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## Living Arrangements Modify the Relationship between Depressive Symptoms and Self-care in Patients with Heart Failure

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Heart failure (HF) is a chronic condition in which active patient engagement in self-care is essential to achieve optimal outcomes.<sup>1–3</sup> Self-care is a naturalistic decision-making process involving self-care maintenance, defined as activities to maintain physiological stability (e.g., low sodium diet) and self-care management, defined as recognizing altered health status, responding to it in a timely manner, and evaluating the effectiveness of the response undertaken.<sup>1</sup> Self-care confidence is a critical component influencing patients' self-care maintenance and management behaviors.<sup>1</sup>

Adequate self-care contributes to improving health status and decreasing hospitalizations and mortality.<sup>1</sup> However, most patients' self-care is sub-optimal.<sup>4,5</sup> Jaarsma and colleagues reported that less than half of patients with HF in 15 countries worldwide followed recommended self-care maintenance activities, such as following a low-sodium diet and regular weight monitoring.<sup>5</sup>

It is challenging for patients with HF to become competent in self-care because performing self-care entails following therapeutic regimens that require constantly engaging in decision-making and problem-solving.<sup>1,6</sup> The presence of depressive symptoms may limit the ability to adequately perform self-care even when patients have adequate self-care knowledge and skills.<sup>7</sup> According to Johansson and colleagues, patients with HF and depressive symptoms were 1.5 times more likely to wait longer than 72 hours before seeking treatment from health

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care providers after the onset of worsening HF symptoms than those without depressive symptoms.<sup>8</sup>

Social support is identified as a facilitator of successful self-care for patients with chronic illnesses (e.g., HF, diabetes, and arthritis).<sup>1,6,9–14</sup> There are four types of social supports: emotional support providing caring, empathy, and love; instrumental support providing tangible services and goods, informational support assisting a problem-solving process, and appraisal support providing assistance with self-evaluation and affirmation of one's action and statements by others.<sup>15</sup>

Social support is conveyed through members in the individual's social network, which is defined as the web of relationships around an individual (e.g., number of co-habitants or friends).<sup>15</sup> Social support is the function of social network, a structure of social ties around an individual.<sup>15</sup> According to a recent systematic review on contributions of social support to HF self-care,<sup>16</sup> main sources of social support among patients with HF were their spouses (62%) and adult children (32%), and relatives or friends (6%).

There are two different ways to conceptualize social support, which are received and perceived social support. Received social support refers to actual receipt of social support, while perceived social support refers to potential access to social support.<sup>17</sup> Patients with HF often receive various types of social support from their informal caregivers (e.g., monitoring HF symptoms and arranging clinical appointments) and perceive high levels of social support, which helps to enhance their engagement in self-care.<sup>16,18</sup> Received and perceived social support and structure of social ties (social network) also contributes to relieving psychological distress by fulfilling a sense of coherence and belonging.<sup>19</sup> In a study in which patients with HF without depressive symptoms were followed for one year, patients who lived alone were 2.6 times more likely to develop depressive symptoms than those who lived with someone at baseline.<sup>20</sup>

Given the positive relationships of social support with better self-care and fewer negative emotions (e.g., depressive symptoms) in patients with HF, it can be hypothesized that social support may counteract the impact of depressive symptoms on self-care. However, few studies have investigated if social support plays a role in the relationship between depressive symptoms and self-care in patients with HF.

Living arrangements are considered as one of the most salient indicators of social support as living arrangements is a channel which social support is provided through.<sup>10</sup> Information about whether patients live with others in a shared space is an indication of the availability of informal care provided within the household and the possibility of frequent assessment of the patient's health status and self-care behaviors.<sup>21</sup> Living alone is identified as a risk factor for poor self-and mortality in patients with chronic illness<sup>13,22,23</sup> and nursing home admission and hospitalizations in older adults.<sup>24,25</sup> Therefore, the purpose of this study was to examine the potential buffering effect of living arrangements, as an indicator of social support, on the relationship between depressive symptoms and self-care in patients with HF. The specific aim was to determine whether depressive symptoms had direct and/or indirect effects on self-care constructs proposed by Riegel and colleagues (i.e., self-care maintains,

self-care management, and self-care confidence)<sup>1,26</sup> in HF patients living alone and those living with others.

## Methods

This study was a secondary analysis of cross-sectional data collected on stable HF patients recruited from ambulatory HF clinics affiliated with large community hospitals and academic medical centers in the United States. Data included in this analysis were collected at baseline of two large studies. One study was a randomized-controlled trial to test whether the combined biofeedback and cognitive therapy is effective to improve HF outcomes (National Institutes of Health/National Institutes of Nursing Research R01 NR 008567). The other study was a longitudinal observational study aimed at examining the relationship between sodium intake and HF outcomes.<sup>27</sup> Those two parent studies had a similar participant eligibility and shared recruitment sites. The institutional review board was approved for each study site where patients were recruited. All participants gave written, signed informed consent.

## Sample

Potential participants referred to study staff by cardiology providers in HF clinics. All patients had a cardiologist confirmed diagnosis of HF with either preserved or reduced ejection fraction. Patients were excluded for any of the following criteria: (1) age of < 21 years; (2) recent myocardial infarction within 3 months prior to the enrollment; (3) referral for heart transplant; (4) non-cardiac serious or life-threatening comorbid conditions (e.g., end-stage renal or active cancer treatment); (5) obvious cognitive impairments that hindered providing informed consent; or (6) non-English speaking. In this analysis a total of 206 patients who had variables of interest, such as three constructs of self-care and depressive symptoms, were included.

## Measures

**HF self-care**—The Self-Care of Heart Failure Index (SCHFI) was used to measure self-care.<sup>28</sup> This instrument consists of a total of 17 items measuring three constructs of self-care: self-care maintenance (5 items about monitoring signs and symptoms of HF exacerbation and adhering to therapeutic regimens), self-care management (8 items about ability to recognize and react appropriately to changes in symptoms), and self-care confidence (4 items about perceived confidence to perform the specific tasks of self-care). Patients are asked to rate each item on a 4-point Likert scale from 1 to 4. Items in the subscale of self-care management are answered only by patients who had dyspnea or lower-extremity edema past three months. Scores of each construct were summed and standardized to 100 with higher scores indicating better self-care. A score of 70 is used as a cut-off point to define adequacy of self-care.<sup>29</sup> The reliability and validity of the SCHFI were demonstrated.<sup>28</sup>

**Depressive symptoms**—Depressive symptoms were measured with the self-administered Patient Health Questionnaire nine-item depression scale (PHQ-9), which has been widely validated.<sup>30</sup> The PHQ-9 consists of the nine criteria for depression from the

Diagnostic and Statistical Manual of Mental Disorders, fourth edition (DSM-IV). Each item is assigned points from 0 to 3 (0=not at all and 3=nearly every day). Scores for each item are summed to yield a total score with higher scores indicating a greater level of depressive symptoms. A total score of 5 to 9 represents mild depressive symptoms; 10 to 14, moderate; 15 to 19, moderately severe; and 20 to 27, severe. The PHQ-9 scores of  $\geq 10$  suggest clinical depression with a sensitivity of 88% and a specificity of 88% for detecting clinical depression in the primary care setting.<sup>31</sup>

**Living arrangements**—Patients' report of whether or not they were living with someone was used to determine their living arrangements.

**Socio-demographic and clinical characteristics**—Self-report was used to collect information regarding the patients' socio-demographic characteristics (e.g., age, gender, ethnicity, and education). Most information on the patients' clinical characteristics (e.g., HF etiology) was abstracted by trained research nurses from medical records. Information about New York Heart Association (NYHA) functional class was determined by trained research nurses using structured interviews.

### Data analysis

Demographic and clinical differences by living arrangement (i.e., living alone vs. living with someone) were tested with chi-square test or independent t-test using SAS 9.3 (SAS Institute Inc., Cary, NC). The strength of the associations among depressive symptoms and three self-care constructs (i.e., self-care maintenance, self-management, and self-care confidence) was evaluated with Spearman's correlation coefficients ( $\rho$ ).

In this study we only included patients who had scores of all three subscales of SCHFI (n=206) in order to include all three self-care constructs in the structural equation modeling. Structural equation modeling was used to conduct path analyses using Mplus version 7.0 (Muthen and Muthen). NYHA functional class was used as a covariate throughout the path analyses because NYHA functional class is related to self-care.<sup>32–35</sup> We first examined the relationship between depressive symptoms and three self-care constructs. The first series of paths corresponded to the relationship among the three constructs based on the conceptual framework by Riegel and colleagues in which self-care maintenance leads to self-care management, and self-care confidence influences both self-care maintenance and management.<sup>26</sup> A second series of paths corresponded to the association between depressive symptoms as an independent variable and the three self-care constructs, as dependent variables. Next, we compared the series of paths examined above between patients living alone and those living with someone. The overall model fit was judged to be adequate if the p-value of the chi-square test was below 0.05, Comparative Fit Index (CFI) values were above 0.90 and Standardized Root Mean Square Residual (SMSR) values were below 0.08.<sup>36</sup>

## Results

### Sample characteristics

The majority of the patients were male (66.5%) and white (77.2%) with an average age of 60 years (range: 32–87 years) (Table 1). More than half of the patients were married or cohabitating with a partner (52.4%) and in NYHA functional class III/IV (55.8%). On average, patients had poor self-care maintenance and management according to the cut-off score of 70 suggested by Riegel and colleagues.<sup>29</sup> Patients having PHQ-9 scores of  $\geq 10$  were 29.6% (61/206) of the total sample, who had probable clinical depression. (Figure 1)

Demographic and clinical characteristics between patients living alone vs. with someone were not significantly different except for marital status, etiology of HF, and self-care confidence (Table 1). Of patients living with someone more than two thirds of their informal caregivers (69.6%) were their spouses. Patients living with someone had higher scores on self-care confidence than patients living alone ( $p$ -value  $< 0.05$ ). There were no significant differences in scores for depressive symptoms between patients living alone and patients living with someone.

### Correlation among depressive symptoms and self-care

As shown in Table 2, there were weak negative correlations between scores for depressive symptoms and scores for self-care maintenance and confidence ( $\rho = -0.171$  and  $-0.151$ , respectively). As depressive symptoms increased, self-care maintenance and confidence scores decreased. Scores for three self-care constructs were positively correlated with each other ( $\rho = 0.242$ – $0.360$ ).

**Patients living alone**—Among patients who lived alone, depressive symptoms scores were moderately correlated with self-care maintenance and management scores ( $\rho = -0.364$ ,  $p$ -value  $< 0.001$ ; and  $\rho = -0.388$ ,  $p$ -value  $< 0.001$ , respectively). The positive correlation between self-care maintenance and management scores indicates better self-care maintenance was associated with higher self-care management ( $\rho = 0.300$ ,  $p$ -value  $< 0.05$ ). Self-care management scores were moderately positively correlated with self-care confidence ( $\rho = 0.421$ ,  $p$ -value  $< 0.001$ ).

**Patients living with someone**—Among patients who lived with someone, depressive symptoms scores were not correlated with any of the self-care constructs. The scores for self-care maintenance were moderately correlated with the scores for self-care management and confidence ( $\rho = 0.377$ ,  $p$ -value  $< 0.001$ ; and  $\rho = 0.244$ ,  $p$ -value  $< 0.001$ , respectively). The scores for self-care management were positively correlated with the scores for self-care confidence ( $\rho = 0.304$ ,  $p$ -value  $< 0.001$ ).

### Path analyses

The path diagrams with standardized coefficients are presented in Figures 2 and 3.

**Patients living alone**—Depressive symptoms had direct effects on self-care maintenance and management (standardized  $\beta = -0.362$  and  $-0.351$ , respectively) after controlling for

NYHA functional class, indicating that higher levels of depressive symptoms were related to poorer self-care maintenance and management (Figure 2). However, there was no significant direct effect of depressive symptoms on self-care confidence. There were also no indirect effects of depressive symptoms on self-care maintenance and management via self-care confidence.

**Patients living with someone**—Depressive symptoms did not have any significant direct effects on self-care maintenance, management, or confidence after controlling for NYHA functional class (Figure 3). Similarly, there were no indirect effects of depressive symptoms on self-care maintenance and management through self-care confidence.

## Discussion

In this study we addressed whether the relationship between depressive symptoms and self-care differed by living arrangement as a proxy of social support in patients with HF. Depressive symptoms were negatively related to self-care behaviors among patients living alone, but were not associated with self-care behaviors among patients living with someone. Our results suggest that the negative effect of depressive symptoms on self-care is buffered by the presence of others living in a shared household.

Depressive symptoms have been shown to be a determinant of poor self-care in patients with HF. For example, patients with depressive symptoms are less likely to follow recommended therapeutic regimens such as a low-sodium diet.<sup>9,32,37,38</sup> Similarly, we also found the negative relationship between depressive symptoms and self-care maintenance ( $\rho=-0.171$ ). Although the mechanism underlying the association between depressive symptoms and self-care is not clearly understood, motivation and cognitive function are two plausible mechanisms that could explain the relationship. In the general population, individuals with depression had a shift in cost/benefit gradients of behaviors, such as over-estimating costs of obtaining rewards or under-estimating expected benefits compared with individuals without depression.<sup>39</sup> This inaccurate cost/benefit evaluation of activities contributes to diminishing motivation to pursue activities.<sup>39-41</sup> Thus, depressed patients with HF may perceive self-care activities as burdensome compared to potential positive outcomes and be less likely to exert efforts to follow recommended self-care behaviors. In a meta-analysis of depression and cognitive function,<sup>42</sup> depression negatively affected cognitive function in the domains of episodic memory, executive function, and processing speed. Given that self-care is a priority setting and decision-making process, poor cognitive function can negatively impact self-care in patients with HF.<sup>9,43</sup>

When the relationship between depressive symptoms and the three self-care constructs (i.e., self-care maintenance, management, and confidence) was examined in our study, the association among these constructs proposed by Riegel and colleagues<sup>1</sup> (i.e., self-care maintenance leads to self-care management, and self-care confidence influences both self-care maintenance and management) was found only in patients who lived with someone, but not in patients who lived alone. This discrepancy might be related to the strong direct effects of depressive symptoms on self-care maintenance and management in patients living alone.

In an intervention study in which the effect of the cognitive behavioral therapy (CBT) aimed at decreasing depression on smoking cessation was examined in post-myocardial infarction patients, the CBT intervention was only effective to decrease depression and increase rates of smoking cessation only in the group of the patients who were depressed and had adequate social support.<sup>44</sup> This result indicates that social support contributes to patients with depression engaging in healthy behaviors. Thus, this finding demonstrates that depressive symptoms play a more substantial role in self-care in HF patients living alone than in those living with someone.

It may be that those patients who live with someone have the advantage of assistance from their co-habitants, which results in increased adherence to self-care and negating the observation that depressed patients with HF are less likely to engage in self-care.<sup>9,32,37,38</sup> Potential sources of support within the household include companionship, emotional support, and regular instrumental, and informational assistance.<sup>21</sup> Such social support systems may positively contribute to self-care in patients experiencing depressive symptoms. High levels of social network systems (defined as being married, living with others, having face-to-face or telephone contacts with family members living away daily or almost daily, and being at home alone for < 2 hours a day) were associated with decrease in rehospitalizations among HF patients living in Spain.<sup>45</sup>

An informal caregiver's contribution to the patient's day-to-day self-care can be substantial. For example, approximately 80% of patients with HF living in Netherlands reported that they received emotional and practical support in their medical care from informal caregivers defined as a partner.<sup>18</sup> Spousal caregivers' confidence in their contribution to the patients' self-care was positively associated with patients' self-care according to a study conducted in Italy.<sup>46</sup> Patients' self-care confidence was also related to spousal caregivers' contribution to self-care.<sup>46</sup> A study conducted in the United States by Artinian and colleagues<sup>22</sup> provides further insight in terms of the benefits of co-residence. They found that living arrangements made a larger contribution to self-care activities than did marital status. Thus, having someone living in the same household regardless of relationship may have a positive impact on self-care and buffer the negative effect of depressive symptoms in patients with HF.

According to Riegel and colleagues self-care confidence influences both self-care maintenance and management.<sup>1</sup> Interestingly, for patients living alone, the indirect paths from depressive symptoms to self-care maintenance and managements via self-care confidence were not significant in our study. This result suggests that improving self-care confidence does not result in promoting self-care maintenance and management among depressed patients who live alone. Therefore, arranging resources that can provide practical support might be an effective way to improve self-care maintenance and management in depressed patients who live alone, instead of efforts focusing on promoting self-care confidence alone.

## Limitations

Several limitations of this study are recognized. Because this was a cross-sectional design, we cannot draw causal relationships among living arrangements, depressive symptoms, and self-care. In this study we used living arrangements as a proxy of social support, which is the

availability of support through one's living circumstances. However, we did not collect the number of informal caregivers within the household and actual or perceived social support (e.g., emotional and instrumental support), which limits our understanding of the role of social support on the relationship between depressive symptoms and self-care in patients with HF. The information about reasons for living alone was not asked in this study although it might be possible that people who chose to live alone are more likely to be capable of performing activities of daily living and have different levels of self-care confidence compared to those who are subject to living alone due to a lack of social ties. Among people aged above 80 years who are at risk of or with atherothrombosis, living alone was not associated with mortality.<sup>23</sup> Future studies addressing this additional information are needed.

## Conclusions

An emphasis on self-care increases in HF management because of its pivotal role in preventing poor outcomes. Depressive symptoms hinder patients with HF from actively engaging in self-care. However, our findings suggest that the potential availability of support in a shared household can offset the negative impact of depressive symptoms on self-care in patients with HF. Patients with depressive symptoms who live alone lack support and may be more vulnerable to poor self-care than those who live with someone. Therefore, clinicians should pay particular attention to assessment and management of depressive symptoms in patients living alone who may be most vulnerable to poor self-care.

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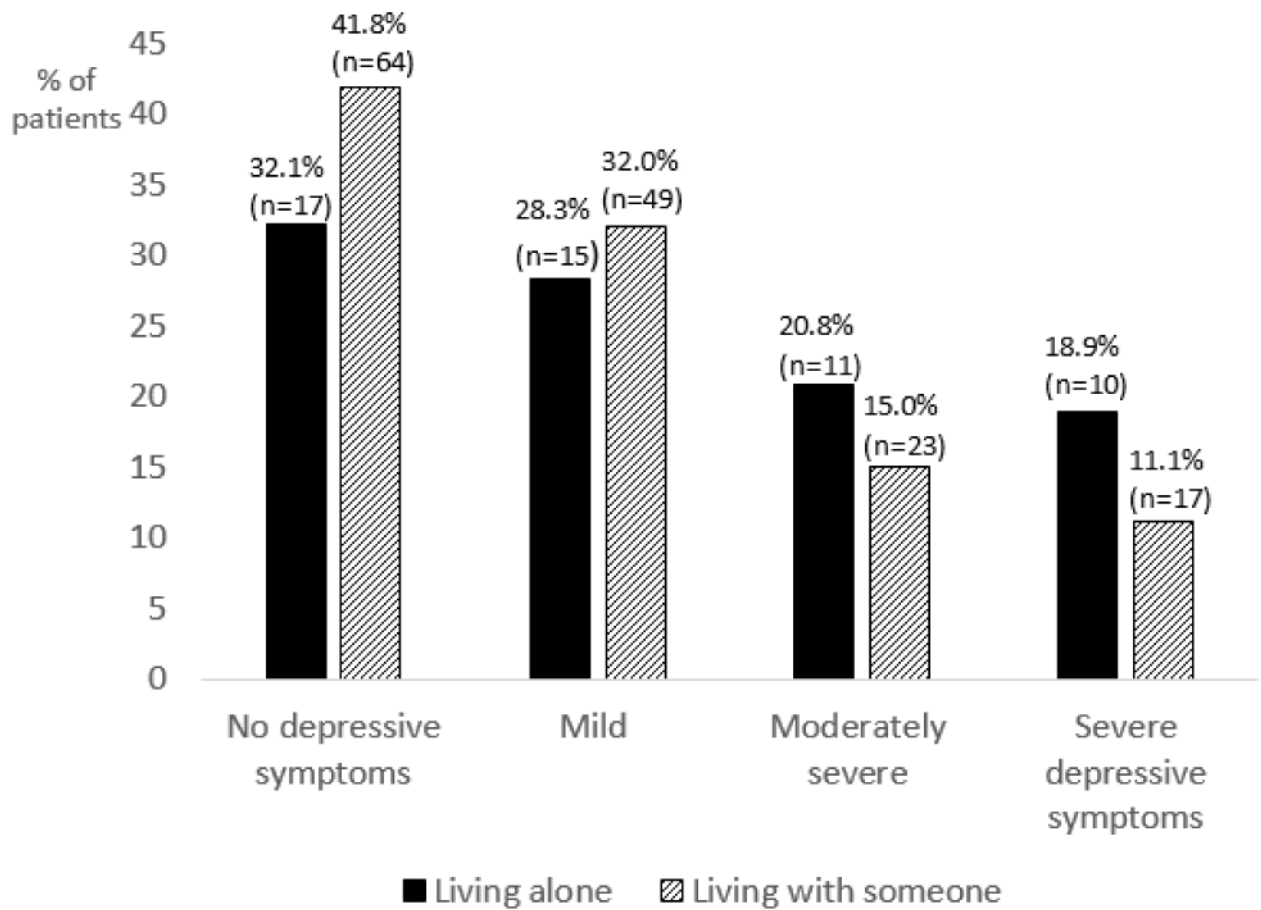
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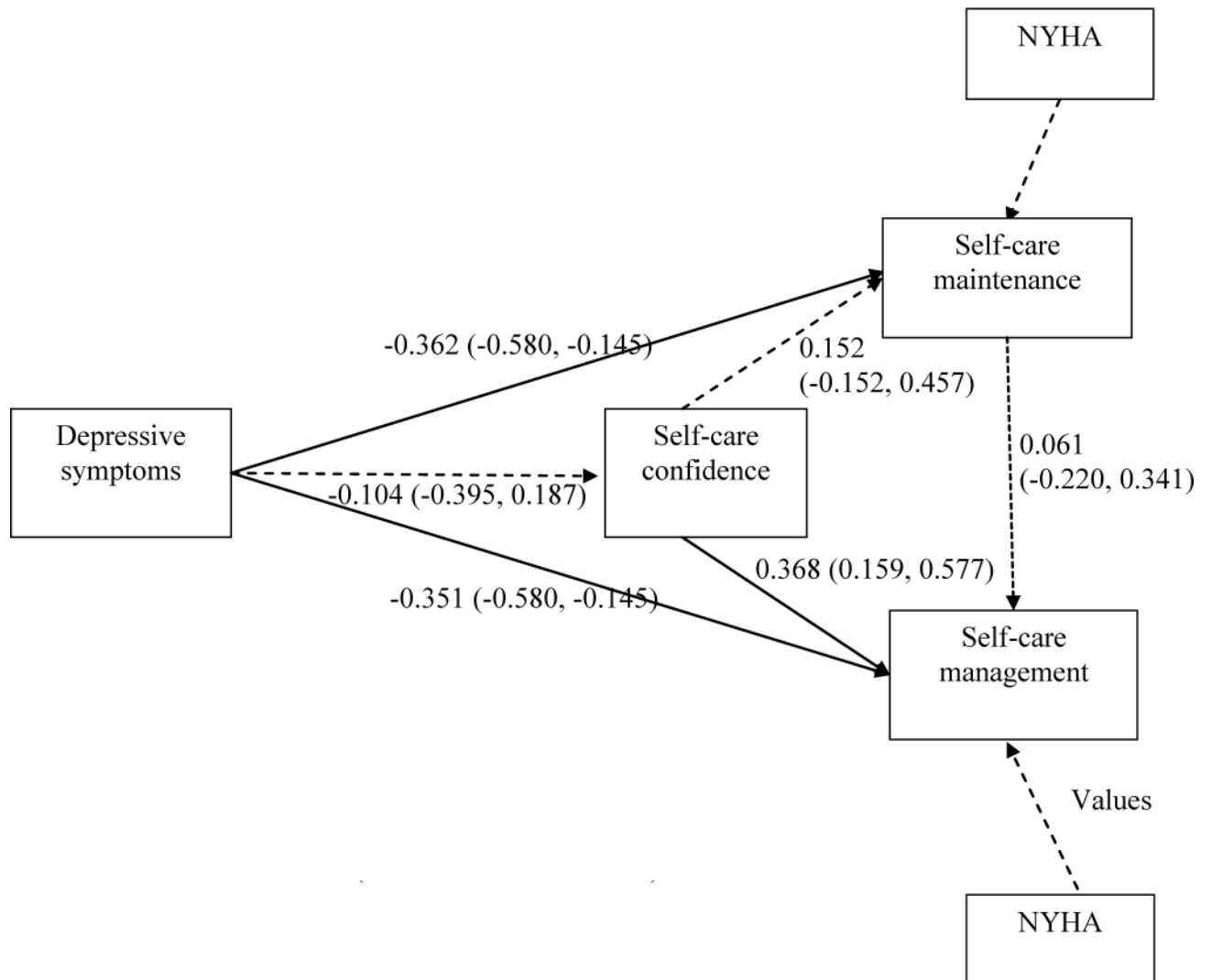
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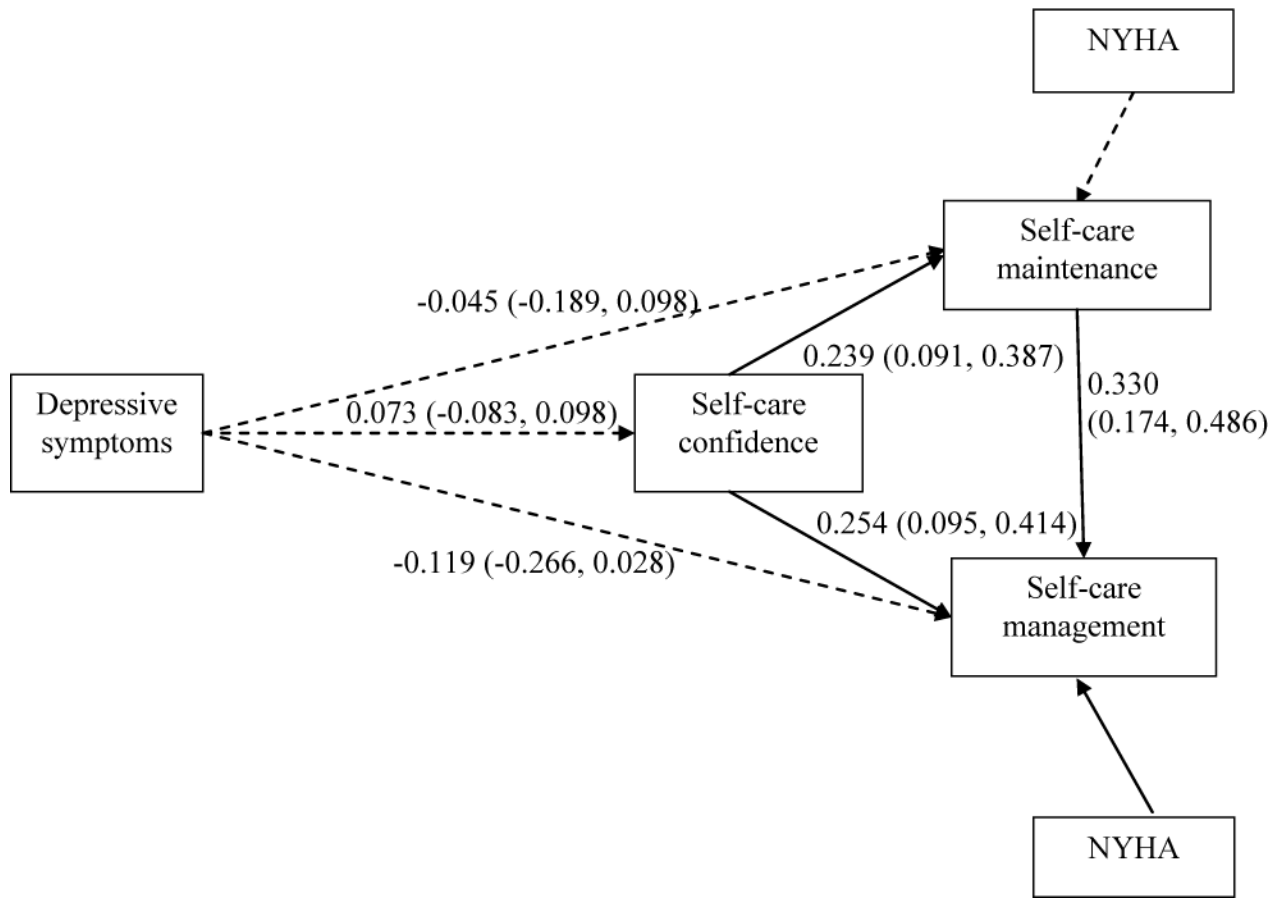
**Figure 1.**

Depressive symptoms by living arrangements (n=206)

Note. There were no differences in proportion of patients living alone to those living with someone by each depressive symptom level ( $p=0.294$ ).



**Figure 2.**  
 Path model with patients living alone (n=53)  
 Note. Solid lines indicate significant paths dotted lines indicate insignificant paths. Values are standardized coefficients (95% confidence interval).  
 Model fit indices:  $X^2 = 31.971$  (df = 9,  $p < 0.001$ ), Comparative Fit Index = 0.859, Standardized Root Mean Square Residual = 0.062.  
 NYHA= New York Heart Association functional class



**Figure 3.**

Path model with patients living with someone (n=153)

**Note.** Solid lines indicate significant paths dotted lines indicate insignificant paths. Values are standardized coefficients (95% confidence interval).

Model fit indices:  $X^2 = 51.500$  (df = 9,  $p$  value < 0.001), Comparative Fit Index = 1.000, Standardized Root Mean Square Residual <0.0001.

NYHA= New York Heart Association functional class

**Table 1**

## Sample Characteristics (N=206)

	Total (N = 206)	Living alone (n = 53)	Living with someone (N = 153)	p-value
Age, years	60 (11.6)	61 (11.6)	59 (11.6)	0.187
Female	69 (33.5%)	23 (43.4%)	46 (30.1%)	0.076
Education level, years	13 (3.3)	13 (2.9)	13 (3.4)	0.614
Ethnicity				0.427
White	159 (77.2%)	43 (81.1%)	116 (75.8%)	
Minority	47 (22.8%)	10 (18.9%)	37 (24.2%)	
NYHA class				0.650
I/II	91 (44.2%)	22 (41.5%)	69 (45.1%)	
III/IV	115 (55.8%)	31 (58.5%)	84 (54.9%)	
Ischemic etiology of HF (n=197)	139 (70.6%)	39 (78.0%)	100 (68.0%)	0.027
Chalson Comorbidity Index	3.3 (2.0)	3.7 (2.2)	3.2 (1.9)	0.124
Self-care				
Maintenance	49.6 (22.5)	46.9 (21.5)	50.5 (22.9)	0.314
Management	54.7 (21.3)	52.6 (20.9)	55.5 (21.4)	0.407
Confidence	56.5 (22.0)	49.2 (18.7)	59.0 (22.6)	0.005
Depressive Symptoms	6.9 (5.6)	8.0 (5.5)	6.5 (5.6)	0.098
Medications				
ACEI or ARB (n=204)	158 (77.5%)	39 (73.6%)	119 (78.8%)	0.434
Beta Blocker (n=203)	177 (87.2%)	46 (88.5%)	131 (86.8%)	0.751
Diuretics (n=203)	154 (75.9%)	40 (75.5%)	114 (76.0%)	0.938
Antidepressants (n=203)	50 (24.6%)	17 (32.1%)	33 (22.0%)	0.143

Note. Values are mean (SD) or n (%).

NYHA=New York Heart Association; HF= Heart Failure; ACEI = angiotensin converting enzyme inhibitor; ARB = angiotensin receptor blocker

**Table 2**

Correlation coefficients of variable of interest (N=206)

	Self-care maintenance	Self-care management	Self-care confidence
Depressive symptoms	-0.171 <sup>*</sup>	-0.071	-0.151 <sup>*</sup>
Self-care maintenance	1.00	0.360 <sup>‡</sup>	0.242 <sup>‡</sup>
Self-care management		1.00	0.334 <sup>‡</sup>
Self-care confidence			1.00

Note.

\*  
=p-value <0.05;‡  
= p-value <0.001

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