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Perception of health control and self-efficacy in heart failure

Short title: Health control and self-efficacy in heart failure

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Abstract

Background: The issue of self-perceived health control and related sense of self-efficacy has not received any attention in patients with heart failure (HF), although these psychological features have been established to determine the patients' approach towards healthcare professionals and their recommendations, which strongly affects compliance.

Methods: 758 patients with systolic HF (age: 64±11years, men:79%, NYHA classIII-IV:40%, ischaemic aetiology:61%) were included in a prospective Polish multicenter Caps-Lock-HF study. A Multidimensional Health Locus of Control (MHLC) scale was used to assess subjective perception of health control in 3 dimensions (internal control, external control by-the-others & by-chance); Generalised Self-efficacy scale (GSES) was used to estimate subjective sense of self-efficacy; Beck Depression Inventory (BDI) was used to determine depressive symptoms.

Results: Majority of patients perceived the external control (by-the-others) and internal control of their health as high (77%and 63%,respectively) or moderate (22%and 36%), whereas self-efficacy as high or moderate (63%and 27%), which was homogenous across the whole spectrum of HF cohort, being related to neither HF severity, HF duration, the presence of co-morbidities nor the applied treatment. The stronger perception of internal health control the higher self-efficacy ($p<0.05$); both features were related to less pronounced depressive symptoms ($p<0.05$).

Conclusions: The established pattern of self-perceived control of own health and self-efficacy indicates that patients with HF acknowledge the role of the others (i.e. healthcare providers) and themselves in the process of the management of HF, and are convinced about high efficacy of their undertaken efforts. Such evidence is in favour of an implementation of a partnership model of specialists' care of patients with HF.

Key words: heart failure, psychological features, health control localisation, self-efficacy

Przekonania dotyczące kontroli zdrowia i poczucie skuteczności u chorych z niewydolnością serca

Streszczenie

Wstęp: Umiejscowienie kontroli zdrowia i poczucie skuteczności to zmienne, które nie zostały dokładnie przebadane wśród chorych z niewydolnością serca (NS), mimo iż te cechy psychologiczne mogą determinować stosunek pacjenta do personelu medycznego i realizowanie zaleceń lekarskich.
Metody: 758 ze skurczową NS (wiek: 64±11 lat, mężczyźni:79%, klasy NYHA III-IV:40%, etiologia niedokrwienna:61%) włączono do Prospektywnego Polskiego Badania Wieloośrodkowego Caps-Lock-HF. Umiejscowienie Kontroli Zdrowia oceniano z użyciem skali MHLC, wyróżniającej 3 wymiary(kontrolę wewnętrzną, zewnętrzną podkreślającą wpływ innych pub zewnętrzą podkreślającą wpływ przypadku); Skala GSES została użyta do oceny poczucia skuteczności, a Inwentarz Depresji Becka (BDI) - do oceny nasilenia objawów depresyjnych.
Wyniki: Większość zbadanych chorych oceniała kontrolę zdrowia opartą na wpływie innych jak również własny wpływ na zdrowie jako wysokie (odpowiednio 77 i 63%) lub przynajmniej umiarkowane (22 i 36%);poczucie skuteczności było również wysokie lub umiarkowane (63 i 27%). Co ważne, było to niezależne od stopnia zaawansowania NS, czasu trwania choroby, obecności schorzeń towarzyszących ani stosowanego leczenia. Im silniejsze poczucie własnego wpływu na zdrowie, tym silniejsze poczucie skuteczności (p<,05), a obie te cechy były odwrotnie proporcjonalne do nasilenia objawów depresyjnych (p<,05).
Wnioski: Zbadana konfiguracja cech psychologicznych: poczucie kontroli zdrowia i poczucie skuteczności sugerują że chorzy z NS są w stanie doceniać wpływ innych osób (w tym lekarzy) jak również siebie samych na przebieg choroby oraz są przekonani o skuteczności swoich działań. Takie wyniki wskazują, że warto rozważyć wprowadzenie partnerskiego modelu opieki medycznej w leczeniu przewlekłej, skurczowej NS.
Słowa kluczowe: niewydolność serca, cechy psychologiczne, umiejscowienie kontroli zdrowia, poczucie skuteczności

INTRODUCTION

Chronic disease with severe persistent symptoms and grave prognosis, reveals a profound impact on the patient’s psychological status [1]. The individual psychological features of each patient determines the approach towards the administered diagnostic and therapeutic interventions, which affects compliance [2-4] and the effectiveness of treatment of such a patient [5].

Oncology is an example of a medical specialty, where a comprehensive clinical assessment of a patient compromises a psychological examination [6], which allows to implement psychological interventions aiming to strengthen certain features, which could be beneficial in the context of a struggle with severe long-lasting disease [7]. Healthcare professionals (physicians, nurses, physio- and psychotherapists) adjust their approach to a patient respectively to his/her psychological status which improves the effectiveness of medical care [8].

The diagnosis of heart failure (HF), similarly to cancer disease, is associated with an administration of lifelong pharmacotherapy, a common implementation of invasive diagnostic and therapeutic procedures and frequent hospitalizations [9], which affects daily functioning of patients with HF, and worsen their quality of life [10]. However, as measuring quality of life and depressive symptoms are still not enough for the comprehensive assessment of a broad range of psychological features [11], we decided to perform a multicenter prospective study in order to investigate the personal beliefs regarding the control over own health and the subjective sense of self-efficacy in patients with systolic HF.

METHODS

Study population

The study included patients hospitalised or visiting outpatient clinics in 11 cardiology centres in Poland between September 2012 and March 2013 (one in Wroclaw, Lublin, Łódź, Białystok and Cracow, two in Warsaw, and four in Katowice) fulfilling the following inclusion criteria: (a) a >6-month documented history of HF (New York Heart Association [NYHA] I-IV classes [10]); (b) clinical stability with unchanged medications for ≥3 months preceding the study; (c) left ventricular ejection fraction (LVEF) <45%. 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 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

Psychological questionnaires were given to each patient during his/her hospital stay or during his/her visit in an outpatient clinic. Clinical data were collected from medical records. The following parameters were analysed: basic demographic and anthropometric data: age (years), gender, body height and mass (analysed as calculated body mass index (BMI), kg/m^2); resting heart rate (beats/min), systolic and diastolic blood pressure (mmHg); parameters reflecting the severity of HF: number of years since the initial diagnosis of HF, NYHA class, HF aetiology; left ventricular ejection fraction (LVEF, %) derived from standard transthoracic echocardiography; basic laboratory parameters: sodium (mmol/L), haemoglobin (g/dL), glomerular filtration rate (GFR, $mL/min/1.73m^2$) calculated using the Modification of Diet in Renal Disease equation); the presence of the following co-morbidities: myocardial infarction, hypertension, atrial fibrillation, stroke and/or transient ischaemic attack, diabetes mellitus, chronic kidney disease, anaemia, chronic obstructive pulmonary disease, cancer); the information of administered drugs (ACE inhibitors and/or ARB, Aldosterone antagonists, β-blockers, Loop diuretics, Thiazide diuretics, Statins, Antiplatelet drugs, and Digoxin), implanted devices (implantable cardioverters-defibrillators, cardiac resynchronization therapy or other type of pacemaker), previously performed revascularisation procedures (e.g. percutaneous coronary intervention or coronary artery bypass graft).

Psychological evaluation was based on standardised questionnaires. The set of psychological questionnaires (all Polish, officially adapted and psychometrically validated versions) included: Multidimensional Health Locus of Control (MHLC) Scale; Generalised Self Efficacy Scale (GSES); The modified Mental Adjustment to Cancer Scale (modified Mini-MAC); Coping Inventory for Stressful Situations (CISS) and Beck Depression Inventory (BDI). In the current paper we are reporting results obtained from MHLC, GSES and BDI.

The Polish version of MHLC (adopted and validated by Juczynski, 2009) [12] was used in order to assess the health locus of control, which refers to personal beliefs regarding the control of individual health status based on 3 possible localizations of health control: ‘Internal’ or two external localizations. Patients with high scores within the subscale assessing an ‘Internal localisation’ are convinced that their health status depends only on their own behaviours. Patients who believe that their individual health status is a consequence of the actions performed by ‘powerful people’, e.g.: doctors, family members, friends have high level of ‘External control (by the others)’. Those who believe that mainly a chance, fate or luck determine their health status would have high scores on the second subscale measuring external control, named ‘External control (by chance)’. Each MHLC subscale is composed of

6 items; . The answers for each item are expressed using a 6-point Likert scale, where the lowest score (1 point) means ‘strongly disagree’, and the highest score (6 points) means ‘strongly agree’, thus it is possible to obtain from 6 to 36 points in each subscale. There is no global sum / result expressing a certain general level of health control [12]. Moreover, a high score within one subscale does not exclude the possibility of having high scores also in other subscales. Scores in MHLC as continuous variables are presented in tables 2 and 3. Moreover, we calculated the score of each patient in all 3 subscales and assigned each score to the following categories defined arbitrary by us: ‘low’ 0-33.3% of the maximum score, ‘moderate’ 33.4-66.6 % of the maximum score or ‘high’ 66.7 – 100% of the maximum score (in each subscale). Afterwards we calculated the percentage of patients localised in the particular categories of all 3 types of control. The percentages were demonstrated as cubes (the volume of each cube was equal to the calculated percentage) placed in a 3-dimensional graph according to the particular categories of health control. The results obtained using this approach (scores in MHLC assigned to 3 categories) are presented on the figure 1.

Polish version of GSES (adopted and psychometrically validated also by Juczyński) [12] was applied in order to measure the sense of self efficacy, i.e. the conviction of an individual regarding his/her own competence in completing tasks (by the means of behaviours, thoughts, emotions) and reaching desired goals. GSES includes 10 items, answered with a 4-point Likert type scale (1, 2, 3 and 4 mean ‘no’, rather no’, ‘rather yes’ and ‘yes’, respectively) [12].

Each patient completed also BDI (version Ia) [13], a self-administered 21-item self-report inventory, which allows to differentiate cognitive-affective (based on the first 13 items) and somatic (based on the remaining 8 items) depressive symptoms. BDI total score ≤10 points was interpreted as no depressive symptoms, whereas BDI score ≥14 suggested the presence of at least mild depressive symptoms [13].

Statistical analyses

Normally distributed continuous variables were presented as means ± standard deviations. The differences were tested using the student’s t-test or ANOVA, where appropriate. Variables with a skewed distribution were expressed as medians with lower and upper quartiles, and were log transformed in order to normalize their distribution. The categorical variables were expressed as numbers with percentages. The inter-group differences were tested using the χ^2 test.

Relationships between variables were assessed using Pearson's (r) or standardised (β) correlatory coefficients in univariable linear regression models, and if they were statistically significant, they were included in multivariate models. Both scores in MHLC as well as in GSES were used as dependent variables. As depression (assessed using a questionnaire) was related to 'Internal control', 'External control (by chance)' and self-efficacy, models for those variables were built with as well as without the BDI score included, in order to verify the relations between clinical and psychological variables with and without an adjustment for the BDI score. $P<0.05$ was considered statistically significant.

RESULTS

758 patients with systolic HF were recruited among 11 cardiology centres in Poland. The majority of them were inpatients (82%) and males (79%), aged 64±11 years old. 60% was classified in NYHA II-III classes, with reduced ejection fraction (mean LVEF 31±9%). 61 of them had an ischemic HF aetiology. All patients received standard pharmacotherapy (i.e. 90 % received ACE inhibitors and/or ARB, 69% received aldosterone antagonists whereas 96% were treated with β-blockers). Baseline, detailed characteristics of all examined patients is presented in table 1.

There were the following mean scores (with standard deviations) obtained by patients with HF: 26±5 for 'Internal control', 28±5 for 'External control (by the others)' and 22±6 for 'External control (by chance)'. The vast majority of patients perceived the 'External control (by the others)' and 'Internal control' of their health as high (77% and 63%, respectively) or moderate (22% and 36%) (see figure 1). The MHLC scores are not focused around mean values, but are shifted towards scores above the mean, especially in the context of 'External control (by the others)' and 'Internal control'. Indeed, more than 25 % of patients perceived their 'Internal control' as 'high', which was accompanied by a perception of both types of external localisation of health control also as 'high'. Almost 24% of them presented 'high Internal control' accompanied by 'high External control (by the others)' and 'moderate External control (by chance)'. Less than 10% of patients demonstrated scores reflecting 'moderate' level of all 3 localisations of health control, and none of them demonstrated low scores in all 3 MHLC subscales.

There were only few weak associations between the localisation of health control and clinical variables (Table 2), and majority of them did not remain significant after and adjustment for BDI (except for the 'Internal control' which was higher in patients taking statins, even after the adjustment for BDI) ($p<0.05$). In general, 'Internal control' was

negatively, whereas ‘External control (by chance)’ was positively related to BDI total score ($p<0.01$) (table 2). ‘External control (by the others)’ was not related to depression, and in multivariable model, was positively related to the patients age, taking thiazide diuretics as well as to having an implanted device (all $p<0.05$, table 2).

Mean score (with standard deviation) for GSES obtained by all patients was 31±5 points. The vast majority of patients estimated their self-efficacy as high or moderate (63% and 27%).

In multivariable model, the subjective perception of self-efficacy was not related to clinical variables, however it was inversely associated with BDI ($p<0.001$) (table 2).

Self-efficacy was related to ‘Internal control’ ($r=0.29$) and ‘External control (by the others)’ (both $p<0.05$) but not to ‘External control (by chance)’ ($p>0.05$). There were no differences in the strength of aforementioned associations in other prespecified subgroups of patients as shown in table 3.

DISCUSSION

In the present study we have shown that majority of examined patients with HF placed themselves on the highest (or at least moderately high) level of all three types of health control. Importantly, anyone placed him or herself at the lowest level of and Internal and/or ‘External control (by the others)’. This suggests that patients with systolic HF perceive the level of the ‘External control (by the others)’ and ‘Internal control’ of their health (as well as their subjective feeling of self-efficacy) as particularly high. Based on such results we can conclude that the majority of examined patients believe that their health is strongly dependent on the decisions and/or actions performed by other people, including healthcare professionals. Moreover, they also acknowledge a strong feeling of their own influence on their health and their high capability of effectiveness in reaching any desired goals (including those related to health).

The pattern of these psychological features appears to be different from those seen in patients with other chronic diseases (like, for instance, diabetes [2] epilepsy [14]).

The pattern of the subjective perception of health control observed in our study was homogenous across the whole spectrum of a HF cohort, as there were practically no relations with either HF severity, HF duration, the presence of co-morbidities or the applied treatment, except for the relation between ‘Internal control’ and taking statins and the relation between ‘External control (by the others)’ and taking diuretics as well as having an implanted device. Although the relations between the scores in MHLC subscales and particular medications are

hard to explain, the fact that, patients having implanted devices were characterised by higher level of the External control (by the others) seems to be reasonable from the psychological point of view. The experience of the reduction of symptoms (e.g. resulting from having CRT) may be linked to the conviction about the role of physicians in the patients' health status. On the other hand, it is very probable that each patient who actually have an implanted device, had believed in the physician's role before they agreed to have an implantation, as this procedure require entrusting life and health to healthcare professionals, which is related to the perception of high 'External control (by the others)' [15].

Presented results confirmed also previous findings, suggesting that depressive symptoms are inversely related to 'Internal control' and positively related to 'The External control (by chance) [16].

Scores in GSES were also independent from the clinical characteristic of the examined patients. It is surprising because it is known that the sense of self-efficacy is related to self reported physical functioning and to the severity of the disease (e.g. in patients with COPD and HF [17]). Self-efficacy is also known as an important predictor of emotional and psychosocial adjustment of patients with epilepsy [18].

The subjective perception of self-efficacy was inversely related to depressive symptoms, which is consistent with the majority of previous findings [19]. We have also observed relations between particular localisation of the health control and the sense of self-efficacy, which is also consistent with the results of the studies conducted earlier [20].

Limitation of the study

As there are psychological differences between patients who agree vs. who disagree to participate in this type of a study, our results may be biased and should not be easily generalized beyond the studied group.

Clinical implications

Presented results indicate that patients with systolic HF are convinced that they control their own health and that their activities are efficient. Perhaps healthcare professionals should give the patients the greater opportunity to take care of themselves in the process of HF management. Moreover, it appears that patients with systolic HF are conscious about the role of the others (including healthcare providers). Healthcare professionals should consider this information in their clinical practice as it is in favour of an implementation of a partnership model of specialists' care of patients with HF. Such observations should be taken into account

while designing any type of initiatives aimed to help patients with HF in their everyday management.

What is particularly important from the practical point of view, it has been shown that the localisation of health control is crucial in the context of the adherence to medical treatment. This conclusion was made based on numerous studies involving patients with other chronic diseases, like: diabetes [2], hypertension [3], hypercholesterolemia [4], schizophrenia [21] as well as patients treated using haemodialysis [22]. Moreover, it has been demonstrated that the modulation of believes regarding health control [23] as well as the level of self-efficacy [19], can reduce depressive symptoms, which are very common in patients with HF. There is also evidence suggesting that there is a link between locus of health control and survival in patients after lung transplantation (i.e. patients with an 'Internal control' lived significantly longer [24]).

CONCLUSIONS

In sum, we suggest that the patient's socio-emotional state (e.g. in term of health control believes and the sense of self-efficacy) should be assessed as a part of multidimensional approach towards HF patients, which is suggested by current guidelines related to the management of HF.

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Figure 1. The distribution of 758 patients with systolic heart failure, according to their subjective perception of internal control, external control (by the others) and external control (by chance) using scores obtained with the Multidimensional Health Locus of Control Scale (categorized as low, moderated or high scores, as defined within the 'Methods' section).

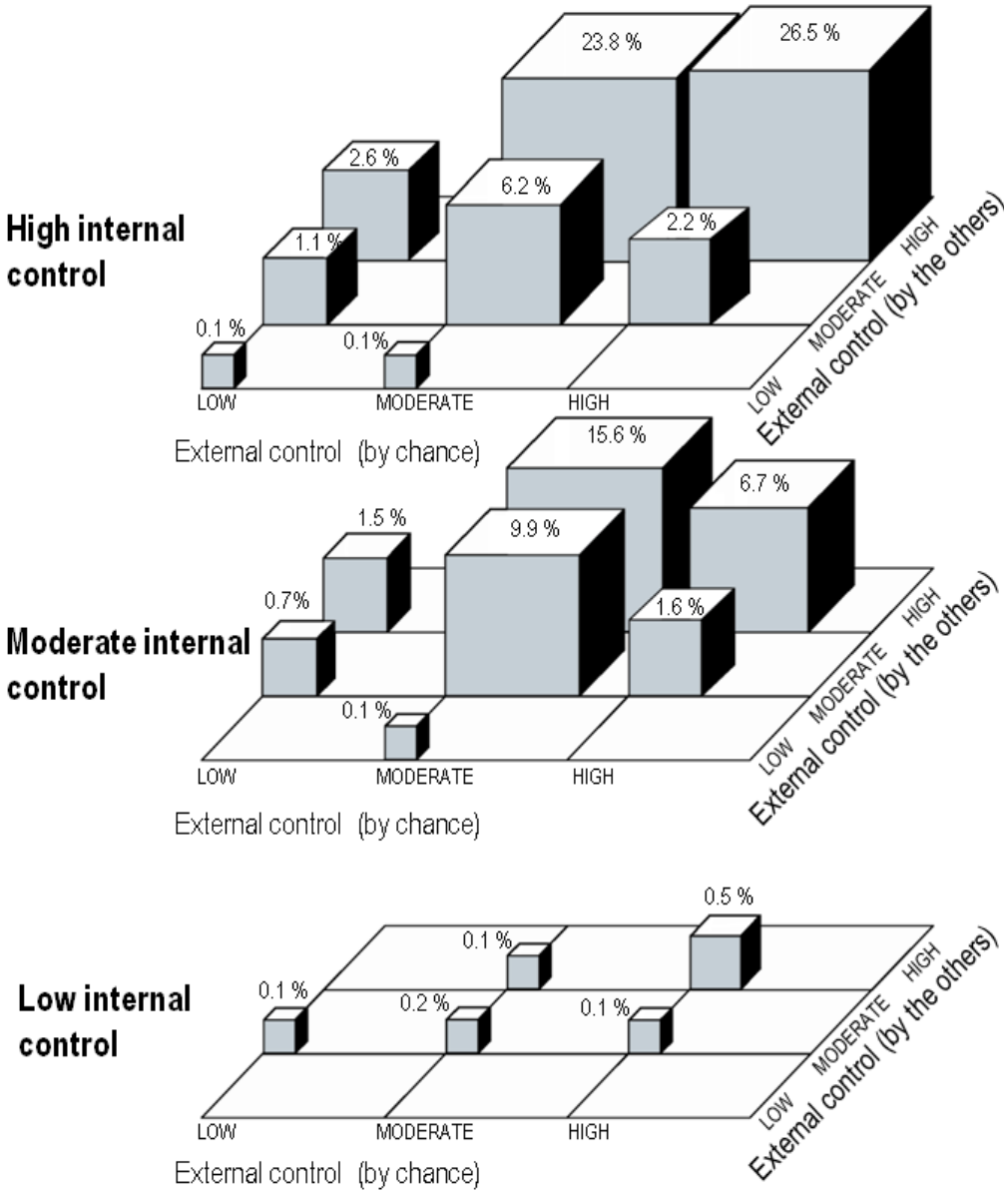

Table 1. Baseline characteristics of 758 patients with systolic heart failure examined in 11 cardiology centres in Poland, participants of the multicenter Caps-Lock-HF study.

Variables (units)	All HF patients included in the Caps-Lock-HF study	Centers recruiting HF patients											F/ χ^2
		WROC	KAT1	LUBL	WAR1	KAT2	LODZ	KAT3	BIAL	KRAK	WAR2	KAT4	
Number of patients (n)	758	133	102	100	59	56	53	53	52	50	50	50	103.3***
Inpatients (n, %)	624 (82)	59 (44)	64 (63)	100 (100)	59 (100)	56 (100)	43(81)	53 (100)	40 (77)	50 (100)	50 (100)	50 (100)	249.4***
Men (n, %)	599 (79)	109 (82)	81 (79)	74 (74)	47 (80)	43 (77)	42 (79)	39 (74)	45 (87)	40 (80)	38 (76)	31 (82	5.7
Age (years)	64±11	62±9	66±10	69±10	64±12	64±11	60±12	63±9	63±13	59±13	64±10	62±11	4.7***
BMI (kg/m^2)	28.3±4.6	28.1±4.6	28.4±3.9	28.4±3.6	28.6±5.5	27.8±4.0	28.0±4.4	28.2±4.7	28.8±4.4	27.4±5.0	29.3±5.8	28.8±5.4	0.7
SBP (mmHg)	123±16	120±15	121±13	121±14	138±18	125±12	121±11	120±13	125±17	121±19	126±18	123±14	7.0***
Heart rate (beats/min)	74±14	74±15	69±10	76±9	71±9	77±18	73±10	70±15	74±17	73±11	82±23	75±12	4.2***
Time since HF diagnosis (years)	4(2-10)	10(4-15)	1(1-6)	4(3-6)	5(2-9)	2(1-4)	4(2-10)	5(4-8)	7(4-10)	6(2-11)	4(1-7)	6(2-12)	15.0***
NYHA classes, I/II/III/IV (n, %)	35/414/283/26 (5/55/37/3)	12/91/30/0 (9/68/23/0)	7/55/39/1 (7/54/38/1)	2/46/52/0 (2/46/52/0)	1/30/25/3 (2/51/42/5)	0/11/15/0 (0/73/27/0)	4/34/14/1 (8/64/26/2)	7/26/19/1 (13/49/36/2)	0/14/31/7 (0/27/60/16)	0/18/22/10 (0/36/44/20)	1/24/22/3 (2/48/44/6)	1/35/14/0 (3/70/27/0)	148.9***
LVEF (%)	31±9	32±8	29±9	35±7	32±10	34±9	32±9	31±8	24±8	27±9	32±9	37±5	11.7***
HF aetiology, CAD (n, %)	460 (61)	83 (62	66 (65)	50 (50)	36 (61)	36 (64)	36 (68)	36 (68)	25 (48)	24 (48)	24 (48)	44 (88)	34.1
Sodium (mmol/L)	140±3	139±4	139±3	141±3	140±3	140±3	140±3	141±3	140±3	140±3	140±3	138±3	6.6***
Haemoglobin (g/dL)	13.7±1.6	13.7±1.5	14.0±1.5	13.5±1.5	13.3±1.7	13.6±1.7	14.0±1.3	13.3±1.8	13.7±1.4	14.2±1.6	13.4±1.9	13.5±2.2	2.1*
eGFR (mL/min/1.73 m^2)	73±25	76±26	73±22	66±26	76±23	76±28	72±24	71± 26	73±23	84±25	67±25	79±28	2.8**
Previous MI (n, %)	382 (50)	75 (56)	52 (51)	45 (45)	31 (53)	22 (39)	35 (66)	27 (51)	20 (38)	21 (42)	21 (42)	33 (66)	21.8*
HT (n, %)	542 (72)	77 (58)	76 (75)	85 (85)	48 (81)	42 (75)	49 (92)	31 (58)	29 (56)	30 (60)	32 (64)	43 (86)	56.6***
AF (n, %)	322 (42)	49 (37)	38 (37)	80 (80)	25 (42)	25 (45)	21 (40)	22 (42)	16 (31)	12 (24)	24 (48)	10 (20)	81.7***
Previous stroke and/or TIA (n, %)	56 (7)	16 (12)	8 (8)	3 (3)	3 (5)	3 (5)	5 (9)	4 (8)	6 (12)	1 (2)	4 (8)	3 (6)	11.8
DM (n, %)	231 (30)	42 (32)	36 (35)	27 (27)	18 (31)	14 (25)	18 (34)	9 (17)	19 (37)	16 (32)	16 (32)	16 (32)	8.5

CKD # (n, %)	227 (29)	36 (27)	28 (27)	46 (46)	10 (17)	18 (32)	16 (30)	18 (34)	16 (31)	9 (18)	22 (44)	8 (16)	31.2***
Anaemia $ (n, %)	188 (25)	30 (23)	15 (15)	29 (29)	21 (36)	16 (29)	9 (17)	12 (23)	16 (31)	9 (18)	14 (28)	17 (34)	17.6
COPD (n, %)	92 (12)	15 (11)	12 (12)	13 (13)	7 (12)	5 (9)	4 (8)	7 (13)	9 (17)	7 (14)	5 (10)	8 (16)	4.2
Cancer (n, %)	41 (5)	4 (3)	12 (12)	5 (5)	5 (8)	5 (9)	0 (0)	0 (0)	3 (6)	3 (6)	2 (4)	2 (4)	18.5*
Number of co-morbidities (n)	3±1	3±2	3±1	3±1	3±1	3±1	3±1	3±1	3±2	2±2	3±2	3±1	3.1***
Treatment													
ACE inhibitor and/or ARB (n, %)	680 (90)	127 (95)	92 (90)	78 (78)	57 (97)	48 (86)	53 (100)	45 (85)	49 (94)	47 (94)	43 (86)	41 (82)	37.2***
Aldosterone antagonist (n, %)	524 (69)	105 (79)	80 (78)	53 (53)	37 (63)	32 (57)	32 (60)	45 (85)	47 (90)	42 (84)	31 (62)	20 (40)	72.6***
β-blocker (n, %)	727 (96)	131 (98)	102 (100)	91 (91)	57 (97)	52 (93)	52 (98)	49 (92)	52 (100)	48 (96)	45 (90)	48 (96)	23.1*
Loop diuretic (n, %)	517 (68)	70 (53)	67 (66)	90 (90)	47 (80)	32 (57)	33 (62)	36 (68)	49 (94)	35 (70)	37 (74)	21 (42)	77.6***
Thiazide diuretic (n, %)	127 (17)	72 (54)	7 (7)	10 (10)	4 (7)	7 (13)	0 (0)	5 (9)	8 (15)	1 (2)	8 (16)	5 (10)	170.8***
Digoxin (n, %)	123 (16)	25 (19)	14 (14)	11 (11)	9 (15)	10 (18)	17 (32)	6 (11)	16 (31)	9 (18)	5 (10)	1 (2)	31.1***
Statin (n, %)	574 (76)	109 (82)	73 (72)	65 (65)	51 (86)	40 (71)	50 (94)	44 (83)	38 (73)	30 (60)	30 (60)	44 (88)	43.6***
Antiplatelet drugs (n, %)	481 (63)	84 (63)	67 (66)	64 (64)	28 (47)	40 (71)	45 (85)	28 (53)	30 (58)	24 (48)	24 (48)	47 (94)	52.5***
Number of drugs (n)	5±1	6±1	5±1	5±1	5±1	5±1	6±1	5±1	6±1	5±1	5±1	5±1	4.2***
Implanted device (n, %)	369 (49)	88 (66)	82 (80)	47 (47)	26 (44)	10 (18)	25 (47)	23 (43)	37 (71)	12 (24)	17 (34)	2 (4)	146,9***
ICD (n, %)	291 (39)	84 (63)	36 (35)	39 (39)	22 (37)	7 (13)	21 (40)	22 (42)	37 (71)	9 (18)	14 (28)	50 (100)	117,0***
CRT (n, %)	127 (17)	31 (23)	35 (34)	14 (14)	5 (9)	2 (4)	7 (13)	5 (9)	23 (44)	3 (6)	2 (4)	50 (100)	87,8***
Other pacemaker (n, %)	46 (6)	4 (3)	18 (18)	8 (8)	2 (4)	3 (5)	3 (6)	1 (2)	0 (0)	2 (4)	3 (6)	2 (4)	33,4***
Previous revascularisation (yes, %)	350 (46)	69 (52)	50 (49)	43 (43)	27 (46)	28 (50)	33 (62)	27 (51)	21 (40)	17 (34)	15 (30)	20 (40)	18.5*
Previous PCI (n, %)	288 (48)	54 (41)	33 (32)	36 (36)	24 (41)	25 (45)	29 (55)	20 (38)	19 (37)	15 (30)	15 (30)	18 (36)	12.3
Previous CABG (n, %)	137 (18)	36 (27)	27 (26)	18 (18)	5 (8)	8 (14)	11 (21)	15 (28)	5 (10)	5 (10)	2 (4)	5 (10)	33.9***

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; WROC – Wroclaw; KAT – Katowice; LUBL – Lublin; WAR – Warszawa; BIAL – Bialystok; KRAK – Krakow; 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 infarction; HT – hypertension; AF – atrial fibrillation; TIA – transient ischaemic attack; DM – diabetes mellitus; CKD – chronic kidney disease; COPD – chronic obstructive pulmonary disease,; 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. Associations between the scale scores reflecting the localisation of health control and self-efficacy, and clinical variables in 758 patients with systolic heart failure examined in 11 cardiology centres in Poland (linear regression, uni- and multivariable models).

		Localisation of health control								Self-efficacy		
		Internal control			External control							
					by the others		by Chance					
		Univariable models	Multivariable model §		Univariable models	Multivariable model	Univariable models	Multivariable model §		Univariable models	Multivariable model §	
Variables	Units		without BDI	with BDI				without BDI	with BDI		without BDI	with BDI
Inpatients	yes vs no	-0.01	-	-	-0.01	-	-0.09 **	-0.07 *	-0.07	-0.01	-	-
Gender	men vs women	-0.05	-	-	-0.06 *	-0.01	0.02	-	-	-0.03	-	-
Age	Year	-0.04	-	-	0.15 ***	0.14 ***	0.08*	0.06	0.06	-0.05	-	-
BMI	kg/m^2	-0.004	-	-	-0.03	-	-0.03	-	-	0.07	-	-
SBP	mmHg	-0.03	-	-	0.01	-	-0.04	-	-	0.03	-	-
Heart rate	beats/min	-0.04	-	-	-0.03	-	0.004	-	-	-0.04	-	-
Time since HF diagnosis	Year	0.04	-	-	0.05	-	0.05	-	-	-0.03	-	-
NYHA class	I / II / III / IV	-0.05	-	-	0.04	-	0.12 ***	0.06	0.04	-0.11 **	-0.08	-0.01
LVEF	%	0.05	-	-	0.05	-	-0.10 **	-0.07	-0.07	0.08 *	0.02	0.02
HF aetiology, CAD	yes vs no	0.02	-	-	0.04	-	-0.03	-	-	-0.04	-	-
Sodium	mmol/L	0.03	-	-	-0.02	-	-0.05	-	-	0.08 *	0.07	0.03
Haemoglobin	g/dL	-0.02	-	-	-0.09*	-0.06	-0.04	-	-	0.004	-	-
eGFR	mL/min/1.73 m^2	0.08 *	0.02	0.02	-0.004	-	-0.004	-	-	0.05	-	-
Previous MI	yes vs no	0.01	-	-	-0.001	-	-0.04	-	-	-0.04	-	-
HT	yes vs no	0.07 *	0.02	-	-0.01	-	0.02	-	-	0.02	-	-
AF	yes vs no	-0.10 **	-0.08 *	-0.07	0.03	-	-0.02	-	-	-0.05	-	-
Previous stroke and/or TIA	yes vs no	-0.01	-	-	-0.03	-	0.004	-	-	-0.004	-	-
DM	yes vs no	0.04	-	-	0.02	-	.06	-	-	-0.06	-	-
CKD #	yes vs no	-0.10 **	-0.07	-0.06	0.01	-	0.03	-	-	-0.05	-	-
Anaemia $	yes vs no	0.01	-	-	0.06	-	0.01	-	-	0.02	-	-
COPD	yes vs no	-0.04	-	-	0.05	-	0.04	-	-	-0.02	-	-
Cancer	yes vs no	-0.03	-	-	0.02	-	-0.01	-	-	-0.06	-	-
Number of co-morbidities	number	-0.04	-	-	0.04	-	0.03	-	-	-0.06	-	-
BDI	Point	-0.14 ***	-	-0.12 ***	0.002	-	0.13 ***	-	0.10 **	-0.37 ***	-	-0.36 ***
BDI subscale 1	Point	-0.13 ***	-	-	-0.02	-	0.10 **	-	-	-0.37 ***	-	-
BDI subscale 2	Point	-0.12 ***	-	-	0.04	-	0.15***	-	-	-0.27 ***	-	-
Depression ₸	yes vs no	-0.16 ***	-	-	-0.05	-	0.05	-	-	-0.30 ***	-	-
Treatment												
ACE inhibitor and/or ARB	yes vs no	-0.01	-	-	-0.01	-	-0.05	-	-	0.04	-	-
Aldosterone antagonist	yes vs no	0.03	-	-	0.04	-	0.05	-	-	0.07	-	-
β-Blocker	yes vs no	-0.004	-	-	-0.01	-	-0.09 *	-0.08 *	-0.07	-0.04	-	-
Loop diuretic	yes vs no	-0.03	-	-	0.01	-	0.09 *	0.03	0.02	0.10 **	-0.07	-0.02
Thiazide diuretic	yes vs no	0.03	-	-	0.09 *	0.07 *	-0.01	-	-	0.03	-	-
Digoxin	yes vs no	-0.03	-	-	0.022	-	-0.01	-	-	-0.04	-	-
Statin	yes vs no	0.1 **	0.08 *	0.07 *	-0.005	-	-0.02	-	-	0.07	-	-
Antiplatelet drugs	yes vs no	0.02	-	-	-0.04	-	-0.03	-	-	-0.01	-	-

Table 3. Associations between the scale scores reflecting the localization of health control and self-efficacy in selected subgroups of 758 patients with systolic heart failure.

Analyses were performed in the following subgroups of patients with systolic HF	N	GSES VS internal control	GSES VS external control (by the others)	GSES VS external control (by chance)
All	758	0.29 ***	0.09 *	0.03
Men	599	0.28 ***	0.09 *	0.04
Women	159	0.32 ***	0.10	-0.002
Inpatients	624	0.28 ***	0.06	0.01
Outpatients	134	0.30 ***	0.22 *	0.10
Age ≤ 64 years (median)	392	0.26 ***	0.11 **	-0.02
Age > 64 years	366	0.32 ***	0.09	0.07
NYHA class: I and II	449	0.29 ***	0.11 *	0.04
NYHA class: III and IV	309	0.28 ***	0.08	0.03
HF aetiology: CAD	460	0.03 ***	0.06	0.01
HF aetiology: non - CAD	298	0.27 ***	0.15 **	0.05
< 3 co-morbidities	355	0.30 ***	0.13 *	0.05
≥ 3 co-morbidities	403	0.28 ***	0.07	0.02
With any device	365	0.32 ***	0.13 *	0.01
Without any device	393	0.26 ***	0.07	0.05
< 5 medications	200	0.27 ***	0.06	-0.05
≥ 5 medications (median)	558	0.30 ***	0.10 *	0.05
BDI score ≥ 14 points Ŧ	225	0.24 ***	0.12	0.12
BDI score < 14 points Ŧ	533	0.26 ***	0.06	0.007

Results are presented as Pearson's linear correlatory coefficients (r); *p<0.05, **p<0.01 and ***p>0.001 reflect a statistical significance of the correlatory coefficients; MHLC – Multidimentional Health Locus of Control; GSES – Generalised Self Efficacy Scale; HF – heart failure; NYHA – New York Heart Association; CAD – coronary artery disease; BDI – Beck depression inventory.
Ŧ depression was defined as BDI score ≥14 points.