ORIGINAL RESEARCH

Validity and reliability of the Korean version of self-care of heart failure index

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ABSTRACT

Purpose: Self-care and associated decisions for therapeutic recommendations have been a focus of attention recently in Korea. The purpose of this study was to address the dimensionality and reliability of a Korean version of Self-care of Heart Failure Index (SCHFI v.6.2), a measure of self-care of patients with heart failure within a clinical context.
Methods: The study sample completed 120 surveys that consisted of demographic variables and the SCHFI v.6.2, which was created to measure self-care maintenance, self-care management, and self-care confidence in HF patients. Confirmatory factor analysis using Mplus verified a robust structural fit of the three dimensionality for each subscale.
Results: Self-care maintenance, CFI = .92, TLI = .88, SRMR = .06, RMSEA = .07; self-care management, CFI = .93, TLI = .78, SRMR = .05, RMSEA = .24; self-care confidence, CFI = .95, TLI = .92, SRMR = .05, RMSEA = .13. Multidimensionality yielded the self-care maintenance scale having 4-factor structures, while each self-care management and confidence scale had a unidimensionality. Reliability estimates using methods compatible with each scale's dimensionality were adequate to high, ranging from .71 to .96.
Conclusions: Psychometric testing of the SCHFI demonstrates a sound model fit, with desirable reliability estimates given each scale dimensionality, using Cronbach's alpha coefficient and alternative options.

Key Words: Heart failure, Self-care, Factor analysis, Validity and reliability

1. INTRODUCTION

Heart failure (HF) is one of the most debilitating chronic conditions worldwide, which often accompanies other troublesome healthcare problems.[1,2] Heart failure has become primarily associated with an increasing number of underlying cardiovascular conditions, such as uncontrolled hypertension and ischemic heart disease, over the past years (2010-2015), with this condition affecting approximately 21%, following in South Korea. As a result, cost of HF care has increased, burdening individuals, as well as society, with a 53.4% increase in resource use.[3]

Despite prolonged survival resulting from substantial progress in medical management in HF, frequent hospital admissions tend to accompany this longer survival period. Moreover, the numbers of individuals in advanced stages of

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HF as the course of disease progression and mortality have sustained, leading to patients suffering physically, psychologically, and financially.[4,5]

In such circumstances, lifelong practice of self-care strategies, which involve cognitive decisional process to perform therapeutic regimens for HF management, such as symptom management, sodium restriction, or medication adherence, attenuates the adverse consequences associated with HF.[6–8] These strategies, if poorly adhered to, have been shown to contribute to adverse impacts on health outcomes, including poor quality of life, frequent hospitalization for HF decompensation, mortality, and/or other adverse events in HF patients.[6,7,9,10] In Korea, the guidelines for the management of chronic heart failure published by the Korean Society of Heart Failure emphasize the importance of self-care.[11] One measure of assessing self-care is the Self-care of Heart Failure Index (version 6.2) (SCHFI v.6.2).[12] Psychometric testing of the original and translated versions in multiple languages including Italian and Chinese has been extensively performed.[13–16] The three subscales of the SCHFI evaluate self-care maintenance, self-care management, and self-care confidence (respectively, the scMAIN, scMANA, and scCONF) of HF patients, with structural equation modeling or confirmatory factory analysis (CFA) verifying robust structural fits with each index, indicating satisfactory use potential.[13–16] The SCHFI also showed its usefulness as an outcome measure of self-care interventions in HF,[17] with the scale showing responsiveness after the intervention, particularly improvements in self-care management and confidence were shown to be clinically significant from entry to 6 months.[18]

However, past studies have revealed inadequate reliability issues in two subscales of the original, specifically the scMAIN and the scMANA.[13] The suboptimal levels of internal consistency of these two subscales could be associated with their multidimensionality, with each having four and two structures, respectively, while the scCONF showed unidimensionality. Reliability coefficients using alternative methods, which take into account the multidimensionality of the scMAIN and scMANA subscales, were all better than the alpha coefficient, reaching acceptable levels, with coefficients ranging from .75 to .83 for scMAIN. However, results were lower than the recommended level of .70 for scMANA, ranging from .66 to .77.[19] The reliability issue can be addressed by guidelines for calculating estimates with prior testing of scMAIN and scMANA dimensionality, and then using alternative methods to Cronbach's alpha coefficient that are appropriate for multidimensional structures, as Cronbach's alpha is based on an assumption of unidimensionality. These would include model-based internal consistency, composite reliability or omega and maximal reliability coefficients. After this, it would be appropriate to follow reliability estimates that give consideration to the yielded dimensionality for the two subscales.[19,20]

Today, research and practice in self-care of HF patients has moved toward the next level, with it being explored as a possible instrument to screen persons at risk for poor outcomes, monitor disease progression, and/or incorporate innovative technology for advanced HF.[17] Yet, suboptimal levels of self-care behaviors have been reported worldwide, with less than half of HF patients following most of the recommended self-care behaviors, with the exception of self-administration of prescribed medication.[21] In Korea, few studies have been conducted on self-care of HF patients in the past. However, attention on the subject has grown over the last decade, in accordance with the shift from the previous medical and pharmacologic treatment paradigm, to simultaneous approaches to HF management of both pharmacologic and non-pharmacologic treatment modalities (e.g., lifestyle and behavioral change or self-care). As a result, associated research papers published in major cardiovascular journals, and/or scholarly presentations in Korea have increased over the past five years.

As important as medical treatment in the management of patients with heart failure, it is self-care that patients themselves must perform on a daily basis. To improve the quality of life of patients with heart failure.

A key intervention plan is needed and a tool is needed to help patients perform well. This study is aimed to confirm whether the Korean version of the self-care tool which has been globally used is suitable for the culture in Korea.

Therefore, it is timely to perform a psychometric evaluation of the Korean language version of the SCHFI (kSCHFI v.6.2). The specific objectives of this psychometric testing and evaluation of the kSCHFI were to (1) examine the factorial structures of a three-factor model of the kSCHFI, with adequate fit for each subscale, using CFA, and (2) estimate reliability coefficients using multiple alternate methods to Cronbach's alpha as internal consistency estimates, including omega, factor score determinacy, and maximal reliability coefficients, in accordance to the dimensionality of each subscale.

2. METHODS

2.1 Design and procedures

The study sample completed 120 surveys that consisted of demographic variables and the SCHFI v.6.2, which was created to measure self-care maintenance, self-care management, and self-care confidence in a larger comparative study for

neuropsychological testing was used in HF patients. Psychometric testing was conducted, using a multilevel descriptive design, to evaluate the kSCHFI among HF patients with left ventricular systolic dysfunction. The institutional review boards of the university and university affiliated hospitals approved this study. All patients signed written informed consent statements prior to participating in this study. Patients completed the kSCHFI through face-to-face interviews, which were conducted at locations designated for research interviews or counseling, in the hospital after their outpatient visits for routine check-ups, or during hospitalization.

2.2 Sample

Patients were eligible if they met the following criteria: (a) aged 21 years or older, (b) medical diagnosis of HF with left ventricular dysfunction (EFs < 52% for males and < 54% for females),[22] and (c) at least one outpatient follow-up after HF diagnosis. Exclusion criteria included: (a) advanced HF with a life expectancy limited to 6 months or less, (b) severely decreased visual or hearing acuity, (c) medical conditions, such as dementia, Alzheimer's disease, stroke, brain disorders, or psychiatric diagnosis which impose or induce a potentially high risk for cognitive impairment and poor self-care, (d) and/or a poor understanding of, or inability to provide informed consent or follow the instructions of the study.

2.3 Measures

Self-care. The 22-item SCHFI is a measure of self-care behaviors related to HF, performed over the past month, in three components: scMAIN, scMANA, and scCONF.[12] Ten items of the scMAIN scale involve measures of symptom monitoring for body weight or ankle swelling and adherence to recommended behaviors, such as physical activity or sodium restriction. Six items of the scMANA scale involve measures of symptom recognition, such as breathing difficulty or ankle swelling, and evaluation of, and attempts to perform remedies for symptom relief accordingly, such as water or sodium restriction among patients who have experienced symptoms. Finally, 6 items of the scCONF scale involve measures of the degree of one's confidence in ability to perform self-care. The scores in each subscale are weighted and transformed to a standardized 0–100 score for each subscale, with higher scores indicating greater self-care.[12] Self-care adequacy for each subscale was determined using a cut-off point of 70 or higher.[12] The SCHFI v.6.2 has been translated into multiple languages, and their validity and reliability are well documented.[12]

Permission for the translation of the SCHFI ver. 6.2[12] was obtained from the author who possessed the copyright. Two different translations into Korean were performed independently by two qualified translators with the agreement between the translators determined by a graduate nursing student using a 5-point scale (1 "strong disagreement" to 5 "strong agreement"). Consensus was determined by the principal investigator when items received a degree of agreement of less than 4 by the graduate student. The Korean version was then back-translated into English by a qualified translator who was proficient in the English and Korean languages. The back-translated version was then compared with the original questionnaire by the principal investigator using a 5-point scale (1 "strong disagreement" to 5 "strong agreement") to evaluate semantic agreement. Item 8 (Forget medication taking), which typically requires reverse coding due to its negative wording, was translated into a positive statement which captures Korean language semantics more accurately, thereby eliminating the need for reverse coding.

Comorbidity and other clinical variables. The Charlson Comorbidity Index (CCI) was a measure of comorbidity[23] including cardiovascular comorbidities such as hypertension, dilated cardiomyopathy (DCM), valve disease, atrial fibrillation (AF), ischemic heart disease (IHD), diabetes, chronic obstructive pulmonary disease (COPD), and chronic kidney disease (CKD). Comorbidity scores were a sum of these weighted values with possible scores ranging from 0 to 34; higher scores indicated more comorbid conditions. The New York Heart Association classification was also used to classify the severity of HF and imposed functional limitation. It provides a simple way of classifying the extent of heart failure and places patients in one of four categories based on how much they are limited during physical activity; the limitations/symptoms are in regard to normal breathing and varying degrees in shortness of breath and/or angina. Clinical data were abstracted by trained graduate nursing students through patient medical record reviews, using standardized data abstraction forms. Clinical information obtained included etiology of HF, duration of HF, left ventricular ejection fraction, and prescribed medications.

2.4 Statistical analyses

Statistical analyses were performed to describe the sample characteristics using the Statistical Package for Social Science program (version 23).[24] CFAs were conducted to assess dimensionality,[19,25] using Mplus 7.4.[26] A level of significance was set at a p-value of .05.

Before performing the CFA, proportion of maximum scoring was computed to equalize the option numbers of a Likert scale by [(the observed score for each question – the minimum possible score on the SCHFI)/(the maximum possible score on the SCHIFI –the minimum possible score on

the SCHFI)].[27] Converted values ranged from zero to one. To evaluate model fit of the kSCHFI, comparative fit index (CFI), Tucker-Lewis index (TLI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR), were used. The acceptable fit of factorial structures of the kSCHFI was determined by cut points of CFI > .90, TLI> .90, RMSEA $\leq$ .08, and SRMR $\leq$ .08.[19] The latent relationships were then examined to identify subscale inter-correlations among three subscales: scMAIN, scMANA, and scCONF. The reliability was then examined using multiple methods, including Cronbach's alphas, omega, factor score determinacy, and maximal reliability coefficients.

2.5 Ethical considerations

This psychometric study was a secondary analysis of a larger comparative study obtained from face-to-face interviews with 120 HF patients. Approval from the University Institutional Review Board (HYI-15-035-4) was obtained prior to data collection.

3. Results

A total of 120 HF patients were included in this psychometric testing of kSCHFI. The mean age was 65.0 years ($\pm$ 9.6) with a range of 37-84 years. Fifty patients were female (41.7%). The length of time since HF diagnosis ranged between 6.0-264.0 months (mean 35.4 $\pm$ 45.6 months). The major underlying cause of HF was ischemic heart disease (35.0%), followed by association with hypertension (20.8%), valvular heart disease (15.8%), or unknown causes (13.3%). The mean left ventricular ejection fraction (LVEF) was 35.1% ($\pm$ 8.8; range 14.9%-53.0%). Most patients were on optimal medication, including angiotensin-converting-enzyme (ACE) inhibitor (43.30%) or angiotensin II receptor blockers (ARB) (8.30%), beta-blockers (61.70%), digoxin (28.30%), and/or diuretics (51.70%). Patient HF severity was classified as follows: NYHA class I = 30.0%, class II = 45.0%, class III = 22.5%, and class IV = 2.5%. The mean comorbidity score was 2.0 ($\pm$ 1.5) (see Table 1).

Table 1. Sample characteristics of patients with heart failure (N = 120)

Variables		*n* (%) or Mean (SD)	Range
Age (yrs)		65.03 (9.85), *Mdn* = 66.50	37-84
Gender	Women	50 (41.7)	
Marital status	Married	97 (80.3)	
Education (yrs)		10.06 (4.07)	0-16
NYHA classes	I	36 (30.0)	
	II	54 (45.0)	
	III	27 (22.5)	
	IV	3 (2.5)	
Heart failure etiology	Ischemic	42 (35.0)	
	Hypertension	25 (20.8)	
	Valvular	19 (15.8)	
	Idiopathic	16 (13.3)	
	Others	18 (15.0)	
Heart failure duration (months)		35.38 (45.62), *Mdn* = 20.50	6.00-264.00
Comorbidities		2.01 (1.46)	
LVEF (%)		35.10 (8.76), *Mdn* = 35.00	14.90-53.00
Medications† (yes)	ACE inhibitor	52 (43.3)	
	ARB	10 (8.3)	
	Beta-blocker	74 (61.7)	
	Loop diuretics	62 (51.7)	
	Statins	56 (46.7)	
	Aspirin	63 (52.5)	
	Digoxin	34 (28.3)	

Note. SD = standard deviation; Mdn = median; NYHA = New York Heart Association; LVEF = left ventricular ejection fraction; † multiple response.

Validity and reliability testing

Dimensionality. Using CFA, dimensionality of the original three-subscales (e.g., scMAIN, scMANA, and scCONF) was confirmed with the kSCHFI v.6.2. CFA with a single model was not satisfactory, but acceptable, with fit indices of CFI = .83, SRMR = .09, and RMSEA = .09 ($p < .001$, 90% CI [0.08, 0.11]) ($\chi^2(145) = 295.28$, $p < .001$). In addition, weak to strong correlations were found among three dimension scores, indicating that subscales of the self-care measure were inter-correlated, but also distinct aspects of self-care. In analyses of scMAIN with scMANA and scCONF, correlations ranged from .30 to .42, with all inter-correlations significant at the .01 level. In analysis of scMANA with scCONF, the correlation was strongly significant, with a correlational coefficient of .72 at the .001 level.

A separate CFA for each individual subscale was followed. First, self-care maintenance comprised of 10 items showed a multidimensional nature, supporting a good fit with a four-factor model, while a single factor in the original[12] or two-factor alternative multidimensional models, such as a two-factor model[16] displaying poor fits (see Table 2). In testing the four-factor model derived from previous work by Barbaranelli and colleagues,[19] item 10 (i.e., use of a system for medication taking) showed low and non-significant loading on the posited factor. Therefore, a four-factor model was retested with exclusion of item 10, resulting in good fit indices of CFI = .92, SRMR = .06, and RMSEA = .07 (90% CI [.01, .11]). We also tested a higher-order factor model without item 10 (see Figure 1) by replacing 6 correlations, among four factors of the lower-order CFA model, with 4 regression paths of the higher-order model. The higher-order factor structure was evaluated by the same model fit indices addressed previously (i.e., CFI > .90, TLI > .90, RMSEA $\leq$ .08, and SRMR $\leq$ .08). As shown in Table 2, the higher-order model without item 10 provided an acceptable fit to the data. To identify which model (i.e., lower-order CFA model vs. higher-order CFA model) provides a better fit to the data, we performed a follow-up nested chi-square comparison: χ^2diff (2) = 2.45, $p = .294$. Because the higher-order CFA model did not produce a significant decrease in model fit based on the alpha level of .05, the higher-order factor structure was preferred. In other words, the higher-order CFA model provided comparable fit when compared with a lower-order CFA model, but was more parsimonious; therefore, the higher-order factor structure was chosen to conceptualize the self-care maintenance construct.

Table 2. Fit Indices from CFA Models (analysis of covariance matrix using maximum likelihood estimator)

Model	χ^2	*df*	*p*	CFI	TLI	SRMR	RMSEA	*p* (RMSEA < .05)	RMSEA 90% CI
Self-care maintenance (n = 119)									
One-Factor Model	73.23	35	.002	.757	.687	.076	.096	.010	.065-.127
Two-Factor Model	71.19	34	.000	.763	.687	.077	.096	.011	.064-.127
Four-Factor Model*	44.36	29	.034	.902	.848	.060	.067	.228	.019-.104
Four-Factor Model w/o item #10	32.92	21	.047	.923	.868	.056	.069	.228	.008-.112
Second-order Model w/o item #10	35.37	23	.048	.920	.875	.060	.067	.242	.007-.109
First vs. Second-order Model w/o #10	$\Delta\chi^2$ (2) = 2.448, $p = .294$, the higher-order model was preferred.								
Self-care management (n = 119)									
One-Factor Model† (n = 119)	47.06	9	.000	.814	.690	.095	.189	.000	.137-.243
Two-Factor Model† (n = 119)	31.31	8	.000	.886	.786	.009	.156	.002	.101-.216
One-Factor Model w/o items #11, 16 (n = 118)	15.24	2	.000	.927	.780	.049	.237	.002	.136-.354
Self-care Confidence (n = 119)									
One-Factor Model	26.99	9	.001	.950	.916	.048	.130	.011	.075-.187
Self-care maintenance, management, & confidence (n = 119)	295.28	145	.000	.828	.797	.089	.093	<.001	.078-.109

Note. CFI = comparative fit index; TLI = Tucker-Lewis index; SRMA = Standardized root mean square residual; RMSEA = Root mean square error of approximation; w/o = without; *Item 10 was not significant; †Items 11 and 16 were not significant regardless of one- or two-factor model.

In this four-factor model without an item 10, factor loadings corresponded to those derived from the previous four-factor model[19] with items 1 and 2 loading on Factor 1 (symptom monitoring) of the second-order self-care maintenance construct, items 4 and 7 on Factor 2 (physical activity); 6 and 9 loading on Factor 3 (sodium intake); and items 3, 5, and 8 loading on Factor 4 (medical treatment adherence). Because the higher-order CFA model was chosen for the

self-care maintenance construct, we provided standardized factor loadings of the second-order factor in Table 3: symptom monitoring (.46), physical activity (.93), sodium intake (.60), and medical treatment adherence (.84). These factor loadings were all significant at the alpha level of .05, and generally medium to high attesting substantial proportions of common variance in the first-order factors explained by the second-order factor.

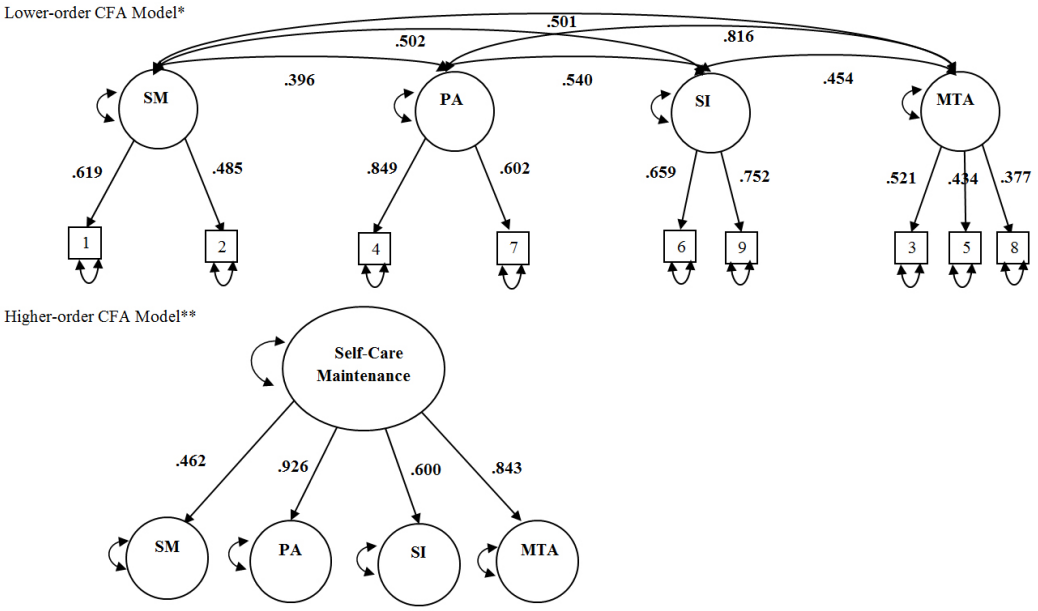

Figure 1. Confirmatory factor analysis models on self-care maintenance

*SM = Symptom Monitoring; PA = Physical Activity; SI = Sodium Intake; MTA = Medical Treatment Adherence. *Model fit:* χ^2 *= 32.922, df = 21, p = .047, CFI = .923, RMSEA = .069, SRMR = .056; **Model fit:* χ^2 *= 35.370, df = 23, p = .048, CFI = .920, RMSEA = .067, SRMR = .060*

Table 3. Factor loadings, residual variances, and R2 of each item

Item	Unstandardized Loading	*SE*	Standardized Loading	*p*	Residual Variance	R^2
Maintenance						
Symptom Monitoring	1.00	.00	.46	.016	.79	.21
Physical Activity	4.70	6.30	.93	< .001	.14	.86
Sodium Intake	1.44	.76	.60	< .001	.64	.36
Medical Treatment Adherence	3.01	2.56	.84	< .001	.29	.71
Management						
# 12	.12	.03	.46	< .001	.79	.21
# 13	.20	.02	.85	< .001	.28	.72
# 14	.18	.02	.81	<.001	.35	.65
# 15	.21	.02	.76	< .001	.43	.57
Confidence						
# 17	.15	.02	.60	< .001	.64	.36
# 18	.11	.02	.53	< .001	.72	.28
# 19	.19	.02	.75	< .001	.43	.57
# 20	.17	.02	.75	< .001	.44	.56
# 21	.19	.02	.83	< .001	.31	.70
# 22	.21	.02	.91	< .001	.18	.82

Note. SE = Standard Error; Factor 1 of the Second-order self-care maintenance construct consists of items #1 and #2. Factor 2 consists of items #4, #7; factor 3 consists of items #6, #9; and factor 4 consists of items #3, #5, and #8

Self-care management comprised of 6 items did not support a two-factor model; while incomplete CFA with 4 items, which previously composed one of the two factors, showed an acceptable fit (see Table 2). Testing of an original one-factor[12] and a two-factor model[16, 19] derived from previous studies resulted in poor fits, in which items 11 (symptom recognition) and 16 (evaluation of remedies for symptom relief) were non-significantly loaded on the posited factor. A one-factor model with items 12 to 15 (attempts for symptom relief) was retested, resulting in good fit indices of CFI = .93, SRMR = .05, and RMSEA = .24 (p = .002, and 90% CI [.14, .35]) ($\chi^2(2) = 15.24$, $p < .001$).

Items of exclusion in this study, 11 and 16, were loaded on Factor 1 (symptom recognition and treatment evaluation) in a previous two-factor model; other items were loaded on Factor 2 (attempts for symptom relief).[19] In this study, the four items (i.e., 12, 13, 14, and 15) were loaded on Factor 2 (attempts for symptom relief) as hypothesized. All factor loadings were significant at an alpha level of .05, confirming a substantial proportion of common variance among the items (see Table 3). However, these study results should be further validated with a larger sample to examine whether a full set of the management items would support the two-factor model.

Self-care confidence comprised of 6 items supported a single factor as the underlying original subscale[12] with good fit indices of CFI = .95, SRMR = .05, and RMSEA = .13 (p = .011, 90% CI [.08, .19]) ($\chi^2(9) = 26.99$, p = .001). In this one-factor model, items derived from the previous one-factor model[19] with all six items being significantly loaded on the self-care confidence construct with standardized factor loading coefficients, ranging from .53 to .91 (see Table 3).

Reliability. The reliability estimates for the final models yielded through CFAs were all at the recommended .70 or higher (see Table 4). Despite the multidimensionality of the self-care maintenance scale (four factors), a Cronbach's alpha coefficient was adequate with nine items, with an alpha of .71. Other alternate reliability coefficients, omega, maximal reliability, and factor score determinacy were all more appropriate than the alpha coefficient, with these coefficients ranging from .81 to .90. Reliability coefficients for the self-care management scale were computed with four items, which constituted one factor, unidimensional factor. All coefficients were acceptable, including an alpha coefficient of .79, and coefficients of other alternates ranging from .82 to .93. Reliability coefficients for self-care confidence also confirmed the high reliability, with coefficients ranging from .88 to .96.

Table 4. Reliability indices for each subscale

	Reliability Index	Coefficients derived from maximum likelihood estimators
Self-care Maintenance	Cronbach's Alpha	.71
	McDonald's Omega	.81
	Maximal Reliability	.90
	Factor Score Determinacy	.85
Self-care Management	Cronbach's Alpha	.79
	McDonald's Omega	.82
	Maximal Reliability	.86
	Factor Score Determinacy	.93
Self-care Confidence	Cronbach's Alpha	.88
	McDonald's Omega	.88
	Maximal Reliability	.91
	Factor Score Determinacy	.96

4. Discussion

This is the first study that evaluated the psychometric properties of the kSCHFI v.6.2 among patients with HF in Korea. Validity of the overall single model of the kSCHFI with the three components was supported with acceptable fit and inter-correlated relationships. After inspection of the dimensionality of individual scales, reliability estimators, including the alpha, were found to be adequate, regardless of the methods for internal consistency, with coefficients of all estimates higher than the recommended value of .70.

CFA supported three subscales with goodness of fit indices for overall kSCHFI and each subscale satisfactory. Model fits for each scale were acceptable, with good fit indices of CFI ranging from .92 to .95, and SRMR ranging from .05 to .06 for all scales meeting the cut points of criteria. RMSEA measures ranged from .07 to .24, with only scMAIN

meeting the cut point. However, RMSEAs can report poor fit, resulting in misleading findings, when sample sizes are small and thus, models have small degrees of freedom.[28]

In prior studies which tested for validity and reliability of the SCHFI v.6.2 in multiple languages, good fits of individual scales of the SCHFI were reported.[14,16,29,30] In testing overall fit of the original construct of the three component model, the structural fit showed adequacy with the fit indices of CFI = .73, normed fit index (NFI) = .55, and RMSEA = .07.[14] Overall fit of the SCHFI as a single model was also reported in versions of Portuguese and Italian, but were found to be only limitedly adequate.[13,16] The Brazilian Portuguese version, with its cross-cultural adaptation, supported the original three-factor model showing a poor fit, but the best fit through CFA, with the goodness of fit indices of CFI = 0.77, NFI = 0.68, and RMSEA = 0.11.[13] Overall fit of the Italian version of SCHFI v.6.2 with the original three component model showed poor fit indices of CFI = 0.65, NFI = 0.62, and RMSEA = 0.11, while construct validity of each subscale showed excellent goodness of fit indices of CFI ranging from 0.92 to 0.99 and RMSEA ranging from .02 to .07.[16] The supportive goodness of fit indices with the Italian version of the SCHFI v.6.2 was also later reported, with fit indices of CFI ranging from 0.93 to 0.99, and RMSEA ranging from 0.02 to 0.07.[28] The Chinese version of the SCHFI also supported its construct validity through structural equation modeling, with 3 factors explaining 43% of the variance.[14]

The scMAIN, subscale revealed multidimensionality, supportive of a four-factor structure model. The higher-order solution (factor level) provided a comparable fit when compared to a lower-order model (item level) in which, with the deletion of item 10 (use a system for medication taking), the model fit improved. This could be explained by this item possibly not being an essential self-care strategy in clinical circumstance in Korea, where pharmacists provide prescribed medications in packages by meal plans. Most patients adhere to the physician's prescription, rarely employing systems, such as pill boxes or reminders. Whether the paraphrasing of this item, with consideration of such clinical circumstances, can contribute to the fit of this scale requires further investigation. The original 6 item scMANA scale was problematic in this study, with both one-and two-factor models displaying poor fit, in which items 11 (symptom recognition) and 16 (evaluation of remedies for symptom relief) were nonsignificant. In a previously derived two-factor model,[16,19] items 11 (symptom recognition) and 16 (evaluation of remedies for symptom relief), and the remaining items, except for item 15, were loaded on to one of the two factors. In this study, testing of a one-factor model with items 12–15 (attempts for symptom relief) demonstrated a good fit, with improvement of fit indices, potentially providing support for a two-factor model for the scMANA scale.[19] Similar to the one factorial structure of the scCONF scale in previous studies,[16,19,29] the unidimensionality of the scCONF scale was confirmed in the current study.

It is recommended that factorial inspection precedes and employs alternatives to the alpha coefficient for reliability estimates when scales appear multidimensional in nature.[19] In the current study, reliability coefficients measured by multiple methods were all adequately acceptable, regardless of the estimators, with even an alpha coefficient for the multidimensional maintenance scale being satisfactory. Prior studies have also supported the multidimensionality of the scMAIN and scMANA scales, and a unidimensionality for the scCONF scale;[16,19] while some items demonstrated insignificant contribution to the computation of the reliability coefficients.[19] Reliability coefficients of the Italian version were tested for stability and internal consistency, with moderate to high coefficients, using an intraclass correlation coefficient (ICC) with the two factors of the scMAIN scale. The overall confidence scale showed inadequate stability, with ICCs of .64, and the two factors of the scMANA scale displayed a desirable stability, with both ICCs > .80). Internal consistency tested by factor score determinacy showed that all coefficients for the yielded factors of the individual scale were desirable, ranging from .74 to .90.[16] In another study in which internal consistency, using alternatives to the alpha coefficient for scales demonstrating multidimensionality, the four-factor structured scMAIN scale reliability coefficients ranged from .75 to .82 using the global reliability index, and from .76-.83 using the model-based internal consistency coefficient. The two-factor model of the scMANA scale showed reliability coefficients with WLS-MV estimates as desirable, with coefficients of .77 and .76. For the unidimensional scCONF scale, all reliability coefficients reached the level of adequacy, with coefficients ranging between .84-.86.[19]

5. Conclusion

In conclusion, despite a small sample size for CFA to examine psychometric testing of the scale, results of the kSCHFI emerged adequate and somewhat consistent with reports from multiple versions examined in larger studies. The psychometric properties of the kSCHFI confirm that it facilitates the description of the self-care behaviors performed by HF patients in Korea. In addition, a problem regarding reliability issues was also solved, accomplishing desirable levels of reliability using alternative methods. Given that the SCHFI is a useful outcome measure of HF management interventions,[15,17,18] our findings have clinical implications for the identification of individuals at risk for poor self-care, as well

as aiding in the improvement of their self-management of HF at a clinically significant level, thus further advancing the care of individuals with the complex syndrome of chronic HF in South Korea.

This study involves a few major limitations. First, although the sample size for a CFA should be at least 100 observations for a single-group model,[31] and this assumption was met, validation should be reported from a larger sample. Additionally, model testing of individual self-care subscales were only partly supportive, and the deletion of items from the full set of items of the original SCHFI requires caution when scoring individual subscales, particularly the scMAIN and scMANA. Finally, the preliminary results gained from the current study require more empirical evidence for its psychometric properties in larger samples, as well as an evaluation of self-care of Korean HF patients in clinical practice.

CONFLICTS OF INTEREST DISCLOSURE

The authors declare that there is no conflict of interest.

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