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ORIGINAL RESEARCH

The Effect of Health Literacy on Health Status in Patients with Heart Failure: A Path Analysis

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Background: Managing heart failure (HF) is challenging because of its complexity and high rates of hospitalization, morbidity, and mortality. Effective management requires coordination between patients' abilities and healthcare services; however, low health literacy among patients with heart failure can adversely affect their health status. Therefore, the understanding relationship between health literacy and health status would provide the evidence for developing future intervention.

Methods: This analytical study explored multilevel factors influencing health literacy and health status in patients with heart failure (HF) who underwent health service delivery at outpatient clinics. The sample consisted of 453 patients with HF from 12 hospitals located in five regional areas (north, south, east, northeast, central, and Bangkok) in Thailand. A hypothetical model was used to test the association between comorbidity, social support, patient-centered care, health service delivery, health literacy, and health status. Path analysis was used to analyze the data.

Results: The results indicated that 40.8% of patients with HF exhibited low or inadequate levels of health literacy, yet perceived their health status as good, with an average of 25.2±19.8 points. Health service delivery by a cardiologist and nurse case manager directly influences health literacy. Comorbidity had a direct impact on health status, whereas social support, patient-centered care, and the aforementioned health service delivery indirectly affected health status through health literacy. Importantly, health literacy status directly influences health status.

Conclusion: Comorbidity, social support, patient-centered care, and health service delivery were related with health literacy and high level of health literacy could influence the better health status. To increase the quality of health care services, health care providers should promote health literacy and integrate the concept of patient-centered care for HF patients at outpatient clinics. Recommendations include the training of nurses as case managers.

Keywords: health literacy, health status, patient centered care, social support, heart failure

Introduction

The increasing prevalence of heart failure (HF) is a growing burden on global public health given its significant impact, marked by high rates of hospitalization and mortality.[1] Patients with heart failure have a range of distressing physical and emotional symptoms with adverse effects on their health status, quality of life, and healthcare expenses worldwide.[2,3] Health status is defined as the impact of heart failure symptoms on patients function and quality of life. Health status is one indicator of health outcomes, representing the quality of care provided by the healthcare system. It is an indicator of the impact of the disease on patient functioning, with a range of symptom burdens, functional limitations, and quality of life experienced by the patient.[4] Health status is limited in patients with heart failure and may affect many aspects of individual life, including lifestyle, social activity, and work life. Despite improvements in heart failure (HF) treatment, including the development of new effective drugs and innovative device therapies, patients still have poor prognoses and unfavorable outcomes. Furthermore, the health status of patients with HF is influenced by factors both at the individual patient level and within the healthcare system. Health literacy is acknowledged as a key factor in improving health outcomes, including health status.[5] Therefore, the understanding relationship between health literacy and health status would provide the evidence for developing

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future intervention. Health literacy is the ability of individuals to understand, seek health information, appraise, use health information, and make appropriate health decisions to modify behavior to improve and maintain good health.[6] Previous studies related to health literacy in patients with HF across different settings have reported that health literacy is associated with HF knowledge, self-care behavior, drug adherence, hospitalization, mortality, and quality of life.[7] Patients with limited health literacy are more likely to experience disparities in health outcomes and inequalities in access to healthcare. Inadequate health literacy may be a barrier to accessing and maintaining health status by setting the stage for poor decision-making and delays in seeking health treatment, which results in increased illness burdens. Therefore, improving health literacy is fundamental for enhancing the health of patients with heart failure. Multiple factors associated with health literacy include both the individual and healthcare systems. At the patient level, the factors affecting health literacy and the health status of patients with heart failure have been reported to include patient characteristics as well as social determinants of health. The dimensions of patient characteristics and comorbidity diseases in patients with HF were identified as statistically significant factors associated with poor health outcomes.[8,9] Patients with heart failure with low health literacy had higher Charlson Comorbidity Index (CCI) and higher rates of coexisting illnesses.[9] There is a lack of research on the correlation between comorbidities and health literacy in patients with heart failure (HF). The results of the study provide an understanding of whether or not comorbidity affect the level of health literacy and leads to designing an appropriate monitoring and control of comorbidity. HF is a chronic condition that requires social support to assist with activities of daily living. Social support appears to have a positive relationship with HF self-care behaviors, with family playing an important role in assisting individuals in maintaining and managing positive self-care behaviors.[10] Only one study on patients with HF reported that health literacy and social support had a significant positive correlation, and health literacy had a direct positive association with social support.[11] Limited evidence regarding the relationship between social support and health literacy in patients with HF. Nevertheless, a literature review was conducted of the general population and other chronic diseases.[12,13] On the other hand, health literacy and social support had a significant positive correlation, health literacy had a direct positive association with social support.[14] Whereas several studies have confirmed a positive association between social support and the quality of life or health status.[15,16]

The ultimate goal of the treatment and care of patients with HF is to improve or maintain their health status by focusing on effective health service systems to support patients with HF.[17] The management programs should emphasize the concept of patient-centered care for use at work to improve the quality of care in the health service system. This concept is based on respect for people's preferences, values, and beliefs in health decision making, while the goal of patient-centered care is to empower patients to become active participants in their care.[18] Therefore, evaluations of patients' perceptions are more interesting to explore, and the data obtained in the findings can be used to improve health service behavior in the future.

Currently existing knowledge has focused on the effectiveness of multidisciplinary teams or HF clinics and interventions in health outcomes. Studies exploring the effects of other components of the health service system on improving health outcomes are rare, particularly in Thailand. In summary, HF is a complex condition that requires effective management of both patient and health service system factors to improve health literacy and health status. Therefore, this study aimed to analyze the path relationship between health literacy and health status among patients with heart failure, and to consider the comorbidity, social support, patient-centered care, and health service system in the pathway. It is hypothesized that adequate health literacy not only has a direct effect on health status but also acts as a mediator contributing to health status. Comorbidity, social support, patient-centered care, and health service systems had a positive direct effect on health status.

Material and Methods

Study Design and Sampling

This study was an analytical study. Participants were recruited from 12 outpatient clinics of tertiary care hospitals with more than 500 beds in five regions of Thailand (north, south, east, northeast, central, and Bangkok. The inclusion criteria were being older than 18 years, being diagnosed with HF, and belonging to NYHA functional classes I–III. Patients with

cognitive impairments were excluded from the study. Screened using the 6 item cognitive function test, a cutoff score of cognitive impairment ≥ 8.[19]

The sample size was calculated using multilevel sampling to determine the number of hospital settings. The sample size of the hospital was calculated based on an ICC of 0.10 as 13 hospitals, because the number of units should be more than 10 for adequate data analysis. The minimum sample size of patients in each hospital was a least 30 subjects for a closed normal approximation of distribution Unfortunately, during data collection had a global outbreak of coronavirus pandemic (the COVID-19 pandemic) as a resulted of one hospital denied to data collection. The final sample comprised of 12 hospitals. Each hospital setting had participants ranged from to 30–60 HF patients for a total of 453 HF patients.

Data Collection

This study complies with the Declaration of Helsinki and was performed according to ethics committee approval by the Human Research Ethics Committee of Siriraj Hospital COA no.Si 1042/2020 and each participating hospital. Eligible participants were fully informed the information related to this study asked for their willingness to participate in the study. After participants agreed and signed the consent, researcher provided the questionnaire to complete. The questionnaire comprised of the Charlson's Co-morbidity Index (CCI), the Multidimensional Scale of Perceived Social Support (MSPSS), the Consultation Care Measure (CCM), the health literacy specific for heart failure, and the Minnesota Living with Heart Failure Questionnaire (MLHFQ). The questionnaire was completed through face-to-face or telephone interviews using a structured questionnaire, and each interview lasted 30 minutes.

Data Analysis

The collected data were analyzed using IBM SPSS Statistics version 22 (SPSS Inc). Patient characteristics were analyzed using descriptive statistics. The kurtosis coefficient was less than 3 and the skewness coefficient was near zero; therefore, the data met the assumption of a normal distribution. Given that the variance inflation factor (VIF) of each variable was less than 5, there was no multicollinearity between the variables. We regarded comorbidity, social support, patient-centered care, and health service delivery as exogenous variables, whereas health literacy and health status were regarded as endogenous variables. A path analysis was performed to test the relationship between exogenous and endogenous variables among patients with HF in Thailand, and the direct and indirect effects between the variables were calculated. Path analysis, including the estimation of path coefficients and assessment of the overall fit of the structural model, was performed using the IBM SPSS AMOS 24. The overall fitness of the acceptable model was evaluated using the CMIN/DF, comparative fit index (CFI), Tucker-Lewis index (TLI), and root mean square error of approximation (RMSEA). CMIN/DF or ($\chi 2$/df) is the relative chi-square index, and it explains how much the fit of the data to the model. The model was considered acceptable when the CMIN/DF was less than 3, CFI and TLI values were greater than 0.95, and RMSEA was less than 0.05. All *P* values were two-tailed, and the level of significance was set at *P* value less than 0.05.

Measures

Comorbidity

Comorbidity was assessed using the Charlson Comorbidity Index (CCI).[20] This instrument uses a weighted sum of secondary diagnoses (comorbid conditions) to reflect the functional burden of the illness conditions. The Charlson Comorbidity Index was adapted to predict the costs of chronic diseases, including 23 diseases/conditions, and each condition was assigned a score of 1, 2, 3, or 6 points, depending on the risk of mortality. A higher score indicates a poorer condition. In this study, HF was the principal diagnosis; therefore, it was excluded from the list. Thus, the 22 items with total scores range from 0–41 scores, with higher scores indicating severe comorbid disease.

Social Support

The Patients' perception of social support was measured using the Thai version of The Multidimensional Scale of Perceived Social Support (MSPSS), translated and revised by Wongpakaran et al.[21] This instrument is a self-report measure of subjectively assessed social support divided into three subscales of different sources of support from family, friends, and significant others. Each of the three subscales contains four items. MSPSS has been widely used in both

clinical and non-clinical samples. The MSPSS is a brief, easy-to-administer self-report instrument containing 12 items rated on a 7-point Likert scale ranging from 1 (Strongly Disagree) to 7 (Strongly Agree). The total score ranges from 12 to 84, with higher scores indicating a better perception of receiving social support.

Patient Centered Care

Patients' perception of patient centeredness was measured using the Thai version of The Consultation Care Measure (CCM), translated by Choocherd (2016).[22] The CCM was developed based on empirical studies of the doctor–patient relationship. The questionnaire had five main domains of the patient-centered model: exploring the disease and illness experience, understanding the whole person, finding common ground, health promotion, and enhancing the doctor-patient relationship. The instrument has five subscales: communication and partnership (11 items), personal relationships (3 items), health promotion (2 items), positive and clear approach to the problem (3 items), and interest in effect on life (2 items). The responses were given in a 7-point Likert scale (1–7) ranging from "very strongly agree" to "very strongly disagree. There were 21 items, with total scores range from 1–147 scores, with higher scores indicating a higher perception of patient-centeredness.

Health Service Delivery

Health service delivery is defined as the health service model that patients receive in outpatient clinics. The types of health service delivery devised are based on the type of healthcare providers provided to patients with HF, categorized into cardiologists with nurse case managers and cardiologists with registered nurses. These data were collected from the questionnaire administered by nurses at the outpatient clinic, who were the primary care of patients with HF at each hospital/clinic.

Health Literacy

Health literacy was evaluated using the Thai version of a questionnaire developed to assess health literacy for heart failure in HF patients. This instrument was constructed to evaluate the ability of people to obtain health information, access health service systems, acquire knowledge related to self-care in heart failure, and monitor and recognize symptom changes. Moreover, it includes management of appropriate health decisions. This instrument was developed based on an extensive literature review and used the concept of health literacy of the World Health Organization (1998),[23] and The Institute of Medicine (2004),[6] to create health literacy in patients with HF. It consists of 26 items covering five dimensions: accessibility and comprehension related to heart failure conditions, making decisions to take on symptom management, making decisions to take on self-management, health behavior, and patient-provider interaction. The health literacy questionnaire is a self-report questionnaire, in which each item is a 5-point Likert scale ranging from 0 (not understand and never practice) to 4 (always practice). The total scores ranged from 0–104 scores, with higher scores indicating higher health literacy. Content validity was obtained from one cardiologist, two advanced practice nurses, and two lecturers in the Faculty of Nursing. The content validity index (CVI) was 0.78. Cronbach's Alpha Coefficient was 0.92.

Health Status

Health status was assessed using The Minnesota Living with Heart Failure Questionnaire (MLHFQ). The MLHFQ is a standard instrument for assessing patient perceptions of the effects of heart failure and its treatment on daily life. It is the most widely used instrument for clinical trials of HF, and its good psychometric properties have been confirmed in several studies.[24] This questionnaire was composed of 21 questions and two dimensions (physical and emotional) related to lifestyle limitations associated with HF. The questions covered the signs and symptoms of the disease, social relationships, physical activity, sexual relationships, and work-related and emotional topics. It is self-administered and uses a 6-point Likert response scale ranging from 0 (no effect on QoL or no limitations) to 5 (highest impact on QoL or maximum limitations), with higher scores reflecting poorer health status. The total scores range from to 0–105. Total scores were categorized as good ($0 \leq 24$), moderate (24–45), or poor (> 45).[25] The average was approximately five minutes. The Thai version of the MLHFQ has demonstrated acceptable psychometric properties in terms of practicality, reliability, validity, and responsiveness. The Cronbach's α and ICCs of the MLHFQ were 0.86–0.93 and 0.84–0.88, respectively.[24]

Results

In total, 453 participants with HF were included in the final analysis. The mean age of the participants was 59.5 ± 13.9 years, and 64.9% were male. Most participants were married (70.6%), and 49.4% had completed an elementary school education. In total, 90.9% of participants lived with their families. Furthermore, 51.4% of the patients were classified as NYHA class II, followed by NYHA class I (34.9%), and 60.2% had LVEF less than 40%. The mean score of the Charlson Comorbidity Index was 1.8±1.4 with score ranging from to 0–9 points. The total mean score for social support indicates a moderate degree of perceived social support. Most patients with HF reported experiencing moderate-to-high levels of social support and perceived a good level of patient-centered care. Nearly half of HF patients have a low level of health literacy. Although most patients with HF had low levels of health literacy, they had a good health status following a moderate level of health status (Table 1).

The bivariate correlation matrix showed that the variables were significantly associated with health literacy and health status in the model (Table 2). Social support (r = 0.301) and patient-centered care (r = 0.549) were significantly correlated with health literacy. In addition, comorbidity (r = 0.155), patient-centered care (r = −0.131), and health literacy (r = −0.097) were

Table 1 Demographic and Clinical Characteristics of the Participants (N = 453)

Characteristics	Category	Frequency	(%)
Age (Years)	< 59	197	43.5
	60–69	147	32.5
	70–79	86	19.0
	≥ 80	23	5.1
Mean 59.5 ± SD 13.9			
Gender	Men	294	64.9
	Women	159	35.1
Marital status	Single	65	14.3
	Married	320	70.6
	Divorced/Widowed	68	15.1
Education level	≤ Elementary school	224	49.4
	Junior or high school	154	34.0
	≥ bachelor's degree	75	16.5
Living with	Family	412	90.9
	Relative/Friend	24	5.3
	Alone	17	3.8
NYHA class	I	158	34.9
	II	233	51.4
	III	62	13.7
EF	HFrEF (LVEF ≤ 40%)	272	60.2
	HFmEF (LVEF 41–49%)	52	11.6
	HFpEF (LVEF ≥ 50%)	128	28.3
Social support (score)	Low (score 12–48)	130	28.7
	Moderate (score 49–68)	236	52.1
	High (score 69–84)	87	19.2
Patient centered care (score)		118.23	15.33
Health service delivery	Cardiologist with registered	249	55
	Cardiologist with nurse case manager	204	45
Health literacy (score)	Low or inadequate level (0–60)	185	40.8
	Moderate or marginal level (61–74)	144	31.8
	High or adequate level (74–104)	124	27.4
Mean 63.7 ± SD 17.5			
Health status (score)	Good (0–24)	250	55.2
	Moderate (24–45)	125	28.3
	Poor (45–105)	75	16.6

Table 2 Correlation Matrix of the Variables in the Model

	(1)	(2)	(3)	(4)	(5)
(1) Comorbidity	1.000				
(2) Social support	−0.044	1.000			
(3) Patient centered care	−0.093*	0.203**	1.000		
(4) Health literacy	0.004	0.301**	0.549**	1.000	
(5) Health status	0.155**	0.018	−0.131**	−0.097*	1.000

Note: P < 0.05*, P < 0.01**.

significantly correlated with health status. Linear regression was used to test the correlation between health service delivery, health literacy, and health status. The results showed that health service delivery was significantly correlated with health literacy (ß = 0.163) but not with health status. This indicates that health service delivery by cardiologists and nurse case managers improves health literacy in patients with heart failure.

Based on these results, we developed a structural equation model to examine the correlation between comorbidity, social support, patient-centered care, health service delivery, health literacy, and health status. The final model revealed an adequate fit with a model fit of $\chi^2 = 7.34$ (df = 4, $P = 0.119$), CFI = 0.986, TLI = 0.949, RMSEA = 0.043, and CMIN/DF = 1.835. Table 3 presents the estimates for each path. As shown in Table 4, which displays the indirect effect pathway.

The hypothesized model consisted of 4 exogenous variables and 2 endogenous variables. Exogenous variables composed of 1) comorbidity, 2) social support, 3) patients centered care and 4) health service delivery. Endogenous variables consisted of health literacy and health status. The result show comorbidity had a significant positive effect on health literacy (ß = 0.09, P<0.05) and health status (ß = 0.16, P<0.001). Health literacy had a significant negative effect on health status (ß = −0.12, P<0.05) Social support had a significant positive effect on health literacy (ß = 0.20, P<0.001) but not significant effect on health status (ß = 0.06, P 0.214). Patients centered care had a significant positive effect on health literacy (ß = 0.51, P<0.001). Health service delivery had a significant positive effect on health literacy (ß = 0.15, P<0.001) but not significant effect on health status (ß = 0.02, P 0.742) as shown in Figure 1.

Table 3 Path Coefficients Based on the Final Model

Pathway	S.E	Standardize Coefficient Estimate (Direct Effect)	P value
Health literacy ← Comorbidity	0.465	0.09	0.025
Health literacy ← Social support	0.051	0.20	< 0.001
Health literacy ← Patient centered care	0.044	0.51	< 0.001
Health literacy ← Health service delivery	1.339	0.15	< 0.001
Health status ← Comorbidity	0.650	0.16	< 0.001
Health status ← Social support	0.073	0.06	0.214
Health status ← Health service delivery	1.886	0.02	0.742
Health status ← Health literacy	0.055	−0.12	0.016

Table 4 Indirect Pathway in the Final Model

Pathway	Standardize Coefficient Estimate	P value
Comorbidity→ Health literacy→ Health status	−0.01	0.013
Social support→ Health literacy→ Health status	−0.23	0.005
Patient centered care→ Health literacy→ Health status	−0.06	0.006
Health service delivery→ Health literacy→ Health status	−0.018	0.006

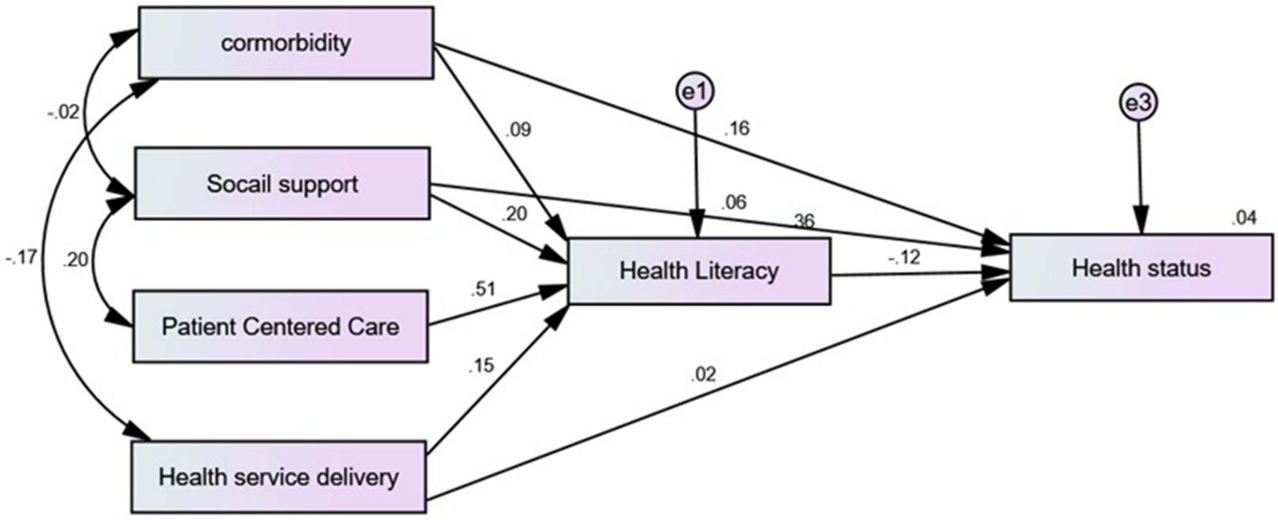

Figure 1 Path analysis with standardized coefficient in the final model.

The final model revealed that comorbidity, social support, patient-centered care, and health service delivery had a direct positive influence on health literacy. Additionally, comorbidity had a positive direct impact on health status, while health literacy had a negative direct effect on health status. However, health literacy had a negative indirect effect on the association between comorbidity, social support, patient-centered care, health service delivery, and health status through health literacy.

Discussion

The results of this study identified comorbidity, social support, patient-centered care, and health service delivery as important factors in health, while health literacy was a key factor associated with health status. Path analysis revealed that the association between comorbidity, social support, patient-centered care, health service delivery, and health status occurred through health literacy pathways. As hypothesized, adequate health literacy not only had a direct effect on health status, but also a mediator contributing to health status. Comorbidity, social support, patient-centered care, and health service systems had a positive direct effect on health status. Patients with HF have remarkably complex conditions with a large burden of cardiac and non-cardiac comorbidities. Comorbid diseases in HF patients were identified as statistically significant factors associated with poor health outcomes.[9,26] This study revealed comorbidity had a significant positive effect on health literacy and health status. Patients with HF and low health literacy had higher CCI scores and higher rates of coexisting illnesses.[5,27] Unfortunately, literature review found that there was no research to examine the relationship between comorbidities and health literacy in patients with HF. More studies investigating factors associated health literacy revealed that most independent variables were socioeconomic factors that did not include comorbidity. Hence, this finding is new and to confirm that comorbidity is positively associated with health literacy in HF patients. Patients with HF and severe comorbidities are more likely to have a high level of health literacy. A possible reason may be that describing patients with multiple comorbid living and long-term illnesses results in gaining knowledge from healthcare providers to learn to deal with their disease. The results revealed that comorbidity had a significant positive effect on health status and a negative indirect effect on health status through health literacy. This indicated that HF patients with multiple comorbidities were more likely to have poor health status. This finding is congruent with those of previous studies. Consistent with a scoping review, it was found that HF patients with non-cardiovascular comorbidities, such as diabetes mellitus, anemia, iron deficiency, and COPD, had a worse health status than those without this comorbidity.[28] Our study confirmed health literacy as a mediator of the association between comorbidity and health status, revealing that multiple comorbid in HF patients with adequate health literacy had better health status. A previous study did not examine the mediating effect of health literacy on comorbidity and health status. This result indicates that the adequate control of comorbidities may have a positive impact on the health status of patients with HF. The

comprehensive management of patients with HF should include the management of comorbidities and recognized levels of health literacy to improve their health status.[29]

Social support appears to have a positive relationship with heart failure self-care behaviors; an individual's family plays an important role in assisting individuals in maintaining and managing positive self-care behaviors by increasing patient self-confidence to perform activities, assisting with symptom monitoring and medical adherence, participating in decision-making, and seeking health care resources.[10] In this study, social support had a significantly positive effect on health literacy. Only one study on patients with HF reported that health literacy and social support had a significant positive correlation, and health literacy had a direct positive association with social support.[11] Limited evidence regarding the relationship between social support and health literacy in patients with HF. Nevertheless, a literature review was conducted of the general population and other chronic diseases.[12,13] Among chronic diseases, including hypertension and coronary heart disease, social support was positively correlated with health literacy.[14,30] On the other hand, health literacy and social support had a significant positive correlation, health literacy had a direct positive association with social support.[11] The results of the studies are very interesting: social support has an effect on health literacy, and health literacy has an effect on social support. Social support is multifaceted, and contributes to positive emotional and physical health. Social support can also help patients with HF maintain physical health by improving their ability to learn, resulting in a high level of health literacy. Hence, health care providers should assess and identify patients' perceived social support, which will play an important role in enhancing health literacy. Social support was not associated with health status. This result is inconsistent with previous studies that have confirmed a positive association between social support and health status.[15,16] This may be explained by the most of HF patients in this study reported experiencing moderate to high level of social support and good to moderate level of health status. Most participants were elderly individuals. In Thai society, the elderly are respected and receive support from their families. Therefore, social support was not significant in HF Thai society. However, social support had an indirect effect on health status through health literacy. This implies that HF patients with good social support and health literacy were more likely to have good health status.

Patients with HF have complex care needs that often make healthcare delivery difficult and costly. Health service delivery based on patient-centered care has been widely advocated and acknowledged as a strategy for improving health outcomes. This study found that patient-centered care had a significant positive effect on health literacy. Patient-centered care was significantly associated with cost reduction in patients with HF.[31] Literature review of the HF population and other diseases showed stronger evidence for the positive influences of patient-centered care on health outcomes, such as quality of life, physical and social well-being, self-management, reduction of hospital admissions, reducing costs of care, and satisfaction with care.[32] In conclusion, previous studies have not explored the relationship between patient-centered care and health literacy. This study is the first to show the importance of patient-centered care and health literacy in patients with HF in the outpatient department. Hence, tailoring care to the needs of patients with HF by paying attention to patient-centered care may contribute to better health literacy. However, patient-centered care had a negative indirect effect on health status through health literacy. This finding was inconsistent with that of a systematic literature review of patients with heart failure, which found that patients who received patient-centered care interventions had positive health outcomes. The benefits include an increase in quality of life, improved clinical status for both physical and mental health, self-care, less symptom burden, more effective discharge processes, and shorter hospital stays.[33]

Nurse case management is a method designed to provide intensive, personally tailored care to meet the needs of patients with multiple chronic conditions who are at the greatest risk of needing hospitalization and are responsible for the highest costs, such as patients with HF. The current literature provides strong evidence that nurse case managers increase adherence to treatment guidelines, improve patient satisfaction, and reduce the use of emergency departments, hospital admissions, and readmissions.[34] There was no research which aimed to explore the effectiveness of nurse case manager to health literacy. Our results demonstrated a positive effect between health service delivery by cardiologists, nurse case managers, and health literacy. Health service delivery by cardiologists with nurse case managers results in a higher level of health literacy than that provided health service delivery by cardiologists with registration nurses. This finding may be explained by nurse case managers being directly involved in educating their patients so that they can better understand their medical conditions and treatment, help their patients make better decisions, and ensure that they fully understand these decisions. Furthermore, health service delivery by cardiologists and nurse case managers had an indirect effect on health status through health literacy. This

may be explained by the fact that patients with HF who received cardiologists and nurse case managers were more likely to have a high level of health literacy and may have a better health status.

Health literacy had a significant negative effect on health status, it meant patients who had good level of health literacy score or adequate health literacy were more likely had good health status than those with inadequate health literacy. These results are similar to those reported in previous studies.[35] Health literacy is a fundamental component in the development of a state of well-being, and is linked to literacy and the ability to understand, appraise, and apply health information to make decisions in everyday life. Patients with HF and low health literacy may pay less attention to their health status and exhibit unhealthy behaviors. Health literacy is closely related to the health status of patients with HF; it improves medical adherence and reduces the incidence of rehospitalization and death rates.[36] Thus, each patient's health literacy should be assessed carefully and strategies to improve health literacy and health status should be adjusted based on the patient's level of health literacy.

In addition, we found that comorbidity, social support, patient-centered care, and health service delivery influenced health status through health literacy. The results confirmed that improvements in health literacy can effectively enhance health status. Nursing interventions for HF patients with a low level of health literacy should be considered for these factors (comorbidity and social support). According to these findings, to increase the quality of health care services, health care providers should promote health literacy and integrate the concept of patient-centered care for HF patients at outpatient clinics. Nurses in heart failure clinics should be trained in nurse-case management programmes. Future research should include patients and caregiver in healthcare planning decision and develop the intervention focusing on increasing patient and caregiver engagement in order to promote health literacy and health status among patients with HF.

Strength and Limitations

This multicenter study gathered data from five regions of Thailand to demonstrate the representativeness of patients with failure (HF) patients in the country. However, this study employed a novel questionnaire designed specifically for assessing health literacy related to HF rather than a standardized questionnaire. This choice could potentially hinder the comparability of health literacy levels across populations, thus limiting generalizability. Conversely, the Minnesota Living with Heart Failure Questionnaire (MLHFQ) was used to evaluate the health status. However, relying on questionnaire-based assessments can be imprecise and may introduce the risk of social desirability in patients who may report over-or underestimation of their health status.

Conclusion

Factors associated with health literacy include patient-level and health-service system factors. Health literacy was also directly and statistically significantly associated with health status and had a mediating effect on health status. The results suggest that health service delivery should focus on enhancing health literacy to improve health status. Therefore, the results from this study provided the background for developing future intervention to increase knowledge, literacy, and health status in patient with HF.

Ethics Approval

This study complies with the Declaration of Helsinki and was performed according to ethics committee approval by the Human Research Ethics Committee of Siriraj Hospital COA no.Si 1042/2020 and each participating hospital.

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Disclosure

The authors report no conflicts of interest in this work.

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