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Psychometric Testing of the Revised Self-Care of Heart Failure Index

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Abstract

Background: Self-care is essential in people with chronic heart failure (HF). The process of self-care was refined in the revised situation specific theory of HF self-care, so we updated the instrument measuring self-care to match the updated theory. The aim of this study was to test the psychometric properties of the revised 29-item Self-Care of Heart Failure Index (SCHFI).

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Methods: A cross-sectional design was used in the primary psychometric analysis using data collected at 5 sites in the United States. A longitudinal design was used at the site collecting test-retest data. We tested SCHFI validity with confirmatory factor analysis and predictive validity in relation to health-related quality of life. We tested SCHFI reliability with Cronbach α , global reliability index, and test-retest reliability.

Results: Participants included 631 adults with HF (mean age, 65 ± 14.3 years; 63% male). A series of confirmatory factor analyses supported the factorial structure of the SCHFI with 3 scales: Self-Care Maintenance (with consulting behavior and dietary behavior dimensions), Symptom Perception (with monitoring behavior and symptom recognition dimensions), and Self-Care Management (with recommended behavior and problem-solving behavior dimensions). Reliability estimates were 0.70 or greater for all scales. Predictive validity was supportive with significant correlations between SCHFI scores and health-related quality-of-life scores.

Conclusions: Our analysis supports validity and reliability of the SCHFI v7.2. It is freely available to users on the website: www.self-care-measures.com.

Keywords

heart failure; psychometrics; reliability; self-care; validity

Self-care is integral in maintaining the physical and emotional stability of chronically ill individuals.¹ In chronic heart failure (HF), self-care is particularly important because the treatment regimen is complex. These patients typically take an average of 10 medications daily.² They are advised to limit dietary sodium, stay physically active, monitor signs and symptoms, and actively engage in symptom management when changes are observed.³ Given the intricacies of self-care and the importance of self-care to clinical stability, it is essential to have an instrument to measure self-care.

We developed an instrument to measure HF self-care,⁴ which was updated most recently in 2009.⁵ The instrument was based on our theoretical work, the situation specific theory of HF self-care, which was originally published in 2008.⁶ In 2016, we updated this theory to address the important observation that symptom perception is an essential element of the HF self-care process.⁷ Now, we have updated the Self-Care of Heart Failure Index (SCHFI) to match the updated theory. In this article, we describe the psychometric properties of the revised SCHFI 7.2.

The SCHFI has been used frequently since it was originally published. A PubMed search in August 2018 revealed 74 articles citing the SCHFI. Another search in Google Scholar, which included unpublished materials (eg, master and PhD theses), revealed 911 documents citing the SCHFI. What we have learned from these studies is that a wide variety of factors predict self-care behaviors: experience,⁸ skill,⁹ values,¹⁰ cognitive and functional abilities,¹¹ depression,¹² confidence or self-efficacy,^{13–16} social support,^{13,17–20} and access to healthcare.²¹ We have also learned that HF self-care can improve outcomes, including quality of life.^{22–26} The SCHFI v6.2 has been translated into 21 international languages. Translations are freely available on the website (www.self-care-measures.com), attesting to the international relevance of the instrument.^{24,25}

The original version of the SCHFI v.4 was 15 items in length, rated on a 4-point response scale, and divided into 3 scales measuring self-care maintenance, self-care management, and self-care confidence.⁴ Although confidence is not a self-care behavior, we included it because it is an important predictor of self-care. We tested this version in a sample of 760 patients with HF enrolled from 7 US sites. At that point, we were adding the scores to obtain a summary score. Reliability of the summary score, tested by Cronbach α , was adequate (0.76), but reliability of the Self-Care Maintenance scale was only 0.56. Reliability of the Self-Care Management scale was 0.70, whereas the reliability of the Self-Confidence scale was 0.82. Construct validity was supported. We updated the instrument in 2009 (v.6.2) by adding items to the Self-Care Maintenance scale and refining the response format. We modified the SCHFI scoring procedure, advocating that the scale scores be used separately (not added).⁵ Unfortunately, the addition of items did not significantly change the Self-Care Maintenance scale coefficient α . At that point, we advocated a score of 70 or greater as a cut point to judge self-care adequacy. This cut point was chosen on a pragmatic basis but later found to be associated with the best 1-year event-free survival.²⁷

Further evidence of reliability and validity was published over the years. Construct validity, contrasting groups' validity, internal consistency, and test-retest reliability were demonstrated in a large sample of 659 patients with HF from Italy.²⁸ Noting that Cronbach α coefficient assumes a unidimensional scale, Barbaranelli et al²⁹ tested dimensionality and internal consistency reliability of the SCHFI in a sample of 629 adults with HF enrolled in the United States. Dimensionality was tested using confirmatory factor analysis (CFA); reliability was tested using coefficient α and alternative options. The Self-Care Maintenance and Self-Care Management scales were found to be multidimensional, meaning that more than 1 latent variable explains correlations among observed variables in the data set. Because Cronbach α is not the best estimate of reliability for multidimensional scales, new and more appropriate reliability estimates such as the global reliability index for multidimensional scales were used.³⁰ When reliability was estimated with these methods, reliability was adequate or high.

Revised Situation-Specific Theory of Heart Failure Self-Care

In 2012, we published the middle-range theory of self-care of chronic illness,¹ in which we proposed the concept of self-care monitoring, which includes the processes of symptom detection, interpretation, and response. In 2013, we demonstrated a linear self-care process in which self-care maintenance was associated with symptom monitoring, which was then associated with treatment implementation and evaluation.³¹ Together, these findings raised our awareness that the process of symptom monitoring was not sufficiently addressed in the situation-specific theory of HF self-care.⁶ Thus, we revised the theory to incorporate symptom monitoring. The addition of content on symptom monitoring was the major addition to this instrument revision. Because HF causes neurological lesions that can interfere with the ability of patients to detect and interpret changes in signs and symptoms,^{32,33} we named the concept *symptom perception* in the situation-specific theory.⁷ Symptom perception was said to involve monitoring, body listening, symptom recognition and interpretation, and labeling of signs and symptoms.

Methods

The aim of this study was to test the psychometric properties of the revised SCHFI after it was revised to match the updated situation specific theory of HF self-care.⁷ A cross-sectional design was used in the primary psychometric analysis. A longitudinal design was used at the site collecting test-retest data.

Sampling

Data for this analysis were obtained from 5 US sites representing the northeast, the southeast, and the southwest. After local institutional review board approval at all sites, stable patients were recruited from both inpatient and outpatient sites. All participants were older than 18 years, were able to read and write in English, and had been diagnosed with chronic HF according to the American Heart Association guidelines.³ No specific type of HF was targeted for enrollment because all patients with HF need to perform self-care. Patients with a diagnosis of dementia or listed for heart transplantation were excluded. All participants provided informed consent to participate. At the site where longitudinal follow-up survey data were collected, patients were excluded if they did not have a telephone or a mailing address.

In the hospital, potential subjects were identified from automated hospital records or by referral from clinicians at the hospital. In outpatient sites, patients were recruited from outpatient cardiology clinics and cardiac rehabilitation settings. After potential participants were identified and agreed to meet with a research team member, they were approached and invited to join the study. Those who met the inclusion criteria and chose to participate completed a survey packet including a sociodemographic questionnaire and the SCHFI. Clinical information about HF and comorbid conditions were collected at each site.

Instrument

The revised SCHFI (v7.2) consists of 29 items divided into 3 scales measuring self-care maintenance, symptom perception, and self-care management. The Self-Care Confidence scale is not reported here because it is not part of self-care per se. That is, self-care confidence is a powerful influence on self-care, and we always collect data on self-care confidence with the scale on the website, but it is not a self-care behavior.

Each SCHFI scale uses Likert-type response options. The Self-Care Maintenance scale includes 10 behaviors measured in terms of frequency (1, never, to 5, always). The Symptom Perception scale includes 9 items assessing frequency of behaviors and 2 items on how quickly symptoms were recognized and identified as HF related. Response options for the 2 recognition items range from “not applicable” (no symptoms) or 0 (did not recognize symptom) to 5 (very quickly). The Self-Care Management scale includes 8 items. Seven of these items ask how likely the respondent would be to try behaviors commonly used to control HF symptoms (1, not likely, to 5, very likely). One Self-Care Management question asks how sure the patient is that the treatment last used to manage symptoms helped with feeling better. Response options for this item range from 0 (I did not do anything) or 1 (not sure) to 5 (very sure).

Each scale (Self-Care Maintenance, Symptom Perception, and Self-Care Management) is scored separately. Response choices for all items in the scale are summed and standardized to achieve a possible score of 0 to 100, with higher scores indicating better self-care. On the basis of the earlier version of the SCHFI v6.2, we believe that a score of 70 or better can be used to identify an adequate level of HF self-care. One half standard deviation, or an 8-point difference in the standardized score, was recommended as a minimal clinically relevant change in scores for the previous version, and we see no need to change this recommendation at this point.³⁴

Analysis

Testing of dimensionality precedes reliability testing,³⁰ so we began with factor analysis and then assessed reliability. Because the instrument is theory based, we also tested a general model, where all items and all 3 scales were analyzed with CFA to confirm the factorial validity of the 3 separate scales. We conducted the CFA in Mplus 8.1.³⁵ Factor loadings greater than |0.30| were considered adequate.^{36,37} Because several items had nonnegligible positive kurtosis, we used the robust maximum likelihood method for parameter estimation. Several goodness-of-fit indices were used to examine model fit: the comparative fit index (CFI), the Tucker-Lewis Index (TLI), the root mean square error of approximation (RMSEA), and the standardized root mean square residual (SRMR).^{38–40} The CFI and TLI were used to compare the model of interest with a null model.⁴¹ Values of 0.90 to 0.95 indicate acceptable fit, and values greater than 0.95 indicate good model fit.⁴² Root mean square error of approximation was used to estimate lack of model fit, with values of 0.05 or less indicating a well-fitting model, 0.05 to 0.08 indicating a moderate fit, and 0.10 or greater indicating poor fit.⁴³ Standardized root mean square residual was used as a measure of fit in the sample, with values of 0.08 or less indicating good fit. Traditional χ^2 statistics are reported but were not used in interpreting model fit because the χ^2 likelihood ratio test is sensitive to sample size.

Using SPSS v.25 (IBM, Armonk, New York), we randomly split the sample into 2 subsamples. For each one of the 3 scales of the SCHFI, we conducted CFAs where 1 subsample was used to develop the model (eg, eliminating items with inadequate loadings) and the second subsample was used to validate the trimmed solution obtained from the first subsample.^{44,45} The final replicated trimmed model was rerun on the total sample to obtain parameter estimates that were more stable in dimensionality and reliability. The total sample also was used to conduct a simultaneous CFA in which we tested the whole model with all the 3 scales, their dimensions, and the items belonging to each dimension. This analysis was conducted to provide further evidence of the dimensionality of the revised situation-specific theory of HF self-care.

Scale reliability was estimated with Cronbach α coefficients, as well as with composite reliability⁴⁶ or the omega coefficient,⁴⁷ where values of 0.7 or greater are considered adequate.⁴⁸ Item discrimination was estimated with item-total corrected correlation coefficients,⁴⁹ where values of 0.3 or greater are considered adequate.⁵⁰ Test-retest reliability was computed on a subsample of 50 subjects from 1 site. In these participants, the SCHFI was read-ministered 2 weeks after the first administration.

Predictive validity was tested using data on health-related quality of life (HRQL) collected using the Short-Form (SF)-36 v2 (used with permission from QualityMetric, Inc). The SF-36 has been demonstrated repeatedly to be a reliable and valid measure.⁵¹ Higher scores reflected poorer HRQL. Data on HRQL were collected on a sample of 89 participants from a single site. Participants were asked to report their HRQL over the 4 weeks before hospitalization. We hypothesized that individuals practicing better self-care would report better general health, fewer role limitations, better mental health, and better physical health on the SF-36. Data were analyzed with Pearson correlation coefficient. This analysis was performed in a small subsample, so any *P* value less than .10 was considered statistically significant in this analysis.

Results

The sample of 631 adults was predominately male, white, non-Hispanic, and married, with a mean age 65 years (range, 20–104 years) (Table 1). Most had at least some college education and were unemployed or retired. On average, participants had HF for more than 10 years. Half of this sample had moderate to high comorbidity burden, measured at most sites by the Charlson Comorbidity Index.⁵² The most common comorbid conditions were hypertension, diabetes, and arthritis.

Self-Care Maintenance Scale

Dimensionality.—Authors of previous psychometric studies^{22,53} have shown that the self-care maintenance behaviors comprise 2 dimensions: consulting behaviors and dietary behaviors. Consequently, we expected the 11 items of the Self-Care Maintenance scale to reflect these 2 dimensions. In the consulting behavior dimension, we put the following items: try to avoid getting sick, get some exercise, see your healthcare provider for routine healthcare, take prescribed medicines without missing a dose, make sure to get a flu shot annually, avoid cigarettes and tobacco smoke, ask your healthcare provider about your medicines, and use a system or method to help you remember to take your medicines. In the dietary behavior dimension, we put the following items: eat a low-salt diet, order low-salt items when eating out, and ask for low-salt foods when visiting family and friends. Thus, we first specified a 2-factor confirmatory model. One item (avoid cigarettes and tobacco smoke) fit poorly and was eliminated from further analyses but retained in the scale for further testing. Without this item, the goodness of fit indices of the model with 10 items were good: $\chi^2(33, N = 316) = 65.06, P < .001, CFI = 0.93, TLI = 0.90, RMSEA = 0.055$ (90% confidence interval [CI], 0.035–0.075), $P = .30, SRMR = 0.048$. Because the item on using a method to help remember medicines presented nonsignificant loadings, the model was respecified fixing this loading at zero. When the CFA was rerun, the model had an adequate fit to the data: $\chi^2(34, N = 316) = 65.38, P < .001, CFI = 0.93, TLI = 0.90, RMSEA = 0.054$ (90% CI, 0.034–0.074), $P = .35, SRMR = 0.048$. This final trimmed model was perfectly replicated on the second validation subsample: $\chi^2(43, N = 315) = 39.74, P = .23, CFI = 0.99, TLI = 0.98, RMSEA = 0.023$ (90% CI, 0.00–0.049), $P = .96, SRMR = 0.037$.

When we merged the 2 subsamples and reran the CFA on the full sample of 631 subjects, the model had excellent fit indices: $\chi^2(34, N = 631) = 70.95, P < .001, CFI = 0.96, TLI = 0.94,$

RMSEA = 0.042 (90% CI, 0.028–0.055), $P = 0.84$, SRMR = 0.036 (Table 2). All factor loadings were significant and high except for the item “Get some exercise,” which had a low but significant loading of 0.23. The 2 dimensions or factors were positively correlated at 0.51.

Scale Internal Coherence and Item Analysis.—We used the total sample to derive internal coherence estimates. When the α coefficient was computed, an adequate coefficient of .71 was obtained. However, α assumes that the items satisfy a unidimensional structure. Knowing that there are 2 dimensions represented in this scale, we used a reliability coefficient that takes multidimensionality into account—the global reliability index for multidimensional scales.⁵⁴ This coefficient was better at 0.75.⁵⁰ All the items had adequate discrimination, with an item-to-total corrected correlation greater than 0.30.

Symptom Perception Scale

Dimensionality.—The 11-item Symptom Perception scale was hypothesized to have 2 dimensions. We hypothesized that most of the items in the scale would measure monitoring behaviors, but 2 items (How quickly did you recognize that you had symptoms? How quickly did you know that the symptom was due to HF?) were thought to measure symptom recognition. When a 2-factor model was tested, the model fit was adequate: $\chi^2(43, N = 316) = 98.75$, $P < .001$, CFI = 0.94, TLI = 0.92, RMSEA = 0.064 (90% CI, 0.047–0.081), $P = .08$, SRMR = 0.045. However, inspection of the modification indices suggested an estimation of 2 error covariances. One covariance was between “Keep a record of symptoms” and “Check for shortness of breath with activity.” Because both items address symptoms, these 2 items were allowed to covary. Another covariance was between “Keep a record of symptoms” and “Ask your healthcare provider how you’re doing.” Because, presumably, the record of symptoms is kept to facilitate the discussion with the provider, the 2 items were allowed to covary.

When the model was respecified to include these error covariances, model fit was adequate: $\chi^2(41, N = 316) = 72.66$, $P < .01$, CFI = 0.97, TLI = 0.95, RMSEA = 0.049 (90% CI, 0.03–0.068), $P = .50$, SRMR = 0.041. This final trimmed model was perfectly replicated on the second validation subsample: $\chi^2(41, N = 315) = 74.51$, $P < .01$, CFI = 0.95, TLI = 0.93, RMSEA = 0.051 (90% CI, 0.032–0.069), $P = .44$, SRMR = 0.045.

When we reran the CFA on the full sample of 631 subjects, the model fit was excellent: $\chi^2(41, N = 631) = 106.5$, $P < .001$, CFI = 0.96, TLI = 0.94, RMSEA = 0.050 (90% CI, 0.039–0.062), $P = .46$, SRMR = 0.038 (Table 2). All factor loadings were significant. The 2 dimensions were named *monitoring behaviors* and *symptom recognition*.

Scale Internal Coherence and Item Analysis.—When the internal coherence analysis was performed on the whole sample, the Cronbach α coefficient of the Symptom Perception scale was .81. Knowing that α assumes a unidimensional structure and that 2 dimensions are represented in this scale, we used a reliability coefficient that takes multidimensionality into account—the global reliability index for multidimensional scales.⁵⁴ This coefficient was better at 0.85.⁵⁰ Regardless of the method used, the internal coherence of this scale was

adequate. All items had adequate discrimination, with an item-to-total corrected correlation greater than 0.30.

Self-Care Management Scale

Dimensionality.—The 8 items measuring self-care management were hypothesized to reflect 2 dimensions. One set of behaviors is recommended by providers: further limit the salt you eat that day, reduce your fluid intake, take a medicine, and call your healthcare provider for guidance. The second set of behaviors involves problem solving: ask a family member or friend for advice, try to figure out why you have symptoms, limit your activity until you feel better, and consider if the treatment you used made you feel better. Thus, we first specified a 2-factor CFA model. The goodness of fit indices of this model were very good: $\chi^2(19, N = 316) = 29, P = .06, CFI = 0.95, TLI = 0.93, RMSEA = 0.041$ (90% CI, 0.00–0.069), $P = .67, SRMR = 0.040$. This model had an excellent fit when the analysis was replicated on the second validation subsample: $\chi^2(19, N = 315) = 24.5, P = .18, CFI = 0.98, TLI = 0.96, RMSEA = 0.031$ (90% CI, 0.00–0.061), $P = .83, SRMR = 0.037$.

When we merged the 2 subsamples and reran the CFA on the full sample, the model had excellent fit indices: $\chi^2(19, N = 631) = 30.5, P = .05, CFI = 0.97, TLI = 0.96, RMSEA = 0.031$ (90% CI, 0.004–0.051), $P = .94, SRMR = 0.029$ (Table 2). All factor loadings were significant, and factor correlation was 0.67. The 2 factors were named *recommended behaviors* and *problem-solving behaviors*.

Scale Internal Coherence and Item Analysis.—We used the total sample to derive internal coherence estimates on the Self-Care Management scale. The α coefficient was not adequate (coefficient, .66), as expected, knowing that the scale has 2 dimensions. When we used the global reliability index for multidimensional scales,⁵⁴ the coefficient was an adequate 0.70.⁵⁰ All the items had adequate discrimination, with an item-to-total corrected correlation greater than 0.30.

Simultaneous Confirmatory Factor Analysis

As a final step, we conducted a simultaneous CFA on the combined set of items using data from the total sample. Confirmatory factor analysis supported this more general model with the following fit indices: $\chi^2(360, N = 631) = 730, P < .001, CFI = 0.90, TLI = 0.89, RMSEA = 0.04$ (90% CI, 0.036–0.045), $P = 1.0, SRMR = 0.046$. The factors underlying the scales emerged clearly in this combined analysis as can be seen in Table 2 (see factor loadings simultaneous analysis). Factor correlations ranged from 0.25 (symptom recognition with self-care maintenance dietary behaviors) to 0.76 (self-care monitoring behaviors with self-care maintenance consulting behaviors), with a mean (SD) of 0.498 (0.16).

Test-Retest Reliability

When test-retest reliability was computed, correlations (corrected for the attenuation due to unreliability) were 0.89 for self-care maintenance, 0.70 for symptom perception, and 0.84 for self-care management.

Predictive Validity

When self-care scores were analyzed in relation to HRQL, we found better general health in participants with higher self-care maintenance scores ($r = -0.19$, $P = .08$) and higher symptom perception scores ($r = -0.31$, $P = .003$). Mental health as measured by the SF-36 was better in participants with higher self-care maintenance scores ($r = -0.20$, $P = .06$) and higher symptom perception scores ($r = -0.19$, $P = .08$). The Physical Component Summary score, a measure of physical health, was better only in those with higher symptom perception scores ($r = -0.22$, $P = .04$). Role limitations were not related to self-care. No relationship was found between self-care management and HRQL.

DISCUSSION

The aim of this study was to test the psychometric properties of the SCHFI v7.2 after it was revised to match the updated situation-specific theory of HF self-care. We supported factorial validity in the dimensions of self-care maintenance, symptom perception, and self-care management in the SCHFI v7.2 and supported internal consistency and test-retest reliability. Predictive validity was demonstrated in relation to the SF-36. These results are extremely promising, and we are comfortable advocating use of the SCHFI v7.2 in research and clinical practice.

Because this revised version of the SCHFI was based on the updated situation-specific theory of HF self-care,⁷ we used CFA to test instrument validity. The process used in CFA was strong because we used half of the sample to develop the model according to the theory⁷ and previous work^{4,5,28,29} and the other half of the sample to validate the model. Then, we used the whole sample to obtain solid estimates for the final loadings. All of these steps demonstrated similar fit indices, attesting to the factorial validity of the instrument.

One item in the Self-care Maintenance scale, “get some exercise,” performed poorly in model testing. This finding was not unexpected because authors of previous research have demonstrated that HF self-care behaviors are inconsistent²² and exercise is commonly low in patients with HF.⁵⁵ Another item, “avoid cigarettes and tobacco smoke,” was eliminated from the analysis. The item is not essential because it is not specific to HF, but we kept the item in the instrument and will continue to test the item and reconsider it in the future.

This was the first time we tested the newest SCHFI scale measuring symptom perception. In the previous version of the SCHFI v6.2, symptom monitoring was included in the Self-Care Maintenance scale and symptom recognition was captured in the Self-Care Management scale. However, authors of psychometric studies,^{4,5,28,29} conducted before updating the theory, demonstrated that these 2 items loaded on a single factor, providing evidence that symptom perception deserved more attention. In the SCHFI v7.2, 11 items address this new dimension of the theory. These items cover monitoring of daily weights and ankle swelling but also address new aspects of the concept. For example, looking for medication side effects, feeling tired, asking the provider how one is doing, and keeping a record of symptoms are all included in this scale. In this analysis, our hypothesis that symptom perception includes monitoring symptoms (eg, paying attention to changes in how one feels) and recognition of symptoms (eg, how quickly one recognizes HF symptoms) was

confirmed in the analysis. Indeed, symptom monitoring implies that patients “listen” to their bodies, whereas recognition requires that patients engage in more active behaviors of symptom interpretation and attribution to the correct cause, which drives the treatment implemented during self-care management.³¹

The 8 items of the Self-Care Management scale, as hypothesized, fit the data well, reflecting 2 dimensions: recommended behaviors and problem-solving behaviors. These 2 dimensions reinforce previous studies in which it was shown that the management of HF symptoms includes performance of both recommended behaviors (eg, take a medicine) and problem-solving behaviors.^{56,57} Problem-solving behaviors reflect a realization that action is needed but there is some uncertainty about the situation (eg, Try to figure out why you have symptoms).

We also conducted a simultaneous CFA in which we tested the whole self-care model with the 3 scales, their dimensions, and the items belonging to each dimension. This analysis yielded fit indices that supported the whole model, providing evidence that the revised situation-specific theory of HF self-care, with 3 dimensions of self-care maintenance, symptom perception, and self-care management, fits the data well and is a faithful representation of how the self-care process works in patients with HF.

In previous work, we demonstrated that Cronbach α cannot be used to test the reliability of multidimensional scales.²⁹ In this study, we further support this important point and advocate using the correct reliability estimate after assessing instrument dimensionality. In this analysis, Cronbach α coefficients were .71, .81, and .66 for the Self-Care Maintenance, Symptom Perception, and Self-Care Management scales, respectively. However, when we used the global reliability index for multidimensional scales, the reliability estimates reached 0.75, 0.85, and 0.70, respectively. For future studies of the psychometric characteristics of the SCHFI, we strongly recommend first testing dimensionality and then choosing the best estimate of reliability based on dimensionality.

The reliability estimate of the Self-Care Management scale was only adequate, which may illustrate that self-care management behavior is inconsistent in patients with HF, as we found in a previous study.²² Test-retest reliability was adequate overall, demonstrating that the SCHFI v7.2 is stable in measuring self-care. The lowest estimate of stability was in symptom perception. This score may be evidence that symptoms changed over the 2-week testing period rather than instability of the scale. Symptoms are known to change rapidly in patients with HF, so presumably symptom monitoring behaviors change as well.⁵⁸

Predictive validity of the SCHFI was supported with correlations between the SCHFI v7.2 scales and the SF-36. We found better physical and mental health in participants with higher self-care maintenance and/or symptom perception scores, which reinforces previous evidence that self-care can influence physical and mental health.²² The finding that self-care management was not related to HRQL was surprising, though, because others have found that improvements in self-care management are related to improvements in HRQL.⁵⁹ This result may reflect the small sample size or the fact that data were collected while patients were hospitalized.

Limitations of the study include the use of convenience sampling. Another limitation is that predictive validity and stability testing were performed in small subgroups of the sample, which may make our estimates unstable. Finally, the self-care behaviors measured reflect patients' perceptions of self-care and may not reflect actual self-care behaviors. A strength of the study was the large sample size collected at multiple sites.

Although this is the first psychometric test of the SCHFI v7.2, the instrument is based on theory and our previous work with the SCHFI, so we are comfortable advocating use of this new version of the SCHFI in research and clinical practice. In research, the SCHFI v7.2 is anticipated to better characterize the self-care process and predict outcomes better than the previous version. In clinical practice, results obtained using the SCHFI v7.2 can be used to tailor education to specific patient issues. Identifying where patients are struggling—in maintaining disease stability, in monitoring and “listening to their body,” or in knowing what to do when symptoms get worse—can indicate what we should emphasize in patient teaching.

In conclusion, our psychometric analysis of the SCHFI v7.2 resulted in an improved instrument with characteristics that support factorial and predictive validity, internal consistency, and test-retest reliability. This is the first study testing the SCHFI v7.2, and more studies are needed. However, on the basis of our previous work on the SCHFI v6.2^{4,5,28,29} and the theory supporting this new version of the SCHFI,⁷ we anticipate that the SCHFI v7.2 will be found to be valid and reliable in future studies. Translations of the SCHFI v7.2 into other languages are anticipated to be available on the website soon.

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What's New and Important

- The SCHFI has been revised to match the updated situation-specific theory of HF self-care.
- The revised SCHFI now has 3 scales measuring the 3 concepts of the theory: Self-Care Maintenance, Symptom Perception, and Self-Care Management.
- The revised SCHFI is valid, reliable, and freely available to users on the website: www.self-care-measures.com.

TABLE 1

Sociodemographic and Clinical Characteristics of the Sample (N = 631)

	Mean $\pm$ SD or n (%)
Age (N = 626), y	64.6 $\pm$ 14.3
Gender (N = 628)	
Male	396 (63.1)
Female	232 (36.9)
Race (N = 604)	
Black/African American	131 (21.7)
White/Caucasian	432 (71.5)
Asian	5 (0.8)
Other (eg, mixed race)	36 (6)
Ethnicity (N = 455)	
Hispanic	36(7.9)
Non-Hispanic	419(92.1)
Highest education (N = 608)	
Less than high school graduate	61 (10)
High school graduate, vocational, or trade school	212 (34.9)
Some college or associate degree	214(35.2)
Bachelor's degree or higher	121 (19.9)
Employment (N = 608)	
Employed	131 (21.6)
Unemployed or retired	477 (78.5)
Marital status (N = 631)	
Single, never married	112(17.8)
Married or partnered	346 (54.8)
Divorced, separated, or widowed	173 (27.4)
Self-reported income (N = 613)	
More than enough to make ends meet	206 (33.6)
Enough to make ends meet	279 (45.5)
Not have enough to make ends meet	128 (20.9)
HF duration in months (N = 514)	126.7 $\pm$ 130.4
Categorized Charlson Comorbidity Index (CCI) score (N = 629)	
Low level (CCI 1–2)	337 (53.4)
Moderate level (CCI 3–4)	188 (29.8)
High level (CCI > 5)	106 (16.8)
Common comorbid conditions ^a	
Hypertension	406 (64.3)
Diabetes	253 (40.1)
Arthritis	247 (39.2)
Dysrhythmia ^b	135 (31.2)
Other heart condition	190 (30.2)

	Mean $\pm$ SD or n (%)
Pulmonary disease	183 (29.1)
Renal disease	142 (22.6)
Solid tumor cancer	83(13.2)
Neurological disorders	78(12.4)
Mental health issue ^b	46(10.6)
Anemia ^b	43 (9.9)
Peripheral vascular disease ^b	29 (6.7)
Gastrointestinal disease ^b	26 (6)
Liver disease	32 (5.1)
Blood cancer ^b	9(2.1)
Other diseases ^b	57(13.2)

Abbreviation: HF, heart failure.

^aEach disease was treated individually, so the percentage under “common comorbidity conditions” is not 100.

^bOnly some of the patients (433/631) were asked about these specific comorbid conditions.

TABLE 2

Factor Loading of Items on the Self-Care of Heart Failure Index v7.2

Self-Care Maintenance Scale	Factor Loadings	Factor Loadings (Simultaneous Analysis)	Item Mean	Skewness	Kurtosis
Listed below are behaviors that people with heart failure use to help themselves. How often or routinely do you do the following?					
Consulting behaviors (7 items)					
1. Try to avoid getting sick (e.g., wash your hands)	0.357	0.386	4.55	-2.218	4.778
2. Get some exercise (e.g., take a brisk walk, use the stairs)	0.228	0.276	3.27	-0.167	-1.112
4. See your healthcare provider for routine healthcare	0.538	0.538	4.35	-1.641	1.715
5. Take prescribed medicines without missing a dose	0.531	0.479	4.59	-2.325	5.689
7. Make sure to get a flu shot annually	0.315	0.309	3.23	-0.251	-1.417
9. Use a system or method to help you remember to take your medicines	0.488	0.447	2.88	0.105	-1.608
10. Ask your healthcare provider about your medicines	0.556	0.590	4.08	-1.312	0.032
Dietary behaviors (3 items)					
3. Eat a low salt diet	0.651	0.652	3.83	-0.799	-0.483
6. Order low salt items when eating out	0.798	0.799	4.53	-2.389	4.252
8. Ask for low salt foods when visiting family and friends	0.797	0.794	4.01	-1.201	-0.337
Symptom perception					
Monitoring behaviors (9 items)					
Listed below are changes that people with heart failure commonly monitor. How often do you do the following?					
11. Monitor your weight daily	0.541	0.559	3.53	-0.502	-1.180
12. Pay attention to changes in how you feel	0.621	0.617	4.28	-1.335	1.280
13. Look for medication side effects	0.672	0.666	3.72	-0.774	-0.816
14. Notice whether you tire more than usual doing normal activities	0.555	0.546	4.21	-1.381	1.322
15. Ask your healthcare provider how you're doing	0.550	0.581	3.89	-0.978	-0.347
16. Monitor closely for symptoms	0.836	0.821	3.96	-1.063	-0.009
17. Check your ankles for swelling	0.552	0.540	4.13	-1.363	0.454
18. Check for shortness of breath with activity such as bathing and dressing	0.586	0.573	4.23	-1.520	1.145
19. Keep a record of symptoms	0.454	0.476	2.41	0.595	-1.214

Symptom recognition (2 items)

The last time you had symptoms.

Self-Care Maintenance Scale	Factor Loadings (Simultaneous Analysis)	Item Mean	Skewness	Kurtosis
2. How quickly did you recognize that you had symptoms?	0.680	3.47	-0.788	-0.675
21. How quickly did you know that the symptom was due to heart failure?	0.763	2.70	-0.175	-1.582
Self-care management				
Recommended behaviors (4 items)				
Listed below are behaviors that people with heart failure use to control their symptoms. When you have symptoms, how likely are you to use one of these?				
22. Further limit the salt you eat that day	0.621	3.81	-0.855	-0.656
23. Reduce your fluid intake	0.711	3.32	-0.327	-1.293
24. Take a medicine	0.389	4.03	-1.210	-0.060
25. Call your healthcare provider for guidance Problem-solving behaviors (4 items)	0.514	3.72	-0.758	-0.877
26. Ask a family member or friend for advice	0.295	3.09	-0.125	-1.571
27. Try to figure out why you have symptoms	0.482	4.01	-1.074	0.268
28. Limit your activity until you feel better	0.535	4.21	-1.361	1.112
29. Think of a treatment you used the last time you had symptoms. Did the treatment you used make you feel better?	0.390	2.96	-0.384	-1.228

Results come from Mplus completely standardized solutions. All coefficients are statistically significant ($P < .05$ or less), except where noted.