A quasi-experimental study examining a nurse-led educational program to improve disease knowledge and self-care for patients with acute decompensated heart failure with reduced ejection fraction

Jolanta Kolasa1,2,A–F, Magdalena Frączek-Jucha3,4,B,D–F, Marcin Grabowski4,B–F, Ewa A. Jankowska5,6,A,E,F, Małgorzata Lelonek7,A,E,F, Agnieszka Pawłak2,8,A,B,E,F, Izabella Uchmanowicz9,A,B,D–F, Jadwiga Nessler10,A,B,E,F

1 Medical Unit Cardiology, Novartis Poland Ltd., Warszawa, Poland
2 Mossakowski Medical Research Centre, Polish Academy of Sciences, Department of Applied Physiology, Warszawa, Poland
3 Department of Emergency Medical Care, Jagiellonian University Medical College, John Paul II Hospital, Kraków, Poland
4 1st Department of Cardiology, Medical University of Warsaw, Poland
5 Institute of Heart Diseases, Wroclaw Medical University, Poland
6 Institute of Heart Diseases, University Hospital in Wroclaw, Poland
7 Department of Noninvasive Cardiology, Medical University of Lodz, Poland
8 Department of Invasive Cardiology, Central Clinical Hospital of the Ministry of Interior and Administration, Warszawa, Poland
9 Department of Clinical Nursing, Faculty of Health Sciences, Wroclaw Medical University, Poland
10 Department of Coronary Disease and Heart Failure, Jagiellonian University Medical College, John Paul II Hospital, Kraków, Poland

A – research concept and design; B – collection and/or assembly of data; C – data analysis and interpretation; D – writing the article; E – critical revision of the article; F – final approval of the article

Abstract

Background. Nurse-led education can improve heart failure (HF) knowledge and self-care behaviors, and consequently lead to better patient outcomes.

Objectives. To assess the effectiveness of “The Weak Heart” educational model in enhancing the level of disease knowledge and self-care behaviors among patients hospitalized with acute decompensated heart failure with reduced ejection fraction (HFrEF).

Materials and methods. An evidence-based, standardized educational program was implemented for HF patients in Poland. We compared the initial level of HF knowledge – as rated using a self-developed questionnaire and self-care behaviors, evaluated according to the 9-item European Heart Failure Self-care Behavior Scale (9-EHFScBS) – to the results obtained at the 3-month follow-up period with a sample of patients (n = 231) hospitalized with acute decompensated HF (ADHF).

Results. The results showed a significant increase in total score of HF knowledge test depending on the time of measurement ($\chi^2 = 356.526, p < 0.001$) and in all individual questions on HF. The significant change of the 9-EHFScBS self-care questionnaire was also found in total score (Z = −7.317, p < 0.001), in all domains: autonomous-based adherence (Z = −5.870, p < 0.001); consulting behavior (Z = −7.238, p < 0.001); provider-based adherence (Z = −4.162; p < 0.001) and in relation to all individual statements except statement 7 (“I eat a low salt diet”) and statement 9 (“I exercise regularly”). Within 3 months of hospital discharge, 84% (193 out of 231) of participants visited their primary care physician and 79% (183 out of 231) visited a cardiologist in accordance with their individual treatment plan.

Conclusions. “The Weak Heart” educational model is effective in enhancing the level of HF knowledge and self-care behaviors among patients with decompensation of HFrEF.

Key words: heart failure, cardiology, disease management, adherence, disease education
Background

Heart failure (HF) is an important public health problem, with an estimated prevalence of 1–2% among adults and >10% among people aged >70 years in developing countries. In Poland, over 700,000 patients suffer from HF, which can lead to premature death. Heart failure requires multidisciplinary management programs, including self-care education. Indeed, self-management interventions often led by nurses are effective at improving knowledge, self-care behaviors, quality of life, and reducing the number of hospitalizations and mortality among patients with HF. Furthermore, the active post-discharge monitoring of patients with HF (e.g. via post-discharge phone calls) should translate into better adherence, a reduction in the number of decompensated HF cases and slower disease progression.

The European Society of Cardiology (ESC), American College of Cardiology Foundation (ACCF) and American Heart Association (AHA) practice guidelines recommend a nurse-led HF education in HF patients. The correlations between patients’ knowledge of HF and self-care skills were found in studies conducted in the USA.

To meet this need, multidisciplinary HF programs, including various types of nurse-led interventions, should be implemented. Similarly, a disease management system for patients with HF named “KONS” (Comprehensive Care for Patients with Heart Failure) was proposed in Poland.

Objectives

The purpose of this study was to implement a standardized nurse-led HF education program focused on improving disease knowledge and self-care behaviors in patients hospitalized with acute decompensated heart failure with reduced ejection fraction (HFrEF) and evaluate its effectiveness.

Materials and methods

Study population and design

“The Weak Heart” program was a nurse-led HF educational program conducted in 2019 in 14 cardiology centers in Poland and consisted of 2 hospital educational visits and 3 post-discharge phone calls. Prior to initiating patient education, nurse educators completed HF training and certification in accordance with the HF nurse curriculum developed by experts of Nurses and Medical Technicians and the Heart Failure Section of the Polish Cardiac Society. Total number of 259 patients hospitalized due to acute decompensated heart failure (ADHF) were consecutively recruited based on the following inclusion criteria: diagnosed HF with reduced ejection fraction (ejection fraction (EF) < 40% as evaluated using echocardiography), cognitive function enabling the participation in the program and a declaration of the patient’s involvement in the treatment; there were no exclusion criteria to enter the program. To assess the effectiveness of the program in a clinical setting, a prospective, quasi-experimental, pre-test and post-test method was applied.

The Weak Heart” program was based on HF guidelines of European Society of Cardiology and tailored to the needs of patients with HFrEF. The scope of education included the following topics: basic information about HF, etiology, symptoms, principles of self-care, basics of treatment, and the importance of lifestyle, diet and exercise, based on the content from patient portal (www.slabyserce.pl) displayed on tablet. After completing educational sessions, participants received a heart failure passport with an individual treatment plan, a cover letter to primary care physician and a drug dispenser. A detailed description of “The Weak Heart” educational program has already been published.

Ethical aspects and recommendations

The Bioethical Commission at the University of Warsaw has approved the project (approval No. KB/3/A/2019). The study was performed in accordance with the ethical principles for clinical research based on the Declaration of Helsinki.

Data collection

Trained HF nurses interviewed participants using the questionnaires to assess the level of HF knowledge and self-care behaviors. Measurements were conducted before the implementation of any educational activities (visit 1), before discharge but after finishing all educational activities (visit 2 – only for the assessment of HF knowledge) and at the end of the 3-month follow-up period (visit 5).

Instruments

The research team has developed a 10-item HF knowledge questionnaire to assess the level of disease knowledge. Patient’s responses were scored on a scale from 0 to 2 (0 – incorrect response, 1 – partially correct, 2 – correct), based on key words. The maximal score was 20 points – the higher the score, the better the level of HF knowledge. The calculated Cronbach’s alpha for the knowledge test was 0.86. The value of the correlation coefficient of individual test items was not less than the minimum acceptable value of 0.20.

The 9-item European Heart Failure Self-care Behavior Scale (9-EHFScBS) contains 9 statements concerning self-care behaviors among HF patients. The answers to the statements were given on the 5-point Likert scale,
with the result being the aggregation of the points from all statements included in the 9-EHFScBS. The scores vary from 9 to 45 – the higher the score, the lower the self-care capability. The questionnaire also enables the assessment of the level of self-care in terms of individual statements. Additionally, a patient’s self-care can also be measured by computing the scores for each subdimension of self-care: consulting behavior, autonomy-based adherence and provider-based adherence. The calculated Cronbach’s alpha for the behavior test was 0.89.

Statistical analysis

Statistical analysis was performed using SAS® software v. 9.4 (SAS Institute, Cary, USA). The Friedman’s test was applied to verify the hypotheses of influence of the intervention program on scores of the knowledge test. Time of measurement was considered the within-group factor: before the commencement of the program (visit 1) compared to directly after finishing all educational activities (visit 2) compared to 3 months after its end (visit 5). The Bonferroni correction was used to adjust the significance value for multiple tests. The adjusted significance level was 0.017.

The Spearman’s rank correlation coefficient was used to verify the correlation between scores on the 1st knowledge test and duration of the disease. The Mann–Whitney U test was conducted to compare the scores of patients participating in any educational activities on HF with those who did not, as well as patients who required several hospitalizations and those hospitalized for the first time.

Results

The final analysis consists of 231 patients who signed written consent and fulfilled all educational visits, while a sample size of 199 patients was required to achieve a statistical significance of p < 0.05. Out of 259 patients included in the program, all visits were finished regarding 89% of patients (Fig. 1). The baseline characteristics of patients included in the study are presented in Table 1.

The results showed a significant difference in performance in the level-of-knowledge test depending on the time of measurement ($\chi^2 = 356.526, p < 0.001$). The scores from the 1st measurement were significantly lower than those from the 2nd ($Z = -1.227, p$-value adjusted with Bonferroni correction ($p_{adj} < 0.001$) and 3rd measurement ($Z = -1.649, p_{adj} < 0.001$). The scores from the 2nd measurement were significantly lower than those from the 3rd measurement ($Z = -0.422, p_{adj} < 0.001$). The results are presented in Table 2. A significant improvement in HF knowledge has been observed for all individual questions (Fig. 2).

The results demonstrated that patients educated on HF prior to the program, patients who underwent several

---

**Table 1. Baseline characteristics of patients included in the study**

| Visit 1 (in hospital – baseline) | 259 (100%) patients finished visit 1 |
| Visit 2 (in hospital) | 257 (99%) patients finished visit 2, 2 (0.8%) patients refused to continue |
| Visit 3 (1st phone call) | 244 (94%) patients finished visit 3, 6 (2.3%) died, 2 (0.8%) refused to continue, 5 (1.5%) did not pick up the phone |
| Visit 4 (2nd phone call) | 238 (92%) patients finished visit 4, 1 (0.4%) died, 1 (0.4%) refused to continue, 4 (1.5%) did not pick up the phone |
| Visit 5 (3rd phone call - final) | 231 (89%) patients finished visit 5, 3 (1.2%) died, 2 (0.8%) refused to continue, 2 (0.8%) did not pick up the phone |

---

**Fig. 1. Patient flowchart**
hospitalizations and with long-lasting HF scored better on the knowledge test compared to patients not educated previously, hospitalized for the first time and with HF de novo (Table 3).

The results indicate that self-care behaviors improved after the intervention ($Z = -5.870, p < 0.001$) was demonstrated. The level of consulting behavior also significantly increased after 3 months following the intervention ($Z = -7.238, p < 0.001$). Likewise, the level of provider-based adherence behaviors was more frequent after 3 months of follow-up than prior to the intervention ($Z = -4.162; p < 0.001$). The significant improvement in self-care was seen in all individual questions except statements 7 (“I eat a low salt..."
Adv Clin Exp Med. 2021

5

diet”) and 9 (“I exercise regularly”) of the 9-EHFScBS questionnaire (Fig. 2).

All patients were educated about the importance of post-hospital ambulatory visits and treatment optimization. Most patients fulfilled their individualized post-discharge treatment plan (Fig. 3).

### Discussion

Like previous studies, we found disease awareness and self-management skills initially poor among Polish patients with HF. However, “The Weak Heart” model, prepared based on HF guidelines and practical recommendations, was effective in enhancing HF patients’ knowledge and developing self-management behaviors. In the study, the education program was delivered by a certified nurse educator working in a given cardiology ward. From a practical perspective, it is worth mentioning that 3.5 h in total were allocated to an individual patient’s education. Based on nurses’ feedback, in most cases, the time devoted to education was sufficient from the patient’s point of view, but it caused a considerable burden on staff. Therefore, there is a need to introduce a qualified HF educator working in the cardiology wards responsible for patients’ education, or to consider group education instead – to reduce the staff burden.

This observation is of significance since previous meta-analysis showed that self-management interventions in patients with HF improve the outcomes. Therefore, evidence-based educational programs should be considered when designing multidisciplinary programs of coordinated care. Unfortunately, any direct comparison of the effectiveness of our program with other educational interventions of this kind is difficult due to the heterogeneity of the design and methodology used in the research (Table 4).

Telephone support may reduce mortality and hospitalizations and improve quality of life among patients with HF. Currently, it is the most commonly used monitoring strategy. We found post-discharge phone calls performed by nurses had an additional, positive effect on patients’ HF knowledge and self-care behaviors. Yet another important strategy is to deliver educational programs during hospitalization, as patients after an acute episode are at a higher risk of recurrent hospitalizations. Moreover, it helps in building a trusting relationship with patients and caregivers. The time of hospitalization can also be used successfully to teach patients perform regular pulse, blood pressure and weight measurements, which was well received by participants of our program.

Early ambulatory visits within 7 days of discharge may lower the risk of hospital readmissions for patients with HF. According to the study by Chuda et al., over 90% of cardiac ward patients were referred to cardiac visits treatment modification scheduled visits treatment modification

| Measurement | Mean rank | Me | Z-value | Mann–Whitney U test | p-value |
|-------------|-----------|----|---------|---------------------|---------|
| 1           | 1.04      | 8  |         |                     |         |
| 2           | 2.27      | 16 |         |                     |         |
| 3           | 2.69      | 18 |         |                     |         |

\[ \chi^2 = 356.526, \ p < 0.001 \]

### Table 2. Comparisons of the scores on heart failure (HF) knowledge test prior to, directly after and 3 months after participation in the program, based on the results of the Friedman’s test

| Patients                      | Mean rank | Z-value | Mann–Whitney U test | p-value |
|-------------------------------|-----------|---------|---------------------|---------|
| Previously educated on HF     | 165.71    | −4.451  | 3984.00             | <0.001  |
| Without prior education on HF | 118.04    | −5.137  | 4009.50             | <0.001  |
| > 1 hospitalization           | 144.94    | −       |                     |         |
| First hospitalization         | 91.92     | −       |                     |         |

HF – heart failure.

### Table 3. Summary of differences in the knowledge test scores based on the results of the Mann–Whitney U-test

### Fig. 3. Fulfillment of ambulatory visits to primary care physicians and cardiologists within the follow-up period in accordance with the individual treatment plan

**Table 3.** Comparisons of the scores on heart failure (HF) knowledge test prior to, directly after and 3 months after participation in the program, based on the results of the Friedman’s test

**Table 2.** Comparisons of the scores on heart failure (HF) knowledge test prior to, directly after and 3 months after participation in the program, based on the results of the Friedman’s test

**Table 3.** Summary of differences in the knowledge test scores based on the results of the Mann–Whitney U-test
| Study (author/year/ref) | Study design | Sample size (location) | Population | Key components of intervention/control | Follow-up period | Outcome variables | Main findings |
|-------------------------|-------------|------------------------|------------|---------------------------------------|-----------------|------------------|---------------|
| Kolasa et al., 2021     | Multicenter, non-randomized, quasi-experimental study; pre-test and post-test methodology (14 centers) | n = 259 (Poland) | HF-HF patients hospitalized with decompensated HF | Intervention: standardized educational program based on the ESC guidelines, multimedia education with the content of www.slabezgerce.pl website displayed on tablet, individual treatment plan, HF passport, cover letter to primary care physician. Two individual teaching sessions (60 min) and 3 telephone calls 7, 30 and 90 days post-discharge delivered by a nurse. Control: N/A | 3 months | Change in HF knowledge (self-developed questionnaire) and self-care (9-EHFScBS). The percentage of ambulatory visits realized in accordance with the treatment plan. | A significant change in HF knowledge test ($\chi^2 = 356.526, p < 0.001$) and in all individual questions. A significant change in self-care in total score ($Z = -7.317, p < 0.001$) in all domains: autonomous-based adherence ($Z = -5.870, p < 0.001$); consulting behavior ($Z = -7.238, p < 0.001$); provider-based adherence ($Z = -4.162; p < 0.001$) and in relation to all individual statements except statement 7 (“I eat a low salt diet”) and statement 9 (“I exercise regularly”). Within 3 months of hospital discharge, 84% (193 out of 231) of participants visited their primary care physician and 79% (183 out of 231) visited a cardiologist in accordance with their individual treatment plan. |
| Sahlin et al., 2021     | Multicenter, randomized trial (7 centers) | n = 118 (Sweden) | Ambulatory HF patients | Intervention: home-based mobile device in a form of tablet wirelessly connected to a weight scale and incorporated symptom monitoring, interactive education, adjustment of loop diuretics and alerts of HF deterioration. Control: N/A | 8 months | Change in self-care behavior (9-EHFScB). The number of in-hospital days due to HF. Event-free survival, defined as the composite endpoint of time to the 1st occurrence of HF-related emergency room (ER) visit, HF admission, or death and unplanned hospital visits due to HF after 240 days of intervention. | A significant change in self-care (21.5 (13.25; 28) compared to 26 (18; 29.75), $p = 0.014$). Significantly shorter time in the hospital when admitted for HF (2.2 days less, RR 0.48; 95% CI: [0.32; 0.74]; $p = 0.001$). A significant difference in HF-related event-free survival (HR = 0.50, 95% CI: [0.24; 0.98], $p = 0.046$). Non-significant difference in all-cause hospital admission or death (HR = 0.77, 95% CI: [0.46; 1.28], $p = 0.32$). |
| Huynh et al., 2019      | Multicenter, randomized trial (2 centers) | n = 412 (Tasmania) | Patients hospitalized with HF | Intervention: standard care plus leaflet and video instruction, “transition coach” to provide telephone support, home visits of a cardiac nurse during the 1st and 2nd week of discharge, additional telephone calls if needed. Control: standard care including guideline-based care, self-care education during the hospital stays, a standard discharge plan with a formal discharge summary and advice sent to primary care physicians, treatment plan for comorbidity, and routine preventive care from treating physicians. A follow-up telephone call was conducted within a month after discharge. | 3 months | All-cause readmission (defined as at least 24 h unplanned stay in hospital) or death within 30 and 90 days of discharge. | Readmission or death occurred in 74/197 (37%) of usual care patients and 30/215 (23%) of DMP patients, within 30 days (RR: 0.62, 95% CI: [0.46; 0.84]), and 113/197 (57%) of usual care patients and 78/215 (36%) of DMP patients within 90 days (RR: 0.63, 95% CI: [0.51; 0.78]). |
| Study (author/year/ref) | Study design | Sample size (location) | Population | Key components of intervention/control | Follow-up period | Outcome variables | Main findings |
|-------------------------|--------------|------------------------|------------|----------------------------------------|-----------------|------------------|---------------|
| Awoke et al., 2019<sup>16</sup> | Multicenter non-randomized quasi-experimental study, pre-test and post-test methodology (2 centers) | n = 29 (USA) | Patients hospitalized with HF | Intervention: standardized educational program based on AHA guidelines, standard education based on printed material in a form of visual color-coded guide to monitor symptoms. One teaching session delivered by a nurse reinforced with daily follow-up education sessions and telephone follow-up 7, 30 and 90 days post-discharge. Control: N/A | 3 months | All-cause unplanned hospital readmissions 30 days after hospital discharge. Change in HF knowledge (DHFKS) and self-care (SCHFI). | A significant difference in HF knowledge test at day 7 (p ≤ 0.001) and day 90 (p ≤ 0.032). A significant difference in self-care maintenance at day 7 (p ≤ 0.000), self-care management at day 7 (p ≤ 0.000), self-care confidence at day 7 (p ≤ 0.017), but not at day 7 follow-up call. No significant change in 30-day readmissions (p ≥ 0.03). |
| Boyde et al., 2018<sup>19</sup> | Single center, randomized trial | n = 200 (Australia) | Patients diagnosed with HF referred to the hospital | Intervention: multimedia education based on an individual patient’s needs (verbal discussions with a HF nurse, written manuals and a DVD to use at home). One teaching session (60–90 min) delivered by a nurse. Control: standard care | 12 months | All-cause unplanned hospital readmissions. Change in HF knowledge (DHFKS) and self-care (SCHFI). | No significant change in HF knowledge test at 3 months (p = 0.132) and 12 months post-recruitment (p = 0.612) between groups. No significant differences in self-care maintenance (p = 0.241), management (p = 0.232) or confidence (p = 0.194) between the intervention and control groups at 3 months and at 12 months, for maintenance (p = 0.604), management (p = 0.903) or self-confidence (p = 0.132). Reduced risk of readmission at 12 months by 30% (RR: 0.703; 95% CI: [0.548; 0.903]). |
| Moon et al., 2018<sup>20</sup> | Single-center, quasi-experiment study | n = 38 (South Korea) | Ambulatory patients with HF (EF < 50%) | Intervention: the telephone-based self-management support program. One 30-minute face-to-face education session and 4 telephone follow-up consultations. Control: not described | 5 weeks | Change in the self-care behavior (9-EHFSbBS), NT-proBNP, LVEF, LVEDP and depression score. | A significant change in self-care behavior (t = 6.65, p < 0.001), decreased N-terminal pro-brain natriuretic peptide level (U = −2.28, p < 0.022), improved LVEF values (t = 2.24, p < 0.032), and decreased depression scores (t = 3.49, p < 0.001). |

9-EHFSbBS – European Heart Failure Self-care Behavior Scale; DHFKS – Dutch Heart Failure Knowledge Scale; SCHFI – Self-Care of Heart Failure Index; ESC – European Society of Cardiology; N/A – not applicable; 95% CI – 95% confidence interval; AHA – American Heart Association; EF – ejection fraction; NT-proBNP – N-terminal pro B-type natriuretic peptide; LVEF – left ventricular ejection fraction; LVEDP – left ventricular end-diastolic pressure; RR – relative risk; HR – hazard ratio; DMP – Disease Management Program; HFREF – heart failure with reduced ejection fraction.
ambulatory care after hospital discharge, compared to only 60% among those discharged from the internal medicine ward. In our program, all patients were educated about the importance of post-discharge ambulatory visits and were given individual treatment plans. This strategy proved to be effective, with 72% of patients fulfilling visits in primary care and 30% visiting a cardiologist within 7 days of discharge.

The results of our study showed that patients undergoing any kind of education before participating in the program and patients hospitalized due to HF many times have higher initial knowledge of HF and obtained higher tests scores than the patients who had not been previously educated or hospitalized due to HF. It suggests that patients build their disease awareness from multiple educational sources and learn through their own experience during hospitalizations.46 Although 68% of patients recruited to the study had history of HFrEF for more than 1 year and 72% had been hospitalized for HF decompensation at least once in the previous year, only 25% of participants declared being educated by a healthcare provider prior to the program. According to the participants, the cardiologist (78%), nurses (11%) and primary care physicians (11%) were the healthcare professionals who most frequently delivered disease education. This indicates that currently in Poland, there is no structured approach to health education for HF patients.

Limitations

Some important limitations of the “The Weak Heart” program have to be acknowledged. Firstly, this program had quasi-experimental, non-randomized design, without an appropriate control group, with short observation period and relatively small sample of patients. Secondly, the cohort recruited was relatively young, had a higher education level, lived with family, and the majority lived in the city. However, these factors had a limited impact on the effectiveness of the proposed program. The multivariable analysis, the results of which were presented elsewhere,46 has shown that only age may affect self-care behaviors, but not the level of HF knowledge. Lastly, only patients with HFrEF hospitalized with ADHF were included in the study. All these factors suggest that those patients may present a higher level of health literacy and initial disease knowledge and may be significantly different from “an average patient” in routine practice. The other important limitations are the utilization of unstandardized HF knowledge questionnaire and short follow-up period. Finally, limitations resulting from the design of the project including small group size and the lack of longer-term, longitudinal data precludes a comment regarding the impact of investigated intervention on clinical outcomes, only allowing to draw general conclusions about the short-term effect of the tested model on the level of HF knowledge and self-care behaviors in the studied population of HFrEF patients hospitalized due to decompensation.

Conclusions

The HF knowledge and self-care behaviors among patients with HFrEF can be improved by introducing a structured, nurse-led educational programs to clinical practice. “The Weak Heart” educational model created based on HF guidelines recommendations proved to be effective in enhancing the level of HF knowledge and self-care behaviors among patients with HFrEF hospitalized with ADHF. The time spent in hospital should be used to prepare patients for challenges of post-discharge “vulnerable phase” by providing a proper training on self-care skills delivered by certified nurses.

ORCID iDs

Jolanta Kolasa https://orcid.org/0000-0003-4160-7821
Magdalena Frączek-Jucha https://orcid.org/0000-0003-3935-6250
Marcin Grabowski https://orcid.org/0000-0003-3306-0301
Ewa A. Jankowska https://orcid.org/0000-0002-9202-432X
Malgorzata Lelonek https://orcid.org/0000-0003-0756-5541
Agnieszka Pawlak https://orcid.org/0000-0001-9032-9130
Izabella Uchmanowicz https://orcid.org/0000-0001-5452-0210
Jadwiga Nessler https://orcid.org/0000-0002-5076-5816

References

1. Ponikowski P, Voors A, Anker S, et al. 2016 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure. Eur Heart J. 2016;37(27):2129–2200. doi:10.1093/eurheartj/ehw128
2. Rywik TM, Zielinski T, Potradowski W, Leszek P, Wilkins A, Korewicki J. Heart failure patients from hospital settings in Poland: Population characteristics and treatment patterns. A multicenter retrospective study. Cardiol J. 2008;15(2):169–180. PMID:18651402.
3. Maniecka-Bryla I, Bryla M, Bryla P, Pikala M. The burden of premature mortality in Poland analysed with the use of standard expected years of life lost. BMC Public Health. 2015;15:101. doi:10.1186/s12889-015-1487-x
4. Lainscak M, Blue L, Clark AL, et al. Self-care management of heart failure: Practical recommendations from the Patient Care Committee of the Heart Failure Association of the European Society of Cardiology. Eur Heart J. 2011;32(2):115–126. doi:10.1093/eurheartj/hfq219
5. Stromberg A. The crucial role of patient education in heart failure. Eur J Heart Fail. 2005;7(3):363–369. doi:10.1016/j.ejheart.2005.01.002
6. Riegel B, Dickson VV, Faulkner KM. The situation-specific theory of heart failure self-care: Revised and updated. J Cardiovasc Nurs. 2016;31(3):226–235. doi:10.1097/JCN.0000000000000244
7. McDonagh TA, Blue L, Clark AL, et al. European Society of Cardiology Heart Failure Association Standards for delivering heart failure care. Eur J Heart Fail. 2011;13(3):235–241. doi:10.1093/eurjhf/hfq221
8. Ditewig JB, Blok H, Havers J, van Veenendaal H. Effectiveness of self-management interventions on mortality, hospital readmissions, chronic heart failure hospitalization rate and quality of life in patients with chronic heart failure: A systematic review. Patient Educ Couns. 2010;78(3):297–315. doi:10.1016/j.ped.2010.01.016
9. Jovovic A, Holroyd-Leduc JM, Strauss SE. Effects of self-management intervention on health outcomes of patients with heart failure: A systematic review of randomized controlled trials. BMC Cardiovasc Disord. 2006;6:43. doi:10.1186/1471-2261-6-43
10. Barnason S, Zimmerman L, Young L. An integrative review of interventions promoting self-care of patients with heart failure. J Clin Nurs. 2012;21(3–4):448–475. doi:10.1111/j.1365-2702.2011.09390.x
11. McAlister FA, Stewart S, Ferrua S, McMurray JJ. Multidisciplinary strategies for the management of heart failure patients at high risk for admission: A systematic review of randomized trials. J Am Coll Cardiol. 2004;44(4):810–819. doi:10.1016/j.jacc.2004.05.055
12. Kommuri NV, Johnson ML, Koelling TM. Relationship between improvements in heart failure patient disease specific knowledge and clinical events as part of a randomized controlled trial. Patient Educ Couns. 2012;86(2):233–238. doi:10.1016/j.pec.2011.05.019
13. Albert NW. Fluid management strategies in heart failure. *Crit Care Nurse*. 2012;32(2):20–33. doi:10.4037/ccn2012277

14. Dominguez FB, Glausell N, Aliti GB, Dominguez DR, Rabelo ER. Education and telephone monitoring by nurses of patients with heart failure: Randomized clinical trial. *Arq Bras Cardiol*. 2011;96(3):233–239. doi:10.1590/S0004-782X2010000500014

15. Paul S, Hice A. Role of the acute care nurse in managing patients with heart failure using evidence-based care. *Crit Care Nurs Q*. 2014;37(4):357–376. doi:10.1097/CNQ.0000000000000366

16. Awoke MS, Baptiste DL, Davidson P, Roberts A, Dennison-Himmelfarb C. A quasi-experimental study examining a nurse-led education program to improve knowledge, self-care, and reduce readmission for individuals with heart failure. *Contemp Nurse*. 2019;55(1):15–26. doi:10.1080/14490758.2019.1568198

17. Feltner C, Jones CD, Cene CW, et al. Transitional care interventions to prevent readmissions for persons with heart failure: A systematic review and meta-analysis. *Ann Intern Med*. 2014;160(11):774–784. doi:10.7326/M14-0083

18. Yancy CW, Jessup M, Bozkurt B, et al. 2013 ACC/AHA/ESC focused update of the 2012 ACCF/AHA guideline for the management of heart failure: A report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines and the American College of Cardiology Foundation. *Circulation*. 2013;128(12):e238–e337. doi:10.1161/CIRCULATIONAHA.113.004718

19. Kolasa J, Uchmanowicz I, Wleklik M, et al. Polish adaptation and reliability test of a nine-item scale (EHFScB-9): A reliable and valid international instrument. *Adv Clin Exp Med*. 2019;28(4):251–257. doi:10.5603/ACM.2019.0058

20. Raines E, Dickey SL. An exploration of learning needs: Identifying knowledge deficits among hospitalized adults with heart failure. *Aims Public Health*. 2019;6(3):248–267. doi:10.3934/publichealth.2019.3.248

21. Nowak K, Stepień K, Kurczyńska P, et al. The awareness and knowledge about heart failure in Poland: Lessons from the Heart Failure Awareness Day and internet surveys. *Folia Med Cracov*. 2019;59(2):93–109. PMID:31693533.

22. Piotka A, Prokop E, Migaj J, Straburszczyńska-Migaj E, Grajek S. Patients’ knowledge of heart failure and their perception of the disease. *Patient Prefer Adherence*. 2017;11:1459–1467. doi:10.2147/PPA.S126133

23. Lambriñou E, Protopapas A, Kalogirou F. Educational challenges to the health care professional in heart failure care. *Curr Heart Fail Rep*. 2014;11(3):299–306. doi:10.1007/s11897-014-0203-y

24. Sahind D, Rezanazad B, Edvinsson ML, Bachus E, Melander O, Gerward S. Self-Care Management Intervention in Heart Failure (SMART-HF): A multicenter randomized controlled trial. *J Card Fail*. 2021;27(1):20–27. doi:10.1016/j.cardfail.2021.06.009

25. Huynh QL, Whitmore K, Negishi K, Marwick TH; ETHELRED Investigators. Influence of risk on reduction of readmission and death by disease management programs in heart failure. *J Card Fail*. 2019;25(5):330–339. doi:10.1016/j.cardfail.2019.01.015

26. Boyde M, Peters R, New N, Hwang R, Ha T, Korczyk D. Self-care educational intervention to reduce hospitalizations in heart failure: A randomised controlled trial. *Eur J Cardiovasc Nurs*. 2018;17(2):178–185. doi:10.1177/14745151177727740

27. Moon MK, Yim JE, Jeon MY. Effect of a telephone-based Self-Management Program led by nurses on self-care behavior, biological index for cardiac function and depression in ambulatory heart failure patients. *Asian Nurs Res (Korean Soc Nurs Sci)*. 2018;12(4):251–257. doi:10.5603/ANR.2018.10.001

28. Rice H, Say R, Bethavas V. The effect of nurse-led education on hospitalisation, readmission, quality of life and cost in adults with heart failure: A systematic review. *Patient Educ Couns*. 2018;101(3):363–374. doi:10.1016/j.pec.2017.10.002

29. Breathett K, Maffett S, Foraker RE, et al. Pilot randomized controlled trial to reduce readmission for heart failure using novel tablet and nurse practitioner education. *Am J Med*. 2018;131(8):974–978. doi:10.1016/j.amjmed.2018.02.017

30. Son YJ, Choi J, Lee HJ. Effectiveness of nurse-led heart failure self-care education on health outcomes of heart failure patients: A systematic review and meta-analysis. *Int J Environ Res Public Health*. 2020;17(18):6559. doi:10.3390/ijerph17186559

31. Hernandez AF, Greiner MA, Fonarow GC, et al. Relationship between early physician follow-up and 30-day readmission among Medicare beneficiaries hospitalized for heart failure. *JAMA*. 2010;303(17):1762–1772. doi:10.1001/jama.2010.333

32. Chuda A, Berner J, Lelonek M. The journey of the heart failure patient based on data from a single center. *Crit Care Nurse*. 2019;39(4):489–498. doi:10.4179/ccrn.jcn170799

33. Kolasa J, Uchmanowicz I, Grabowski M, et al. 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. *Patient Prefer Adherence*. 2021;15:1289–1300. doi:10.2147/PPA.S297665