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Derivation and Validation of a Scale Assessing Constructive and Destructive Styles of Mental Adjustment to Heart Failure Based on the Mini-MAC Scale Used in Psychooncology: The Results of Multicenter Caps-Lock-HF (Complex Assessment of Psychological Status Located in Heart Failure) Study

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Abstract

Objectives: We aimed to derivate and validate a scale assessing constructive and destructive styles of mental adjustment to heart failure (HF) based on a scale used in psychooncology. **Background:** Mental adjustment to severe disease is commonly assessed in cancer patients, as it strongly determines quality of life and survival, implying some therapeutic interventions. There is no reliable tool for the assessment of mental adjustment to HF. **Methods:** We applied the modified 29-item Mini-MAC scale (assessing constructive and destructive styles of mental adjustment to the disease, where 'cancer' appearing in only 2 items was replaced by 'heart failure') in 717 patients with systolic HF without a history of cancer, participating in the Polish multicentre Caps-Lock-HF study (mean age: 64 ± 11 years, men: 80%, NYHA class III-IV: 41%). Patients were randomly divided in 2 groups. In the first derivation group, 2 sets (factors) from 30 items of the original scale were extracted using factor analysis, and the derived assignment was performed in the second validation group. Cronbach's α were calculated for both factors, and compared between the derivation and validation groups. This procedure was repeated 100 times. **Results:** Cronbach's α for factor 1 were 0.88 ± 0.01 (range: 0.83-0.90) *vs.* 0.88 ± 0.01(0.84-0.89) and for factor 2 were 0.75 ± 0.03 (0.67-0.81) *vs.* 0.74 ± 0.02 (0.70-0.78) (derivation *vs.* validation groups, respectively, both p>0.05). Based on consistently high Cronbach's α values, indicating a high reliability of 2 derived sets of items, we have formed a scale, where factor 1 and 2 (including 13 and 6 items) reflected destructive and constructive styles of mental adjustment to HF, respectively. Factor reflecting the destructive style, was more pronounced in patients with more severe HF and depressive symptoms. **Conclusions:** We propose a scale for the assessment of mental adjustment to HF, which can be implemented in clinical practice.

Keywords: Heart failure; Psychoonchology; Cancer

Introduction

Only recently, there is an increasing awareness among cardiologists, that the diagnosis and the treatment of heart failure (HF) substantially affects the psychological status of patients [1-3]. However, the assessment of the psychological reactions to HF is still limited to the evaluation to 3 variables: Anxiety, depressive symptoms and quality of life [4-7].

On the contrary, psychological features of patients suffering from cancer have been explored for decades [8,9]. As a result, a separate domain of health psychology (psychooncology) has been established, with its own journal, and a wide range of specific research methods [10-12] (i.e. psychological questionnaires [10,11]) and a set of complex strategies aiming to provide psychological support for cancer patients and their families in coping with the disease itself and related psychological burden [12]. Studies in the field of psychooncology showed that psychological adaptation of the patient to his/her disease is crucial not only for the quality of life, but also for the outcome of the applied treatment, including the survival [13-18].

Although it has not been commonly acknowledged, there are numerous similarities between HF and a cancer disease [19-33]: In both cases, the patient suffers from a terminal disease with a fatal prognosis [19,20] and a poor quality of life [21,22], a large number of co-morbidities, requiring frequent contact with healthcare services and recurrent and prolonged hospitalizations [23,24]. All of them are accompanied by dramatic and fundamental changes in the general lifestyle including socio-economic status, the hierarchy of life priorities of the patient himself/herself and all of his/her family members [25-27]. Also, the treatment of both diseases is based on: the causative treatment and the palliative interventions [20,24,25,28] aiming just to alleviate the symptoms. In both diseases, the proportion between the causative *vs.* the palliative treatment changes along with the progression of both of these diseases, with the domination of palliative therapeutic strategies at the final stages [20,24,25,28]. HF and cancer disease are similar also in the term of the prevalence of the well-established phenomena related to psychological status of the affected patients, i.e. depressive symptoms [6,29,30], anxiety [4,31], and the decreased quality of life [21,23].

There is a need for reliable research tools, which will be accurate for specific psychological aspects characteristic for HF considered as a terminal chronic illness [5]. In order to fulfil this need, we decided to learn from the psychooncologists: The aim of the present study was to establish whether a psychological questionnaire designed specifically for cancer patients [11,32], after the simple modification, could be used in patients with HF and also could provide the reliable data on the psychological adjustment to HF.

Material and Methods

Study population

The presented study is a sub-study of the Caps-Lock-HF study, which has been described previously [33] as a study performed in patients with HF hospitalised or visiting outpatient clinics in 11 cardiology centres from Poland, who fulfilled the following inclusion criteria: (a) A>6 month documented history of HF (New York Heart Association [NYHA] I-IV classes); (b) Clinical stability with unchanged medications for ≥ 3 months preceding the study; (c) Left ventricular ejection fraction (LVEF) <45% as assessed by echocardiography. Exclusion criteria comprised: (a) HF decompensation within 3 months preceding the study; (b) Acute coronary syndrome and/or coronary revascularization during 6 months preceding the study; (c) Any psychiatric abnormalities and associated therapy either at the time of examination or in the past. The current sub-study had an additional exclusion criterion i.e.: (d) Any history of cancer.
Cardiology centres are located in the following cities: Wroclaw (the coordinating centre, WROC), 4 centres from Katowice (KAT1-4), 2 centres from Warsaw (WAR1-2), and 1 from Lublin (LUBL), Lodz (LODZ), Bialystok (BIAL) and Cracow (KRAK).

The study was approved by the local ethics committee at the coordinating centre (WROC), which gave the permission to conduct the study in the other participating centres. All subjects gave written informed consent. The study was conducted in accordance with the Helsinki Declaration.

Study protocol

Study protocol of Caps-Lock-HF study has been described previously [33]. In the current paper we are reporting results related mainly to the derivation and validation of the modified Mini-MAC (also in the context of clinical status of patients); the other results are presented in separate papers.

The assessment of the clinical status included basic demographic and anthropometric data, parameters reflecting the severity of HF, HF aetiology, parameters derived from standard transthoracic echocardiography, basic laboratory parameters and the presence of HF co-morbidities. Estimated glomerular filtration rate, GFR, (mL/min/1.73 m^2) was calculated using the Modification of Diet in Renal Disease equation).

Psychological evaluation included the assessment based on the following psychological questionnaires: Multidimensional Health Locus of Control Scale MHLC), Generalised Self Efficacy Scale (GSES), The modified Mental Adjustment to cancer Scale (modified Mini-MAC), Coping Inventory for Stressful Situations and (CISS) and Beck Depression Inventory (BDI).

The original Mini-MAC and its modification

Mini-MAC [11,32] is composed of 29 items. The Polish adaptation was performed by Juczynski [32]. Each examined patient is asked to select 1 of 4 possible answers expressing his/her agreement/disagreement with each item: 'definitely no', 'rather no', 'rather yes' and 'definitely yes', which are subsequently counted as 1, 2, 3 and 4 points, respectively

[33]. Items are originally assigned to 2 subscales reflecting 2 styles of mental adjustment to the disease (Table 1).

Mini-MAC has been chosen purposely from other available psycho-oncological tools, as a measure which contains relatively small number (n=2) of items related literally to the name of the disease (i.e. where the word 'cancer' is mentioned). Thus, in cooperation with the author of the original version of the Mini-MAC scale, we modified this scale by rewording 2 items (14. and 15.), where the word "cancer/tumour" was replaced by "heart failure".

Styles of mental adjustment to the disease	The elements of the styles definition	A sample item
Destructive style	- The severity of anxiety caused by the disease, perceived as a threat causing uncontrollable fear; - The tendency to interpret each change in health status as a signal of a serious deterioration; - Losing hope and self-perception as a person who is gravely ill which negatively influences quality of life; - The feelings of being powerless, confused and passive when confronted with the disease.	*"I feel completely at a loss about what to do"*
Constructive style	- The ability to perceive each symptom of the disease as the stimulus triggering the mobilization and the constructive actions; - The ability to comprehend the individual experiences originating from the disease, leading to an appreciation of the value of life and memories from the time before the disease; - High conscious of the disease severity and of an importance of the actions which have to be performed during the remaining time.	*"I've had a good life; what's left is a bonus"*

Table 1: Styles of mental adjustment to the disease defined in the original Mini-MAC.

The procedures of derivation and validation of the modified Mini-MAC

As it was mentioned, items of the original Mini-MAC are assigned to 2 subscales reflecting 2 styles of mental adjustment to the disease [32]. We aimed to establish the analogous assignment of items in the modified Mini-MAC, using data derived from patients with HF, which is required after each modification of a validated psychological tool.

Examined population has been divided in the derivation and validation groups, using stratified randomisation based on the median values of the following variables: The number of patients, NYHA classes, the number of men and women, and in- and outpatients, LVEF, age and the number of years since the initial HF diagnosis. The procedure of dividing patients was repeated 100 times.

The assignments of items to the two factors within the derivation groups were performed using factor analyses. Cronbach's-α coefficients, reflecting the internal consistency of the novel set of items assigned to two factors [34], were compared between the derivation and the validation groups. Items which were assigned to the particular factor in ≥ 80 per 100 repeated procedures were included in the novel keys for calculating factor 1 and 2.

Afterwards, we calculated Cronbach's-αand the total score in both factors in the whole examined group using the novel keys. We calculated also the relations between scores in both factors and clinical variables in the whole examined group. Moreover, we checked if Cronbach's-α for the novel keys for both factors were different in the following subgroups of patients: Men and women, inpatients and outpatients, patients of age ≤ 64 years and those >64 years, patients in NYHA classes I+II and those in NYHA classes III+IV, patients with CAD aetiology of HF and those without CAD aetiology of HF, patients having <3 HF co-morbidities and those having ≥ 3 co-morbidities, patients having any implanted device and those without any implanted device, patients receiving <5 medications and those receiving ≥ 5 medications, and patients with and without depression (according to the Beck Depression Inventory (BDI) score ≥ or <16 points, respectively).

Depressive symptoms assessment

Depressive symptoms were assessed using BDI version Ia, a self-reported measure, where the severity of 21 depressive symptoms was expressed separately using a 4 point scale (the higher score reflects more pronounced depressive symptoms). BDI can be divided into 2 subscales assessing separately the affective-cognitive and somatic symptoms [35].

Statistical analysis

Continuous variables with a normal distribution were expressed as means ± standard deviations of a mean (SD), those with a skewed distribution were expressed as medians with lower and upper quartiles. The inter-group differences were tested using the Student's t-test, the Mann-Whitney U or the χ^2 test, as appropriate.

Factor analysis was conducted with the assumption of the existence of 2 factors and using biquartimax normalised rotation. Cronbach's-α coefficient was used in the analysis of the internal consistency of the scales.

Relationships between variables were assessed in univariable regression models, and if they were statistically significant, they were included in multivariate models. If relation to BDI score was significant in the univariable models, multivariable

models were calculated twice: Including and excluding BDI score.

A value of $p<0.05$ was considered statistically significant.

Results

A total 717 patients with HF (i.e. 95% of the whole cohort included in a Caps-Lock-HF study) were included in the present analysis. There were no clinical differences between this subgroup and the whole cohort (except for the difference resulting from an additional exclusion criterion).

Despite an additional exclusion criterion, patients still came from 11 cardiology centres. Majority of them were inpatients, males, classified in NYHA II-III classes. All patients received standard pharmacotherapy. Baseline characteristics of the examined group are presented in Table 2.

The results of the psychometric analysis of the modified Mini-MAC

The derivation groups included 359 patients, whereas the validation groups included 358 patients in all 100 repeated divisions. As a result of the application of the stratified randomisation method, all derivation groups did not differ by the number of patients, the distribution of patients in the subsequent NYHA classes, the proportion between men and women, and in and outpatients, mean LVEF, age and number of years since the initial HF diagnosis as compared to all validation groups.

Factor analyses performed within the derivation groups confirmed the existence of 2 factors. In 100 derivation groups factors were composed differentially, using 5-15 items. There were no significant differences between the derivation and the validation groups regarding the internal consistency (calculated using Cronbach's alpha coefficients) of the novel sets of items assigned to both factors (Figures 1 and 2). The minimum frequency of 80 per 100 assignments to each factor was achieved by 13 items assigned to factor 1 and 6 items assigned to factor 2. That is why the novel key for factor 1 included 13 items, whereas the novel key for factor 2 included 6 items (Table 3).

According to the content of the assigned items, factor 1 has been interpreted as a factor reflecting the destructive style of mental adjustment to HF, whereas factor 2–as a factor reflecting the constructive style of mental adjustment to HF. In the derivation and validation groups analysed separately, factor reflecting the destructive style was characterized by higher internal consistency (majority of Cronbach's α were above 0.85) as compared to factor reflecting the constructive style (majority of Cronbach's α between 0.70 and 0.75, $p<0.05$) (Figure 2). Similarly, Cronbach's alpha for factor reflecting the destructive style of mental adjustment to HF calculated for the whole group of patients with HF was 0.88, whereas for factor reflecting the constructive style of mental adjustment was 0.73.

Cronbach's α for factor reflecting the constructive style of mental adjustment to HF was higher when calculated among patient with CAD aetiology of HF as compared to those without CAD aetiology of HF. There were no other differences between the selected subgroups groups (all $p>0.05$).

The relations between mental adjustment to heart failure and clinical parameters

Factor reflecting the destructive style of mental adjustment to HF was more pronounced in patients with more severe HF (i.e. those with higher SBP, in higher NYHA classes and with lower LVEF and those not treated using ACE inhibitors and/or ARB) and in those with more severe depressive symptoms. Importantly, positive relations with SBP, NYHA class and LVEF remained significant also after an adjustment for depressive symptoms (Table 4).

The constructive style was negatively related to heart rate (HR, beats/min) (also after an adjustment for BDI) and to depressive symptoms.

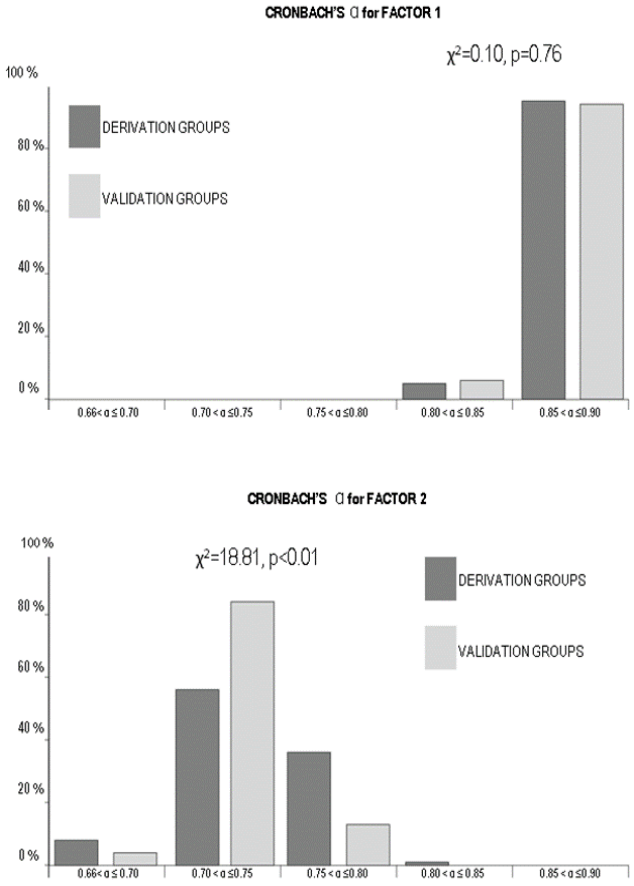

Figure 1: Distribution of Cronbach's α value for the derived factors reflecting destructive and constructive styles of mental adjustment to the disease in 717 patients with systolic heart failure (the procedure was performed 100 times).

Variables	All HF patients included in the Caps-Lock-HF study	HF patients included in the Caps-Lock-HF study without a diagnosis of cancer
Number of patients (n)	758	717
Inpatients (n, %)	624 (82)	593 (83)
Men (n, %)	599 (79)	571 (80)
Age (years)	64 ± 11	64 ± 11
BMI (kg/m^2)	28.3 ± 4.6	28.3 ± 4.6
SBP (mmHg)	123 ± 16	123 ± 15
Heart rate (beats/min)	74 ± 14	74 ± 14
Time since HF diagnosis (years)	4 (2-10)	4 (2-9)
NYHA classes, I/II/III/IV (n, %)	35/414/283/26 (5/55/37/3)	34/389/269/25 (5/54/38/3)
LVEF (%)	31 ± 9	31 ± 9
HF aetiology, CAD (n, %)	460 (61)	438 (61)
Sodium (mmol/L)	140 ± 3	140 ± 3
Haemoglobin (g/dL)	13.7 ± 1.6	13.7 ± 1.6
eGFR (mL/min/1.73 m^2)	73 ± 25	74 ± 25
Previous MI (n, %)	382 (50)	367 (51)
HT (n, %)	542 (72)	508 (71)
AF (n, %)	322 (42)	306 (43)
Previous stroke and/or TIA (n, %)	56 (7)	55 (8)
DM (n, %)	231 (30)	220 (31)
CKD # (n, %)	227 (29)	211 (29)
Anaemia $ (n, %)	188 (25)	174 (25)
COPD (n, %)	92 (12)	92 (13)
Number of co-morbidities (n)	3 ± 1	3 ± 1
BDI (points)	13 ± 9	13 ± 9
BDI subscale 1 (points)	6 ± 6	6 ± 6
BDI subscale 2 (points)	6 ± 4	6 ± 4
Treatment		
ACE inhibitor and/or ARB (n, %)	680 (90)	648 (90)
Aldosterone antagonist (n, %)	524 (69)	494 (69)
β-blocker (n, %)	727 (96)	684 (96)
Loop diuretic (n, %)	517 (68)	490 (68)
Thiazide diuretic (n, %)	127 (17)	123 (17)
Digoxin (n, %)	123 (16)	113 (16)
Statin (n, %)	574 (76)	545 (76)
Antiplatelet drugs (n, %)	481 (63)	455 (63)
Number of drugs (n)	5 ± 1	5 ± 1
Implanted devices (n, %)	365 (48)	345 (48)
ICD (n, %)	234 (31)	227 (32)
CRT (n, %)	123 (16)	114 (16)
Other pacemaker (n, %)	65 (9)	58 (8)
Previous revascularisation (yes, %)	350 (46)	337 (47)
Prevoius PCI (n, %)	288 (38)	276 (38)
Previous CABG (n, %)	137 (18)	132 (18)

Data is presented as a mean ± standard deviation, a median with lower and upper quartiles, or numbers with percentages, where appropriate; $^{*}p<0.05$; $^{**}p<0.01$; $^{***}p<0.001$

HF: Heart Failure; BMI: Body Mass Index; SBP: Systolic Blood Pressure; NYHA: New York Heart Association; LVEF: Left Ventricular Ejection Fraction; CAD: Coronary Artery Disease; Egfr: Estimated Glomerular Filtration Rate Calculated Using MDRD Formula (MDRD: Modification Of Diet In Renal Disease); MI: Myocardial Infrarction, HT: Hypertension; AF: Atrial Fibrillation; TIA: Transient Ischaemic Attack; DM: Diabetes Mellitus; CKD: Chronic Kidney Disease; COPD: Chronic Obstructive Pulmonary Disease, BDI: Beck Depression Inventory; BDI Subscale 1 Assessing Affective-Cognitive Depressive Symptoms; BDI Subscale 2 Assessing Somatic Depressive Symptoms; ACE: Angiotensin Converting Enzyme; ARB: Angiotensin Receptor Blocker; ICD: Implantable Cardioverter-Defibrillator; CRT: Cardiac Resynchronization Therapy; PCI: Percutaneous Coronary Intervention; CABG: Coronary Artery Bypass Graft

$^{\#}$CKD was defined as eGFR <60 ml/min/1.73 m^2; $^{\$}$Anaemia was defined as haemoglobin level <12 g/dL for men and <13 g/dL for women.

Table 2: Baseline characteristics of patients with systolic heart failure examined in 11 cardiology centers in Poland.

Key for the original Mini-MAC scale			**Derivation of the new assignment of items included in the original Mini-MAC scale**		**Novel key based on the derivation procedure of the scale to be applied in HF patients**	
ITEMS of the original version of the Mini-MAC scale	Assignment to the subscale assessing the destructive style	Assignment to the subscale assessing the constructive style	Frequency of the assignment to FACTOR 1 in factor analyses in the derivation groups*	Frequency of the assignment to FACTOR 2 in factor analyses in the derivation groups*	Assignment to the FACTOR 1 reflecting destructive style	Assignment to FACTOR 2 reflecting constructive style
1	+		0	0		
2	+		100%	0	+	
3		+	0	9%		
4		+	0	0		
5		+	0	54%		
6	+		34%	0		
7		+	2%	0		
8		+	0	100%		+
9		+	0	64%		
10		+	0	0		
11	+		100%	0	+	
12	+		100%	0	+	
13		+	0	98%		+
14		+	0	0		
15		+	0	100%		+
16	+		100%	0	+	
17	+		100%	0	+	
18		+	0	99%		+
19		+	0	41%		
20	+		100%	0	+	
21			100%	0	+	
22		+	0	100%		+
23	+		83%	0	+	
24	+		100%	0	+	
25		+	0	93%		+
26	+		100%	0	+	
27	+		100%	0	+	
28	+		100%	0	+	
29	+		100%	0	+	
Number of items included in the particular subscales (factors)	14	14	-	-	13	6
Cronbach's α for the particular subscales (factors)	**0.87**	**0.72**	**-**	**-**	**0.88**	**0.73**
*deriviation groups – 359 (50%) examined patients with HF randomly selected from the whole cohort of 717 subjects (the procedure was repeated 100 times)						

Table 3: Derivation procedure of the extraction of a subscales measuring destructive and constructive styles of mental adjustment to heart failure based on the Mini-MAC scale using factor analysis in 717 patients with systolic heart failure.

Subgroups of patients with systolic HF	N	FACTOR 1 reflecting destructive style	FACTOR 2 reflecting constructive style
Men	571	0.88	0.74
Women	146	0.88	0.73
Inpatients	593	0.88	0.74
Outpatients	124	0.87	0.71
Age ≤ 64 years (median)	378	0.89	0.71
Age >64 years	339	0.87	0.76
NYHA class: I and II	423	0.87	0.71
NYHA class: III and IV	294	0.88	0.77
HF aetiology: CAD	438	0.88	0.77
HF aetiology: non-CAD	279	0.89	0.68*
<3 co-morbidities	345	0.88	0.75
≥ 3 co-morbidities	372	0.88	0.71
With any device	345	0.89	0.73
Without any device	372	0.87	0.74
<5 medications	187	0.89	0.72
≥ 5 medications (median)	530	0.88	0.74
BDI score ≥ 16 points Ŧ	213	0.85	0.77
BDI score <16 points Ŧ	504	0.84	0.71
HF: Heart Failure; NYHA: New York Heart Assosciation; CAD: Coronary Artery Disease; BDI : Beck Depression Inventory			

Table 4: Cronbach's-α for the factors reflecting destructive and constructive styles of mental adjustment to heart failure calculated in the subsequent subgroups of patients with heart failure.

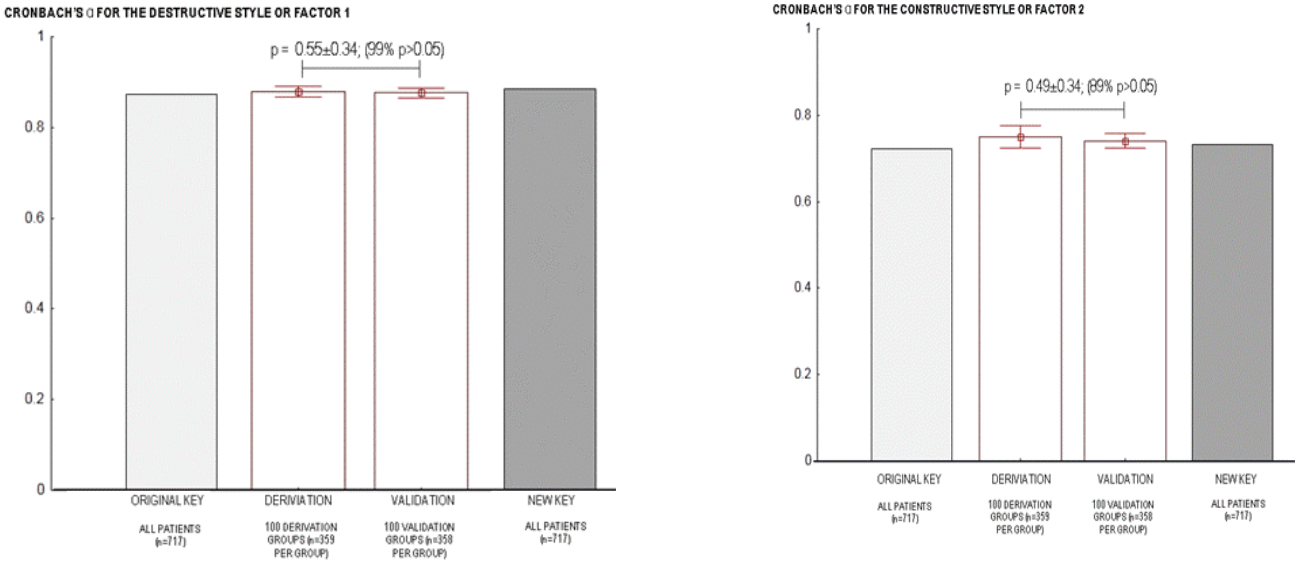

Figure 2: Cronbach's α values for the subscales reflecting destructive and constructive styles of mental adjustment to the disease, and for factors 1 and 2 derived using factor analysis (reflecting the respective 2 styles) in 717 patients with systolic heart failure (patient were randomly assigned to 2 deriviation and validation groups (359 and 358 patients, respectively), the procedure was performed 100 times).

Novel key derived based on factor analysis							
Variables	Units/categories	Factor reflecting the destructive style			Factor reflecting the constructive style		
		Univariable model	Multivariable model §		Univariable model	Multivariable model §	
			Without BDI	With BDI		Without BDI	With BDI
Inpatients	yes *vs.* no	-0.10**	-0.07*	-0.05	-0.001	-	-
Gender	men *vs.* women	0.02	-	-	-0.001	-	-
Age	year	0.05	-	-	-0.04	-	-
BMI	kg/m^2	-0.03	-	-	0.02	-	-
SBP	mmHg	-0.10**	-0.10*	-0.07*	0.04	-	-

Heart rate	beats/min	0.05	-	-	-0.09*	-0.09*	-0.08*
Time since HF diagnosis	year	0.02	-	-	-0.01	-	-
NYHA class	I / II / III / IV	0.18***	0.11*	0.02	-0.03	-	-
LVEF	%	-0.15***	-0.09*	-0.08*	-0.01	-	-
HF aetiology, CAD	yes *vs.* no	0.04	-	-	0.01	-	-
Sodium	mmol/L	-0.07	-	-	0.04	-	-
Haemoglobin	g/dL	-0.02	-	-	-0.06	-	-
eGFR-MDRD	mL/min/1.73 m^2	-0.07*	-0.001	-0.02	0.07*	0.08	0.07
Previous MI	yes *vs.* no	0.02	-	-	-0.01	-	-
HT	yes *vs.* no	0.04	-	-	-0.03	-	-
AF	yes *vs.* no	0.07	-	-	-0.06	-	-
Previous stroke and/or TIA	yes *vs.* no	-0.01	-	-	-0.03	-	-
DM	yes *vs.* no	0.07	-	-	-0.02	-	-
CKD#	yes *vs.* no	0.07	-	-	-0.06	-	-
Anaemia$	yes *vs.* no	-0.02	-	-	0.05	-	-
COPD	yes *vs.* no	0.09*	0.05	0.04	-0.03	-	-
Number of comorbidities (n)	number	0.10**	0.06	0.03	-0.06	-	-
BDI	point	0.56***	-	0.53***	-0.20***	-	-0.19***
BDI subscale 1	point	0.52***	-	-	-0.23***	-	-
BDI subscale 2	point	0.48***	-	-	-0.10**	-	-
Depression₮	yes *vs.* no	0.47***	-	-	-0.19***	-	-
Treatment							
ACE inhibitor and/or ARB	yes *vs.* no	-0.10**	-0.09*	-0.02	0.05	-	-
Aldosterone antagonist	yes *vs.* no	0.05	-	-	0.04	-	-
β-Blocker	yes *vs.* no	-0.03	-	-	0.002	-	-
Loop diuretic	yes *vs.* no	0.1**	0.03	-0.03	-0.03	-	-
Thiazide diuretic	yes *vs.* no	-0.06	-	-	0.07	-	-
Digoxin	yes *vs.* no	0.07	-	-	-0.04	-	-
Statin	yes *vs.* no	-0.03	-	-	-0.05	-	-
Antiplatelet drugs	yes *vs.* no	-0.01	-	-	-0.001	-	-
Number of drugs	number	0.02	-	-	0.03	-	-
Implanted devices	yes *vs.* no	0.07	-	-	0.04	-	-
ICD	yes *vs.* no	0.01	-	-	0.008	-	-
CRT	yes *vs.* no	0.03	-	-	-0.006	-	-
Other pacemaker	yes *vs.* no	0.02	-	-	0.03	-	-
Previous revascularisation	yes *vs.* no	0.007	-	-	-0.01	-	-
Previous PCI	yes *vs.* no	0.01	-	-	0.004	-	-
Previous CABG	yes *vs.* no	-0.01	-	-	0.001	-	-

Data is presented as standardized correlatory coefficients β; *p<0.05; **p<0.01; ***p<0.001

HF: Heart Failure; BMI: Body Mass Index; SBP: Systolic Blood Pressure; NYHA: New York Heart Association; LVEF: Left Ventricular Ejection Fraction; CAD: Coronary Artery Disease; Egfr: Estimated Glomerular Filtration Rate Calculated Using MDRD Formula (MDRD - Modification Of Diet In Renal Disease); MI: Myocardial Infrarction, HT: Hypertension, AF: Atrial Fibrillation, TIA: Transient Ischaemic Attack; DM: Diabetes Mellitus; CKD: Chronic Kidney Disease; COPD: Chronic Obstructive Pulmonary Disease, BDI: Beck Depression Inventory; BDI Subscale 1 Assess Affective-Cognitive Depressive Symptoms; BDI Subscale 2 Assess Somatic Depressive Symptoms; ACE: Angiotensin Converting Enzyme; ARB : Angiotensin Receptor Blocker; ICD: Implantable Cardioverter-Defibrillator; CRT: Cardiac Resynchronization Therapy; PCI: Percutaneous Coronary Intervention; CABG: Coronary Artery Bypass Graft

#CKD was defined as eGFR <60 mL/min/1.73 m^2

$Anaemia was defined as haemoglobin level <12 g/dL for men and <13 g/dL for women

₮Depression was defined as BDI score ≥ 16 points

§The multivariable models included the variables which were significant determinants of the scores in univariable models

Table 5: Associations between the scale scores reflecting destructive and constructive styles of mental adjustment to the disease (assessed using both original and derived keys) and clinical variables in 717 patients with systolic heart failure examined in 11 cardiology centers in Poland (uni- and multivariable models).

Discussion

In our methodological paper we performed the psychological validation of a scale, which allows to assess constructive and destructive styles of mental adjustment to HF. Based on high psychometric indices we can state that the derived scale is highly reliable (Cronbach's-α > 0.70) [34,36] and it could be applied in this group of patients.

Importantly, by using the procedure of derivation and validation, based on a multiple factor analyses, we derived two major clusters of items, which have formed two subscales with content similar to the content of the polish version of the Mini-MAC's subscales [32].

In our population the relationships between the scales scores and clinical variables appeared to be weak. The destructive style of mental adjustment to HF appeared to be characteristic for patients, in whom the symptoms of HF are more severe. Moreover the destructive style of mental adjustment to HF characterizes patients with more pronounced depressive symptoms, whereas the constructive

style is more typical for patients without depressive symptoms. However it has to be underlined that he analysed group consists mainly of patients with mild stable chronic HF. Lack of the associations may result from the fact that this group did not demonstrate a broad spectrum of clinical parameter reflecting severity of HF.

The idea of adaptation the psychological tool which is commonly used in psychooncology raised from clinical similarities between cancer and HF, which concern the general aspects of both diseases, which are particularly burdening for patients (i.e. everyday limitations and the actual number of months/years which the patient can live after the initial diagnosis). Comparing HF to a cancer disease might be considered controversial. However in both diseases the patient has to face the fact that his or her disease will: (a) Require long-term treatment based on frequent hospital visits, medication taking and undergoing more or less invasive procedures; (b) Dramatically change an everyday functioning of a patient himself as well as his/her family, and finally (c) Result in his or her death (ref). At such a situation the name of the disease as well as its medical, pathophysiological characteristics are not important in the context of the patients' mental, emotional state. Presented findings will raise the issue of mental adjustment to HF as important as it is in cancer. In other words our study underlines the need to promote the awareness of HF as a serious, severe and very restrictive illness, requiring attention, support and care, comparable to the attention, support and care being provided for people suffering from cancer, using the expertise of psychooncologists.

Limitations of the Study

We are aware that our study has limitations, which need to be acknowledged: Firstly, there could be the potential selection bias related to the crucial role of the decision of the patient whether he or she wants to participate in a study performed using psychological measures. Secondly, all applied measures are typical self-reported questionnaires, which is associated with a potential risk of misstatement. As a result, our findings cannot be generalized beyond the studied group. The third limitation refers to the fact, that the present study was carried in 11 cardiology centres (which mean that there were at least 11 different investigators). As it is known that some personal features of a researcher may interfere with the questioned subject and his/her responses, high number of involved investigators can be limiting for the standardisation of the whole procedure. On the other hand, this effect was minimalized by using standardised questionnaires, which are filled in by the patient without the investigators help.

Conclusions

In conclusion, the items included in the modified Mini-MAC allow identifying the destructive and constructive styles of mental adjustment to HF, beyond the assessment of depressive symptoms, anxiety and quality of life, demonstrating also the general pattern of complex psychological reaction to the chronic heart disease. Comprehensive studies on psychological phenomena occurring in patients with HF are necessary to develop strategies for psychological support for these patients as well as for building a positive relation between the physician and the patient, which is important for the effectiveness of the treatment and the achievement of high compliance.

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