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ORIGINAL RESEARCH

Structural equation model testing the situation-specific theory of heart failure self-care

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Abstract

Aim. To test the situation-specific theory of heart failure self-care with structural equation modelling.

Background. Several authors have proposed theories on heart failure self-care, but only the situation-specific theory of heart failure self-care by Riegel and Dickson is focused on the process that patients use to perform self-care. This theory has never been tested with structural equation modelling.

Design. A secondary analysis of data from a cross-sectional study.

Methods. Patients with heart failure were recruited in 21 cardiovascular centres across Italy during 2011. Data were collected with a sociodemographic questionnaire, chart abstraction for clinical data and the Self-Care of Heart Failure Index v.6·2.

Results. A sample of 417 participants was enrolled in the study (59% males, mean age 72 years). The following propositions were tested and supported: Symptom monitoring correlates with treatment adherence; symptom monitoring and treatment adherence have a direct, positive relationship with symptom recognition and evaluation that in turn have a direct, positive relationship with treatment implementation; treatment implementation has a direct, positive relationship with treatment evaluation. In addition, the following three relationships were found: Symptom monitoring has a direct, positive relationship with treatment implementation; symptom recognition and evaluation have direct, positive relationships with treatment evaluation and symptom monitoring correlates with treatment evaluation. [Correction added on 9th April 2013, after first online publication: '…symptom monitoring correlates with treatment implementation.' has been corrected to read '…symptom monitoring correlates with treatment evaluation.']

Conclusion. The data support the situation-specific theory of heart failure self-care with the addition of three new relationships that emerged from the analysis. Results of this study lend further support to the use of the situation-specific theory of heart failure self-care in research and practice.

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Keywords: heart failure, nursing, self-care, structural equation modelling, symptom monitoring, symptom recognition and evaluation, theory testing, treatment adherence, treatment implementation

Introduction

Heart Failure (HF) is the most common cardiovascular disease in many countries worldwide (Caldarola *et al.* 2009, Jiang & Ge 2009, Ntusi & Mayosi 2009, Norton *et al.* 2011). It is estimated that 6·6 million North Americans (Roger *et al.* 2012) and 15 million Europeans (Anguita Sanchez *et al.* 2008) are affected by HF. The prevalence of HF is constantly increasing due to the ageing of the population, improved treatment, and survival rates after myocardial infarction and the continuing problem of poor control of hypertension.

Heart failure patients experience lower quality of life than patients affected by other chronic conditions (Juenger *et al.* 2002, Iavazzo & Cocchia 2011, Burstrom *et al.* 2012) and are prone to frequent hospitalization and emergency department visits for illness decompensation (Krumholz *et al.* 2009, Ross *et al.* 2010). Mortality remains high with about the 30% of people with HF dying within the first year after diagnosis (Barsheshet *et al.* 2010, Chen *et al.* 2011).

Self-care of HF is considered essential to improving patients' quality of life and reducing hospitalization, mortality, and emergency department visits (Bird *et al.* 2010, Buck *et al.* 2012). In the last two decades several authors have proposed theories of self-care for use in research and clinical practice. While all these theories identify the components and predictors of HF self-care, only the situation-specific theory by Riegel and Dickson (2008) has specifically focused on the process that HF patients use in the performance of self-care (Figure 1). Although this theory is widely cited no study testing the relationships among the theoretical concepts was located.

Background

Theories of self-care in heart failure

Meleis (2011) defines theory as a coherent vision of the context, process, and outcomes associated with a specific phenomenon. As demonstrated below, numerous nursing investigators have proposed models of HF self-care with variable attention given to these elements of theory.

In studying self-care behaviours of people with HF, Jaarsma *et al.* (2000), used three sets of self-care limitations from Orem's theory of self-care: knowledge, judging and decision making, and action and result achievement. Later, Orem's theory was used by Jaarsma *et al.* (2003) to develop the European Heart Failure Self-care Behaviour Scale (EHFScBS). In this effort, HF self-care was specified as involving three constructs: complying with the regimen, (e.g. daily weighing, sodium and fluid restriction), asking for help (e.g. call the doctor/nurse in case of weight gain or excessive fatigue), and adapting activities (e.g. resting). These three constructs, although describing the components of self-care, do not represent a theory of HF self-care where concepts are linked with propositions to explain a process.

Granger *et al.* (2006) used the middle-range Trajectory of Chronic Illness Theory (TCIT) by Strauss *et al.* (1984) to integrate patients' perspectives in self-care with those of HF providers. The TCIT evolved from ethnographic work with patients affected by chronic illnesses. This theory conceptualizes relationships among factors contributing to the management of illness and the target therapeutic interventions. According to this theory patients have their own perception of the illness; they interpret and report symptoms and perceive prescribed medications differently from healthcare professionals. Using the TCIC, clinicians can integrate their perspectives with those of patients. The principal concepts

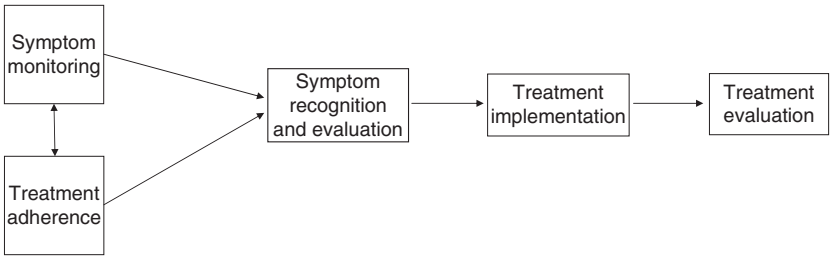

Figure 1 The situation-specific theory of heart failure self-care showing the relationship between Self-care Maintenance and Self-care Management.

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of the TCIC include the trajectory, that is the illness course, the trajectory projection reflecting the goals of care, the trajectory schema or the regimen for reaching the goals of care, the trajectory management specifying how the regimen is carried out, the conditions influencing management that are the personal, interpersonal, and social contexts that influence the regimen and the trajectory phasing, which is the ups and downs of the clinical outcomes. Although this theory can be considered a valuable tool to understand the illness trajectory, it is not specific to HF self-care.

Bennett *et al.* (2001) developed the Beliefs about Medication Compliance Scale (BMCS) and the Beliefs about Dietary Compliance Scale (BDCS) for patients with HF. Both instruments were based on the Health Belief Model (HBM) that attempts to explain and predict health behaviours using a focus on the individual's attitudes and beliefs. From the HBM, these authors took only the concepts of perceived benefits and barriers, which were applied only to perceptions about water pills and the low-salt diet and not to other self-care activities. In addition, the authors did not elaborate a mechanism to explain how self-care works in HF.

From the HBM, Connelly (Connelly 1987, 1993) developed the Model of Self-Care in Chronic Illness (MSCCI) that was modified and tested in people with HF (Rockwell & Riegel 2001). The authors of this study conceptualized that general and therapeutic self-care behaviours are influenced by predisposing variables (self-concept, health motivations, and patient perceptions) and enabling variables (patient characteristics, psychological status, regimen features, cue to action, social support, and system characteristics). Study results showed that only educational level and the severity of symptoms explained HF self-care. Although the concepts of self-care maintenance and self-care management were described in this article and the investigators identified variables influencing self-care, they did not explain the process of self-care *per se* or how self-care maintenance related to self-care management.

Moser and Watkins (2008) described five factors affecting decision making and subsequently self-care maintenance and self-care management in HF patients in a life course model. The five factors were health literacy, psychological status, symptom status, ageing status, prior experiences with symptoms, and the healthcare system. Although this work gave an important overview of the factors affecting decision-making and self-care in HF, the manner where the variables relate to each other was not considered.

In early work, Riegel *et al.* (2000) described a process of self-management of HF that later developed into the situation-specific theory of HF self-care (Riegel & Dickson 2008). According to the situation-specific theory, self-care is a naturalistic decision-making process that includes self-care maintenance and self-care management (Figure 1). Self-care maintenance refers to symptom monitoring (checking weight and ankle for swelling) and treatment adherence (e.g. low salt diet, keeping health provider appointment, exercising) that reflect behaviours used to maintain physiological stability. Self-care maintenance, considered the base of self-care, influences self-care management. Self-care management is a complex process that requires HF patients to act when symptoms of exacerbation occur, particularly ankle swelling and breathing problems. Self-care management has been described as being composed of symptom recognition, symptom evaluation, treatment implementation and treatment evaluation. These actions have been theorized as occurring in sequence, so symptom recognition influences treatment implementation and treatment implementation influences treatment evaluation. According to Riegel, the self-care process is influenced by confidence in one's ability to perform self-care. As the situation-specific theory of HF self-care is most highly developed and an instrument exists with which to measure the various components of the process, we used structural equation modelling (SEM) to improve our understanding of the process of HF self-care and of the relationships among the theoretical concepts.

The study

Aim

The aim of this study was to test the situation-specific theory of HF self-care with SEM. Such testing would improve knowledge of the process of HF self-care and of the relationships among the theoretical concepts of treatment adherence, symptom monitoring, symptom recognition and evaluation, treatment implementation and treatment evaluation.

Research hypothesis

The overarching hypothesis was that the model would fit the data, but the following specific hypotheses derived from the situation-specific theory of HF self-care (Figure 1) were tested as well:

- Symptom monitoring correlates with treatment adherence.
- Symptom monitoring and treatment adherence have direct, positive relationships with symptom recognition and evaluation.
- Symptom recognition and evaluation have direct, positive relationships with treatment implementation.

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- Treatment implementation has a direct, positive relationship with treatment evaluation.

Design

A secondary analysis of data from a cross sectional study was used.

Participants

A convenience sample of 659 participants was enrolled. From these 659, 417 patients with data on self-care maintenance and self-care management were included. Subjects excluded at this point were typically missing data on self-care management because this scale can be measured only in symptomatic patients. All participants were at least 18 years of age and had a confirmed diagnosis of HF. The confirmed diagnosis of HF was established using the diagnostic criteria specified by the European Society of Cardiology guidelines (Dickstein 2008), reconfirmed in 2012 (McMurray *et al.* 2012). In addition, patients without a coronary event in the last three months were selected based on the rationale that soon after a coronary event patients might find it difficult to perform physical exercise (a component of self-care). Patients were recruited from 21 cardiovascular ambulatory clinics or day hospitals across Italy.

Data collection

Instruments

The following instruments were used to collect the data.

The sociodemographic questionnaire. This survey was designed by the research team, even though most items have been used repeatedly in other studies (Riegel *et al.* 2010a, Vellone *et al.* 2012b) to collect age, gender, marital status, job, educational level, New York Heart Association (NYHA) class, ejection fraction, and time since diagnosis. Functional class measured with the New York Heart Association (NYHA) scale, ejection fraction, and time since diagnosis were abstracted from the patient's clinical record.

The Self-care of Heart Failure Index version 6·2 (SCHFI v.6·2) (Riegel *et al.* 2009). It is a widely used measure of HF self-care. The instrument is composed of three scales: (i) the self-care maintenance scale (ten items) measures symptom monitoring (two items), and treatment adherence (eight items); (ii) the self-care management scale (six items) measures HF patients' actions and responses when symptoms occur and specifically symptom recognition and evaluation (one item), treatment implementation (four items), and treatment evaluation (one item); (iii) the self-care confidence scale (six items) evaluates confidence in each of the self-care processes, but this scale was not used in the analysis since self-care confidence is not a component of self-care but instead a factor that influences self-care (Riegel *et al.* 2009). The 22 item SCHFI v.6·2 uses a 4-point self-report scale from Never or Rarely to Always or Daily. Three separate scores can be computed from this index, all of which have a possible range of 0–100, the higher the score the better the self-care.

For the purposes of this study, the individual items were aggregated conceptually as shown in Table 1 to obtain conceptual measures that could be used to model the theoretical structure of the situation-specific theory. Each of these

Table 1 Conceptual aggregations of the SCHFI v.6·2 items

Conceptual components	Definitions	SCHFI v.6·2 item contents
Symptom monitoring	Actions patients engage in to monitor HF symptoms and to prevent HF exacerbation	Daily weighing Ankle checking for swelling
Treatment adherence	Actions patients engage in to follow the HF treatment plan and to live a healthy life	Following low-salt diet Taking medication as prescribed Attending health care provider Doing physical activities Using systems to remind to take medicine
Symptom recognition and evaluation	Recognition and evaluation of changes in health status related to HF	Time for recognition ankle swelling and problem breathing as HF symptoms
Treatment implementation	Decision to take action and implement treatments in case of HF symptoms	Likelihood patients do the following actions in case of ankle swelling or problem breathing: -reducing salt in diet; -drink less water; -taking an extra diuretic; -calling healthcare provider to ask for advice.
Treatment evaluation	Evaluation of the actions taken to treat HF symptoms	Being sure that implemented treatment helped of not helped the patient

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conceptual aggregates was standardized to a 0–100 point scale to be consistent with scoring of the original measure.

Procedure of data collection

Participants signed informed consent after the study was explained by research assistants, all of whom were registered nurses. Sometimes patients completed the instruments on their own but often the research assistants assisted in instrument completion. The same research assistants abstracted clinical records to obtain information, such as NYHA class, ejection fraction, and time since diagnosis. Data were collected during 2011.

Ethical consideration

The Institutional Review Board of each centre approved the study before data collection.

Data analysis

Descriptive statistics were used to describe the sociodemographic and clinical characteristics of the sample (mean, SD, ranges, median, and interquartile ranges) and were used to analyse the component scores. The relationships among the theory components were analysed by Pearson's r. Then the hypothesized model (Figure 1) was tested using SEM. We used SEM because it is particularly well-suited for simultaneously investigating the nomological network among the different constructs specified in the model. In this network, the first series of paths corresponds to the posited relationship between symptom monitoring and treatment adherence as independent variables and symptom recognition and evaluation as the dependent variable. A second series of paths corresponds to the posited relationship between symptom recognition and evaluation as an independent variable and treatment implementation as the dependent variable. Finally, a third series of paths corresponds to the posited relationship between treatment implementation as independent variable and treatment evaluation as the dependent variable (Figure 1). This statistically powerful approach allowed us to investigate the mediating role of symptom recognition and evaluation and treatment implementation, which simultaneously act as both dependent and independent variables.

Using a multifaceted approach to the assessment of the model fit (Tanaka 1993), taking into account the recommendations of Hu and Bentler (Hu & Bentler 1998, 1999), the following fit indices were considered: (i) chi square, (ii) Comparative Fit Index (CFI; (Bentler 1990)), (iii) Root Mean Square Error of Approximation (RMSEA; (Steiger 1990)), and (iv) Standardized Root Mean Square Residual (SRMR; (Jöreskog & Sörbom 1993)). Overall model fit was judged using these cut-off values: CFI $\geq$ 0·95 (Hu & Bentler 1999), RMSEA up to 0·05 and in the lower bound of the 90% CI (Browne & Cudek 1993) and SRMR values below 0·08 (Hu & Bentler 1998, 1999) as indicating a good fit.

Power analyses for SEM models are complicated and often rest on assumptions that are impractical or not viable. We followed the practice recommended by Jaccard and Turrisi (Jaccard & Wan 1996) that provides a rough sense of statistical power by applying power analytic methods for ordinary least squares regression as applied to selected linear equations from the set of linear equations implied by the model in question. To determine an appropriate sample size, in fact, structural equation modeling requires that in addition to statistical power, issues of the stability of the covariance matrix and the use of asymptotic theory be taken into account. In terms of power, it is difficult to evaluate the power associated with specific path coefficients in complex SEM models because of the large number of assumptions about population parameters that must be made. A rough approximation of power can be obtained by using a limited information approach with single indicators of the path models implied by Figure 1. This permits the use of traditional power analysis software to gain a sense of sample size demands (Jaccard & Wan 1996). For a multiple regression analysis with four predictors where the squared multiple correlation is 0·30 and where one wants to detect a predictor that accounts for at least 5% unique variance in the outcome, the required sample size to achieve power of 0·80 is approximately 115. Moreover, Barret (Barret 2007) suggested the use of the rule of a minimum of 200 subjects, since power analysis is too complex in SEM. Overall our sample size of 417 is more than adequate for detecting the effects. The Statistical Package for Social Science 19 and the Mplus 6·12 were the two software programs used to analyse the data.

Validity and reliability

The SCHFI v.6·2 has recently been retested for its psychometric properties both in American and Italian samples (Vellone *et al.* 2012a) and shown to have adequate validity and reliability. Before its use the Italian SCHFI v.6·2 underwent back-translation procedures to assure the equivalence between the English and the Italian version. Specifically, the SCHFI v.6·2 was translated from English into Italian by two Italian nurses with expertise in English medical terminology. Then, the translated version was back translated into English by a bilingual English teacher and this version was reviewed by the scale developer to check the accuracy of the translation. Some minor revisions were required to guarantee the

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same meaning of each item. Construct validity of the SCHFI v.6·2 Italian version showed the following fit indices: χ^2 (28,330) = 39·23; P = 0·08; CFI = 0·97; NNFI = 0·95; RMSEA = 0·035 for the self-care maintenance scale, χ^2 (8,359) = 12·35; P = 0·14; CFI = 0·99; NNFI = 0·98; RMSEA = 0·040 for the self-care management scale, χ^2 (8,330) = 9·69; P = 0·28; CFI = 0·99; NNFI = 0·99; RMSEA = 0·025; SRMR = 0·030 for the self-care confidence scale. Internal consistency reliability tested by the factor score determinacy coefficient was between 0·77–0·91 for the three scales.

Results

Participant characteristics

The sample of 417 participants enrolled in the study were mostly older (59% over 72 years) and male (Table 2). The level of education was quite low in the sample, with almost three quarters educated at an elementary or middle school level. Half of the participants were married and 84·4% were unemployed or retired. All of the NYHA classes were represented in the sample with most individuals in classes II and III. The mean ejection fraction was 42% and the median illness duration was 4 years.

Table 2 Sociodemographic and clinical characteristics of the sample (N = 417)

Variables	N (%)
Gender	
Male	241 (57·8)
Female	176 (42·2)
Age (Mean–SD)	72·3 (12·2)
Education	
Elementary	208 (49·9)
Middle School	101 (24·2)
Professional School	30 (7·2)
High School	46 (11·0)
University Degree	42 (7·7)
Marital Status	
Married	223 (53·5)
Single	38 (9·1)
Widowed	127 (30·5)
Divorced	29 (7·0)
Profession	
Employed	65 (15·6)
Unemployed or retired	352 (84·4)
NYHA Class	
I	48 (11·5)
II	144 (34·5)
III	167 (40·0)
IV	58 (13·9)
Ejection Fraction (%) (Mean–SD)	41·8 (14·0)
Years Since Diagnosis (Median–Interquatile ranges)	4·0 (2–6)

NYHA, New York Heart Association.

Model component scores of the situation-specific theory of HF self-care

Table 3 reports the model component scores. Symptom monitoring and treatment implementation had the lowest score while treatment adherence, symptom recognition and evaluation, and treatment evaluation had higher scores. However, all scores were less than adequate judged at a cut-point of 70 of the maximum of 100 (Riegel *et al.* 2009).

Correlations among the model components of the situation-specific theory of HF self-care

The correlation matrix illustrating the relationships among the components is shown in Table 4. All components were significantly intercorrelated, although none were so highly correlated as to suggest multicollinearity. Only the correlation between treatment adherence and treatment evaluation was not statistically significant.

Testing of the situation-specific theory of HF self-care

The model specified according to Figure 1 showed an unsatisfactory fit: $\chi^2(5)$ = 76·21, P < 0·01; CFI = 0·74; RMSEA = 0·185 (90% CI = 0·149–0·223); SRMR = 0·097. Inspection of the modification indices revealed two significant direct, positive relationships: symptom monitoring on treatment implementation and symptom recognition and evaluation on treatment evaluation. Furthermore, there was evidence of a significant correlation between treatment evaluation and symptom monitoring. The revised model with the three new parameters provided a good fit to the data as revealed by these fit indices: $\chi^2(2)$ = 7·65, P 0·02; CFI = 0·98; RMSEA = 0·08 (90% CI = 0·027–0·148),

Table 3 Model component scores of the situation-specific theory of HF self-care

Components	Mean (SD)	Ranges
Symptom monitoring	49·3 (26·0)	0–100
Treatment adherence	57·5 (17·2)	16·7–100
Symptom recognition and evaluation	56·0 (29·8)	0–100
Treatment implementation	48·6 (24·5)	0–100
Treatment evaluation	62·6 (24·7)	0–100

Components' score were standardized on a 0–100 where higher scores mean higher self-care.

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Table 4 Correlation Matrix of the model components of the situation-specific theory of HF self-care

Components	1	2	3	4	5
1. Symptom Monitoring	1				
2. Treatment Adherence	0·41**	1			
3. Symptom Recognition and Evaluation	0·34**	0·35**	1		
4. Treatment Implementation	0·38**	0·23**	0·23**	1	
5. Treatment Evaluation	0·25**	0·05	0·28**	0·47**	1

**$P < 0·01$.

SRMR = 0·023. As shown in Figure 2, results of this model confirmed that symptom monitoring correlates with treatment adherence (Hypothesis 1), that symptom monitoring and treatment adherence have a direct, positive relationship with symptom recognition and evaluation (Hypothesis 2), that symptom recognition and evaluation have a direct, positive relationship with treatment implementation (Hypothesis 3) and that treatment implementation has a direct, positive relationship with treatment evaluation (Hypothesis 4). In addition to the initial model, we found that symptom monitoring has a direct, positive relationship with treatment implementation and that symptom recognition and evaluation has a direct, positive relationship with treatment evaluation. Finally this model showed a positive correlation between symptom monitoring and treatment evaluation. This model explained 17% of the variance in symptom recognition and evaluation, 16% of treatment implementation, and 25% of treatment evaluation.

Discussion

To our knowledge, this is the first study using SEM to explore relationships among dimensions of the self-care maintenance and self-care management components of the situation-specific theory of HF self-care. Overall, using SEM we were able to confirm the situation-specific theory of HF self-care as proposed and added three additional paths to the theory.

As theorized, symptom monitoring and treatment adherence were correlated, confirming the coexistence of these two components of the self-care maintenance construct. At least in HF, symptom monitoring is a behaviour recommended for patients so that they recognize physiologic decompensation quickly. As symptom monitoring is a behaviour to which patients should adhere, it is not surprising that these two concepts would be significantly related.

Symptom monitoring and treatment adherence together had a direct, positive relationship with the symptom recognition and evaluation components of the model. Several studies have been conducted to identify variables influencing symptom recognition (Patel *et al.* 2007, Hedemalm *et al.* 2008, Jurgens *et al.* 2009, Riegel *et al.* 2010a, Dickson *et al.* 2011, Rushton *et al.* 2011). In various studies age, (Riegel *et al.* 2010a) physical symptom distress, lower anxiety, (Jurgens *et al.* 2009), and comorbidity, (Dickson *et al.* 2011, Rushton *et al.* 2011) all have been found to be associated with symptom recognition. The only study demonstrating that symptom monitoring and treatment adherence were associated with symptom recognition and evaluation was a study demonstrating that immigrants to Sweden were unaware of the connection of their symptoms with HF (Hedemalm *et al.* 2008), which led to delays in treatment implementation and help seeking behaviour (Patel *et al.* 2007).

Results of our study also showed that treatment implementation was influenced not only by symptom recognition and evaluation, as the theory states, but even more by symptom monitoring. This modification to the initial model sheds new light on patients' actions in response to symptoms (reducing salt in the diet, drinking less water,

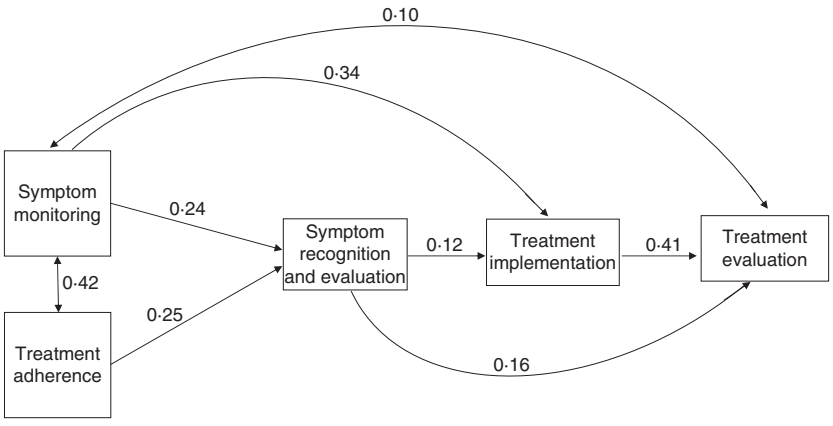

Figure 2 The situation-specific theory of heart failure self-care as tested by the SEM.

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What is already known about this topic

- Self-care of heart failure can improve patients' quality of life and reduce hospitalization, mortality, and emergency department visits.
- Several authors have proposed theories of heart failure self-care but only the situation-specific theory of heart failure self-care by Riegel and Dickson is focused on the process that patients use to perform self-care.
- Some individual propositions of the situation-specific theory of heart failure self-care have been tested statistically and supported but the full model has not been tested with structural equation modelling.

What this paper adds

- The structural equation model supports the situation-specific theory of heart failure self-care.
- Symptom monitoring correlates with treatment adherence; symptom monitoring and treatment adherence have a direct, positive relationship with symptom recognition and evaluation that in turn have a direct, positive relationship with treatment implementation; treatment implementation has a direct, positive relationship with treatment evaluation.
- Three new relationships have been identified that strengthen the situation-specific theory of heart failure self-care: (i) symptom monitoring has a direct, positive relationship with treatment implementation; (ii) symptom recognition and evaluation have direct, positive relationships with treatment evaluation; and (iii) symptom monitoring correlates with treatment evaluation. [Correction added on 9th April 2013, after first online publication: '. . .symptom monitoring correlates with treatment implementation.' has been corrected to read '. . .symptom monitoring correlates with treatment evaluation.']

Implications for practice and/or policy

- The situation-specific theory of heart failure self-care by Riegel and Dickson explains and predicts the relationships among symptom monitoring, treatment adherence, symptom recognition and evaluation, treatment implementation, and treatment evaluation.
- Symptom monitoring, treatment adherence, and symptom recognition and evaluation are the most important elements of the self-care process for clinicians to focus on improving if they hope to improve outcomes in heart failure patients.
- The situation-specific theory of heart failure self-care can guide clinical practice with heart failure patients.

taking an extra water pill, and contacting the provider for help) because not only symptom recognition and evaluation have a direct, positive relationship with treatment actions but also the monitoring of symptoms. Even though it is logical that treatment implementation follows an evaluation of symptoms, no studies have previously demonstrated this relationship in HF.

A moderate amount of the variance in treatment evaluation was explained by treatment implementation. That is, people with HF who were likely to implement a treatment when symptoms occurred were also better at evaluating them. And, differently from the theory, symptom monitoring had a direct, positive relationship with treatment implementation and not only with symptom recognition and evaluation. This relationship is reasonable because the evaluation of treatments is based on symptoms. Again, apart from the specific-situation theory of HF self-care, there are no prior studies demonstrating that treatment evaluation in HF is determined by treatment implementation and symptom recognition and evaluation.

In addition to demonstrating that symptom monitoring had a direct, positive relationship with treatment implementation, we also found that symptom monitoring correlated with treatment evaluation. That is, people good at monitoring their symptoms were also good in evaluating the treatments they tried. These behaviours are consistent with the description of the 'Expert' typology developed by Dickson and colleagues (Dickson *et al.* 2008). In this study, experts were proficient in self-care management, were able to link symptoms with the HF pathophysiology and knew that eating salty food and experiencing overexertion preceded fluid retention. Experts felt also a positive attitude towards self-care (Dickson *et al.* 2008).

Limitations

Even though participants were selected from several cardiovascular ambulatory clinics across Italy, this was a convenience sample of adults with HF. Another limitation is that participants were all symptomatic, that is all reported problems breathing or ankle swelling in the last month, so the study results apply only to HF patients who are symptomatic. Another limitation is that all participants were Italian and cultural characteristics are known to influence self-care (Chaudhry *et al.* 2011). So, the generalizability of the study results to other cultures should be done with caution. Undoubtedly, the cross-sectional nature of our data does not allow us to draw alternative causal relations among our variables, even though the posited model is strongly grounded in prior theory (Riegel & Dickson 2008).

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Future research

Testing the situation-specific theory of HF self-care in this manner can help to build a broader theory of HF self-care with additional predictors and outcomes. For example, since a relatively small amount of the variance in symptom recognition and evaluation was explained by symptom monitoring and treatment adherence, clearly other variables predict the rest of the variance. Investigators have already identified older age, symptom distress, lower anxiety, immigration, and comorbidity as predictors of symptom recognition (Patel *et al.* 2007, Hedemalm *et al.* 2008, Jurgens *et al.* 2009, Riegel *et al.* 2010a, Dickson *et al.* 2011, Rushton *et al.* 2011). The same can be said for treatment implementation and treatment evaluation.

Further studies should be conducted with self-care confidence since the moderator and the mediator role of this variable is still uncertain. Even though we know that self-care confidence moderates the relationship between self-care and HF costs (Lee *et al.* 2007) and self-care confidence mediates the relationship between social support and self-care (Salyer *et al.* 2012) the role of self-care confidence in HF patients is still understudied. Future studies might also explore the effect of cognitive impairment on the various components of the self-care process since it has been shown that cognitive impairment affects self-care management (Lee *et al.* 2012). Finally, since our data were cross-sectional, future longitudinal and experimental studies would strengthen the tested model.

Conclusion

Results of this study give more strength to the situation-specific theory of HF self-care in predicting HF patients' behaviours for guiding clinical practice. Using these results, healthcare providers have a 'picture' of how self-care works for patients. As theorized by Riegel and Dickson (2008) self-care in HF is a process of subsequent phases and these phases, some newly identified in this study, have been found to be statistically related. From a clinical perspective this study emphasizes how important it is to educate patients to monitor HF symptoms (e.g. checking the body weight and ankles for swelling every day) and to adhere to HF treatments (e.g. taking medications regularly, attending healthcare provider visits, exercising, reducing salt in the diet) since these two components influence the subsequent phases of the self-care process. Helping patients to build skill in symptom monitoring could improve the recognition and evaluation of HF symptoms, (e.g. problems breathing and ankle swelling) as already stated in the theory, but also increase the probability of treatment implementation when symptoms occur. The importance of symptom monitoring (weight monitoring) in preventing emergency department visits and hospitalization was demonstrated in a recent study (Jones *et al.* 2012). Education in symptom monitoring could also improve patients' abilities to evaluate the effectiveness of treatment, providing security that the implemented treatment was effective.

In conclusion, it appears from our analysis that it is essential for patients to adhere to treatments, monitor the symptoms of HF, and recognize changes quickly if they are to be successful in self-care. In fact, these three self-care components directly and indirectly influence the rest of the self-care process. Nevertheless, it is a challenge for patients to constantly adhere to HF treatments; a recent study showed that only 9·1% of HF patients adhere with every recommended self-care behaviour (Marti *et al.* 2012). Symptom recognition is also a challenge for elderly people and for those with high comorbidity (Riegel *et al.* 2010b, Lam & Smeltzer 2012). However, both treatment adherence and symptom recognition have been identified as key components to improve patients' outcomes, so renewed efforts are needed in these specific areas (Lam & Smeltzer 2012, Wu *et al.* 2012).

Overall, the components of self-care and their relationships as described by the situation-specific theory of HF self-care and as tested in this study provide researchers and clinicians with a framework for developing further knowledge about HF self-care and for predicting and improving HF patients' outcomes.

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Conflict of interest

No conflict of interest has been declared by the authors.

Author contributions

All authors have agreed on the final version and meet at least one of the following criteria (recommended by the ICMJE*):

- Substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data.
- Drafting the article or revising it critically for important intellectual content.

*http://www.icmje.org/ethical_1author.html

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