have shown for acute myocardial infarction patients, an early point of intervention might be more effective. Accordingly, we were also able to show that a priori reassurance before medical investigations not only is helpful to reduce negative expectations, but also improves outcome in terms of symptom perception and reassurance [38]. Consultation–liaison psychiatrists should take into consideration patients' idiosyncratic ideas about their illness and use them as a starting point for intervention. Our study clearly indicates that some patients need presurgery cognitive interventions targeted at changing maladaptive assumptions about their illness.

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