

# Factors Associated with Heart Failure Knowledge and Adherence to Self-Care Behaviors in Hospitalized Patients with Acute Decompensated Heart Failure Based on Data from “the Weak Heart” Educational Program

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**Purpose:** As insufficient adherence to recommendations is a major cause of poor health outcomes in patients with heart failure (HF), it is important to identify the factors that improve disease knowledge and self-care behaviors. We aimed to identify factors associated with HF knowledge and self-care behaviors in patients hospitalized due to acute decompensated heart failure (ADHF) in Poland.

**Patients and Methods:** This was a secondary analysis of data from a multi-center, prospective, non-randomized educational program named “The Weak Heart”, which was conducted in 14 cardiology centers in Poland. The level of HF knowledge was assessed using a questionnaire developed by the research team, and self-care behaviors were evaluated using the European Heart Failure Self-care Behaviour Scale (9-EHFScBS) questionnaire.

**Results:** The study included 259 patients admitted to the hospital with ADHF. The mean HF knowledge and 9-EHFScBS questionnaire scores were  $8.25 \pm 4.34$  and  $25.2 \pm 9.5$ , respectively. The patients’ level of education ( $P = 0.002$ ), number of prior HF hospitalizations ( $P = 0.008$ ), and previous disease education ( $P < 0.001$ ) were independently associated with better HF knowledge. Age ( $P = 0.03$ ) and disease education ( $P = 0.02$ ) were independently associated with self-care behaviors.

**Conclusion:** The adherence to self-care recommendations among patients with ADHF is insufficient. Disease education positively influenced both HF knowledge and self-care abilities. To improve patients’ adherence to HF recommendations, well-designed models of education based on HF management guidelines should be implemented.

**Keywords:** adherence, heart failure, health education, self-care behaviors

## Introduction

Heart failure (HF) is a progressive clinical syndrome characterized by increased mortality, frequent hospitalizations, and a complex therapeutic regimen.<sup>1,2</sup> It has one of the worst prognoses among all chronic diseases and places a reasonable burden on patients, caregivers, and the healthcare system.<sup>3,4</sup> Recent studies demonstrated that 25% of hospitalized patients with HF are readmitted within 30 days of discharge and 50% are readmitted within 6 months.<sup>5</sup> According to the analysis of data from the HF Pilot Survey (ESC-HF Pilot), which included Polish patients with HF, 57% of patients

were previously hospitalized due to ADHF.<sup>6</sup> Patients discharged after hospitalization for HF also remained at high risk of death and hospital readmission.<sup>7</sup> Although the “transition phase” is the most vulnerable period after hospital discharge, 75% of readmissions in this time may be preventable.<sup>8,9</sup> There is evidence that discharge education improves outcomes in patients with HF,<sup>10</sup> which is why “The Weak Heart” program was developed for patients hospitalized for ADHF.

Medical education, self-care management, and other related long-term activities are important non-pharmacological treatments for chronic diseases, including HF.<sup>11,12</sup> These activities can reduce morbidity and mortality, as well as improve patients’ quality of life.<sup>11,12</sup> Indeed, the 2016 European Society of Cardiology guidelines and practical recommendations for HF (ESC-HF) specify several non-pharmacological methods that are relevant for patients with HF, emphasizing the importance of multi-specialty teams, monitoring, physical activity, self-care, and education.<sup>2</sup> Despite this, many studies suggest that the level of disease knowledge and self-care abilities are insufficient among patients with HF.<sup>13–20</sup>

A low level of adherence to non-pharmacological recommendations increases the occurrence of adverse outcomes and may impact HF prognosis.<sup>11,21</sup> Hospital readmissions are also known to contribute to poor prognosis.<sup>22</sup> Moreover, a lack of disease knowledge and incorrect recognition of symptoms among patients with HF can result in poor patients’ compliance as the disease progresses.<sup>23</sup> Therefore, increasing disease knowledge and self-management skills among patients with HF should improve patient outcomes.<sup>24,25</sup>

Data concerning disease education among patients with HF in Poland is scarce. To the best of our knowledge, this is the first comprehensive study revealing the level of HF knowledge and self-care behaviors among Polish patients with ADHF. The purpose of this study was to identify factors associated with HF knowledge and self-care behaviors in patients hospitalized due to ADHF in Poland and to examine the current level of HF knowledge and self-care behaviors within this cohort.

## Materials and Methods

### Design, Settings, and Participants

“The Weak Heart” was a nurse-led educational model for patients hospitalized due to ADHF. It was conducted between February 2019 and October 2019 in 14 cardiology

centers in Poland. This study was a prospective, multi-center, non-randomized, quasi-experimental program to evaluate the impact of the abovementioned model on enhancing the level of patients’ knowledge of HF and their adherence to self-care recommendations in the three-month follow-up period. Trained and certified HF nurses educated patients based on online content ([www.slabservice.pl](http://www.slabservice.pl)). The program consisted of two one-hour long educational sessions conducted at the hospital. Following patient discharge, the HF nurses performed three 30-minute monitoring telephone calls according to the established schedule (ie, at the end of the first week, the first and the third month). The knowledge and health-promoting behaviors among patients were evaluated before starting any educational activities (visit 1), immediately after completing in-hospital education (visit 2 – only HF knowledge), and three months later (visit 5 – the end of the program). A detailed description of the “The Weak Heart” program has been published elsewhere.<sup>26</sup>

Consecutive patients admitted to the cardiology centers with ADHF as the principal reason for hospitalization were screened for eligibility for the program. Patients who met the following inclusion criteria were recruited to the program: ejection fraction below 40% (EF < 40% documented by echocardiography), cognitive function enabling participation in the program (as subjectively assessed by a recruited physician) and declaration of a patient’s active involvement in the treatment following the signing of the Informed Consent Form.

### Data Collection: Sociodemographic and Clinical Questionnaires

A checklist was developed by the research team to measure the following sociodemographic and clinical variables: age, gender, education, place of residence, professional activity, marital status, comorbidities, prior HF hospitalizations, time to HF diagnosis, and prior disease education ([Supplementary material, Figure S1](#)). The initial level of HF knowledge was assessed by the HF knowledge questionnaire, which was created by the research team and based on the 2016 ESC-HF guidelines.<sup>2</sup> The survey includes 10 questions about patients’ perceptions of the disease. The questionnaire assessed knowledge of the definition and symptoms of HF, as well as recommendations related to nutrition, physical activity, pharmacotherapy, and outpatient care.

Questions to the patient were posed verbally and the HF nurse scored the patient's response on a scale of 0 to 2 based on predetermined key words (0 – incorrect response, 1 – partially correct response, 2 – correct response). The maximal score was 20 points. A higher score corresponded to better disease knowledge. Since a non-standardized test of knowledge was used, we performed reliability analysis of the test based on the calculation of Cronbach's alpha coefficients for each of the three measurements, stratified according to disease duration, number of hospitalizations, and prior education on HF. The discriminant power of each test item was analyzed using the Corrected Item-Total Correlation Coefficient. The research team decided to use self-created HF knowledge questionnaire based on the 2016 ESC-HF guidelines<sup>2</sup> because in Poland there are no validated tools for the HF knowledge assessment.

Self-care behaviors were measured using the European Heart Failure Self-care Behaviour Scale questionnaire (9-EHfScBS), which contains nine statements, and has been adapted for the Polish population.<sup>27,28</sup> Five of these statements are related to aspects of self-care, including body mass control, limitation of fluid intake, use of low-salt diet, use of medications as prescribed, and physical activity. The remaining four statements assess the level of symptom reporting (shortness of breath, excessive fatigue, lower extremity swelling, and body mass increase in one week), which are indicative of disease progression. The questionnaire also enables the assessment of the level of self-care in terms of the individual statements. The scores varied from 9 to 45, with a lower score corresponding to better self-care.<sup>27,29,30</sup>

## Ethics Approval and Funding

The study was performed in line with the ethical principles for clinical research based on the Declaration of Helsinki. The Bioethics committee at the Medical University of Warsaw approved the project (approval number: KB/3/A/2019). The study was funded by Novartis Pharma Poland.

## Statistical Analysis

All continuous variables were presented as the mean values and standard deviations (SD). For categorical variables, absolute and relative frequencies were presented. The predictive value of the analyzed variables on HF knowledge status and self-care behaviors were calculated using multivariable linear regression analysis. To analyze differences between groups for the dependent variables (ie, results in the knowledge and self-care tests), a mixed

analysis of variance (ANOVA) was performed in the 3x2x2x2 plan, including an intra-group factor of time measurement (ie, before the start of the educational program vs immediately after the educational program vs three months after the program) and three inter-group factors: number of hospitalizations (one vs more than one), duration of the disease (<1 year vs >1 year), and prior education (attendance vs no education). A value of  $P < 0.05$  was considered significant for all tests. All statistical analyses were performed using the SAS<sup>®</sup> software, version 9.4.

A sample size of 199 patients is required to achieve a statistical significance of  $P < 0.05$ . This was calculated on the assumption that a patient has a baseline score of 10 points, and their knowledge improves by 10% (1 point) after 3 months, with a standard deviation of 5 points and a statistical power of 80%. Due to the innovative nature of this study, and a lack of prior published results, this sample size calculation assumes a large diversity of results among the patients. Moreover, the loss of contact with some patients over the 3-month follow-up should be accounted for. If the loss to follow-up is estimated at 20%, the number of patients enrolled in the study should be 250.<sup>26</sup>

## Results

### Patient Characteristics

In total, 259 patients with ADHF were included in the program. In terms of their sociodemographic characteristics, 75% (193/259) were younger than 70 years old, and 76% (198/259) of participants were male. Overall, 10% (27/259) had undergone higher education, 67% (173/259) lived in cities, 23% (60/259) were professionally active, and 83% (216/259) lived with a family.

All participants had an ejection fraction below 40%. A total of 68% of patients were diagnosed with HF more than one year prior, while 14% (36/259) were first diagnosed with HF during the current hospitalization (de novo). Regarding the history of previous HF decompensations, 74% (193/259) of patients had been hospitalized at least once in the last year, and 76% had at least one comorbidity (ie, chronic obstructive pulmonary disease, diabetes, atrial fibrillation or stroke). All participants were asked about prior disease education delivered by a healthcare professional (HCP). Only 25% (65/259) had been previously educated: 20% by a cardiologist, 3% by a nurse, and 3% by a primary care physician. The characteristics of the studied sample are presented in Table 1.

**Table 1** Sociodemographic Characteristic of the Study Group

Variable [Categorical]	Features	N = 259 (%)
Age, years (%)	40–70	193 (74.5%)
	> 70	66 (25.5%)
Gender	Female	61 (23.6%)
	Male	198 (76.4%)
Education	Primary	69 (26.6%)
	Secondary or higher	190 (73.4%)
Place of residence	City	173 (66.8%)
	Rural area	86 (33.2%)
Professional activity	Working	60 (23.2%)
	Retired	199 (76.8%)
Comorbidities	None	66 (15.8%)
	One	104 (24.8%)
	> 1	89 (21.2%)
HF education by HCP	No	194 (74.9%)
	Yes	65 (25.1%)
Marital status	Single	43 (16.6%)
	Married	216 (83.4%)
Hospitalizations	None	73 (28.2%)
	Once in the last year	99 (38.2%)
	> 1 in the last year	87 (33.6%)
<b>Variable [continous]</b>		
Duration of the HF [years]	M (SD)	6.71 (8.85)
	Me	2.98
	Min-Max	0–42
	Q1; Q3	0.27; 9.86

## HF Knowledge and Self-Care Behavior Outcomes

The alpha Cronbach for the HF knowledge test was 0.859. Satisfactory reliability of the HF knowledge test was also found for all three measurements, both independently and when patients were divided into groups, in terms of (1) disease duration, (2) number of hospitalizations, and (3) prior education of patients (Table 2). The discriminant power of individual test items, as estimated by Corrected Item-Total Correlation, is in the range of 0.33–0.66 in each

of the three measurements. The value of the correlation coefficient of individual test items was not less than the minimum acceptable value 0.20. The alpha Cronbach for the 9-EHFScBS questionnaire was 0.888.

The mean (SD) score obtained from the HF knowledge questionnaire was  $8.25 \pm 4.34$  out of a possible 20 points (the higher the score, the better). Regarding self-care behaviors, the mean (SD) score of the 9-EHFScBS questionnaire was  $25.2 \pm 9.5$  out of a possible 45 points (the lower the score, the better). The baseline level of HF knowledge (assessed by the HF knowledge questionnaire) and self-care (assessed by the 9-EHFScBS questionnaire) with respect to the various factors such as age, gender, education, place of residence, professional activity, marital status, comorbidities, prior HF hospitalizations, time to HF diagnosis, and prior disease education is presented in Table 3.

The multivariable regression analysis showed that the independent factors associated with a higher level of HF knowledge were education, prior HF hospitalizations, and previous disease education.

The independent factors associated with improved self-care behaviors were age and prior disease education (Table 4).

## Level of Knowledge About HF and Self-Care Behavior in Patients Before Participating in the Program and After Completing the Program

The four-factor mixed ANOVA showed a significant main effect of the measurement time on the level of knowledge about HF ( $F [2, 450] = 195.101$ ;  $P < 0.001$ ,  $\eta^2 = 4.64$ ). The highest level of HF knowledge was obtained by respondents three months after the end of the educational program (visit 5;  $M = 17.63$ ,  $SD = 0.36$ ). This result was significantly higher than those obtained before the start of the program (visit 1;  $M = 8.05$ ,  $SD = 0.492$ ) and after finishing in-hospital education (visit 2;  $M = 15.79$ ,  $SD = 0.366$ ). Additionally, the number of previous hospitalizations had a significant effect on the level of knowledge about HF ( $F [1, 225] = 4.88$ ;  $P = 0.028$ ,  $\eta^2 = 0.021$ ). People who were hospitalized for the first time obtained lower results in the knowledge tests ( $M = 13.09$ ,  $SD = 0.37$ ) than those who were hospitalized previously ( $M = 14.57$ ,  $SD = 0.52$ ;  $P = 0.022$ ).

Measurement time also had a significant effect on the knowledge of self-care behavior ( $F [1, 226] = 12.66$ ;  $P < 0.001$ ,  $\eta^2 = 0.053$ ). More self-care behaviors were

**Table 2** Cronbach's Alpha Reliability Coefficients for the Knowledge Test in Each of the Three Measurements, Stratified According to Disease Duration, Number of Hospitalizations, and Prior Education on HF

	Measurement 1		Measurement 2		Measurement 3	
Duration of Disease	<1 Year	≥1 Year	<1 Year	≥1 Year	<1 Year	≥1 Year
	0.860	0.844	0.856	0.820	0.835	0.838
Number of hospitalizations	First	>1	First	>1	First	>1
	0.840	0.842	0.860	0.809	0.846	0.837
Prior education	Yes	No	Yes	No	Yes	No
	0.830	0.850	0.695	0.847	0.760	0.856

displayed by the respondents after the end of the educational program (visit 5;  $M = 36.20$ ,  $SD = 1.27$ ) than before the start of the program (visit 1;  $M = 29.42$ ,  $SD = 1.14$ ). The level of education on HF prior to participation in the program also had a significant effect on self-care behaviors ( $F [1, 226] = 8.04$ ;  $P = 0.005$ ,  $\eta^2 = 0.034$ ). People who took part in educational activities before participating in the program showed more self-care behaviors ( $M = 35.86$ ,  $SD = 1.35$ ) than those who had not previously participated in any training ( $M = 31.28$ ,  $SD = 1.19$ ;  $P = 0.012$ ). The duration of HF and the number of hospitalizations had no significant effect on self-care behavior (Table 5). In patients who had not been previously hospitalized, those who did not undergo education on HF before the program showed less self-care behaviors ( $M = 25.38$ ,  $SD = 1.23$ ) than those who were previously educated ( $M = 36.67$ ,  $SD = 3.10$ ;  $P < 0.001$ ). Meanwhile, in patients who were re-hospitalized, those who were educated before participating in the program did not differ in terms of self-care behavior ( $M = 31.14$ ,  $SD = 1.33$ ) from those who had not previously had any educational activities on HF ( $M = 28.96$ ,  $SD = 2.72$ ; Figure 1).

All data are available upon request.

## Discussion

"The Weak Heart" program revealed an insufficient level of disease knowledge among program participants. Similarly, the single-center survey-based registry performed by Plotka and colleagues showed that 61% of patients perceive HF as a curable disease, and although patients generally know the most alarming symptoms, most do not attribute them to HF.<sup>31</sup> Self-care in HF is fundamental but remains a challenge for multidisciplinary teams.<sup>25</sup> In our research, self-care abilities assessed by the 9-EHFSBS questionnaire were also insufficient.

Likewise, the mean score on the 9-EHFSBS scale reported by Uchmanowicz et al was  $27.65 \pm 7.13$ ,<sup>28</sup> which is in line with other studies.<sup>29,32–37</sup> Moreover, Ni et al found that the HF knowledge and self-care behaviors was also low in their survey of 113 patients visiting the HF clinic: the mean score on the HF knowledge questionnaire was  $11.6 \pm 2.4$  (with a maximum score of 17) and the mean score on the self-care scale was  $16.6 \pm 3.2$  (with a maximum score of 30).<sup>38</sup>

Although some socio-demographic and clinical characteristics have previously been described in the literature to influence the level of self-care in HF patients, the data are inconclusive.<sup>39</sup> In particular, the experience, motivation, habits, cultural beliefs and values, functional and cognitive abilities, confidence, support, and access to care among HF patients are potential barriers encountered in daily clinical practice.<sup>30</sup> Riegel et al identified seven main reasons why self-care remains a challenge.<sup>40</sup> The authors pointed out two categories: (a) behavior change factors, which address habits, lack of motivation, decision making, and the challenges of persistence; and (b) illness-related factors, such as multi-morbidity, symptoms, and stress.<sup>40</sup> The implementation of specific educational solutions can be an effective action in overcoming the above-mentioned challenges for self-care.<sup>40</sup> Multivariable regression analysis in our study showed that factors such as the level of education, previous HF hospitalizations, and disease education influence the level of disease knowledge, while age and disease education influenced compliance with self-care behaviors. These findings reflect those of Ni et al, although they found that in addition to previous HF hospitalizations and disease education, female sex had an impact on HF knowledge, and marital status (but not age) influenced self-care behaviors.<sup>38</sup> Meanwhile, others have shown that older age is associated with a lower level



**Table 3** Relationships Between Sociodemographic and Clinical Parameters and the Level of Heart Failure Knowledge and Self-Care Among Patients with Acute Decomposed Heart Failure at Baseline (ie, Before Any Educational Activities Were Performed)

Variable		Mean Level of HF Knowledge (SD) Max Score 20	P value	Mean Level of Self-Care Behaviors (SD) Max Score 45	P value
Total population		8.25±0.34		25.2±9.5	
Age, years	<70	8.38±4.42	0.40	25.9±9.9	0.08
	≥ 70	7.86±4.13		23.5±8.4	
Gender	Female	7.79±4.01	0.34	26.5±8.7	0.26
	Male	8.39±4.44		24.9±9.8	
Education	Primary	6.90±4.08	0.01	25.7±9.0	0.65
	Secondary or higher	8.74±4.34		25.1±9.8	
Place of residence	City	5.33±4.09	0.19	25.2±9.7	0.92
	Rural area	8.72±4.21		25.3±9.3	
Professional activity	Working	7.20±4.43	0.03	25.0±10.9	0.78
	Retired	8.57±4.28		25.3±9.1	
HF hospitalizations in the last year	None	6.05±3.89	<0.001	27.6±10.9	0.02
	At least one	9.11±4.21		24.3±8.8	
Comorbidities <sup>a</sup>	None	7.55±4.42	0.13	24.3±10.6	0.39
	At least one	8.49±4.30		25.6±9.2	
Prior HF education <sup>b</sup>	No	7.52±4.19	<0.001	26.3±9.6	0.003
	Yes	10.4±4.08		22.2±8.9	
HF diagnosis	Chronic HF	8.72±4.21	<0.001	24.7±9.2	0.03
	De novo HF	5.33±4.09		28.4±11.0	
Marital status	Single	7.37±4.4	0.15	23.7±9.2	0.25
	Married	8.42±4.3		25.6±9.6	

**Notes:** HF knowledge was assessed by the HF knowledge questionnaire: the higher the score, the better. Whereas for the 9-EHfScBS questionnaire: the lower the score, the better the assessed self-care. <sup>a</sup>Comorbid diseases, including: chronic obstructive pulmonary disease, diabetes, atrial fibrillation, stroke; <sup>b</sup>Health education performed by a healthcare professional, including: cardiologist, primary care physician, nurse.

**Abbreviations:** HF, heart failure; SD, standard deviation.

of disease knowledge.<sup>41</sup> Indeed, older patients may face difficulties acquiring new skills connected to self-care due to declining cognitive abilities, which leads to worse HF prognosis and increased comorbidities.<sup>42</sup> However, its impact on disease education is not clear. In the present study, age was independently associated with self-care behaviors ( $P = 0.03$ ) but not with HF knowledge ( $P = 0.051$ ). Uchmanowicz et al revealed that patients with HF might have worse self-care because of their cognitive

deficits. Age was the strongest predictor of worse MMSE scores.<sup>43</sup> Lainsack et al also stressed that adequate self-care behavior related to HF reflects the actions that a patient undertakes to maintain health and well-being.<sup>13</sup> Elderly patients are often less actively involved in their own care and treatment which may cause inadequate implementation of self-care behaviors in the period after discharge from the hospital, especially if they live alone. Therefore, education of self-care strategies involving

**Table 4** Multivariable Regression Analysis of the Influence of Various Independent Factors on the Level of Heart Failure Knowledge and the Level of Self-Care Behavior (The Baseline Scores Were Used)

Dependent Variable	R2	Independent Variable	B 95% CI	P value
Level of HF knowledge	0.26	Age ( $\geq 70$ vs $< 70$ )	-1.16 -2.33–0.002	0.051
		Gender (male vs female)	0.16 -1.01–1.32	0.79
		Education (secondary/higher vs primary)	1.77 0.68–2.86	0.002
		Place of residence (rural area vs city)	-0.63 -1.65–0.39	0.23
		Professional activity (pension/retirement vs working)	1.03 -0.25–2.30	0.11
		Prior HF hospitalizations (at least one in the previous year vs none)	1.77 0.47–3.08	0.008
		Comorbidities (at least one vs none)	0.54 -0.60–1.69	0.35
		Prior HF education (yes vs no)	1.90 0.76–3.03	0.001
		HF diagnosis (de novo vs chronic HF)	-0.78 -2.56–1.00	0.39
		Marital status (married vs single)	1.01 -0.28–2.31	0.12
Level of self-care behavior	0.09	Age ( $\geq 70$ vs $< 70$ )	-3.14 -5.93–(-0.34)	0.028
		Gender (male vs female)	-1.88 -4.69–0.94	0.19
		Education (secondary/higher vs primary)	-0.74 -3.37–1.90	0.58
		Place of residence (rural area vs city)	-0.41 -2.89–2.06	0.74
		Professional activity (pension/retirement vs working)	2.07 -1.00–5.15	0.19
		Prior HF hospitalizations (at least one in the last year vs none)	-2.55 -5.69–0.59	0.11
		Comorbidities (at least one vs none)	2.04 -0.71–4.81	0.15
		Prior HF education (yes vs no)	-3.29 -6.01–(-0.57)	0.02
		HF diagnosis (de novo vs chronic HF)	2.00 -2.31–6.30	0.36
		Marital status (married vs single)	2.51 -0.61–5.62	0.11

**Abbreviation:** HF, heart failure.

**Table 5** Summary of Scores on the Heart Failure (HF) Knowledge and Self-Care Tests

Score in the HF Knowledge Test			
Main Effects		Mean (SD)	Pairwise Comparisons
Measurement time	Before the program (visit 1)	8.053 (0.492)	(1–2) P < 0.001 (1–5) P < 0.001 (2–5) P < 0.001
	After the program (visit 2)	15.791 (0.366)	
	3 months after the program (visit 5)	17.634 (0.357)	
Prior HF education	No	13.568 (0.418)	ns.
	Yes	14.342 (0.471)	
HF duration	<1 year	13.685 (0.786)	ns.
	≥1 year	13.897 (0.275)	
Hospitalizations	First one	13.087 (0.370)	P = 0.022
	>1	14.565 (0.522)	
Score in the Self-Care Behavior Test			
Main effects		Mean (SD)	Pairwise Comparisons
Measurement time	Before the program (visit 1)	29.416 (1.141)	P < 0.001
	3 months after the program (visit 5)	36.202 (1.272)	
Prior HF education	No	31.283 (1.191)	P = 0.012
	Yes	35.861 (1.346)	
HF duration	<1 year	31.156 (2.242)	ns.
	≥1 year	33.636 (0.785)	
Hospitalizations	First one	33.485 (1.052)	ns.
	>1	32.134 (1.490)	

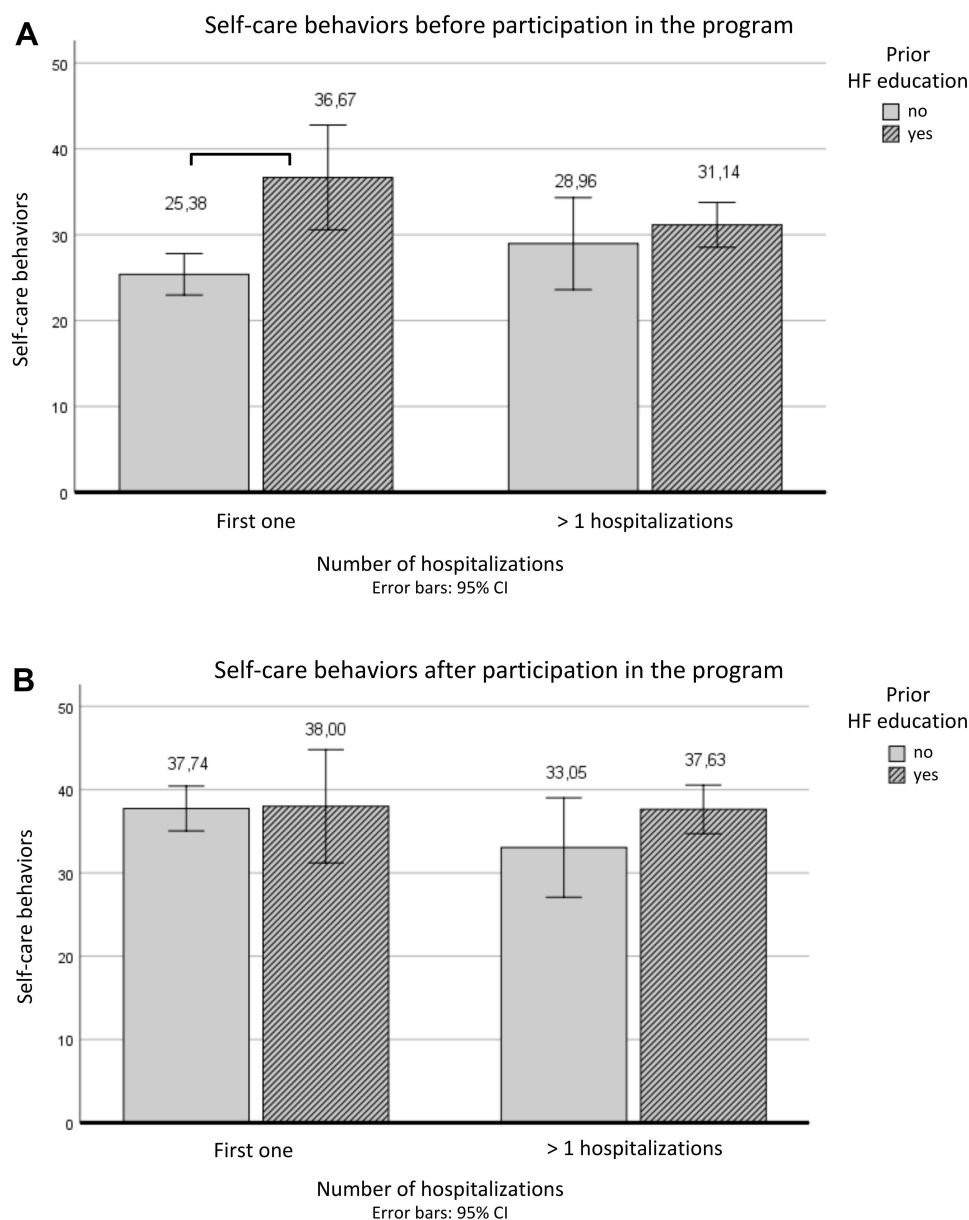
**Abbreviations:** HF, heart failure; ns, not significant; SD, standard deviation.

behaviors such as taking medication, monitoring symptoms, and recognizing exacerbation of symptoms should be individualized and adjusted to the capabilities of elderly HF patients much more than simple education which only aims to enhance HF knowledge.

Previous studies have also shown that patients with a higher education learn more and better engage in self-care.<sup>44,45</sup> Although our data confirmed that secondary or higher education had a positive influence on the level of HF knowledge, it had no impact on self-care behavior. These differences can be partially explained by the fact that only 25% of the patients who participated in our program had undergone prior education by HCPs. Indeed, these patients who were previously educated had the highest scores in both the HF knowledge and 9-EHFSBS questionnaires. Riegel et al reported that previous hospitalizations and some experience with the disease resulted in better self-care among HF patients.<sup>36</sup> These results suggest that patients learn not only through interventional activities, but also through their own experience. It should be emphasized that most patients in the three-month follow-up obtained significantly better results in the knowledge test than at the beginning of the program.<sup>36</sup> One of the factors that contributed to the improvement in knowledge about HF was the number of previous hospitalizations.<sup>36</sup> Correspondingly, we found patients with chronic HF who were diagnosed for at least one year, and those with frequent hospitalizations had higher HF knowledge than those diagnosed de novo without previous hospitalizations. However, these factors did not affect the level of self-care behaviors.

We found that previous HF education by HCPs was the only factor that positively affected both the level of HF knowledge and self-care behaviors, and the same conclusions were derived in the Ni study.<sup>38</sup> Similarly, González et al proved that the application of the one-year nursing intervention among HF patients had a positive impact on self-care behavior, irrespective of the educational level.<sup>46</sup> Chen et al also emphasizes the importance of predischARGE educational interventions, as HF patients who received a profiled educational program showed better self-care behaviors and fewer re-hospitalizations during the year.<sup>20</sup> Furthermore, our finding that health education is important for shaping behavior is aligned with other studies.<sup>47,48</sup>





**Figure 1** Self-care behaviors (A) before participation and (B) after participation in the program in patients stratified according to the number of hospitalizations and participation in any educational activities on heart failure (HF).

Therefore, patient-centered education is important for improving compliance with self-care recommendations and HF prognosis.<sup>49</sup>

Meanwhile, Agvall et al found individuals who participated in educational HF management programs in Sweden showed improvements in self-care behaviors.<sup>44</sup> Similarly, in a randomized controlled trial by Koelling et al, discharge education was found to improve HF knowledge and self-care behaviors, and have a positive impact on clinical outcomes.<sup>10</sup> Moreover, targeted multimedia educational intervention may prove to be an

effective factor in reducing unplanned readmission in people with HF.<sup>50</sup> Indeed, active education that includes self-care behavior practice is necessary to change patients' self-care abilities effectively.<sup>15,51</sup> Correspondingly, we found active disease education and close contact with a devoted HF team were important for enhancing self-care behaviors among patients with ADHF.

Therefore, although disease education alone can influence self-care behaviors, other factors should be considered when planning interventions for developing self-care abilities in patients with HF.<sup>39</sup> The present study provided

insight into the importance of education of HF patients, taking into account clinical outcomes and benefits.

Multidisciplinary team-based interventions significantly improve HF knowledge and self-care as found in a recent systematic review of randomized controlled trials RCTs. The findings of this study indicated that pharmacist-involved multidisciplinary HF management resulted in a significant improvement in HF knowledge, but not in self-care.<sup>52</sup> “The Weak Heart” program included only nurse-led educational interventions, because multidisciplinary care for patients with HF is currently not a standard approach in Poland. Currently, qualified nurses are frequently responsible for educational activities, but other multidisciplinary team members could also be involved after obtaining adequate training.

## Limitations

Some important limitations of the analysis must be acknowledged. “The Weak Heart” was a quasi-experimental educational program. We only enrolled patients hospitalized due to ADHF who may have a higher level of HF knowledge and motivation to improve self-care behavior. Moreover, we have decided to include only patients with reduced ejection fraction to get a more uniform population, meaning the results cannot be generalized to the whole HF population. We also used an unstandardized HF knowledge questionnaire to assess patients’ knowledge, which makes it difficult to compare the results to those presented in other studies. Additionally, our study lacked a control group. On the other hand, the lack of a multidisciplinary intervention in the “The Weak Heart” program can also be considered a limitation, but this was omitted due to practical reasons since multidisciplinary care for patients with HF is not standard in Poland. Finally, we utilized inclusion criteria that eliminated patients with cognitive impairments and non-compliant behaviors.

## Conclusion

Our research revealed that the level of both disease knowledge and self-care abilities among patients with ADHF in Poland is currently insufficient. The multivariable regression analysis showed that secondary and higher education as well as the number of prior HF hospitalizations served as independent factors associated with a higher level of HF knowledge but not with self-care behaviors, while patients’ age below 70 was associated with improved self-care behaviors but not with HF knowledge. Disease education was the only

independent factor that positively influenced both HF knowledge and self-care behaviors. Factors such as gender, place of residence, professional activity, marital status, comorbidities and the time to HF diagnosis showed no significant correlation either with the level of HF knowledge or self-care behaviors. Therefore, to improve patients’ adherence to HF recommendations, standardized models of education based on HF management guidelines should be implemented.

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