Original Papers

PRACE ORYGINALNE

Psychometric properties of the Czech version of the nine-item European heart failure self-care behaviour scale

Właściwości psychometryczne czeskiej wersji dziewięciopunktowej europejskiej skali zachowań związanych z samoopieką w niewydolności serca

Mária Sováriová Soósová[1,A-B,D-L] 🆔, **Elena Gurková**[2,A-B,D-I,L] 🆔, **Kamila Helbichová**[3,4,A-D],
Ewelina Bąk[5,A-B,G,L] 🆔

[1]Department of Nursing Care, Pavol Jozef Šafárik University in Košice, Faculty of Medicine, Slovak Republic
[2]Department of Nursing, University of Prešov in Prešov, Faculty of Health Care, Slovak Republic
[3]Department of Nursing, Palacky University in Olomouc, Faculty of Health Science, Czech Republic
[4]Surgical Department, Hospital TGM, Hodonín, p. o., Czech Republic
[5]Department of Nursing, University of Bielsko-Biala, Faculty of Health Sciences, Polska

CORRESPONDING AUTHOR:
Mária Sováriová Soósová
Department of Nursing Care, Faculty of Medicine, Pavol Jozef Šafárik University in Košice
Trieda SNP 1, 040 11, Košice, Slovak Republic
e-mail: maria.sovariova.soosova@upjs.sk

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STRESZCZENIE

WŁAŚCIWOŚCI PSYCHOMETRYCZNE CZESKIEJ WERSJI DZIEWIĘCIOPUNKTOWEJ EUROPEJSKIEJ SKALI ZACHOWAŃ ZWIĄZANYCH Z SAMOOPIEKĄ W NIEWYDOLNOŚCI SERCA

Cel pracy. Ocena trafności i rzetelności czeskiej wersji Europejskiej Skali Zachowań Samoopiekuńczych w Niewydolności Serca (EHFScBS-9).
Materiał i metody. 130 czeskich pacjentów z niewydolnością serca wypełniło EHFScBS-9 i Kwestionariusz Własnej Skuteczności Kardiologicznej (CSEQ). Przeprowadzono walidację językową. Oceniono analizę pozycji, potwierdzającą analizę czynnikową i trafność zbieżną. Rzetelność obliczono za pomocą współczynnika alfa Cronbacha.
Wyniki. W oparciu o kryteria dopasowania dla modeli konfirmacyjnej analizy czynnikowej, wyniki wskazały na dobre dopasowanie modelu dwuczynnikowego ($\chi^2 = 40,59$, p = 0,013; RMSEA = 0,077; CFI = 0. 972; TLI = 0,956; GFI = 0,937) odpowiednio trójczynnikowego ($\chi^2 = 38,24$, p = 0,017; RMSEA = 0,076; CFI = 0,974; TLI = 0,957; GFI = 0,943) czeskiego EHFScBS-9. Trafność zbieżna została potwierdzona na podstawie istotnej korelacji (r = 0,31, p = 0,001) między czeskim EHFScBS-9 (wynik znormalizowany) a CSEQ. Spójność wewnętrzna została potwierdzona przez wartości alfa Cronbacha dla całego narzędzia (0,84), a także dla podskali „Zachowania konsultacyjne" (0,90). Rzetelność podskali „zachowania związane z przestrzeganiem zaleceń" była wątpliwa (0,59).
Wnioski. Czeska wersja EHFScBS-9 jest trafnym i rzetelnym narzędziem do pomiaru zachowań związanych z samoopieką u pacjentów z niewydolnością serca.

Słowa kluczowe: konfirmacyjna analiza czynnikowa, Europejska Skala Zachowań Samoopiekuńczych w Niewydolności Serca – 9, rzetelność, trafność

ABSTRACT

PSYCHOMETRIC PROPERTIES OF THE CZECH VERSION OF THE NINE-ITEM EUROPEAN HEART FAILURE SELF-CARE BEHAVIOUR SCALE

Aim. To assess validity and reliability of the Czech version of the European Heart Failure Self-Care Behaviour Scale (EHFScBS-9).
Material and methods. 130 Czech heart failure (HF) patients accomplished the EHFScBS-9 and the Cardiac Self-Efficacy Questionnaire (CSEQ). Linguistic validation was performed. Item analysis, confirmatory factor analysis, and convergent validity were evaluated. Reliability was calculated by Cronbach's alpha.
Results. Based on fit criteria for the confirmatory factor analysis models, the results pointed to good fit for the two-factor model ($\chi^2 = 40.59$, p = 0.013; RMSEA = 0.077; CFI = 0.972; TLI = 0.956; GFI = 0.937), respectively for the three-factor solution ($\chi^2 = 38.24$, p = 0.017; RMSEA = 0.076; CFI = 0.974; TLI = 0.957; GFI = 0.943) of the Czech EHFScBS-9. Convergent validity was confirmed on the basis of a significant correlation (r = 0.31, p = 0.001) between the Czech EHFScBS-9 (standardised score) and the CSEQ. Internal consistency was confirmed by Cronbach's alpha values for the whole instrument (0.84), as well as for "Consulting behaviour" subscale (0.90). The reliability of "adherence behaviours" subscale was questionable (0.59).
Conclusions. The Czech version of the EHFScBS-9 is a valid and reliable instrument for measuring self-care behaviour in HF patients.

Key words: confirmatory factor analysis, European Heart Failure Self-Care Behaviour Scale – 9, reliability, validity

INTRODUCTION

Heart failure (HF) is the most common cause of hospital admissions, increased mortality and high healthcare costs [1,2]. Despite the availability of effective treatment methods, the prevalence and incidence of HF continue to increase [1] International guidelines recommend a holistic, multidisciplinary approach aimed at increasing self-care interventions among adults with HF as an effective preventive strategy for HF progression, health outcomes and quality of life improvement [3,4].

According to the self-care theory of chronic illness, self-care is defined as the process of maintaining health through symptoms monitoring and illness management [5,6]. Successful approaches to self-care in HF promote improvements in health of patients and include activities aimed at regular maintenance of self-care, such as adherence to prescribed medication, low-sodium diets, avoidance of smoking, and regular physical exercise; symptoms monitoring, such as daily monitoring of shortness of breath, body weight, swelling and fatigue; and effective disease management, e.g., adjusting medication doses, adapting diet and physical activity, seeking professional help [7-9]. Although systematic reviews and meta-analyses point to the benefit of self-care interventions in adults with HF, self-care in HF patients is still inadequate [8,9]. To effectively improve health outcomes in adult patients with HF, further analyses are needed to evaluate the effectiveness of self-care interventions and clearer practice guidelines for increasing self-care behaviours in this patient group [10]. Therefore, it is crucial to regularly monitor self-care outcomes, develop programs to help increase the effectiveness of self-care activities in adult patients with HF, and evaluate their effectiveness in relation to self-care behaviour, health and clinical outcomes, as well as to assess their performance in different populations of adult patients with HF [10].

The European Heart Failure Self-Care Behaviour Scale (EHFScBS-9) is one of the valid and reliable instruments that allow to evaluate patient self-care behaviour in HF [11-13]. According to the best of our knowledge, there is no Czech language version of this tool, or any other tool used to monitor self-care behaviour in HF. Chronic heart failure has a rising prevalence and incidence in the Czech Republic [14]. Results from Czech clinical practice also suggest that patients with chronic HF are at high risk of death and/or rehospitalization for acute HF after hospital discharge [14].

Therefore , the aim of this study was to perform linguistic validation of the Czech version of the EHFScBS-9 tool in patients with HF and to evaluate its validity and reliability.

MATERIALS AND METHODS

Design

A cross-sectional quantitative descriptive validation design was chosen. During the initial phase, linguistic and cultural adaptation of the instrument, and in the second phase was ensured, and the construct, convergent and discriminant validity, and reliability of the Czech EHFScBS-9 were investigated. The STROBE recommendations for cross-sectional observational studies have been followed in reporting this study.

Translation and cultural adaptation

After obtaining the consent of the author to use the English version of the instrument, the linguistic validation of the Czech EHFScBS-9 version was conducted according to the guidelines for the translation and cultural adaptation process for patient-reported outcomes measures [11,15].

Sample and setting

A convenience sample of HF patients was recruited from two hospitals. Inclusion criteria were as follows: diagnosis of HF confirmed by a doctor (verified in the medical record), age at least 18 years or more, fluency in Czech (as a first language), willingness to cooperate, and signed informed consent. The exclusion criteria were less than 18 years of age, pregnancy, severe cognitive deficit, and severe mental disorder.

For more rigorous statistical analysis, the sample size should be large enough to achieve optimal results for psychometric testing of the instruments. For confirmatory factor analysis (CFA), rules of thumb have been offered at least 10 participants per parameter or 100 to 400 contributors [16]. Taking into account that the EHFScBS-9 consists of nine items, a minimum of 90-100 participants were required for the study. Data collection was carried out between February 2021 and May 2021. The data were collected in the Teaching Hospital in Olomouc in Olomouc. Due to the unfavourable epidemiological situation caused by of the Covid-19 pandemic, the management of the University Hospital in Skalica in Slovakia (situated on the border with the Czech Republic with a high concentration of Czech population) was also asked to conduct the research. In the hospital, only patients of Czech nationality meeting the above selection criteria were included in the study. In order to collect data, 145 questionnaires were distributed. The return rate was 138 questionnaires (95.2%), and 8 respondents did not complete the questionnaire. In total, 130 questionnaires were included (response rate 89.7%) for statistical analysis.

Data collection

HF patients were asked to fulfil the Czech EHFScBS-9 questionnaire, along with the Cardiac Self-Efficacy Questionnaire (CSEQ), and the questionnaire designed to gather socio-demographic and clinical information [17]. Relevant clinical characteristics were obtained directly during the completion of the questionnaire or either transcribed from the patients' records.

The EHFScBS-9 is a 9-point scale used to evaluate counselling behaviours and adherence to treatment regimens in HF patients [11,12]. The instrument is recognized as valid and reliable, making it suitable for assessing self-care behaviours in both clinical practice and research [11-13]. Patients respond according to a Likert scale ranging from 1 (strongly agree) to 5 (strongly disagree). The authors suggest calculating either a total raw score or, more recently, a standardized score. The total raw score is derived by summing the responses to all items, with a range from 9 to 45 points, where higher

scores indicate poorer self-care. A standardized score was also calculated, where item scores were first recoded and then standardized scores (ranging from 0-100) were computed, with higher scores reflecting better self-care.

The CSEQ is a valid and reliable tool, which consists of 13 items designed to assess self-efficacy in symptoms control and functional maintenance in coronary artery disease [17]. Patients respond according to the Likert scale ranging from 0 (not at all confident) to 4 (completely confident). Scores for the two domains are obtained by summing the responses to the items within each domain. The total raw score is calculated by adding the item responses, with higher scores indicating greater levels of self-efficacy. In this study, reliability of the CSEQ was good (0.81).

Sociodemographic and clinical characteristics included age, gender, marital status, level of education, the rate of comorbidities, the length of HF, New York Heart Association (NYHA) functional classification (stage I-IV), and left ventricular ejection fraction (categorized as normal [50% or more], slightly reduced [40-49%], or highly reduced [less than 40%]).

Ethical consideration

The study received approval from the local Ethics Committee of the Palacky University in Olomouc, no. UPOL-117321/1030S-2020, as well as from both hospitals. It was conducted in compliance with the principles of research involving human subjects outlined in the 1964 Declaration of Helsinki and its subsequent amendments, along with national regulations governing ethical aspects of scientific research. All participants were informed about the purpose and content of the study, they were assured of the anonymity and voluntary nature of their participation, and that they could withdraw from the study at any time. Patients confirmed their participation by signing an informed consent form.

Data analysis

Descriptive statistical methods were applied to describe the characteristics of the sample. Within the scope of the item analysis, the distribution of items, item-total correlation, and Cronbach's alpha coefficient were assessed when items were deleted. CFA models were used to test the theoretical assumption that the 9-item version of the EHFScBS-9 has a 2-factor structure or a 3-factor structure [11,13]. In this study, the following fit indices were considered acceptable for the CFA models: Chi-square value (χ^2) with p > 0.05, Root Mean Square Error of Approximation (RMSEA) minimally < 0.08 and optimally < 0.05, Goodness-of-Fit Index (GFI), Tucker-Lewis Index (TLI) and Comparative Fit Index (CFI) minimally ≥ 0.90, optimally ≥ 0.95 [18]. Convergent validity was evaluated using Pearson's correlation coefficient (r) between the EHFScBS-9 and the CSEQ. Differences in EHFScBS-9 scores based on left ventricular ejection fraction and NYHA classification were assessed using analysis of variance. Internal consistency was assessed by Cronbach's alpha coefficient. As the cut-off for statistical significance, a p value of ≤ 0.05 was chosen. IBM SPSS 25.0 and IBM AMOS 23.0 softwares were used for data analysis [19,20].

RESULTS

Sample characteristics

The sample (Tab. 1) consisted of 130 participants with a predominance of male patients(69.2%). The majority of HF patients (32.3%) were aged 61-70 years, followed by 51-60 years (26.2%), and then 31-50 years (21.5%). The total of 17.7% of patients were 71 years or more. The majority of patients lived with a partner (59.2%), had secondary education (68.5%) and university education (24.6%). Most HF patients were classified as NYHA stage II (73.1%) or stage III (26.2%). Only 12.3% of patients had normal left ventricle ejection fraction, 66.9% had ejection fraction 41-50% and ejection fraction 40% or less was found in 20.8% of theexamined patients . The majority of patients (51.5%) had a disease duration of 4 to 8 years, 20% of sample reported a HF duration of 1 to 3 years, and more than 9 years of disease duration was reported by 28.5%.

■ Tab. 1. Sample characteristics (N = 130)

Characteristics	N (%)
Age (years)	
18-30	3 (2.3)
31-50	28 (21.5)
51-60	32 (26.2)
61-70	42 (32.3)
71 and more	23 (17.7)
Sex	
Male	90 (69.2)
Female	40 (30.8)
Marital status	
Living with partner	77 (59.2)
Living without partner	53 (40.8)
Level of educationPrimary	
Secondary	9 (6.9)
University	89 (68.5)
	32 (24.6)
Functional classification of the New York Heart Association	
I. stage	1 (0.8)
II. stage	95 (73.1)
III. stage	34 (26.2)
Left ventricular ejection fraction	
50% or more	16 (12.3)
40-49%	87 (66.9)
Less than 40%	27 (20.8)
Duration of disease (years)	
1-3	26 (20.0)
4-8	67 (51.5)
9-15	23 (17.7)
16 and more	14 (10.8)
Hospitalisations in the last year	
Yes	64 (49.5)
No	66 (50.8)

■ Tab. 2. Analysis of items for the Czech version of the European Heart Failure Self-Care Behaviour Scale – 9 (N = 130)

Item	Median (interquartile range)	Percentages of responses pre each Likert point					Item-total correlation	Cronbach's alpha coefficient after removing the item
		1	2	3	4	5		
1. I weigh myself every day	2.5 (2-4)	20.00	30.00	18.5	23.8	7.7	0.64	0.81
2. If shortness of breath worsensl contact my doctor or nurse	3 (2-4)	10.8	16.9	23.8	39.2	9.2	0.73	0.80
3. If legs/feet are more swollen I contact my doctor or nurse	4 (3-4)	9.2	12.3	24.6	42.3	11.5	0.80	0.79
4. If I gain my weigh more than 2 kg in 7 days I contact my doctor or nurse	3 (2-4)	13.1	22.3	17.7	36.9	10.0	0.68	0.81
5. I limit the amount of fluids intake	2 (2-2)	21.5	56.9	14.6	5.4	1.5	0.35	0.84
6. If I experience fatigue I contact my doctor or nurse	4 (3-4)	3.8	19.2	20.8	45.4	10.8	0.75	0.80
7. I follow a low-salt diet	2 (1-2)	29.2	56.9	10.8	1.5	1.5	0.50	0.83
8. I take my medication as prescribed	1 (1-2)	63.8	33.8	1.5	0.0	0.8	0.42	0.84
9. I exercise regularly	4 (3-4)	5.4	12.3	31.5	36.2	14.6	0.16	0.86

Item analysis

Tab. 2 shows the results of the item analysis. The most common self-care activity (score 1) was taking medications as prescribed and consulted a doctor about shortened breathing. The mean raw total score of the Czech EHFScBS-9 was 24.52 (±6.14) and standardised score was 56.90 (±17.05). The correlations between the means, mentioned above, were perfectly negative (r = - 1.00, p = 0.000), suggesting that both scores share the same measurement properties. Most items showed satisfactory item-total correlations of ≥ 0.3 with increasing Cronbach's alpha when items were deleted.

Confirmatory factor analysis

The CFA (Tab. 3) led to both a 2-factor and 3-factor model of the Czech EHFScBS-9. The 2-factor model (consulting and adherence behaviours) of the Czech EHFScBS-9 initially resulted in a poor fit. Consideration of the modifying indices (Tab. 2) led to an improvement of the 2-factor model with acceptable fit. The fit indices showed a poor structure of the 3-factor model of the Czech EHFScBS-9. When the modifying indicators were considered, an improvement has been achieved with an acceptable fit for the 3-factor model of the Czech EHFScBS-9 (Tab. 1).

Convergent validity

The Czech EHFScBS-9 standardised score was significantly correlated (r = 0.31, p = 0.001) with the total score of the CSEQ, thus confirming the concurrent validity of the instrument. However, no significant differences were found in the standardized EHFScBS-9 scores based on left ventricular ejection fraction or NYHA stages (p > 0.05), as well as no significant association (r = -0.07, p = 0.425) was identified between the Czech EHFScBS-9 and length of HF.

Reliability analysis

The Cronbach's alpha of the Czech EHFScBS-9 confirms the excellent reliability of the instrument as a whole (0.84). Within the 2-factor model, the domain of "Consulting behaviour" had the highest reliability (0.90), while the domain of "Adherence behaviour" had lower reliability (0.59). When assessing the reliability of the 3-factor

■ Tab. 3. Factor loadings, factor correlations, and goodness-of-fit indices for two measurement models of the Czech EHFScBS-9 according to confirmatory factor analysis (n = 130)

Item	2-factor model		3-factor model		
	Factor I	Factor II	Factor I	Factor II	Factor III
2. If shortness of breath worsens I contact my doctor or nurse	0.88	-	0.88	-	-
3. If legs/feet are more swollen I contact my doctor or nurse	0.99	-	0.99	-	-
4. If I gain my weigh more than 2 kg in 7 days I contact my doctor or nurse	0.60	-	0.59	-	-
6. If I experience fatigue I contact my doctor or nurse	0.81	-	0.81	-	-
1. I weigh myself every day	-	0.14	-	0.12	-
5. I limit the amount of fluids intake	-	0.74	-	0.72	-
7. I follow a a low-salt diet	-	0.89	-	0.94	-
8. I take my medication as prescribed	-	0.53	-	-	0.47
9. I exercise regularly	-	0.09	-	-	0.13
Modification indices – covariance					
Consulting behaviour ↔ u1	0.67		0.58		
Adherence behaviour ↔ u4	0.31		-		
u4 ↔ u8	-0.22		-		
Autonomy-based behaviour ↔ u4	-		0.29		
Factor correlations					
Factor I	-	0.33	-	0.30	0.74
Factor II		-		-	1.04
Factor III		-			-
Goodness-of-fit					
χ^2 (df)	40.59 (23)		38.24 (22)		
P-value	0.013		0.017		
RMSEA	0.077		0.076		
GFI	0.937		0.943		
CFI	0.972		0.974		
TLI	0.956		0.957		

EHFScBS-9 – 9-item version of the European Heart Failure Self-Care Behaviour Scale, RMSEA – Root Mean Square Error of Approximation, GFI – Goodness-of-Fit Index, CFI – Comparative Fit Index, TLI – Tucker-Lewis Index

model, the Cronbach´s coefficient value for "Consulting behaviour" subscale remained unchanged, whereas for "Autonomy based adherence" subscale was 0.58, and for "Provider based adherence" subscale was unsatisfactory (0.10).

DISCUSSION

The study demonstrated that the Czech version of the EHFScBS-9 instrument is valid and reliable for measuring self-care behaviour in HF patients. These findings align with previous research which supports the strong psychometric properties of the EHFScBS-9 across different languages and cultures [11-13,21-25].

The mean raw total score and standardized score of the Czech version of the EHFScBS-9 were comparable to the results reported in previous studies [10,12,20,22]. Most items showed satisfactory item-total correlations. A decrease in reliability was observed when an item was deleted. In view of this, there is no need to remove any item from the Czech EHFScBS-9. Weak item-total correlation was identified only for one item – regular exercise which is consistent with some studies but in contrast to the studies of Jaarsma et al. and Son, Won [11,22-24].

The CFA pointed to good fit for the 2-factor and 3-factor solutions of the Czech EHFScBS-9. This supports the theoretical hypothesis that the EHFScBS-9 consists of two subscales or three subscales[11,13]. In the 2-factor model, "Consulting behaviour" subscale and "Adherence behaviour" subscale were saturated with identical items like in the original study [10]. In the 3-factor model, "Consulting behaviour" domain was filled with the same items like in previous studies, "Autonomy-based behaviour" was saturated by items referring to fluid (weighing oneself, water and salt restriction) and "Provider-based behaviour" was filled with medication adherence and regular exercise items similarly to the Korean and Greek studies, but slightly different from the studies by Vellone et al. or Østergaard et al [11,13,21-23, 25].

In the Czech version, a positive covariance was found between the item "daily weighing" and the "Consulting behaviour" subscale as well as between the item "weight gain consulting" and "Adherence behaviour" subscale, suggesting that self-monitoring and symptom recognition lead to consultations and subsequently higher adherence to treatment. Negative associations were found between items "weight gain consulting" and "take medication as prescribed". It can be assumed that if there is less adherence to treatment, there is a weight gain and this in turn leads to more frequent weight gain consultations. On the other hand, after weight gain consultation, there may be a change in the dose of the prescribed medication from the usual one. An additional covariance was identified in the Czech 3-factor solution model in which "weight gain consulting"were closely and logically related to "Autonomy-based behaviour", the second factor saturated mainly with items focused on fluid management (weight yourself, fluid and saltconsumption).

The reliability of the whole instrument was was found to be good (0.84). In the 2-factor model, the subscale "Consulting behaviour" had excellent reliability (0.90).

However, the reliability of the subscale "adherence behaviours" was questionable (0.59). This is consistent with previous results of studies [11,22-23]. In the case of the 3-factor model, the reliability of the subscale "Consulting behaviour" was unchanged, the subscale "Autonomy based adherence" had questionable reliability (0.58), and reliability of the subscale "Provider based adherence" was unsatisfactory (0.10). These results are not consistent with the results demonstrated by studies of Vellone et al. and Son and Won [13,23]. The unsatisfactory reliability of the third domain was identified by the Østergaard et al. [22]. In the present study, these results may be related to the very poor saturation of the adherence factor by the item „I exercise regularly" (similarly to the Østergaard et al. study), and possibly due to some homogeneity of the cohort (mostly hospitalised, symptomatic patients) resulted from the fact that patients were recruited in only two hospitals due to COVID-19 pandemic [22]. The low number (2 items) and heterogeneity of items (taking medication, physical exercise) in the "Provider based adherence" domain also contributes significantly to low reliability [26].

The convergent and discriminant validity of the EHFScBS-9S were confirmed by several studies [11,21,23,25]. Convergent validity was established by identifying positive associations between the Czech EHFScBS-9 and the CSEQ, which means that both instruments measure a similar construct. However, we did not find associations between the Czech EHFScBS-9 and left ventricle ejection fraction and NYHA stages. This may be related to the fact that the cohort included patients in NYHA 1st stage, who did not show any severe symptoms.

The strengths of this study include the linguistic validation and the confirmation of the validity and reliability of the Czech EHFScBS-9. Regarding the analysis of the items, confirmatory factor analysis and reliability test, the 2-factor solution of the Czech version of the EHFScBS-9 appears to be more psychometrically robust than 3-factor solution. The limitation of the study was that the content validity was not evaluated . However, it was confirmed in the original study. The study sample of HF patients was from a limited number of healthcare facilities due to COVID-19 pandemic (patients were from only 2 hospitals from 2 similar regions in contrast to the original intention to conduct the research in specialized HF outpatient settings), which may have affected the responses of some patients. Their current symptoms and the hospitalisation itself may have influenced their statements regarding the item „I exercise regularly" and thus the reliability of the domain „Provider-based adherence". Given the low reliability of the 3-factor model, it does not seem appropriate to calculate scores for individual domains. It is more useful to evaluate the self-care results of patients behaviour by calculating the total score, as the reliability of the instrument as a whole showed the highest values. An unequal distribution of HF patients was found in relation to left ventricle ejection fraction and NYHA stages (patients in stage IV were absent). Furthermore, certain psychometric tests (e.g. test-retest reliability, discriminant validity) were not performed in this study, which could be the subject of future research.

Mária Sováriová Soósová, Elena Gurková, Kamila Helbichová, Ewelina Bąk

CONCLUSIONS

The Czech version of the EHFScBS-9 instrument, especially 2-factor solution, can be considered as a valid and reliable tool for assessing self-care behaviour in the Czech population with heart failure. The instruments can be useful in clinical practice as well as in future research studies.

ORCID

Mária Sováriová Soósová https://orcid.org/0000-0001-5000-821X
Elena Gurková https://orcid.org/0000-0002-5629-9414
Ewelina Bąk https://orcid.org/0000-0002-2014-3717

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