



## Psychometric testing of the Multidimensional Scale of Perceived Social Support in patients with comorbid COPD and heart failure

Andrew Bugajski<sup>a,\*</sup>, Susan K. Frazier<sup>b</sup>, Debra K. Moser<sup>b</sup>, Terry A. Lennie<sup>b</sup>, Misook Chung<sup>b</sup>

<sup>a</sup> University of South Florida College of Nursing, 12901 Bruce B. Downs Blvd., Tampa, FL 33612, United States

<sup>b</sup> University of Kentucky College of Nursing, 800 Rose Street, Lexington, KY 40536, United States



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### ABSTRACT

**Background:** Chronic disease self-management is complex and multidimensional. Optimal performance of self-management behaviors requires support from patient's friends, family, and significant others. The Multidimensional Scale of Perceived Social Support (MSPSS) is a 12-item questionnaire used to measure patient's social support from friends, family, and significant others.

**Objectives:** To examine the psychometric properties of the MSPSS in patients with comorbid chronic obstructive pulmonary disease (COPD) and heart failure (HF).

**Methods:** Reliability, factorial validity, and construct validity of the MSPSS were examined using Cronbach's alpha, split-half reliability, factor analysis via principal components analysis and hypothesis testing via multivariate linear regression, respectively.

**Results:** The MSPSS demonstrated excellent internal consistency with Cronbach's alpha consistently above 0.90. Factor analysis yielded a 3-factor solution, with items loading appropriately on the Friend, Family and Significant Other subscales.

**Conclusion:** The MSPSS is a reliable, valid instrument to measure perceived social support in patients with comorbid COPD and HF.

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### Introduction

Chronic and obstructive pulmonary disease (COPD) and chronic heart failure (HF) are responsible for over 21 million deaths annually, and are two of the top four causes of global mortality.<sup>1,2</sup> An estimated 52% of patients with HF have comorbid COPD.<sup>3</sup> Comorbid COPD and HF are associated with a higher incidence of other cardiovascular diseases, such as atrial fibrillation/flutter and hypertension.<sup>4</sup> Moreover, the risk of developing HF among patients with COPD is 450% greater compared to healthy adult control subjects.<sup>5</sup> COPD and HF are progressive and irreversible; patients are taught about daily self-management behaviors to maintain functional ability, reduce symptom burden, and maintain quality of life.<sup>6,7</sup> Chronic disease self-management is complex and multidimensional; individuals ability to perform self-management behaviors is influenced by comorbid conditions, somatic awareness, and perceived social support.<sup>7–9</sup>

Optimal performance of complex self-management behaviors requires individuals have the support of their friends, family

members, and significant others. Perceived social support plays an important role in outcomes such as self-management ability, depression, and anxiety in patients with COPD. Previous investigators found that higher levels of perceived social support was associated with higher self-management abilities ( $r = 0.252$ ;  $P = .012$ ), and was a significant predictor of reduced depression ( $\beta = -0.25$ ,  $F(6, 85) = 5.10$ ,  $p < .01$ ) and anxiety ( $\beta = -0.20$ ,  $F(6, 85) = 5.61$ ,  $p < .01$ ).<sup>8,10,11</sup> Furthermore, lower levels of social support significantly predicted higher anxiety symptoms ( $F(11, 418) = 34.9$ ,  $p < .001$ ,  $R^2 \text{ adj} = 0.47$ ). Increased loneliness was moderately associated with worsening depressive symptoms ( $r = -0.587$ ;  $p < .001$ ) and reduced feelings of social support ( $r = -0.471$ ;  $p < .01$ ).<sup>12,13</sup> Thus, perceived social support is an important factor in patient outcomes in those with COPD.

In patients with HF, perceived social support has been shown to predict level of self-management ability ( $\beta = 0.33$ ;  $p = .0002$ ),<sup>14</sup> and in a seminal study conducted by Riegel and Carlson,<sup>15</sup> patients who underwent an intervention to improve peer and social support demonstrated a 8.7% increase in self-care management ability ( $r = 0.46$ ; moderate effect), and a 6% increase in self-care confidence ( $r = 0.62$ ; moderate/large effect).<sup>15</sup> Furthermore, poorer social support was an independent predictor of reduced health-related quality of life ( $\beta = -0.132$ ;  $P < .001$ ), worse depressive symptoms ( $\beta = -0.467$ ;  $P < .001$ ) and was associated with a 50% increased risk of

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\* Corresponding author.

E-mail address: [abugajski@health.usf.edu](mailto:abugajski@health.usf.edu) (A. Bugajski).

hospitalization and death.<sup>16,17</sup> Thus, there is a clear association between social support and key outcomes in patients with HF.

It is unclear whether patients with comorbid chronic diseases like COPD and HF may require more perceived social support compared with individuals who have a single chronic disease. It is plausible that the additive self-management requirements from each disease would warrant greater perceived social support. It is vital that the instruments used to measure perceived social support have psychometric rigor in patient with comorbid conditions, so that the data obtained are reliable, valid and useful. Thus, the purpose of this analysis was to examine the psychometric properties of the Multidimensional Scale of Perceived Social Support in patients with comorbid COPD and HF. The specific aims of this study were to examine: 1) internal consistency reliability 2) the factor structure; and 3) construct validity with hypothesis testing. We hypothesized that higher perceived social support scores would predict better self-care management.

## Methods

### Design and sample

This study was a secondary data analysis from a large, multicenter HF registry. This registry contains data from 4,076 inpatient and outpatient participants who were recruited from cardiology centers located in the Southern and Midwest United States.<sup>3,16–22</sup> Recruitment and inclusion criteria were consistent across studies; study participants had a confirmed diagnosis of HF, had a left ventricular ejection fraction (LVEF)  $\leq 40\%$ , were 18 years or older, and had not had a myocardial infarction within three months of enrollment. The selected participants had complete data for demographic (gender, age, ethnicity, marital status, and years of education, smoking history) and clinical variables (diagnosis of HF, diagnosis of COPD, LVEF, body mass index (BMI), New York Heart Association (NYHA) functional class, and scores on the Multidimensional Scale of Perceived Social Support (MSPSS), and self-management scores from the Self-Care of Heart Failure Index (SCHFI).

### Measures

Demographic and clinical variables were collected by interview of patients and review of medical records. Demographic variables collected included sex, age, ethnicity, marital status, years of education and smoking history. Clinical variables include current diagnosis of COPD and HF, LVEF, BMI and NYHA functional class.

#### Perceived social support

There is no consensus definition of perceived social support. However, perceived social support is generally considered to be the physical, cognitive and psychological benefits of interacting with other people.<sup>23</sup> Zimet and colleagues developed the Multidimensional Scale of Perceived Social Support (MSPSS) to measure perceived availability and sufficiency of support from family, friends and significant others.<sup>24</sup> The MSPSS is a self-report instrument with 12 items that are rated on a 7-point Likert scale, ranging from 1 “strongly disagree” to 7, “strongly agree”; this instrument has 3 subscales; family, friends, and significant other. “Significant other” is intentionally undefined so that the respondent can identify their own significant other(s).<sup>24,25</sup> The MSPSS is scored by summing the responses of the 12 items; total scores range from 12 to 84, and higher scores indicate higher levels of perceived social support. The three subscales are also scored individually and may be used independently in analyses.<sup>24,25</sup>

Internal consistency for this instrument in patients with HF previously ranged from 0.85 to 0.94.<sup>17,26</sup> During the initial instrument development, internal consistency for the subscales ranged from 0.85 to 0.91, and test-retest reliability ranged from 0.72 to 0.85;<sup>24,25</sup>

internal consistency for the family, friends and significant other subscales in patients with HF were 0.94, 0.94, and 0.94 respectively.<sup>27</sup> Adequate construct validity was demonstrated by repeated extraction of three factors in patients with HF<sup>27</sup> as well as other populations including undergraduate students, pediatric residents, European adolescents, pregnant women and patients with end stage renal disease.<sup>24,25,27,28</sup>

#### Self-care management

Self-care management is the process by which individuals with chronic disease attain optimal health through learned, intentional actions that include symptom recognition and response, adherence to prescribed treatment and medications, intentional lifestyle alterations, regular interaction with health care professionals, and evaluation of these actions.<sup>7</sup> Self-care management was measured with the self-care management subscale of the Self-Care of Heart Failure Index (SCHFI).<sup>29</sup> The SCHFI comprises three subscales labeled self-care maintenance, self-care management, and self-care confidence; each scale is measured and evaluated independently.<sup>29</sup> Only the self-care management subscale was used for our analyses because it assesses symptomatic patients and their ability to perform management level behaviors, which are theoretically indicative of self-care mastery.<sup>30</sup> This subscale contains six items that measure symptom recognition, implementation of treatment strategies, and evaluation of treatment strategies. This subscale uses a 4-point Likert scale where 1 signals *rarely or never*, 2 signals *sometimes*, 3 indicates *frequently*, and 4 indicates *always or daily*. The six item scores are summed, then transformed to produce a standardized range of potential self-care management scores from 0 to 100; higher scores indicate better self-care management ability.<sup>29</sup> A score of 70 or greater indicates adequate self-care management.<sup>29</sup> Cronbach's alpha for this subscale is acceptable and ranges from 0.597 to 0.70.<sup>29,30</sup> Evidence of construct validity for the SCHFI and self-care management subscale is strong, with consistent extraction of three independent factors (for each of the three subscales) and consistent loading of the appropriate questions on the self-care management construct.<sup>29,30</sup>

### Procedure

The participants included in this secondary data analysis were recruited after each study was approved by the respective Institutional Review Board. All participants provided informed consent. Data were collected by nurse researchers who were trained to perform the study procedures. Nurse researchers were present during the data collection process to aid participants as needed. All data were double entered into a data spreadsheet (SPSS version 21, Armonk, NY) and evaluated for errors prior to analyses. We filtered the data registry to obtain those participants with complete data for the demographic, clinical and research variables of interest.

### Data analysis

Descriptive statistics, frequencies, means with standard deviations, and proportions were used to characterize the participants. To analyze the internal consistency of the MSPSS, Cronbach's alpha was calculated for the total instrument and three subscales. Item-item correlations were analyzed to ensure all correlation coefficients were above 0.3 and below 0.9. Split-half reliability analyses were also conducted for the total scale. A principal components factor analysis with a direct oblimin rotation was conducted to examine the factor structure of the 12-item MSPSS. Sampling adequacy was confirmed by a Kaiser-Meyer-Olkin measure above 0.5.<sup>31</sup> Bartlett's test of sphericity was conducted to assess if correlations between items were sufficiently large to conduct the analysis; a significant level of  $<0.05$  was used as the cut point for this analysis.<sup>31</sup> To further examine the construct validity of the MSPSS,

hypothesis testing was performed using multiple linear regression. We hypothesized that higher perceived social support score was a predictor of better self-care management score after controlling for age, gender, ethnicity, marital status, living situation, smoking status, education level, BMI, LVEF, and NYHA class. All data analyses were conducted using SPSS Version 24.0 (IBM, Armonk, NY). An a priori  $\alpha$  level of  $\leq 0.05$  was used to determine significance.

## Results

### Characteristics of the participants

Participants with comorbid COPD and HF ( $N=303$ ) were primarily male (63%), Caucasians (65%) aged  $61 \pm 12$  years on average (Table 1.) A majority of these participants were married or cohabiting (60%) and 74% reported living with someone. Approximately two thirds (62%) of participants were classified as NYHA class III/IV with an average LVEF of  $37 \pm 15\%$ . A majority of participants had a prior smoking habit but had quit (43%); and 19% were current smokers. The average participant had  $12.4 \pm 3.6$  years of education. Total perceived social support scores were moderately high with an average score of  $63.5 \pm 17.3$ . Average self-care management scores ( $55 \pm 20$ ) were below the recommended cutoff of 70, indicating poor self-management scores in these participants.

### Internal consistency reliability

The MSPSS demonstrated excellent internal consistency yielding a Cronbach  $\alpha = 0.93$  for the total instrument, 0.95 for the Friend subscale, 0.92 for the Family subscale, and 0.92 for the Significant Other subscale. Analysis of item-item correlations ranged from 0.347 to 0.884. Cronbach's  $\alpha$  did not increase during removal of each item during reliability assessment. Split-half reliability analyses of the MSPSS resulted in a Spearman-Brown coefficient of 0.92; a Spearman-Brown coefficient above 0.80 indicates adequate correlation between split halves, and a good indicator of internal consistency of the MSPSS in this sample.<sup>31</sup>

**Table 1**  
Sample characteristics ( $N = 303$ )

Variable	f (%) or mean $\pm$ SD
Age in years	$61 \pm 12$
Gender	
Male	192 (63)
Ethnicity	
Other	105 (35)
Caucasian	198 (65)
Marital status	
Single/Widowed	64 (20)
Married/cohabitate	181 (60)
Divorced/Separated	58 (19)
Live with someone	
Yes	225 (74)
Education in years	$12.4 \pm 3.6$
Smoking History	
Current smoker	25 (34.7)
Non-smoker	47 (65.3)
BMI	$31.5 \pm 7.9$
LVEF	$37 \pm 15$
NYHA class	
I/II	116 (38)
III/IV	187 (62)
Perceived social support (MSPSS)	
Total score	$64 \pm 17$
Friend subscale	$19 \pm 8$
Family subscale	$22 \pm 7$
Significant other subscale	$23 \pm 7$
Self-care management (SCHFI subscale)	$55 \pm 20$

Abbreviations: BMI, body mass index [kg/m<sup>2</sup>], LVEF, left ventricular ejection fraction, NYHA, New York Heart Association functional class.

### Construct validity

A principal component analysis was conducted on the 12 items of the MSPSS with a direct-oblimin rotation for this sample of patients with comorbid COPD and HF (Table 2). A preliminary analysis was conducted to ensure the data were appropriate for further analysis by checking the Kaiser-Meyer-Olkin statistic and Bartlett's test of sphericity. The Kaiser-Meyer-Olkin measure ensured sampling adequacy for this analysis with a KMO = 0.880 which is well above the recommended cutoff of  $\geq 0.60$ .<sup>31</sup> Bartlett's test of sphericity ( $X^2(66) = 3393.17, p < .001$ ) indicated that the correlations between items were sufficiently large to conduct the analysis.<sup>31</sup> Then, an initial analysis was conducted to obtain eigenvalues for each factor. Three factors had eigenvalues greater than Kaiser's criterion of 1 and accounted for 82.4% of the total variance; factor one had an eigenvalue of 6.89, accounting for 57.4% of the total variance, and the other two factors combined for 14.7% (eigenvalue 1.77) and 10.2% (eigenvalue 1.23) of the total variance.<sup>32,33</sup> The scree plot clearly supported a three factor solution evidenced by a modest drop off after the third factor. Thus, three factors were retained for the final analysis. A factor cut-off was set at 0.40, with loadings below 0.40 eliminated from the final model.<sup>34</sup> As a result, there were no cross loadings of items between the three factors. Items that clustered on the same factor suggested that component 1 represents the Family subscale, component 2 represented the Friends subscale and component 3 the Significant Other subscale. The extraction of three factors with no cross loadings replicated the original instrument development and provided support for the three-factor structure in those with comorbid COPD and HF.<sup>24,25</sup>

Multiple linear regression evaluated construct validity (Table 3). We hypothesized that perceived higher perceived social support score would be an independent predictor of better self-care management score after controlling for age, ethnicity, marital status, living alone, education level, smoking history, LVEF, BMI and NYHA functional class. All variables were entered into the regression model in one block. The assumptions of linearity, independence of errors, homoscedasticity, outliers, and normality of residuals were evaluated and met before interpretation of results. In this model, perceived social support score significantly predicted self-care management score ( $F[11, 291] = 2.463, p < .01, R^2 = 0.085, \text{adj } R^2 = 0.051$ ). Specifically, higher LVEF ( $B = -0.234, p < .01$ ) and better perceived social support score ( $B = 0.151, p = .03$ ) were significant predictors of higher self-care management scores. Higher perceived social support was predictive of higher self-care management score; for every 1 unit increase in the MSPSS score, there was an associated 0.151 unit increase in self-care management score. For every 1% increase in LVEF, there was a 0.234 decrease in self-care management score. No other covariates were significant predictors of self-care management.

## Discussion

We found that the MSPSS is a valid and reliable instrument when used to measure perceived social support in patients with comorbid COPD and HF. Our results supported the MSPSS was a highly reliable instrument with Cronbach's  $\alpha$ , consistently above 0.90 in these participants. Results from our exploratory factor analysis using principal components yielded a 3-factor structure consistent with the factor structure elicited during the original scale development and with previous investigators.<sup>24,25,27</sup> We also conducted hypothesis testing to further test the construct validity of the MSPSS. We found that perceived social support score and LVEF significantly predicted self-care management score, which further supported the construct validity of the MSPSS in this population.

Our results demonstrated excellent internal consistency. However, Cronbach's  $\alpha$  surpassed the recommended threshold of 0.90,

**Table 2**  
Rotated pattern matrix of the Multidimensional Scale of Perceived Social Support in patients with COPD and HF (N = 303)

Item		Rotated factor loadings		
		1	2	3
Friend support	6. My friends really try to help me.	0.037	−0.895	−0.013
	7. I can count on my friends when things go wrong.	0.014	−0.936	0.016
	9. I have friends with whom I can share my joys and sorrows.	−0.012	−0.914	−0.035
Family support	12. I can talk about my problems with my friends.	0.024	−0.931	0.003
	3. My family really tries to help me.	0.929	−0.019	0.070
	4. I get the emotional help and support I need from my family.	0.895	−0.004	−0.052
Significant other support	8. I can talk about my problems with my family.	0.773	−0.086	−0.081
	11. My family is willing to help me make decisions.	0.903	0.027	−0.004
	1. There is a special person who is around when I am in need.	0.116	0.140	−0.867
	2. There is a special person with whom I can share my joys and sorrows.	−0.100	−0.088	−0.913
	5. I have a special person who is a real source of comfort to me.	−0.030	−0.116	−0.877
	10. There is a special person in my life who cares about my feelings.	0.071	.002	−0.834
Initial Eigenvalues		6.890	1.767	1.227
Rotated Eigenvalues (direct oblimin)		5.143	5.115	5.274

indicating potential redundancy within the scale. Several items examined in the item-item correlation matrix had coefficients near 0.90; the correlation coefficient between item 6 (My friends really try to help me) and 7 (I can count on my friends when things go wrong) was 0.868; the correlation coefficient between item 9 (I have friends with whom I can share my joys and sorrows) and 12 (I can talk about my problems with my friends) was 0.884. High item-item correlations suggested redundant examination of perceived social support from friends. To further test for redundancy, the examination of Cronbach's  $\alpha$  with deletion of items from the scale was conducted; Cronbach's  $\alpha$  did not decrease below 0.90 when items were deleted, indicating redundancy was unlikely. Thus, our findings support strong reliability of the MSPSS in patients with COPD and HF.

An exploratory factor analysis using principal components with a direct oblimin (oblique) rotation yielded a 3-factor structure with items loading on each of the friend, family and significant other subscales. These results are consistent with previous factorial validity testing of the MSPSS; in patients with HF,<sup>27</sup> pregnant women,<sup>25</sup> adolescents,<sup>25,28</sup> and undergraduate students.<sup>24</sup> A three-factor structure was produced with items corresponding to the dimensions of friends, family and significant other. The findings of our analysis in conjunction with previous investigator's findings support a three-dimension solution in patients with concomitant COPD and HF.

We further tested the construct validity of the MSPSS in this population by hypothesis testing. Previous investigators have supported the importance of perceived social support in performing self-care in COPD and HF populations separately; however, to our knowledge,

investigators have not tested the association of perceived social support with self-management scores in patients with comorbid COPD and HF. Our results confirmed findings from previous investigators who found that higher levels of perceived social support were associated with better self-care management score.<sup>8,11,14,15</sup> Thus, social support is an important factor to consider when measuring self-care management for those with comorbid conditions such as COPD and HF.

Additionally, we also observed that LVEF was a predictor of self-care management score. For every 1% increase in LVEF, there was a 0.234 decrease in self-care management score. This finding is consistent with previous investigators who studied self-care management in patients with HF alone. Lee and colleagues<sup>35</sup> found that worse functional class (NYHA III/IV) and higher ejection fraction were significant predictors of poorer consulting behaviors; consulting behaviors were defined as actions taken by patients to seek guidance about worsening symptoms.<sup>35</sup> Patients with poor consulting behaviors scored an average 12.3 points lower ( $t = 3.1, p < .01$ ) on the self-care management subscale of the SCHFI compared to those patients who had good consulting behaviors.<sup>35</sup> Patients who did not have highly burdensome symptoms or greater functional impairment may have not needed to engage in self-care management behaviors;<sup>35,36</sup> the self-care management subscale is most relevant to symptomatic patients.<sup>30</sup> Thus, patients with a higher LVEF likely had a lower symptom burden, which required less self-care management; subsequently, these patients may not have fully developed self-management skills.

**Table 3**  
Multiple linear regression variables predicting self-care management score (N = 303)

Model Variable	Unstandardized coefficient	Standard error of the coefficient	Standardized coefficient	P value
Age	0.112	0.107	0.065	.30
Gender	3.546	2.711	0.084	.19
Ethnicity	0.010	2.416	0.000	.99
Marital Status	0.937	1.394	0.043	.50
Living Situation	−0.189	2.825	−0.004	.95
Education Level	0.141	0.350	0.025	.69
Smoking History	1.778	1.163	0.096	.13
BMI	0.153	0.163	0.059	.35
LVEF	−0.319	0.084	−0.234	<.01
NYHA Class	1.175	1.644	0.044	.48
Perceived Social Support (MSPSS total score)	0.151	0.070	0.128	.03

Abbreviations: NYHA, New York Heart Association Functional Class; LVEF, left ventricular ejection fraction; BMI, body mass index; MSPSS, multidimensional scale of perceived social support.

$R^2 = 0.085$ , adjusted  $R^2 = 0.051$ ,  $df = 11$ , model  $F$  statistic = 2.463,  $p = .006$ .

## Limitations

The participants included in this secondary data analysis were derived from a registry of patients with HF; thus, we had no control over the variables measured or the data collection process and could not appraise the data for accuracy or validity. The MSPSS and the SCHFI are self-report instruments and may be subject to social desirability bias. However, all data collection procedures were designed to reduce the potential for bias, and data input was evaluated by the original investigators for accuracy prior to analysis.

## Implications for future research and practice

Further research is warranted examining the psychometric properties of the MSPSS. Future hypothesis testing of the MSPSS with other related constructs such as anxiety, depression and health related quality of life using instruments such as the Hospital Anxiety and Depression Scale<sup>37</sup> and the St. George Respiratory Questionnaire<sup>38</sup> would provide additional evidence for the construct validity of the MSPSS in comorbid COPD and HF. Moreover, further examination of the psychometric properties of the MSPSS in patients with solely COPD, as well examining the relationship between comorbidities, perceived social support and self-care are necessary; our results provide preliminary insights suggesting that comorbid diseases did not affect the relationship between social support and self-care.

Results of this analyses suggest that the MSPSS can routinely be administered to patients with HF and COPD as a valid and reliable measure of perceived social support. Given that an estimated 52% of patients with HF have comorbid COPD, use of this instrument may empower providers to tailor care at the patient level and potentially provide resources or referrals to foster greater perceived social support for a large proportion of patients with these comorbidities.<sup>3</sup>

## Conclusion

We conducted rigorous psychometric testing of the MSPSS in patients with comorbid COPD and HF. This instrument was demonstrated to be a reliable and valid measure of perceived social support from friends, family and significant others in patients with COPD and HF.

## Declarations of interest

None.

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