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ORIGINAL RESEARCH

Sex-related differences in self-efficacy in patients with heart failure: a pooled cross-sectional study of the German Competence Network Heart Failure

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Aims To assess the level of self-efficacy in patients with heart failure (HF), identify differences between important subgroups including sex, and identify the determinants of high self-efficacy.

Methods and results This was a pooled cross-sectional analysis of 2030 patients from 4 prospective studies conducted within the German Competence Network Heart Failure. We used the self-efficacy subscale and the overall summary score (OSS) of the Kansas City Cardiomyopathy Questionnaire (KCCQ-23) to assess self-efficacy and health-related quality of life. The cut-off of 75 score points was used for the dichotomization into high (≥75) vs. low (<75) self-efficacy. Depressive symptoms were measured by the Patient Health Questionnaire (PHQ-9). A total of 1615 patients with HF provided complete self-efficacy scores: mean age 66.6 ± 12.3 years and 431 (27%) women. The mean self-efficacy score was 67.5 ± 24.9, with 907 patients (56.2%) showing high self-efficacy and 708 patients (43.8%) showing low self-efficacy. Men had higher self-efficacy scores than women (68.7 ± 24.5 vs. 64.2 ± 26.0; $P = 0.001$). Multivariable logistic regression identified the KCCQ-OSS [odds ratio (OR) per five-point increase 1.08, 95% confidence interval (CI) 1.04–1.12], female sex (OR 0.72, 95% CI 0.56–0.94), depressive symptoms (OR per three-point increase in PHQ-9 0.90, 95% CI 0.83–0.98), and acute HF (OR 0.46, 95% CI 0.34–0.62) as important predictors of high self-efficacy.

Conclusion In patients with HF, women seemed to exhibit lower self-efficacy than men. Health-related quality of life and psychological well-being were dominant determinants of self-efficacy. Future studies should investigate the role of self-efficacy as a therapeutic target for tailored and sex-specific nursing interventions.

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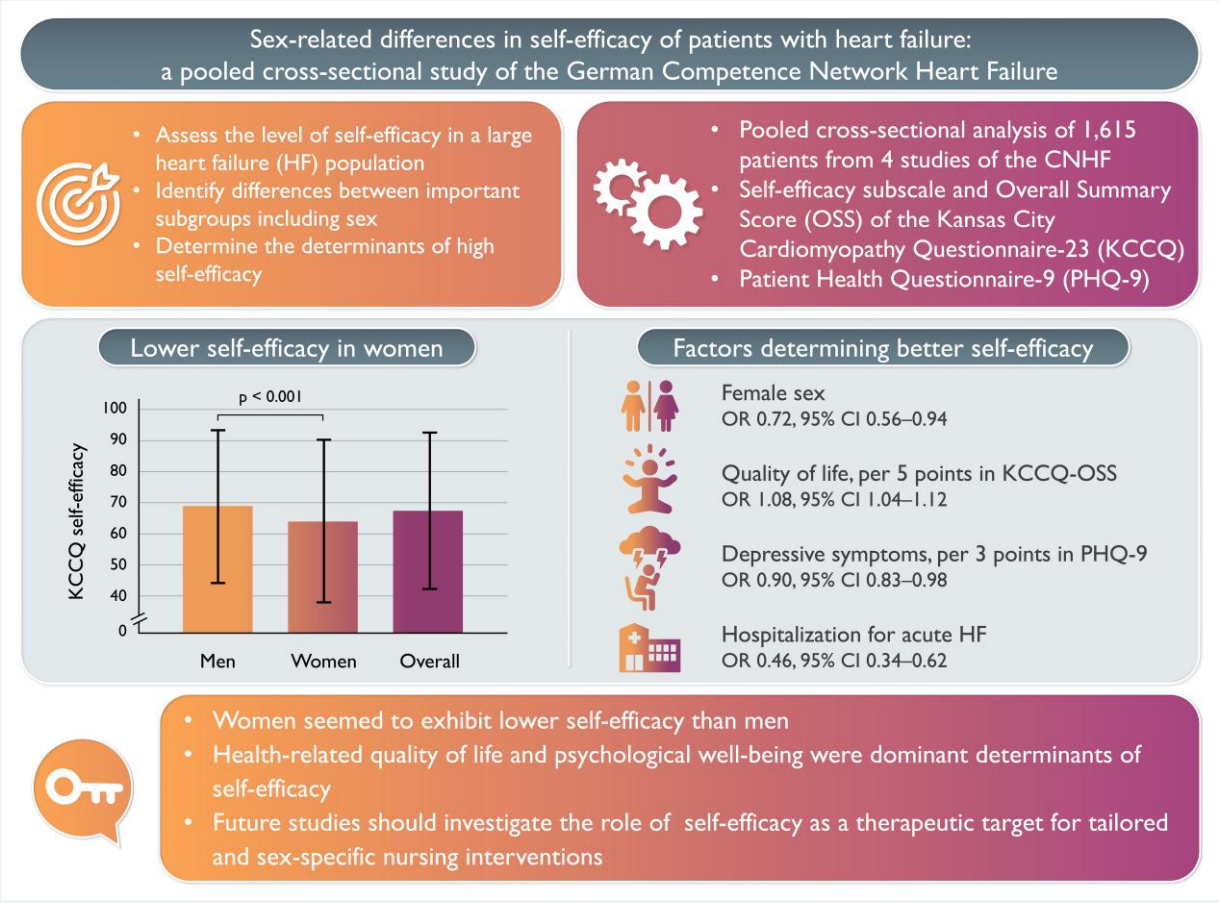
Graphical Abstract



Keywords Depression • Disease management • Heart failure • Nursing • Quality of life • Self-care • Self-efficacy • Sex

Novelty

- There may be sex-related differences regarding self-efficacy in patients with heart failure, with women showing lower self-efficacy than men.
- Health-related quality of life and psychological well-being are important determinants of self-efficacy.

Introduction

Heart failure (HF) is a clinical syndrome affecting more than 64 million people worldwide and ~4% of the general population in Germany.[1,2] Despite major pharmaceutical advancements over the last few decades, the prognosis of patients with HF remains poor, with a 5-year mortality rate of 50–70%.[3,4] Apart from optimal pharmacological therapy, the current HF guidelines of the European Society of Cardiology (ESC) emphasize the importance of self-care in the management of patients with HF.[5,6] Self-care in HF can be defined as a complex behavioural process of maintaining health through health-promoting and preventive practices.[7] Self-care includes decision-making processes and is influenced by multiple intrinsic and extrinsic factors such as health literacy, HF knowledge, comorbidity, and social support.[8] Patients with HF displaying more effective self-care behaviour have been found to experience a higher health-related quality of life, as well as having a lower mortality rate and healthcare utilization compared with patients with poor self-care behaviour.[9,10] However, essential elements in the self-care process remain unclear. The American Association of Heart Failure Nurses states that there is still 'no consensus on factors that can be used as predictors' for self-care in HF.[11] Meanwhile, evidence is growing that self-efficacy is a pivotal component in patients with HF to successfully engage in self-care behaviour.[12–14] According to Lenz and Shortridge-Baggett,[15] self-efficacy 'is the most important predictor of change in behavior'. For patients with HF, Chen *et al.*[12] proposed a comprehensive model for self-care, which includes important factors such as health literacy, HF knowledge, depression, and self-efficacy, hereby assigning self-efficacy a key role in the development of adequate self-care.

The concept of self-efficacy originates from Bandura's[16] social cognitive theory and is defined as 'the belief in one's capabilities to organize and

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execute the courses of action required to manage prospective situations'. Consequently, patients exhibiting higher self-efficacy have more confidence in their self-care ability and are therefore better equipped to successfully manage their condition, act upon symptoms, and ultimately improve their prognosis. According to Bandura's[16] social cognitive theory, four factors influence self-efficacy: performance accomplishments, vicarious experience, verbal persuasion, and physiological cues (i.e. emotional and physiological states). Personal success achieved through individual training and practice is the most important method by which self-efficacy is improved.[17] For example, patients with HF should be shown how to care for themselves and practice it on their own. The experience of successful training will likely increase their self-efficacy. Consequently, the concept of self-efficacy has profound implications for nursing practice, education, and research.[17] By improving self-efficacy through tailored nursing interventions, clinical benefits may be bestowed on patients, since higher self-efficacy is associated not only with improved self-care, but also with a better health-related quality of life and psychological well-being.[18,19]

Despite this prominent role, the evidence for the level of self-efficacy and in particular its determinants in patients with HF is scarce, with prior studies often having limited sample sizes.[12,18–21] Furthermore, multiple sex-related differences in HF have been reported, including aetiology, course, and clinical features.[22] The multitude of sex-related differences and their importance has recently been reaffirmed by a position paper of the Heart Failure Association of the ESC.[23] Therefore, the aim of this study is to assess the level of self-efficacy and its determinants in a large well-defined population with HF by considering differences in dedicated subgroups including sex and other factors.

Methods

Design and study population

We performed a pooled, *post hoc* analysis of baseline measures from four prospective studies conducted within the German Competence Network Heart Failure between 2004 and 2018. The inclusion and exclusion criteria of all studies are listed in Supplementary material online, *Table S1*. In the German Competence Network Heart Failure, all scientific projects used the same clinical data set. This uniform and harmonized data collection allowed for pooled cross-study analyses.[24] All studies were approved by the ethics committees concerned, and all patients provided written informed consent prior to participation in any of the German Competence Network Heart Failure studies.

Data collection and measurements

All data were recorded manually on paper forms, which were then transferred to an electronic database. All patients underwent standardized evaluation including medical history, physical examination, electrocardiogram, laboratory testing, echocardiography, and patient-reported outcome measures including the German version of the 23-item Kansas City Cardiomyopathy Questionnaire (KCCQ).[25–27] The 23-item KCCQ encompassed several summary scores and subscales (see Supplementary material online, *Figure S1*). Except for the KCCQ symptom stability and the KCCQ self-efficacy subscale, all other subscales are included in the overall summary score (OSS).[25] In the current analysis, self-efficacy was operationalized by the KCCQ self-efficacy subscale. This subscale consisted of two items (Questions #10 and #11 of the KCCQ) and rated self-efficacy on a five-point Likert scale. Patients were asked how sure they are on what to do in case of HF decompensation (#10) and how well they understand how to prevent HF decompensation (#11). The answers ranged from 'not sure at all' to 'completely sure' (#10) and from 'do not understand at all' to 'completely understand' (#11). Only patients with complete data on the KCCQ self-efficacy subscale were considered eligible for this analysis. Information about the German Competence Network Heart Failure studies that provided data for the current analysis and the respective number of included patients is given in *Table 1*. Acute HF was defined as hospitalization for acute HF at baseline. According to the universal definition and classification of HF,[29] HF was classified into the following subgroups on the basis of the left ventricular ejection fraction (LVEF): HF with reduced LVEF (HFrEF) (LVEF ≤40%), HF with mildly reduced LVEF (HFmrEF) (LVEF 41–49%), and HF with preserved LVEF (HFpEF) (LVEF ≥50%). In accordance with the definition of the World Health Organization, anaemia was defined as haemoglobin levels of <12.0 g/dL in women and <13.0 g/dL in men. Medical therapy with an angiotensin-converting enzyme inhibitor (ACEi) and an angiotensin receptor blocker (ARB) was grouped within one variable.

Data analysis

Data are presented as *n* (%), mean ± standard deviation, or median (quartiles). Baseline characteristics between subgroups of sex were compared using Fisher's exact test, χ^2 test, or the independent Student's *t*-test, as appropriate. We compared the level of self-efficacy between subgroups of interest [sex, New York Heart Association (NYHA) functional class, LVEF-based phenotypes, KCCQ-OSS, KCCQ total symptom scale (KCCQ-TSS), history of depression, and PHQ-9 sum score] using Student's independent *t*-test or linear regression analysis to compute *P*-values for groupwise trends, as appropriate. For the analysis of the reliability of the KCCQ self-efficacy scale, we assessed Cronbach's alpha as a measure of internal consistency.

We performed univariable and multivariable logistic regression analyses to assess the determinants of high self-efficacy. In accordance with recommendations for the KCCQ,[26] we used the cut-off of 75 score points for the dichotomization into high (≥75) vs. low (<75) self-efficacy. First, the determinants of self-efficacy were sought by univariable logistic regression amongst the baseline characteristics listed in *Table 2*. Amongst the variables describing coronary heart disease, we chose to include only 'ischaemic

Table 1 A description of the four German Competence Network Heart Failure studies included in the pooled analysis

Study	Description	Setting and type of patients	No. of eligible patients
E-INH	Extended INH study: prospective, randomized, controlled trial investigating the effect of the telephone-based, nurse-led remote patient care programme HNC	Inpatient, hospitalized for acute heart failure	855
HNC-SR	Multicentre prospective cohort study applying the disease management strategy HNC	Inpatient, hospitalized for acute heart failure	260
HELPS	Heidelberg study of longitudinal evaluation of quality of life and psychosocial variables in depressed patients with heart failure	Outpatient, chronic stable heart failure	302
HICMan	Heidelberg Integrated Case management: prospective, randomized trial investigating the effect of telephone-based case management in primary care	Outpatient, chronic stable heart failure	198

CNHF, German Competence Network Heart Failure; INH, Interdisciplinary Network Heart Failure; HNC, HeartNetCare-HF™ (telephone-based, nurse-coordinated multidisciplinary remote patient care programme including patient education, coordination of multidisciplinary care, treatment optimization, and telephone-based monitoring[28]).

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Table 2 Characteristics of the 1615 patients with self-efficacy scores at baseline and stratified by subgroups of sex

	Total sample ($n = 1615$)	Women ($n = 431$)	Men ($n = 1184$)	*P*-value
Sociodemographic				
Age (years)	66.6 ± 12.3	69.1 ± 12.8	65.6 ± 11.9	<0.001
Being married	866 (53.6)	154 (43.8)	712 (74.8)	<0.001
Heart failure characteristics				
Heart failure duration ≥1 year	936 (58.0)	234 (62.2)	702 (66.4)	0.150
NYHA class (III/IV)	768 (47.6)	238 (55.3)	530 (44.9)	<0.001
Ischaemic heart failure aetiology	747 (46.3)	158 (36.7)	589 (49.7)	<0.001
Acute heart failure	1115 (69.0)	300 (69.6)	815 (68.8)	0.767
Comorbidities				
Anaemia	431 (26.7)	107 (25.3)	324 (28.0)	0.285
Atrial fibrillation (current)	431 (26.1)	107 (25.0)	314 (26.8)	0.471
History of depression	186 (11.5)	82 (19.1)	104 (8.8)	<0.001
Diabetes mellitus	549 (34.0)	162 (37.7)	387 (32.7)	0.063
Cerebrovascular disease	229 (14.2)	56 (13.0)	173 (14.6)	0.412
Chronic obstructive pulmonary disease	307 (19.0)	67 (15.6)	240 (20.3)	0.033
Coronary artery disease	955 (59.1)	211 (49.0)	744 (62.8)	<0.001
Hyperlipidaemia	1040 (64.4)	263 (61.3)	777 (65.7)	0.100
Hypertension	1251 (77.5)	340 (78.9)	911 (77.1)	0.440
Myocardial infarction	658 (40.7)	147 (34.1)	511 (43.2)	0.001
Current smoker	201 (12.4)	24 (5.6)	177 (15.0)	<0.001
Medical history				
Coronary artery bypass graft	292 (18.1)	51 (11.8)	241 (20.4)	<0.001
Percutaneous coronary angioplasty	428 (26.5)	85 (19.7)	343 (29.0)	<0.001
Implantable cardioverter defibrillator	336 (20.8)	64 (14.8)	272 (23.0)	0.002
Measurements				
Body mass index (kg/m^2)	27.8 ± 5.0	27.3 ± 5.8	28.0 ± 4.7	0.011
Creatinine (mg/dL)	1.3 ± 0.8	1.2 ± 0.7	1.3 ± 0.8	<0.001
Heart rate (b.p.m.)	76.5 ± 17.8	78.8 ± 18.9	75.7 ± 17.3	0.002
LVEDD (mm)	61.0 ± 9.3	57.7 ± 8.5	62.2 ± 9.3	<0.001
LVEF (%)	31.1 ± 9.8	31.8 ± 10.1	30.8 ± 9.6	0.092
Patient-reported outcome				
KCCQ total symptom score	61.5 ± 27.0	55.4 ± 27.5	63.7 ± 26.5	<0.001
KCCQ clinical summary score	60.6 ± 24.8	54.1 ± 25.4	63.0 ± 24.1	<0.001
KCCQ overall summary score	57.1 ± 23.7	51.6 ± 24.3	59.1 ± 23.2	<0.001
KCCQ quality of life score	52.3 ± 26.4	49.0 ± 26.6	53.5 ± 26.3	0.002
KCCQ social limitation score	54.5 ± 30.7	48.5 ± 31.3	56.5 ± 30.2	<0.001
KCCQ physical limitation score	59.5 ± 27.5	52.7 ± 28.5	62.0 ± 26.7	<0.001
KCCQ self-efficacy score	67.5 ± 24.9	64.2 ± 26.0	68.7 ± 24.5	0.001
PHQ-9 Score	7.8 ± 5.5	8.5 ± 5.6	7.6 ± 5.4	0.016
Medication				
ACEi/ARB	1483 (91.8)	393 (91.4)	1090 (92.1)	0.665
Beta blockers	1412 (87.4)	365 (84.9)	1047 (88.4)	0.057

Data are presented as mean (standard deviation) or *n* (%). Subgroups of sex were compared using independent Student's *t*-test and χ^2 or Fisher's exact test, as appropriate.
NYHA, New York Heart Association; b.p.m., beats per minute; LVEDD, left ventricular end-diastolic diameter; LVEF, left ventricular ejection fraction; KCCQ, Kansas City Cardiomyopathy Questionnaire; PHQ-9, Patient Health Questionnaire; ACEi, angiotensin-converting enzyme inhibitor; ARB, angiotensin receptor blocker.

cause of HF', hereby excluding related variables such as 'coronary artery disease', 'history of myocardial infarction', 'coronary artery bypass graft', and 'percutaneous coronary angioplasty'. Given the structure of the KCCQ (see Supplementary material online, *Figure S1*), we used only the KCCQ-OSS, hereby excluding all other subscales for regression analysis. As a result, the 26 remaining baseline variables (see Supplementary material online, *Table S3*) were considered for univariable regression analyses. We used a Bonferroni correction to control for multiple testing

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(0.05/26 = 0.0019). All variables yielding $P < 0.0019$ in a univariable logistic regression model were regarded as potential determinants of self-efficacy and were further investigated in a multivariable logistic regression model (using the backward likelihood ratio selection with exclusion at $P > 0.10$). Odds ratios (ORs) with the respective 95% confidence intervals (CIs) and Wald's statistics were reported. The significance level was set at $\alpha = 0.05$. All tests performed were two-sided. Data were analysed using SPSS version 29.0 (SPSS Inc., Chicago, IL, USA).

Results

Characteristics of the study population and differences in important subgroups

Out of 2030 patients investigated in the four German Competence Network Heart Failure studies, 1615 patients (80%) provided complete self-efficacy scores and were therefore eligible for the current analysis. The patients with complete information about self-efficacy were representative of the entire sample (*Table 2* and Supplementary material online, *Table S2*). Their mean age was 66.6 ± 12.3 years, and 431 (27%) patients were women. The most common cause of HF was ischaemia (46%). A total of 768 patients (48%) belonged to the NYHA functional Class III or IV, and 1115 patients (69%) were hospitalized for acute HF.

The distribution of self-efficacy scores is shown in *Figure 1*. Cronbach's alpha of the KCCQ self-efficacy scale was 0.67. The mean self-efficacy score of all patients was 67.5 ± 24.9 points, and 708 patients (43.8%) showed low self-efficacy (<75 score points), while 907 patients (56.2%) showed high self-efficacy (≥75 score points). As shown in *Table 2* and *Figure 1*, men exhibited better self-efficacy scores than women (68.7 ± 24.5 vs. 64.2 ± 26.0; $P = 0.001$). Men were also younger (65.6 ± 11.9 vs. 69.1 ± 12.8 years) and showed a better health-related quality of life (KCCQ-OSS: 59.1 ± 23.2 vs. 51.6 ± 24.3), lower rates of diagnosed depression (8.8 vs. 19.1%), and a consistently lower burden of depressive symptoms (PHQ-9 sum score: 7.6 ± 5.4 vs. 8.5 ± 5.6) when compared with women.

There were differences in self-efficacy between other important subgroups in HF. Patients with lower NYHA functional classes had higher self-efficacy scores (I: 76.0 ± 28.7 vs. II: 66.0 ± 24.6 vs. III 60.0 ± 27.1 vs. IV: 52.0 ± 24.9; P for trend <0.001; *Figure 2*). Contrarily, lower self-efficacy was associated with a lower health-related quality of life (KCCQ-OSS 0–24: 56.6 ± 27.0 vs. 25–49: 61.0 ± 26.0 vs. 50–74: 68.7 ± 23.1 vs. 75–100: 76.8 ± 21.9; P for trend <0.001) and a higher symptom burden (KCCQ-TSS: P for trend <0.001; *Figure 3*). There were no differences in self-efficacy between patients with HFrEF, HFmrEF, and HFpEF (P for trend = 0.806; *Figure 2*). Patients with chronic stable HF had higher self-efficacy than those who were hospitalized for acute HF (73.2 ± 23.3 vs. 65.0 ± 25.3; $P < 0.001$). As shown in *Figure 4*, patients with diagnosed depression had lower self-efficacy scores than patients without diagnosed depression (61.8 ± 25.6 vs. 68.2 ± 24.8; $P = 0.001$), and depressive symptoms according to subgroups of PHQ-9 sum scores differed similarly (P for trend = 0.001).

Univariable and multivariable regression analysis

Univariable logistic regression models identified nine potential determinants of high self-efficacy from the baseline characteristics (*Table 3*). Women were less likely to have high self-efficacy than men (OR 0.66, 95% CI 0.53–0.82), whereas a higher health-related quality of life (per five-point increase in KCCQ-OSS) was associated with high self-efficacy (OR 1.13, 95% CI 1.10–1.16). Being hospitalized for acute HF (OR 0.49, 95% CI 0.40–0.62) and higher severity of depressive symptoms (per three-point increase in PHQ-9 sum score) decreased the likelihood of high self-efficacy (OR 0.78, 95% CI 0.73–0.83).

Applying backward selection, six variables including male sex, chronic stable HF, lower heart rate, higher KCCQ-OSS, lower PHQ-9 sum score, and treatment with ACEi/ARB remained in the multivariable logistic regression model as independent predictors of high self-efficacy (*Table 3*). When compared with the type of HF (acute vs. chronic), health-related quality of life, sex, and PHQ-9 sum score, the association of heart rate and ACEi/ARB with self-efficacy was small.

Discussion

This pooled, *post hoc*, cross-sectional analysis including 1615 patients with HF from four different studies of the German Competence Network Heart Failure across different settings and types of HF showed sex-based differences in the level of self-efficacy, with women exhibiting a lower self-efficacy than men. Besides sex, type of

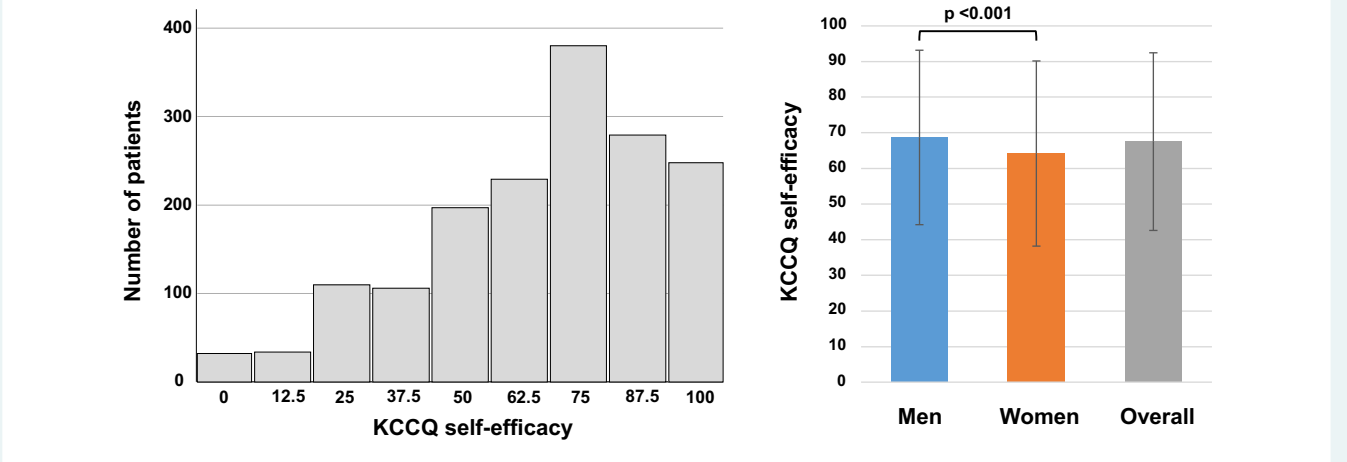

Figure 1 Self-efficacy measured in 1615 patients with heart failure using the Kansas City Cardiomyopathy Questionnaire self-efficacy subscale and its association with sex. Left: A histogram of the Kansas City Cardiomyopathy Questionnaire self-efficacy scale. Right: The level of the self-efficacy cohort (mean value and standard deviation) in the total cohort and stratified by sex (groups were compared using Student's independent *t*-test).

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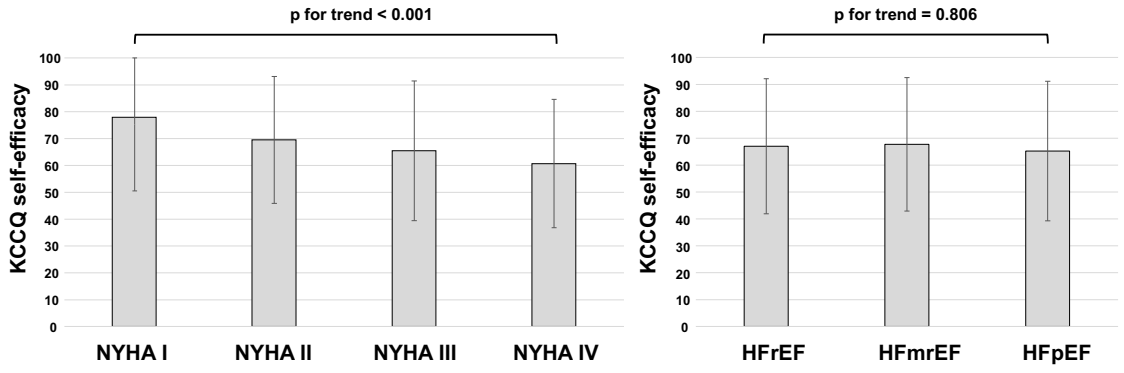

Figure 2 Association of self-efficacy with the New York Heart Association functional class and left ventricular ejection fraction. The bars indicate the mean values and standard deviations of self-efficacy. *P* for trend was calculated using linear regression. HFrEF, heart failure with reduced ejection fraction; HFmrEF, heart failure with mildly reduced ejection fraction; HFpEF, heart failure with preserved ejection fraction.

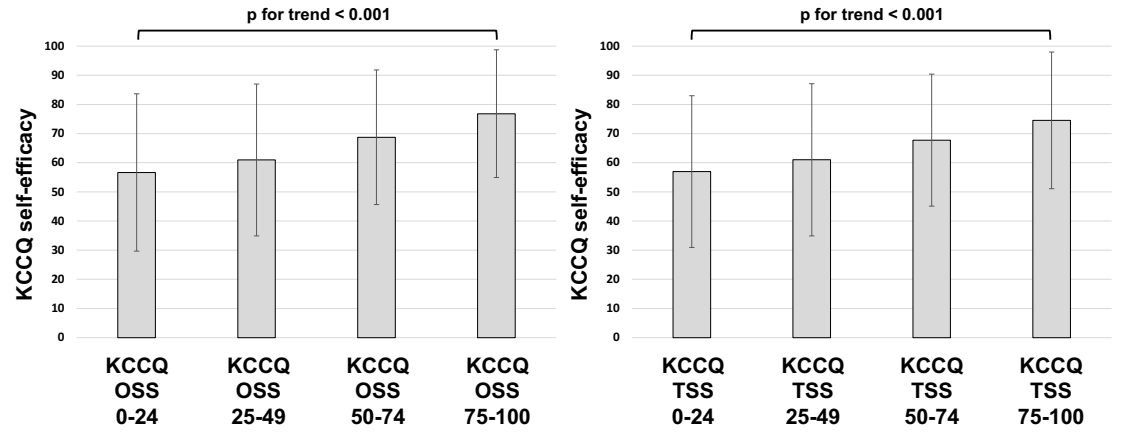

Figure 3 Association of self-efficacy with the Kansas City Cardiomyopathy Questionnaire overall summary score and the Kansas City Cardiomyopathy Questionnaire total symptom score. The bars indicate the mean values and standard deviations of self-efficacy. *P* for trend was calculated using linear regression.

HF (acute vs. chronic), health-related quality of life, and depressive symptoms were identified as independent predictors for self-efficacy.

The identification of health-related quality of life and depressive symptoms as independent determinants of self-efficacy in HF is in line with several studies that demonstrated a strong bidirectional association of self-efficacy with both health-related quality of life and psychological well-being.[12,18,19,21,30] Our findings confirm the importance of depression as a determinant of compromised self-efficacy.[12] Conversely, the strong influence of somatic factors on self-efficacy was underlined by associations between self-efficacy and both KCCQ-TSS score and NYHA functional class. This corroborates previous findings reported on the negative influence of higher NYHA functional class on self-efficacy.[31] The exclusion of the NYHA functional class from the multivariable model is presumably due to the superior predictive power of the KCCQ, which underpins its relevance in the clinical assessment of HF. Our results on heart rate are also consistent with the fact that a low heart rate is associated with better patient-reported outcomes.[32] The positive influence of treatment with ACEi/ARB on self-efficacy may be due to the fact that patients with established and adherent guideline directed medical therapy might be more optimistic regarding the successful prevention and/or handling of future HF decompensations. Of note, despite the broad spectrum of LVEF-specific aspects in HF,[5,29,33,34] neither LVEF-based subgroups nor LVEF as a continuous variable was associated with self-efficacy. Similarly, we found no difference in self-efficacy between patients with ischaemic or non-ischaemic cause of HF. Acute HF was associated with lower self-efficacy in contrast to chronic stable HF. The causality, i.e. whether acute HF is the consequence of poor inadequate self-efficacy and failed prevention of decompensation or whether acute HF compromises the confidence in one's self-care capabilities, remains unknown.

To the best of our knowledge, sex-based differences in self-efficacy in patients with HF have not been reported so far. Our results indicate that men have stronger beliefs in their self-care capabilities than women. In the light of the above-mentioned considerations, it is conceivable that the discrepancies between both subgroups in health-related quality of life (i.e. lower levels in women) and psychological well-being (i.e. higher rates of diagnosed depression and higher PHQ-9 sum scores

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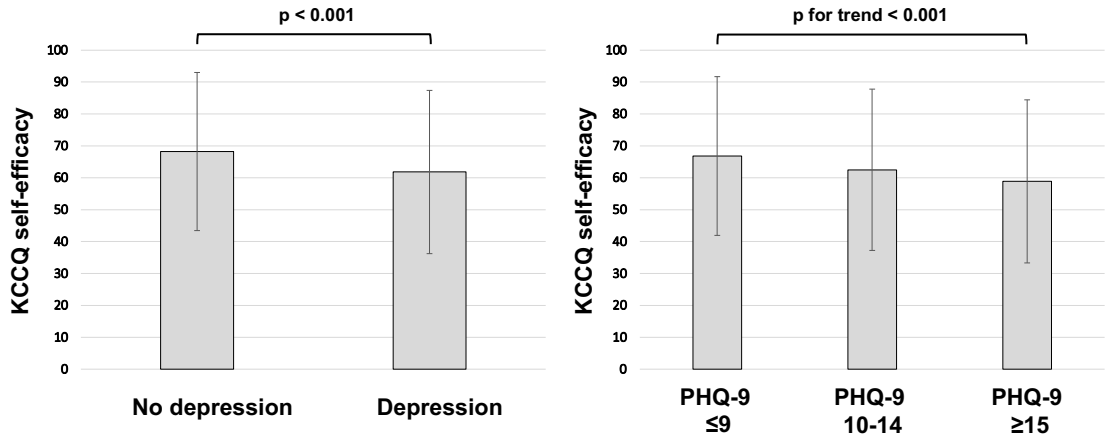

Figure 4 Association of self-efficacy with a history of depression and the Patient Health Questionnaire sum score. The bars indicate the mean values and standard deviations of self-efficacy. Groups were compared by using Student's independent *t*-test. *P* for trend for the categories of Patient Health Questionnaire scores was calculated using linear regression.

in women) contributed to sex-related differences. However, after adjusting for these psychological aspects, female sex remained an independent predictor of low self-efficacy. Hence, it can be hypothesized that alternative sex-related aspects—not represented in the current analysis—may also have had a relevant influence on self-efficacy. Nevertheless, sex-based patterns of health-related self-efficacy have been demonstrated in the context of other disorders. For instance, Samulowitz *et al.*[35] investigated self-efficacy in patients with musculoskeletal pain and found higher self-efficacy in men, which would be in line with our findings. In general, the fluctuating and modifiable character of self-efficacy needs to be taken into account.[17] Furthermore, gender roles including societal expectations and stereotypes could have an important influence on self-efficacy. For instance, men might see themselves as 'strong', independent, and capable of mastering future problems on their own. Contrarily, women might assess their self-care skills more critically or set higher standards for themselves, especially when being hospitalized for acute HF and/or depicting compromised health-related quality of life or depressive symptoms. At the same time, the observed sex-related differences in self-efficacy could be an indication that women feel that they have a stronger deficit or a stronger need for help, which could be a starting point for targeted nursing interventions. Further research is warranted to unravel the reasons for sex-related differences in self-efficacy in patients with HF.

The clinical relevance of self-efficacy in HF should be considered in the light of patients' self-care capabilities. The evidence for the prognostic benefit of self-care is well established: higher levels of self-care are associated with a better health-related quality of life and reduced risks of mortality or hospital readmission when compared with lower levels of self-care.[9,36,37] Underscoring this central role, the HF guidelines of the ESC assign self-care strategies a Class 1A recommendation to reduce the risk of HF hospitalization and death.[5] This strong appreciation is mirrored by the patients' perspective. In a survey of 429 patients with HFrEF, independence in self-care activities ('Being able to take care of myself independently') was rated as the most important treatment goal, even exceeding the reduction in mortality ('Living longer/preventing premature death') and prevention of hospitalizations ('Preventing another HF hospitalization').[38] Hence, patients with HF see self-care as the highest value in managing their condition. However, improving self-care is a complex task and subject to many influencing factors. One of the key components of building up self-care capacity is self-efficacy, and previous studies have demonstrated that the level of self-efficacy determines whether or not patients with HF engage in sufficient self-care.[12,13,20,39–42] Compared with patients with a poor sense of self-efficacy, those with high self-efficacy are more likely to set ambitious (self-care) goals and pursue them persistently. In other words, negative beliefs or attitudes about their own abilities prevent patients from practicing efficient self-care. Qualitative research confirms these quantitative findings. Herber *et al.*[43] proposed a situation-specific theory of barriers and facilitators for self-care and described self-efficacy as a naturalistic decision-making process, which is influenced by two main factors, i.e. self-efficacy and the patients' own disease concept of HF. Besides self-efficacy, depression is an essential barrier to effective and adequate self-care behaviour. A systematic review and meta-analysis encompassing 65 studies on psychological determinants of HF self-care confirmed that self-efficacy and depression were the strongest predictors for self-care.[41] Of note, there is also a substantial interplay between both determinants: Chen *et al.*[12] demonstrated that self-efficacy mediates the association between depression and self-care. In the context of depression and self-care, anxiety should also be taken into account, as it has likewise a negative influence on self-care behaviour.[44] Apart from depression, self-efficacy was also shown to dictate the relationship between cognition and self-care. A previous study demonstrated that self-efficacy mediated the relationship between self-care and two important domains of cognition, i.e. simple attention and working memory.[14] The authors concluded that self-efficacy might influence self-care behaviours more than cognitive performance. In other words, interventions aimed at enhancing self-care confidence may more effectively improve self-care than interventions centred on cognitive training.[14] Given the high prevalence of depression and cognitive impairment in patients with HF, it seems even more promising to address self-efficacy as a target of self-care interventions. In fact, self-efficacy might be a promising treatment target for nurse-led HF interventions, as demonstrated in a recent systematic review and meta-analysis. In 15 studies with 1415 participants, self-care interventions significantly improved self-efficacy, especially if the duration of the intervention was at least 1 month.[45] However, considering the considerable methodological heterogeneity of these studies, prospective randomized controlled trials are warranted.

By assessing self-efficacy and its determinants in a large, heterogeneous, and well-defined population with HF including subgroups of

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Table 3 Univariable and multivariable logistic regression models for high vs. low self-efficacy

Predictor variables	Univariable			Multivariable		
	Wald's statistics	OR (95% CI)	*P*-value	Wald's statistics	OR (95% CI)	*P*-value
Female vs. male sex	14.0	0.66 (0.53–0.82)	<0.001	5.9	0.72 (0.56–0.94)	0.016
Age, per year	11.5	0.99 (0.98–0.99)	<0.001	—	—	—
NYHA functional class, per class increase	28.5	0.66 (0.56–0.77)	<0.001	—	—	—
Acute heart failure, yes vs. no	39.2	0.49 (0.40–0.62)	<0.001	26.0	0.46 (0.34–0.62)	<0.001
ICD, yes vs. no	14.4	1.63 (1.27–2.09)	<0.001	—	—	—
Heart rate, per 5-b.p.m. increase	17.1	0.97 (0.95–0.98)	<0.001	2.7	0.98 (0.97–1.00)	0.100
KCCQ-OSS, per 5-point increase	112.9	1.13 (1.10–1.16)	<0.001	20.1	1.08 (1.04–1.12)	<0.001
PHQ-9, per 3-point increase	61.0	0.78 (0.73–0.83)	<0.001	6.4	0.90 (0.83–0.98)	0.012
ACEi/ARB, yes vs. no	10.2	1.80 (1.26–2.59)	0.001	2.9	1.43 (0.95–2.18)	0.089

Odds ratios (ORs) with 95% confidence intervals (CI), Wald's statistics, and *P*-values are reported.
KCCQ-OSS, Kansas City Cardiomyopathy Questionnaire—overall summary score; NYHA, New York Heart Association; ICD, implantable cardioverter defibrillator; PHQ-9, Patient Health Questionnaire; ACEi, angiotensin-converting enzyme inhibitor; ARB, angiotensin receptor blocker.

interest (e.g. sex), our findings may help to develop, tailor, and optimize self-care interventions in the future. Such studies should also investigate the prognostic role of self-efficacy in patients with HF. Even though self-efficacy has been identified as a predictor for HF hospitalizations and mortality in patients with coronary heart disease,[46] its prognostic relevance in HF remains unclear.

Strengths and limitations

Several limitations of this study need to be considered. First, despite the frequent use of the KCCQ self-efficacy subscale in HF studies, it is still unclear whether all domains of self-efficacy are adequately captured by these two items. Previous reports that used the KCCQ self-efficacy scale argued that it had a relatively low internal consistency (a low value for Cronbach's alpha).[47,48] Yet, it has been stated that thresholds <0.7 for instruments with fewer items are acceptable,[48,49] i.e. a value of 0.6.[50] Future studies should establish a consensus on the optimal assessment of self-efficacy in HF, and the findings generated by this *post hoc* defined analysis await confirmation in prospective studies. Second, the number of patients with HFpEF and HFmrEF was underrepresented in this analysis, thus limiting the generalizability of our findings to these subgroups. Third, health literacy and HF knowledge as potential determinants of self-efficacy were not available for this analysis. However, a previous study found no significant influence of both factors on self-efficacy.[12]

Conclusions

The current analysis assessed the level of self-efficacy in a large, well-phenotyped heterogeneous HF population and found relevant sex-related differences, with men showing higher self-efficacy when compared with women. Further, we identified other important determinants of self-efficacy including health-related quality of life and depressive symptoms. Our findings may contribute to a better understanding of the self-care process in HF and might therefore help to improve self-care and ultimately prognosis in patients with HF. Future studies should investigate the trajectories of self-efficacy over time and its role as a therapeutic target for tailored nursing interventions.

Supplementary material

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

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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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