Validity and Reliability of the Caregiver Contribution to Self-care of Heart Failure Index

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Background: Caregivers make an important contribution to the self-care of patients with heart failure (HF), but few instruments are available to measure this contribution. **Objective:** The objective of this study was to test the psychometric properties of the Caregiver Contribution to Self-care of Heart Failure Index (CC-SCHFI), an instrument derived from the Self-care of Heart Failure Index version 6.2. The CC-SCHFI measures the contribution of caregivers to the self-care maintenance and self-care management of HF patients, as well as their confidence in their ability to contribute to the patients' HF self-care. **Methods:** A cross-sectional design was used to study 291 Italian caregivers whose HF patients were cared for in 17 cardiovascular centers across Italy. Caregivers completed the CC-SCHFI and a sociodemographic questionnaire. Caregivers were retested on the CC-SCHFI 2 weeks later to assess test-retest reliability. **Results:** Most caregivers were women (66%) with a mean age of 59 years. First- and second-order confirmatory factor analysis (CFA) for each CC-SCHFI scale showed good model fit: $\chi^2 = 37.22$, $P = .08$, Comparative Fit Index (CFI) = 0.97, Non-Normed Fit Index (NNFI) = 0.96 for caregiver contribution to self-care maintenance (second-order CFA); $\chi^2 = 14.05$, $P = .12$, CFI = 0.96, NNFI = 0.93 for caregiver contribution to self-care management (first-order CFA); and $\chi^2 = 10.63$, $P = .15$, CFI = 0.99, NNFI = 0.98 for caregiver confidence in contributing to self-care (second-order CFA). The CC-SCHFI was able to discriminate statistical and clinical differences between 2 groups of caregivers who had received or not received HF self-care education. Internal consistency reliability measured by factor score determinacy was more than .80 for all factors and scales except for 1 factor in the caregiver contribution to self-care management scale (.65). Test-retest reliability computed by intraclass correlation coefficient was high (>0.90) for most factors and scales. **Conclusion:** The CC-SCHFI showed good psychometric properties of validity and reliability and can be used to measure the contribution of caregiver to HF patient self-care.

KEY WORDS: caregivers, heart failure, instrument development, psychometrics, self-care, self-management, social support

H eart failure (HF) is extremely common in older adults worldwide. In the United States, it was estimated that 2.3% of the population, or 5 700 000 individuals, had HF in 2008.[1] In Italy, where this study was conducted, 1.1% of the population has HF, with an increasing prevalence of 12.1% in people 70 years or older.[2]

A diagnosis of HF requires significant amounts of self-care, which patients find difficult to perform.[3,4] Caregivers make important contributions to patient self-care.[5,6] However, there has been surprisingly little research on the contributions by informal caregivers to HF patient self-care. This is probably because the

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measurement of caregiver contributions is in its infancy. Although measures of social support are commonly available, only 1 measure of caregiver perceptions of HF patient self-care has been published, and it is available only in English.[5] Furthermore, that instrument was developed as a proxy measure of the patient's self-care rather than the independent contributions made by the caregiver. Thus, the purpose of this study was to describe the psychometric properties of a new scale measuring caregivers' contributions to HF self-care that is based on the Self-care of Heart Failure Index version 6.2 (SCHFI v.6.2).[7,8] This scale is referred to as the Caregiver Contribution to Self-care of Heart Failure Index (CC-SCHFI).

Self-care of HF has been defined as a naturalistic decision-making process used to maintain physiological stability (maintenance) and to manage symptoms when they occur (management).[8,9] We defined the caregiver's contribution to the HF patient's self-care as the provision of time, effort, and support in the behalf of another person who needs to perform HF self-care. This definition is supported by several studies that demonstrated that caregivers contribute to better self-care maintenance and management in HF,[6,10,11] even though the caregiving experience can be stressful.[12] In contributing to HF self-care, caregivers adapt their behaviors to the patient's ability to perform self-care: In some cases, they only make recommendation about the practice of self-care maintenance and self-care management (eg, weigh every day, eat a low-salt diet, take medicines, call the doctor or nurse when symptoms occur). However, when patients are unable to practice self-care for whatever reason, caregivers substitute for patients in all the self-care processes (they weigh the patient, choose and prepare low-salt food, administer medicines , call the doctor/nurse when symptoms occur). Confidence in their contributions is believed to contribute to the success of caregivers in promoting self-care.

Background

Informal caregivers are defined as laypersons who provide unpaid care to a relative or friend to help him/her take care of himself/herself. These caregivers are said to be the invisible workforce in healthcare, as they provide most of the long-term services and supports received by chronically ill persons.[13,14] In 2007, informal caregivers in the United States provided services estimated at $370 billion annually.[15,16]

Previous authors have studied HF caregiving. For example, Clark and Dunbar[17] developed the Family Partnership Intervention for HF caregivers based on the self-determination theory. According to this theory, HF patients change their behaviors (eg, choosing a low-salt diet) when they accept the regulation for changes as their own and not simply as the need to comply with the demands of others. In the Family Partnership Intervention, HF caregivers are taught to develop an autonomy supporting context with HF patients, offering them choices, minimizing pressure, and providing alternatives instead of criticizing and controlling patient's behaviors. This intervention underwent experimental testing,[18] but the measured outcomes were family functioning and sodium intake and not how and to what extent caregivers contributed to self-care.

Sebern[19] developed the Shared Care Instrument to measure the interpersonal processes used to exchange support in a dyadic relationship, based on the assumption that each dyadic member affects the other.[6] The interpersonal processes assessed by this instrument are related to communication, decision making, and reciprocity. The instrument is not specific for HF, and the items did not explore behaviors directly involved in the HF self-care processes of maintenance and management, but the instrument has been used with the SCHFI to analyze the correlation between shared care and patients' self-care.[6] That study showed that patients' and caregivers' decisions were associated with self-care maintenance and that caregiver decision making and reciprocity were correlated with patients' self-care confidence. However, even though the Shared Care instrument dimensions were correlated with the patient's self-care, the Shared Care instrument does not measure specific activities related to HF self-care maintenance, self-care management, and self-care confidence.

Quinn et al[5] modified an earlier version of the SCHFI (version 4.0)[7] to examine whether caregivers could be used as proxy to rate the self-care management and self-care confidence of HF patients. They examined the degree of congruence between 70 HF patients and their primary caregivers, asking caregivers to rate the patient's self-care. For example, 1 item asked: "In the past 3 months, has your family member had trouble breathing or ankle swelling?" In another question, caregivers were asked: "Listed below are remedies that people with heart failure use. If your family member has trouble breathing or ankle swelling, how likely are you to try one of these remedies?" Ratings between patients and caregivers did not differ significantly, illustrating strong congruence. Internal consistency reliability for the self-care management scale as measured by Cronbach α was .51 for the patient and .68 for the family caregiver. For the self-care confidence scale, Cronbach α was .89 for the patient and .86 for the caregiver version. The self-care maintenance scale was not included in that study.

With so few measures of the caregiver contributions to HF self-care available, the purpose of this study was to derive a measure that could capture caregiver contributions to HF patients' self-care and validate it for future use. We modified the SCHFI v.6.2 to

be appropriate for caregivers, translated it into Italian, and back-translated it into English, as described below. Then, we assessed the psychometric properties in an Italian sample of caregivers of patients with HF.

Methods

Design, Sample, Procedure

A cross-sectional design was used in which a convenience sample of HF patients was enrolled from 17 ambulatory cardiovascular centers in the provinces of Rome, Frosinone, Latina, Olbia, Udine, Benevento, Avellino, Messina, Reggio Calabria, Terni, L'Aquila, Livorno, Milan, Rieti, Bolzano, and Ragusa. These provinces are in the north, center, and south of Italy. Of the 659 patients enrolled, 291 had caregivers who completed measures of sociodemographic characteristics and contributions to self-care, as described below. The institutional review board at each site approved the study before data collection began, and all participants provided informed consent.

To be enrolled in the study, caregivers had to be caring for a patient with a confirmed diagnosis of HF who had not experienced an acute coronary event in the last 3 months. Caregivers had to be designated by the patients as the person who provides most of their care; be oriented to person, time, and place; and be able to understand the purpose of the research. If caregivers did not meet these criteria, they were excluded from the study. Data collection took place during routine visits to the cardiovascular centers. Two weeks after the initial data collection, all caregivers were telephoned for readministration of the CC-SCHFI to assess test-retest reliability. All data collection was performed by 20 nurses. These nurses received education about the study aims and protocol and were trained by the first author to collect the data using written material about the study and verbal instruction. The first author was always available by telephone during data collection and every 2 weeks he met with the data collectors to monitor study progress.

Instruments

The following instruments were used:

Sociodemographic and clinical questionnaire. This instrument was developed by the research team to measure sociodemographic variables related to caregivers and patients (gender, age, marital status, education, employment, New York Heart Association class, hours of caregiving).

The CC-SCHFI. The CC-SCHFI is a modification of the SCHFI v.6.2 with the same number of items (22) and scales (self-care maintenance, self-care management, and self-care confidence). The CC-SCHFI measures the contribution of caregivers to patients'

HF self-care. The caregiver contribution to self-care maintenance scale has 10 items that measure symptom monitoring and adherence behaviors performed to prevent an HF exacerbation. In this section of the CC-SCHFI, caregivers are asked how often they recommend the various behaviors (eg, weight monitoring, eating a low-salt diet, taking medications) to the patient or how often they do the activities themselves because the patient is not able to do them.

The caregiver contribution to self-care management scale has 6 items that measure the caregiver's ability to recognize symptoms when they occur, treatment implementation in response to these symptoms, and the ability to evaluate the treatments used. In the CC-SCHFI caregivers are asked, "If the person you care for had trouble breathing or ankle swelling in the past month, how quickly did *you* recognize it as a symptom of heart failure?" In addition, caregivers are asked: "If the person you care for has trouble breathing or ankle swelling, how likely are you to recommend (or do) one of these remedies?" Choices include reduce salt in the diet, reduce fluid intake, take an extra water pill, and call the nurse or doctor for guidance, just as in the SCHFI v.6.2.

The caregiver confidence in contributing to self-care scale uses 6 items to evaluate the caregivers' confidence in their abilities to help the patient engage in each phase of the self-care process. For example, caregivers are asked: "In reference to the person you care for, in general, how confident are you that you can recognize changes in the patient's health when they occur?"

Each of the 3 scales uses a 4-point Likert scale (never or rarely, sometimes, frequently, always or daily) with a standardized score from 0 to 100; higher scores indicate higher contribution to self-care.

The CC-SCHFI was prepared in Italian after first translating the SCHFI v.6.2 into Italian. The SCHFI was translated from English into Italian by 2 Italian researchers with expertise in English cardiovascular terminology. This Italian version was modified to accommodate caregivers. Then, this Italian instrument was back-translated into English by a bilingual individual with expertise in medical English who was blinded to the original version. Finally, the CC-SCHFI was reviewed by the author of the SCHFI v.6.2 to check the content validity of the new scale and the accuracy of the CC-SCHFI translation. Minor revisions to the translation were discussed by e-mail to ensure a correspondence between the English CC-SCHFI format and the Italian version.

Data Analysis

Descriptive statistics, including means and standard deviations, were used to summarize the characteristics of the caregivers and patients.

The factorial structure of the scale was examined using confirmatory factor analysis (CFA) for each separate CC-SCHFI scale, a crucial step in construct validity testing. Testing of the theoretical assumptions began with an examination of the factor structure of the Italian version of the SCHFI v.6.2.[20] The CFA of the CC-SCHFI was carried out using the factor structure of the SCHFI v.6.2. Data were available from the full sample of caregivers for the self-care maintenance and self-care confidence scales, but data for the self-care management scale were available only from caregivers who reported that their patients were symptomatic in the previous month (with problem breathing or ankle swelling). This issue of missing data on the self-care management scale for asymptomatic patients is the same as that for the SCHFI v.6.2. Patients (and caregivers) cannot judge the management of symptoms that do not occur.

The discriminant validity of the CC-SCHFI was established by comparing a subgroup of caregivers who had received self-care education with another subgroup who had not. Because the small number of caregivers in both groups, the nonparametric Mann-Whitney U test was used for this analysis.

Reliabilities for each factor and each scale derived from the CFA were estimated using factor score determinacy coefficients.[21] These coefficients represent "an estimate of the internal consistency of the solution—the certainty with which factor axes are fixed in the variable space."[22(p649)] They represent "the squared multiple correlations (SMCs) of factor scores predicted from scores on observed variables. In a good solution, SMCs range between 0 and 1; the larger the SMCs, the more stable the factors. A high SMC (say, .70 or better) means that the observed variables account for substantial variance in the factor scores. A low SMC means the factors are poorly defined by the observed variables."[22(pp649–650)]

The reliability of the CC-SCHFI scales was also tested with the intraclass correlation coefficient (ICC). This coefficient gives an estimate of the test-retest stability of the scale scores; thus, it provides complementary information to that given by the internal consistency reliability.

The P value was fixed at .05. Statistical analysis was performed using SPSS version 19, except for the CFA, which was performed with Mplus 6.1.

Results

Description of the Sample

The total sample was composed of 291 caregivers of HF patients. Table 1 shows the sociodemographic and clinical characteristics of the patients. The patients were almost equally distributed between men and women, with some predominance of men. Pa-

tients were older than 75 years, on average, and more than the 40% of the sample was educated at only the elementary school level. Half of the patients were married, and more than 30% were widowed. Most (90%) of the patient sample was not working. New York Heart Association class was distributed throughout the 4 classes, with most of the sample in class III and fewest in class IV.

Most of the caregivers were women with a mean age of 59 years (Table 2). Education was equally distributed in the sample, and few (9%) were educated at the university level. Most (70%) caregivers were married, with almost half working outside the home. Most (90%) caregivers were spouses or children, and almost 40% lived with the patient. Caregivers cared for the patients for 9 hours each day, on average.

Item Descriptive Analysis

Table 3 shows the descriptive statistics of the individual items of the CC-SCHFI. Items of the caregiver contribution to self-care maintenance scale with the highest scores were those related to "keeping doctor/nurse appointments," "trying to avoid getting sick," and "not forgetting to take medicines." Items addressing "exercise," "physical activities," and "daily weighing" scored lowest. On the caregiver contribution to self-care management scale, the items that scored lowest were "call the doctor/nurse for guidance" and "take an extra water pill." The item with the highest score in the caregiver contribution to self-care management scale was "reduce

TABLE 1 Patients' Sociodemographic and Clinical Characteristics (n = 291)

	n (%)
Gender	
Male	164 (56.4)
Female	127 (43.6)
Age, mean (SD), y	76.42 (10.81)
Education	
Elementary	129 (44.3)
Middle school	68 (23.4)
Professional school	38 (13.1)
High school	43 (14.8)
University degree	13 (4.5)
Marital status	
Married	157 (54.0)
Single	11 (3.8)
Widowed	99 (34.0)
Divorced	24 (8.2)
Profession	
Employed	34 (11.7)
Unemployed	257 (88.3)
New York Heart Association class	
I	71 (24.4)
II	89 (30.6)
III	100 (34.4)
IV	31 (10.7)

	n (%)
Gender	
Male	101 (34.7)
Female	190 (65.7)
Age, mean (SD), y	59.16 (14.56)
Education	
Elementary	46 (15.8)
Middle school	82 (28.2)
Professional school	47 (16.1)
High school	88 (30.2)
University degree	28 (9.3)
Marital status	
Married	205 (70.4)
Single	42 (14.4)
Widowed	20 (6.9)
Divorced	24 (8.2)
Profession	
Employed	140 (48.1)
Unemployed	151 (51.9)
Relationship with patient	
Spouse	110 (37.8)
Child	149 (51.2)
Friend	12 (4.1)
Nephew/niece	8 (2.7)
Brother/sister	6 (2.1)
Other relative	6 (2.1)
Caregiver living with patient	116 (39.9)
Hours of caregiving per day, mean (SD)	8.90 (7.79)

fluid intake." In the caregiver confidence in contributing to self-care scale, "following treatment advice" and "recognizing health changes in the patient" scored highest. The items regarding confidence to "prevent HF symptoms," "evaluate how well a remedy works," and "do something that relives HF symptoms" were scored lowest.

Factor Structure of the Caregiver Contribution to Self-care of Heart Failure Index

Previous analyses conducted on the patient version of the SCHFI v.6.2[20] revealed a complex structure of the index and provided the initial model to guide the CFA of the CC-SCHFI.

Caregiver Contribution to Self-care Maintenance Scale

According to the results of the CFA on patient's SCHFI v.6.2 scale,[20] a model consisting of 4 factors was specified. These factors were symptom monitoring (items 1 and 2), physical activity (items 4 and 7), medical treatment adherence (items 3, 5, 6, 8, and 10), and sodium intake control (items 6 and 9). All these factors were allowed to freely correlate. The initial model showed poor fit but allowed covariance between individual items (4 and 10, 8 and 9, and 7 and 9; these covariances could be explained theoret-

ically); the fit significantly improved: $\chi^2_{25} = 30.52$ (n = 283), $P = .20$, CFI = 0.98, NNFI = 0.98, root mean square error of approximation (RMSEA) = 0.028, standardized root mean squared residual (SRMR) = 0.031. This analytic approach is consistent with the opinions of Fornell[23] and Bagozzi,[24] who note that it is reasonable to let measurement errors correlate when (a) these correlations are plausible from a theoretical or methodological point of view and (b) their specification does not alter the estimates of the other parameters in the model.

Because the factors were correlated (with correlations ranging from 0.16 to 0.61, with an average correlation of 0.42), a second-order hierarchical model was examined.[25] In this model, a second-order factor was posited that accounted for covariation in the first-order factors. Figure 1 gives a graphical description of the final caregiver contribution to self-care maintenance model, which fit the data well: $\chi^2_{27} = 37.22$ (n = 283), $P = .08$, CFI = 0.97, NNFI = 0.96, RMSEA = 0.037, SRMR = 0.036. This model shows that the factorial structure of the caregiver contribution to self-care maintenance scale, although multidimensional at the level of primary factors, is unidimensional at the level of the secondary, higher order factor. In this regard, as noted by Hattie,[26(p150)] "it is quite reasonable to find a second-order factor underlying a set of correlations between first-order factors and then make claims regarding unidimensionality."

Caregiver Contribution to Self-care Management Scale

Analysis of this scale was conducted with the 154 caregivers reporting symptoms in their patients. The CFA based on the patients' SCHFI v.6.2 results[20] produced a model consisting of 2 factors: autonomous management (items 11, 12, 13, and 16) and provider-directed management (items 14 and 15). The fit of this model was good: $\chi^2_9 = 14.05$ (n = 154), $P = .12$, CFI = 0.96, NNFI = 0.93, RMSEA = 0.06, SRMR = 0.052. As can be easily seen in Figure 2, the 2 factors defined by this solution were poorly correlated, with a small nonsignificant correlation of 0.23. The lack of a significant correlation prevented us from hypothesizing a second-order solution for the caregiver contribution to self-care management scale. Although the first factor was well defined by 4 items with medium to high factor loadings, the second factor had only 2 items with only moderate factor loadings.

Caregiver Confidence in Contributing to Self-care
The CFA using the patients' SCHFI v.6.2 data[20] results in a model with only 1 factor specified (items 17–22). Testing a unidimensional model in the CC-SCHFI resulted in a poor fit: $\chi^2_9 = 64.15$ (n = 283), $P < .001$, CFI = 0.77, NNFI = 0.67, RMSEA = 0.147,

TABLE 3 Descriptive Statistics for Individual Items of the Caregiver Contribution to Self-care of Heart Failure Index

Items	Mean	SD	Min	Max
Caregiver contribution to self-care maintenance				
How often do you recommend that the person you care for do the following things?				
(1) Weigh daily	2.41	0.93	1	4
(2) Check ankles for swelling	2.73	0.96	1	4
(3) Try to avoid getting sick (get a flu shot, avoid ill people)	2.88	1.04	1	4
(4) Do some physical activity	2.46	1.10	1	4
(5) Keep doctor or nurse appointments	3.06	1.03	1	4
(6) Eat a low-salt diet	2.72	1.07	1	4
(7) Exercise for 30 min	2.32	1.07	1	4
(8) Remember to take medicines	2.84	1.15	1	4
(9) Ask for a low-salt items when eating out or visiting others	2.65	1.16	1	4
(10) Use a system (pill box, reminder) to help him/her remember to take medicines	2.73	1.17	1	4
Caregiver contribution to self-care management				
(11) If the person you care for had trouble breathing or ankle swelling, how quickly did you recognize it as a symptom of HF?	2.47	1.07	0	4
If the person you care for has trouble breathing or ankle swelling. how likely are you to recommend (or do) one of following remedies?				
(12) Reduce salt in the diet	2.47	1.07	0	4
(13) Reduce fluid intake	2.73	1.06	1	4
(14) Take an extra water pill	2.46	1.06	1	4
(15) Call your doctor or nurse for guidance	2.28	1.19	1	4
(16) Think of a remedy you tried the last time the patient you care for had trouble breathing or ankle swelling. How sure were you that the remedy helped or did not help him or her?	2.65	1.09	1	4
Caregiver confidence in contributing to self-care				
In reference to the person you care for, how confident are you that you can				
(17) Prevent HF symptoms?	2.29	1.09	1	4
(18) Follow the treatment advice?	3.03	0.99	1	4
(19) Evaluate the importance of HF symptoms?	2.73	1.01	1	4
(20) Recognize health changes in the person you care for?	2.87	0.95	1	4
(21) Do something that relieves HF symptoms?	2.51	0.95	1	4
(22) Evaluate how well a remedy works?	2.49	0.96	1	4

Abbreviation: HF, heart failure.

SRMR = 0.076. However, a closer scrutiny of the solution revealed 2 factors, with 1 factor containing items 17, 21, and 22 and another factor containing items 18, 19, and 20. The first factor related to "sophisticated" activities requiring advanced knowledge by caregivers and so was named "advanced confidence." The second factor included more basic activities requiring only common competence, so it was named "basic confidence." When the 2 factors were allowed to correlate, this 2-factor model had an excellent fit: $\chi^2_7 = 10.63$ (n = 283), $P = .15$, CFI = 0.99, NNFI = 0.98, RMSEA = 0.043, SRMR = 0.028. In this model, the covariance between item 17 and 18 residuals was allowed to correlate, as this did not alter the theoretical point of view or the parameters of the model.[23,24] Because the 2 factors presented a significant and moderately high correlation of 0.50, a second-order hierarchical factor solution was tested. This solution was statistically equivalent to the previous solution, where the 2 primary factors were allowed to correlate. Figure 3 presents the path diagram and the parameter estimates of the hierarchical second-order solution. As noted in the case of the caregiver contribution to self-care maintenance scale,

the factorial structure of the caregiver confidence in contributing to self-care scale is multidimensional at the level of primary factors but unidimensional at the level of the secondary, higher order factor.

Discriminant Validity of the Caregiver Contribution to Self-care of Heart Failure Index

The discriminant validity of the CC-SCHFI was established comparing a subgroup of caregivers who received education in self-care against another group of caregivers who did not. These 2 groups were not statistically different in relation to caregivers' and patients' ages ($P = .16$ and $.15$, respectively) or in the patient's New York Heart Association class ($P = .36$). The first group was followed in an HF clinic, where a dedicated physician met patients and caregivers every 3 months. During these meetings, patients were examined and then, with their caregivers, were educated about HF management: sodium restriction, physical activity, medication use, flu vaccination, and checking weight, and ankles. The second group of caregivers did not receive such education.
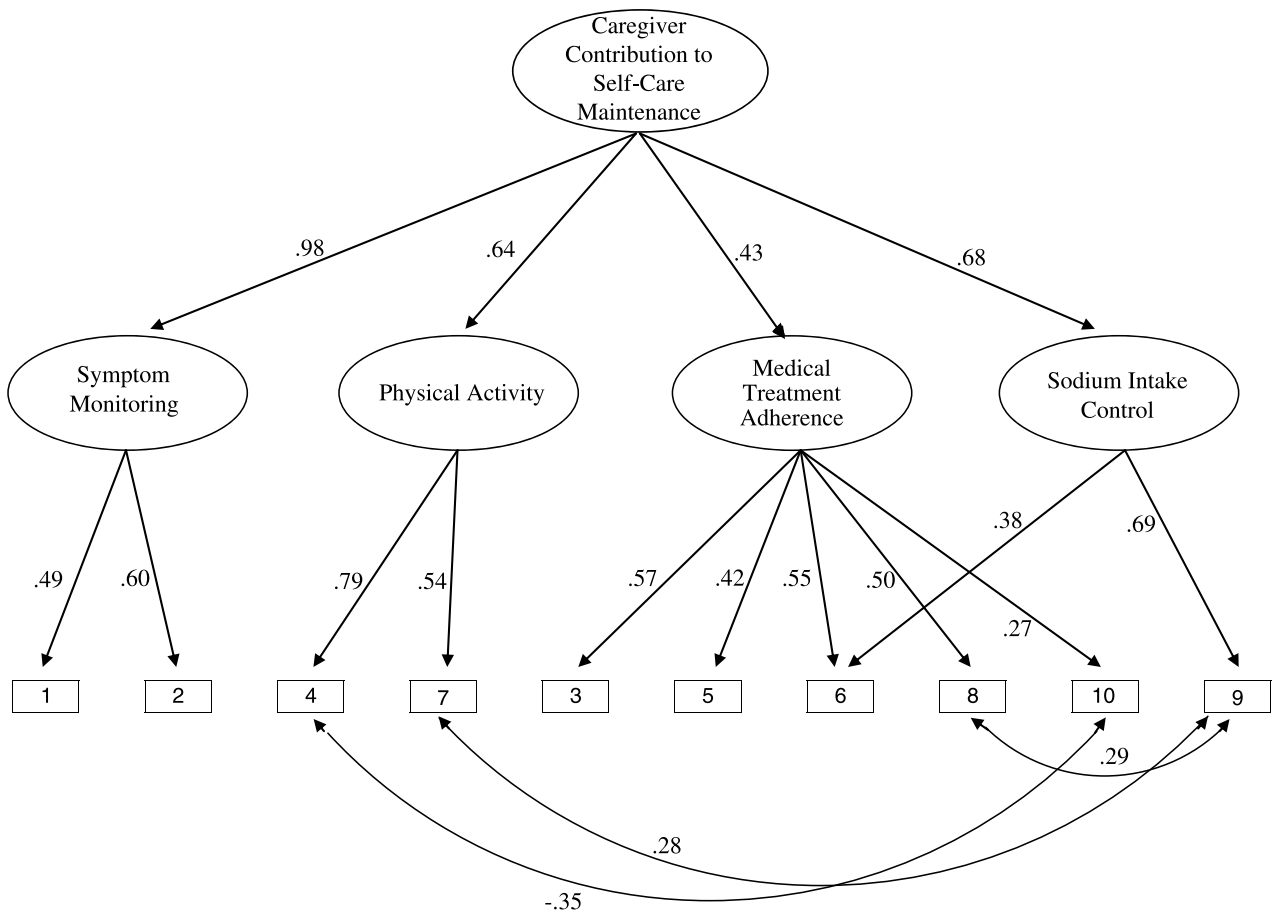
FIGURE 1. *Confirmatory factor analysis of the Caregiver Contribution to Self-care maintenance scale.*

The CC-SCHFI was able to discriminate between the 2 groups in relation to the caregiver contribution to self-care maintenance scale overall score; physical activity, sodium intake control, and autonomous management factor scores; the single item measuring the likelihood of calling the doctor or nurse for guidance; and the self-care confidence scale. These differences were statistically and clinically significant (Table 4). The minimum significant difference was on the caregiver contribution to self-care maintenance scale overall score, which was 9.98 points higher in caregivers who received self-care education. The maximum difference was on the advanced confidence factor, which scored 42.80 more in caregivers who received self-care education. Educated caregivers were significantly less likely to call their doctor or nurse for guidance.

Reliability of the Caregiver Contribution to Self-care of Heart Failure Index

As described above, the internal consistency reliabilities of the CC-SCHFI scales derived from the CFAs were estimated using the factor score determinacy

coefficients. Reliabilities of the primary factors of the caregiver contribution to self-care maintenance scale were high: .80 for symptom monitoring, .85 for physical activity, .82 for medical treatment adherence, and .80 for sodium intake control. The reliability of the second-order factor was .80.
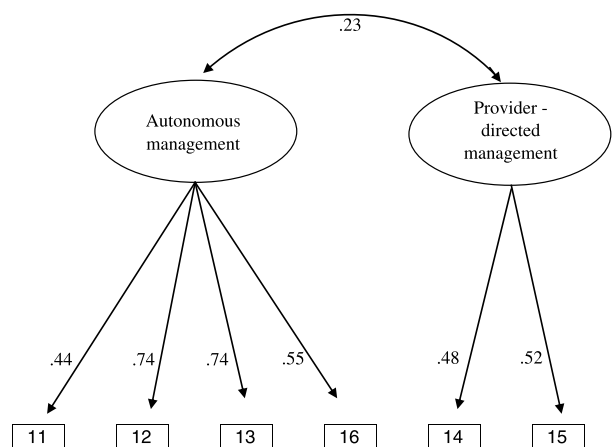

FIGURE 2. *Confirmatory factor analysis of the Caregiver Contribution to Self-care management scale.*
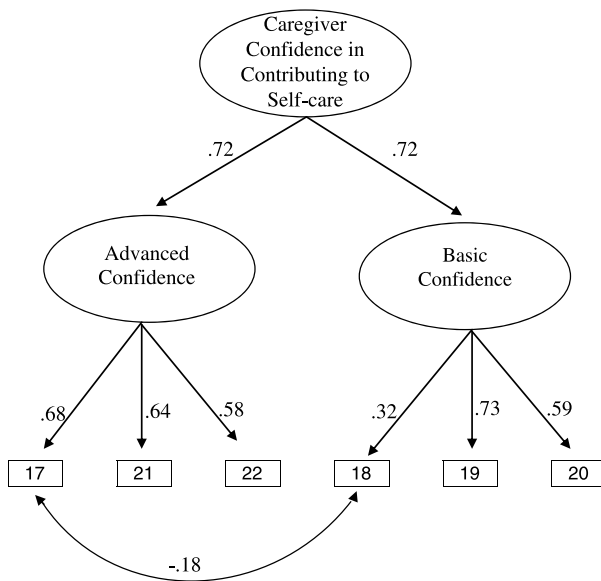
FIGURE 3. *Confirmatory factor analysis of the Caregiver Contribution to Self-care of Heart Failure Index self-care confidence scale.*

The internal consistency reliability of the 2 factors of the caregiver contribution to self-care management scale was .87 for autonomous management and .65 for provider-directed management. Therefore, only the reliability estimate of the first factor was adequate, with that of provider-directed management below the desired .70 threshold suggested by Tabachnick and Fidell.[22]

The internal consistency reliabilities of the primary factors of the caregiver confidence in contributing to self-care scale were high: .84 for advanced confidence and .82 for basic confidence. The reliability of the second-order factor was .72.

Table 5 shows the test-retest reliability (stability) of the CC-SCHFI. This analysis was done with the complete sample and repeated in the subgroup of caregivers of symptomatic patients (those whose HF patient had ankle swelling or problem breathing in the last month). The ICCs were calculated for each factor and scale and separately for items 14 (take an extra water pill) and 15 (call doctor or nurse for guidance) because these items did not load sufficiently onto a single factor. All ICCs demonstrated excellent test-retest reliability, with most of values greater than 0.90 for every factor and scale and for items 14 and 15.

Discussion

This is one of the first studies testing an instrument for measuring the contribution of caregivers to HF self-care. In this study, we demonstrated that the CC-SCHFI is a valid and reliable method of measuring the contribution of caregivers to the self-care of HF patients.

The dimensionality of the CC-SCHFI was analyzed by means of 3 separate CFAs. Each one of these CFAs was conducted on the items defining each 1 of the 3 scales comprising the CC-SCHFI (caregiver contribution to self-care maintenance, caregiver contribution to self-care management, and caregiver confidence in contributing to self-care). The goodness-of-fit indices supported the hypothesized models. These analyses showed a complex and interesting structure of the index. The caregiver contribution to self-care maintenance and caregiver confidence in contributing to self-care scales showed a hierarchical structure, with several valid and reliable primary factors corresponding to narrow dimensions that allow a fine-grained assessment of caregiver

TABLE 4 **Comparison of Mean Scale and Factor Scores Between Caregivers Educated on Heart Failure Self-care Versus Caregivers Not Educated Specifically About Self-care**

Scales and Factors	Educated Caregivers (n = 22)	Noneducated Caregivers (n = 35)	Mean Difference	P
Caregiver contribution to self-care maintenance (overall)	70.17 (19.03)	60.19 (13.87)	9.98	.02
Symptom monitoring	61.36 (29.27)	51.95 (21.62)	9.41	.10
Physical activity	61.11 (30.42)	31.43 (27.35)	29.68	.00
Medical treatment adherence	76.32 (15.81)	75.23 (16.93)	1.09	.68
Sodium intake control	77.27 (35.08)	63.33 (25.18)	13.94	.02
Caregiver contribution to self-care management				
Autonomous management	84.31 (26.98)	57.87 (11.60)	26.44	.00
Item 14: Take extra water pill	21.57 (40.72)	31.47 (35.18)	−9.9	.36
Item 15: Call doctor/nurse for guidance	35.29 (43,25)	66.66 (30.25)	−31.33	.02
Caregiver confidence in contributing to self-care (overall)	84.33 (20.83)	47.54 (12.91)	36.79	.00
Advanced confidence	77.77 (28.69)	34.97 (18.58)	42.80	.00
Basic confidence	90.91 (15.19)	60.13 (16.89)	30.78	.00

Scale and factor scores were standardized to 0 to 100. As suggested by the confirmatory factor analysis, only scores from the autonomous management factor and items 14 and 15 were computed for the Self-care management scale.

TABLE 5 Test-Retest Reliability of the Caregiver Contribution to Self-care of Heart Failure Index (Full Sample and Only Symptomatic Patients)

	ICC (95% CI)	
Scales and Factors	Full Sample (n = 291)	Only Symptomatic Patients (n = 134)
Caregiver contribution to self-care maintenance (overall)	0.92 (0.90–0.94)	0.92 (0.90–0.94)
Symptom monitoring	0.90 (0.87–0.92)	0.92 (0.90–0.94)
Physical activity	0.87 (0.84–0.90)	0.93 (0.89–0.95)
Medical treatment adherence	0.87 (0.83–0.89)	0.92 (0.91–0.95)
Sodium intake control	0.92 (0.91–0.94)	0.93 (0.91–0.96)
Caregiver contribution to self-care management		
Autonomous management		0.96 (0.94–0.97)
Item 14: Take extra water pill		0.93 (0.91–0.94)
Item 15: Call doctor/nurse for guidance		0.95 (0.93–0.96)
Caregiver confidence in contributing to self-care (overall)	0.93 (0.91–0.94)	0.94 (0.91–0.96)
Advanced confidence	0.94 (0.92–0.93)	0.94 (0.92–0.96)
Basic confidence	0.92 (0.90–0.94)	0.93 (0.90–0.95)

Test-retest reliability was calculated with the ICC correlating the Caregiver Contribution to Self-care of Heart Failure Index scores collected twice with a 15-day interval between testing. Test-retest for the caregiver contribution to self-care management scale was computed only with 134 patients who were symptomatic at both intervals. $P < .001$ for each correlation.
Abbreviations: 95% CI, 95% confidence interval; ICC, intraclass correlation coefficient.

contribution to HF self-care and 2 valid and reliable higher order factors that support the conventional use of total scores for a more global assessment.

The factor structure of the caregiver contribution to self-care management scale was more problematic than the others. The CFA of this scale allowed the identification of an autonomous management factor but showed also a narrower provider-directed management factor, with low factor loadings that question its validity. However, the 2 individual items of this proposed construct had high test-retest reliability. More research is needed for a deeper understanding of this result, but it could be a cultural phenomenon reflecting the treatment norms in Italy. In the meantime, we believe that it is prudent to not sum items 14 and 15 together because they do not define a valid factor, nor should they be included with the autonomous management items with which they show a low correlation. In any case, because these 2 items measure an important aspect of caregiver contribution to patient self-care, we recommend their use as single measures.

Scores on the caregiver contribution to self-care maintenance, caregiver contribution to self-care management, and caregiver confidence in contributing to self-care scales were generally higher for caregivers who received self-care education compared with uneducated caregivers, demonstrating discriminant validity of the 3 scales. These differences were both statistically and clinically significant for the caregiver contribution to self-care maintenance overall scale score; the physical activity, sodium intake control, and autonomous management factors; the single item on calling a doctor or nurse for guidance; and the caregiver confidence in contributing to self-care scale score overall and both factors. We saw no statistically sig-

nificant differences in the medical treatment adherence and symptom monitoring factors; there was equal adherence to medical prescription in both groups (eg, avoiding getting sick, keeping medical/nursing appointment, taking medications, using system to remember taking medicines). No differences in medical treatment adherence were expected, as in the Italian culture, patients rely on the physician's prescription. The fact that there were no statistical differences in symptom monitoring probably reflects the small subsample available for comparison.

It is interesting that educated caregivers scored lower on the item measuring calling the doctor or nurse for guidance. This suggests that educated caregivers are more confident (as the high scores at the caregiver confidence in contributing to self-care scale showed) on what to do in case of HF symptoms, and thus, they do not need to call for advice. This finding could be used to argue for the benefit of educating HF patients and caregivers about self-care. Caregiver confidence in contributing to self-care overall and both factors of this scale showed the highest differences with the educated caregivers scoring much higher on both dimensions. The differences between the 2 factors with higher scores on basic confidence might further demonstrate that activities measured by these items are easier than activities measured in the advanced confidence factor. Differences on the CC-SCHFI scores between educated and noneducated caregivers suggest that there is an opportunity in Italy to improve the quality of the education provided to patients and caregivers about HF self-care.

Apart from the proposed provider-directed management factor, internal consistency reliability was good for each factor and scale. The internal consistency

What's New and Important

- The Caregiver Contribution to Self-care of Heart Failure Index (CC-SCHFI) is a new instrument driven from the Self-care of Heart Failure Index v.6.2 that measures the contribution of caregivers to the self-care maintenance and self-care management and confidence in the ability to contribute to the patients' heart failure self-care.
- The CC-SCHFI has good psychometric characteristics of validity and reliability and can be used in clinical settings and research.

reliability of the provider-directed management factor was .65, marginally lower than the .70 threshold, which was probably due to the fact that the 2 items that loaded on this factor were only moderately correlated. Actually, this result was expected because the contents of these items are very different: take an extra water pill and call doctor/nurse in case of problem breathing or ankle swelling. This result probably reflects the norms in Italy, where patients are not encouraged to self-medicate. The low score of the other item could be explained by the fact that patients were enrolled in several public cardiovascular ambulatory clinics across Italy, and procedures for calling doctors/nurse for guidance in case of HF symptoms might be very different from one clinic to another. Therefore, at least with Italian caregivers, the dimension of provider-directed management is not well measured in the CC-SCHFI.

The test-retest reliability was excellent for most factors and scales in the CC-SCHFI. This result indicates that caregivers are stable in their contribution to patient's self-care. This "stability" of caregivers' behaviors could be very important in situations where caregivers receive specific education about how to care for patients. That is, even though patients might not be very good in HF self-care,[27,28] caregiver contributions might be sufficient to compensate. Because caregiver contribution to HF self-care is unknown and until now was impossible to measure, we think this could be an area for future research.

A limitation of this study was that the analysis excludes the patients' self-care data; thus, we cannot comment on the effectiveness of the caregivers' contributions to patients' HF self-care. However, the study aims were to establish the basic psychometric properties of the CC-SCHFI, and those aims were achieved. Further analysis should demonstrate if the CC-SCHFI scores predict patients' self-care to establish predictive validity of the tool. Another limitation was that the CC-SCHFI has not undergone content validity testing, and some items may not be culturally relevant in the Italian population. For example, it is rare that Italian HF caregivers decide autonomously to administer a diuretic without first asking the physician. Thus, in this study, the item querying

about the probability of administering a diuretic for HF symptoms was one of those with the lowest score. Preliminary analysis from an ongoing study suggests that HF patients describe self-care as more related to adherence to doctor orders than to autonomous behaviors such as weighing daily. Probably, HF caregivers would have a similar point of view on self-care. Even the term *self-care* is not widely used among healthcare professionals in Italy, so a similar term or sentences were needed to focus caregivers on the exact meaning of the term *self-care*. Therefore, further research on the conceptualization of self-care may identify items to be modified or added to make the CC-SCHFI more culturally sensitive in an Italian population.

Several studies have focused on HF caregivers,[29–33] and there is a general agreement that caregivers and patients influence each other's outcomes[34] and that stress, burden, and depression in caregivers are associated with depression and hospital readmission in patients. Further studies should focus on determining if the contribution of caregivers to HF patients' self-care has an effect on patient outcomes. It would be important to demonstrate if caregivers are even more important than patients in checking HF symptoms, facilitating patient adherence to the treatment regimen, or managing symptoms. Understanding the contributions of caregivers to HF patient self-care may provide another avenue for intervention for this common condition. Because the CC-SCHFI is equal in its contents with the SCHFI v.6.2, future studies could include a dyadic analysis to account for dependency in the dyadic data.

The CC-SCHFI was developed in an Italian population. Because its content is so similar to that of the SCHFI v.6.2, there are no cultural concerns regarding its use in American HF caregivers. Because self-care and the role of informal caregivers are influenced by culture and local healthcare systems, it is advisable for other countries to test the content validity and the psychometric properties of the CC-SCHFI before using it.

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