Factors associated with outcomes 3 months after implantable cardioverter defibrillator insertion*

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Abstract:

BACKGROUND: Adjustment to living with an implantable cardioverter defibrillator (ICD) is a dynamic process that varies among individuals. The purpose of this study was to describe patterns of recovery and to examine the relationships among demographic and clinical factors, illness appraisal and coping behaviors, and outcomes of physical and emotional function in the early recovery period of the first 3 months after initial ICD insertion.

METHODS: Data were collected in the acute care setting and again at 1 and 3 months after ICD insertion. Subjects were 213 patients (83% men), ages 24-85 (mean 59.6) years. Demographic and clinical variables representing personal and situational factors, illness appraisal, and coping variables were examined using hierarchical multiple-regression analyses to predict outcomes of mood disturbance and functional status.

RESULTS: The data revealed that symptoms, illness appraisal, and coping behaviors significantly explained additional variance in both functional status and mood disturbance above that accounted for by the less modifiable demographic and clinical variables.

CONCLUSIONS: Symptoms, illness appraisal, and coping behaviors were predictors of outcomes in ICD patients. These factors are modifiable aspects of the recovery process, and interventions aimed at symptom management, appraisal reframing, and coping training should be tested to improve mood and functional outcomes for ICD patients.

Article:

With more than 300,000 persons in the United States experiencing sudden cardiac arrest (SCA) annually,[1,2] and more than 100,000 annual hospital admissions for the management of recurrent ventrlcular tachycardia,[3] the implantable cardioverter defibrlllator (ICD) has gained prominence in treating high-risk patients. Data from clinical trials in the last decade have caused ICDs to

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become a widespread mode of treatment with applications to a broader range of patients.[4-7] The 5-year recurrence rate of SCA is about 50% with drug therapy, compared with less than 5% when patients are treated with an ICD.[6-9]

The recovery process and the patient's adjustment to living with an ICD are dynamic processes that vary for individual patients. Although studies on the quality of life and psychosocial aspects of ICD treatment indicate fairly high acceptance of the device by patients and families, [10-13] varying degrees of psychological distress and psychiatric disorders in 15-50% of study populations have been reported, including such responses as anxl-

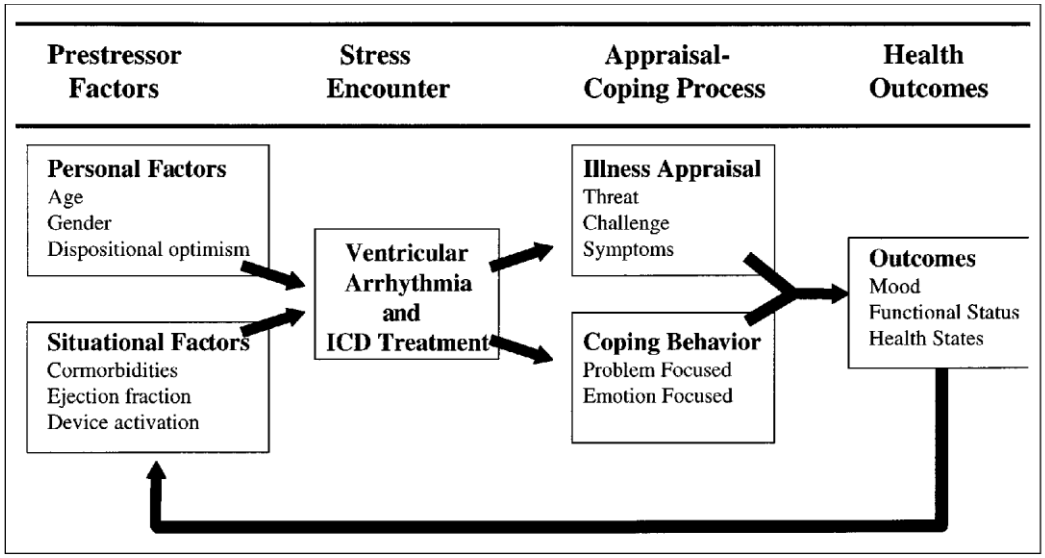

Fig 1 Appraisal coping processes and outcomes.

ety, anger, depression, and withdrawal. [14-18] Feelings of vulnerability, 10, 18-20 lifestyle changes such as restricted driving,[21] and experiences related to device discharge[22,23] contribute to these responses. A better understanding of factors that influence physical and emotional outcomes in the early recovery periods would inform the design of programs of care to facilitate adjustment.

Thus, the purposes of this study were (l) to describe patterns of recovery in terms of appraisal-coping processes and outcomes of emotional status (mood disturbance) and functional status in the first 3 months after ICD implant and (2) to examine factors related to outcomes of emotional and functional status in the first 3 months after ICD implant.

The study was based on the Lazarus Stress and Coping Framework,[24] which suggests that appraised meaning of a stressor and concomitant coping behaviors contribute to outcomes. Individual stressors are appraised as a challenge, as a threat, or as benign or harmless. Coping behaviors are the cognitive and behavioral efforts exerted to manage the stressful encounter. These behaviors serve to decrease the emotional response (through emotion-focused behaviors) or resolve issues and address aspects of the stressful situation (through problem-focused behaviors).[24] Both types of coping are used interchangeably; however, there is some evidence that

problem-focused coping may influence adaptation to illness in a more positive direction than emotion-focused coping.[25,26]

The framework also notes that the individual's personal characteristics and the nature of the situation (or context) in which the stressful encounter occurs are important factors in determining the appraised meaning of the stressful encounter. For example, several studies reported that the personal characteristic of dispositional optimism, or the tendency to view situations with optimism, resulted in more positive recovery outcomes from cardiac surgery.[27,28] Situational variables for the ICD patient include other illness experiences such as concomitant illnesses (comorbidities). After insertion of the device, ICD activation may also become part of the context or situation in which the stressful encounter and coping process are taking place. Personal and situational factors are viewed as less modifiable than the appraisal and coping processes of the transactional stress framework. An overview of the appraisal-coping model and variables used in this study are presented in Fig 1.

In the model, outcomes of the appraisal and coping process are interrelated and include physical and psychosocial functioning and overall health states. The model is not linear, and the outcomes ultimately influence the context of the situation in which the stressor is encountered. This is especially important in an ongoing dynamic adjustment process such as living with the vulnerability caused by ventricular arrhythmia and the experiences of treatment with the ICD. We hypothesized that how patients appraised the meaning of the stressor (living with ventricular arrhythmia and treatment with the ICD) and their coping behaviors (emotion- focused and problem-focused) would be significant predictors of functional status and mood outcomes after controlling for selected personal (demographic) and situational (clinical) factors. The model suggests that the higher levels of mood disturbance and lower levels of functional status would be predicted by greater threat appraisals, lower challenge appraisal, greater use of emotion-focused coping, and less use of problem-focused coping.

METHODS

Design

This study was part of a larger study in which a repeated-measures, iongitudinal design was used to follow ICD patient-family dyads from the preoperative period through the first 9 months after ICD insertion. This report outlines the results of the patient data from the first 3 months. Data were collected before surgery at baseline in the acute care setting and again at 1 and 3 months after ICD implantation.

Setting and sample

Subjects were recruited from 5 hospitals in the Southeast and Midwest. Two hundred thirteen patients (77% of those eligible) who met the following criteria were enrolled: initial ICD placement, intact cognitive status, absence of history of psychiatric disorder, and ability to read and write in English.

Variables and measures

Demographic variables were age, sex, and the personal characteristic of dispositional optimism obtained from the Life Orientation Test (LOT).[28] The LOT is a 12-item, self-reported measure of global optimism with a Likert response format. Previous reports of internal reliability coefficient

alpha were .76, with support of both convergent and discriminant validity,[28] and, in this study, Cronbach's alpha was .75.

Clinical data were history of SCA, left ventricular ejection fraction (LVEF), New York Heart Association (NYHA) classification, and whether the ICD had delivered a shock during the recovery time frame of the study. Measures of comorbidity were calculated by using the Charlson co-morbidity index (CMI), which was originally developed to quantify risk of death from co-morbid diseases for patients admitted to a hospital medical service.[29] In this study, the CMI represented the situational variable of concomitant stressors from other illnesses.

Measures of illness appraisal were obtained by using the Threat and Challenge subscales from the Meaning in illness Questionnaire (MIQ)[30] and the symptom and fear components from the ICD Concerns Questionnaire.[31] The MIQ was developed to elicit concurrent yet independent and divergent meaning ascribed to an illness by chronically ill patients. The ICD Patient Concerns questionnaire lists physical, psychological, and economic issues, and patients mark the questionnaire according to whether they had concerns about each issue. These 2 appraisal perspectives represented global as well as specific appraisal of the stress caused by living with an ICD. Coping was measured by using the Jalowiec Coping Scale (JCS),[32,33] and subjects were asked to rate frequency of their use of 60 coping behaviors to deal with the stressor of "living with an abnormal heart rhythm and its treatment with an ICD." In order to examine coping behavior in accordance with the theoretical model, the instrument was scored into emotion-focused coping (EFC) and problem-focused coping (PFC) subscales based on categorization of the behaviors by a panel of experts.[34] Internal consistency was present in the form of Cronbach's alpha coefficients of .90 and .91 for the emotion-focused and problem- focused subscales respectively.

Emotional outcome was measured by the total mood disturbance (TMD) score on the Profile of Mood States (POMS) .35 Total mood disturbance represents the emotional state of an individual, when that state is transient and responsive to the environment or interventions rather than an enduring personality trait.[36] The POMS includes 65 adjectives that subjects rate on a 5-point scale according to how well the adjective describes their feelings during the past week, including the day the test is administered. Six emotional dimensions: tension- anxiety, depression-dejection, anger-hostility, vigor- activity, fatigue-inertia, and confusion-bewilderment, are measured. A TMD score is obtained by adding the 6 primary mood scores (with vigor weighted negatively). internal consistency for the scales ranged from .84 to .97 in the ICD population.[37]

Functional status, defined as the patient's perception of his or her physical ability in relationship to the cardiac illness, was measured by the Heart Failure Functional Status Inventory (HFFSI), which was adapted from a standardized functional status measure and revised for patients with cardiac disease with low LVEF by Dracup and colleagues.[38] This instrument was selected for its applicability to the ICD patient population, which tends to have compromised left ventricular function. The HFFSI lists 12 specific physical activities, and subjects rate the degree to which they can perform each activity. Subjects also rate any limiting symptoms.

Table I
Characteristics of the sample

Variable	n = 213
Age (y)	
Range	24-85
Mean + SD	59.6 + 13
Sex	
Men	177 (83%)
Women	36 (17%)
Education	
≤Eighth grade	17 (8%)
High school	101 (47%)
College/postgraduate	95 (45%)
Work status	
Working	83 (40%)
Retired/disabled	130 (60%)
Functional status	
NYHA class I	79 (37%)
NYHA class II	78 (37%)
NYHA class III	42 (20%)
NYHA class IV	14 (6%)
LVEF (mean ± SD)	32.3% ± 13
History of SCA	49 (23%)
History of CAD	171 (80.3%)
Antiarrhythmic drugs (at time of enrollment in the study)	
Amiodarone	30 (14.1%)
β-Blockers	38 (17.8%)

The HFFSI is scored by averaging the 3 highest metabolic equivalents (METs) assigned to the activities. Content validity of the tool was established by a panel of judges in the field of cardiology, and interrater reliability in assigning MET level to activity was confirmed.[38] In this study the MET level (METLEV) was used as the dependent measure of functional status for hypotheses testing. In the ICD population, the HFFSI had a Cronbach's alpha of .86, and correlated significantly with concurrent indexes of functional status.[39]

Separate, audiotaped, semistructured telephone interviews regarding experiences during the recovery process were conducted with patients at 1 and 3 months. The interview questions were structured to elicit patients' perceptions of experiences, as well as their perceptions of what was most helpful in coping with their concerns. Content analysis of interview data was performed to identify themes, which were coded by using Ethnograph .40 Coding was initially performed by 2 raters, and interrater reliability was established and verified. The interview data were used to clarify the quantitative data obtained from the ICD concerns and coping instruments.

Procedure

The Short Portable Mental Status Questionnaire (SPMSQ)[41] was used to determine cognitive eligibility to give informed consent and participate in the study. The SPMSQ measures orientation, remote memory, and ability to perform mental functions with reported test-retest reliability at .83; concurrent criterion-related validity was established by comparing the patient's mental status clinical assessment and the SPMSQ.[41] Nine percent of those screened were excluded because of cognitive difficulties. After written informed consent to participate according to the policies of the Institutional Review board of Emory University, clinical and demographic data were obtained, and a battery of questionnaires (POMS, JCS, MIQ, LOT, HFFSI, ICD Concerns) was completed before ICD implantation. For a small percentage (7%) whose ICD procedure was scheduled more imminently, the battery of questionnaires was completed as soon as possible after implantation, at a time after recovery from sedation. At 1 and 3 months, questionnaires (minus the LOT) were mailed to subjects with a stamped, return-addressed envelope. After receipt of the completed 1-month and 3- month questionnaires, the telephone interviews were conducted. Chart reviews were performed to examine medication changes and device therapy over the 3 months.

Because subjects were recruited from 5 hospitals, patient education standards for ICD care from each site were reviewed to determine whether there were differences in practice patterns. Although there was variation in the actual printed materials and videotapes used for patient teaching, no substantive differences in content areas or patient education standards were found by site.

Table II
Means and SD for appraisal and coping variables over the first 3 months after ICD

Variable	Entry	1 Mo	3 Mo
Symptoms*	10.0 ± 5	6.7 ± 4	7.4 ± 5
Fear*	2.45 ± 5	1.81 ± 2	1.64 ± 2
Threat*	10.5 ± 5	8.9 ± 5	7.2 ± 5
Challenge	18.5 ± 5	17.6 ± 4	18.0 ± 5
PFC coping*	36.6 ± 9	28.8 ± 13	28.6 ± 13
EFC coping*	65.8 ± 15	54.1 ± 17	51.9 ± 18
TMD*	37.4 ± 36	21.0 ± 33	21.0 ± 35
Range	–21 to 143	–32 to 136	–32 to 135
HFFSI (METLEV)*	6.4 ± 2	6.0 ± 2	6.3 ± 2
Range	2 to 7.8	2 to 7.8	2 to 7

*Significant change over time for entry, 1, and 3 months, $P < .001$.

Data analysis

Before addressing the research questions, demographic and outcome data were compared by enrolling sites, and no differences on predictor variables by site were found. Changes in medications noted from the chart reviews were examined. This review revealed no changes or introduction of medications, such as anti-anxiety or antidepressant drugs, which would potentially influence the outcome data. Repeated-measures analyses of variance (ANOVA) were performed for each appraisal and coping variable to determine change over time. In addition, separate hierarchical multiple- regression equations4[2] were used to determine the amount of the variance that could be accounted for in the outcome variables of mood disturbance (TMD) and functional status (METLEV). Hierarchical regression models were used to control the effects of the personal or situational factors or both so that the unique predictive power of the appraisal and coping variables could be evaluated. The order of entry of variables was determined by the concepts of the theoretical model. The pre- stressor variables representing personal and situational variables were entered first on step l, followed by the appraisal and coping variables on step ll. In other words, challenge and threat appraisal scores, symptoms, fear, problem-focused coping, and emotion-focused coping scores were

Table III
Patient concerns at entry, 1 month, and 3 months after ICD

Concern/ symptom	Percentage of sample reporting the concern		
	Entry	1 mo after ICD	3 mo after ICI
Tiredness	88%	87%	78%
Shortness of breath	68%	40%	49%
Interrupted sleep	65%	56%	53%
Difficulty falling asleep	47%	36%	35%
Reduced sexual activity	66%	54%	54%

the predictor variables entered in step ll, aiong with age, sex, LOT score, LVEF, NYHA, Charlson CMI score, history of SCA, and number of ICD shocks (personal and situational variables) entered first as a block to control for the effects of these variables. Because of the theoretical and

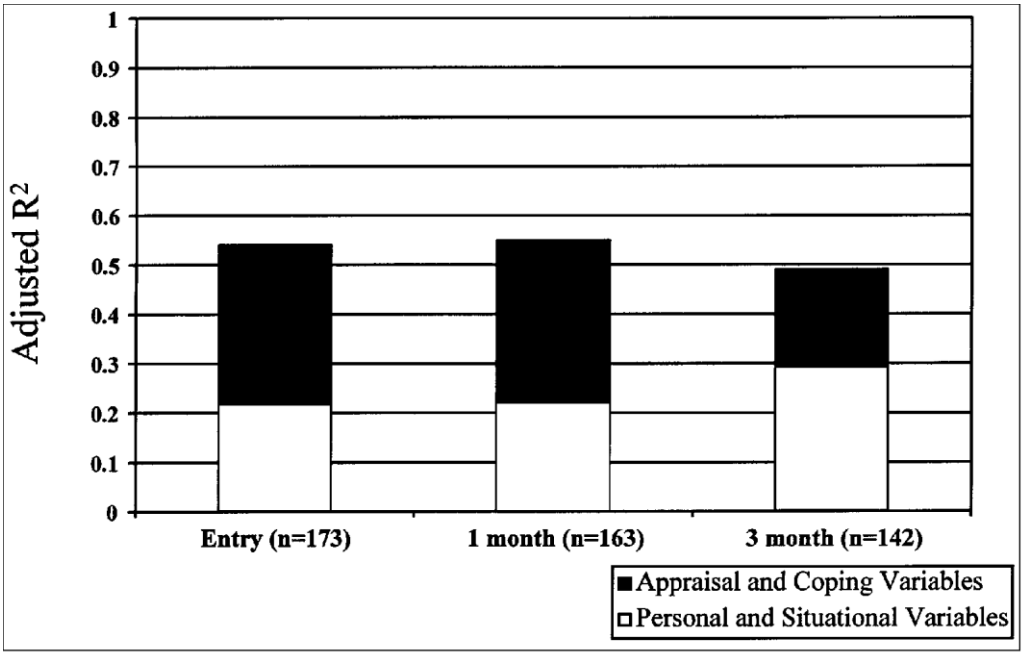

Fig 2 Adjusted variance of TMD accounted for by hierarchical regression models.

clinical relationship between mood and functional status outcomes and their reciprocal influence on the context of the stress-coping process, METLEV was also used as a situational variable when predicting TMD, and, vice versa, TMD was used as a situational variable when predicting METLEV. Evaluation of the data and regression diagnostics suggested that the appropriate statistical assumptions for the hierarchical multiple-regression procedures were met.

Findings

Characteristics of the total ICD patient sample (Table l) included mean age of 59.59 ± 13% (range 24 to 85) years, with 83% men and 17% women. The majority of the subjects were married and retired, and the sample represented a fairly well educated group. Mean LVEF was 32.3% ± 13, representing fairly compromised cardiac function. Approximately 23% of the subjects had experienced SCA. The majority had transvenous lead placement, with pectoral site for ICD implant used in 40% of subjects. Attrition from the study was 16%, with withdrawals because of the death of subjects (n = 10), subjects' deteriorating physical or mental health or both, or subjects' deteriorating cognitive status (n = 17). Loss to follow up (n = 7) because of rehospitalization at time of data collection resulted in missing data on selected instruments at various time points; therefore, the numbers of subjects in the various statistical analysis varied slightly.

Separate repeated-measures (ANOVA) across time showed significant change for all appraisal, coping, and outcome variables, except challenge appraisal (Table ll). All values were highest at entry, the time surrounding ICD implantation. TMD scores decreased slightly, but significantly, from entry to 1 month, with no change from 1 to 3 months. Analysis of the subscales of the POMS revealed that initial declines in TMD scores were primarily due to decreases in the subscale of confusion, and slight increases in vigor. Tension/anxiety and depression subscale scores showed little change. Although mean length of hospital stay (LOS) changed from 10.7 days at the beginning to 3.5 days during the third year of data collection, outcome measures of TMD and METLEV did not vary by LOS or surgical approach, suggesting that emotional responses persisted even though surgical procedures and devices became less invasive. Similar to TMD, threat appraisal scores showed little decline after the 1-month time point.

The most frequently reported concerns from the ICD Concerns Asssessment are reported in Table lll. Concerns about tiredness, shortness of breath, reduced sexual activity, and sleep disturbances

Table IV
Hierarchical multiple regression to determine predictors of TMD at 1 month after ICD (n = 163)

	Beta	Multiple *R*	Adjusted R^2	Unique R^2	*F*	P
Summary of overall model						
Step 1: Personal-situational variables		.51	.22	.22	7.78	.000
Step 2: Appraisal-coping variables		.76	.55	.33	16.5	.000
Predictors						
Personal-situational variables						
Sex	0.05					
Age	–0.05					
Optimism	0.02					
History of SCA	–0.1					
Ejection fraction	0.006					
Device activations	0.002					
METLEV	–.14†					
Appraisal-coping variables						
Symptoms	.43‡					
Fear	.14*					
Threat	.07					
Challenge	–.11*					
Emotion-focused coping	.24‡					
Problem-focused coping	-0.10					

N does not equal 213 because of missing data or subject mortality.
*$P \leq .05$.
†$P \leq .01$.
‡$P \leq .001$.
Beta, Standardized beta weight. Negative beta values indicate an inverse relationship between variables.

(both initiating and maintaining sleep) persisted across time. Symptoms of fast pulse and dizziness, reported by at least two thirds of the subjects at entry, were not reported as concerns in the 1- month and 3-month periods.

The results of the hierarchical multiple-regression analysis performed by regressing the TMD score on personal-situational variables and appraisal-coping variables at entry, 1 month, and 3 months revealed different predictors at the 3 time points. At entry, 54% of the variance (adjusted R^2) in TMD could be accounted for by the model with independent predictors of LOT, sex, number of concerns about symptoms, fear, threat appraisal, higher use of EFC and lower use of PFC. At 1 month, 55% of the variance was accounted for with the following independent

predictors of TMD scores: history of SCA, lower METLEV, greater number of concerns about symptoms, higher fear, lower challenge appraisal, and greater use of EFC (Table lV). The direction of the relationship of SCA and TMD suggests that subjects who had experienced SCA had

Table V
Hierarchical regression to determine predictors of TMD at 3 months after ICD (n = 142)

	Beta	Multiple *R*	Adjusted R^2	Unique R^2	*F*	*P*
Summary of overall model						
Step 1: Personal-situational variables		.57	.29	.29	9.43	.000
Step 2: Appraisal-coping variables		.73	.49	.20	11.3	.000
Predictors						
Personal-situational variables						
Sex	–0.03					
Age	–0.08					
Optimism	–.14*					
History of SCA	–0.09					
Ejection fraction	–0.05					
Device activations	–0.05					
METLEV	–.18†					
Appraisal-coping variables						
Symptoms	.31‡					
Fear	0.03					
Threat	.14*					
Challenge	–.17†					
Emotion-focused coping	.26†					
Problem-focused coping	–.17†					

N does not equal 213 because of missing data or subject mortality.
*$P \leq .05$.
†$P \leq .01$.
‡$P \leq .001$.
Beta, Standardized beta weight. Negative beta values indicate an inverse relationship between variables.

lower TMD at 1 month than those who had not. At 3 months, 49% of the variance in TMD was accounted for with LOT, METLEV, concerns about symptoms, threat and challenge appraisal,

and greater EFC as independent predictors (Table V). By testing separate hypotheses for preoperative and postimpiantation period, the contributions of the variables at different times in the encounter of the stressor (ICD) were clarified. Fig 2 reflects the total variance in TMD accounted for at each time point and designates the proportion associated with the blocks of personal/situational and coping/appraisal variables.

At entry, the predictors of functional status accounted for 28% of the variance, with sex, LVEF, CMI, and number of concerns about symptoms as the independent predictors. At 1 month, 33% of the variance was accounted for by sex, TMD, comorbidity index, threat appraisal, and problem-focused coping as predictors (Table Vl). At 3 months, 36% of the variance was accounted for by sex, TMD, CMI, and number of concerns about symptoms as predictors (Table Vll).

To better understand the outcomes given the wide range of 1-month and 3-month TMD scores (-32 to 138 and -32 to 135, respectively), subjects were divided into quartiles based on TMD scores, and content analysis of the interview data from subjects in the highest and lowest quartiles were examined. At 1 month, themes from the highest mood disturbance quartile differed from the lowest respectively on reporting device shocks (40% vs no shocks), rehospitalizations (36% vs none), complications related to heart rhythm or device activity or both (12% vs none), sleep disturbances (60% vs 26%), incisional and device pain (53% vs 10.5%), and heightened awareness of the device (52% vs 31.6%). At 3 months, subjects in the highest TMD quartile had experienced greater use of health services for the following reasons: ICD shocks, ICD complications such as infection or lead problems, physiologic symptoms such as pain, and rehospitalization. In the group with higher TMD, interviews showed a greater number of reported themes about sleep disturbances than the low-TMD group (42.9% vs 26.3%). The same trend was found with reporting of low activity levels (25% in high TMD group vs 15.8% in the low TMD group). Twenty-one percent of the high-TMD group vs only 1 person in the low-TMD group had received 1 or more ICD shocks at 3 months.

DISCUSSION

Patterns of recovery

The scores on the appraisal-coping variables and outcome measures reveal that patterns of recovery after ICD vary over time and are quite diverse for individuals. The TMD scores were highest before implantation, suggesting that this is a vulnerable time characterized by high levels of anxiety and confusion. Although mean TMD scores dropped significantly by 1 month, the range or variability remained high, suggesting that a cohort of patients may require targeted intervention. TMD and illness appraisal scores in terms of perceived threat and challenge remained stable between 1 and 3 months, suggesting that without targeted activities to improve mood states, adjustment did not continue beyond this early time frame.

The persistence of symptoms is important in the recovery process for ICD patients in that symptoms influence appraisals by reminding patients of cardiac impairment and perpetuating concerns about health.[43] The proportion of patients reporting tiredness and shortness of breath and the persistence of these symptoms across the early recovery period are likely caused by the low cardiac function and low LVEF in this sample. These data of low LVEF and low overall functional status were consistent with clinical characteristics of other ICD outcome studies.[44,45]

Sleep difficulties in terms of both initiating and maintaining sleep are prime areas for targeted intervention, and successful approaches may also influence the concerns about tiredness. Many causes of sleep disturbance are amenable to intervention.

Predictors of TMD

Hierarchical multiple-regression analyses revealed that the appraisal-coping variables accounted for significant increases in the amount of variance accounted for in TMD over that accounted for by the personal-situational variables at each time point in the early recovery process. In the total models, dispositional optimism was important at entry and 3 months, and functional status was an important factor in both postimplant time frames. Patients who had experienced SCA actually had lower TMD at 1 month. Content analysis of the interview data helped explain this finding and suggested that the ICD provided a sense of security for this group whereas many who had not experienced SCA questioned the need for the device. Activation of the ICD did not prove to be a statistically significant predictor of mood or functional status; however, those who had experienced ICD activations discussed these experiences as important themes in the interviews from the high-TMD quartile. Several interesting patterns emerged with regard to ability of the appraisal and coping variables to predict TMD. Noteworthy is the role of greater number of concerns about symptoms and fear at entry and 1 month. Threat appraisal was an independent predictor at entry and again at 3 months, whereas challenge was significant in the postrecovery period only. These cognitive appraisals reflect an ongoing interpretation of the ventricular arrhythmia and ICD experience as characterzied by seriousness, uncontrollability, and fear, with potentially disabling or disfiguring consequences or both. Most important, the impact of these combined appraisals is greater mood disturbance. In other chronically ill patients, appraisal of illness as a harm or threat coupled with low challenge appraisal explained a significant amount of variance in poor adjustment.[30] In patients who have had myocardial infarctions, threat appraisal has been related to negative emotional outcomes.[46] Cognitive appraisal, or interpre-

Table VI
Hierarchical regression to determine predictors of Functional Status (METLEV) at 1 month after ICD (n = 155)

	Beta	Multiple *R*	Adjusted R^2	Unique R^2	*F*	*P*
Summary of overall model						
Step 1: Personal-situational variables		.54	.26	.26	7.80	.000
Step 2: Appraisal-coping variables		.59	.33	.07	6.54	.000
Predictors						
Personal-situational variables						
Sex	–.15*					
Age	–0.07					
Optimism	–0.02					
History of SCA	–0.09					
Ejection fraction	–0.01					
CMI	–.26†					
Device activations	–0.04					
TMD	–.28‡					
Appraisal-coping variables						
Symptoms	–0.06					
Fear	0					
Threat appraisal	–.24†					
Challenge appraisal	0.06					
Emotion-focused coping	–0.07					
Problem-focused coping	.20*					

N does not equal 213 because of missing data or subject mortality.
*$P \leq .05$.
†$P \leq .01$.
‡$P \leq .001$.
Beta, Standardized beta weight. Negative beta values indicate an inverse relationship between variables.

tation of the meaning of the ICD is a prime area for developing interventions aimed at providing patients with a greater sense of control and reducing symptoms and fear.

Higher levels of emotion-focused coping predicted TMD at all time points, with problem-focused coping associated with lower TMD at entry and 3 months. These data are similar to the findings of Craney et al[45] and to our preliminary report of entry data from the first 100 patients, in which a reduced model for analysis was used.[37] In our preliminary report we suggested that

evasive coping (EFC) was not effective in the acute care setting because of the overwhelming illness-related cues and patient education; however, data from this analysis suggest that EFC is less effective in the outpatient setting as well. Although EFC is theorized to reduce the negative emotional response to

Table VII
Hierarchical regression to determine predictors of functional status (METLEV) at 3 months after ICD (n = 147)

	Beta	Multiple *R*	Adjusted R^2	Unique R^2	*F*	*P*
Summary of overall model						
Step 1: Personal-situational variables		.59	.31	.31	9.17	.00
Step 2: Appraisal-coping variables		.65	.36	.05	6.88	.00
Predictors						
Personal-situational variables						
Sex	–.25†					
Age	0.03					
Optimism	–0.08					
History of SCA	0.04					
Ejection fraction	0.04					
CMI	–.36‡					
Device activations	0.08					
TMD	–.24†					
Appraisal-coping variables						
Symptoms	–.34‡					
Fear	0.09					
Threat appraisal	–0.08					
Challenge appraisal	0.02					
Emotion-focused coping	–0.06					
Problem-focused coping	0.14					

N does not equal 213 because of missing data or subject mortality.
†$P \leq .01$.
‡$P \leq .001$.
Beta, Standardized beta weight. Negative beta values indicate an inverse relationship between variables.

a stressor, in the ICD population EFC appears to jeopardize recovery by promoting avoidance in the context of intense symptoms.[24] More active, problem-focused coping in the form of seeking

information and the support of others may in fact be more important in reducing feelings of helplessness and anxiety when confronted with novel and highly somatic illness situations, such as ICD implantations. The quantitative data of symptoms as predictors of TMD triangulated with the interview data reflecting themes of device awareness and symptoms emphasize the importance of the role of psychophysiologic symptom awareness in ICD patient recovery.

Predictors of functional status

At entry, the personal-situational variables of sex, ejection fraction, and comorbidity were significant predictors of functional status, with number of symptoms adding a small amount to the variance. The 1-month and 3-month regression analyses for functional status were deemed as more important because the entry level is not amenable to modification given the short lengths of stay. Being female remained a significant predictor of lower functional level across the 3-month recovery period, even though women did not have lower LVEF or greater CMI. Craney et al[45] reported that men and less emotional ICD subjects were more physically active at the time frame of 2 years or more after implant. The role of TMD and sex as significant predictors of lower functional status in the 1-month and 3-month recovery time frame reflects the important influence of these variables early in the recovery process. These data emphasize the interrelationship of physical and emotional outcomes and underscore the importance of emotional recovery. Aspects of the appraisal process, specifically threat and number of concerns about symptoms, were significant predictors of functional status at 1 and 3 months respectively. Contrary to findings by Craney et al[45] of reduced physical functioning related to higher emotion-focused behavior at 2 years, emotion-focused coping was not related to functional status in our sample. However, problem-focused coping was a significant predictor at 1 month, indicating that those with greater use of problem-focused coping behaviors had higher functional status. Although less variance in functional status was predicted by the model than was predicted for TMD, the influence of appraisal and the mood state on functional status warrants further attention in this patient population. Interventions addressing the cognitive appraisal-coping process should be tested for their effects on physical functioning as well as emotional outcomes in ICD patients. These data could be used to design interventions to reduce symptom distress and improve functional ability, which in turn may improve symptom presentation and mood.

Conclusions

These findings suggest that candidates for ICD insertion bring certain personality factors, appraisal, and coping behaviors to the implant situation that should be further examined in relationship to subsequent recovery outcomes. Underlying cardiac function is an important factor in the overall recovery trajectory and symptom presentation of patients with ICDs and should be considered when examining outcomes. The appraisal and coping variables, which are modifiable aspects of the adaptation process, accounted for significant increases in the adjusted R^2 over the personal-situational variables at each time point. The interrelationship of the mood and functional status outcomes gives support to the nonlinear nature of the stress-coping process. The patterns of change in the appraisal-coping variables and outcomes suggest that the early recovery time frame of the first 3 months is important for targeted intervention. By targeting interventions for patients at higher risk for less adaptive recovery, nursing and health provider efforts may be used more efficiently and for those in greatest need. These findings provide direction for the development and testing of interventions aimed at symptom management, appraisal, reframing, and coping skills training to improve recovery outcomes for ICD patients.

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