Original Article

Factors impacting heart failure patients' knowledge of heart disease and self-care management

Wenying Zeng[1], Shaw Yang Chia[2], Yiong Huak Chan[3], Suan Choo Tan[1], Esther Ju Huey Low[1] and Meng Kum Fong[1]

Abstract

Background: Heart failure (HF) contributes significantly to the morbidity and mortality of the ageing population and is one of the leading causes of re-hospitalization in Singapore. Studies have shown that patient education covering HF and self-care management can lead to greater compliance with treatment regimens, resulting in lower re-hospitalization rates. This study aimed to measure HF patients' knowledge on the disease and self-care management, and to explore factors influencing their knowledge level.

Methods: A questionnaire adapted from the Dutch Heart Failure Knowledge Scale (DHFKS) was completed by 187 patients who were recruited from a tertiary center's outpatient HF clinic. Data from the survey were analyzed using SPSS (version 22).

Results: Knowledge of HF in general had the highest score and that of HF symptoms/recognition of HF symptoms the lowest. The knowledge deficit identified was mainly on therapeutic regimens and HF symptoms/recognition of HF symptoms. The respondents' knowledge was significantly related to their educational level and whether they had received HF education.

Conclusion: For HF patient education to be effective, the program has to be customized to cater to different target groups and individuals. There is a need to develop patient teaching materials and a program with consideration to the patients' educational levels, demographic, and comorbidity backgrounds.

Keywords

Knowledge, knowledge scale, heart failure, patient education, self-care

Introduction

Heart failure (HF) is a major and growing public health problem worldwide with a significant burden of disease on society and the individual.[1,2] This burden of disease can be measured in terms of mortality, readmission rate, and healthcare costs. Repeated HF hospitalization is a burden on the healthcare system and adversely impacts long-term patient outcomes.[3,4]

Studies have shown that approximately half of hospital readmissions could be prevented if HF patients were compliant to their treatment regimen, and performed symptom monitoring and self-care at home.[4–11] Patients', as well as their caregivers', level of HF knowledge is significantly related to their level of adherence to recommended care regimens.[4–13] Knowledge, therefore, is an essential component for the implementation of self-care strategies.[6,12]

In addition to advanced therapies, comprehensive and competent care for patients hospitalized with HF requires a strong focus on the education of patients and their families to improve their knowledge on self-care and compliance.[12]

Studies measuring HF patients' knowledge and the outcomes of patient education reported that health literacy was associated with higher HF knowledge and patients' demographics such as younger age and higher educational level.[6,7,12,13] There is a lack of information in the Singapore context on HF patients' knowledge and self-care skills, as well as preventive interventions in reducing HF admission.

In Singapore, congestive HF accounted for 4.5% of all hospital admissions and 2.5% of overall mortality in patients who

---

[1]Nursing Department, National Heart Centre Singapore, Singapore
[2]Singapore Cardiac Data Bank, National Heart Centre Singapore, Singapore
[3]Biostatistics Unit, National University of Singapore, Singapore

Corresponding author:
Wenying Zeng, Nursing Department, National Heart Centre Singapore, 5 Hospital Drive, 168752, Singapore.
Email: zeng.wenying@nhcs.com.sg

were 56 years old and above.[15] Based on unpublished data from a local tertiary hospital, 489 out of 872 (56%) HF admission episodes in 2012 were due to non-compliance to diet (mainly fluid and salt) and medications. The current HF education program was started in 2002 by a multidisciplinary team, which comprised physicians, HF specialty nurses, ward nurses, dieticians, physiotherapists, and pharmacists. Education was delivered through individual bedside teaching and weekly teaching sessions, followed by discussions with the patients and supplemented with written material. Topics of discussions included the self-administering of medications, sodium and fluid restrictions, recognition of disease progression signs and symptoms, daily self-monitoring of weight, and daily activities.

The objective of this study was to assess the effects of demographic conditions and co-morbidities that may influence HF patients' knowledge level on the disease and self-care. The specific objectives were:

1. to measure HF patients' knowledge level on the disease and self-care under the current patient education program; and
2. to examine the correlation between HF patients' knowledge level on the disease and self-care, and their demographic conditions and co-morbidities.

The Dutch Heart Failure Knowledge Scale (DHFKS) developed by Van der Wal et al.[14] was adapted in this study. We chose the DHFKS as both English and Mandarin versions were available, have been used extensively, and have been shown to be both reliable and valid for different populations in the Netherlands, US, Taiwan, and Vietnam.[6,12–14,16,18]

Methods

Design, setting, and participants

This was a quantitative study and was descriptive in nature. It comprised a pilot and main study and was conducted over a period of five months between March and August 2013. The pilot study involving five patients was conducted in March 2013 to test the clarity of the English and Chinese version of DHFKS and the validity of the instrument in the Singapore context. The main study was conducted from 10 April to 28 August 2013. A total of 225 patients in an outpatient HF clinic of a local tertiary center were recruited in the study. Ethical approval was obtained from the Centralized Institutional Review Board prior to study.

Inclusion criteria were patients who had been admitted to the tertiary center for HF between 1 January 2008 and 31 December 2012, been discharged from the hospital for more than three months, been following-up at the outpatient HF clinic, were able to read or speak English or Mandarin, and were between 21 and 75 years old. Exclusion criteria were patients who had cognitive impairment, visual impairment, physical disability, end-stage renal disease, end-stage HF, or who were pregnant or bedridden. An information sheet was given to the participants prior to answering the questionnaire. Consent to participate in the survey was assumed by the return of a completed questionnaire.

Survey questionnaires and data collection

The survey instrument consists of two parts. The first part contains participant's demographic characteristics (age, gender, marital status, educational level, mobility status, employment status, whether living with caregivers, etc.), comorbidities (diabetes, smoking, alcohol drinking, depression, etc.), and whether they had received HF education during the past hospitalization. The second part is the DHFKS (see Appendices 1 and 2).

The 15 self-administered, multiple-choice questions covered HF knowledge in general (four items: Q6, Q7, Q9, Q11), knowledge of HF treatment (six items: Q3, Q4, Q10, Q12, Q13, Q15), and knowledge of HF symptoms and symptom recognition (five items: Q1, Q2, Q5, Q8, Q10). Respondents were given three options for each question and they had to circle the most appropriate answer. Each correct answer is awarded one point; no points are awarded for wrong or unanswered questions. The total possible score for HF knowledge ranges from 0 to 15. The higher the score, the more the respondent is presumed to know about HF.

We obtained permission from the author of the DHFKS to slightly modify the scale in our study to make the questions more appropriate in a local context. On the advice of a HF specialist, the fluid restriction range in Q3 was modified from 1.5–2.5 liters to 1.0–1.5 liters, in line with the fluid intake of the Singapore-based study population. As the available Chinese version of DHFKS was modelled for the Taiwanese population, a slight adjustment was made in light of the local linguistic differences. A pilot study was conducted after the adjustments to test the content validity and face validity of both the Chinese and English versions of the questionnaire.

Statistical analysis

Analyses were performed using SPSS version 22.0. Descriptive statistics were presented as mean (SD) for numerical variables, and n (%) for categorical variables. Univariate and multivariate analyses were performed using the General Linear Model to determine the relationship of demographical and clinical categorical variables with HF knowledge, both across and within all HF knowledge categories. Post-hoc pairwise comparisons were made and adjusted with the Bonferroni correction. Statistical significance was set at $p < 0.05$.

Results

A total of 225 HF patients participated in the study (a response rate of 100%). There were 38 questionnaires excluded from statistical analysis due to incomplete answers. There were no significant differences in age, gender, educational level, diabetes, smoking, depression, and whether the subjects received HF education during previous hospitalization between the 187 participants who completed the questionnaire and the 38 participants who did not. There were 143 (76.5%) participants that used the English version of questionnaire and 44 (23.5%) who used the Chinese version.

Demographic and clinical characteristics

Chinese participants made up 73.8% of the population. Most of the respondents in this population were aged 50 years old and above (n = 127, 67.9%), male (78.6%), and married (70.1%). More than two thirds of this study population had less than high school education and 46.0% of participants were living with their caregivers. In clinical variables, 40.6% of the respondents were suffering from diabetes and 28.3% were current smokers. The

Table 1. Demographic and clinical characteristics of the study population.

Characteristics (N = 187)	n (%)
Age (50 years and above category)	127 (67.9%)
Sex (male)	147 (78.6%)
Race	
• Chinese	138 (73.8%)
• Malay	22 (11.8%)
• Indian	24 (12.8%)
• Others	3 (1.6%)
Marital status	
• Married	131 (70.1%)
• Single (including unmarried/widowed/ separated/divorced)	56 (29.9%)
Educational level	
• Less than high school	136 (72.7%)
• High school and above	51 (27.3%)
Employment status	
• Employed (full/part-time)	87 (46.5%)
• Retired/disability/unemployed	100 (53.5%)
Diabetes mellitus	76 (40.6%)
Smoker	53 (28.3%)
Alcohol	**30 (16%)**
Depression	8 (4.3%)
Mobility status	
• Ambulate independently	166 (88.8%)
• Ambulate with assistance/wheelchair bound	21 (11.2%)
Living with a caregiver	86 (46.0%)
Received heart failure education	151 (80.7%)

demographic and clinical characteristics of participants are shown in Table 1.

Level of knowledge on HF

The total mean score of HF knowledge in this population was 10.1 (±2.4). Among the three categories of knowledge, knowledge of HF in general had the highest score and those of HF symptoms/symptom recognition the lowest (Figure 1).

The key areas of knowledge deficit identified in this study were: 1) treatment, especially in therapeutic regimen; and 2) causes, symptoms, and consequences of HF (Table 2). In the treatment category, respondents lacked adequate understanding of weighing monitoring. Only 55.6% of the respondents were able to make the connection between an increase in weight and HF condition, and only 40.1% of respondents knew that those with severe HF condition should weigh themselves daily. A total of 74.9% of the respondents were aware that they needed to be on a fluid restriction, while 71.3% knew that they should suck an ice cube when thirsty. However, 20% of them held the misperception that they should consume as little water as possible. In addition, more than 50% of the respondents in our study group were unable to recognize signs and symptoms of worsening HF. Only 13.9% of respondents were aware that the flu can cause rapid worsening of HF condition, while 59.4% thought that a high-fat diet would cause rapid worsening of HF condition.

Factors affecting HF knowledge

The significant differences shown in the overall HF knowledge section were: educational level ($p < 0.001$, Table 3), diabetes mellitus ($p = 0.049$), living with a caregiver ($p = 0.034$), and having received HF education ($p = 0.020$). However, only two factors remained significant in the multivariate analysis (education level: $p < 0.001$; the receipt of HF education: $p = 0.011$).

Post-hoc pairwise comparisons showed individuals with a lower educational level (below the high school level) had
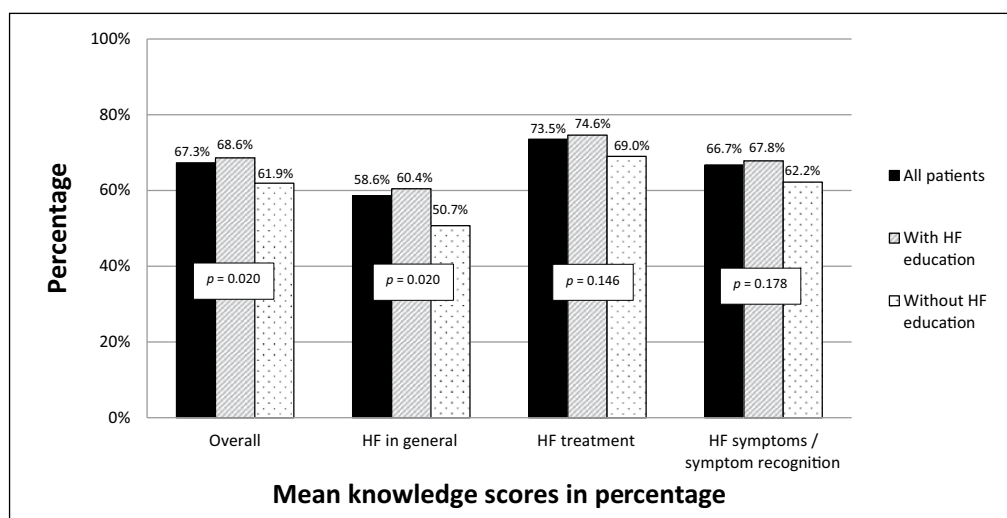
Figure 1. Knowledge score (%) of respondents with HF education as compared to those without HF education.

Table 2. Itemized breakdown of heart failure (HF) knowledge questionnaire comparing patients with and without HF education.

	No. of Patients who answer correctly, n (%)	Received HF education		P^a
		Yes	No	
HF in general				
What can cause a rapid worsening of HF symptoms? (6)	26 (13.9%)	20	6	0.594
What does HF mean? (7)	153 (81.8%)	124	29	0.827
What is the function of the heart? (9)	136 (72.7%)	115	21	0.031
What are the main causes of HF? (11)	123 (65.8%)	106	17	0.009
HF treatment				
How much fluid are you allowed to take at home each day? (3)	140 (74.9%)	118	22	0.034
Which of these statements (about medication) is true? (4)	163 (87.2%)	133	30	0.444
Why should someone with HF follow a low salt diet? (10)	110 (58.8%)	90	20	0.658
Which statement about exercise for people with HF is true? (12)	108 (57.8%)	86	22	0.650
Why are water pills prescribed to someone with HF? (13)	173 (92.5%)	144	29	0.002
What is the best thing to do when you are thirsty? (15)	131 (70.1%)	105	26	0.752
HF symptoms/symptom recognition				
How often should patients with severe HF weigh themselves? (1)	75 (40.1%)	63	12	0.356
Why is it important that patients with HF should weigh themselves regularly? (2)	146 (78.1%)	124	22	0.006
What is the best thing to do in case of increased shortness of breath or swollen legs? (5)	148 (79.1%)	120	28	0.822
Why can the legs swell up when you have HF? (8)	151 (80.7%)	120	31	0.364
Which statement about weight increase and HF is true? (14)	104 (55.6%)	85	19	0.703

^{a}P-value for comparison of "Patients with HF education" and "Patients without HF education" groups.

a lower overall HF knowledge score than those with a higher educational level (high school level and above; 64.7% vs. 74.2%, $p < 0.001$). There is a significant difference in all three categories of knowledge scores between the groups with lower educational level and those with at least high school education, with HF knowledge in general 56.1% vs. 65.2% ($p = 0.014$), treatment 71.3% vs. 79.4% ($p = 0.018$), and HF symptoms/symptom recognition 63.5% vs. 75.3% ($p = 0.001$).

A total of 151 (80.7%) participants in this study indicated that they had received HF education during hospitalization (Table 1). Participants who had received HF education scored higher in all the categories of knowledge than those who did not (Table 3). However, HF education was only found to be significantly related with the high score in HF general knowledge (60.4% vs. 50.7%, $p = 0.020$). There was no significant relation found in the knowledge score in HF treatment and in HF symptoms/symptom recognition. HF education was also found to be significantly related to patients' high scoring in questions asked about the function of the heart (Q9, $p = 0.031$), the main causes of HF (Q11, $p = 0.009$), fluid restriction (Q3, $p = 0.034$), the important reason for regular weighing (Q1, $p = 0.006$), and the purpose of water pills (Q13, $p = 0.002$).

Notably, respondents living with a caregiver had significantly lower scores than those not living with one in overall HF knowledge (64.7% vs. 69.5%, $p = 0.034$, Table 3) and knowledge of HF symptoms/symptom recognition (63.3% vs. 69.7%, $p = 0.049$).

There were no significant differences in overall HF knowledge scores when respondents were compared by age group, gender, ethnic group, marital status, employment status, or mobility status (Table 3).

Discussion

This study is the first to employ a well-validated questionnaire to assess a wide variety of aspects related to knowledge of HF disease and self-care management in Singapore.

Current HF patients' knowledge of disease and self-care management

The mean HF patients' knowledge score of this study population was 10.1 (±2.4), which was above the level considered to be adequate (>10), but lower than the ideal for individuals who had recently received standardized in-hospital HF education. These findings are similar to those in the study by Dennison et al. in which mean knowledge score was 11.4 ±2.3.[13] The knowledge deficits identified in this study such as weight monitoring, fluid restriction, and recognition of worsening signs and symptoms were consistent with studies conducted in patient populations outside Singapore.[6,18] A local study carried out by Malhotra et al. also reported that patients expressed the desire for more functional knowledge about symptom management, side effects, and disease progression.[19] These findings would inform future educational interventions to focus on the areas of therapeutic regimen, general HF knowledge, symptoms, and symptom recognitions.

Diabetes, smoking, and HF knowledge

Participants with diabetes scored lower than participants without diabetes in the questionnaire. In the univariate analysis, there was a positive correlation between the diabetic group and their low scores in overall knowledge, general HF knowledge, as well as in symptom recognition (Table 3). Knopman et al. reported that older adults with

Table 3. Relationship of demographical and clinical variables across the different categories of heart failure (HF) knowledge.

	HF knowledge[a]											
	Overall			HF in general			HF treatment			HF symptoms/symptom recognition		
	Mean ± SD	P[b]	P[c]	Mean ± SD	P[b]	P[c]	Mean ± SD	P[b]	P[c]	Mean ± SD	P[b]	P[c]
Age group		0.526	0.927		0.662	0.232		0.073	0.104		0.757	0.469
21 to 50 years	68.3 ± 16.6			57.5 ± 22.2			77.5 ± 21.2			66.0 ± 26.1		
50 years and above	66.8 ± 15.2			59.1 ± 22.9			71.7 ± 20.5			67.1 ± 20.4		
Gender		0.902	0.683		0.951	0.389		0.284	0.346		0.130	0.339
Male	67.3 ± 15.5			58.5 ± 23.5			72.7 ± 20.7			68.0 ± 21.7		
Female	67.0 ± 16.6			58.8 ± 19.2			76.7 ± 21.3			62.0 ± 24.3		
Ethnic group		0.330	0.261		0.43	0.589		0.866	0.718		0.189	0.108
Chinese	68.3 ± 15.0			60.1 ± 23.1			74.2 ± 20.9			67.8 ± 21.8		
Malay	63.0 ± 16.4			53.4 ± 22.2			71.2 ± 19.4			60.9 ± 23.5		
Indian	64.4 ± 19.1			55.2 ± 20.8			71.5 ± 23.3			63.3 ± 24.1		
Others	73.3 ± 6.7			50.0 ± 0.0			77.8 ± 9.6			86.7 ± 11.5		
Marital status		0.995	0.160		0.838	0.261		0.377	0.959		0.403	0.052
Married	67.3 ± 15.4			58.8 ± 23.0			72.6 ± 21.4			67.6 ± 22.4		
Single[d]	67.3 ± 16.4			58.0 ± 21.9			75.6 ± 19.6			64.6 ± 22.2		
Education level		<0.001	<0.001		0.014	0.005		0.018	0.084		0.001	<0.001
Less than high school	64.7 ± 14.5			56.1 ± 23.5			71.3 ± 21.0			63.5 ± 20.5		
High school and above	74.2 ± 16.6			65.2 ± 18.8			79.4 ± 19.6			75.3 ± 24.8		
Employment status		0.995	0.324		0.971	0.736		0.984	0.484		0.968	0.333
Employed (full/part-time)	67.3 ± 16.6			58.6 ± 21.8			73.6 ± 22.5			66.7 ± 24.1		
Retired/disability/unemployed	67.3 ± 14.9			58.5 ± 23.4			73.5 ± 19.4			66.8 ± 20.7		
Diabetes mellitus		0.049	0.400		0.013	0.102		0.878	0.472		0.051	0.213
Yes	64.6 ± 15.5			53.6 ± 20.7			73.2 ± 21.3			62.9 ± 22.6		
No	69.1 ± 15.6			61.9 ± 23.3			73.7 ± 20.7			69.4 ± 21.9		
Smoker		0.075	0.590		0.201	0.765		0.029	0.149		0.788	0.421
Yes	64.0 ± 16.2			55.2 ± 21.6			68.2 ± 21.2			66.0 ± 24.4		
No	68.6 ± 15.3			59.9 ± 22.9			75.6 ± 20.4			67.0 ± 21.6		
Depression		0.135	0.120		0.058	0.129		0.710	0.675		0.233	0.130
Yes	59.2 ± 20.6			43.8 ± 25.9			70.8 ± 21.4			57.5 ± 31.1		
No	67.6 ± 15.4			59.2 ± 22.3			73.6 ± 20.9			67.2 ± 21.9		
Mobility status		0.497	0.905		0.185	0.473		0.664	0.463		0.399	0.986
Ambulate independently	67.6 ± 15.6			59.3 ± 22.3			73.3 ± 21.2			67.2 ± 21.7		
Ambulate with assistance/ wheelchair bound	65.1 ± 16.7			52.4 ± 24.9			75.4 ± 18.0			62.9 ± 27.0		
Living with a caregiver		0.034	0.089		0.172	0.582		0.223	0.295		0.049	0.060
Yes	64.7 ± 15.8			56.1 ± 23.0			71.5 ± 20.3			63.3 ± 23.3		
No	69.5 ± 15.2			60.6 ± 22.2			75.2 ± 21.3			69.7 ± 21.1		
Received HF education		0.020	0.011		0.020	0.024		0.146	0.087		0.178	0.144
Yes	68.6 ± 15.0			60.4 ± 21.9			74.6 ± 20.7			67.8 ± 21.8		
No	61.9 ± 17.4			50.7 ± 24.3			69.0 ± 21.1			62.2 ± 24.3		

[a]Reported in percentage (%).
[b]P-value (unadjusted).
[c]P-value (adjusted).
[d]Marital status "single" includes unmarried/widowed/separated/divorced.

diabetes are at an increased risk of cognitive dysfunction with regard to verbal learning, memory problems, working memory, and psychomotor function.[20] In a local study by Malhotra et al., HF patients reported that dealing with comorbidities further complicated their physical and psychological symptoms such as poor memory, attention, fatigue, and depression.[19] Although the differences in our study were not statistically significant after adjustment for other variables, this could possibly explain the low scores in the current study. This highlights the need for patient education and intervention to be tailored to the needs of this group of patients.

Smokers also scored poorly compared with non-smokers in this study. This can be explained by the established link between cognitive function and smoking.[21] The psychological construct of the risk-taking attitude of smokers, including feeling less control over their lives and chronic condition, might also contribute to the low score.[22,23] HF patient education needs to be integrated with a smoking cessation counseling program in this group of patients.

Respondents' educational level

The respondents' educational levels showed significant correlation to HF knowledge levels in both bivariate and multivariate analyses. This indicates that educational level is an independent predictor of HF respondents' knowledge in our study population.

This reinforces findings from other studies that there is a direct correlation between the educational level of HF patients and the level of disease-specific knowledge.[6,7,14,16] This finding demonstrates that different educational strategies may be required to tailor the information to suit the individual's educational level and learning needs, in order to aid their understanding and retention of information about HF.

In-patient HF education

HF education was positively correlated with the respondents' HF knowledge score in both bivariate and multivariate analyses, which indicated that the current HF education program is a major determinant of knowledge for this study population.

Our findings show that HF education may need to be more specific to allow or provide opportunity for patients to clarify their own belief, doubt, and misconceptions; for instance, the misunderstandings in fluid restriction and weighing monitoring, as well as causes of worsening HF. Also, HF education was only found significantly associated with the high score in HF general knowledge but not in the treatment knowledge and HF symptom/symptom recognition knowledge. Studies have shown that HF patients require more information than previously thought by healthcare workers.[24–26] Despite receiving HF education, there remains a significant knowledge deficit in HF treatment and cause, symptoms, and consequences of HF. HF education should employ different types of intervention strategies to enhance patients' understanding and improve information retention rates. There also needs to be more seamless communication and coordination within the multidisciplinary team administering the HF education program.

HF patients are often in a poor condition when hospitalized, and lack the physical and mental capacity to assimilate the information provided.[25] Many patients and their families may not be ready to learn at the time of diagnosis, regardless of how thorough the instructional session. The physical and psychological symptoms of HF such as breathlessness, mild cognitive impairment, fatigue, anxiety, sleep disturbance, and depression make it generally challenging for patients to receive and retain information, especially in the acute environment, when symptoms are present.[12] Dealing with comorbidities may further complicate the situation, especially among older patients.[18,21] Most of our respondents in this study population were aged 50 years or older, with almost half having diabetes. In current practice, patient education is documented in medical records, even if the education provided is cursory. The documentation may not reflect the extent of the counseling and patients' understanding, or any assessment of their understanding.[26] Although this study was not designed to test the in-hospital education intervention, findings showed that effective HF education strategies are needed in additional to oral and/or printed educational information. More interactive discussions, various communication platforms, the evaluation of learning outcome, and follow-up with healthcare providers may help patients better understand their condition, prevent misunderstandings, and promote the retention of knowledge taught.

Living with a caregiver

The presence of a caregiver was found in our study to be significantly related to HF respondents' knowledge in the bivariate and multivariate analysis. In this study, a caregiver was defined as someone who assists in either or all of the patient's daily living activities, including seeing to dietary needs, the taking of medications, etc. The overall knowledge score of HF patients living with caregivers was lower than those who had no caregiver. This is different from overseas studies, where the patients who are married tend to have a greater knowledge about their disease.[4,12,27,28]

This result could have arisen from the targeting of HF education at the caregivers rather than the patients. According to a study by Malhotra et al., local patients felt that physicians discussed their illness with their family rather than with them. They felt that being better informed would allow them to manage their disease and get a general understanding of their condition, as well as empower them to make decisions and plan for their remaining days.[19] Social support from family and friends has been shown to indirectly affect patients' motivation and cognitive ability to receive and process information provided on HF and self-care management.[9,10,17,22,29] However, both patients and caregivers should be equally involved in HF education.

The factors identified in our findings include HF education, the respondents' educational level, and living arrangements (with or without caregiver). These factors may be used to identify high-risk patients and to tailor interventions to improve HF patients' knowledge. Effective HF education strategies such as more interactive discussions, various communication platforms, and follow-up with healthcare providers may help patients better understand their condition, prevent misunderstandings, and promote retention of knowledge taught. Educational intervention should be tailored to suit the learning needs of different groups of patients (who may have different learning styles) and followed by an evaluation or reassessment of its effectiveness. Due to the unique characteristics, behaviors, and beliefs in the multi-racial and multicultural context of Singapore, we should focus on individualized educational and therapeutic interventions to maximize the effectiveness of patient education.

Study limitations

The number of respondents in this study was small and drawn from a single center. As a convenience sample, the population studied did not represent the total HF patient population of Singapore. Moreover, the questionnaire did not allow for subjects to elaborate on their views and answers, and demographic data such as specific age, type of diabetes, hypertension, and atrial fibrillation were not collected. Detailed information on respondents' HF stage and their caregivers was also not collected. A pre- and post-design could also be used to best evaluate an educational intervention. The results of this study could be a baseline for the evaluation of a revised educational program in the near future. Future research should establish what type and what level of information has the potential to improve physiological, cognitive, emotional, and behavioral outcomes for patients and their caregivers.

Future studies should explore effective educational interventions, evaluate different educational outcomes and quality of life of HF patients, as well as establish the types and levels of information that have the potential to improve physiological, cognitive, emotional, and behavioral outcomes for HF patients and their caregivers.

In our study, Cronbach's alpha was calculated to assess internal consistency (reliability) of the questionnaire after the modification of the fluid restriction question. Our study had a small statistical power reliability of 0.538 measured via Cronbach's alpha, which was lower than the values reported by DHFKS authors (0.62), but comparable to the values reported in the US study (0.58).[12,13]

Conclusion

The results of this study indicate that the knowledge of HF patients in Singapore may be inadequate, despite the education provided. There are considerable knowledge deficits among HF patients, especially in the areas of weight monitoring, cause of HF disease, symptoms, and symptom recognition.

The patients' educational level, whether in-patient HF education has been administered, and the patients' living arrangements are factors identified in our study to be significantly related to patients' knowledge of disease and self-care management. These factors identified in our study implicate the high-risk population and target groups differentiated by demographics. Clinical education should incorporate these factors as they evolves in order to be relevant and effective. Both caregivers and patients should be actively involved in patient education and be equally empowered. The rapid growth of the aging population requires efficient and cost-effective education, practical measures, and interventions in patient self-care that can empower patients at the community level. Hopefully, our study sheds light on how patient education can be tailored to the individual's needs and encourages attempts to address and enhance patients' retention of knowledge.

References

1. Hunt AS. ACC/AHA 2005 guideline update for the diagnosis and management of chronic heart failure in the adult: a report of the Cardiology/American Heart Association Task Force on Practice Guidelines. *J Am Coll Cardiol* 2005; 46: e1–e82.
2. Lee S, Khurana R and Leong GKT. Heart failure in Asia: the present reality and future challenges. *Eur Heart J Supp* 2012; 14(Suppl A): 51–52.
3. Lam CSP. Heart failure in Southeast Asia: facts and numbers. *ESC Heart Fail* 2015; 2: 46–49.
4. Ni H, Nauman D, Burgess D, et al. Factors influencing knowledge of and adherence to self-care among patients with heart failure. *Arch Intern Med* 1999; 159: 1613–1619.
5. Schweitzer RD, Head K and Dwyer JD. Psychological factors and treatment adherence behavior in patients with chronic heart failure. *J Cardiovasc Nurs* 2007; 22: 76–83.
6. Van der Wal MH, Jaarsma T, Moser DK, et al. Compliance in heart failure patients: the importance of knowledge and beliefs. *Eur Heart J* 2006; 27: 434–440.
7. Sneed NV and Paul SC. Readiness for behavioral changes in patients with heart failure. *Am J Crit Care* 2003; 12: 444–453.
8. Van der Wal MH, Jaarsma T and van Veldhuisen DJ. Non-compliance in patients with heart failure; how can we manage it? *Eur J Heart Fail* 2005; 7: 5–17.
9. Riegel B and Dickson VV. A situation-specific theory of heart failure self-care. *J Cardiovasc Nurs* 2008; 23: 190–196.
10. Nieuwenhuis, van der Wal MH and Jaarsma T. The body of knowledge on compliance in heart failure patients: we are not there yet. *J Cardiovasc Nurs* 2011; 26: 21–28.
11. Sahebi A, Mohammad-Aliha J, Ansari-Ramandi M, et al. Investigation the relationship between self-care and readmission in patients with chronic heart failure. *Res Cardiovasc Med* 2015; 4: e25472.
12. Macabasco-O'Connell A, DeWalt DA, Broucksou KA, et al. Relationship between literacy, knowledge, self-care behaviors, and heart failure-related quality of life among patients with heart failure. *J Gen Intern Med* 2011; 26: 979–986.
13. Dennison CR, McEntee ML, Samuel L, et al. Adequate health literacy is associated with higher heart failure knowledge and self-care confidence in hospitalized patients. *J Cardiovasc Nurs* 2011; 26: 359–367.
14. Van der Wal MH, Jaarsma T, Moser DK, et al. Development and testing of the Dutch Heart Failure Knowledge Scale. *Eur J Cardiovasc Nurs* 2005; 4: 273–277.
15. Ng TP and Niti M. Trends and ethnic differences in hospital admissions and mortality for congestive heart failure in the elderly in Singapore, 1991 to 1998. *Heart* 2003; 89: 865–870.
16. Huyen NN, Jullamate P and Kangchai W. Factors related to self-care behaviors among older adults with heart failure in Thai Nguyen General Hospital, Vietnam. *Int J Comp Internet Manage* 2011; 19(SP1): 7.1–7.6.
17. Van der Wal MH, van Veldhuisen DJ, Veeger NJ, et al. Compliance with non-pharmacological recommendations and outcome in heart failure patients. *Eur Heart J* 2010; 31: 1486–1493.
18. Liu MH, Wang CH, Lee CM, et al. Disease knowledge, self-care behaviors and life quality in heart failure: experience of the Taiwan National Health Care. *Brunei Int Med J* 2011; 7: 269–279.
19. Malhotra C, Wong GCS, Tan BC, et al. Living with heart failure perspectives of patients from Singapore. *Proc Singapore Healthc* 2016; 25: 92–97.
20. Knopman D, Boland LL, Mosley T, et al. Cardiovascular risk factors and cognitive decline in middle-aged adults. *Neurology* 2001; 56: 7–13.

21. Walden JA, Dracup K, Westlake C, et al. Educational needs of patients with advanced heart failure and their caregivers. *J Heart Lung Transplant* 2001; 20: 766–769.
22. Ert E, Yechiam E and Arshavsky O. Smokers' decision making: more than mere risk taking. *PLoS ONE* 2013; 8(7): e68064.
23. Jenksa RJ. Attitudes, perceptions, and risk-taking behaviors of smokers, ex-smokers, and nonsmokers. *J Psychol* 1992; 132: 569–575.
24. Burns N and Grove SK. *The practice of nursing research: conduct, critique and utilization*. 4th ed. Philadelphia, PA: Saunders, 2001.
25. Evangelista LS, Doering LV and Dracup K. Usefulness of a history of tobacco and alcohol use in predicting multiple heart failure readmissions among veterans. *Am J Cardiol* 2000; 86: 1339–1342.
26. Dunbar SB, Clark PC, Quinn C, et al. Family influences on heart failure self-care and outcomes. *J Cardiovasc Nurs* 2008; 23: 258–265.
27. Clark AM, Freydberg CN, McAlister FA, et al. Patients and informal caregivers' knowledge of heart failure: necessary but insufficient for effective self-care. *Eur J Heart Fail* 2009; 11: 617–621.
28. Molloy GJ, Johnston DW and Witham MD. Family caregiving and congestive heart failure. Review and analysis. *Eur J Heart Fail* 2005; 7: 592–603.
29. Sawafta FJS and Chen XH. Quality of life of Chinese heart failure patients and their family caregivers. *Intl J Appl Sci Tech* 2013; 3: 77–88.

Appendix I

You may or may not be familiar with the items below, but please try your best to answer each question by circling one of three options. All answers will be kept private. Thank you for your participation.

1. How often should patients with severe heart failure weigh themselves?
   a. Every week
   b. Now and then
   c. Everyday
2. Why is it important that patients with heart failure weigh themselves regularly?
   a. Because many patients with heart failure have a poor appetite
   b. To check whether the body is retaining fluid
   c. To assess the right dose of medicines
3. How much fluid are you allowed to take at home each day?
   a. 1.0 to 1.5 liters at the most
   b. As little fluid as possible
   c. As much fluid as possible
4. Which of these statements is true?
   a. When I cough a lot, it is better not to take my heart failure medication
   b. When I am feeling better, I can stop taking my medication for heart failure
   c. It is important that I take my heart failure medication regularly
5. What is the best thing to do in case of increased shortness of breath or swollen legs?
   a. Call the doctor or the nurse
   b. Wait until the next check-up
   c. Take less medication
6. What can cause a rapid worsening of heart failure symptoms?
   a. A high-fat diet
   b. A cold or the flu
   c. Lack of exercise
7. What does heart failure mean?
   a. That the heart is unable to pump enough blood around the body
   b. That someone is not getting enough exercise and is in poor condition
   c. That there is blood clot in the blood vessels of the heart
8. Why can the legs swell up when you have heart failure?
   Because
   a. the valves in the blood vessels in the legs do not function properly
   b. the muscles in the legs are not getting enough oxygen
   c. of accumulation of fluid in the legs
9. What is the function of the heart?
   a. To absorb nutrients from the blood
   b. To pump blood around the body
   c. To provide the blood with oxygen
10. Why should someone with heart failure follow a low-salt diet?
    a. Salt promotes fluid retention
    b. Salt causes constriction of the blood vessels
    c. Salt increases the heart rate
11. What are the main causes of heart failure?
    a. A myocardial infarction and high blood pressure
    b. Lung problems and allergy
    c. Obesity and diabetes
12. Which statement about exercise for people with heart failure is true?
    It is important to exercise
    a. as little as possible at home in order to relieve the heart
    b. at home and to rest regularly in between
    c. as much as possible at home
13. Why are water pills prescribed to someone with heart failure?
    a. To lower the blood pressure
    b. To prevent fluid retention in the body
    c. Because then they can drink more
14. Which statement about weight increase and heart failure is true?
    In case of an increase of over 2 kg in 2 or 3 days, you should
    a. report to the doctor at the next check up
    b. contact your doctor or nurse
    c. eat less
15. What is the best thing to do when you are thirsty?
    a. Suck an ice cube
    b. Suck on a cough drop/lozenge
    c. Drink a lot of fluid

Appendix 2

本问卷包括多条有关心脏衰竭的问题及叙述。请在你认为确定的答案前加上✓号。
（每条问题只限一个✓号）

1. 有严重心脏衰竭的患者应每隔多久测量自己的体重？
   - ☐ 每周一次
   - ☐ 不定时
   - ☐ 每日
2. 为什么定期测量体重对心脏衰竭患者是那么重要？
   - ☐ 因很多心脏衰竭患者的食欲是较差的
   - ☐ 为了检查身体是否储存水份
   - ☐ 为了评估正确的药量
3. 依照医护人员的指示，你每日最多可饮用多少水份或流质？
   - ☐ 最多1.0至1.5公升
   - ☐ 尽可能地少
   - ☐ 尽可能地多
4. 以下那项叙述是正确的？
   - ☐ 当我咳嗽频密时，最好不要服用治疗心脏衰竭的药物
   - ☐ 当我的病情稍为好转时，我可停止服用心脏衰竭的药物
   - ☐ 定时服用心脏衰竭的药物是非常重要的
5. 当呼吸困难或脚肿的症状严重了时，应如何处理最为妥当？
   - ☐ 致电医生或护士
   - ☐ 留待下次复诊才处理
   - ☐ 减少药物的份量
6. 以下那一项为导致心脏衰竭症状急速转坏的原因？
   - ☐ 高脂餐
   - ☐ 伤风或感冒
   - ☐ 缺乏运动
7. 何谓心脏衰竭？
   - ☐ 心脏不能泵足够血液到身体各部位
   - ☐ 缺乏运动和身体状况欠佳的人
   - ☐ 心脏血管内有血块凝结

8. 为什么当你患上心力衰竭后，你会有脚肿的情况出现呢？
   - ☐ 因脚内血管的瓣膜不能正常运作
   - ☐ 因双脚肌肉没有得到足够的氧气
   - ☐ 因脚部积存过多水份
9. 心脏的功能是什么？
   - ☐ 从血液中吸取养分
   - ☐ 将血液泵至身体各部位
   - ☐ 为血液提供氧气
10. 心脏衰竭的患者为何应该食用低盐餐？
    - ☐ 盐会促使水份滞留
    - ☐ 盐会令血管收缩
    - ☐ 盐会令心跳加速
11. 心脏衰竭的主要成因是什么？
    - ☐ 心肌梗塞和高血压
    - ☐ 肺部疾病和敏感
    - ☐ 肥胖和糖尿病
12. 以下那项对心脏衰竭患者的运动习惯的叙述是正确的？
    - ☐ 最重要的是在家里尽量少做运动，以减轻心臟的负担
    - ☐ 最重要的是在家里保持运动习惯，并在运动期间定时作出休息
    - ☐ 最重要的是在家里尽量多做运动
13. 为何会开处方,消水丸...給心脏衰竭的患者？
    - ☐ 以减低血压
    - ☐ 以预防水份积存体内
    - ☐ 因此患者就能饮更多水份及流质
14. 以下那项有关体重上升和心脏衰竭的叙述是正确的？
    - ☐ 如在2至3日间，体重上升2公斤以上，就应该在下次复诊时通知医生
    - ☐ 如在2至3日间，体重上升2公斤以上，就应该联络医生或护士
    - ☐ 如在2至3日间，体重上升2公斤以上，就应该减少进食
15. 感到口渴时，最好该怎么做？
    - ☐ 吸啜冰块
    - ☐ 含服喉糖
    - ☐ 饮大量水份