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Keywords
heart failure, symptoms, self-care

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Symptom Clusters of Heart Failure

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Abstract

Patients with heart failure (HF) report multiple symptoms. Change in symptoms is an indicator of HF decompensation. Patients have difficulty differentiating HF symptoms from comorbid illness or aging. The study purpose was to identify the number, type, and combination of symptoms in hospitalized HF patients and test relationships with comorbid illness and age. A secondary analysis from a HF registry (*N*=687) was conducted. The sample was 51.7% female, mean age 71±12.5 years. The theory of unpleasant symptoms informed the study regarding the multidimensional nature of symptoms. Factor analysis of 9 items from the Minnesota Living with HF Questionnaire resulted in three factors, acute and chronic volume overload and emotional distress. Clusters occurred more frequently in older patients, but caused less impact.

Keywords

heart failure; symptoms; self-care

Symptoms can be used by patients as indicators of their illnesses. Patients with heart failure (HF) commonly report multiple symptoms, including dyspnea on exertion, fatigue, and peripheral edema. As HF is a chronic and progressive syndrome, these symptoms occur even in persons who are clinically stable. However, a change or increase in severity or frequency of these symptoms is an important early indicator of decompensation. HF patients often have difficulty recognizing their symptoms, attributing their symptoms to the correct cause, and differentiating symptoms of HF from those of comorbid illness or normal aging. Previous hospitalization for HF does not improve patients' timely response to their symptoms (Friedman, 1997; Jurgens, 2006).

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Symptom clusters have been examined in other illnesses, most commonly cancer (Armstrong, Cohen, Eriksen, & Hickey, 2004; Dodd et al., 2001). Cancer symptom clusters have been found useful in assessing the effect of multiple co-occurring symptoms (versus discrete individual symptoms) on patient outcomes such as quality of life and functional status (Miaskowski, Dodd, & Lee, 2004). We reasoned that if clusters of HF symptoms could be identified, patients with HF might be helped to recognize their early symptoms of decompensation more readily. That is, the understanding of relationships among co-occurring HF symptoms may assist patients to attribute their symptoms to their heart instead of more benign causes. Accurate symptom attribution could facilitate timely self-care and potentially avert hospital admission for acute symptom management. The purpose of this study was to identify the number, type, and combination of symptoms in hospitalized HF patients. A secondary purpose was to identify the contribution of comorbid illness and age to symptom clusters.

Theoretical Framework

The theory of unpleasant symptoms guided this study, as it specifies that the experience of symptoms is multidimensional (e.g., more than a physical sensation). The theory also incorporates the potential interactions of multiple symptoms (Lenz, Pugh, Milligan, Gift, & Suppe, 1997; Lenz, Suppe, Gift, Pugh, & Milligan, 1995). The 3-tier theoretical model describes the influence of antecedent physiological, psychological, and situational factors on symptom characteristics and patient response.

The significance of this perspective is that when symptoms are multidimensional, cognitive, affective, and situational stimuli may make it difficult to differentiate symptoms and accurately label underlying pathologies. When there is interaction among symptoms, patients may have difficulty differentiating their dyspnea from other psychosocial and situational factors that affect symptom perception and response to symptoms (L. Cameron, Leventhal, & Leventhal, 1993). Antecedents such as depression or previous illness experience can influence patients' perceptions about their symptoms. A depressed patient might ignore the timing, intensity, quality and distress characteristics of new onset edema.

In the theory of unpleasant symptoms, symptoms are conceptualized both individually and in combination with other symptoms. Furthermore, according to the theory when multiple symptoms are experienced simultaneously, it may be more difficult to differentiate the quality of each individual symptom. Therefore, there are benefits to identifying clusters of HF symptoms for both patients and clinicians. Patients who are unable to attribute a symptom to HF may ignore the symptom and delay performing self-care behaviors or seeking medical advice. With knowledge of which symptoms cluster together, clinicians can teach patients who have trouble recognizing dyspnea to monitor for another symptom in the cluster. Knowledge of symptoms as clusters may improve the ability to attribute symptoms appropriately and make symptom monitoring more meaningful for patients.

Background

Early symptoms of impending decompensated HF include weight gain, development of or increasing peripheral edema, increasing dyspnea with activity, increased abdominal girth, and fatigue. Without medical intervention, these symptoms often progress to include more physically compromising (acute) symptoms such as severe dyspnea, limiting the ability to speak in full sentences, paroxysmal nocturnal dyspnea (waking at night unable to breathe), or orthopnea (inability to breathe while lying flat). Some of the most common etiologies of decompensated HF are lack of adherence to medications, sodium indiscretion, and infection (Paul & Vollano, 2008). Sensitivity to and recognition of a subtle and insidious increase in

HF symptom severity (e.g., decreased activity tolerance) from chronic baseline symptoms to decompensated HF is challenging for patients.

Patients with HF who experience multiple symptoms have been shown to have particular difficulty with symptom perception. In a study of patients treated for HF in a hospital emergency department, some patients responded to a change in the intensity or perceived distress of their symptoms while others responded to symptom duration (Parshall et al., 2001).

Comorbid illnesses (physical and psychological) have been shown to complicate accurate symptom attribution for HF patients. Common comorbid illnesses in this population include hypertension, coronary artery disease, diabetes, chronic lung disease, atrial fibrillation, renal failure, depression, and anemia (Ceia et al., 2004; Dahlstrom, 2005; Masoudi & Krumholz, 2003). Differentiating the origin of symptoms in the presence of comorbid illness is difficult. For example, fatigue is common to many of these diagnoses. Dyspnea, the most commonly experienced symptom among HF patients, is often attributed to chronic lung disease (Horowitz, Rein, & Leventhal, 2004). In some cases, dyspnea of HF is eventually accepted as normal and patients do not identify dyspnea as a problem (Edmonds et al., 2005). For patients with both HF and chronic lung disease (e.g., chronic obstructive pulmonary disease), differentiating the source of dyspnea is challenging.

Psychological factors such as depression can affect the perception of dyspnea distress. Ramasamy and colleagues (2006) examined psychological correlates of dyspnea in patients ($N = 67$) with chronic HF. Dyspnea was related to depression, fatigue, and overall health perception. Symptoms are not simply unpleasant physical sensations. Rather, they have cognitive and affective components that influence how the physical sensations are perceived and reported.

Advanced age complicates symptom assessment, as elders may experience or interpret physical symptoms differently. In the United States, HF is the most common hospital discharge diagnosis in persons 65 years of age and older (DeFrances, Lucas, Buie, & Golosinskiy, 2008; Thomas & Rich, 2007). Among patients with HF, older patients reported less physical symptom distress when admitted to the hospital with decompensated HF (Jurgens, Fain, & Riegel, 2006). Some illnesses present atypically in older adults (e.g., atrial fibrillation; Resnick, 1999), and others are commonly dismissed as signs of aging (Stoller, 1993). Considering the interplay of advanced age, comorbid illness, and the lack of specificity of symptoms of HF, it is not surprising that HF patients have difficulty determining the meaning of their symptoms.

Methods

A secondary analysis was conducted to identify acute and chronic HF symptom clusters in patients hospitalized for decompensated HF. For the purpose of this study, new and or worsening HF symptoms, or acute HF symptoms leading to hospitalization, are referred to as decompensated HF. Symptom clusters were defined as three or more concurrent symptoms that are related to one another (Dodd, Miaskowski, & Lee, 2004).

Sample

A sample of patients was drawn from a data registry of the Heart Failure Quality of Life Trialist Collaborators. The data were contributed by investigators from six sites representing the southwestern, southeastern, and northeastern regions of the United States. Only patients with a confirmed diagnosis of HF were included in this study. The diagnosis of HF was determined by the attending physician based on echocardiographic and clinical criteria. Both newly diagnosed patients and those with a history of HF were included. Patients with acute myocardial infarction, unstable angina, cognitive impairment, or severe psychiatric problems were excluded, as were those discharged to an extended care or skilled nursing facility and those who were homeless. To be included in this secondary analysis, the patients had to speak either English or Spanish.

At the time this study was conducted (2007), contributors to the data registry had enrolled a total of 2244 hospitalized and community-dwelling patients. All of the data used in this analysis were obtained from patients who were hospitalized at the time of enrollment (N=687) and collected for other primary studies (Armola & Koduru, 2001; Moser, Macko, & Worster, 2000; Riegel, Carlson, Glaser, & Romero, 2006; Riegel et al., 2002; Sethares & Elliott, 2004). We included only hospitalized patients because we sought to differentiate acute and chronic HF symptom clusters. Acute symptoms (e.g., paroxysmal nocturnal dyspnea, orthopnea) were assumed to be more common among hospitalized patients.

The sample of 687 patients was elderly, about half female, mostly white and functionally compromised (i.e., New York Heart Association [NYHA] class III or IV; Table 1). Many had less than a high school education.

Local Institutional Review Boards approved each individual study of the contributors to the data registry. In addition, this secondary analysis was approved by the university Institutional Review Board of the principal investigator.

Measurement—Symptoms were measured during hospitalization (N = 687) using items from the Minnesota Living with HF Questionnaire (MLHFQ), a 21-item disease-specific Likert-type scale measuring quality of life in patients with HF (Rector, Kubo, & Cohn, 1987). The response scale assessing the impact of HF on living as desired ranges from 0 (*no*) to 5 (*very much*; range 0 to 105) with higher scores indicating higher physical and emotional impact related to HF. Congruent with the theory of unpleasant symptoms, the questionnaire focuses on a patient's self-assessment of how HF affects various aspects of their quality of life over the past month. This time frame and focus of the items affords assessment of both chronic symptoms and those more acute in nature. Nine of the MLHFQ instrument items specifically ask about the effect on living related to symptoms significant enough to influence quality of life. The physical HF symptoms (6 MLHFQ items) and emotional symptoms (3 MLHFQ items) were used in this analysis (refer to Table 2 for the symptom items used). General quality of life items (e.g., relationships, difficulty working, medical care costs) and items deemed nonspecific to HF (e.g., HF medication side effects) were not included in this analysis. The nine symptom items used in this secondary analysis were assessed for sampling adequacy using the Kaiser-Meyer-Olkin Test (.848) and for interrelationships using Bartlett's Test of Sphericity; both were acceptable (Pett, Lackey, & Sullivan, 2003).

When the psychometric properties of the MLHFQ were assessed in prior studies, internal consistency reliability was high, with Cronbach's alpha ranging from .73 to .93 in one study (Briancon et al., 1997). In another study, test-retest reliability was high after a 7-21 day period (weighted kappa reliability coefficients .84; Rector et al., 1987). In a secondary analysis of 1,906 HF patients, nearly half of whom were 65 years of age or older, the MLHFQ reliability, calculated using structural equation modeling, was .86 (Rector, Anand, & Cohn, 2006). Other investigators have used a select subset of items from the MLHFQ and another health status measure (SF-12; Baker, Brown, Chan, Dracup, & Keeler, 2005). They reported adequate reliability (Cronbach's alpha .88) and validity using 7 items.

Analysis

Symptom clusters were identified using principal components analysis to extract the factors (SPSS 13.0, Chicago, IL). Oblique rotation was used because the symptom items were related, albeit most were not highly correlated. Inter-item correlation ranged from .23 to .65, with 64% of the correlations equal to or less than .40. The pair with the highest inter-item correlation was shortness of breath and fatigue/low in energy (r = .65); depression and worry were correlated at .64. Oblique rotation assumes that there is some relationship between factors. Therefore, in this study, Direct Oblimin with Kaiser normalization was used to rotate factors for interpretation (Pett et al., 2003). Factors with an eigenvalue >.8 were extracted and evaluated using the criterion of interpretability (Costello & Osborne, 2005; Munro, 2005). In addition, the criteria of total variance explained by the factors and the analysis of the scree plot were used to determine the factors. Items that loaded on more than one factor (common with an oblique rotation) were examined using differences in the coefficient alpha if an item was deleted (Pett et al.). There were minimal differences in the coefficient alpha with deletion of any item; therefore all 9 symptom items initially selected for the analysis were retained.

Logistic regression was used to identify the contribution of age and comorbid chronic lung disease, diabetes, renal disease, and peripheral vascular disease to occurrence or non occurrence of HF symptom clusters. Age groups were determined based on differences in symptom distress reported in prior studies among patients with HF (Friedman, 1997; Jurgens et al., 2006). Age was grouped into three categories (< 65 years; 65-74; ≥75 years), and one-way ANOVA with Scheffe post hoc analysis was used to explore statistical differences. Lower symptom distress also has been reported among patients of advanced age (e.g. ≥75 years). Furthermore, multiple symptoms together with being age 65 and older were predictive of HF rehospitalization (Roe-Prior, 2004). We therefore further divided the groups to examine differences between those younger than 65 years and the two older age groups.

Results

Three unique symptom clusters were identified. Factors were identified from the factor structure matrix (Table 2). According to Pett et al. (2003) the factor structure matrix is more stable than the factor pattern matrix as it is unaffected by the size of the correlations among the factors. Factors were confirmed with the pattern matrix (Table 3). The item *"need to lie down and rest during the day"* double loaded on both the acute volume overload cluster and the chronic volume overload cluster. Based on its loading in the structure matrix and a conceptual relationship to dyspnea with activity, this item was placed with the chronic volume cluster. The higher loading (.699) also indicates a higher shared variance with the other items in that factor further supporting placement in the chronic volume overload factor (Pett et al.).

The cluster that explained the most variance in impact of symptoms on living as desired in this hospitalized sample was the acute volume overload cluster, with shortness of breath, fatigue, and sleep problems presumably reflecting nocturnal dyspnea (45.7%). Another 13.1% of variance in symptom impact was explained by the emotional cluster of depression, memory problems, and worry. The third cluster, reflecting chronic volume overload included swelling, an increased need to rest, and dyspnea on exertion. The chronic volume overload cluster explained 9.3% of the variance in symptom impact. These three clusters explained a total of 68.1% of the variance in symptom impact.

Symptom cluster scores could range from 0 to 15; lower scores indicated lower symptom impact. The alpha coefficients for each cluster were adequate and ranged from .72 to .76

(Table 2). There were moderate correlations between clusters ranging from .45 to .62 (p = .001, 2-tailed).

When the contribution of comorbid illness and age in relation to symptom cluster occurrence was assessed using logistic regression, older age predicted the occurrence of each of the 3 clusters (Table 4). Diabetes was a significant predictor only for the emotional cluster. In examining symptom clusters in relation to age group, patients age 75 years and older reported significantly less symptom impact when compared with the younger age groups for each cluster (Table 5).

Discussion

Three unique symptom clusters (acute volume overload; emotional; chronic volume overload) were identified in this large sample of hospitalized HF patients. Comorbid illness was a poor predictor of symptom clusters; only diabetes was associated with the emotional symptom cluster. In each case, the clusters occurred more frequently but with less impact on living as desired in patients aged 75 and older. That is, the presence of *all* three symptoms comprising the cluster occurred more often in older patients but they were less affected by them. Others have noted that symptoms become less severe with aging (Soiza, Leslie, Harrild, Peden, & Hargreaves, 2005), but little is written explaining why elders are relatively less sensitive to symptoms. Perception of cardiac symptoms may be influenced by changes in adrenergic function associated with aging, body composition (e.g., leanness), fitness, and symptom proneness or the tendency to be aware of and report symptoms (O. G. Cameron, 2001).

The theory of unpleasant symptoms proposes an interplay between intensity (severity, amount), timing (duration, frequency), distress (how much one is bothered), and quality (how it is manifested) of multiple symptoms. Our analysis supports the premise of the theory that the multidimensional nature of symptoms includes more than merely a physical sensation. An example is that shortness of breath, fatigue, and sleep problems, the cluster described as acute volume overload, explained the most variance in symptom impact. One potential explanation is that shortness of breath severe enough to disturb sleep (timing) may partly explain the greater variance in impact seen in the sample with this cluster.

Only a small amount of variance in symptom impact was attributable to the chronic volume overload cluster (swelling, an increased need to rest, and dyspnea on exertion). One explanation for this finding is that the early symptoms of HF decompensation such as these often increase insidiously over several weeks and cause little physical or emotional impact. As a result, patients may not be conscious of symptoms in this cluster until they patient are severely compromised (Jurgens, 2006). Patients also may compensate for their symptoms by decreasing their daily activity to make their symptoms less noticeable. In a classic study, Friedman (1997) reported edema found on physical exam is often not noticed by patients hospitalized with decompensated HF. This explanation is consistent with the theory of unpleasant symptoms which holds that the symptom experience is influenced by factors beyond physiological changes and physical sensation. The physical severity of symptoms (e.g., edema) may not always prompt concern in the patient. Finally, increased dyspnea with exertion and the subsequent increased need to rest are changes in HF status that may be ignored without specific guidance from health care providers.

A single emotional symptom cluster was identified in the current study; memory problems grouped with depression and worry. The aggregation of these three symptoms into a single group is understandable, as prior investigators have demonstrated that worry is a symptom of depression (Taillefer, Kirmayer, Robbins, & Lasry, 2003), and depression is associated with memory problems in patients with HF (Vogels, Scheltens, Schroeder-Tanka, & Weinstein, 2007).

It is not surprising that unique acute and chronic volume overload symptom clusters were identified in this sample, as the physiology of symptoms for decompensated HF and chronic HF is different. Decompensated HF is characterized by volume overload resulting in acute shortness of breath. The most commonly reported symptoms of chronic HF are dyspnea on exertion and fatigue, which may be related to skeletal muscle abnormalities, including reduced muscle bulk, endurance, and capacity to exercise. Consequently, abnormal muscle performance during exercise is sensed as fatigue. Similar abnormalities believed to occur in respiratory muscles may result in breathlessness. Additionally, skeletal muscle ergoreceptors, sensitive to work load, are abnormally enhanced in patients with chronic HF. Stimulation of the ergoreceptors increases ventilation and sympathetic stimulation and is sensed as breathlessness (Clark, 2006).

These results support the theory of unpleasant symptoms and extend our prior work (Jurgens et al., 2006). In our prior study, we identified an acute symptom cluster (dyspnea, orthopnea, paroxysmal nocturnal dyspnea) and a chronic symptom cluster (fatigue, weight gain, dyspnea on exertion) that occurred in 52% and 30% of the sample ($N = 201$) respectively. The acute and chronic symptom clusters from our current and prior work are consistent with the symptoms identified by Ahmed and colleagues (Ahmed, Allman, Aronow, & DeLong, 2004), who noted that three or more of the following symptoms--dyspnea at rest, dyspnea on exertion, orthopnea, paroxysmal nocturnal dyspnea, fatigue, or swelling--increased the positive predictive value for the diagnosis of HF. Schiff, Fung, Speroff, and McNutt (2003) noted that dyspnea (98%), edema (77%), and weight gain (41%) are common among patients with decompensated HF. However, these symptoms were not analyzed as a cluster in the study by Schiff, so the consistency of the cluster and its value in predicting outcomes such as their duration prior to seeking care remain unknown.

Clinicians often assume they can predict patient outcomes based on clinical characteristics, but the degree of distress of HF symptoms bears little relationship to the degree or type of cardiac dysfunction (Clark, 2006; Coats, 2001; Witte, Nikitin, Cleland, & Clark, 2006). Knowledge of symptom clusters may assist *both* patients and clinicians to evaluate the meaning and importance of early symptoms of decompensation. With the recent trend toward remote monitoring of patients through telephone or telemonitoring devices, clinicians are at a disadvantage in not being able to physically assess patients. Questioning patients about other, concurrent symptoms may be a useful method of discerning whether early symptoms are evidence of HF or other comorbid illnesses.

The ultimate goal of this research is to find ways to help patients recognize and appropriately label their early symptoms of fluid retention. It is difficult to discern from the published literature how HF patients are taught to monitor their symptoms. Most researchers have reported that patients are taught to monitor symptoms such as shortness of breath and edema (Martensson, Stromberg, Dahlstrom, Karlsson, & Fridlund, 2005), what to do if individual symptoms progress (Koelling, Johnson, Cody, & Aaronson, 2005), and the importance of seeking assistance when symptoms of HF worsen (Stromberg, 2005). When symptoms prompt patients to seek emergency care, dyspnea is the most frequent complaint reported (Friedman, 1997). In the acutely ill patient presenting with decompensated HF, fatigue, unless specifically asked about, is reported less often or not at all. Understandably, difficulty breathing probably would be of more concern to hospitalized patients than fatigue.

Evidence to date suggests that persons with HF ignore, deny, or adapt to symptoms that are not acute or perceived as important (Edmonds et al., 2005; Horowitz et al., 2004). Teaching patients to monitor clusters of symptoms versus individual symptoms may provide a tool that patients can use to make rational judgments about their early symptoms of HF decompensation. For example, patients might be less likely to accept fatigue as normal if they were taught to look for other symptoms occurring at the same time. If they also noted swelling in their extremities and an increase in dyspnea with activity, then attributing the symptoms to their HF versus something more benign would be possible. Furthermore, given the unique and variable symptom profiles among patients with HF, identifying each patient's individual symptom cluster(s) may improve self-care in this population.

Limitations on the generalizability of this study include the heterogeneous designs of the studies comprising the data set. Although most data were collected in clinical trials, this study was a secondary analysis of data from multiple, unique studies. Patients with HF typically experience a wide variety and number of symptoms (Jurgens et al., 2006; Zambroski, Moser, Bhat, & Ziegler, 2005) secondary to HF. The number and type of HF symptoms available in the MLHFQ is limited to the 9 items used in this analysis and as such the clusters from this analysis are not as rich as those from our original research. Lastly, the number of emotional symptoms is limited in the MLHFQ. Only three emotional symptoms were measured, which may explain why they clustered together.

Future research is needed to determine at what point the chronic volume symptom cluster evolves into the acute volume symptom cluster and the individual factors, like symptom perception, that influence response to this transition. It would be ideal to be able to identify symptoms as they occur, instead of retrospectively. One approach that may be effective in accomplishing this goal would be use of the “talk aloud” method of data collection, where patients are given a tape recorder and asked to describe their experiences as they occur (Paterson & Thorne, 2000). A final suggestion for future researchers is to determine whether the individual clusters increase diagnostic accuracy by clinicians.

In summary, we have identified three conceptually valid clusters of HF symptoms that may be useful in helping HF patients and clinicians to judge HF symptoms as a group versus individual and unrelated symptoms. Viewing symptoms as clusters may be key to providing a meaningful context for interpreting their meaning. The results also suggest that age is an important consideration when assessing the clusters, as elders 75 years and older had less symptom impact than younger patients. Better symptom recognition may decrease delay in response to early symptoms and improve outcomes such as averting hospitalization, but further research is needed to test these hypotheses.

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Table 1

Sociodemographic Characteristics (*N* = 687)

	N (%)[a]
Age (*M* 71, *SD* 12.5 years)	
< 65 years	165 (25.5)
65 – 74	193 (29.8)
≥75	289 (44.7)
Missing data	40 (5.8)
Sex (female)	355 (51.7)
Race and Ethnicity	
African American	45 (6.6)
White	418 (61)
Asian	12 (1.7)
Hispanic	209 (30.5)
Other	1 (0.1)
New York Heart Association Class	
Class 1	3 (0.5)
Class 2	103 (16)
Class 3	293(45.4)
Class 4	246 (38.1)
Education	
< high school	242 (42.9)
High school	212 (37.6)
Some college	68 (12)
College degree	31 (5.5)
Graduate degree	11 (2)
Missing data	146 (20.6)
Marital status	
Single	67 (9.8)
Married	322 (47.1)
Divorced/Separated	69 (10.1)
Widowed	226 (33)

[a]Numbers of participants varied slightly in each response set, so percentages also vary slightly.

Table 2

Factor Analysis: Structure Matrix

Symptom	***N* = 687**		
	Factor 1 Acute volume overload	**Factor 2 Emotional**	**Factor 3 Chronic volume overload**
Percent of variance in symptom impact explained by the cluster	45.7%	13.1%	9.3%
Alpha coefficient	.72	.758	.734
Eigenvalue	4.113	1.179	.839
Did your heart failure prevent you from living as you wanted during the last month by:			
Making you **short of breath**	**.865**	.368	.253
Making you **tired, fatigued, or low on energy**	**.879**	.426	.363
Making your **sleeping** well at night difficult	**.586**	.443	.475
Making you feel **depressed**	.324	**.892**	.291
Making you **worry**	.412	**.833**	.222
Making it difficult for you to **concentrate or remember things**	.335	**.728**	.336
Causing **swelling** in your ankles, legs, etc.	.255	.317	**.875**
Making you sit or lie down to rest during the day **(need to rest)**	.686	.398	**.699**
Making your walking about or climbing stairs difficult **(dyspnea on exertion)**	.633	.381	**.712**

Factor loadings in **bold** indicate the clusters Extraction Method: Principal Components Analysis Rotation Method: Oblimin with Kaiser Normalization

Table 3

Factor Analysis: Pattern Matrix

Symptom	N = 687		
	Factor 1 Acute volume overload	**Factor 2** Emotional	**Factor 3** Chronic volume overload
Did your heart failure prevent you from living as you wanted during the last month by:			
Making you **short of breath**	**.904**	.016	-.115
Making you **tired, fatigued, or low on energy**	**.855**	.054	.002
Making your **sleeping** well at night difficult	**.408**	.178	.250
Making you feel **depressed**	-.077	**.926**	-.003
Making you **worry**	.412	**.833**	.222
Making it difficult for you to **concentrate or remember things**	-.005	**.698**	.093
Causing **swelling** in your ankles, legs, etc.	-.133	.056	**.909**
Making you sit or lie down to rest during the day **(need to rest)**	.480	.013	**.502**
Making your walking about or climbing stairs difficult **(dyspnea on exertion)**	.410	.013	**.544**

Factor loadings in **bold** indicate the clusters Extraction Method: Principal Components Analysis Rotation Method: Oblimin with Kaiser Normalization

Table 4

Logistic Regression of Influence of Age and Comorbid Illness as Predictors of Clusters

Cluster	Predictor	Odds ratio (95% CI)	*SE*	*p*	Estimate of variance
Acute symptom cluster	Age	.956 (.94-.98)	.012	<.001	
	Lung disease	1.21 (.72-2.0)	.265	.472	
	Diabetes	.952 (.59-1.5)	.248	.841	7.3%
	Renal disease	.806 (.46-1.4)	.290	.458	
	PVD	.771 (.41-1.4)	.318	.771	
Emotional cluster	Age	.965 (.95-.98)	.009	<.001	
	Lung disease	.754 (.48-1.2)	.235	.231	
	Diabetes	.644 (.42-.99)	.221	.046	7.4%
	Renal disease	1.090 (.65-1.8)	.265	.754	
	PVD	.871 (.48-1.6)	.301	.646	
Chronic symptom cluster	Age	.969 (.95-.99)	.009	.001	
	Lung disease	1.423 (.90-2.2)	.233	.130	
	Diabetes	1.22 (.80-1.9)	.217	.350	5.6%
	Renal disease	.989 (.59-1.7)	.264	.966	
	PVD	1.080 (.61-.99)	.295	.793	

PVD = peripheral vascular disease

Estimate of variance = Nagelkerke R^2

Table 5

Mean Differences of Symptom Clusters and Age

Age Group	*N*	Mean (*SD*)	Significance between groups
Cluster 1			
Acute volume overload			
< 65 years	165	11.8 (3.6)	<.001
65-74	193	11.1 (3.5)	
75 and >	289	10 (3.9)	
Cluster 2			
Emotional			
< 65 years	165	9 (4.6)	<.001
65-74	193	7.9 (4.4)	
75 and >	289	6.5 (4.7)	
Cluster 3			
Chronic volume overload			
< 65 years	165	9.6 (4.3)	.002
65-74	193	9 (4.3)	
75 and >	289	8.1 (4.4)	