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Assessment

The European Heart Failure Self-care Behaviour Scale: New insights into factorial structure, reliability, precision and scoring procedure

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ABSTRACT

Objective: To evaluate a new factorial structure of the European Heart Failure Self-care Behaviour Scale 9-item version (EHFScBS-9), and to test its reliability, floor and ceiling effect, and precision. To propose a new 0–100 score with a higher score meaning better self-care.
Methods: A sample of 1192 Heart Failure (HF) patients (mean age 72 years, 58% male) was enrolled. Psychometric properties of the EHFScBS-9 were tested with confirmative factor analysis, factor score determinacy, determining the floor and ceiling effect, and evaluating the precision with the standard error of measurement (SEM) and the smallest real difference (SRD).
Results: We identified three well-fitting factors: consulting behaviour, autonomy-based adherence, and provider-based adherence (comparative fit index = 0.96). Reliability ranged from 0.77 to 0.95. The EHFScBS-9 showed no floor and ceiling effect except for the provider-based adherence which had an expected ceiling effect. The SEM and the SRD indicated good precision of the EHFScBS-9.
Conclusion: The new factorial structure of the EHFScBS-9 showed supportive psychometric properties.
Practice implications: The EHFScBS-9 can be used to compute a total and specific scores for each identified factor. This may allow more detailed assessment and tailored interventions to improve self-care. The new score makes interpretation of the EHFScBS-9 easier.

1. Introduction

It is estimated that 15 million people are affected by HF in Europe [1], and this figure is enlarging due to the improved treatment of acute coronary events and ageing of the population. HF is associated with frequent hospital admissions, emergency department visits, and low quality of life but better self-care has been shown to improve patients' outcomes [2,3].

To evaluate HF self-care and interventions to improve self-care reliable and valid instruments are needed. To date, only two tools are available in the literature: the European Heart Failure Self-care Behaviour Scale (EHFScBS) [4] and the Self-Care of Heart Failure Index v.6.2 (SCHFI v.6.2) [5,6] which has also a caregiver version [7]. The EHFScBS was developed in 2003 [4] and was reduced to a 9-item scale (EHFScBS-9) in 2009. It consists of two factors: consulting behaviours and adherence to regimen [8].

Examining the factorial structure of an instrument is very important to test its internal validity. In fact, EFA and CFA determine if the theoretical dimensionality of a tool is supported and whether items designed to measure each dimension do so as expected [11].

So far, the factorial structure and the reliability of the EHFScBS-9 have shown less than optimal psychometric properties. In the 2009 study [8], Confirmatory Factor Analysis (CFA) showed poor normed fit index (NFI) and comparative fit indices (CFI) (0.76 and 0.77, respectively). Reliability testing demonstrated an adequate Cronbach's alpha for the total scale and the consulting behaviours factor (both > 0.80), yet with a Cronbach's alpha of 0.56 for the adherence to regimen factor. The EHFScBS-9 was also tested in Germany and United States [9,10]. In both studies construct validity was not supportive for all fit indices and reliability was adequate for the total scale and the consulting behaviours factor but not for the other extracted factors.

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A recent study [12] testing the psychometric properties of the SCHFI v.6.2, that is very similar in content to the EHFScBS-9, has shown that the items pertaining the adherence to treatment loaded on an "autonomous" and a "provider-directed" factor. This new factorial structure of the SCHFI v.6.2 has shown more supportive fit indices than prior analyses and has provided with a new insight in the dimensions of HF self-care.

The reliability of the EHFScBS-9 for the total scale and the consulting behaviours factor is supportive but it is not for the adherence with the regimen factor. However, psychometric literature has demonstrated that Cronbach's alpha is not a consistent estimator of scale reliability [13–15]. An alternative option to test reliability is the factor score determinacy coefficient [16], successfully used also on the SCHFI v.6.2 [12], which has never been used on the EHFScBS-9. In addition, the floor and ceiling effect as well as the responsiveness to change of the EHFScBS-9 have never been determined. These three characteristics can give insight into the precision of the scale. The EHFScBS-9 currently has a score from 9 to 45 with a higher score indicating worse self-care. A standardised score from 0 to 100 with a higher score indicating better self-care can make interpretation of the score easier. Therefore, the aims of this study were to: (1) evaluate a new factorial structure of the of the EHFScBS-9 based on the factorial structure of the SCHFI v.6.2; (2) evaluate the reliability of the EHFScBS-9 by factor score determinacy coefficient; (3) evaluate the floor and ceiling effect of the EHFScBS-9 and its responsiveness to change; and (4) propose a 0–100 standardised score of the EHFScBS-9, where a higher score means better self-care.

2. Methods

2.1. Design

A cross-sectional design was used.

2.2. Sample and setting

A sample of 1,192 patients with HF was enrolled in this study. Patients were recruited from cardiovascular outpatient clinics located in 28 provinces located in the North, Centre, and South of Italy. To be eligible in the study patients had to speak and understand the Italian language, had to have a confirmed diagnosis of HF, and had not had an acute coronary event in the previous 3 months.

2.3. Instruments

The EHFScBS-9 was employed [8]. Each item uses a 5-point Likert scale from 1 ("completely agree") to 5 ("completely disagree"). The nine items can be grouped in two dimensions: consulting behaviours and adherence with the regimen. The consulting behaviours dimension investigates how often people with HF call their doctor/nurse in case of shortness of breath, ankle swelling, weight gain, and fatigue, whereas the adherence with the regimen dimension groups items that investigate how often patients weigh themselves, try to drink less water, follow a low-sodium diet, regularly take their medications, and exercise. The possible score is 9–45, with a lower score indicating better self-care. For reasons of interpretation we introduced a standardised score from 0–100 for the EHFScBS-9. The score was also reversed such that a higher score means better self-care. The translation and back-translation of the EHFScBS-9 into Italian language was performed in a prior study [8].

We also employed a sociodemographic and clinical questionnaire designed by the research team to collect sociodemographic (age, gender, marital status, and education) and clinical variables [New York Heart Association (NYHA) class, ejection fraction, and illness duration].

2.4. Procedure

This study was approved by the Institutional Review Boards of each centre where patients were recruited. Patients were approached during ambulatory visits, and nurses trained on the research protocol administered the instruments after informed consent was obtained.

2.5. Statistical analysis

Sociodemographic and clinical variables were analysed with descriptive statistics (frequencies, means, standard deviations, medians, and interquartile ranges). Each of the nine items of the EHFScBS-9 underwent item analysis with computation of the median and interquartile range. CFA was performed to establish the construct validity of the scale considering the following fit indices: Chi square, RMSEA, CFI, NNFI, and standardised root mean square residual (SRMR) [17].

According to Hu and Bentler [18], a model has a good fit if the RMSEA is up to 0.06 and in the lower bound of the 90% confidence interval, the CFI and NNFI are $\geq$95, and the SRMRs are below 0.08. CFA was initially used to test the one-factor model of the EHFScBS-9, but because this analysis resulted in an inadequate fit [Chi square (27, 1192) = 551.17; $p < 0.000$; CFI = 0.86; NNFI = 0.81; RMSEA = 0.13 (90% CI 0.12–0.14); and SRMR = 0.08)], CFA was performed taking into consideration the factorial structure of the SCHFI v.6.2 that showed recently excellent fit indices [12]. As described above, the SCHFI v.6.2 [5] is a 22-item instrument that measures self-care of HF with three scales: self-care maintenance, self-care management, and self-care confidence. The first two of these scales are very similar in their content to the EHFScBS-9, and within each, a recent study [12] identified factors pertaining to "autonomous" self-care maintenance and management and factors pertaining to "provider-directed" self-care maintenance and management. The SCHFI v.6.2 item asking about salt restriction (corresponding to item number 7 of the EHFScBS-9) had a loading on the "provider-directed" self-care maintenance. The items of the EHFScBS-9 were similarly aggregated taking into consideration the factorial structure of the SCHFI v.6.2. Specifically, item numbers 1, 5, and 9 were hypothesised to be in a factor that we called "autonomous-based adherence" item numbers 2, 3, 4, and 6 were hypothesised to be in the factor "consulting behaviours" (already identified in prior studies [4,8]), and item numbers 7 and 8 were hypothesised to be in the factor that we called "provider-based adherence" (Table 1).

Table 1
The hypothesised factorial structure of the EHFScBS-9 used to perform confirmatory factor analysis.

Items	Factors
1. I weigh myself every day	Autonomous-based adherence
5. I limit the amount of fluids	
9. I exercise regularly	
2. If SOB increases I contact my doctor or nurse	Consulting behaviour
3. If legs/feet are more swollen, I contact my doctor or nurse	
4. If I gain weight more than 2 kg in 7 days I contact my doctor or nurse	
6. If I experience fatigue I contact my doctor or nurse	
7. I eat a low-salt diet	Provider-based adherence
8. I take my medication as prescribed	

SOB, shortness of breath.