

# The role of patient activation in self-care behaviours of Korean older adults with heart failure

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## Abstract

**Aim:** This study was aimed at investigating the level of patient activation, and its association with self-care behaviours in older people with heart failure.

**Design:** Cross-sectional secondary data analysis was conducted.

**Methods:** We included a total of 182 Korean patients with heart failure who were aged  $\geq 65$  years for a cardiovascular outpatient clinic visit. Baseline characteristics, the Patient Activation Measure (PAM), health literacy, disease knowledge and self-care behaviours were collected via a self-administered questionnaire.

**Results:** The proportion of patient activation at Levels 1 and 2 was 22.5% and 14.3%, respectively. Highly activated patients had a high level of health literacy, disease knowledge and self-care behaviours. After adjusting for confounding factors, we observed that patient activation was the only statistically significant predictor of self-care behaviours among older people with heart failure. Healthcare professionals should help patients take active roles in their self-care through a comprehensive needs assessment including health literacy and disease knowledge.

## KEYWORDS

health literacy, heart failure, knowledge, older adults, patient activation, self-care

## 1 | INTRODUCTION

Heart failure (HF), a chronic and life-limiting illness, has become a global burden because of the high medical costs related to the high risk of mortality and frequent rehospitalization (Emmons-Bell et al., 2022). Heart failure prevalence rises sharply with age, which can cause highly prevalent rehospitalization in patients older than the age of 65 years (Savarese et al., 2022). The prevalence of HF in Korea is estimated to rise from 1.6% in 2015 to 3.4% in 2040 related to rapid population ageing and the westernization of lifestyles (Choi et al., 2021). Adherence to self-care behaviours is statistically significant in the long-term HF management (Savarese et al., 2022).

Nevertheless, self-care behaviours in HF patients was suboptimal because HF self-care mainly includes complex management skills, such as taking medications, symptom monitoring, fluid and sodium restrictions, and lifestyle modification (Pobrotyn et al., 2021). Heart failure self-care is more difficult for older adults than it is for younger adults. In particular, managing long-term HF conditions and multimorbidity is a key challenge for older adults with HF (Savarese et al., 2022). Namely, older HF patients more frequently experience polypharmacy, frailty and cognitive decline, which can lead to non-adherence to self-care than younger patients (Pobrotyn et al., 2021). In addition, age-related factors such as visual and hearing problems may interfere with HF self-care in older adults (Hafkamp et al., 2022).

Youn-Jung Son and Suk Jeong Lee co-first authors contributed equally to this work.

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Accordingly, it is necessary to assess factors influencing older patients' self-care abilities. A recent systematic review with 30 studies found that depression was a major factor related to poor adherence to HF self-care (Sedlar et al., 2017). It implies that more studies are warranted to explore other potential factors associated with self-care behaviours in HF patients.

Patient activation as a behavioural concept is described as willingness to take action to sustain one's own health and the confidence to engage in health behaviour changes (Carey et al., 2018; Masterson Creber et al., 2017). Patient activation is a dynamic rather than a static condition and is different from patient engagement or patient empowerment that reflects the patient's care experience and encourages patients to make informed decisions regarding health (Hickmann et al., 2022). More activated patients are shown to promote the adoption of healthy behaviours and better self-management (Carey et al., 2018). For this reason, increasing patient activation for engaging in self-care has been considered an integral part of new strategies for chronic disease management to improve health outcomes (Hafkamp et al., 2022). Understanding patient activation for self-care behaviours among HF patients is important for healthcare providers before delivering individualized care (Jacobson et al., 2018). Based on previous studies regarding patients with chronic diseases, patient activation has been mainly linked to several sociodemographic and clinical factors, such as age, education, income, living arrangements, long-term condition and comorbidities (Na et al., 2018; Yao et al., 2021; Zimbudzi et al., 2017). However, previous studies on identifying factors influencing patient activation for self-care behaviours were mainly conducted in Western countries and had provided inconsistent results (Newland et al., 2021; Tang et al., 2022).

Health literacy refers to people's ability to gain, comprehend and utilize health information, which can influence adherence to HF self-care behaviours (Matsuoka et al., 2016; Wu et al., 2017). Health literacy, cognitive skill-based concept is more closely related to with sociodemographic characteristics than is patient activation (Hibbard, 2017). Previous studies have presented that patient activation and health literacy can each make independent contributions to health outcomes (Hibbard, 2017; Huang et al., 2021). Disease knowledge is also necessary to change self-care behaviours in HF patients.<sup>18</sup> Previous findings have shown a statistically significant positive association between patient activation and health literacy and/or disease knowledge in patients with cardiovascular diseases (Dunlay et al., 2017; Jacobson et al., 2018). However, previous findings on the relationships between these variables are inconsistent in HF population (Jacobson et al., 2018; Magnani et al., 2018). Furthermore, the influences of these individual factors on HF self-care have been considerably investigated (Son & Song, 2012; Wu et al., 2017), but studies simultaneously examining the association of patient activation, health literacy and disease knowledge with self-care of patients with HF are lacking. Only one cross-sectional study has reported that higher patient activation level was only related to better disease management, regardless of health literacy or disease knowledge in adults with HF (Jacobson et al., 2018). Unfortunately, this study was not focussed on older adults with HF.

To date, there is a lack of knowledge on patient activation level and its association with self-care in older patients with HF in Korea. Thus, identifying the relationship of patient activation with HF self-care behaviours among older people may be beneficial for designing patient-centred interventions.

## 1.1 | Aim and hypothesis

Our main purpose was to investigate patients' activation level for self-care and its influence on self-care behaviours in older Korean HF patients. More specifically, we hypothesized that higher patient activation level is related to better self-care behaviours after adjusting for baseline characteristics, health literacy and disease knowledge of the participants.

## 2 | METHODS

### 2.1 | Study design, participants and data collection

We performed a secondary analysis using cross-sectional samples aged 65 years and older from a prospective cohort study that investigated the relationship of baseline health literacy with one-year hospital readmission among patients with HF in Korea (Son & Won, 2020a). The sampling strategies and data collection techniques have been detailed elsewhere. In summary, 286 survey questionnaires with clinical information were completed at two tertiary care hospitals between March and November 2018 in Korea. Our study analysed data from 182 outpatients (1) diagnosed with HF, (2) aged 65 years or older, (3) completed questionnaires on main study variables (patient activation, health literacy, disease knowledge and self-care behaviours) at 1 year after hospital discharge and (4) had sufficient understanding Korean language. However, patients who are required hospice care or heart transplantation, history of cognitive impairment including dementia and psychiatric diseases were excluded. Two trained research assistants who had clinical experiences collected data using self-report questionnaires and medical records review.

### 2.2 | Measures

#### 2.2.1 | Baseline patient characteristics

Data for sociodemographic information included age (years), sex, education, living arrangements and monthly income (US dollars). The New York Heart Association (NYHA) functional class, time after a first diagnosis of HF, left ventricular ejection fraction (LVEF, %), Charlson comorbidity index (CCI) and current cardiac medications for managing HF symptoms were included as clinical data via electronic medical records. Charlson comorbidity index for evaluating comorbidity burden is determined by the absence or presence of

the chronic disease over 10 years such as liver disease, chronic obstructive pulmonary disease and cancer (Formiga et al., 2018). The CCI are weighted and summed. Higher scores indicate severe conditions. Prescribed medications for relieving HF symptoms were collected.

### 2.2.2 | Health literacy

To assess patients' health literacy, we used the Heart Failure-Specific Health Literacy developed by Matsuoka et al. (2016). The Korean version of the tool includes 12 items with three dimensions—functional (four items), communicative (four items) and critical literacy (four items)—used to evaluate essential skills for reading and writing, abilities to actively engage in their self-care behaviours and capability to critically analyse information (Son & Won, 2022). Examples of the items are as follows: 'It is difficult to write documents from hospitals', 'I have been able to understand information regarding the treatment' and 'I have gathered information on treatments and hospitals to make my own decisions'. Each item was rated on a 4-point Likert scale (1—strongly disagree, 2—disagree, 3—agree, 4—strongly agree). Higher scores indicate better health literacy (Matsuoka et al., 2016). In this study, the obtained Cronbach's alpha was 0.80.

### 2.2.3 | Disease knowledge

The Patient Knowledge Questionnaire (PKQ) was used to measure the disease knowledge of patients with HF (Lainscak & Keber, 2005). The Korean version of the PKQ includes a 10 item with yes/no responses (Son & Song, 2012). Each correct answer was awarded one point. The higher the score, the more likely the respondent was to know about HF. Cronbach's alpha of 0.72 was obtained in this study.

### 2.2.4 | Patient activation

For evaluating patient activation, we used the patient activation measure (the PAM) (Hibbard et al., 2004). The PAM questionnaire included 13 items and measured on a 4-point Likert scale (1—strongly disagree, 4—strongly agree). Scores range from 0 to 100, higher scores indicate a more active participation in their own care. After obtaining a research licence for the PAM-13, we followed the Insignia Health Guidelines (Insignia Health, 2015) that divide patient activation into four levels of action. Patients at Level 1 (scores of 0.0–47.0) may not understand their roles and engage in their self-care. Patients at Level 2 (scores of 47.1–55.1) may have increased awareness but lack confidence in and knowledge of their self-care. Patients at Level 3 (scores of 55.2–72.4) are ready to take action. Patients at Level 4 (scores of 72.5–100)

actively engage in self-care and have more self-care skills. In this study, we obtained a Cronbach's alpha of 0.85.

### 2.2.5 | Self-care behaviours

To measure patients' self-care behaviours, we used the 9-item European Heart Failure Self-Care Behavior Scale (EHFScBS-9) (Jaarsma et al., 2009). This tool consists of nine items on a 5-point Likert scale. The Korean version of the EHFScBS-9 scale evaluates how people with HF monitor and cope with symptoms, such as breathlessness, fatigue and oedema, and how they perform self-care behaviours, including going onto a low-sodium diet (Son & Won, 2020b). Overall score ranges from 9 to 45, with higher scores reflecting a better level of self-care behaviour. A Cronbach's alpha of 0.83 was obtained in this study.

## 2.3 | Data analysis

Data analysis was conducted using SPSS version 26.0 for Windows. Descriptive statistics including frequencies, percentages, means and standard deviation (SD) were used. The chi-squared test and one-way analysis of variance (ANOVA) were used to present differences in patient characteristics, and main study variables by patient activation. For post hoc analysis, we applied Scheffe test. Pearson's correlation coefficient was applied to present bivariate relationships between the study variables.

Two-step hierarchical multiple regression models were performed to identify the impact of patient activation on self-care behaviour. In the first step, education level, monthly income and NYHA functional class that significantly differed by patient activation ( $p < 0.05$ ) were entered. Then, in the second step, patient activation, health literacy and disease knowledge were entered. A  $p$ -value less than 0.05 is considered as statistical significance in this study.

## 3 | RESULTS

### 3.1 | Patients' characteristics

As shown in Table 1, average age of the participants was 74.03 ( $SD = 5.50$ ), and 58.8% of participants were male ( $n = 107$ ). Participants who finished elementary school (sixth grade) or lower and lived alone were 51.6% ( $n = 94$ ) and 20.9% ( $n = 38$ ), respectively. Most participants' monthly income (85.7%,  $n = 156$ ) was less than 1000 (U.S. dollars). Most participants had NYHA classes I (53.8%,  $n = 98$ ) and II (40.1%,  $n = 73$ ). The mean score of time since HF diagnosis, CCI and LVEF (%) was 7.19 ( $SD = 2.72$ ), 1.89 ( $SD = 1.05$ ) and 54.13 ( $SD = 11.37$ ), respectively. Participants receiving ACE inhibitors (angiotensin-converting enzyme inhibitors) and ARB (angiotensin receptor blockers) were about one-half.

TABLE 1 Baseline characteristics of patients (N=182).

Characteristics	n (%) or mean $\pm$ SD
Age (years)	74.03 $\pm$ 5.50
65–69	41 (22.5)
70–79	112 (61.5)
80–84	29 (16.0)
Sex	
Male	107 (58.8)
Female	75 (41.2)
Education	
$\leq$ Elementary School	94 (51.6)
Middle school	88 (48.4)
Living arrangement	
Alone	38 (20.9)
Spouse	101 (55.5)
Family members	43 (23.6)
Monthly income (US dollars)	
<1000	156 (85.7)
$\geq$ 1000	26 (14.3)
NYHA functional class	
I	98 (53.8)
II	73 (40.1)
III–IV	11 (6.1)
Time since HF diagnosis (years)	7.19 $\pm$ 2.72
<5	57 (31.3)
$\geq$ 5	125 (68.2)
Charlson comorbidity index	1.89 $\pm$ 1.05
Left ventricular ejection fraction (%)	54.13 $\pm$ 11.37
<40	23 (12.6)
40–49	25 (13.7)
$\geq$ 50	134 (73.6)
Current cardiac medication	
ACEI or ARB, yes	91 (50.0)
Beta blocker, yes	120 (65.9)
Diuretics, yes	66 (36.3)
Digoxin, yes	45 (24.7)
Patient activation (total)	65.82 $\pm$ 26.67
Level 1	41 (22.5)
Level 2	26 (14.3)
Level 3	32 (17.6)
Level 4	83 (45.6)
Health literacy	31.05 $\pm$ 6.84
Disease knowledge	4.25 $\pm$ 2.23
Self-care behaviours	30.10 $\pm$ 6.52

Note: Patient activation using the Patient Activation Measure (PAM) survey was used under licence and reproduced with permission from Insignia Health (USA). All rights reserved.

Abbreviations: ACEI, Angiotensin Converting Enzymes inhibitor; ARB, Angiotensin Receptor Blocker; HF, Heart Failure; NYHA, New York Heart Association; PA, patient action measure; SD, standard deviation.

The average score of patient activation was 65.82 (SD=26.67). The proportion of patient activation at Levels 1 and 2 was 22.5% (n=41) and 14.3% (n=26), respectively. The mean score of health literacy, disease knowledge and self-care behaviours was 31.05 (SD=6.84), 4.25 (SD=2.23) and 30.10 (SD=6.52), respectively (Table 1).

### 3.2 | Differences in patients' characteristics by patient activation level

In Table 2, statistically significant differences existed in education level ( $p=0.027$ ), monthly income ( $p=0.024$ ) and NYHA functional class ( $p=0.034$ ) according to patient activation level. Namely, in Level 1, there was a higher proportion of patients with less than elementary level education, a monthly income under 1000 (US dollars) and having severe functional limitation in NYHA functional class III/IV than those in Level 4. However, no statistically significant differences in the other patient characteristics existed according to the patient activation level.

### 3.3 | Differences in health literacy, disease knowledge and self-care behaviours by patient activation level

In Table 3, significant differences existed in health literacy ( $p<0.001$ ), disease knowledge ( $p<0.001$ ) and self-care behaviours ( $p<0.001$ ) according to patient activation level. Patients in Level 1 had lower scores for health literacy, disease knowledge and self-care behaviours than those in Levels 2, 3 and 4.

### 3.4 | Relationships among patient activation, health literacy, disease knowledge and self-care behaviours

Table 4 shows a statistically significant association of patient activation with health literacy ( $p<0.001$ ), disease knowledge ( $p<0.001$ ) and self-care behaviours ( $p<0.001$ ). Additionally, statistically significant associations of health literacy existed with disease knowledge ( $p<0.001$ ) and self-care behaviours ( $p<0.001$ ). A statistically significant association of disease knowledge with self-care behaviours ( $p<0.001$ ) was also found.

### 3.5 | Predictors of self-care behaviours in patients with HF

In Table 5, in the first hierarchical multiple regression model, patients who had NYHA functional class I were more likely to have good adherence to self-care than those who had NYHA functional

TABLE 2 Differences in patients' characteristics by patient activation level (N=182).

Characteristics	Patient activation, Level 1 (n=39) n (%) or mean ± SD	Patient activation, Level 2 (n=28) n (%) or mean ± SD	Patient activation, Level 3 (n=28) n (%) or mean ± SD	Patient activation, Level 4 (n=87) n (%) or mean ± SD	$\chi^2$ (p)
Age (years)					5.09 (533)
65–69	6 (15.4)	7 (25.0)	4 (14.3)	24 (27.6)	
70–79	25 (64.1)	17 (60.7)	21 (75.0)	49 (56.3)	
≥80	8 (20.5)	4 (14.3)	3 (10.7)	14 (16.1)	
Sex					2.75 (0.431)
Male	24 (61.5)	15 (53.6)	20 (71.4)	48 (55.2)	
Female	15 (38.5)	13 (46.4)	8 (28.6)	39 (44.8)	
Education					14.22 (0.027)
≤Elementary School	28 (71.8)	13 (46.4)	13 (46.4)	40 (46.0)	
Middle school	11 (28.2)	15 (53.6)	15 (53.6)	47 (54.0)	
Living arrangement					6.60 (0.359)
Alone	8 (20.5)	3 (10.7)	7 (25.0)	20 (23.0)	
Spouse	23 (59.0)	18 (64.3)	18 (64.3)	42 (48.3)	
Family members	8 (20.5)	7 (25.0)	3 (10.7)	25 (28.7)	
Monthly income (US dollars)					9.41 (0.024)
<1000	39 (100.0)	24 (85.7)	24 (85.7)	69 (79.3)	
≥1000	0 (0.0)	4 (14.3)	4 (14.3)	18 (20.7)	
NYHA functional class					13.67 (0.034)
I	14 (35.9)	14 (50.0)	14 (50.0)	56 (64.4)	
II	20 (51.3)	14 (50.0)	13 (46.4)	26 (29.9)	
III-IV	5 (12.8)	0 (0.0)	1 (3.6)	5 (5.7)	
Time since HF diagnosis (years)					4.18 (0.652)
<5	15 (38.5)	10 (35.7)	10 (35.7)	22 (25.3)	
≥5	24 (61.5)	18 (64.3)	18 (64.3)	65 (74.7)	
Charlson comorbidity index	1.92 ± 0.96	1.79 ± 0.92	1.82 ± 1.02	1.93 ± 1.14	0.19 (0.904)
LVEF (%)					10.20 (0.117)
<40	2 (5.2)	6 (21.4)	4 (14.3)	11 (12.6)	
40–49	7 (17.9)	1 (3.6)	1 (3.6)	16 (18.4)	
≥50	30 (76.9)	21 (75.0)	23 (82.1)	60 (69.0)	
Current medication					
ACEI or ARB, yes	17 (43.6)	10 (35.7)	20 (71.4)	44 (50.6)	5.66 (0.130)
Beta blocker, yes	24 (61.5)	20 (71.4)	17 (60.7)	59 (67.8)	1.19 (0.756)
Diuretics, yes	13 (33.3)	12 (42.9)	8 (28.6)	33 (37.9)	1.49 (0.684)
Digoxin, yes	4 (10.3)	10 (35.7)	10 (35.7)	21 (24.1)	8.04 (0.052)

Note: Patient activation using the Patient Activation Measure (PAM) survey was used under licence and reproduced with permission from Insignia Health (USA). All rights reserved.

Abbreviations: ACEI, Angiotensin Converting Enzymes inhibitor; ARB, Angiotensin Receptor Blocker; HF, Heart Failure; LVEF, Left Ventricular Ejection Fraction; NYHA, New York Heart Association; PA, patient action measure; SD, standard deviation.

classes II to IV ( $p=0.002$ ). In the second model, patient activation was the only statistically significant predictor of self-care behaviour ( $p<0.001$ ). In Step 2, patient activation, health literacy and disease knowledge explained approximately 25% of the variance in the self-care behaviours of older patients with HF.

## 4 | DISCUSSION

This study presents the first findings on the levels of patient activation and the association of patient activation with self-care behaviours in Korean older HF patients. First of all, the mean patient

TABLE 3 Differences in health literacy, disease knowledge and self-care behaviours by patient activation level (N = 182).

Variables	Patient activation, Level 1 (n = 39) <sup>a</sup> Mean ± SD	Patient activation, Level 2 (n = 28) <sup>b</sup> Mean ± SD	Patient activation, Level 3 (n = 28) <sup>c</sup> Mean ± SD	Patient activation, Level 4 (n = 87) <sup>d</sup> Mean ± SD	F (p)	Post-hoc (Scheffe test)
Health literacy	25.46 ± 6.52	29.82 ± 5.15	30.79 ± 4.37	34.05 ± 6.45	18.86 (<0.001)	a < b, c, d
Disease knowledge	2.51 ± 1.88	4.14 ± 1.67	5.15 ± 1.98	5.11 ± 1.98	15.84 (<0.001)	a < b, c, d
Self-care behaviours	24.77 ± 6.87	29.07 ± 5.44	30.25 ± 5.40	32.78 ± 5.40	17.65 (<0.001)	a < b, c, d

Note: Patient activation using the Patient Activation Measure (PAM) survey was used under licence and reproduced with permission from Insignia Health (USA). All rights reserved.

TABLE 4 Correlation between patient activation, health literacy, disease knowledge, and self-care behaviours (N = 182).

Variables	Patient activation r (p)	Health literacy r (p)	Disease knowledge r (p)
Health literacy	0.61 (<0.001)		
Disease knowledge	0.56 (<0.001)	0.41 (<0.001)	
Self-care behaviours	0.58 (<0.001)	0.41 (<0.001)	0.28 (<0.001)

activation was 65.82. This result was lower than 67.8 of a study on atrial fibrillation in the United States (McCabe et al., 2018), 69.9 of a study on chronic diseases in Finland (Tusa et al., 2020) and 70.5 of a study on advanced HF in the United States (Carey et al., 2018). In contrast, our finding was considerably higher than 58.1 of a study on atrial fibrillation in China (Gholami et al., 2021) and 53.2 of a study on acute decompensated HF in the United States (Dunlay et al., 2017). Furthermore, nearly half of the patients in this study were in activation in Level 4 (45.6%) compared with a previous study on HF (Dunlay et al., 2017). The reason for the inconsistent result might be related to the study participants' age, chronic conditions and ethnicity (Masterson Creber et al., 2017). Namely, the relatively higher level of patient activation in this study may be linked to the fact that the age gap of the participants was narrow, and chronic conditions were considerably homogeneous on NYHA functional classes I and II. Another reason may be related to the patient's residency. All patients included in this study were urban residents. Existing literature on patient activation has reported that rural residents may have poor activation levels because of a lack of available healthcare resources (Masterson Creber et al., 2017). In Korea, the geographical maldistribution of the healthcare infrastructure and medical personnel resources is noted between urban and rural areas, which can lead to health disparities (Yi et al., 2019). Hence, further studies on older adults with HF are needed to identify ethnicity, chronic condition and urban–rural differences at the national and global levels.

Regarding associated factors of patient activation, our univariate and bivariate analysis showed that patient activation was statistically significantly related to education level, monthly income, NYHA functional class, health literacy and disease knowledge. For patients' characteristics by patient activation level, Level 1 patients were less educated and had lower monthly incomes than Level 4 patients. Our finding is similar to the finding from the previous studies that patients with higher educational levels and higher total income are more likely to be highly activated in their health care (Dunlay et al., 2017; Yao et al., 2021). Individuals with higher educational levels and income may have stronger self-care confidence and fewer difficulties in accessing healthcare utilization related to better health literacy (Magadi et al., 2022; Yao et al., 2021). In addition, patients with the lowest level of patient activation in this study had NYHA functional class III/IV compared with the highest level of patient activation. NYHA functional class III/IV is defined as marked mobility limitations and symptom burden at rest (Son & Won, 2020a). Our findings are supported by studies showing that functional impairment and higher symptom burden can act as major obstacles to patient activation for self-care among older adults with chronic illnesses (Na et al., 2018; Westman et al., 2022). However, the majority of the participants belonged to NYHA functional class I/II in this study due to convenience sampling method, which can lead to selection bias. Large sample size, and use of propensity score matching, can reduce bias (Ahmed & Aronow, 2008).

Compared with previous findings that have shown that older age is related to low activation (Newland et al., 2021; Zimbudzi et al., 2017), advanced age in this study was not associated with patient activation level. Future studies are needed to compare differences in youngest-old, middle-old and oldest-old patients by patient activation level among older adults with HF. With regard to health literacy and disease knowledge, we observed that there was a statistically significant positive correlation among patient activation, health literacy and disease knowledge. This finding was in line with the results from previous findings that patients with a higher level of activation are more likely to develop their self-care skills by gathering information, understanding it better, and obtaining it from various healthcare resources (Jacobson et al., 2018; Newland et al., 2021). On the contrary, patients with low level of health

TABLE 5 Predictors of self-care behaviours among older adults with heart failure (N = 182).

Predictors	Step 1			Step 2		
	$\beta$	95% CI	t (p)	$\beta$	95% CI	t (p)
Education (1 = $\geq$ middle school)	0.12	-0.01 to 0.69	1.89 (0.060)	0.08	-0.08 to 0.53	1.44 (0.152)
Monthly income (1 = $\geq$ 1000 US dollars)	0.09	-0.42 to 2.19	1.34 (0.182)	0.28	-0.86 to 1.42	0.49 (0.628)
NYHA functional class (1 = $\geq$ II)	-0.20	-3.57 to -0.79	-3.09 (0.002)	-0.11	-2.43 to 0.07	-1.86 (0.064)
Patient activation				0.56	0.26 to 0.42	8.15 (<0.001)
Health literacy				0.05	-0.08 to 0.21	0.91 (0.366)
Disease knowledge				-0.11	-0.75 to 0.07	-1.62 (0.106)
Adjusted $R^2$ , F (p), $\Delta R^2$	0.07, 6.34 (<0.001), 0.08			0.31, 18.25 (<0.001), 0.25		

Abbreviations: CI, confidence interval; NYHA, New York Heart Association; SD, standard deviation.

literacy and disease knowledge are less likely to play active roles in chronic illness management (Munkhtogoo et al., 2022). As this study is secondary analysis based on a cross-sectional study, there is a need for longitudinal studies that can examine the causality between these variables.

After adjusting for confounding factors, our main finding showed that patient activation was the only statistically significant determinant of HF self-care behaviours among older people. Our result is supported by similar findings from previous studies that there was a positive association between patient activation and self-care behaviours in patients with chronic conditions (Newland et al., 2021; Shively et al., 2013). Highly activated HF patients tend to be better informed and more proactive about their self-care, which can result in improved health outcomes (Shively et al., 2013). Therefore, healthcare providers should consider closely evaluating patient activation before designing patient-centred self-care strategies. In this study, we found that there was statistically significant correlation among health literacy, disease knowledge and self-care behaviours. More researches are required to determine the mediating roles of health literacy and disease knowledge in the relationship of patient activation with self-care behaviours in older HF patients considering cultural diversity.

Furthermore, this study showed that patient activation, health literacy and disease knowledge explained only approximately 25% of the total variance in the self-care behaviours of older HF patients. According to recent studies regarding the role of partners in patient activation among cardiac patient, partners may be a key resource in HF management because partner presence can contribute to or impede activation in patients' self-care behaviours (Rapelli et al., 2020, 2022). Unfortunately, this study did not include additional information on partner or spouse such as relationship quality and type of caregiving. Rapelli et al. (2020) found that partners' overprotection was found to be high for patient in NYHA functional class II. It implies that partner support may differ depending on the severity of the disease, which may link to patient activation for HF self-care. Therefore, future studies are needed to consider possible factors related to partner presence and patients' perspective

including depression, and cognitive function in older HF patients (Sedlar et al., 2017).

#### 4.1 | Limitations

This study has some limitations. First, this study presents a secondary analysis using cross-sectional data from an existing data set from two hospitals in Korea. Hence, causality cannot be inferred. Future research should collect multicentre longitudinal data to confirm our findings in the older HF population. Second, most study participants had NYHA functional classes I and II, which may have influenced the overestimation of the level of patient activation and self-care behaviours in this population. In addition, the patients who voluntarily decide to participate at a research subject in this study might have been more motivated than those who refused to participate, which can lead to sampling bias. Third, self-reported measures can cause response bias, which is influenced by socially desirable answers. Fourth, even though patient activation primarily focusses on behaviour change through having confidence to take action to maintain one's health compared with health literacy, there may be overlapping features such as knowledge and skills regarding managing one's own health care (Hibbard, 2017; Huang et al., 2021). Lastly, partner presence may play a statistically significant role in encouraging patient activation for HF self-care in older population (Berton et al., 2022). However, this study only focussed on patient's individual aspects. Thus, further studies are required to investigate the role of partner support, dyadic coping, and relationship quality between patients and their partners in patient activation for HF self-care.

#### 5 | CONCLUSIONS

In HF disease management, adherence to self-care behaviours is a key component in preventing adverse outcomes and reducing unnecessary healthcare costs. Our findings showed that higher levels of patient activation predicted better HF self-care behaviours

in older patients. Healthcare professionals should be highly aware of the significance of evaluating patient activation as a modifiable factor before patient education regarding self-care or designing patient-centred self-care strategies. Additionally, our results highlight that it may be beneficial to comprehensively evaluate patients' socio-economic and functional status, health literacy and disease knowledge to promote patient activation in older people with HF. Future longitudinal studies are required to examine the causal relationship among the identified variables, patient activation and self-care behaviours in older HF patients considering living arrangements and disease severity.

## AUTHOR CONTRIBUTIONS

The authors had made substantial contributions to the conception, design of the work, the acquisition, analysis, interpretation of data and draft of the manuscript.

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## CONFLICT OF INTEREST STATEMENT

The author has no conflicts of interest to declare.

## DATA AVAILABILITY STATEMENT

The data are not publicly available due to privacy or ethical restrictions.

## ETHICS STATEMENT

The institutional research board of Chung-Ang University in Seoul (IRB: 1041078-202,203-HR-083) approved the study protocol. Before conducting the study, we obtained voluntary written informed consent from all study participants.

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