Received: 28 January 2020 | Revised: 5 May 2020 | Accepted: 10 June 2020

DOI: 10.1111/jjns.12359



JAPAN JOURNAL OF NURSING SCIENCE WILEY

ORIGINAL ARTICLE

# The mediating effect of resilience on the relationship between Type D personality and self-care behavior in patients with heart failure

**Ji Min Heo**[1] | **Chul-Gyu Kim**[2]

[1]Management & Welfare Division, Settlement Support Center for North Korea Refugees (Hanawon), Anseong-si, Gyeonggi-do, South Korea

[2]Department of Nursing, Chungbuk National University, Cheongju, Chungbuk, South Korea

**Correspondence**
Chul-Gyu Kim, Department of Nursing, Chungbuk National University, 1 Chungdae-ro, Seowon-Gu, Cheongju, Chungbuk, 28644, South Korea.
Email: cgkim@cbnu.ac.kr

**Abstract**

**Aim:** There have been few studies done looking at the relationship between resilience, Type D personality, and self-care behavior in patients with heart failure. The purpose of this study was to identify the mediating effect of resilience on the relationship between Type D personality and self-care behavior in patients with heart failure.

**Methods:** The subjects consisted of a sample of 90 heart failure patients aged ≥20 years who visited the cardiology outpatient clinic in the Chungbuk area of South Korea.

**Results:** Among 90 patients, 49 subjects (54.0%) were classified as Type D personality, who exhibited statistically significant differences in resilience and self-care behavior ($p < .001$). A statistically significant correlation was also observed between self-care behavior score and resilience score ($p < .01$). The resilience had full mediation effects on the relationship between Type D personality and self-care behavior. In other words, the higher their resilience, the better their self-care behavior.

**Conclusions:** The study showed that resilience and Type D personality have important effects on self-care behavior.

KEYWORDS

heart failure, resilience, self-care, Type D personality

## 1 | INTRODUCTION

Heart failure is a chronic disease with which a patient may live long after the onset, and treatment is focused more on symptom relief rather than the cure. The in-hospital mortality rate of heart failure in South Korea is 6.4%, and the mortality rate at 1 year after the onset is 15%, and at 4 years, it is 30% (The Korean Society of Heart Failure, 2017). Moreover, the readmission rates are as high as 6.4 and 24.0% within 30 days and 90 days, respectively (Lee et al., 2014). A vicious cycle of repeated hospitalizations and repeated visits to the emergency department often ensue with such patients (The Korean Society of Heart Failure, 2017). In order to reduce the mortality and readmission rate of patients with heart failure, fostering self-care is as important as providing treatment. Several studies have reported that enhancing self-

Addresses of the institutions at which the work was carried out: Cheongju St. Mari's Hospital, 173-19 Juseong-ro, Cheongwon-Gu, Cheongju, Chungbuk, 28323, Republic of Korea.

**Credits**: This article is a revision of the first author's master thesis at Chungbuk National University. Chul-Gyu Kim was the supervising professor of the thesis.

  

care activities reduced hospitalization, readmission rates, and mortality (McAlister, Stewart, Ferrua, & McMurray, 2004; Moser et al., 2012). Therefore, increasing self-care is essential for the heart failure patient. Since the level of self-care behaviors among heart failure patients is low (Bidwell et al., 2015; Daryasari, Karkezloo, Mohammadnejad, Vosooghi, & Kagi, 2012; Shim & Hwang, 2016), it is necessary to identify modifiable factors to improve self-care behaviors.

The factors influencing self-care behavior are personal factors, clinical factors, social factors, psychological factors, and cognitive factors (Biddle, Moser, Pelter, Robinson, & Dracup, 2020; Bidwell et al., 2015; Moser et al., 2012; Pelle, Schiffer, Smith, Widdershoven, & Denollet, 2010). Of these factors, personal factors and clinical factors are characteristics difficult to change. With regard to social factors, 20% of elderly people in South Korea are living alone (Chung et al., 2015), which necessitates building community or national support networks. Therefore, personal, clinical, and social factors are relatively harder in which to intervene than psychological and cognitive factors such as depression, self-efficacy, resilience, Type D personality, health literacy, and knowledge (Biddle et al., 2020; Bidwell et al., 2015; Cao, Wang, Wong, & Chow, 2016; Cheon & Kang, 2016; Pelle et al., 2010; Shin, Chu, Jang, & Kang, 2016; Widdershoven, Kessing, Schiffer, Denollet, & Kupper, 2013).

Type D personality is the tendency to be vulnerable to negative emotions and the tendency to suppress self-expression consciously in social interaction. It is related to the occurrence, prognosis, and mortality of coronary artery disease (Mols, Martens, & Denollet, 2010). This personality is also a factor that decreases the adherence to treatment orders (Cheon & Kang, 2016), and it is known that it causes the deterioration of the quality of life (Pedersen & Denollet, 2003). In a study examining the effects of Type D personality in heart failure patients, Type D personality was considered to be an important influential factor in increasing mortality (Coyne et al., 2011) and readmission (Lin et al., 2019), as it interferes with health practices, and diminishes health-related coping skills (Schiffer, Denollet, Widdershoven, Hendriks, & Smith, 2007). In addition, Type D personality is a negative factor in self-care behaviors in patients with heart failure (Widdershoven et al., 2013), and it showed a negative relationship with self-efficacy and self-care in a Chinese study (Cao et al., 2016).

Since patients with heart failure usually suffer repeated crises, resilience for managing and overcoming these is important (Kralik, van Loon, & Visentin, 2006). Resilience to overcome crises and adversity and to perform adaptive functions (Masten, 2001), can be strengthened by external help or education (Grafton, Gillespie, & Henderson, 2010) and improved well-being in adults with chronic disease (Tecson, Wilkinson, Smith, & Ko, 2019). Coronary artery disease patients with higher resilience showed higher health-promoting behaviors (Cheon & Kang, 2016), and hypertension patients showed similar results; the higher the resilience, the higher the self-care capacity (Jeong, Lee, & Kim, 2017). Resilience also had mediating effects on the relationship between Type D personality and self-care behavior in patients with coronary artery disease (Cheon & Kang, 2016).

In other words, resilience increases health promotion and self-care behavior to maintain health status and improve quality of life. However, there is no study on the relationship between resilience, Type D personality, and self-care behavior in patients with heart failure. Therefore, the purpose of this study is to identify the mediating effects of resilience on the relationship between Type D personality and self-care behavior in patients with heart failure.

## 2 | METHODS

### 2.1 | Study design

This cross-sectional descriptive study explores the mediating effect of resilience on the relationship between Type D personality and self-care behavior in patients with heart failure.

### 2.2 | Participants and setting

The subjects were heart failure patients who visited the cardiology outpatient clinic at the C hospital located in the Chungbuk area of South Korea.

The inclusion criteria for this study were:

1 a person who is 20 years of age or older who understands the research content and agrees to participate
2 a person who has been diagnosed with heart failure by a cardiologist
3 a person who is conscious and able to communicate.

The study sample size was calculated with the NCSS & PASS 12 (2014) program. Given a conservative $R^2$ of 0.3 (0.22 as adjusted $R^2$ [Cheon & Kang, 2016]) for the self-care behavior score as the primary outcome, a power of 0.95, an alpha of .05, with 14 controlled variables, and two independent variables (Type D personality and resilience), calculations were made in line with Cohen's sampling formula, and a minimum sample of 76 was determined. A sample of 90 respondents was accessed, allowing for dropouts and non-responses. The total

number of patients who provided reliable responses was 90, and none of the participants were dropped for the analysis.

## 2.3 | Ethical considerations

Ethical approval for this study was granted by the institutional review board of Chungbuk National University (IRB Approval No. CBNU-201701-BMSB-448-01). Informed consent was obtained from patients who voluntarily agreed to participate in the study while ensuring them about confidentiality and anonymity of their information. Participants were informed that they could withdraw from the study at any point during the study.

## 2.4 | Measures

### 2.4.1 | Type D personality

To measure Type D personality, the personality measurement tool developed by Denollet (2005) was utilized, and the Type D Personality Scale-14 (DS14) was also used, which was modified by Lim et al. (2011). This tool measures 14 questions and five points on a Likert scale, from 0 (no) to 4 (yes). Type D personality is defined as having more than 10 points in both negative emotions (seven questions) and social suppression (seven questions). The instrument reliability of Denollet (2005) at the time of development was Cronbach's $\alpha = .88$ in negative emotion, and .86 in social suppression. In Lim et al.'s (2011) study, negative emotions were .87, and social restraints were .77. In this study, Cronbach's $\alpha$ for negative emotions was .94, and for social suppression, it was .96.

### 2.4.2 | Resilience

Cardiovascular Disease Resilience (CDR) developed by Shin (2010) was used to measure resilience. A total of 25 questions were tested on the five-point Likert scale, and each item was measured from 1 point (not very similar) to 5 points (very strongly), indicating that the higher the score, the higher the resilience. The reliability at the time of development was Cronbach's $\alpha = .84$ (Shin, 2010), which was .96 in this study.

### 2.4.3 | Self-care behavior

Self-care behavior measures were used as revised and supplemented with the EHFScB (European Heart Failure Self-care Behavior) tool developed by Jaarsma, Strömberg, Mårtensson, and Dracup (2003), which was originally created for patients with heart failure. Although the tool consists of 12 questions, consideration was also given to items such as quitting smoking and avoiding taking non-steroidal anti-inflammatory drugs (NSAIDs), as proposed by Jaarsma et al. (2003). Moreover, the 2016 guidelines for the management of chronic heart failure as presented by The Korean Society of Heart Failure (2016) was also used, along with the Self-Care of Heart Failure Index (SCHFIV 6) by Riegel, Lee, Dickson, and Carlson (2009). Five items—which were ankle edema symptoms, regular hospital visits, no smoking, stopping drinking, and drug use such as NSAIDs—were added. The revised instrument was validated for content validity by two cardiologists, two head nurses, and one professor of the nursing department. The content validity index of all items was 0.80 or higher.

Consequently, we used a total of 17 questions with five questions added to this tool. The self-care instrument measures the likelihood on a five-point scale and measures each item from 1 point (always) to 5 points (not at all), with a lower score indicating greater self-care. The instrument reliability of Jaarsma et al. (2003) at the time of development was Cronbach's $\alpha = .76$, and it was .89 in this study.

## 2.5 | Data collection

Data collection was conducted from May to August 2017. Among the outpatient department cardiology patients, suitable participants were screened with electronic medical records, and by directly interviewing them. After describing the purpose and method of the study to the research subjects, the questionnaire was read to the subjects who agreed to participate, and data were recorded by writing their answers for them.

## 2.6 | Data analysis

The data were analyzed using the SPSS WIN 23.0 program. Subjects' characteristics, Type D personality, resilience, and self-care behavior were analyzed by frequency, percentage, mean, and standard deviation. Differences in the degree of self-care behavior according to the characteristics of the subjects and Type D personality were analyzed by independent *t* test, one-way analysis of variance, and Mann–Whitney *U* test. Correlations between resilience and self-care behavior were analyzed using Pearson's correlation coefficient. To examine the mediating effects of resilience on the relationship between Type

D personality and self-care behavior, hierarchical multiple regression – the test method of mediating effect suggested by Baron and Kenny (1986) – was conducted. This method comprised four steps: step 1 – regress the dependent variable (self-care behavior) on the independent variable (Type D personality); step 2 – regress the

**TABLE 1** Differences in self-care behavior according to the characteristics of patients with heart failure ($N = 90$)

| Variables | Category | *N* (%) | Self-care behavior | | |
|---|---|---|---|---|---|
| | | | Mean ± *SD* | t/F/U | *p* |
| Total | | 90 (100.0) | 41.71 ± 12.31 | | |
| Age | <60 years | 11 (12.2) | 45.36 ± 12.01 | 1.03 | .382 |
| | 60 ~ 69 years | 19 (21.1) | 41.89 ± 14.51 | | |
| | 70 ~ 79 years | 34 (37.8) | 39.06 ± 11.36 | | |
| | ≥80 years | 26 (28.9) | 41.71 ± 12.31 | | |
| Gender | Men | 33 (36.7) | 44.58 ± 13.27 | 1.70 | .090 |
| | Women | 57 (63.3) | 40.05 ± 11.52 | | |
| Marital status | Single | 6 (6.7) | 47.00 ± 14.21 | −1.14[a] | .254 |
| | Married | 84 (93.3) | 41.33 ± 12.17 | | |
| Education | Illiteracy (0 years) | 27 (30.0) | 44.11 ± 12.18 | 0.90 | .410 |
| | Elementary ~ middle school (6 ~ 9 years) | 39 (43.3) | 39.97 ± 10.84 | | |
| | More than high school (>9 years) | 24 (26.7) | 41.83 ± 14.59 | | |
| Occupational status | No occupation | 75 (83.3) | 40.35 ± 11.76 | −2.41 | .018 |
| | Occupation | 15 (16.7) | 48.53 ± 13.15 | | |
| Religion | No religion | 47 (52.2) | 45.68 ± 12.37 | 3.38 | .001 |
| | Religious | 43 (47.8) | 37.37 ± 10.81 | | |
| Monthly individual income | Less than 500 USD | 72 (80.0) | 41.21 ± 11.48 | −0.65 | .524 |
| | Larger or equal to 500 USD | 18 (20.0) | 43.72 ± 15.42 | | |
| Types of medical security | Health insurance | 66 (73.3) | 43.29 ± 12.13 | 2.05 | .043 |
| | Medical aid | 24 (26.7) | 37.38 ± 12.01 | | |
| Participation in heart failure education | No | 70 (77.8) | 43.73 ± 11.57 | 3.04 | .003 |
| | Yes | 20 (22.2) | 34.65 ± 12.51 | | |
| Duration of disease | <2 years | 31 (34.4) | 41.81 ± 12.63 | 0.57 | .569 |
| | ≥2 ~ 6 years | 26 (28.9) | 39.73 ± 11.45 | | |
| | ≥6 years | 33 (36.7) | 43.18 ± 12.81 | | |
| A causative disease | Coronary artery disease | 38 (42.2) | 42.21 ± 12.00 | 0.66 | .578 |
| | Cardiomyopathy | 29 (32.2) | 39.52 ± 11.53 | | |
| | Hypertensive heart disease | 11 (12.2) | 45.45 ± 13.08 | | |
| | Valvular disease of the heart | 12 (13.3) | 42.00 ± 14.84 | | |
| Left ventricle ejection fraction | <50% | 47 (52.2) | 40.23 ± 12.27 | −1.19 | .236 |
| | ≥50% | 43 (47.8) | 43.33 ± 12.29 | | |
| Experience of hospitalization | No | 14 (15.6) | 41.64 ± 10.74 | −0.02 | .982 |
| | Yes | 76 (84.4) | 41.72 ± 12.65 | | |
| Number of comorbidities | 1 ~ 2 | 30 (33.7) | 40.23 ± 12.94 | 0.45 | .641 |
| | 3 ~ 4 | 41 (46.1) | 42.98 ± 11.81 | | |
| | ≥5 | 18 (20.2) | 41.22 ± 12.80 | | |
| New York Heart Association class | Class I ~ II | 58 (64.4) | 40.19 ± 12.29 | −1.59 | .115 |
| | Class III ~ IV | 32 (35.6) | 44.47 ± 12.06 | | |

[a]Mann–Whitney *U*.

mediator (resilience) on the independent variable; step 3 – regress the dependent variable on the mediator; step 4 – regress the dependent variable on both the mediator and independent variable. Sobel's test was used to verify the significance of the mediation effects.

## 3 | RESULTS

### 3.1 | Characteristics of the subjects and differences in self-care behavior

The mean age of the subjects was 72.61 ± 11.88 years, and 57 (63.3%) of the participants were female. There were 39 elementary and middle school graduates (43.3%), the unemployed or ones with no occupation were 75 (83.3%), and 72 subjects (80.0%) had a monthly individual income of less than 500 USD. Seventy subjects (77.8%) had no participation in heart failure education, and 76 patients (84.4%) had previous hospitalization experience (Table 1).

Self-care behaviors by occupation, religion, type of medical security, and participation in heart failure education were significantly different ($p < .05$). Namely, the self-care behaviors were better in cases of no occupation, having a religion, medical aid, and subjects with previous participation in heart failure education (Table 1).

Self-care behaviors according to the severity of heart failure were measured with left ventricular ejection fraction, New York Heart Association (NYHA) class, or comorbidity, and these were not significantly different ($p > .05$, Table 1).

### 3.2 | Type D personality and resilience, self-care

Forty-nine (54%) were subjects of Type D personality, and negative affectivity and social inhibition were 19.16 ± 3.27 and 19.93 ± 4.09 respectively for the Type D personality, 7.07 ± 3.77 and 4.95 ± 2.61 for the non-D type personality. The mean (± *SD*) of the resilience score was 81.88 ± 17.38, and that of the self-care behavior score was 41.71 ± 12.31 (Table 2).

### 3.3 | Difference between resilience and self-care behavior according to personality type and relationships between resilience and self-care behavior

There were statistically significant differences between resilience and self-care behavior scores according to the personality type ($p < .001$). In other words, the resilience score was higher, and the self-care behavior score was better in the non-D type personality than those in the Type D personality. Self-care behavior scores showed a strong negative correlation with resilience scores ($r = -0.728$, $p < .001$). This means that the higher the resilience (higher score), the better the self-care behavior (lower score, Table 3).

### 3.4 | Mediating effects of resilience on the relationship between Type D personality and self-care behavior

In order to test the mediating effect, occupation, religion, type of medical security, and experiences with heart failure education, which were found to have a statistically significant impact on self-care behavior, were adjusted for control factors. Prior to performing multiple regression, as a test of multicollinearity, the tolerance limits ranged from 0.469 to 0.745, with 0.1 or more. The variance inflation factor was 1.000 to 2.092, which was smaller than 10, confirming that multicollinearity was not a problem. In addition, residual autocorrelation of the model showed that the Durbin-Watson value was 1.639, and there was no autocorrelation of the residuals. Moreover, the results of the Shapiro–Wilk test also showed that the regression model is valid because the normality of the residual was satisfied with a $p$ value of .269.

**TABLE 2** Type D personality, resilience, and self-care behavior of study subjects ($N = 90$)

| Variables | Category | *N* (%) | Range | Negative affectivity Mean ± *SD* | Social inhibition Mean ± *SD* | Mean ± *SD* | Min ~ max |
|---|---|---|---|---|---|---|---|
| Personality type | Type D | 49 (54.0) | 10 ~ 28 | 19.16 ± 3.27 | 19.93 ± 4.09 | | 12 ~ 27 |
| | Non-Type D | 41 (46.0) | 0 ~ 9 | 7.07 ± 3.77 | 4.95 ± 2.61 | | 0 ~ 9 |
| Resilience | | | 25 ~ 125 | | | 81.88 ± 17.38 | 52 ~ 121 |
| Self-care behavior | | | 17 ~ 85 | | | 41.71 ± 12.31 | 18 ~ 67 |

**TABLE 3** Differences in self-care behavior and resilience according to Type D personality and correlation between resilience and self-care behavior ($N = 90$)

| Variable | Type D personality Mean ± *SD* | Non-Type D personality Mean ± *SD* | t | *p* | Resilience r (*p*) | Self-care behavior r (*p*) |
|---|---|---|---|---|---|---|
| Resilience | 70.47 ± 10.79 | 95.54 ± 13.47 | −9.80 | <.001 | 1 | |
| Self-care behavior | 47.37 ± 10.20 | 34.95 ± 11.25 | 5.49 | <.001 | −.728 (<.001) | 1 |

**TABLE 4** Mediating effect of resilience on the relationship between Type D personality and self-care behavior ($N = 90$)

| Path | | | B | *SE* | β | *t* | *p* | Adj. $R^2$ | F | *p* |
|---|---|---|---|---|---|---|---|---|---|---|
| Step 1 | Type D personality | → Self-care behavior | −9.173 | 2.41 | −.391 | −3.80 | <.001 | .355 | 11.17 | <.001 |
| Step 2 | Type D personality | → Resilience | 22.342 | 3.02 | .615 | 7.41 | <.001 | .580 | 26.55 | <.001 |
| Step 3 | Resilience | → Self-care behavior | −.488 | .050 | −.689 | −9.70 | <.001 | .565 | 58.75 | <.001 |
| Step 4 | Type D personality | → Self-care behavior | 2.263 | 2.50 | .096 | .91 | .368 | .613 | 24.45 | <.001 |
| | Resilience | | −.512 | .074 | −.798 | −7.13 | <.001 | | | |

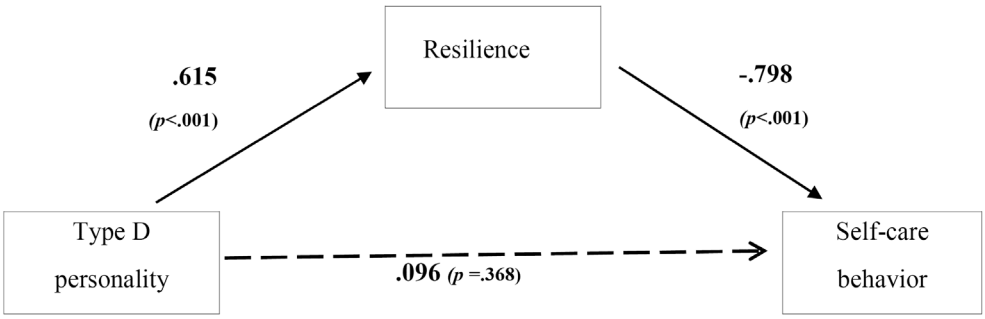


**FIGURE 1** Model for mediating effect for resilience between Type D personality and self-care behavior

The influence of resilience on self-care behavior was statistically significant ($p < .001$), while the influence of Type D personality was not statistically significant ($p = .368$, Table 4). In other words, resilience had a full mediation effect on the relationship between Type D personality and self-care behavior (Table 4, Figure 1). The Sobel's test was used to confirm the statistical significance of the mediator effect, and the direct effect of Type D personality was not significant, while the indirect effect of Type D personality through resilience was statistically significant ($z = -4.57$, $p < .001$).

## 4 | DISCUSSION

In this study, 54.0% of subjects were Type D personality, which showed 9 ~ 21% higher proportion than those of previous studies involving heart failure patients (Cao et al., 2016; Schiffer et al., 2005). The possible reason for this difference might be that the subjects of this study were of higher age, lower left ventricular ejection fraction, and higher NYHA class than those of the previous study subjects. However, this result is consistent with the findings that patients with cardiovascular disease, hypertension patients, and patients with peripheral vascular disease were more likely to have Type D personality distribution than healthy people (Aquarius, Denollet, de Vries, & Hamming, 2007; Hwang & Shin, 2015; Pelle et al., 2010). Type D personality was found to be more frequent than the non-D type personality in heart failure patients who are in the final stages of cardiovascular disease.

It was also found that the resilience of heart failure patients was lower than that of cancer patients (Kim & Byun, 2013) and higher than that of other chronic disease patients such as dialysis patients (Kong, 2009), and the elderly with chronic diseases (Kong, Hong, & Jeong, 2015). It is plausible that the higher seriousness of the disease may demonstrate higher resilience. However, there is no study of the resilience in heart failure patients, so we cannot compare the results. Therefore, more research is needed in this area.

The self-care behavior score was similar to the results of Shim and Hwang (2016), and self-care has been well

conducted in cases with unemployed rather than employed subjects, with religion rather than without religion, and with medical aid rather than health insurance. This is consistent with previous studies' reports (Daryasari et al., 2012; Jeong et al., 2017). Occupation is a significant contributor to lowering self-care behavior (Kato et al., 2009), and this may be due to the difficulties in implementing changes in lifestyle, such as exercise and dietary habits in the case of the employed. The religion and reduction of the economic burden of treatment also positively affects the emotional state of patients with heart failure, and it seems to increase self-care behavior by allowing patients to respond more effectively to their physical symptoms. Furthermore, patients who had previous experience with heart failure education had higher self-care behavior than those who did not, which also supports previous studies, suggesting that self-care is performed better by increasing knowledge of disease (Daryasari et al., 2012; Shin et al., 2016). Therefore, to improve the self-care behavior of heart failure patients, an effective education program is needed.

Also, in the case of the Type D personality, resilience was low, and self-care behavior was worse (higher score) in this study, which is consistent with a study done by Cheon and Kang (2016) which reported lower resilience in subjects with Type D personality. The one possible reason for this result might be the patients with Type D personality seemed to respond negatively to their condition and did not follow the treatment instruction by using a negative coping method (Williams et al., 2008). Moreover, interventions such as stress management, social interaction, group activity, and individual counseling to rehabilitate from coronary artery disease led to a lower tendency of Type D personality and a change of non-Type D personality (Karlsson et al., 2007; Pelle et al., 2008). Nursing interventions to lessen Type D personality in heart failure patients is also needed.

When the model was controlled for variables affecting self-care behavior, such as occupation, religion, type of medical security, and participation in heart failure education, resilience had a full mediation effect on the relationship between Type D personality and self-care behavior. Similarly, in the case of patients with systemic lupus erythematosus, resilience was shown to have a full mediating effect between stress and therapeutic compliance (Lee & Min, 2017). In addition, resilience in cancer patients receiving chemotherapy was found to have a direct or indirect effect on adaptation (Lee, Ryu, & Kim, 2011). For patients with heart failure, resilience was found to be a very important factor in the self-care behavior of patients with Type D personality. Therefore, a program that can improve self-care behavior is plausible by improving the resilience of patients with heart failure.

Programs have been developed to improve resilience in previous studies, and the effects have been reported (Giovannetti et al., 2020; Lim & Han, 2013; Loprinzi, Prasad, Schroeder, & Sood, 2011). One of the programs to improve resilience consists of 12 weekly 2.5-hr sessions. The first seven weekly sessions consist of an introductory module, five main modules (mindfulness, acceptance, cognitive defusion, self-as-context, values and meaningful action), and a review module. The last five sessions provide a review of the program as a booster (Giovannetti et al., 2020). Another program consists of fostering effective communication skills, crisis management, coping methods, problem-solving, and utilizing available resources for 5 weeks (Lim & Han, 2013). The other program consists of two 90-min sessions, one optional 45 min session, and three telephone calls (Loprinzi et al., 2011). Therefore, these resilience improvement programs could be applied to patients according to individual situations such as job and marital status. Patients with heart failure would benefit improved resilience, self-care behavior, and long-term health outcome from this kind of program.

When we develop a nursing intervention program, cultural differences may be considered. For example, when a family member is ill, other family members are more frequently involved in caring in Asian countries compared to Western countries (Moser et al., 2012). Similar to this context, since family support was related to self-care behavior and the resilience of patients with chronic diseases in South Korea (Cho & Yoo, 2015; Park, Moon, & Park, 2009), nursing intervention encompassing family education was effective to increase self-care behavior (Ko, Seong, Cho, & Sok, 2018). Therefore, family support and education may need to be included in the nursing program for self-care behavior in Korean or Asian culture.

### 4.1 | Limitation

There are several limitations to acknowledge in the study. First, because the design of this study was cross-sectional, there was a limit to inferring causality. Moreover, there was a limit to the generalization of these results, since we used a convenience sampling method to select heart failure patients from a single general hospital. Finally, a nonparametric test for marital status was done because of the not so large sample size. Therefore, repeated studies of larger sample size would be needed to increase the power.

## 5 | CONCLUSIONS

This study was conducted to investigate the mediating effect of resilience on the relationship between Type D

personality and self-care behavior in patients with heart failure, and it was found that the effects of Type D personality on self-care behavior in heart failure patients were mediated by resilience. Therefore, these data support the need to develop and test an active intervention program to improve the resilience of patients with heart failure and to prevent the recurrence and deterioration of heart failure by improving self-care behavior.

## CONFLICT OF INTEREST

The authors declare no conflict of interest to disclose.

## AUTHOR CONTRIBUTIONS

J.M.H and C-G.K contributed to the conception and design of this study; J.M.H collected the data and performed the statistical analysis. J.M.H and C-G.K drafted and critically revised the manuscript. All authors read and approved the final manuscript.

## ORCID

*Chul-Gyu Kim* https://orcid.org/0000-0002-2512-139X

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**How to cite this article:** Heo JM, Kim C-G. The mediating effect of resilience on the relationship between Type D personality and self-care behavior in patients with heart failure. *Jpn J Nurs Sci*. 2020; 17:e12359. https://doi.org/10.1111/jjns.12359