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A Model Predicting the Health Status of Patients with Heart Failure

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A Model Predicting the Health Status of Patients with Heart Failure

Abstract

Objective: To test the causal relationships among the components of sociodemographics,illnesscharacteristics, and selfmanagement ability, and health status in the model of health status of patients with heart failure (HSHF).

Design: Descriptive cross-sectional study

Materials and methods: Four hundred heart failure patients, either hospitalized or attending out-patient clinics at six hospitals in southern Thailand, were interviewed. Questionnaires covered sociodemographics, the duration of illness, severity of illness, comorbid diseases, measured by the New York Heart Association Functional Classification (NYHA-FC) using the Charlson Comorbidity Index, self-management ability, using the Self-Care of Heart Failure Index (SCHFI), and health status using the Short Form-36 Health Survey (SF-36). The relationships among the study variables were tested and modified under the structural equation modeling (SEM) technique by using LISREL.

Results: The collected data were found not to fit with the initial hypothesized model but after modification the new derived model gave an adequate fit with the data and accounted for 64% of the variance in health status. Age had a direct negative effect on health status (β=-0.20, $p < 0.01$) and had an indirect negative effect on health status through self-management ability, severity of illness and comorbid disease (β=-0.13, $p < 0.01$). Education had a direct positive effect on health status (β=0.12, $p < 0.01$). Gender and income had indirect negative effects on health status through severity of illness (β=-0.05; -0.05, $p < 0.05$). Duration of illness had an indirect positive effect on health status through self-management ability (β=0.09, $p < 0.05$). Severity of illness and comorbid disease had a direct negative effect on health status (β=-0.31; -0.16, $p < 0.01$, respectively) and indirect negative effect on health status through self-management ability (β=-0.06; -0.05, $p < 0.05$, respectively). Selfmanagement ability had a direct positive effect on health status (β=0.38, $p < 0.01$).

Conclusions: The final model provides a guideline for explaining and predicting the health status of patients with heart failure. To improve health status continuity care programs promoting self management ability should be developed and imple-mented both in hospital-based and home-based settings.

Keywords
heart failure, self-management, self-care, health status

Disciplines
Cardiology | Cardiovascular Diseases | Circulatory and Respiratory Physiology | Health Services Research | Medical Humanities | Medicine and Health Sciences | Nursing

A model predicting the health status of patients with heart failure

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Abstract:

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Design: *Descriptive cross-sectional study*

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บทคัดย่อ:

วัตถุประสงค์: *เพื่อทดสอบความสัมพันธ์เชิงเหตุผลระหว่างองค์ประกอบด้านลักษณะส่วนบุคคล (เพศ อายุ ระดับการศึกษา และรายได้) ลักษณะความเจ็บป่วย (ระยะเวลาการเจ็บป่วย ระดับความรุนแรงของการเจ็บป่วย และโรคร่วม) ความสามารถในการจัดการสุขภาพตนเอง กับภาวะสุขภาพ ในโมเดลภาวะสุขภาพของผู้ป่วยหัวใจล้มเหลว*

แบบวิจัย: *วิจัยเชิงบรรยายแบบภาคตัดขวาง*

วัสดุและวิธีการ: *กลุ่มตัวอย่างจำนวน 400 ราย เป็นผู้ป่วยที่ได้รับการวินิจฉัยว่ามีภาวะหัวใจล้มเหลวขณะเข้ารักษาตัวในโรงพยาบาล หรือผู้ป่วยที่มารักษาแบบผู้ป่วยนอกในโรงพยาบาลภาคใต้ 6 แห่ง เก็บรวบรวมข้อมูลครั้งเดียวโดยใช้แบบสอบถามลักษณะส่วนบุคคล ระยะเวลาการเจ็บป่วย แบบประเมินสมรรถนะในการทำกิจกรรมการใช้แรงตามการจำแนกของสมาคมโรคหัวใจแห่งนิวยอร์ก บันทึก โรคร่วมของ Charlson แบบสัมภาษณ์การดูแลตนเองของผู้ป่วยหัวใจล้มเหลว และแบบสัมภาษณ์ภาวะสุขภาพฉบับย่อ วิเคราะห์ข้อมูล เพื่อทดสอบและปรับโมเดลที่สร้างขึ้นด้วยวิธีการวิเคราะห์สมการเชิงเส้นโดยใช้โปรแกรม LISREL*

ผลการวิจัย: *โมเดลที่ปรับแล้วสามารถทำนายภาวะสุขภาพของผู้ป่วยหัวใจล้มเหลวได้สอดคล้องข้อมูลเชิงประจักษ์ ชุดของตัวแปร ในโมเดลร่วมกันทำนายภาวะสุขภาพได้ร้อยละ 64 ปัจจัยด้าน อายุ มีอิทธิพลโดยตรงทางลบ (β=-0.20, p<0.01) และอิทธิพล โดยอ้อมทางลบต่อการคงภาวะสุขภาพผ่านความสามารถในการจัดการสุขภาพตนเอง ความรุนแรงของการเจ็บป่วยและโรคร่วม (β= -.13, p<0.01) การศึกษา มีอิทธิพลโดยตรงทางบวกต่อภาวะสุขภาพ (β=0.15, p<0.01) เพศและรายได้ มีอิทธิพลโดยอ้อม ทางลบต่อภาวะสุขภาพผ่านระดับความรุนแรงของการเจ็บป่วย (β=-0.05; -0.05, p<0.05) ระยะเวลาการเจ็บป่วยมีอิทธิพล โดยอ้อมทางบวกต่อการภาวะสุขภาพผ่านความสามารถในการจัดการสุขภาพตนเอง (β=0.09, p<0.05) ระดับความรุนแรงของ การเจ็บป่วยและโรคร่วมมีอิทธิพลโดยตรง ทางลบ (β=-0.31; -0.16, p<0.01, ตามลำดับ) และอิทธิพลโดยอ้อมทางลบต่อ ภาวะสุขภาพผ่านความสามารถในการจัดการสุขภาพตนเอง (β=-0.06; -0.05, p<0.05, ตามลำดับ) และความสามารถในการจัดการ สุขภาพตนเองมีอิทธิพลโดยตรงทางบวกต่อภาวะสุขภาพ (β = 0.38, p<0.01) ของผู้ป่วยหัวใจล้มเหลว*

สรุป: โมเดลที่พัฒนาขึ้นให้แนวทางในการอธิบาย และทำนายภาวะสุขภาพของผู้ป่วยหัวใจล้มเหลว ในการการจัดการบำบัดเพื่อคงภาวะสุขภาพของผู้ป่วยหัวใจล้มเหลวจะต้องเน้นให้ผู้ป่วยมีส่วนร่วมในการจัดการสุขภาพตนเองอย่างต่อเนื่องทั้งในระยะเข้ารับการรักษาในโรงพยาบาลและที่บ้าน

คำสำคัญ: หัวใจล้มเหลว, การจัดการสุขภาพตนเอง, การดูแลตนเอง, ภาวะสุขภาพ

Introduction

Heart failure is a significant global health problem because of its effect on the decline in an individual's health status and the increased demands made on health care resources.[1] The number of hospital discharges associated with heart failure in Thailand have been increasing; in 1993, there were approximately 58.5 per 100,000 patients dying of cardiac dysfunction, which had increased to 72.1 per 100,000 cases as of 1997,[2] with the further rise in 1998 to 162 per 100,000 deaths from heart failure.[3] The long-term prognosis associated with heart failure is grim; statistics currently show that approximately 1 in 4 patients die within the first year and 2 in 3 patients die within the five year period following the diagnosis of heart failure with the three month and one year survival rates among newly diagnosed cases of heart failure were 75% and 65%, respectively.[4] Additionally, heart failure is responsible for considerable functional disability and health decline, even in those with mild to moderate symptoms.

An inability of the heart to maintain a cardiac output sufficient to meet the metabolic and oxygen demands of peripheral tissues disrupts daily living and limits energy. Inadequate cardiac output is responsible for considerable functional disability even in people with mild to moderate heart failure, especially those with a reduced left ventricular ejection fraction[5] where these patients commonly live with poor physical energy.[6] Similar to those with chronic health problems, heart failure patients live with an unpredictable course of illness, face unpleasant symptoms, and, are inhibited by functional limitation even though they may feel eager to engage in normal life activities. Many adverse health outcomes have been reported as a consequence of heart failure; symptoms include a rapid decline in health status, a decrease in health-related quality of life, a decline in physical functioning, poor psychosocial wellness, negative mood or affect, and limitations in daily life.[7-8] This study intended to clarify an understanding of health status in patients living with heart failure by providing empirical data linking the concepts in a model of health status for heart failure patients (HSHF).

Patients with heart failure exhibit many symptoms that are related to over expression of neurohormonal dysfunction and its associated hemodynamic effects.[6] Common and bothersome symptoms include lack of energy, fatigue, shortness of breath, swelling, and difficulty breathing while sleeping supine.[9] Patients with heart failure experience an average of three to 13 symptoms.[9-10] In one study, more than 90% of the 139 patients observed had multiple symptoms; 15% had every symptom under investigation.[9] Low energy reserves may induce dyspnea while performing physical activity in which case patients then restrict their activity level, resulting in a lack of appropriate energy expenditure and consequently fatigue. A number of studies have found that heart failure patients with inappropriate energy resources may experience more intense symptoms and poor health outcomes. Patients with lower energy resources have more difficulty in achieving maximum health status,[8] frequently fail to return to normal life activities, and delay returning to daily work and social activities.[11] However, the debilitating effects of these cycles may be minimized by self-management.

Maintaining health throughout an episode of illness arising from heart failure is a central focus of clinical therapeutics that aims to improve self-management ability and maximize health status. Self-management ability is an essential component in controlling heart failure-related symptom and in improving health status of patients with heart failure as

suggested by the European Society of Cardiology (ESC)'s guideline.[12] Factors contributing to self-management ability and health status of patients with heart failure need further investigation to provide evidence for the development of clinical therapeutics. Prior studies have examined those factors contributing to health status but the data were fragmentary and isolated. None of the studies examined a full model of causal relationships among sociodemographics, illness characteristics, and self-management ability on health status. In this study, several factors predicting health status were selected based on theoretical knowledge and prior research evidence. Sociodemographics referred to age, gender, education, and income. Illness characteristics included severity of illness, duration of illness, and comorbid disease.

Self-management ability was conceptualized as mediating the effect of sociodemographics and illness characteristics on health status.

Objective

The general purpose of this study was to develop and test a model of health status of patients with heart failure (HSHF). Specifically, the aims were to examine: 1) the fit of the initial HSHF model with the data, 2) the direct effects of sociodemographics and illness characteristics on self-management ability, 3) the direct effects of sociodemographics, illness characteristics, and self-management ability on health status, and 4) the mediating effects of self-management ability on the relationships between sociodemographics as well as illness characteristics on health status.
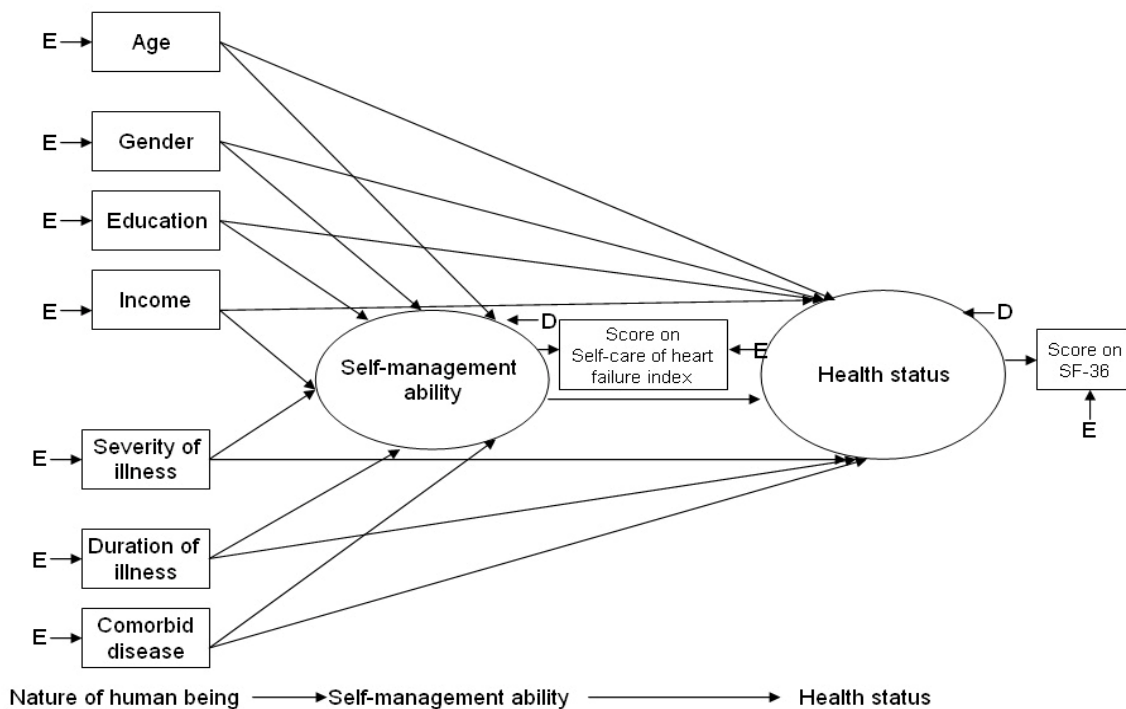
Note: D = disturbances, unexplained variances not included in the model, E = errors

Figure 1 An initial model of health status of patients with heart failure (HSHF)

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Conceptual framework

An initial theoretical model of health status of patients with heart failure (HSHF) (Figure 1) guiding this study was synthesized from the model of symptom management[13] and self-care for heart failure.[14] Three components of the HSHF model included the nature of human being (sociodemographics and illness characteristics), self-management ability, and health status. The nature of human beings, a factor affecting self-management ability and health status, refers to sociodemographic and illness characteristics.[13]

Self-management is a primary strategy used by a patient to manage their health, illness, and unpleasant symptoms.[13] Self-management is defined as *"a process of maintaining health status through treatment adherence, symptom monitoring and management, and confidence in self-management."* Key self-care maintenance behavior includes adherence to a complex medication regimen, dietary restrictions, daily weight monitoring, physical activity, and monitoring of symptom severity.[14] Self-care management is essential for the control of what may be the precarious balance between relative health and symptomatic heart failure.[14] An underlying assumption of the self-care of heart failure model is that if people with heart failure are to be successful at self-care, they must embrace health behavior that helps them to stay physiologically stable (self-care maintenance: SCMT) and make good decisions about symptoms when they occur (self-care management: SCMN). As self-care maintenance and management improve, self-care self confidence (SCSC) in the ability to exert control over the symptoms and the treatment regimen builds.

Health status is conceptualized as the consequence of self-management ability, as influenced by sociodemographic and illness characteristics.[13] The term "health status" was used to capture physio-psycho-socio-emotional dimensions, functional status, and health-related quality of life.[15] Health is consistently included as an important aspect of quality of life. Consequently, health-related quality of life measures have been developed to assess aspects of an individual's subjective experience that relate both directly and indirectly to health, disease, disability, and impairment.[16]

Materials and methods

Sample

The accessible population was Thai heart failure patients. The size of this population is currently unknown and the target population was patients diagnosed with heart failure at least four weeks prior to the date of data collection. Following already published guidelines, the diagnosis of heart failure was based on the clinical signs and symptoms, left ventricular ejection fraction (LVEF), or both.[12] The inclusion criteria having experienced heart failure and performed self-management during the past four weeks, being 18 years of age or older; and being able to comprehend the Thai language. Patients who had cognitive impairment were excluded. The sample size was calculated using the variance of health status as determined from a pilot study of 30 patients (SD=14.46) and with the significance level of 0.05 and a power of 0.80. A minimum of 383 subjects were needed but this number was simply rounded up to 400. Initially we approached 410 potential subjects. However, eight subjects were not able to complete all the questions because of time constraints and data from a further two subjects were discarded because of significant missing data resulting in only data from 400 subjects being used for analysis. The size of sample in this study was considered large and adequate to detect the small to medium effect size.[17]

Measures

Sociodemographics and duration of illness were measured using the Personal Information Questionnaire to directly ask the patients and/or recorded from medical and nursing records. Duration of illness was measured in months.

Severity of illness was measured using the widely used clinical measure of New York Heart Association (NYHA) functional classes.[6] Patients were interviewed regarding their symptoms, which were then assigned by the primary investigator or research assistants to one of four functional classes depending on the degree of effort needed to elicit the symptoms: at rest (class IV); on less-than-ordinary exertion (class III); on ordinary exertion (class II); or only at levels that would limit normal individuals (class I). The widely used

comorbidity index was used for comorbid diseases and was assessed through the use of the interview format of the 17-item Charlson Comorbidity Index (CCI).[18] In this study, heart failure was the principal diagnosis, therefore, it was dropped from the list. Hypertension was added since it has been recognized as the major comorbidity associated with heart failure.[6] The possible total score ranged from 0 to 30 with a high score on the CCI indicating a higher comorbid disease. A high predictive validity for the NYHA-FC[6] and the CCI on one-year disability and mortality have been reported.[16, 19] In this study, the inter-rater reliability of these two measures tested among the three investigators was found to be 0.98.

Self-management ability was measured using a 15-item Self-Care of Heart Failure Index (SCHFI).[14] There are three components of SCHFI: 1) self-care maintenance (SCMT), measures a level of achievement in adherence to self-care regimens, 2) self-care management (SCMN), measures a level of achievement in the management of symptom, and 3) self-care self confidence (SCSC), measures a level of self-care confidence. The Thai version used in this study was translated from English by the first author and the translation was confirmed by a panel of experts. A set of four alternative responses followed each item. Items in SCMT and SCMN contain the best answer on a graded forced-choice 4-point (13 items, range of score 1 to 4) and 5-point (2 items, ranged of score 0 to 4). The response scale allows an assessment of progress, with higher numbers indicating better self-management ability. As the number of items in each scale is not equal, responses in SCMT, SCMN, and SCSC are each transformed to 100 points. Reliability of the aggregate SCHFI, Thai version in this sample of 400 was 0.85. Cronbach's alpha coefficients were 0.63, 0.69, and 0.91 for the subscale SCMT, SCMN, and SCSC, respectively.

Health status was measured using the gold standard: the Short Form-36 Health Survey (SF-36).[20] The translation and validation of the Thai version was also conducted in a similar manner to the SCHFI. The SF-36 is a multi-purpose, short-form health survey containing 36 items that are aggregated into eight scales of 2-10 items each. The subscales reflect physical functioning; role limitations due to physical health; bodily pain; general health perceptions; vitality; social functioning; role limitations due to emotional problems; and general mental health. The score for each scale was computed by summing scores and transforming them onto a 0-100 scale.[20] The total SF-36 score can range from 0 to 800 with the higher scores indicating better health status. The reliability of the SF-36, Thai version for the 400 patients was 0.94, and for the eight subscales Cronbach's alpha coefficient ranged from 0.70 to 0.93.

Procedures

Data were collected only after approval was obtained from the board of ethical review and/or the directors of the six target hospitals. Patients who met the criteria were approached individually and informed about the study and the time required for participation. All of the subjects were assured of their confidentiality and the freedom to withdraw from the study at any time. After permission was granted, the participants were asked to respond to a package of instruments before or after either seeing the physician or at a mutually convenient time and place. Approximately 30-45 minutes were needed to complete the survey.

Data analysis

The SPSS for Windows software package, Version 11, was used for both data processing and preliminary analysis. Single-item variables included age, educational level, family income, the CCI, duration of illness, and NYHA-FC were coded as the raw data. Dummy code was used with gender (male = 1, female = 0). All the assumptions of multivariate analyses were assessed and met, including normality, homoscedasticity, linearity, and mulitcollinearity. Zero-order correlations among predictor variables were r = -0.01 to 0.58 (Table 1), indicating there was no multicollinearity. The initial hypothesized model was tested under a structural equation modeling (SEM) technique through LISREL 8.53. Confirmatory Factor Analysis (CFA), first and second order, was conducted before testing the full model to evaluate the two measurement models for their model fit for both the self-management ability (SCHFI) and health status (SF-36). Calculations were made for the factor loading by examining the correlation between each indicator and its factor and the R^2

or the proportion of variance accounted for by a factor were calculated. The overall model fit of these measurement models was evaluated using the following criteria similar to an evaluation of the structural model fit.

Indicators of the overall fit of the model with the data used in this study were goodness-of fit index (GFI), the adjusted goodness of fit index (AGFI), comparative fit index (CFI), normed fit index (NFI), and non-normed fit index (NNFI). Values above 0.90 are regarded as adequate and above 0.95 reflect good model fit.[21] The root mean square error of approximation (RMSEA) was used to determine the parsimonious fit of the model. A RMSEA value of less than 0.05 indicates a good fit with a value between 0.05 and 0.08 showing a moderate fit and values 0.08 to 0.10 indicate a mediocre or fair fit while values greater than 0.10 indicate a poor fit.[21] We did not expect any non-significant Chi-square (X^2) and normed Chi-square (X^2/df) results because of the large sample size used. The results of the overall model fit and diagram output were used to respecify the initial model together with its theoretical reasoning and produced a modified model that was used to explain the hypothesized relationships.

Results

The age range of the participants was 26 to 96 years old with a mean of approximately 64 and a half years. Fifty-two percent of the subjects were men. The education level ranged from 0 to 16 years of school with a mean of approximately five years. The overall household income was the national average for most subjects with a mean income of 7,440.50 Baht (SD=7,188.64). Looking at the illness; duration of illness ranged from 1 to 240 months with a mean of approximately 27 months (SD=33.99) and severity on the NYHA functional class ranged from 1-4 with a mean value of 2.82 (SD=0.93), indicating that the patients were functionally compromised. The comorbid disease score ranged from 0 to 10 with a mean value of 3.16 (SD=1.74), suggesting only relatively low comorbid diseases. Standardized scores on the total SCHFI ranged from 66.67 to 295 with a mean score of 145.72 (SD=43.30), indicating a low self-management ability. The mean score on the SF-36 total scale was 383.35±169.77 (range 40-790 of 800), indicating a moderate level of health status.

Table 1 Correlations among sociodemographics, illness characteristics, self-management ability, and health status (N=400)

Variable	GEN	AGE	EDU	INC	DOI	SOI	COD	SMA	HS
Sociodemographics									
Gender	1								
Age	−0.01	1							
Education	0.21**	−0.40***	1						
Income	0.11*	−0.03	0.41***	1					
Illness characteristics									
Duration of illness	−0.13*	0.02	0.01	−0.02	1				
Severity of illness	−0.17**	0.20**	−0.23**	−0.04	−0.02	1			
Comorbid disease	−0.01	0.19**	−0.05	0.02	−0.13*	0.58***	1		
Self-management ability	0.05	−0.20**	0.14*	0.15**	0.18**	−0.28**	−0.12*	1	
Health status	0.13*	−0.29**	0.09	0.23**	−0.02	−0.66***	−0.24**	0.32***	1

*p<0.05, **p<0.01, ***p<.001, One-tailed

Note: GEN = gender, AGE = age, EDU = education, INC = income, DOI = duration of illness, SOI = severity of illness, COD = comorbid disease, SMA = self-management ability, HS = health status
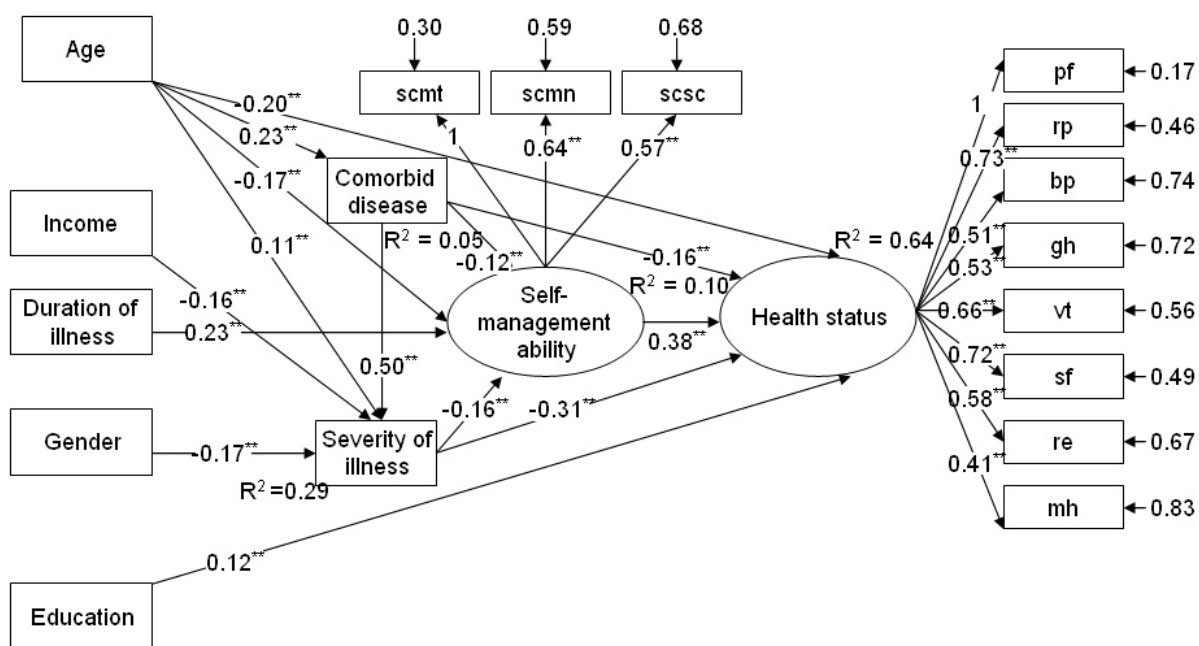
Note: Model fit indices: X^2 (104, n=400) = 184.12, *p*=0.00; X^2/df=1.77; GFI=0.94; AGFI=0.96; CFI=0.96; NFI=0.96; NNFI=0.97; RMSEA=0.05

**p<0.01

scmt = self-care maintenance, scmn = self-care management, scsc = self-care confidence, pf = physical functioning, rp = role-physical, bp = bodily pain, gh = general health, vt = vitality, sf = social functioning, re = role-emotional, mh = mental health

Figure 2 A final modified model of health status of patients with heart failure

The measurement models of self-management ability and health status tested under CFA revealed good to excellent factor loadings and the percentage of variance in each item was adequately accounted for by its latent construct. None of the fit indices were acceptable in the initial hypothesized model (structural model) resulting in a modified model based on both the statistical evidence and prior knowledge. The results from the initial model suggested that none of the variables significantly predicted the ability to self-manage and two other variables, gender and duration of illness, had no significant relationship with health status. The subsequent respecified model dropped non-significant paths, changed some structure of the model, and added new paths. Six non-significant paths were dropped from the model: gender; education; income and comorbid disease to self-management ability and gender; duration of illness to health status. Following a suggestion from existing research evidence[7-8] the 'severity of illness' and 'comorbid disease' were both respecified and categorized as "endogenous variables." Additionally, five path coefficients were added: age to severity of illness and comorbid disease; income to severity of illness; gender to severity of illness; and comorbid disease on severity of illness. The final modified model showed the best fit with the data (Figure 2) in which all the parameters in the model yielded a significant p-values and overall, the model accounted for 64% of the variance in health status.

The final model showed that age had a direct negative effect on health status (β=-0.20, p<0.01) and an indirect

negative effect on health status through self-management ability, severity of illness, and comorbid disease (β=-0.13, p<0.01). Education had a direct positive effect on health status (β=0.12, p<0.01). Gender and income had indirect negative effects on health status through severity of illness (β=-0.05; -0.05, p<0.05). Duration of illness had an indirect positive effect on health status through self-management ability (β=0.09, p<0.05). Severity of illness and comorbid disease had a direct negative effect on health status (β=-0.31; -0.16, p<0.01, respectively) and an indirect negative effect on health status through self-management ability (β=-0.06; -0.05, p<0.05, respectively). Self-management ability had a direct positive effect on health status (β=0.38, p<0.01).

Discussion

The findings of this study confirmed that self-management was affected by the sociodemographic and illness characteristics, as proposed in the model of symptom management[13] and health status was affected by these factors and by self-management ability.[13-14] The following discussion focuses on the predictors of self-management ability and health status, and also the mediating effect of self-management ability on the relationships between sociodemographic and illness characteristics and health status.

Predictors of self-management ability

The final HSHF model demonstrated that age, duration of illness, severity of illness, and comorbidity of illness had direct effects on self-management ability. Better self-management ability was found in patients who were younger, longer duration of illness, less severity of illness, and less comorbid disease.

The finding that patients with advanced age had less self-management ability is consistent with that of Krumholz and colleagues[22] who suggested that diminished self-management ability in the older age group might be a manifestation of other sociodemographic factors, physiological changes of the aging, or illness characteristics. Possibly, older patients may have less skill in accessing self-care information;[22] difficulty

transforming health care messages into daily self-management practices because of the nature of aging and illness[23] or need more time to learn and translate the new information into daily practice as a result of a reduction in cognitive function from age-related changes and the progression of heart failure.[6]

Patient who had had heart failure longest had the better self-management ability. This finding is consistent with that of both Carlson and his colleagues[24] and Francque-Frontiero's team.[25] It appears that patients with a history of heart failure had learned to manage their symptoms, health, and illness through their daily experiences. This experience may help them recognize symptoms of heart failure and other changes in their health. The recognition of signs and symptoms is the first step of self-management process and the foundation of self-care so patients who cannot recognize their symptoms cannot manage them.[24]

This HSHF model expands our knowledge about self-care that patients with less severe illness and fewer comorbid diseases have better self-management ability. More comorbid diseases also predicted a poorer functional class of heart failure and poor self-management ability. There is a possibility that more comorbid diseases might have triggered the amount and type of symptoms.[26] Clusters of heart failure-related symptoms may lead to high frequency and severity of symptoms and in fact this severity appears to have created the new and complex self-management regime required. It has been found the patients with higher levels of comorbid disease experienced symptoms frequently and apparently had difficulty controlling them.[27] Consequently, these conditions lead to the high rates of health care resource utilization for emergency visits and unplanned hospitalizations.

Predictors of health status

The HSHF model illustrates that age, education, severity of illness, comorbid diseases, and self-management ability all had a direct effect on health status with the older patients having more illness severity, more comorbid disease, and worse health status. These findings can be explained through the relationships among age, severity of illness, and comorbid disease. Age had a direct effect on severity of illness

and comorbid disease and had only a small indirect effect on health status through severity of illness and comorbid disease. Furthermore, severity of illness was strongly affected directly by comorbid diseases. The concurrence of age, severity of illness, and comorbid disease on the level of health as found in this study was consistent with the findings of others.[7-8, 26] This finding, however, is not surprising because it is evident that advanced age leads to the reduction in overall health status.[8]

The effects of prior education on health status might be better explained by its relationship with income. This model demonstrates that education directly affected health status, whereas income affected health status indirectly through severity of illness. Patients with higher education and higher income had a better state of health. Furthermore, we found that higher income and less severe illness resulted in a better state of health, since self-management ability failed to mediate the effect of education and income on health status, except illness severity. Access to health services might explain these findings. Patients with less education and income might receive less quality service.

We found that older women with low education together with low income were those who had more severe illnesses, more comorbid diseases, and a worse health status. These results are consistent with Krumholz and colleagues,[22] who found a gender and economic bias in the health care resources provided and also the quality of care and although women often had worse illness on presentation than men, they were less likely to receive advanced clinical investigations, standard medication regimen, and also the continuity of care needed during their rehabilitation periods.[27-28] These variations were also found to exist with those patients in health care insurance programs. Similar to a group of patients with heart failure enrolled in this study, none of the patients who had joined the national health care coverage policy, known as the "30 Baht for All Health Care Service" received coverage for a full cardiac care regimen. Extra payments are required for invasive cardiac assessment and further advanced treatment. Not all, but only those patients of a high economic status can afford full coverage.

The HSHF model has indicated that patients with greater severity of illness and more comorbid diseases had a poor health status. These findings suggested that health status was highly affected by the severity of illness. Comorbid disease influenced severity of illness and moderately affected health status through severity of illness. The association between higher NYHA class and poorer health outcomes in patients with heart failure is widely recognized.[29] Improved NYHA class has been shown to be an independent predictor of better health outcomes.[30] There are several explanations given for the adverse health outcomes seen in patients with more severe heart failure. First, the individual components of the NYHA class capture several important components of heart health, including symptoms, physical capacity, cardiorespiratory function, and heart failure pathology. Illness severity limits activities of daily living, work status, and physical, role and social performance.[29] Second, illness severity is a leading cause of hospitalization and is usually triggered by the symptom of dyspnea. The three to six-month readmission rate has been reported to be as high as 30% to 50% because of the exacerbation of symptoms.[31] Finally, patients with severe illness had more comorbid diseases, which could have led to an advanced progress of pathology, a rapid decline in cardiorespiratory function, decreased overall functional capacity, and poor health status.[6]

As expected, self-management ability had a positive effect on health status. Furthermore, we found that the effect of self-management ability on health status was above and beyond the effect of severity of illness and comorbid disease. These findings suggested that patients with higher ability in self-management might be able to reduce the severity of illness and comorbid disease.[32] Four major self-management regimens: low salt diet, appropriate physical activity, weight control, and influenza prevention are addressed in the self-care of heart failure theory. In this study, self-management ability was influenced by a patient's age, duration of illness, severity of illness, and comorbid disease as discussed above. The better health status was found in those with higher self-management ability and is consistent with the reported findings in several randomized controlled trials,[32-33] a systematic review,[34] and a

meta-analysis[35] all of which have concluded the importance of improved self-management ability on better health status. Confidence in self-management might motivate patients to adhere to their self-care regimens[26] and as a study by Ni and colleagues,[36] found heart failure patients who had more confidence in self-management adhered more to their self-care, engaged in physical activity, and followed a heart-healthy, low salt diet.

Mediating effects of self-management ability on the relationships between sociodemographic/illness characteristics and health status

The final HSHF model provides new knowledge of how self-management mediates the effect of sociodemo-graphics and illness characteristics on a person's health status. The model showed a magnitude of self-management ability in mediating the relationships between all three illness charac-teristics: duration of illness, severity of illness and comorbid disease, and health status. Since the model showed only a small mediating effect of self-management ability, it should be noted that this effect might be either the result of a large sample size or the true small effect of self-management ability. Age was the only variable that had an indirect effect on health status through self-management ability. Poor self-manage-ment in those who were older, with a shorter duration of illness, high severity of illness, and more comorbid diseases led to a poor health status but then again perhaps these older patients were misinterpreting their symptoms as another illness because of their relative inexperience with heart failure.

The mediating effect of self-management ability on the relationships between severity of illness, comorbid disease, and health status deserve attention. We found that better self-management was associated with better health status despite an advanced stage of heart failure severity. Possibly, patients with better self-management ability reduced the severity of their symptoms and controlled their others illness, 14 suffi-ciently to improve their health status.[6] As discussed previously, those patients with better self-management were seen to perform regular exercise; eat a low-salt diet; control their body weight; and take precautions against influenza resulting in a better health status.

The effects of old age on poor health status through self-management ability might be explained by the reduction in self-management decisions, perhaps because of their many comorbid diseases and heart failure severity. Patients could be learning self-management through their daily experiences. Once self-care maintenance and self-care management improved, they had an improvement in self-care confidence, which, in turn, built more confidence in self-care and improved their self-management skills,[14] resulting in better health status.[13-14]

Conclusion

A central finding of this study was that sociodemo-graphic characteristics suggest that specific patient groups, that is to say, women, the aged, low education, and low income, are predicted to have a poor health status. Those patients with a high severity of illness and more comorbid diseases had less self-management ability, which increased their overall burden from disease and predicted a poor health outcome. If patients at risk for a poor health status were identified at an early stage, then a specific self-management program could be offered to them. For example, simplifying the self-care message for older and for low literacy patients may be particularly beneficial. Screening should be made for certain comorbid diseases early and aggressively managed to reduce the severity of illness and improve health outcomes. In order to improve the patient outcomes, a comprehensive self-management program is needed for all heart failure patients during hospitalization and also after discharge home. Knowledge of heart failure, symptoms, and self-care strate-gies is an essential first step in improving self-management. Future testing of the HSHF model is recommended in order to increase our understanding of the influence of self-manage-ment on health outcomes and a longitudinal study is needed to confirm the causal relationships suggested in this set of nine variables. In addition, experimental research is needed to test the effect of a comprehensive self-management program and a specific self-management regimen on the improvement of self-management ability and health status.

Acknowledgement

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