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Review Article

Factors related to self-care behaviours in heart failure: A systematic review of European Heart Failure Self-Care Behaviour Scale studies

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Abstract

Background: Self-care is an important element in the comprehensive management of patients with heart failure. The European Heart Failure Self-Care Behaviour Scale (EHFScBS) was developed and tested to measure behaviours performed by the heart failure patients to maintain life, healthy functioning, and wellbeing.

Aims: The purpose of this review was to evaluate the importance of factors associated with heart failure self-care behaviours as measured by the EHFScBS.

Methods: Preferred Reporting Items for Systematic Review and Meta-Analysis guidelines were used to search major health databases (PubMed, Scopus and ScienceDirect). Obtained associating factors of heart failure self-care were qualitatively synthesised and the association levels of most commonly addressed factors were further explored.

Results: We identified 30 studies that were included in the review; a diverse range of personal and environmental factors associated with self-care behaviours in heart failure patients were identified. Age, health-related quality of life, gender, education, New York Heart Association class, depressive symptoms and left ventricular ejection fraction were most often correlated with the EHFScBS score. Consistent evidence for the relationship between self-care behaviours and depression was found, while their association with New York Heart Association class and health-related quality of life was non-significant in most of the studies. Associations with other factors were shown to be inconsistent or need to be further investigated as they were only addressed in single studies.

Conclusion: A sufficient body of evidence is available only for a few factors related to heart failure self-care measured by the EHFScBS and indicates their limited impact on patient heart failure self-care. The study highlights the need for further exploration of relationships that would offer a more comprehensive understanding of associating factors.

Keywords

Self-care behaviours, European Heart Failure Self-Care Behaviour Scale, systematic review, heart failure

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Introduction

According to estimates, 15m people are affected by heart failure (HF) in Europe[1,2] and a further increase in numbers is expected in future years due to improved treatment of acute coronary events and an aging population. With increasing burden and strong association with high morbidity, mortality and costs, HF is a major public health concern.[3]

A growing body of evidence supports the importance of HF self-care to prevent patient related outcomes and to improve health-related quality of life.[4,5] Despite the importance of HF self-care on positive health outcomes, many patients with HF have inadequate self-care behaviours.[6]

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Individual differences exist and are influenced by several factors, e.g. gender, educational level, income, co-morbidity, knowledge of HF and social support.[7–9] The influence of individual factors on patients self-care is poorly investigated and available literature remains inconclusive. However, to optimally tailor our educational and supportive interventions to improve outcomes, more knowledge is needed about interplay between self-care behaviours in HF patients and associated personal and environmental factors, i.e. socio-demographic (e.g. age, race, sex, marital status, living arrangements, income, education), psychological, physical (health state) and social characteristics.

In order to measure the behaviours that HF patients perform to maintain life, healthy functioning, and wellbeing the European Heart Failure Self-care Behaviour Scale (EHFScBS) was developed in 2003.[10] The original version consisted of 12 items and was in 2009 reduced to a nine-item version (EHFScBS-9) that showed supportive psychometric properties.[11] This systematic review focuses on the evidence of personal and environmental factors associated with self-care behaviours in HF patients, obtained in observational studies using the EHFScBS.

Methods

Search strategy

A systematic electronic literature search of PubMed, Scopus and ScienceDirect was conducted according to the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) statement[12] for the period between 9 June 2003 (when the EHFScBS-12 was first published) and 1 November 2015. Search terms: 'self-care' OR 'self-care behaviour' OR 'self-care behavior' OR 'European Heart Failure Self-care Behaviour Scale' OR 'EHFScBS' OR 'EHFScBS-9' AND 'chronic heart failure' OR 'heart failure' were used. Alternative searches were conducted on Google Scholar, contacts with experts and by hand-searching reference lists of relevant articles. Obtained papers (n=2154; PubMed n=621, Scopus n=1295 and ScienceDirect n=238) were initially screened based on the title and abstract. In the next phase, all relevant articles (n=74) were retrieved in full-text and reviewed by two reviewers (NS, JF); disagreements were resolved through discussion or by consulting a third reviewer (ML). A total of 30 studies fulfilled the inclusion criteria. A PRISMA flow diagram shows the selection of papers for inclusion and exclusion (Figure 1).

Studies were included in the systematic review if they: (a) recruited patients with HF; (b) included measures of self-care by using the EHFScBS-12 or the EHFScBS-9; (c) were observational studies that examined the association of self-care behaviours and personal or environmental factors (at the baseline); (d) were full reports published in English language.

Papers were excluded if they: (a) were randomised controlled trials; (b) were study protocols; (c) were reviews, editorials; (d) used only some items or one subscale of the EHFScBS; (e) included only descriptive results or analysed only selected self-care behaviours.

Assessment of risk of bias

Risk of bias in individual studies was assessed by two independent reviewers (NS, JF) using the risk of bias tool for observational studies from the Agency for Health care Research and Quality (the revised RTI Item Bank to Assess Risk of Bias and Confounding - the item bank, developed at RTI International).[13] Eight items to assess selection, performance, attrition, detection and reporting bias were applied for the scope of this review (see Supplementary Material, Appendix 2(a)). Based on assessment across key domains and one item to assess overall quality of a study, overall bias of individual study was rated as low, medium or high. A study was labelled as having a low risk of bias in the case that no key domains were rated as unclear or negative, moderate risk of bias in the case of up to two domains rated as unclear or negative and high risk of bias if three or more domains were rated as unclear or negative. Disagreements between reviewers were resolved by discussion or consultation with a third reviewer (ML). Confounding was assessed separately with three items (see Supplementary Material, Appendix 2(a)); when scoring the third item, studies controlling for variables in minimally two out of three domains (demographics or other individual characteristics, clinical characteristics, characteristics of environment) were rated as having minimised the risk of bias related to confounding.

Of the included studies the overall risk of bias (see Supplementary Material, Appendix 2(a) and 2(b)) was either low or medium. Selection bias occurred in two studies,[14,15] where strategy for recruiting participants differed across individuals; six studies[11,16–20] failed to provide sufficient information. Based on the descriptions in methods sections, studies were free of performance bias. Attrition bias occurred in four studies; one study[21] had a different length of follow-up across participants, while three studies[22–24] had loss to follow-up higher than 20% (Cochrane standard for attrition)[25] and did not assess the impact. Non-adequately addressed loss to follow-up in these studies also imposes a risk of detection bias that was partially identified in another study[26] using the measure created for the study. Reporting bias was not detected in selected studies as the outlined outcomes were reported and potential unplanned analyses seemed appropriate.

Risk of bias related to confounding was recognised in four studies,[23,27–29] that failed to take important confounding variables into account.

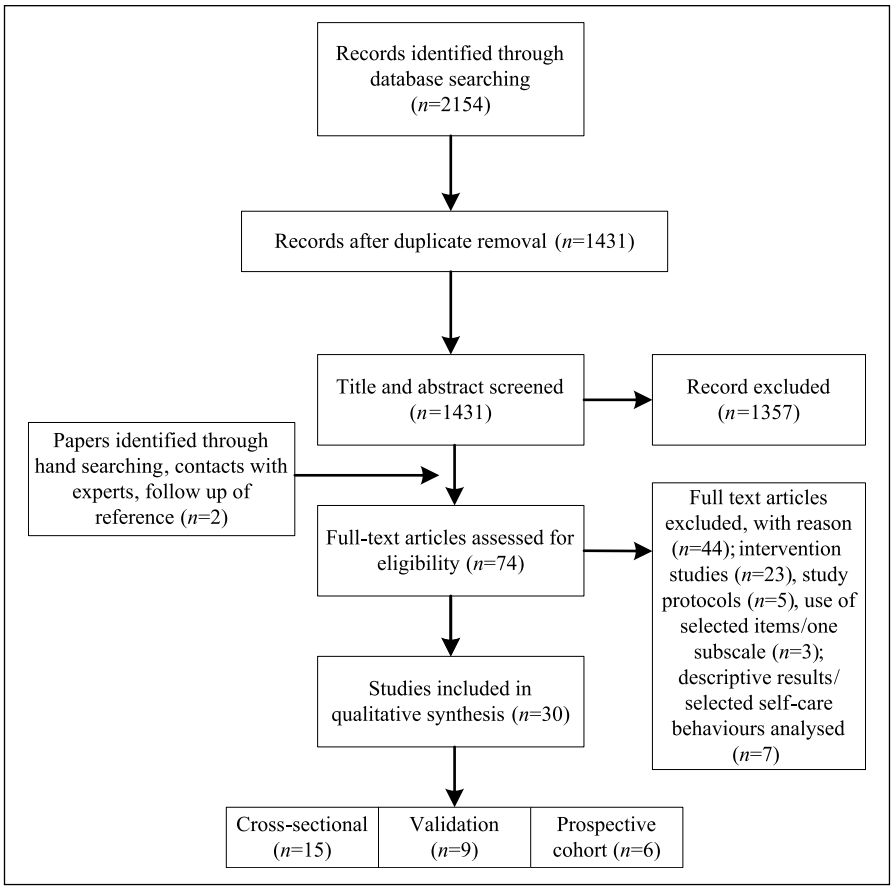

Figure 1. Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) flow diagram of study selection process.

Data extraction

Data concerning study design, participants and outcomes were extracted using a predesigned data extraction form. Relevant data extracted for study design included country undertaken, sample size, setting and version of the EHFScBS used with corresponding reliability coefficient (Cronbach's alpha); participant characteristics included age, gender, New York Heart Association (NYHA) class, left ventricular ejection fraction (LVEF); relevant outcomes included detailed information on addressed correlates of HF self-care (i.e. depression, social network, comorbidities) and their association with HF self-care behaviour score (instruments used, type of statistical analysis, association with HF self-care).

Data analysis

As identified studies were heterogeneous in aims, participant characteristics, settings, measurement tools and outcome variables, framework-based synthesis of the extracted factors related to HF self-care was performed. The categories of variables were adapted from Wilson and Cleary's conceptual model of health-related quality of life.[30] The model proposes six categories of the physical, psychological and social variables that are directly or indirectly related to health-related quality of life: individual characteristics, biological and physical characteristics, symptom status, general health perceptions, functional status and environmental characteristics. The same conceptualisation of categories was used in our study as a basis for grouping of the extracted factors related to HF self-care. Most commonly addressed factors were further examined. Results regarding their association with HF self-care behaviour were considered consistent (according to statistical significance of $p<0.05$),[31] when demonstrated in at least 75% of the studies. In order to compare the results obtained by different types of statistical analysis (methods to compare group means or/and correlational analysis or/and multivariate analysis) absolute correlation coefficient and beta coefficients as reported in the studies were used as the measures of association. For studies where independent-groups *t*-test was performed, squared point-biserial correlations between the group membership and the dependent variable were calculated. In studies that performed analysis of variance (ANOVA), eta squared was calculated as an estimate of the degree of association. In both cases, square roots of obtained values were used. Unstandardised regression coefficients were standardised.

As a measure of internal consistency values of Cronbach's alpha coefficient above 0.70 were considered satisfactory.[32]

Results

Description of studies

Among 30 studies that were included in the qualitative synthesis there were cross-sectional studies,[14–18,26–29,33–38] cross-sectional validation studies[11,19,20,39–44] and prospective cohort studies.[21–24,45,46] Studies were performed in Europe (Germany, Greece, Iceland, Italy, the Netherlands, Poland, Spain, Sweden, UK), Middle East (Iran), Asia (China, Japan, Korea), USA and Canada in a range of settings (hospitals, outpatient clinics, primary care, other). Studies included 60–2592 patients (NYHA class I–IV), with a mean age 57–82 years and 38–79% were men. The LVEF (%) was assessed in 18 studies and ranged from 21–54% (Table 1). In total 16 studies used the 12-item EHFScBS-12 and 14 studies used the nine-item version EHFScBS-9 (Figure 2).

Mean HF self-care score ranged from 18–34 on the EHFScBS-9 and from 24–34 on the EHFScBS-12 (Supplementary Material, Appendix 1). Reliability coefficient for the total scale was reported in 18 studies and ranged from 0.66–0.80 for the EHFScBS-9 and from 0.66–0.82 for the EHFScBS-12 (Table 1).

Further analysis of association levels included studies addressing relationship of HF self-care operationalised by the EHFScBS and: age (11 studies), health-related quality of life (eight studies), gender, education and NYHA class (seven studies), depression (six studies) and LVEF (five studies).

Association with HF self-care

Table 2 shows factors included in each predefined category and the number of studies that considered their association with HF self-care (at the baseline).

In general, studies varied in addressed factors related to self-care behaviours in HF patients; many of factors were addressed only by one or two studies, while most commonly addressed factors were investigated in 20–40% of studies at most: age (11 studies), health-related quality of life (eight studies), gender, education, NYHA class (seven studies), depression/depressive symptoms (six studies) and LVEF (five studies). More than half of the studies addressing gender, education, NYHA class, health-related quality of life as associating factors of HF self-care found statistically non-significant ($p>0.05$) associations. On the other hand, more than half of the studies addressing age, depression, LVEF as associating factors of the HF self-care found statistically significant ($p<0.05$) associations (Figure 3).

Considering association consistent (according to statistical significance of $p<0.05$) when demonstrated in at least 75% of the studies,[31] the evidence for consistent significant association between HF self-care behaviour and depression was found. NYHA class and health-related quality of life showed consistent non-significant association with HF self-care behaviour according to this definition. On the other hand, evidence for inconsistent associations between HF self-care behaviour and other selected factors (age, gender, education, LVEF) was found (proportion of studies reporting statistically significant or statistically non-significant results not reaching 75%) (see Figure 3). Most of the correlation and beta coefficients are distributed between zero and 0.3 which indicates negligible or low associations.

The detailed study description (study characteristics and reported outcomes) is available in the Supplementary Material, Appendix 1.

Discussion

This systematic review evaluated studies that used the EHFScBS, with specific emphasis to identify factors associated with self-care in patients with HF. Reviewing the evidence from 30 studies using the EHFScBS, a diverse range of personal and environmental factors were identified (Table 2). Overall, depression demonstrated significant and consistent low association with self-care behaviour whereas NYHA class and health-related quality of life were consistently non-significant in this respect. The analysis also highlights the unmet need in the field, namely the lack of evidence on associating factors/predictors for self-care behaviour operationalised by the EHFScBS. Even adding data that are collected with other instrument measuring self-care, such as Self Care of Heart Failure Index (SCHFI)[47] this gap seems to exist.[48] Therefore, adequately powered and designed studies are needed to identify patient characteristics that predict performance in terms of self-care. Regarding the HF self-care behaviour scale used, generally, the study provides evidence for satisfactory reliability of both versions of the EHFScBS.

Many of factors related to HF self-care behaviours were studied in single studies. Therefore, conceptually similar factors were merged into predefined categories in order to summarise the findings. The results indicated that individual characteristics (demographics), biological, physical characteristics (comorbidities), general health perceptions (health-related quality of life), functional status (NYHA class) and characteristics of the environment (use of healthcare) were studied most extensively (Table 2). Likewise, Carlson et al.,[49] identified similar predictors (demographics, comorbidities, physical and social functioning) of overall perceived health. They were also using the Wilson and Cleary model[30] as a conceptual framework. Similar models, linking physical, psychological and social factors, might therefore give a useful framework for theory-informed research on predictors of HF self-care as measured by the EHFScBS.

Table 1. Description of studies addressing factors associated with self-care behaviours in heart failure (HF) patients measured by the European Heart Failure Self-Care Behaviour Scale (EHFScBS).

Author/year	Study design					Participants			
	Type of study	Country	Sample size	Setting	Version of EHFScBC (reliability)	Age, years (mean±SD)	Male	NYHA	LVEF, % (mean±SD)
Gallagher et al. (2011)[26]	CS (secondary analysis COACH)	Netherlands	*n*=333	Hosp	12-item (α=0.71)	72 ± 11	66%	II–IV	
Graven et al. (2015)[14]	CS	USA	*n*=201	OPC	9-item (α=0.67)	72.6 ± 8.9	62.6%	I–IV	
Hajduk et al. (2013)[33]	CS	USA, Canada	*n*=577	Hosp	9-item	71.0 ± 12.9	56%		
Hjelm et al. (2015)[16]	CS	Sweden	*n*=105	OPC	9-item (α=0.76)	Me (IQR)=72 (65–79)	68%	II–IV	mild=28% medium=44% severe=28%
Holzapfel et al. (2009)[17]	CS	Germany	*n*=287	CHF, OPC	12-item	63.0 ± 11.8	74.7%	II–IV	(⩽25%)=38.4
Hwang et al. (2014)[15]	CS	USA	*n*=612	OPC	9-item (α=0.72)	65.9 ± 12.9	59%	I–IV	
Ingadottir et al. (2015)[34]	CS	Sweden, Iceland	*n*=104	OPC	9-item	70 ± 10	79%	I–IV	
Johansson et al. (2011)[35]	CS (secondary analysis – COACH index hospitalisation)	Sweden	*n*=958	Hosp	9-item	71 ± 11	63%	II–IV	
Kamrani et al. (2014)[27]	CS	Iran	*n*=184	Hosp	12-item (α=0.74)	Women: 70.7 ± 8.4 Men: 70.0 ± 9.0	38.6%	II–IV	(⩽40%)=54% (>40%)=46%
Kato et al. (2009)[36]	CS	Japan	*n*=116	OPC	12-item	64.6 ± 15.3	70.7%	I–III	54.1 ± 14.0
Lee et al. (2013)[37]	CS	USA	*n*=148	OPC	9-item (α=0.80)	57 ± 12	61.5%	II–IV	27.7 ± 11.8
Ok and Choi (2015)[38]	CS	Korea	*n*=280	OPC	12-item (α=0.66)	59.5 ± 13.8	65%	I–III	
Peters-Klimm et al. (2013)[18]	CS	Germany	*n*=318	PC	12-item	69.0 ± 10.4	71.4%	I–IV	35.3 ± 7.2
Shojaei et al. (2011)[28]	CS	Iran	*n*=250	OPC	12-item (α=0.68)	57.9	68.4%		34
Uchmanowicz et al. (2015)[29]	CS	Poland	*n*=110	Hosp	9-item	66.0 ± 11.4	53.6%	I–IV	
Hattori et al. (2011)[39]	VALID	Japan	*n*=142	OPC	12-item (α=0.81)	64.8 ± 13.7	64.8%	I–IV	43.2 ± 10.5
Jaarsma et al. (2009)[11]	VALID	Sweden, Netherlands, UK, Italy, Germany, Spain	*n*=2592	Hosp, OPC	9-item (α=0.80)	71 ± 12	64%	I–IV	34 ± 14
Kato et al. (2008)[40]	VALID	Japan	*n*=116	OPC	12-item (α=0.71)	64.6 ± 15.3	70.7%	I–III	54.1 ± 14.0

(Continued)

Table 1. (Continued)

Author/year	Study design					Participants			
	Type of study	Country	Sample size	Setting	Version of EHFScBC (reliability)	Age, years (mean±SD)	Male	NYHA	LVEF, % (mean±SD)
Köberich et al. (2013)[41]	VALID	Germany	*n*=109	Hosp, OPC	9-item (α=0.71)	62.5 ± 11.9	70.6%	I–IV	Me (IQR)=25 (20–35)
Lambrinou et al. (2014)[42]	VALID	Greece	*n*=128	Hosp. OPC	9-item (α=0.66)	69.6 ± 10.2	78.1%	I–IV	35.5 ± 10.8
Lee et al. (2013)[19]	VALID	USA	*n*=200	OPC	9-item (α=0.80)	57.0 ± 13.3	50%	II–IV	28.5 ± 12.3
Pulignano et al. (2010)[20]	VALID	Italy	*n*=93	OPC	12-item (α=0.82)	77 ± 6	47%	M ± SD=2.8 ± 0.6	31 ± 11
Shuldham et al. (2007)[43]	VALID	UK	*n*=183	OPC	12-item (α=0.69)	65.6 ± 12.3	78.1%	I–IV	46.8 ± 14.7
Yu et al. (2011)[44]	VALID	China	*n*=143	OPC	12-item (α=0.82)	78.1 ± 14.5	37.8%	I–IV	
González et al. (2014)[22]	COH – educational intervention study	Spain	Baseline *n*=335	OPC	12-item	Me (IQR)=67 (57–75)	73.1%	I–IV	Me (IQR)=30 (24–37)
Holst et al. (2007)[23]	COH (subgroup analysis of a larger randomised trial) – educational intervention study	Sweden	Baseline *n*=60	PC	12-item	79 ± 7	52%	II–IV	
Kessing et al. (2014)[45]	COH	Netherlands	Baseline *n*=238	OPC	9-item	66.9 ± 8.6	78%	I–IV	33.5 ± 6.7
Mohammadi et al. (2009)[21]	COH	Sweden	Baseline *n*=124	OPC	12-item	70 ± 11	71%	I–IV	
Nasstrom et al. (2014)[24]	COH – prospective pre-post longitudinal design	Sweden	Baseline *n*=100	Oth	9-item	81.7 ± 8.8	62%	II–IV	
Schiffer et al. (2007)[46]	COH	Netherlands	*n*=178	OPC	12-item (α=0.81)	66.6 ± 8.4	79%	I–IV	20.9 ± 6.7

COACH: Coordinating Study Evaluating Outcomes of Advising and Counseling in Heart Failure; COH: prospective cohort study; CS: cross-sectional study; Hosp: hospital; IQR: interquartile range; LVEF: left ventricular ejection fraction; Me: median; NYHA: New York Heart Association; OPC: outpatient clinic; Oth: other; PC: primary care; SD: standard deviation; VALID: cross-sectional validation study.

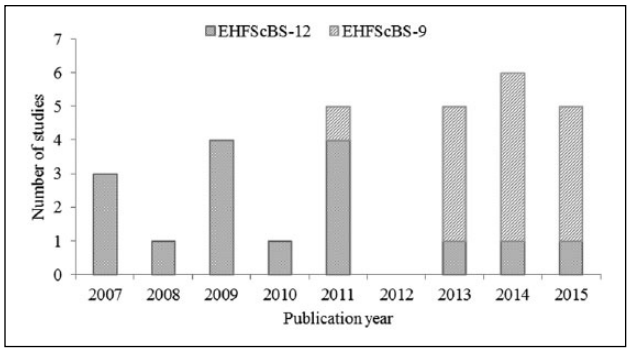

Figure 2. Number and version of the European Heart Failure Self-Care Behaviour Scale (EHFScBS) used by the publication year.

The relationships between HF self-care operationalised by the EHFScBS and age, quality of life, gender, education, NYHA class, depression and LVEF were most frequently investigated. We found inconsistent relationships between HF self-care and patient characteristics (age, gender, education, LVEF) as the number of studies that found a significant association was similar to the number of studies reporting non-significant associations. In principle, this may be due to false positive studies, false negative studies or variability in association among different populations. Herein, it is important to note that the statistical significance is dependent on the sample size, i.e. with the larger sample size it is possible that weaker correlations can reach statistical significance. However, low association levels (between zero and 0.3) indicate that these factors have limited impact on patient self-care as measured by the EHFScBS. This could reflect the notion that factors other than age, gender, education and LVEF have more influence on the ability to perform self-care behaviours. Nevertheless, future research in an adequately powered sample should give attention to their role as confounders or mediators for the associations between HF self-care behaviours and other associating factors. Results, however, should be interpreted with some caution because association between selected factors and HF self-care was reported by 20–40% of included studies, which reduces the statistical power of our findings.

The significant relationship between self-care measured by the EHFScBS and depression was consistently found in four[14,15,35,45] out of five studies that studied this relationship. Better self-care behaviour was found to be associated with fewer depressive symptoms or lower depression severity. Individuals with depression may have distinct problems in performing self-care due to impaired motivation and it is also known that HF patients with depressive symptoms might not be optimal candidates for 'conventional' self-care interventions.[50] However, obtained low negative associations between depression and HF self-care show, that depression might not have such an important role in poor HF self-care or that this relationship might not be so straightforward as assumed. Similar findings were obtained in recently published meta-analysis on psychological determinants of HF self-care[48] (r=−0.19, p<0.001), where they were partially attributed to methodological differences in assessment methods and depression measures which could be the case in our study as well.

We also observed that consistently non-significant associations were found with health-related quality of life. This on one hand can be expected since previous validation studies reasoned that these are different concepts.[11] On the other hand, consistently non-significant association between NYHA class and HF self-care behaviour indicates HF self-care behaviours have a weak impact on NYHA class. Without significant improvement in cardiovascular functioning, no change in health-related quality of life would be expected. As a result, if self-care cannot bring significant improvement in functioning, health-related quality of life would not improve. However, based on our study we cannot conclude whether this relationship is influenced by some other factors. According to some recent studies[48,51,52] psychological (subjective) factors, such as perceived self-care confidence, self-efficacy, self-care agency etc. might have an important role when explaining the nature of this association. Moreover, along with perceived ability for HF self-care, perceived impairments due to HF (i.e. perceived tiredness, perceived impairments in physical activity etc.) might be relevant as well. Despite the notion that subjective factors might be important in untangling potential linking mechanisms of health-related quality of life and HF self-care operationalised by the EHFScBS, or could contribute towards better understanding of HF self-care behaviours in general, only a few of the included studies focused on their possible links with HF self-care (Table 2, Supplementary Material, Appendix 1).

Limitations

The main issue with the current analysis is the fact that included studies varied considerably with respect to addressed associating factors; also, only a few factors related to HF self-care behaviours were investigated in a sufficient number of studies that allowed for a more in-depth analysis. This however leaves potential for unknown confounding or modifying variables that can influence self-care behaviour measured by the EHFScBS – i.e. psychological factors,[48,53] some common barriers to HF self-care,[54] contribution of caregivers to HF patients' self-care[55] etc. Moreover, our analysis gives no definite answers regarding standard patient characteristics, which are mostly included in studies as controlling variables, and the nature of their association with HF self-care behaviour.

This article focused primarily on self-care behaviours operationalised by the EHFScBS. Therefore it lacks the additional evidence on the topic that could be provided from studies using another commonly used

Table 2. The number of studies that reported on factors associated with self-care behaviours in heart failure (HF) patients measured by the European Heart Failure Self-Care Behaviour Scale (EHFScBS)-12 or the EHFScBS-9.

Categories of determinants		
Individual characteristics	Demographics	Age (*n*=11), gender (*n*=7), education (*n*=7), employment (*n*=2), occupation (*n*=1), marital status (*n*=4)
	Self-care	HF compliance (*n*=1), self-monitoring (*n*=1), self-care agency (*n*=1), patient views of involvement in care (*n*=1), alcohol intake (*n*=1)
	HF knowledge	HF knowledge (*n*=4), health literacy (*n*=1)
	Affect, personality	Perceived control (*n*=1), health locus of control (*n*=1), positive affect (*n*=1), anhedonia (*n*=1), type D personality (*n*=1), self-efficacy (*n*=1)
	Cognitive status	Global (*n*=5), (impaired) memory (*n*=2), (impaired) processing speed (*n*=1)
Biological and physical characteristics	HF aetiology	HF aetiology (*n*=1)
	Comorbidities	Type (*n*=1), number (*n*=1), comorbidity (*n*=3), multimorbidity (*n*=1), COPD (*n*=1), diabetes mellitus (*n*=3), depressive symptoms, depression (*n*=6), anxiety (*n*=1), ishaemic heart disease (*n*=1), hypertension (*n*=1), systolic blood pressure (*n*=2), diastolic blood pressure (*n*=2), anaemia (*n*=1), overweight (*n*=1), renal problems (*n*=1), gastrointestinal problems (*n*=1), peripheral arterial disease (*n*=1), frailty syndrome (*n*=1)
	LVEF	LVEF (*n*=5)
	Medication	Medication (*n*=2)
	Bio-chemical characteristics	NT-pro-BNP (*n*=1), sodium level (*n*=1), creatinine-clearance (*n*=1)
Symptom status		Physical symptoms (*n*=1)
General health perceptions	Perceived health status	Severity of CHF (health complaints) (*n*=1)
	Health-related quality of life	Health-related quality of life (*n*=8)
Functional status	NYHA class	NYHA class (*n*=7), functional status (*n*=1)
	Physical limitations	General physical limitation (*n*=1), visual impairment (*n*=1), hearing impairment (*n*=1), sleep disorders (*n*=1), implantable cardioverter defibrillator (*n*=1), coronary artery bypass graft surgery (*n*=1), prosthetic heart valve (*n*=1), (impaired) executive function (*n*=2), length of disease (*n*=1)
Characteristics of environment	Income	Income (*n*=1)
	Social support	Social support (*n*=4), social network (*n*=1), social problem solving (*n*=1)
	Use of healthcare	Previous admissions/previous HF hospitalisations (*n*=2), previous cardiologist referrals (*n*=1), hospitalisation frequency (*n*=1), number of hospitalisation during past 6 months (*n*=1), already followed in HFC (*n*=1), delay (time between worsening HF symptoms and hospital admission) (*n*=1), time since diagnosis (*n*=1)

CHF: chronic heart failure; COPD: chronic obstructive pulmonary disease; LVEF: left ventricular ejection fraction; NT-pro-BNP: N-terminal pro B-type natriuretic peptide; NYHA: New York Heart Association.

assessment tool (SCHFI),[47,56] which also has a caregiver version[57] and gives an example of theory informed research.[58,59] It is important to note that the EHFScBS and the SCHFI measure different constructs of HF self-care, which should be taken into account when interpreting results obtained by one or another instrument.

Furthermore, the identified studies were heterogeneous in design, reported variables and methodology to assess associations between the EHFScBS score and potential predictors (Table 1, Supplementary Material, Appendix 1), which limits the generalisability of findings. Methodological heterogeneity and relatively low proportion of studies addressing selected associating factors reduces the statistical power of our analyses. Also, since most of the included studies were cross-sectional it is not possible to make any conclusions about direction and possible causality of associations.

Reviewing the methodological quality of observational studies is another aspect that needs to be mentioned here; despite numerous appraisal tools being available in the literature, none of them is widely accepted. Even though the overall risk of bias in studies was low (60% of all studies) or medium (40% of all studies) and specific biases were recognised in relatively low proportion of studies, this should be taken into account when interpreting the obtained results.

Finally, our results could have been affected by our search strategy, including only studies published in English and referenced in electronic databases.

Conclusions

The current review identified a broad range of factors related to HF self-care behaviours measured by the EHFScBS that were investigated so far; yet, a sufficient body of evidence is

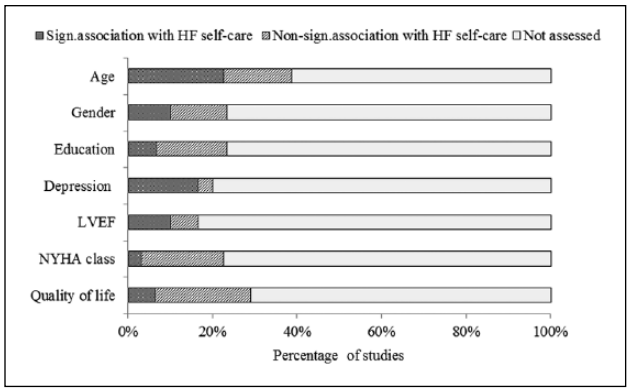

Figure 3. Most commonly addressed factors associated with self-care behaviours in heart failure (HF) patients measured by the European Heart Failure Self-Care Behaviour Scale (EHFScBS)-12 or the EHFScBS-9. Statistical significance level $p<0.05$. Studies addressing age, gender, education, left ventricular ejection fraction (LVEF), New York Heart Association (NYHA) mostly used the EHFScBS-12. Studies addressing depression and quality of life used the EHFScBS-12 and the EHFScBS-9 with similar frequency.

available only for a handful and, even then, a significant and consistent association was found only for depression. Thus, we believe that the next step in obtaining a more comprehensive overview of the associating factors would be theory informed research that is currently lacking but could explain the relationship of included factors with the self-care behaviours and help uncover associating factors that have not yet been explored. Conceptualisation of categories of variables adapted from Wilson and Cleary's model[30] used in this review could present the basis for future research.

Implications for practice

- A sufficient body of evidence is available only for a few factors associated with heart failure self-care as measured by the European Heart Failure Self-Care Behaviour Scale and their limited impact is indicated. Further exploration of relationships that would offer a more comprehensive understanding of associating factors is needed.
- Increasing understanding of heart failure self-care associating factors could be of great practical relevance for healthcare providers and users as it presents the first step in determining specific patients' characteristics that need to be targeted in educational interventions aiming to promote heart failure self-care.
- The findings could further support the existing recommendations[60] for healthcare professionals working with heart failure patients. Also, the skills necessary to facilitate the development of patients' self-care skills and adoption of self-care behaviours should be a part of the curriculum[61] for healthcare professionals.

Declaration of conflicting interest

The authors declare that there is no conflict of interest.

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