

# Health-Related Quality of Life as a Predictor of Hospital Readmission and Death Among Patients With Heart Failure

Fernando Rodríguez-Artalejo, MD, PhD; Pilar Guallar-Castillón, MD, PhD; Carlos Rodríguez Pascual, MD, PhD; Carmen Montoto Otero, MD; Ana Ortega Montes, MD; Adoración Nieto García, MD, PhD; Pedro Conthe, MD, PhD; Maite Olcoz Chiva, MD; José R. Banegas, MD, PhD; Manuel Conde Herrera, MD, PhD

**Background:** We sought to examine the relationship between health-related quality of life (HRQL) and a first emergency rehospitalization and mortality in patients with heart failure (HF) having a wide variation in ventricular ejection fraction and functional status.

**Methods:** Prospective study conducted with 394 patients admitted for HF-related emergencies at 4 Spanish hospitals. Baseline HRQL was measured with a generic questionnaire, the Medical Outcomes Study 36-item Short Form Survey (SF-36), and with an HF-specific instrument, the Minnesota Living With Heart Failure (MLWHF) questionnaire. Cox proportional hazards models were used to calculate hazard ratios (HRs) for hospitalization and death on the basis of HRQL scores.

**Results:** During a median follow-up of approximately 6 months, 138 patients (35.0%) underwent a first emergency rehospitalization and 70 (17.8%) died. After adjustment for biomedical, psychosocial, and health care variables, the frequency of hospital readmission was

higher in patients with worse scores on the SF-36 physical functioning (HR, 1.65; 95% confidence interval [CI], 1.11-2.44;  $P=.01$ ), general health (HR, 1.73; 95% CI, 1.19-2.52;  $P=.003$ ), and mental health (HR, 1.65; 95% CI, 1.10-2.47;  $P=.02$ ) subscales. Results were similar for the mortality end point. For the MLWHF questionnaire, worse overall and worse physical and emotional summary scores were associated with higher mortality.

**Conclusions:** Worse HRQL is associated with hospital readmission and death in patients with HF. The magnitude of this association, for both physical and mental HRQL components, is comparable to that for other well-known predictors of hospital readmission and death, such as personal history of diabetes, previous hospitalizations, and treatment with angiotensin-converting enzyme inhibitors.

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**Author Affiliations:** Department of Preventive Medicine and Public Health, School of Medicine, Universidad Autónoma de Madrid, Madrid (Drs Rodríguez-Artalejo, Guallar-Castillón, and Banegas); Division of Geriatrics, Hospital de Meixoeiro, Vigo (Drs Rodríguez Pascual, Ortega Montes, and Olcoz Chiva); Service of Internal Medicine I, Hospital General Universitario Gregorio Marañón, Madrid (Drs Montoto Otero and Conthe); Department of Social and Health Sciences, Universidad de Sevilla, Seville (Drs Nieto García and Conde Herrera); and Service of Preventive Medicine, Hospital Universitario Virgen del Rocío, Seville (Dr Conde Herrera), Spain.

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**H**EART FAILURE (HF) RANKS as one of the leading chronic disorders affecting health-related quality of life (HRQL).<sup>1</sup> Moreover, many patients with advanced HF attach greater importance to HRQL than they do to duration of life,<sup>2</sup> which is itself limited by HF. Accordingly, HRQL is an important end point in clinical trials that assess health care interventions aimed at controlling HF (eg, medication and disease management programs among such patients).<sup>3,4</sup>

However, few studies have examined the role of HRQL as a predictor of HF clinical outcomes. Two studies that analyzed Studies of Left Ventricular Dysfunction (SOLVD) data have shown that lower HRQL is associated with a higher frequency of hospital readmission<sup>5,6</sup> and death<sup>5</sup> in a pool of symptomatic and asymptomatic patients with left ventricular ejection

fraction (LVEF) less than 35%. However, the results were limited by a substantial degree of missing HRQL data during follow-up, which was not satisfactorily explained<sup>6,7</sup>; furthermore, the high correlation between the scales used to measure HRQL rendered it difficult to clearly identify the independent effect of each on hospitalization or death.<sup>5</sup> Another study<sup>8</sup> involving 96 patients with HF and reduced LVEF showed that worse scores on the Minnesota Living With Heart Failure (MLWHF) questionnaire, an instrument specifically designed to measure HRQL in patients with HF, were associated with a greater frequency of the combined event of death or worsening of HF. The authors, nevertheless, did not furnish a quantitative summary of the study association, and analyses were not adjusted for age, sex, or comorbidity, when these variables are known to be associated with HRQL and clinical outcomes. Similarly, the Epidemi-

ologie de l'Insuffisance Cardiaque Avancee en Lorraine (EPICAL) study, which was conducted in 108 patients with advanced HF (New York Heart Association functional grade III/IV) and an LVEF less than 30%, reported that lower HRQL (measured with both generic and HF-specific instruments) was associated with a higher frequency of hospitalization.<sup>9</sup> However, the study was underpowered to measure the impact of HRQL on mortality, and the analyses were not adjusted for sex, even though they included an important number of covariables.

Finally, 2 more studies have furnished information on the association between the MLWHF questionnaire score and mortality<sup>10</sup> or hospital readmission<sup>11</sup> in patients with HF and reduced LVEF but the reported associations were only univariate; likewise, 2 additional studies have examined the relationship between HRQL and mortality<sup>12</sup> and hospitalization<sup>13</sup> in patients with HF but, because of the small study sizes, these results are only preliminary or exploratory.

To our knowledge, ours is the first study to examine the relationship between HRQL and hospital readmission and mortality in a sufficient number of patients with HF and a wide variation in LVEF and functional status. To this end, HRQL was measured with both generic and HF-specific instruments and the study relationship was adjusted for a greater number of factors than in earlier studies, including treatment at discharge from index hospitalization.

## METHODS

### STUDY DESIGN AND SUBJECTS

A prospective study was conducted in 433 patients admitted for HF-related emergencies at 4 Spanish hospitals from January 1, 2000, through June 30, 2001. The study included patients of both sexes who were 65 years and older and had received a diagnosis (principal or secondary) of suspected HF according to the criteria used by Chin and Goldman.<sup>14</sup> A confirmed diagnosis of HF according to European Society of Cardiology guidelines<sup>15</sup> was made before hospital discharge.

Baseline information was obtained during the index hospitalization, after the clinical situation of the subjects was stable, by medical staff through personal interviews with patients complemented by a review of their clinical record. The outcome variables were first all-cause emergency rehospitalization after the index admission and all-cause death. Information on these variables was obtained from the hospital management information system and a telephone call to the patient or the patient's next of kin. Data on hospital readmission and death (when it occurred in the hospital) were verified against the clinical record.

Patient enrollment and data collection were undertaken after written informed consent was obtained from the patient and an accompanying family member.

### STUDY VARIABLES

Three types of baseline data were collected:

First, we collected data on patient biomedical variables. These consisted of age; sex; personal history of acute myocardial infarction, diabetes mellitus, and chronic obstructive pulmonary disease; physician's opinion of the possible cause of HF; LVEF; functional grade; comorbidity; plasma creatinine level; plasma sodium level; clinical instability at hospital discharge;

and influenza vaccination. We measured ejection fraction by echography,<sup>16</sup> functional grade with the New York Heart Association classification of heart disease,<sup>17</sup> comorbidity according to the Charlson Index,<sup>18</sup> and clinical instability at discharge according to the Kosecoff Index.<sup>19</sup> The Charlson Index counts the number of major health disorders (from a list of 16) presented by patients in addition to HF. The Kosecoff Index assesses at discharge the presence of 9 clinical symptoms and signs that have been shown to increase the short-term risk of rehospitalization. In the present study, instability at discharge was defined as the presence of any of these symptoms and signs.

Second, we sought data on patient psychosocial variables, which included educational level, physician's opinion of the patient's compliance with previous treatment, and HRQL. The patient's HRQL was measured with a generic instrument, the Spanish version of the Medical Outcomes Study 36-Item Short-Form (SF-36) questionnaire,<sup>20,21</sup> and an HF-specific instrument, the MLWHF questionnaire.<sup>22</sup>

The SF-36 questionnaire is made up of 36 items that assess the following 8 HRQL dimensions or subscales: physical functioning, role-physical, bodily pain, general health, vitality, social functioning, role-emotional, and mental health. The SF-36 allows for imputation methods to replace missing items in cases where individuals answer more than half the items of a subscale. Response to the questionnaire was very good, with the result that a value was allocated to only 4.6% of the subjects. Subjects' answers to any given item receive a numerical value, which, after being coded, is ranked on a scale of 0 to 100 (the higher the score, the better the state of health). The SF-36 questionnaire also allows for constructing scores that summarize physical and emotional components of quality of life across the 8 subscales. The range for the summary scores is 0 (worst) to 100 (best).

The MLWHF questionnaire was developed at the University of Minnesota, Minneapolis, to assess the perception of the effect of HF and its treatment on the life of patients. It is made up of 21 items that cover HF-related physical, psychological, and social impairments. The patient's perception of such impairments is assessed on a scale ranging from no (score of 0) to very much (5). The total MLWHF score is obtained by adding the scores for all 21 items (range, 0-105); the higher the score, the worse the HRQL. In addition, it is possible to calculate a summary of the impact of HF on physical dimensions, constructed on the basis of 8 items, and another summary of its impact on emotional dimensions, constructed on the basis of 5 items. One of the characteristics that most differentiates the MLWHF questionnaire from the SF-36 is that the former includes some HF-specific signs and symptoms, such as swelling of the legs and ankles, shortness of breath, and fatigue, as well as the cost of medication and the medication's adverse effects. The response rate in our study exceeded 95% for all MLWHF questionnaire items except, "making your sexual activities difficult" and "making your recreational pastimes, sports, or hobbies difficult," for which the responses were 65.7% and 82.5% respectively. These 2 items were excluded from our analysis, and the possible MLWHF range in our study is 0-95.

Third, we collected data on health care variables, that is, treatment prescribed on discharge,<sup>23</sup> duration of index hospitalization, and hospitalization for HF in the past year.

### STATISTICAL ANALYSIS

To examine the relationship between each of the outcome variables (time until first emergency rehospitalization and time to death) and HRQL, data from the 4 hospitals were pooled and Cox proportional hazards models were stratified by health center.<sup>24</sup> We conducted separate analyses for each of the SF-36 subscales and its summary scores and for the MLWHF question-

**Table 1. Characteristics of 394 Subjects at Index Hospitalization**

Variable	Finding*
Age, mean $\pm$ SD, y	77.21 $\pm$ 6.66
Male sex	173 (43.9)
Educational level	
Illiterate	63 (16.0)
No formal education	79 (20.1)
Primary education	229 (58.1)
Secondary or higher education	23 (5.8)
Personal medical history	
Acute myocardial infarction	68 (17.3)
Diabetes mellitus	124 (31.5)
COPD	113 (28.7)
Possible cause of HF	
Ischemic cardiopathy	139 (35.3)
Hypertensive cardiopathy	210 (53.3)
Heart valve disease	97 (24.6)
Other	111 (28.2)
Left ventricular ejection fraction, mean $\pm$ SD, %	45.97 $\pm$ 20.24
Functional grade (NYHA classification)	
I	38 (9.6)
II	217 (55.1)
III or IV	139 (35.3)
Charlson Index, mean $\pm$ SD, score	1.77 $\pm$ 0.67
Plasma creatinine level, mean $\pm$ SD, mg/dL	1.34 $\pm$ 0.63
Plasma sodium level, mean $\pm$ SD, mEq/L	136.85 $\pm$ 9.91
Instability at discharge	72 (18.3)
Treatment at discharge	
ACEIs	241 (61.2)
$\beta$ -Blockers	45 (11.4)
Digitalis	143 (36.3)
Poor treatment compliance in physician's opinion	64 (16.2)
Influenza vaccination	231 (58.6)
Previous hospitalization for HF in past year	179 (45.4)
Duration of hospital stay at index hospitalization, mean $\pm$ SD, d	14.69 (33.54)

Abbreviations: ACEIs, angiotensin-converting enzyme inhibitors; COPD, chronic obstructive pulmonary disease; HF, heart failure; NYHA, New York Heart Association.

\*Data are given as number (percentage) unless otherwise indicated.

naire, including its overall and its physical and emotional scores. Hazard ratios (HRs) for the outcome variables were calculated on the basis of median HRQL scale scores. Hazard ratios were adjusted for the biomedical, psychosocial, and health care variables specified. The HRQL and adjustment variables were modeled using dummies, except for LVEF, duration of hospital stay at index hospitalization, plasma sodium level, and plasma creatinine level, which were analyzed continuously.

Finally, to compare the influence of the physical and emotional summary scores of the SF-36 and MLWHF questionnaires with those of other statistically significant predictors of hospital readmission and death, we ran Cox proportional hazards models with a backward stepwise procedure for selecting variables, retaining those with  $P \leq .10$ .

Analyses were performed using the SAS statistical computer software program.<sup>25</sup>

## RESULTS

Among the 433 patients enrolled, 39 subjects (9.0%) were lost to follow-up for the hospital readmission end point

and 24 (5.5%) for the mortality end point. Thus, we analyzed data for 394 subjects (91.0%) with complete information. The characteristics of these 394 study subjects are outlined in **Table 1**.

**Table 2** shows the scores on the SF-36 and the MLWHF questionnaires at the index hospitalization among the study subjects. For both questionnaires, the scores displayed a wide range of variation among the subjects. In the SF-36, the worst scores were observed for role-physical, physical functioning, vitality, and general health; the best scores corresponded to role-emotional, bodily pain, and social functioning. In general, these scores were 20 points worse than those for persons of the same age in the general population, according to normative SF-36 questionnaire data available for the elderly population in Spain.<sup>26</sup> A reduction of more than 5 points in the SF-36 score has clinical and social relevance.<sup>27</sup>

The median patient follow-up was 6.2 months for hospital readmission and 6.6 months for death. During follow-up, 138 patients (35.0%) underwent a first emergency rehospitalization and 70 (17.8%) died.

**Table 3** shows the results of the association between HRQL and a first emergency rehospitalization. Patients with scores below the median on any of the SF-36 subscales were rehospitalized more frequently (HRs  $> 1$ ) than those with higher scores. Excess hospital readmission attained statistical significance ( $P < .05$ ) on all subscales except role-physical and bodily pain. After adjustment for biomedical, psychosocial, and health care variables, the association remained statistically significantly ( $P < .05$ ) on the physical functioning, general health, and mental health subscales, as well as on the physical summary score. For the total and the physical and emotional summary scores on the MLWHF questionnaire, a value above the median was associated with a higher frequency of hospital readmission; nevertheless, this association lost statistical significance when biomedical, psychosocial, and health care variables were adjusted for.

Table 3 also displays the results for the association between HRQL and mortality. The results were similar to those obtained for hospital readmission, except that in the adjusted analyses statistical significance remained in evidence for the vitality subscale and the emotional summary score on the SF-36 but not for the physical summary score. For the MLWHF questionnaire, statistical significance was attained in the adjusted analyses for the total, physical, and emotional scores. Subjects with scores above the median on the MLWHF questionnaire and its physical and emotional summaries registered a mortality that was approximately 2 or more times higher than that of subjects with lower scores.

In the stepwise Cox proportional hazards model, a value below the median on the physical and emotional summary scores of the SF-36 showed an HR of rehospitalization comparable to those obtained for a personal history of diabetes, plasma creatinine level, and previous hospitalization for HF in the past year. Similar results were observed for the physical score on the MLWHF questionnaire but not for the emotional score because it did not achieve a  $P \leq .10$  (**Table 4**). For the occurrence of death, the HR associated with the summary scores of the SF-36 were also comparable to those for a previous hospitalization for HF and

for treatment with angiotensin-converting enzyme inhibitors (0.59, which represents a 41% reduction in mortality). For the physical summary score on the MLWHF questionnaire, the observed HR was even greater than those estimated for other predictors of death (**Table 5**). The HRs for the summary scores of the SF-36 and MLWHF questionnaires in Tables 4 and 5 showed slight changes compared with those observed in Table 3 because of the different covariates adjusted for in the models.

## COMMENT

Our results indicate that worse HRQL as measured by the SF-36 and MLWHF questionnaires is associated with hospital readmission and death in patients with HF, independent of biomedical, psychosocial, and health care variables. The magnitude of the associations observed, for both physical and emotional components of HRQL, is comparable to that existing with other well-known predictors of hospital readmission and death, such as personal history of diabetes, previous hospitalizations, or treatment with angiotensin-converting enzyme inhibitors.

Our results are generally consistent with those of earlier studies.<sup>5,6,8,9</sup> However, the analysis of data from the SOLVD study<sup>6</sup> in persons 65 years and older reported a relationship between the physical—although not the psychosocial—components of HRQL and hospitalization. Furthermore, Hülsmann et al<sup>8</sup> did not break down the results according to the physical and emotional components of the MLWHF questionnaire. Finally, in the EPICAL study,<sup>9</sup> worse scores in the physical and emotional components of the MLWHF questionnaire were associated with a higher frequency of hospitalization, and a worse score in the physical—but not the mental—component of the Duke Health Profile (a generic HRQL questionnaire) was also associated with a greater risk of hospitalization, yet that study failed to find any association between HRQL and mortality.

The question is why HRQL should furnish prognostic information additional to that obtainable from classic biomedical indicators in patients with HF. Measurement of HRQL provides subjective information as to how patients perceive the impact of the disease and the limitations that this perception imposes. This information is difficult to obtain from biological measurements, although we acknowledge that a few potentially relevant indicators were not considered in our analysis (eg, brain natriuretic peptide). Moreover, such information is patient-specific, inasmuch as disease impact varies with each individual's expectations regarding health and functional capacity. In patients with HF there is some evidence that worse self-reported health is associated with greater hospital readmission.<sup>28</sup> There is also evidence that, among the general population, subjective health is associated with HRQL<sup>29</sup> and mortality.<sup>30</sup>

Some methodological comments should be made for a correct interpretation of our results. First, the 2 instruments used to measure HRQL are widely used in studies of patients with HF.<sup>3</sup> The Spanish version of the SF-36 has been used previously to measure HRQL in elderly individuals<sup>26,31,32</sup> and has shown good reproducibility and validity.<sup>21</sup> In addition, the MLWHF questionnaire has been

**Table 2. Scores on HRQL Scales Among 394 Study Subjects at Index Hospitalization**

HRQL Questionnaire, Subscale	Median	Mean	Range
SF-36			
Physical functioning	30.00	34.73	0-100
Role-physical	0.00	26.65	0-100
Bodily pain	62.00	63.81	0-100
General health	40.00	42.58	0-100
Vitality	30.00	34.83	0-100
Social functioning	62.50	63.32	0-100
Role-emotional	100.00	62.52	0-100
Mental health	56.00	55.00	0-100
Physical summary score	33.31	33.88	13-57
Emotional summary score	45.71	42.79	10-70
Minnesota Living With Heart Failure			
Total (19 items)	49.00	48.23	7-88
Physical summary score (8 items)	27.00	25.67	4-40
Emotional summary score (5 items)	10.00	9.91	0-25

Abbreviations: HRQL, health-related quality of life; SF-36, Medical Outcomes Study 36-Item Short-Form Survey.

used previously in Spain, and information regarding its validity has been published.<sup>33</sup> Specifically, worse New York Heart Association functional grade, the presence of diabetes and anemia, the number of hospital admissions in the preceding year, and heart valve disease as a possible cause of HF were associated with worse scores on the MLWHF questionnaire.<sup>33</sup> Second, we had high response rates to both HRQL questionnaires, probably because rather than being self-administered by the patients, as in other studies,<sup>5,6</sup> these were completed through a personal interview between the physician and the patient. Third, the high mortality of patients with HF might have competed with hospital readmission, hindering the measurement of the latter. However, hospital readmission was observed in 138 subjects, whereas death was the first-occurring end point in only 27. Thus, it is not likely that mortality substantially affected our results on the relationship between HRQL and rehospitalization. Fourth, HRQL may have changed after the index hospitalization. Thus, our results on the relationship between HRQL and the prognosis of HF refer only to HRQL assessed at the index hospitalization and the 4-week reference period of the instruments used. Finally, the comparison between the HRs for the HRQL summary scores and the HRs for other predictors of rehospitalization or death in Tables 4 and 5 should be interpreted with caution because the variables were assessed with different measurement scales.

In conclusion, we consider our results to be relevant for the knowledge generated and their practical implications. They extend existing knowledge because our study included a higher proportion of women, elderly subjects, and patients with preserved systolic function than did most previous research.<sup>5,6,8,9</sup> Moreover, a wider generalization of our results is possible because, unlike previous studies undertaken in the context of clinical trials,<sup>5,6</sup> our patients were drawn from standard clinical practice and were being admitted to the emergency ward and finally hospitalized in different departments (cardiology, internal medicine, and geriatrics). This is in contrast to studies in which patients

**Table 3. Association Between HRQL and First Emergency Rehospitalization and Between HRQL and Mortality**

HRQL Questionnaire, Subscale	Hospital Readmission		Death	
	Crude HR (95% CI)	Adjusted HR* (95% CI)	Crude HR (95% CI)	Adjusted HR* (95% CI)
SF-36				
Physical functioning	1.84 (1.32-2.58)†	1.65 (1.11-2.44)‡	2.43 (1.49-3.97)†	2.08 (1.16-3.72)‡
Role-physical	1.30 (0.90-1.88)	1.26 (0.86-1.86)	1.16 (0.70-1.92)	1.36 (0.79-2.36)
Bodily pain	1.29 (0.92-1.81)	1.26 (0.88-1.81)	1.53 (0.95-2.48)	1.41 (0.82-2.41)
General health	1.94 (1.39-2.72)†	1.73 (1.19-2.52)§	1.77 (1.10-2.84)‡	1.72 (1.00-2.96)‡
Vitality	1.53 (1.09-2.13)‡	1.25 (0.87-1.80)	2.33 (1.44-3.77)†	2.08 (1.22-3.53)§
Social functioning	1.54 (1.09-2.17)‡	1.45 (0.99-2.11)	1.67 (1.02-2.74)‡	1.71 (0.99-2.95)
Role-emotional	1.48 (1.06-2.07)‡	1.38 (0.95-2.00)	1.63 (1.02-2.61)‡	1.61 (0.92-2.80)
Mental health	1.84 (1.31-2.58)†	1.65 (1.10-2.47)‡	2.43 (1.49-3.97)†	2.46 (1.38-4.40)§
Physical summary score	1.68 (1.20-2.36)§	1.52 (1.04-2.21)‡	1.99 (1.22-3.24)§	1.61 (0.93-2.79)
Emotional summary score	1.54 (1.10-2.16)‡	1.39 (0.96-2.03)	2.03 (1.25-3.30)§	2.02 (1.15-3.54)‡
Minnesota Living With Heart Failure				
Total (19 items)	1.59 (1.13-2.22)§	1.33 (0.92-1.93)	2.61 (1.58-4.30)†	2.50 (1.42-4.40)§
Physical summary score (8 items)	1.65 (1.18-2.31)§	1.32 (0.91-1.91)	3.02 (1.82-5.01)†	2.83 (1.60-4.99)†
Emotional summary score (5 items)	1.69 (1.21-2.36)§	1.41 (0.98-2.04)	2.08 (1.29-3.34)§	1.93 (1.12-3.33)‡

Abbreviations: CI, confidence interval; HR, hazard ratio; HRQL, health-related quality of life; SF-36, Medical Outcomes Study 36-Item Short-Form Survey.  
 \*Adjusted for age; sex; educational level; personal history of acute myocardial infarction, diabetes mellitus, and chronic pulmonary disease; cause of heart failure; left ventricular ejection fraction; functional grade (New York Heart Association classification); Charlson Index; plasma creatinine level; plasma sodium level; instability at hospital discharge; treatment at discharge with angiotensin-converting enzyme inhibitor,  $\beta$ -blocker, and digitalis; a physician opinion of poor treatment compliance; previous hospitalization for heart failure in the past year; duration of stay at index hospitalization; influenza vaccination; and hospital center.  
 † $P < .001$ .  
 ‡ $P < .05$ .  
 § $P < .01$ .

**Table 4. Predictors of First Emergency Rehospitalization, as Determined by Stepwise Cox Regression (Variables Retained at  $P \leq .10$ )**

Variable	First Emergency Rehospitalization, Adjusted HR (95% CI)
Physical summary score	1.59 (1.12-2.26)†
Emotional summary score	1.41 (0.99-2.01)
Personal history of diabetes	1.45 (1.02-2.06)‡
Left ventricular ejection fraction	1.01 (0.99-1.02)
Plasma creatinine level	1.33 (1.09-1.64)†
Previous hospitalization for HF in past year	1.88 (1.24-2.83)†
Minnesota Living With Heart Failure§	
Physical summary score	1.40 (0.99-1.97)
Personal history of diabetes	1.47 (1.04-2.10)‡
Plasma creatinine level	1.40 (1.14-1.72)†
Instability at discharge	1.44 (0.94-2.21)
Previous hospitalization for HF in past year	1.77 (1.19-2.64)†

Abbreviations: CI, confidence interval; HF, heart failure; SF-36, Medical Outcomes Study 36-Item Short-Form Survey.  
 \*Model with quality of life assessed through answers to the SF-36.  
 † $P < .01$ .  
 ‡ $P < .05$ .  
 §Model with quality of life assessed through answers to the Minnesota Living With Heart Failure Questionnaire.

have principally been drawn from cardiology departments.<sup>5,6,8</sup> In addition, our results are largely consistent with those reported for patients found in health care systems with different funding systems and different cultural settings, such as those found in the United States, Canada, Belgium,<sup>5,6</sup> Austria,<sup>8</sup> and France.<sup>9</sup>

Our results show that short, simple HRQL questionnaires can be used to identify patients who are at a relatively higher risk of hospital readmission and death. Such

**Table 5. Predictors of Mortality, as Determined by Stepwise Cox Regression (Variables Retained at  $P \leq .10$ )**

Variable	Mortality, Adjusted HR (95% CI)
SF-36*	
Physical summary score	2.28 (1.38-3.79)†
Emotional summary score	1.60 (0.96-2.67)
Age	1.06 (1.02-1.10)†
Left ventricular ejection fraction	0.97 (0.96-0.99)†
Charlson index	1.22 (1.08-1.38)†
Use of ACEIs	0.59 (0.36-0.97)‡
Previous hospitalization for HF in past year	2.41 (1.36-4.27)†
Minnesota Living With Heart Failure§	
Physical summary score	2.93 (1.74-4.95)
Age	1.06 (1.02-1.09)†
Left ventricular ejection fraction	0.98 (0.96-0.99)†
Charlson Index	1.23 (1.08-1.40)†
Use of ACEIs	0.50 (0.30-0.83)‡
Previous hospitalization for HF in past year	1.82 (1.05-3.14)‡
Duration of hospital stay at index hospitalization	0.97 (0.94-1.00)

Abbreviations: ACEIs, angiotensin-converting enzyme inhibitors; CI, confidence interval; HF, heart failure; HR, hazard ratio; SF-36, Medical Outcomes Study 36-Item Short-Form Survey.  
 \*Model with quality of life assessed through the SF-36.  
 † $P < .01$ .  
 ‡ $P < .05$ .  
 §Model with quality of life assessed with the Minnesota Living With Heart Failure Questionnaire.  
 || $P < .001$ .

patients could benefit from closer follow-up, and their eligibility for inclusion in disease management programs should be assessed.<sup>34,35</sup> Indeed, such programs enhance HRQL and reduce hospitalizations without increasing net health care costs in patients with HF.<sup>4,34</sup>

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Correspondence: Fernando Rodríguez-Artalejo, MD, PhD, Departamento de Medicina Preventiva y Salud Pública, Facultad de Medicina, Universidad Autónoma de Madrid, Avda, Arzobispo Morcillo, sn 28029 Madrid, Spain (fernando.artalejo@uam.es).

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