Patterns of self-care in adults with heart failure and their associations with socio-demographic and clinical characteristics, quality of life and hospitalizations: A cluster analysis

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What's New?

- Four clusters of heart failure patients were identified: high consistent adherence with high consulting behaviours; low consistent adherence with low consulting behaviours; inconsistent adherence with low consulting behaviours; and inconsistent adherence with high consulting behaviours.
- The cluster identified showed different ways to perform self-care; each cluster showed typical characteristics for socio-demographic and clinical variables, quality of life, and number of hospitalizations.
- The clusters identified could be used to tailor interventions aimed at improving self-care behaviours in HF patients.

Keywords. Heart failure, Self-care, Medication adherence, Cluster analysis.

Abstract

Background. Self-care is important in heart failure (HF) treatment, but patients may have difficulties and be inconsistent in its performance. Inconsistencies in self-care behaviours may mirror patterns of self-care in HF patients that are worth identifying in order to provide interventions tailored to patients.

Objectives. To identify clusters of HF patients in relation to self-care behaviours and to examine and compare the profile of each HF patient cluster considering the patient's socio-demographics, clinical variables, quality of life and hospitalizations.

Methods. This was a secondary analysis of data from a cross sectional study that enrolled 1,192 HF patients across Italy. A cluster analysis was employed to identify clusters of patients based on the European Heart Failure Self-Care Behaviour Scale factor scores. Analysis of variance and Chi square were used to examine characteristics of each cluster.

Results. Patients were 72.4 years old on average and 58% males. Four clusters of patients were identified: 1) high consistent adherence with high consulting behaviours, characterized by younger patients, with higher formal education and higher income, less clinically compromised, with the best physical and mental quality of life (QOL) and lowest hospitalization rates; 2) low consistent adherence with low consulting behaviours, characterized mainly by male patients, with lower formal education and lowest income, more clinically compromised and worse mental QOL; 3) inconsistent adherence with low consulting behaviours, characterized by patients who were less likely to have a caregiver, with the longest illness duration, the highest number of prescribed medications and the best mental QOL; 4) and inconsistent adherence with high consulting behaviours, characterized by patients who were mostly female, with lower formal education, worst cognitive impairment, worst physical and mental QOL, with higher hospitalization rates.

Conclusion. The four clusters identified in this study and their associated characteristics could be used to tailor interventions aimed at improving self-care behaviours in HF patients.

Introduction

Heart failure (HF) is a chronic condition that has a significant impact on the western population. HF affects 15 million people in Europe and 5.7 million people in the US [1,2] and its prevalence is increasing in the aging population. In fact, while only 0.4–2% of the general population is affected by HF, this prevalence rises to more than 12% in adults over 80 years [2]. HF has a high impact on patients' quality of life (QOL). Several studies have shown that QOL in HF patients is worse than the QOL of cancer patients and those with other chronic illnesses [3,4] because of the burden of symptoms, recurrent hospitalizations and use of emergency services [5].

Self-care is an important component of HF treatment [6,7]. Self-care of HF is a multidimensional construct that includes adherence to the treatment regimen (e.g., taking medication as prescribed) and consulting behaviours (e.g., calling the provider in case of shortness of breath) [8]. Several studies have shown that people who perform adequate self-care have better QOL, fewer hospitalization and longer survival [9-11].

Although self-care is important in HF treatment, patients struggle to perform adequate self-care [12]. Self-care requires life style changes (e.g., physical activity), vigilance over symptom exacerbation (e.g., weight gain) and prompt interventions to reduce fluid overload (e.g., take extra diuretics), and all these tasks may be burdensome for patients [12]. Consequently, patients are often inconsistent in self-care. In fact, most patients find it easier to take medications, keep provider appointments or call the provider in case of necessity, but find it more difficult to exercise and reduce their salt intake [13,14]. This inconsistency in self-care behaviours was also found in the psychometric testing of the HF self-care scales existing in the literature where the correlations among the self-care dimensions were from low to moderate [8,15,16].

The inconsistency in self-care behaviours supports the existence of different typologies or patterns of self-care in HF patients that can be identified with cluster analysis. Cluster analysis

creates a classification of entities that maximizes the between-group variation and minimizes within-group variation [19]. In cluster analysis, individuals belonging to the same cluster are homogeneous in term of patterns of behaviours. For example, they may have high consulting behaviours and low treatment adherence. Also, individuals belonging to the same cluster may have a similar characteristic profile (e.g., high level of depression). By knowing the patterns of behaviours that emerge from cluster analysis (e.g., high consulting behaviours and low treatment adherence) and the characteristics associated to each cluster (e.g., high level of depression), clinicians can use patterns to predict characteristics of each cluster and characteristics of each cluster to predict pattern belonging. By doing so, clinicians can tailor interventions that meet patients' real need. It was shown that tailored interventions in HF are better than a "one-size-fits-all" approach [17]. Tailored interventions in cardiovascular care have also been advocated by a recent position statement of the Council on Cardiovascular Nursing and Allied Professionals of the European Society of Cardiology [18].

Although in the literature three studies were conducted to identify typologies of self-care in adults with HF [20-22], only one study used a cluster analysis [22]. This study was conducted with 689 adults with HF and found three typologies of self-care: "novice," "expert" and "inconsistent." The "novice" and the "expert" reported the lowest and the highest levels of self-care respectively, while the "inconsistent" were in the middle. Higher activity status was a predictor of membership in the "inconsistent" and the "novice" cluster, while self-care confidence was a predictor of membership in the "expert" or "inconsistent" cluster. So far, no study has given a profile of HF patient clusters considering patients' socio-demographic and clinical variables, quality of life, and hospitalization. As said earlier, identifying patients' clusters and the profiles of each cluster may be useful in identifying individuals who belong to a particular cluster and thus to tailor interventions aimed at improving individual self-care. Therefore, the aims of this study were twofold: 1) to identify clusters of HF patients in relation to self-care behaviours and 2) to examine the profile of each HF

patient cluster considering patients' socio-demographic and clinical variables, quality of life and hospitalization.

Methods

Design

This was a secondary analysis from a cross-sectional study aimed at describing self-care in the Italian population [23].

Sample and setting

A convenience sample of 1,192 patients with HF was enrolled in the parent study [23]. Patients were recruited during routine ambulatory visits from many cardiovascular outpatient clinics located in 28 provinces in the north, centre, and south of Italy. To be included in the study, patients had to meet the following criteria: 1) a confirmed diagnosis of HF according to international guidelines [6]; 2) 18 years of age or older; 3) without a coronary event in the last three months; 4) able to read and understand the Italian language; and 5) be willing to sign the informed consent form. Patients were excluded if their medical record reported a diagnosis of dementia.

Instruments

The following instruments were considered in this study.

The nine-item version of the European Heart Failure Self-Care Behaviour Scale (EHFScBS) [8] is a disease-specific self-report tool designed to measure self-care behaviours in HF patients. In its original version, the EHFScBS is composed of two theoretical dimensions: "adherence with the regimen" and "consulting behaviours" [8]. Psychometric properties of the EHFScBS were tested in several countries, including Germany [24] and USA [25]. In Germany and in USA Cronbach's alphas were 0.71 and 0.80, respectively; A recent study [15] found three well-fitting and reliable factors in an Italian sample within the scale: "autonomous adherence," "provider-directed adherence" and "consulting behaviours." The "autonomous adherence" factor consists of items that investigate the extent to which a patient agrees to weigh himself/herself daily, to limit the amount of fluid and to

exercise regularly. The "provider-directed adherence" factor includes items measuring the extent to which a patient agrees to take the medications as prescribed and eat a low salt diet. The "consulting behaviour" factor includes items that evaluate the extent to which a patient agrees to call a health care provider in case of symptoms of HF exacerbation such as shortness of breath, ankle swelling, weight gain and fatigue. Validity and reliability of the EHFScBS were tested in the parent study from which this secondary analysis was performed. In the parent study, validity was tested with confirmatory factor analysis that resulted with the following fit indices: Chi square χ^2 (23) = 168.06, p = 0.000; RMSEA = 0.073 (90% C.I. 0.06–0.08); CFI = 0.96; NNFI = 0.95; SRMR = 0.04. Reliability was tested with the factor score determinacy coefficient that ranges from 0.77 to 0.95.

From the EHFScBS and its factors a total and a factorial standardized score can be computed that ranges from 0 to 100. Higher scores indicate better self-care [15]. For the purpose of this study all three EHFScBS factors were used in data analysis.

The Barthel Index (BI) [26] is a 10-item instrument used worldwide [27-29] to measure functional independence in activities of daily living, such as feeding, bathing, mobility, grooming, toilet use, climbing stairs, transfers, dressing, and bowel and bladder control. The total score ranges from 0 to 100, with higher scores indicating higher functional independence. Psychometric properties of the BI have been shown to be supportive in several studies [30,31]. The BI has also been widely used in HF patients [27,32].

The Charlson Comorbidity Index (CCI) [33] is a tool to assess the presence of comorbid conditions. CCI has established validity and predicts mortality, health care resources use, complications and length of hospital stay. After being updated in 2011 [34], the CCI now has 12 items and each item has a possible score of 1, 2, 3 or 6. A higher score means a higher risk of mortality [35]. HF is given a score of 2. The total score ranges from 0 to 24 and a higher score means higher comorbidity.

The Mini Mental State Examination (MMSE) [36] is a 19-item instrument to measure cognitive impairment. It evaluates the following areas: orientation to time and place, registration of

three words, attention and calculation, recall of the three words, language and visual construction. The total score ranges from 0 to 30 and higher scores indicate a better cognitive state. The MMSE has been extensively used in HF patients [37-39].

The Short-Form 12 (SF-12) [40] is a generic instrument used worldwide to measure QOL. It includes 12 items grouped in two dimensions: the Physical Component Summary and the Mental Component Summary. Each dimension has a possible score ranging between 0 and 100 with a higher score meaning better QOL. Construct, convergent and discriminant validity as well as reliability of the SF-12 were shown for HF patients [41,42].

The Minnesota Living with Heart Failure Questionnaire (MLHFQ) [43] is a 21-item disease specific instrument to measure the Quality of Life (QOL) in HF patients. Each item evaluates the extent to which physical and psychological symptoms of HF prevented patients from living how they wanted during the last month. For each item, the MLHFQ uses a six-point Likert scale from 0 (never) to 6 (very often). MLHFQ items are grouped in physical and emotional dimensions that have scores ranging from 0 to 40 and from 0 to 25 respectively, with a higher score indicating worse QOL. The MLHFQ's validity and reliability was shown in several studies [44,45].

We also collected baseline socio-demographic (e.g., age, gender, marital status, education, employment, income, the presence of a caregiver) and clinical variables by medical chart review (e.g., illness duration, ejection fraction (EF), New York Heart Association (NYHA) functional class, body mass index, number of medications taken, Brain Natriuretic Peptide (BNP) level and hospitalizations during the last year).

Procedure of data collection

Before data collection, ethical approval was obtained from each centre where patients were enrolled. Data collection was performed during routine visits in ambulatory clinics, where nurses, trained on the research protocol, explained the study to the patients and obtained the signed informed consent form. Next, nurses administered all research instruments and collected information from patient clinical records.

Statistical analysis

Our analysis strategy consisted of three consecutive steps. First, we examined the descriptive statistics of the sample socio-demographic and clinical characteristics and of the three previously found factors in the EHFScBS (autonomous adherence, provider-directed adherence and consulting behaviours). Then, we used cluster analysis techniques to create patients' profiles using the three EHFScBS factors described above. Next, we examined the differences in profile membership.

Cluster analysis was conducted by using five modules of SLEIPNER v. 2.1 (IMPUTE, RESIDUE, CLUSTER, SIMULATE and RELOCATE) [46]. As recommended by Asendorpf, Borkenau, Ostendorf and Van Aken [47], a two-phase cluster analysis was performed, after checking multivariate outliers and imputing missing values (IMPUTE and RESIDUE modules). A hierarchical clustering algorithm was applied (CLUSTER module using Ward's method and squared Euclidean distances as dissimilarity measure). The explained and increased error sum of squares (ESS) from the 2 to 20-cluster solutions were compared (see Figure 1 and Table 1) to determine the statistically justifiable upper and lower number of cluster groups that provide unique information [19]. Clusters located prior to steeper decline in ESS were selected for a more fine-grained evaluation in order to determine the optimal number of clusters for the final solution.

After this screening procedure, the more eligible hierarchical solutions were further compared by computing different data-cluster solution fit indexes: the Point-Biserial Correlation (PBC)[48], the Gamma index [49], the C-Index [50], the G(+) index [51] and the W/B index [46]. Higher values of PBC and Gamma index and lower values of C-index, G(+) and W/B are indicative of better cluster solutions. Then we used Sleipner's module SIMULATE to compare the original fit indexes described above with those derived from 20 "shaken" samples [46]: if the originals perform significantly better than the indexes averaged across the 20 random replications, it means that the goodness of the partition is not due to chance. Finally, after having determined the optimal number

of clusters, subjects were relocated (RELOCATE module) into clusters by applying a non-hierarchical procedure (i.e., k-means), in order to increase within-cluster homogeneity.

Analysis of variance (ANOVA) was then used to test whether members of different clusters were significantly different in the three EHFScBS factor scores. Finally, in order to validate the chosen cluster solution, a series of χ^2 cross-tabulations and ANOVAs were conducted considering participants' socio-demographic (e.g., age) and clinical variables (e.g., ejection fraction), as well as QOL and data regarding hospitalization.

Results

Patient characteristics

Patients characteristics of the parent study have been published elsewhere [52]. In brief, enrolled patients were 72.4 years old on average (SD=11.2) and 58% males. Most were married (57%) and 70.5% had only an elementary or middle school level education. Half the patients (51.2%) had a family income from 1001–2000 Euros and only 18% were employed. More than three quarters of the sample (76.6%) reported having a caregiver. Clinically, patients were mainly in the NYHA functional class II and III (75.6%), with a mean EF of 44.7% (SD=10.8) and the median duration of illness was 38 months (interquartile range=24–68). The mean score of the CCI was 2.9 (SD=1.2), which indicates that on average patients suffered from at least one other illness in addition to HF. The mean score of the MMSE was 24.2 (SD=6), which is indicative of mild cognitive impairment. Patients were quite independent in activities of daily living as shown by the Barthel index score (mean 84.4, SD=20.2). More than half of patients (54.5%) had been hospitalized at least once during the year preceding data collection.

Clustering of patients based on EHFScBS factor scores

No multivariate outliers were detected and no subject had missing values on the EHFScBS. Figure 1 shows the increase in ESS for the first 20 cluster solutions. Both the 2- and the 4-cluster hierarchical partitions provided statistical justification for selecting them or further analysis in order

to determine the best fitting hierarchical solution (they were associated with ESS values that anticipated the two steepest moments of decline in ESS). Table 1 shows the fit indexes for both the 2- and 4-cluster solutions. As can be noted, excepting the point-biserial correlation coefficient, the 4-cluster solution was the most supported. Consequently, the 4-cluster solution was selected. Results of the SIMULATE module showed that all the "simulated" fit indexes performed more poorly than the original, suggesting that the structure of relationship among data and the emergence of the 4-cluster solution was not significantly biased by chance. Finally, after the optimal number of clusters was determined and the quality of the final hierarchical solution was ascertained, participants were relocated into the four clusters by the k-means clustering procedure. All homogeneity coefficients were lower than one and the final explained error sum of squares was 63%, both supportive of substantial between-cluster variability and of the quality of the patterns.

Table 2 and Figure 2 show the mean scores of the three EHFScBS factors for each cluster. The first cluster had higher scores in all three EHFScBS factors and was labelled "high consistent adherence with high consulting behaviours." The second cluster showed a low score in all EHFScBS factors and was labelled "low consistent adherence with low consulting behaviours." The third cluster exhibited a slightly low score in the autonomous adherence factor and the lowest score in the consulting behaviour factor; however, this cluster showed the highest score in provider-directed adherence. This cluster was labelled "inconsistent adherence with low consulting behaviours." The fourth cluster showed a low score in the autonomous adherence factor, a high score in provider-directed adherence and quite a high score in the consulting behaviour factor. This group of patients was labelled "inconsistent adherence with high consulting behaviours." ANOVA analysis, with Duncan post hoc test, attested that the scores of each EHFScBS factor among the four clusters were statistically different, with the sole exception of the provider-directed adherence factor score of cluster 1 that was not significantly different from the provider-directed adherence factor score of cluster 4 ($p=.79$).

Cluster comparison

Tables 3 and 4 report clusters comparison. Results of ANOVAs and Chi square showed that clusters had a different profile in the majority of the considered variables but there were also overlaps among clusters.

Cluster 1, “high consistent adherence with high consulting behaviours,” consisted of patients who had more favourable socio-demographics and better clinical status. This group of patients was younger, with a higher formal education, with the highest number of employed patients and with higher income. Clinically, this cluster was composed of patients with the shortest illness duration, a higher EF, mostly in NYHA class I and II, taking the lowest number of medications, with a lower BNP level, the highest independence in ADL, the highest cognition level, the best generic and specific physical QOL, and with the highest portion of patients who had never been hospitalized during the last year.

Cluster 2, “low consistent adherence with low consulting behaviours,” was mostly composed of male patients, with a lower level of education, mostly unemployed and with the lowest income. From a clinical point of view, this cluster consisted mostly of patients in NYHA class III and IV and with a worse specific mental QOL.

Cluster 3, “inconsistent adherence with low consulting behaviours,” consisted of patients who were less likely to have caregivers, had the longest illness duration, the lowest EF, had the highest number of prescribed medications, had a lower BNP level and the best mental generic QOL.

Finally, cluster 4, “inconsistent adherence with high consulting behaviours,” included older patients with the highest portion of female patients and with a lower formal education. This cluster had the highest percentage of patients with caregivers, patients with a higher BNP level, with the lowest autonomy in ADL, worst cognitive impairment, the worst generic and specific physical and mental QOL. Also, this cluster was composed mostly of patients who were hospitalized during the last year.

Discussion

To our knowledge, this is the second study that has performed a cluster analysis of HF patients based on their self-care performance. In relation to prior studies that have identified three typologies of HF patients [20-22], our study identified four typologies of patients and this improves our understanding of patterns of HF self-care and variables that characterize membership in each cluster.

The four "ways" to perform self-care show that some patients might be quite consistent in adhering to the HF regimen, as we have seen in clusters 1 and 2, but they might also be inconsistent in adherence, performing, for example, higher provider-directed adherence but lower autonomous adherence, as we have seen in clusters 3 and 4. Also, the patients in the identified clusters consulted their provider differently, quite often in clusters 1 and 4 but less often in clusters 2 and 3. The different combinations of autonomous adherence, provider-directed adherence and consulting behaviours clearly show that patients might give different priorities or importance to the various aspects of self-care behaviours even though *all* self-care behaviours are important to ensure better outcomes.

Riegel et al. [22] previously used cluster analysis to identify typologies of HF patients using the score of the self-care maintenance and self-care management scales to generate the clusters. The analysis resulted in three patient typologies, "expert," "inconsistent" and "novice," that exhibited progressively lower and lower scores in the above two scales, respectively. Interestingly, the "inconsistent" cluster in the above study showed high inconsistency in self-care behaviours (self-care maintenance and self-care management) and our study reinforces that finding, that is, patients may perform some behaviours more frequently and others less frequently. In the study by Riegel et al., the "inconsistent" cluster was identified considering the inconsistency within all items of the self-care maintenance and self-care management scales. In our study, the two inconsistent clusters (clusters 3 and 4) were identified with more specific dimensions within the EHFScBS (autonomous adherence, provider-directed adherence and consulting behaviours) that can give more insights into

inconsistency of self-care. In fact, in clusters 3 and 4, provider-directed adherence was higher than autonomous adherence, and this differentiation might be useful to tailor interventions aimed at improving self-care.

In this study, we compared the four identified clusters for socio-demographic and clinical variables, quality of life and hospitalization rates. These variables might help identify cluster membership that, according to our analysis, showed different ways of performing self-care. Also, cluster membership might help identify some characteristics in each cluster that could be modified with interventions. Younger patients, with higher education, who are still employed, have better income, better clinical conditions, more autonomy in ADL, with better cognition and QOL, who have been hospitalized less frequently (cluster 1) might need less intensive interventions with regard to self-care, since they showed high consistent adherence and high consulting behaviours. This group of patients might only need self-care monitoring. Male patients, who have lower educational level, lower income, are in a more advanced NYHA class and have a better emotional QOL may fall into cluster 2 and patients in this cluster might need interventions to improve autonomous adherence, provider-directed adherence and consulting behaviours. Patients who do not have a caregiver, who have a lower EF, lower BNP and higher generic mental QOL might belong to cluster 3. Patients in this cluster had high provider-directed adherence (e.g., take medications very carefully) but did not have good autonomous adherence and did not consult the provider in the case of symptoms. This group of patients might benefit from interventions that improve weigh monitoring, physical activity and limit fluid intake. Also, this group needs interventions to improve symptom recognition (e.g., ankle swelling) and a faster consultation with the provider in the case of symptoms. Older female patients with a lower level of education, who have a caregiver, have a higher BNP level, less independence in ADL, with higher cognitive impairment, lower physical and mental QOL and who have been hospitalized more frequently might fall into cluster 4. This typology of patients does not need particular interventions in the provider-directed adherence and consulting behaviours, but more interventions to improve autonomous adherence. This group is also

physically compromised (since they showed the lowest Barthel index score), so the interventions aimed at improving autonomous adherence might be particularly challenging in this group.

The association between cluster membership, socio-demographic and clinical variables, quality of life and hospitalization rates can be useful also in the opposite way, by identifying firstly cluster membership with the administration of the EHFScBS. For example, if a patient scores low (around 37) in the autonomous adherence, higher in the provider directed adherence (around 82) and pretty high (around 66) in the consulting behaviours, this patient may belong to cluster 4, which exhibited the worst cognitive impairment. Consequently, the clinician can activate a tailored intervention specifically focused on cognitive impairment, for example, asking an informal caregiver to monitor if the patient takes medications regularly since cognitive impairment decreases pharmacological adherence. However, the association between cluster membership and the profile of each cluster does not exclude an individualized patient's assessment by clinician.

This study has several limitations. First, the sample was selected with convenience criteria and included participants from only one European country; thus, generalization of results should be done with caution. Second, this was a secondary analysis of data from a cross-sectional study. Third, we measured self-care only once but self-care might change over time [53,54]. Fourth, we measured self-care with a self-report instrument but it was shown that "real" self-care behaviours might be overestimated by self-reported measures [55]. Finally, the characteristics of each cluster cannot be considered predictors of cluster belonging and vice versa; therefore, there could not be any causal relationship between cluster belonging and cluster characteristics and vice versa. In conclusion, this study identified four clusters of patients based on the factor scores of the European Heart Failure Self-Care Behaviour Scale. The clusters showed different ways to perform self-care and significant differences for socio-demographic and clinical variables as well as quality of life and data regarding hospitalization.

This study has provided information that would be useful when conducting future studies. It would be interesting to explore if the clusters identified in this study change over time. For

example, it seems that cluster 1 could be the “first” cluster to which patients might belong, but this cluster had the disease for an average of 42 months. In literature “novice” patients have been shown to perform self-care insufficiently [22]; however, in our study this cluster performed a high level of self-care. Probably cluster 1 was not “so novice” in terms of self-care in our study, since this cluster had HF for an average of 42 months. Future studies could look at the existence of clusters closer to the time of the diagnosis. Since this study used a cross-sectional design, future studies could analyze if cluster belonging could be a predictor of patient outcomes such as QOL, hospitalization and mortality. Further studies in other HF populations are also needed in order to see if clusters identified in our study are similar to clusters identified in other countries.

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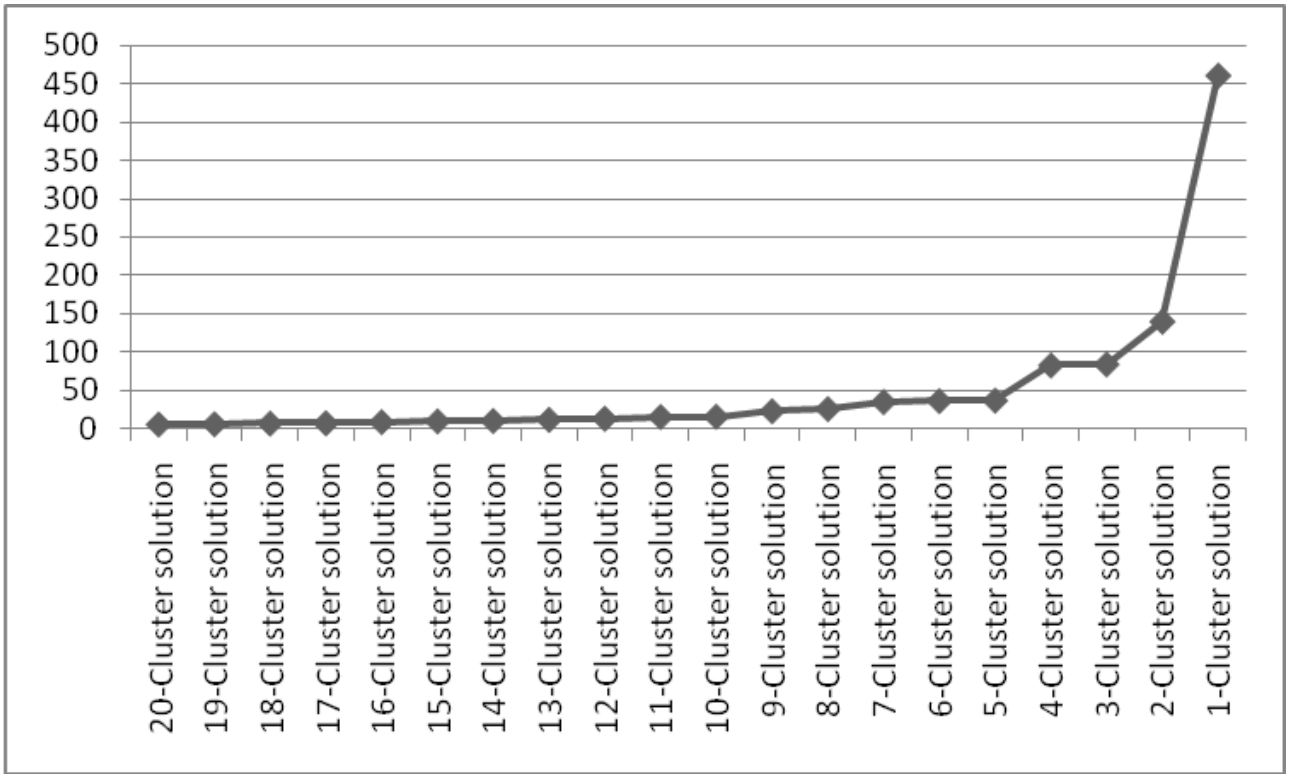

Figure 1. Increase in error sum squares of the 20 final cluster solutions.

Table 1. Fit indices for the comparisons of hierarchical partitions.

N Cluster	PB	C	GAMMA	W/B	G+	EESS
2 clusters	.55	.13	.67	.40	.08	38.7
4 clusters	.44	.12	.66	.35	.07	57.4

Note: PB = Point-Biserial coefficient; C = the C index; WB = the W/B index; G(+) = the G(+) index; EESS = explained error of sum of squares. In bold the best coefficients**.**

Table 2. Cluster comparison with ANOVA according to the three EHFScBS Factors

EHFScBS Factors	Mean (SD)				F	p
	Cluster 1 High consistent adherence with high consulting behaviours (n=408; 34,2%)	**Cluster 2** Low consistent adherence with low consulting behaviours (n=202; 16,9%)	**Cluster 3** Inconsistent adherence with low consulting behaviours (n=257; 21,6%)	**Cluster 4** Inconsistent adherence with high consulting behaviours (n=325; 27,3%)		
Autonomous Adherence	74.55[a] (12.87)	32.80[b] (17.10)	49.55[c] (21.16)	37.31[d] (14.43)	454.30	<.001
Provider-directed Adherence	83.09[a] (16.08)	53.28[b] (16.33)	92.85[c] (10.09)	82.77[a] (14.54)	301.70	<.001
Consulting behaviors	78.22[a] (14.73)	24.51[b] (17.25)	14.52[c] (13.73)	66.35[d] (14.53)	1287.89	<.001

Note. SD = Standard Deviation. The same letter (a, b, c, d) near each number means no significant difference, and different letters mean significant difference between clusters

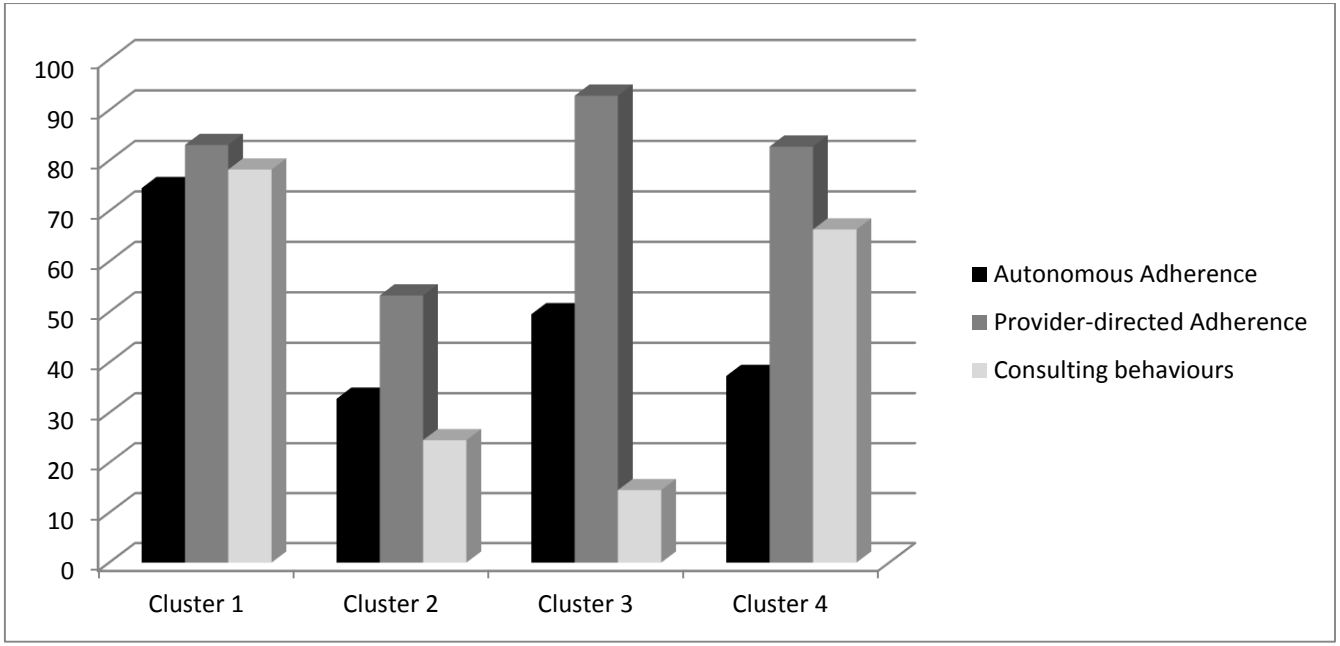

Figure 2. Graphical representation of the EHFScBS scores per each cluster. Each factor scores has a standardized 0-100 score with higher score meaning better self-care

Table 3. Cluster comparison for socio-demographic variables

	Cluster 1 High consistent adherence with high consulting behaviours (n=408; 34,2%) **Mean or n (%)**	**Cluster 2** Low consistent adherence with low consulting behaviours (n=202; 16,9%) **Mean or n (%)**	**Cluster 3** Inconsistent adherence with low consulting behaviours (n=257; 21,6%) **Mean or n (%)**	**Cluster 4** Inconsistent adherence with high consulting behaviours **(n=325; 27,3%)** **Mean or n (%)**	**F or χ^2**
Age	*70.81*[a]	73.51[b]	71.14[a]	**74.55**[b]	8.54**
Gender					11.37*
Female	166 (40.7)	*68 (33.7)*	107 (41.6)	**157 (48.3)**	
Marital Status					3.55
With partner	173 (42.4)	85 (42.1)	103 (40.1)	154 (47.4)	
Without partner	235 (57.6)	117 (57.9)	154 (59.9)	171 (52.6)	
Years of education	**9.1**[a]	*7.3*[b]	8.5[a]	*7.3*[b]	20.54**
Job					16.35**
Employed	**96 (23,5)^**	*23 (11,4)^*	46 (17.9)	49 (15,1)	
Income					33.93**
1-1000	*84 (20.7)^*	**80 (41.2)^**	83 (32.8)	114 (35.3)	
1001-2000	**242 (59.6)^**	*84 (43.3)*	121 (47.8)	155 (48)	
>2000	80 (19.7)	30 (15.5)	49 (19.4)	54 (16.7)	
Presence of a caregiver	203 (74.2)	147 (73.5)	*171 (67.1)*	**277 (85.5)^**	28.21**

Note. Only significant effects were reported. The same letter (a, b, c, d) near each number means no significant difference, and different letters mean significant difference between clusters. * $p < 0.05$; ** $p < 0.01$;. ^ = Significant standardized residual. In **bold** and in *Italicus* the highest and lowest significant value for each variable respectively

Table 4. Cluster comparison for clinical variables, quality of life and hospitalization

	Cluster 1 High consistent adherence with high consulting behaviours (n=408; 34,2%)	**Cluster 2** Low consistent adherence with low consulting behaviours (n=202; 16,9%)	**Cluster 3** Inconsistent adherence with low consulting behaviours (n=257; 21,6%)	**Cluster 4** Inconsistent adherence with high consulting behaviours (n=325; 27,3%)	
	Mean or n (%)	**Mean or n (%)**	**Mean or n (%)**	**Mean or n (%)**	**F or χ^2**
Month of illness	*41.78*[a]	59.00[b]	**60.04**[b]	54.79[b]	11.83**
Ejection Fraction	**46.04**[a]	43.64[b]	*42.84*[b]	44.79[ab]	4.26**
NYHA class					34.07**
I - II	**286 (70.1)**^	*98 (48.8)*	147 (57.2)	173 (53.4)	
III - IV	*122 (29.9)*^	**103 (51.2)**^	110 (42.8)	151 (46.6)	
Body Mass Index	26.74	27.35	26.85	26.30	1.05
Number of medication	*3.69*[a]	5.81[c]	**6.11**[c]	4.71[b]	50.82**
Brain Natriuretic Peptide	840.01[a]	1266.01[ab]	*506.79*[a]	**2152.24**[b]	4.98**
Barthel Index	**89.03**[a]	82.84[b]	87.28[a]	*77.35*[c]	23.36**
Charlson Comorbidity Index	2.80	2.86	2.91	2.98	1.34
Mini Mental State Exam	**26.50**[a]	22.41[c]	24.05[b]	*22.34*[c]	39.32**
SF-12 PCS	**38.81**[a]	34.49[b]	33.89[b]	*33.08*[b]	29.56**
SF-12 MCS	43.46[b]	43.25[b]	**45.20**[a]	*41.89*[b]	5.15**
MLHFQ Physical	*17.68*[a]	21.36[b]	20.11[b]	**21.88**[b]	15.22**
MLHFQ Emotional	10.92[b]	*10.55*[b]	10.56[b]	**12.08**[a]	3.96**
Hospitalizations during the last year					9.17*
Never hospitalized	**205 (50.2)**	88 (43.6)	121 (47.1)	*128 (39.4)*	
Hospitalized at least 1 time	*203 (49.8)*	114 (56.4)	136 (52.9)	**197 (60.6)**	

Note. NYHA = New York Heart Association; The Barthel Index has a score from 0 to 100, with higher score meaning more autonomy in activity of daily living; Charlson Comorbidity Index has a score from o to 24 with higher score meaning more comorbid conditions; Mini Mental State Examination has a score from 0 to 30 with higher score meaning better cognition; SF-12 PCS = Short Form 12 Physical Component Summary has a score from 0 to 100 with higher score meaning better physical quality of life; SF-12 MCS = Short Form 12 Mental Component Summary has a score from 0 to 100 with higher score meaning better mental quality of life; MLHFQ = Minnesota Living with Heart Failure Questionnaire; MLHFQ Physical has a score from 0 to 40 with higher score meaning worse physical quality of life; MLHFQ Emotional has a score from 0 to 25 with higher score meaning worse emotional quality of life. Only significant effects were reported. The same letter (a, b, c, d) near each number means no significant difference, and different letters mean significant difference between clusters. * $p < 0.05$, ** $p < 0.01$;. ^ = Significant standardized residual. In **bold** and in *Italicus* the highest and lowest significant value for each variable respectively.