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A prospective, observational study

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Determinants of quality of life in acute heart failure patients with and without comorbidities: a prospective, observational study

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Aims	The relation between non-cardiac comorbidities and health-related quality of life (HRQoL) in patients with heart failure (HF) has been studied to a limited extent. To investigate the HRQoL and their determinants among HF patients with and without comorbidities.
Methods and results	TRIUMPH (TRanslational Initiative on Unique and novel strategies for Management of Patients with Heart failure) is a Dutch prospective, multicentre study enrolling 496 acute HF patients between 2009 and 2014. We included 334 patients who had completed the HRQoL questionnaires at baseline. The HRQoL was measured by the Kansas City Cardiomyopathy Questionnaire (KCCQ) en EuroQuality-of-life five Dimensions (EQ-5D). Comorbidity was defined as having a history of at least one of the following comorbidities: chronic kidney disease, diabetes mellitus, chronic obstructive pulmonary disease (COPD), and/or cerebrovascular accident. Patients with comorbidity ($n = 205$, 61%) had lower scores on the physical limitation scale and clinical summary score of the KCCQ ($P = 0.03$ and $P = 0.01$, respectively). Female sex, COPD, previous HF, increasing body mass index (BMI), elevated N-terminal pro-B-type natriuretic peptide (NT-proBNP), high systolic blood pressure, and the presence of anxiety and/or depression negatively influenced the HRQoL among HF patients with comorbidity. Besides anxiety and depression, we hardly found any other determinant of HRQoL in patients without comorbidity.
Conclusion	Heart failure patients without comorbidity had better HRQoL than patients with comorbidity. Sex, previous HF, BMI, COPD, systolic blood pressure, NT-proBNP levels, and also anxiety and depression were determinants of HRQoL in patients with comorbidity. In those without comorbidity, apart from anxiety and depression, no further determinants of HRQoL were found.
Keywords	Comorbidity • Health-related quality of life • Heart failure

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Implication for practice
- Heart failure (HF) patients value health-related quality of life (HRQoL) at least as relevant as longevity
- HRQoL should get more attention among clinicians
- Optimal HF treatment is important to improve HRQoL
- Optimal treatment of comorbidities may improve HRQoL

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Introduction

Heart failure (HF) is a clinical syndrome that is frequently accompanied by non-cardiac comorbidities such as renal dysfunction, chronic obstructive pulmonary disease (COPD), diabetes, cerebrovascular accident (CVA), and anaemia. Some of these comorbidities may be a result of HF, whereas other diseases may be associated with the development of HF.[1,2]

It has also been established that among patients with HF, those with one or more comorbidities have a worse prognosis when compared with those without comorbidities.[2] Besides a poor prognosis, HF patients also have an impaired health-related quality of life (HRQoL).[3] The HRQoL among patients with HF has not only been found to be worse than that in the general population, but it is even worse than that of patients with other chronic conditions.[4,5] Moreover, an impaired HRQoL is a driver of adverse outcomes in HF.[6] Also from a patient's perspective, HRQoL is very important. Some studies have found that patients value the quality of life at least as important as longevity.[7,8] Therefore, HRQoL is an interesting and important topic from a clinical and research perspective.

The relation between non-cardiac comorbidities and HRQoL in patients with HF has been studied to a limited extent. The relative few studies available have shown a relation between comorbidities and HRQoL,[3,9–11] but there is inconsistency among the different studies.[12] However, there have been no studies reporting on differences in determinants of HRQoL between patients with and without (multi-)comorbidity. Therefore, we aimed to investigate the HRQoL and their determinants among HF patients with and without somatic comorbidities based on data from the TRIUMPH study [TRanslational Initiative on Unique and novel strategies for Management of Patients with Heart failure (TRIUMPH): NTR1893].

Methods

Study population and procedures

The design of the TRIUMPH study has been described previously.[13,14] In short, this study is a prospective, observational study performed in 14 hospitals in the Netherlands. In the period of September 2009 until December 2013, patients aged 18 years and older hospitalized with acute HF were enrolled. Acute HF was defined as either new-onset HF or worsening symptoms of chronic HF. We included patients admitted with acute HF with evidence of sustained systolic of diastolic dysfunction. Additionally, patients were included if their natriuretic peptide level should be at least three times higher than the upper limit of normal and they should be treated with intravenous diuretics during the hospitalization. We obtained written informed consent from all patients. All participating centre's ethical committees have given approval for the study. The investigation conforms with the principles outlined in the Declaration of Helsinki.[15]

The primary aim of the TRIUMPH study was to investigate the clinical value of repeated measurements of several biomarkers in patients with acute HF. One of the secondary aims was to study HRQoL in patients with acute HF.

During hospitalization, patients were visited three times: at admission, at Days 2–4 following admission and on the day of discharge. After hospital discharge, four follow-up moments were planned: at 2–4 weeks, 3 months, 6 months, and 9–12 months. At each measurement moment, patients underwent physical examination (including blood pressure, heart rate, and weight measurement), blood sampling, and patients were scored according to the New York Heart Association (NYHA) classification. Patients were treated in accordance with the European Society of Cardiology Guidelines[16] by their treating physician. The TRIUMPH study did not intervene in the usual care.

Quality of life measurement

Patients were asked to complete several questionnaires before hospital discharge and at the last follow-up visit. HRQoL was measured by the Kansas City Cardiomyopathy Questionnaire (KCCQ) en EuroQuality-of-life 5 Dimensions (EQ-5D). Symptoms of anxiety and depression were measured by the Hospital Anxiety and Depression Scale (HADS).

The KCCQ is a disease-specific questionnaire to measure the HRQoL of patients with HF. This 23-item questionnaire covers the following six domains: physical limitation (KCCQ-PL), symptom stability, total symptom score (combination of symptom frequency and symptom burden), self-efficacy score, quality of life score, and social limitation. Two summary scores can be computed from these domains: the clinical summary score (KCCQ-CS) comprising the domains physical limitation and total symptom score, and the overall summary score (KCCQ-OS) which captures the domains physical limitation, total symptom score, quality of life, and social limitation. Each domain and summary score has been transformed into a 0–100 scale. Higher scores indicate better HRQoL.[17] The EQ-5D is a general, non-disease-specific HRQoL questionnaire that consists of two components. The first component is the health state description and the second component is the health state evaluation. We used the three-level version of the EQ-5D for the health state description. The three levels were: (i) no problems, (ii) some problems, and (iii) extreme problems. A total of five dimensions (mobility, self-care, usual activities, pain/discomfort, and anxiety/depression) were scored according to these three levels. For each dimension, patients were asked to choose the statement which best described their health status that day. In the second part (i.e. health state evaluation) patients were asked to score their health status by using a visual analogue scale within a range of 0 (worst imaginable health status) to 100 (best imaginable health status).[18]

The HADS has been shown a valid and reliable instrument to assess symptoms of anxiety and depression. Patients were asked to answer fourteen questions. Seven items contribute to each of the two subscales (anxiety and depression, respectively) and were answered on a 4-point Likert scale from 0 to 3, which implies a total score range per subscale of 0–21.[19,20] A score of ≥ 8 points on the subscale anxiety as well as on the subscale depression was used to determine whether patients had an anxiety disorder and/or depression.[19]

Definitions

To answer our research question, analyses were stratified by comorbidity. Comorbidity was defined as having a history of at least one of the following significant, non-cardiac comorbidities: chronic kidney disease, diabetes mellitus, COPD, and/or CVA. The presence of the comorbidities was according to the investigator's statement of the medical history in the case report form. These four comorbidities were chosen because of their high prevalence in HF and because there is evidence that they may influence HRQoL and/or the presence of anxiety and depression.

Heart failure with reduced ejection fraction was defined as a left ventricular ejection fraction below 50%. During admission, NYHA classification was determined at three-time points. Since the NYHA classification at discharge was considered the most stable of these three, this measurement was used as the baseline NYHA classification.

Statistical analyses

Categorical variables are presented as numbers and percentages. The χ^2 test was used to compare categorical variables. Continuous variables are given as median with interquartile range (IQR) and were compared with the Mann–Whitney U test.

The determinants of HRQoL (based on the EQ-5D and KCCQ) were analysed by using linear regression models and logistic regression, respectively. First, we performed univariable analyses in the total study population with all baseline characteristics. Anxiety and depression were included as predictors, using the HADS model to define whether there was anxiety and/or depression or not. Then, all determinants with $P < 0.2$ in the univariable analyses were included in the multivariable analyses (forward step method) in order to search for determinants of HRQoL in the total population. Further, the significant (i.e. $P < 0.05$) determinants of HRQoL in the total population plus age and sex were included in the multivariable analyses (enter method) to test determinants of HRQoL in patients with and without comorbidity. Finally, we tested for interaction between comorbidity and the determinants of HRQoL.

All tests were two-tailed and P-values <0.05 were considered statistically significant. We used SPSS software (SPSS 24.0, IBM Corp., Armonk, NY, USA) for all statistical analyses.

Results

Baseline characteristics

In total, 496 patients were enrolled in the TRIUMPH study. Three patients withdrew their informed consent. Another 18 patients were excluded from statistical analyses because of inclusion violation since they had no evidence of sustained systolic or diastolic dysfunction. Of the 475 remaining patients, we included the 334 patients (70%) who had completed the HRQoL questionnaires at baseline into the analyses set. Besides higher occurrence of comorbidity and higher levels of NT-proBNP, the baseline characteristics of the 141 patients (74% with comorbidity) who did not complete the HRQoL questionnaires were almost comparable with that of the patients in the analyses set (see Supplementary material online, Table S1).

The included patients consisted of 219 men (66%), the median age was 74 years (IQR 65–81) and 205 patients (61%) had at least one of the comorbidities diabetes mellitus, chronic kidney dysfunction, COPD, or prior CVA (Table 1). Almost half of the patients had ischaemic HF and 85% had HF with reduced ejection fraction.

On average, patients with comorbidity were 3 years older, more frequently male, and more often had a history of HF and an ischaemic cause of HF. Of the patients with comorbidity, 135 patients (65%) had only one of the four comorbidities and 14 patients (7%) had three or more. The most common comorbidity was diabetes mellitus. Notably, indicators of cardiac function like left ventricular ejection fraction, NT-proBNP, and NYHA class did not differ between patients with and without comorbidity.

Differences in health-related quality of life according to comorbidity

The NYHA classification at the discharge of patients with and without comorbidity was comparable (Table 2). Furthermore, the EQ-5D score neither did differ between patients with and without comorbidity ($P = 0.16$). In contrast, the HRQoL measured by the disease-specific questionnaire (i.e. KCCQ) showed that patients with comorbidity had a significant lower KCCQ-PL and KCCQ-CS ($P = 0.03$ and $P = 0.01$, respectively). Lastly, patients with comorbidity had more depressive symptoms than those without comorbidity (42% vs. 30%, $P = 0.03$).

A total of 154 of the 334 included patients (46%) also completed the HRQoL questionnaires after 9–12 months of follow-up. This response rate was comparable between patients with and without comorbidity ($P = 0.43$). After 1 year follow-up, the NYHA classification was worse in patients with comorbidity (Table 2). Both the generic (i.e. EQ-5D) and disease-specific (i.e. KCCQ) questionnaires measured a worse HRQoL in patients with comorbidity after 9–12 months of follow-up.

Determinants of health-related quality of life

The studied comorbidities (i.e. COPD, CVA, chronic kidney dysfunction, and diabetes mellitus) were found to be modest predictors of the HRQoL in the total study population. After multivariable adjustment, COPD was the only of these comorbidities that was found to be a significant determinant, namely for KCCQ-PL and KCCQ-CS [β −10.439 (95% CI −18.721 to −2.157), β −7.815 (95% CI −14.527 to 1.103), respectively; Table 3].

Besides the studied comorbidities, other factors were associated with HRQoL. Increasing age, female sex, increasing body mass index (BMI), and higher NT-proBNP were the major determinants of an adverse score on the KCCQ. Furthermore, depression (as measured with the HADS) was also associated with lower HRQoL scores, both on the EQ-5D [β −0.244 (95% CI −0.314 to −0.174)] and on the KCCQ [PL: β −15.179 (95% CI −21.841 to −0.8517); CS: β −13.677 (95 CI −19.142 to −8.212); OS: −14.279 (95% CI −19.695 to −8.864)].

The determinants of HRQoL differed considerably between patients with and without comorbidity (Figure 1). Sex, previous HF, BMI, NT-proBNP, and systolic blood pressure at discharge were determinants of HRQoL among HF patients with comorbidity. The presence of anxiety and/or depression also negatively influenced the HRQoL of patients with and without comorbidity. Besides anxiety and depression, we hardly found any other determinant of HRQoL in patients without comorbidity.

Discussion

In this prospective, multi-centre study, we found that patients with one or more of the four investigated comorbidities (i.e. COPD, diabetes mellitus, chronic kidney disease, and/or prior CVA) had a higher prevalence of depression at baseline than patients without comorbidity. Of the four comorbidities, only COPD was modestly associated with worse HRQoL. Important determinants of HRQoL in our population were sex, history of HF, BMI, NT-proBNP at admission, systolic blood pressure at discharge, and the presence of a depression. Most of these characteristics were also associated with HRQoL in the subgroup of patients with comorbidity. In contrast, besides anxiety and depression, we hardly found any other determinant of HRQoL in patients without comorbidity.

Table 1 Baseline characteristics of patients with and without comorbidity

	Overall sample n = 334	Comorbidity + n = 205	Comorbidity - n = 129	p-value
Demographics				
Age years)	74 (65–81)	76 (66–81)	73 (60–80)	0.04
Male	219 (66%)	145 (71%)	74 (57%)	0.01
Caucasian	319 (96%)	196 (96%)	123 (95%)	0.59
Medical history				
Previous heart failure	215 (65%)	144 (71%)	71 (55%)	0.004
Previous heart failure hospitalization within last 6 months	69 (21%)	49 (24%)	20 (16%)	0.06
Ischaemic heart failure	158 (47%)	115 (56%)	43 (33%)	<0.001
Heart failure with reduced ejection fraction	228 (85%)	134 (82%)	94 (89%)	0.15
Hypertension	166 (50%)	119 (58%)	47 (36%)	<0.001
Atrial fibrillation	143 (43%)	94 (46%)	49 (38%)	0.16
Diabetes mellitus	118 (35%)	118 (58%)	0 (0%)	<0.001
Chronic obstructive pulmonary disease	65 (20%)	65 (32%)	0 (0%)	<0.001
Chronic kidney dysfunction	55 (17%)	55 (27%)	0 (0%)	<0.001
Cerebrovascular accident	52 (16%)	52 (25%)	0 (0%)	<0.001
Baseline measurements				
Body mass index, kg/m^2)	28 (25–31)	28 (25–32)	26 (24–30)	0.004
Systolic blood pressure, mmHg)	125 (110–148)	125 (110–148)	124 (110–145)	0.53
Diastolic blood pressure, mmHg)	74 (64–85)	70 (65–82)	78 (64–89)	0.049
Heart rate, bpm)	85 (72–100)	84 (70–99)	90 (76–105)	0.02
Kreatinin, µmol/L)	122 (100–158)	134 (106–181)	111 (95–140)	<0.001
NT-proBNP, pg/mL)	3738 (1928–8601)	3726 (1928–9381)	3738 (2072–6816)	0.79
Left ventricular ejection fraction %)	30 (21–40)	30 (22–42)	30 (20–39)	0.09
NYHA classification				0.29
I	35 (13%)	20 (12%)	15 (14%)	
II	127 (47%)	71 (43%)	56 (52%)	
III	98 (36%)	65 (39%)	33 (31%)	
IV	12 (4%)	9 (6%)	3 (3%)	

Results depicted as median (interquartile range) or N (%).
NT-proBNP, N-terminal pro-B-type natriuretic peptide; NYHA, New York Heart Association.
Comorbidity defined as presence of one or more of the following: diabetes mellitus, chronic obstructive pulmonary disease, chronic kidney disease and/or prior cerebrovascular accident.
P-value for comparison between patients with and those without comorbidity.

Differences in health-related quality of life

To the best of our knowledge, this study is the first investigating differences in HRQoL between HF patients with and without a cluster of four selected non-cardiac comorbidities. Despite a comparable severity of HF (indicated by equal NT-proBNP levels and comparable NYHA classification) in patients with and without comorbidity, we found lower HRQoL and higher prevalence of depression in HF patients with comorbidity. A possible explanation of this might be that patients with comorbidity already had a worse HRQoL pre-admission. This potential lower HRQoL pre-admission may not only be due to the comorbidities for which was stratified in this study (i.e. prior CVA, chronic kidney dysfunction, diabetes, and COPD), but we also found other factors that may cause lower HRQoL in patient with comorbidity, like higher BMI, more frequent a history of HF before inclusion and hypertension.[9]

Question remains why there was a difference in HRQoL measured with the KCCQ questionnaire between patients with and without comorbidity and no difference in the EQ-5D score despite the fact that there is some overlap in the questions among both questionnaires.[17,18] This inconsistency may be due to the fact that two questionnaires consist of different questions on different aspects of HRQoL and, hence, may give different outcomes. Further, the KCCQ questionnaire is disease-specific and the EQ-5D is short and very generic. On the other hand, we think that the difference in way of asking the questions may also be responsible for this difference. In the EQ-5D questionnaire, patients were asked about their functioning at that day.[18] However, the KCCQ questionnaire specifically asked to complete the questions about their functioning and to compare it with their functioning 2 weeks ago.[17] This explicitly stated 2-week time frame may cause that patients answer the questions in a different way.

Table 2 HRQoL, anxiety, and depression in patient with and without comorbidity

		Baseline			1-year follow-up		
		Comorbidity +	Comorbidity −	*P*-value	Comorbidity +	Comorbidity −	*P*-value
NYHA	I	20 (12%)	15 (14%)	0.29	10 (12%)	23 (37%)	0.002
	II	71 (43%)	56 (52%)		55 (65%)	24 (39%)	
	III	65 (39%)	33 (31%)		19 (22%)	14 (23%)	
	IV	9 (6%)	3 (3%)		1 (1%)	1 (2%)	
EQ-5D	EQ-5D score	0.68 (0.34–0.81)	0.69 (0.43–0.86)	0.16	0.81 (0.65–0.89)	0.86 (0.77–1.00)	0.04
	EQ-5D VAS	60 (49–70)	60 (50–70)	0.33	70 (55–80)	70 (60–80)	0.19
KCCQ	KCCQ-PL	33 (13–63)	42 (21–71)	0.03	58 (33–82)	75 (44–96)	0.01
	KCCQ-CS	31 (16–54)	35 (25–61)	0.01	69 (41–88)	77 (50–96)	0.05
	KCCQ-OS	30 (18–51)	35 (21–56)	0.14	65 (40–85)	77 (49–91)	0.06
HADS	Anxiety	63 (32%)	46 (36%)	0.41	17 (19%)	12 (20%)	0.8
	Depression	83 (42%)	38 (30%)	0.03	24 (26%)	10 (17%)	0.19

Results depicted as median (interquartile range) or *N* (%).
CS, clinical summary score; EQ-5D, EuroQuality-of-life 5 Dimensions; HADS, Hospital Anxiety and Depression Scale; HRQoL, health-related quality of life; KCCQ, Kansas City Cardiomyopathy Questionnaire; NYHA, New York Heart Association; OS, overall summary score; PL, physical limitation; VAS, visual analogue scale.

Determinants of health-related quality of life

A unique aim of this study was to investigate the determinants of HRQoL in patients with and without comorbidity. Female sex, previous HF, COPD, increasing BMI, and higher NT-proBNP levels at admission were found to be important determinants of worse HRQoL in patients with comorbidity. Those determinants were also associated with HRQoL in studies that did not investigate differences in determinants of HRQoL in patients with and without comorbidity.[21,22] Furthermore, female patients, patients with a history of CVA and patients with worse NYHA classification at discharge were at higher risk for depression.

A striking finding was that we, apart from depression, hardly found any determinant of HRQoL in patients without comorbidity. A possible explanation for this might be that HF itself is by far the most important determinant of the reduced HRQoL in patients without comorbidity. Another possible explanation might be that there are other determinants of HRQoL in patients without comorbidity that we did not measure (e.g. patients' illness knowledge, patients' coping strategy,[23] and socioeconomic status[24]). Indeed, these determinants may also influence the HRQoL of patients with comorbidity and not only in those without comorbidity.

Besides the above-mentioned demographic and clinical factors, we also found psychosocial determinants of HRQoL: the presence of anxiety and depression negatively influenced HRQoL. This may have important clinical implications for both patients with and without comorbidity.

Clinical implication

Our opinion is that HRQoL should get more attention among clinicians. Prognosis should not be the only therapeutic goal. Since HF patients value HRQoL at least as important as longevity,[7,8] clinicians should strive for better HRQoL instead of focusing on survival per se. Indeed, in our study, we only found a limited number of determinants of HRQoL that may be influenced by clinicians, although we think that optimal HF treatment in accordance with the guidelines is an important intervention for improving HRQoL.[25] Also, optimal treatment of comorbidities like diabetes mellitus, chronic kidney disease, and COPD, and managing the risk factors BMI and systolic blood pressure may improve HRQoL. This is in line to what Lawson *et al.*[9] recently stated based on data of the Swedish Heart Failure Registry, namely that in order to improve HRQoL, HF guideline-driven care needs to include optimal management of the most prevalent non-cardiovascular comorbidities. Furthermore, psychosocial interventions to intervene with depressive and anxiety symptoms may also break the vicious circle of anxiety/depression and HRQoL. The last, but very important and maybe a 'bit forgotten' intervention we would like to emphasize, is cardiac rehabilitation. Cardiac rehabilitation should at least consist of exercise therapy and patient education.[25–27] Besides improving HRQoL, cardiac rehabilitation in patients with HF has proven to be favourable for other endpoints like rehospitalization and probably (long-term) mortality.[28] Despite the proven effectiveness and the strong recommendations in the HF guidelines,[25] the number of referrals to cardiac rehabilitation[29] and patients' adherence[30] may be increased enormously.

Strengths and limitations

This study is the first reporting HRQoL and their determinants in HF patients with and without comorbidity. Moreover, we used a set of different questionnaires to get an impression of a patient's QoL, namely EQ-5D, KCCQ, and HADS. However, some limitations should be mentioned. First, this study was designed as a sub-study of the TRIUMPH study. Therefore, results of this sub-study may be underpowered. Another limitation is that the choice for the comorbidities CVA, chronic kidney disease, COPD and diabetes was relatively arbitrary. Indeed, we have chosen common HF non-comorbidities that may influence HRQoL[9] but others may have chosen other comorbidities. However, as there were no previous studies investigating this topic, we should make a selection. Finally, 70% of the initial study population completed the baseline questionnaires. Part of the patients who could not complete the questionnaires at discharge were those who died during admission. The other parts of the 30% non-responders were patients who have not

Table 3 Multivariable adjusted determinants of HRQoL in the total population

	β	95% CI lower bound	95% CI upper bound
EQ-5D score			
Age (per 10 years increase)	−0.038	−0.061	−0.015
Male	0.109	0.046	0.172
NYHA Class III/IV	−0.081	−0.143	−0.02
Anxiety	−0.150	−0.221	−0.079
Depression	−0.244	−0.314	−0.174
EQ-5D VAS			
Age (per 10 years increase)	−0.093	−2.978	0.471
Male	3.820	−0.868	8.508
Previous HF	−5.051	−9.646	−0.456
LVEF (per % increase)	0.252	0.095	0.409
Anxiety	−8.342	−13.589	−3.094
Depression	−5.803	−10.963	−0.644
KCCQ-PL			
Age (per 10 years increase)	−0.382	−2.939	2.175
Male	13.607	6.977	20.238
Previous HF	−9.090	−15.686	−2.494
Chronic obstructive pulmonary disease	−10.439	−18.721	−2.157
BMI (per 1 point increase)	−0.845	−1.429	−0.262
NT-proBNP (per 100 points increase)	−0.063	−0.107	−0.020
Depression	−15.179	−21.841	−8.517
KCCQ-CS			
Age (per 10 years increase)	−0.526	−2.635	1.583
Male	10.185	4.749	15.621
Previous HF	−7.133	−12.643	−1.622
Chronic obstructive pulmonary disease	−7.815	−14.527	−1.103
BMI (per 1 point increase)	−1.047	−1.527	−0.567
Systolic blood pressure (per 10 points increase)	1.143	0.209	2.077
NT-proBNP (per 100 points increase)	−0.058	−0.094	−0.022
Depression	−13.677	−19.142	−8.212
KCCQ-OS			
Age (per 10 years increase)	0.441	−1.511	2.393
Male	7.167	2.183	12.151
Previous HF	−5.872	−10.907	−0.836
Ischemic HF	−6.009	−10.904	−1.115
BMI (per 1 point increase)	−0.718	−1.150	−0.285
Systolic blood pressure (per 10 points increase)	1.034	0.184	1.884
NT-proBNP (per 100 points increase)	−0.052	−0.084	−0.019
Anxiety	−7.463	−12.945	−1.981
Depression	−14.279	−19.695	−8.864

BMI, body mass index; CI, confidence interval; CS, clinical summary score; EQ-5D, EuroQuality-of-life 5 Dimensions; HADS, Hospital Anxiety and Depression Scale; HF, heart failure; HRQoL, health-related quality of life; KCCQ, Kansas City Cardiomyopathy Questionnaire; LVEF, left ventricular ejection fraction; NT-proBNP, N-terminal pro-B-type natriuretic.

Figure 1 Multivariable adjusted determinants of HRQoL in patients with and without comorbidity. Round symbols indicate results for patients with comorbidity, square symbols indicate results for patients without comorbidity. BMI, body mass index; CI, confidence interval; COPD, chronic obstructive pulmonary disease; CS, clinical summary score; EQ-5D, EuroQuality-of-life 5 Dimensions; HADS, Hospital Anxiety and Depression Scale; HF, heart failure; HRQoL, health-related quality of life; KCCQ, Kansas City Cardiomyopathy Questionnaire; LVEF, left ventricular eje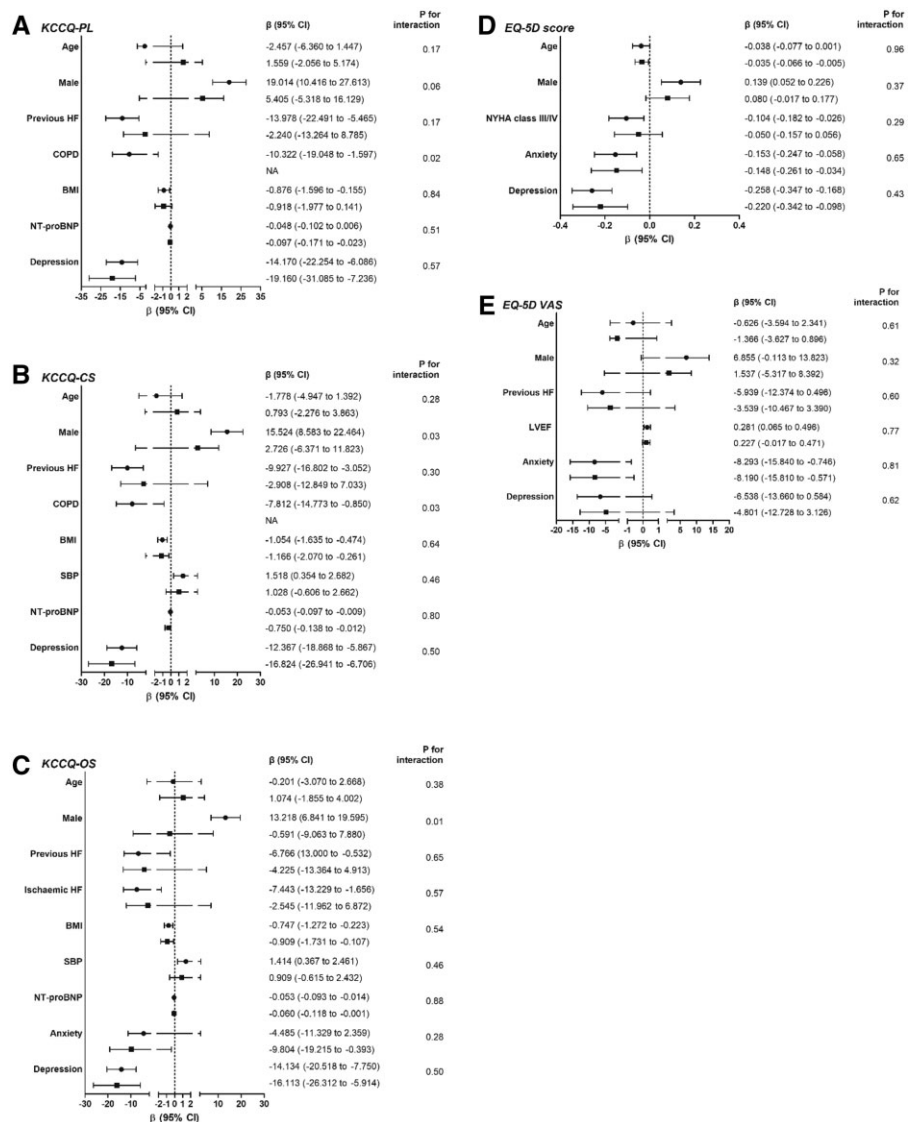ction fraction; NT-proBNP, N-terminal pro-B-type natriuretic peptide; NYHA, New York Heart Association; OS, overall summary score; PL, physical limitation; SBP, systolic blood pressure; VAS, visual analogue scale

completed the questionnaires for reasons unknown or who may have not received the questionnaires from their caregivers. Anyway, the baseline characteristics of the responders and non-responders were largely comparable so the missing seems to be at random.

Conclusions

In conclusion, HF patients without comorbidity had better HRQoL and less depression than patients with comorbidity. Sex, previous HF, COPD, BMI, NT-proBNP levels, and presence of anxiety and depression were determinants of HRQoL in patients with comorbidity. In contrast, we have found hardly any demographic or clinical determinants of HRQoL in those without comorbidity. In clinical practice, in addition to aiming for improved survival, physicians may pay greater attention to improving HRQoL of HF patients both with and without comorbidity.

Supplementary material

Supplementary material is available at *European Journal of Cardiovascular Nursing*.

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Data availability

The data underlying this article will be shared on reasonable request to the corresponding author.

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