

# Effect of Web-Based Education on Self-efficacy and Self-care Ability in Heart Failure Patients

## Abstract

**Background:** Self-care prevents rehospitalization and reduces mortality from heart failure. The self-care of heart failure patients is influenced by their sense of self-efficacy. Traditional educational methods are time-consuming, require patients to meet with health experts, and frequently cannot be accessed remotely. A web-based educational platform might be one of the innovations included in the development of health education for people with heart failure. The aim of this study is to determine the effect of web-based education on self-efficacy and self-care ability in heart failure patients. **Materials and Methods:** This study design is quasi-experimental. The study sample consisted of 80 individuals with heart failure with New York Heart Association (NYHA) II-IV classes and separated into two groups: the intervention group (n = 40) and the control group (n = 40). The sampling technique used in this study is consecutive sampling. Self-care is measured using the Self-Care Heart Failure Instrument version. A pre-test was administered before the intervention, and post-test and follow-up were administered two weeks after the intervention. The control group received information leaflets and the intervention group received web-based education. **Results:** The results showed that the main group effect was significant, indicating a significant increase self-care ( $F_{1,80} = 2769, p < 0.001$ ) and self-efficacy ( $F_{1,67} = 1600, p < 0.001$ ) in the intervention group after web-based education and two weeks follow-up. **Conclusions:** Web-based education is more effective in increasing self-efficacy and self-care abilities among heart failure patients. Providing education via a web-based platform in phases and continuously can promote healthy behaviors.

**Keywords:** Heart failure, self-care, self-efficacy, web-based intervention

## Introduction

Heart failure has been one of the most prevalent chronic disorders over the past two decades.<sup>[1]</sup> The incidence of heart failure in Europe and the United States is between 0.1% and 0.9% per year.<sup>[2]</sup> In Asian countries, the prevalence of heart failure ranges between 1.26 and 6.7%.<sup>[3]</sup> Indonesia has the highest frequency of heart failure in Asia, with 5% of the population affected.<sup>[4]</sup> The incidence of heart failure in Indonesia increased from 0.13% in 2013 to 1.5% in 2018.<sup>[5,6]</sup> Heart failure is associated with higher rehospitalization and mortality rates, as well as a decline in the patient's quality of life.<sup>[7]</sup> Self-care is an essential component of a multidisciplinary heart failure management program.<sup>[8]</sup> Adequate self-care is essential for heart failure patients' quality of life and prevention of rehospitalization.<sup>[9]</sup> Inadequate self-care in heart failure patients is influenced by a lack of self-care-related knowledge and information.<sup>[10]</sup>

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Self-efficacy is an important modifiable factor that can influence the self-care practices of heart failure patients.<sup>[11]</sup> Improving heart failure patients' self-efficacy is a major factor in enhancing self-care.<sup>[12]</sup> Self-efficacy is one of the key components to consider when developing health education for heart failure patients.<sup>[13]</sup> Self-care education is a crucial method for empowering heart failure patients and encouraging their active participation in integrating and modifying their care.<sup>[14,15]</sup> Education could be conducted via both conventional and technologically innovative ways. Traditional-based education is commonly delivered face-to-face through the use of pamphlets or posters, whereas technology-based education could be delivered remotely through the use of mobile applications or websites.<sup>[16-18]</sup> Traditional-based education has advantages, such as the presence of nurses as educators who interact with patients, but it is more resource-intensive and faces practical difficulties.<sup>[16,19]</sup>

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Educational interventions in heart failure patients can also be carried out based on mass technology platforms such as via websites.<sup>[17]</sup> Based on previous reviews, web-based educational interventions for heart failure patients are still rarely used; therefore, this intervention has scope to serve as one of the educational interventions used to promote self-care in heart failure patients.<sup>[20]</sup> The website is more user-friendly than applications and is compatible with all operating systems, both Android and iOS, so there is no need to download and no storage space is required on the patient's device.<sup>[21,22]</sup> Interactive interventions such as web-based self-care education might improve patient empowerment in patients with a variety of chronic conditions.<sup>[23]</sup> Previous review studies explained that website-based self-care interventions are already used for other chronic patients such as e-consultation, telemonitoring, and online course services.<sup>[24]</sup> In our study, a website was developed using audiovisual media as a method of delivering self-care educational materials for heart failure patients. In Indonesia, web-based educational interventions for heart failure patients have not been extensively implemented; thus, additional study is required. This study aimed to examine the effect of web-based education on self-efficacy and self-care ability in heart failure patients.

## Material and Methods

The study was conducted in 2022, and a quasi-experimental study design using pre-test and post-test questionnaires was used to evaluate the effects of the educational website on heart failure patients' self-efficacy and self-care. This study's sample calculation employs the mean and standard deviation values from prior research ( $Z_a = 1.96$ ,  $Z_b = 10\%$  = 1.28,  $S = 6.74$ ,  $X_1 - X_2 = 23,53 - 18,55$ ).<sup>[25]</sup> The number of samples in this study was computed using numerical comparisons in pairs with two groups, with the formula: <sup>[26]</sup>

The participants in this study were heart failure patients who had routine check-ups at the Cardiology Polyclinic. Eligibility criteria for this study included heart failure patients who were the first control to the Cardiology Clinic after being hospitalized in the intensive care unit, were older than 18 years, had New York Heart Association (NYHA) II-IV severity, owned and could use electronic devices such as smartphones and laptops, and had a moderate to high level of knowledge of heart failure. Prior to collecting data from patients, the researcher evaluated the knowledge of patients with heart failure using the "The Dutch Heart Failure Scale" (DHFKS) questionnaire<sup>[27]</sup>; if the respondent received a score of moderate to high for knowledge, the patient was considered a research respondent. Exclusion criteria for this study consisted of patients with heart failure who had decreased visual function, were refusing to participate as respondents, and did not partake in the study activities to completion.

There were 80 patients with heart failure who participated in this trial, and they were separated into two groups: the control group ( $n = 40$ ) and the intervention group ( $n = 40$ ) [Figure 1].

The sampling technique used in this study is consecutive sampling. Patients who presented during the first three weeks and the subsequent three weeks in the heart polyclinic were used to separate the control group and the intervention group. Patients with heart failure who underwent care at the heart polyclinic in the first three weeks were assigned to the control group. The researchers then assigned patients with heart failure who were under care at the cardiac polyclinic for the next three weeks to an intervention group.

Educational content was developed by researchers using prior research as a reference.<sup>[28]</sup> The website developed as part of this study provides general information on heart failure, as well as guidance on recognition and management of deteriorating symptoms, diet and fluid modification, physical activity, and medication adherence. The educational content is displayed as animated videos. The educational website consists of several menus, including user profiles, four modules, and a quiz within each module. This educational website is accessible via laptop or mobile device.

Based on the previous studies, the duration of the intervention differed between two weeks until 12 months. Therefore, in our research, the duration of the intervention was two weeks.<sup>[14]</sup> In this study, the intervention group received web-based education for two weeks. The educational content is organized into four modules [Table 1]. Study participants received the first module for three days and the second module for four days during the first week. Participants then received the third module for three days and the fourth and final module for four days during the second week. Each session lasts three and four days. During the session, the patient freely accesses the educational material provided. In this study, website access is not given any restrictions. However, researchers carry out regular follow-ups to remind patients to access the website for each session. In our study, four educational sessions were performed over the course of two weeks. Families of heart failure patients do not participate in study activities; however, we collaborated with families to assist patients in accessing the website and to remind patients to do so. After the participant has engaged for two weeks in the educational program, an evaluation was conducted. The evaluation stage was performed three times, namely before and immediately after the intervention and two weeks' follow-up post-intervention. The control group received the standard educational approach, consisting of one day of face-to-face education utilizing pamphlets.

Self-efficacy and self-care were the outcomes examined in this study of heart failure patients. Self-efficacy was measured using the Cardiac Self-Efficacy Scale (CSES).<sup>[29,30]</sup> Self-care was measured using the Self-Care Heart Failure Instrument version 6.2 (SCHFI v6.2).<sup>[31]</sup> The Cronbach alpha value is 0.805, and the validity value is 0.378 for the Cardiac Self-Efficacy Scale (CSES). The Cronbach alpha value is 0.935, and the validity value is 0.444 for the

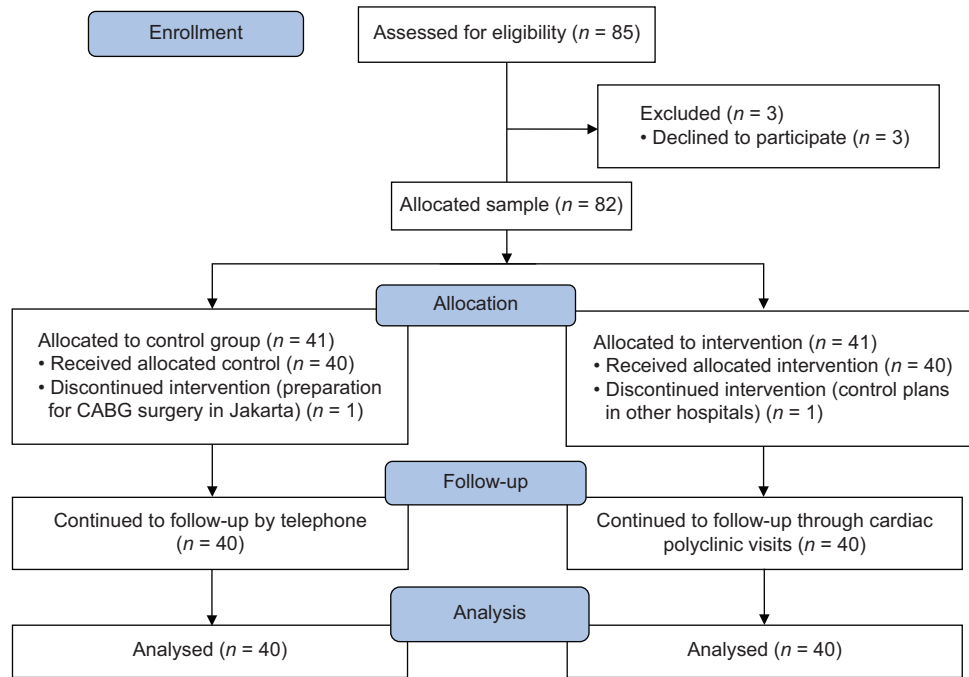


Figure 1: The CONSORT flow diagram of the study

Table 1: Educational session

Educational session	Topic	Discussion	Time
Session 1	Concept of Heart failure in general	<ul style="list-style-type: none"> <li>- Definition of heart failure</li> <li>- Causes of heart failure</li> <li>- Manifestations of heart failure</li> </ul>	First week
Session 2	Recognition and Management of Worsening Symptoms	<ul style="list-style-type: none"> <li>- Recognizing the symptoms and how to manage it</li> <li>- Management of worsening symptoms</li> </ul>	Second Week
Session 3	Diet modification and fluid modification	Diet modification <ul style="list-style-type: none"> <li>- The importance of quitting smoking</li> <li>- Salt restriction recommendations</li> </ul> Fluid modification <ul style="list-style-type: none"> <li>- What to do to modify the fluid</li> <li>- Recommendations for fluid restriction</li> <li>- How to measure the fluid consumed</li> <li>- Measures to prevent dehydration</li> </ul>	
Session 4	Physical activity and medication adherence	Physical activity <ul style="list-style-type: none"> <li>- Recommendations for physical activity and sports</li> <li>- The importance of rest</li> </ul> Medication Adherence <ul style="list-style-type: none"> <li>- Recommendations for taking medication as prescribed</li> <li>- Aware of pharmacological indications and adverse effects</li> <li>- When to inform the healthcare provider about the medication being taken</li> </ul>	

Self-Care Heart Failure Instrument version 6.2. This shows that both instruments were valid and reliable.<sup>[31,32]</sup>

All data were entered into a database and analyzed using IBM SPSS statistics (Statistical Package for the Social Sciences) version 25. We used descriptive statistics to analyze

demographic variables. A repeated ANCOVA test was conducted to assess the effects of the web-based education on self-efficacy and self-care before and immediately after education and two weeks follow-up by telephone and polyclinic visits. The independent *t*-test was then used to compare the control group to the intervention group.

### Ethical considerations

Informed consent was obtained from all respondents who participated in this study. This study was conducted with approval from the Health Research Ethics Commission of the Faculty of Health Sciences at Universitas Brawijaya No. 3337/UN10.F17.10/TU/2022 on 22 July 2022.

### Results

According to the data in Table 2, the majority of the participants in this study were male, with 31 (77.50%) in the control group and 26 (65%) in the intervention group. With 22 participants (55%) in the control group and 17 (42.20%) in the intervention group at the highest educational level, high school students dominated both groups. Concerning employment status, the majority of participants did not work, according to the distribution of participants in the control group, which was as high as 30 (75%) and 23 (57.50%) in the intervention group.

Basic comparisons of self-care between the intervention and control groups showed significant differences. To control for pre-test scores, repeated measure ANCOVA was adopted. The results showed that the main group effect was significant, indicating a significant increase in self-care within the intervention group after web-based education ( $p < 0.001$ ) [Table 3]. On the variable of self-efficacy, the comparison between the intervention and control groups revealed a statistically significant difference. The results showed that the main group effect was significant, indicating that web-based education led to a significant increase in self-efficacy in the intervention group ( $p < 0.001$ ) [Table 4].

### Discussion

Self-efficacy is influenced by web-based education, according to the findings of this study. After receiving web-based education, the intervention group's participants displayed high self-efficacy. This is in agreement with

previous studies which found that educational interventions result in an improvement in self-efficacy.<sup>[33,34]</sup> The provision of an effective educational program could increase patient self-efficacy up to one month after the educational program's administration.<sup>[35]</sup>

In our study, there was an increase in respondents' self-efficacy immediately after intervention and two weeks follow-up after providing educational programs through the website. Increasing self-efficacy will increase the promotion of self-care behavior in patients with heart failure and promote more active participation.<sup>[36]</sup> Web-based education in this study utilized visual means to deliver educational material. Education imparted through the audiovisual content was intended to increase understanding and self-efficacy based on persuasive communication techniques, images, and modelling, which have been proven to be effective in influencing behavioral change.<sup>[37]</sup> Thus, effective education will lead to increased patient self-efficacy and positively modify health behavior among patients with heart failure.

Inadequate educational provision could lead to deficient self-care in heart failure patients.<sup>[38]</sup> Patients with heart failure may possess misconceptions regarding their disease, resulting in noncompliance with self-care and worsening of their condition.<sup>[39]</sup> The results indicated that leaflet-based face-to-face education had no significant positive impact on participants' self-care abilities. Traditional education utilizing leaflets for patients with heart failure cannot result in the development of appropriate self-care skills because it is only administered once. It is ineffective for influencing self-care behavior and is susceptible to inadequate knowledge retention.<sup>[40]</sup> Information retention is the process of retaining information in long-term memory in a way that makes it readily retrievable.<sup>[41]</sup> This inadequacy in retention might occur when standard educational interventions are insufficient to achieve the intended effects due to the absence of educational repetition.<sup>[42]</sup> Information retention

**Table 2: Characteristics of respondents**

Characteristics of respondents	Statistical descriptive categories	Control Group	Intervention Group	<i>p</i>
Age (years)	Mean (SD)	54.02 (7.55)	52.7 (8.07)	0.495**
	Median (min-max)	54.50 (32-66)	55.0 (8.07)	
Duration of heart failure	Mean (SD)	14.65 (18.2)	16.82 (17.92)	0.171**
	Median (min-max)	11 (1-84)	12 (3-96)	
Charateristics of respondents	Categories	<i>n</i> (%)	<i>n</i> (%)	<i>p</i>
Gender	Male	31 (77.50)	26 (65.00)	0.765*
	Femmale	9 (22.50)	14 (35.00)	
Educational level	Elementary School	7 (17.50)	7 (17.50)	0.586**
	Middle School	7 (17.50)	7 (17.50)	
	High School	22 (55.00)	17 (42.50)	
	College	4 (10.00)	9 (22.50)	
Employment status	Employed	10 (25.00)	17 (42.50)	0.57*
	Unemployed	30 (75.00)	23 (57.50)	

\*Mann–Whitney. \*\*Kruskal–Wallis. <sup>a</sup>2-tailed



**Table 3: Comparison of mean self-care scores at baseline, immediately after and two weeks after intervention in the intervention and control groups and estimation of the effect of the group and time using the repeated measure ANCOVA**

Variable	Time	Control group Mean (SD)	Intervention group Mean (SD)	p	Interaction			
					F (df1, df2)	p	F (df1, df2)	p
Self-care	Preintervention	38.50 (2.58)	38.20 (2.01)	0.564***	F <sub>1,80</sub> =2769	<0.001	F <sub>1,80</sub> =2527	<0.001
	Postintervention	38.92 (2.09)	61.80 (1.88)	<0.001***				
	Two weeks follow-up	39.3 (1.97)	71.55 (1.83)	<0.001***				

\*\*\*ANCOVA repeated measure

**Table 4: Comparison of mean self-efficacy scores at baseline, immediately after and two weeks after intervention in the intervention and control groups and estimation of the effect of the group and time using the repeated measure ANCOVA**

Variable	Time	Control group Mean (SD)	Intervention group Mean (SD)	p	Interaction			
					F (df1, df2)	p	F (df1, df2)	p
Self-efficacy	Preintervention	21.37 (1.76)	21.32 (2.46)	0.917	F <sub>1,67</sub> =1600	<0.001	F <sub>1,67</sub> =1395	<0.001
	Postintervention	22.05 (1.76)	38.45 (2.03)	<0.001				
	Two weeks follow-up	22.07 (1.84)	43 (1.35)	<0.001				

ANCOVA repeated measure

may be appropriately developed if the educational program being implemented provides recurrent information. Patients with heart failure who have poor information retention tend to experience symptom recurrence.<sup>[43]</sup> Different health education strategies are required to help individuals understand and retain information about self-care.<sup>[27]</sup>

The findings of the study indicated that the intervention group's self-care abilities increased after undergoing web-based education. After intervention and two weeks follow-up of web-based education, participants in the intervention group demonstrated an adequate level self-care skills. According to this study's findings, there was a significant improvement in self-care after two weeks of imparting education via a website, which is consistent with previous studies.<sup>[44]</sup> This may occur as a result of the patient's requirement to allocate sufficient time to implement the educational program that has been implemented after two weeks. At least 14 to 254 days are required for a person to acquire a new habit.<sup>[45]</sup> This is supported by prior studies showing that after receiving instruction, heart failure patients did not have enough self-care, but after being evaluated for one month, adequate self-care behavior was formed.<sup>[46]</sup>

In this study, audiovisual content is utilized as an educational tool delivered via a web-based platform. Educational interventions utilizing video content have been shown to be helpful in improving health-related behaviors, such as those of patients with heart failure, due to the fact that the audiovisual format is advantageous both in terms of the patient's comprehension and the delivery of the information.<sup>[47,48]</sup> The results of previous studies show that education using video is very efficient, consistent, comfortable to use, and patient-centered in accordance

with heart failure guideline recommendations.<sup>[49]</sup> In addition, patients can rewatch the videos at their own pace and in their desired settings until the content fully comprehended.<sup>[50]</sup>

Audiovisual formats can improve the retention of health information.<sup>[49]</sup> The provision of educational videos via the website could be repeated until the patient is comfortable with the presented material and an acceptable level of retention is achieved. Patients with heart failure should be educated using a variety of intervention modalities to enhance patient comprehension and information retention.<sup>[27]</sup> The provision of educational videos through the website could be repeated until the patient is comfortable with the presented material and adequate retention is achieved. Education for heart failure patients must employ a variety of intervention strategies to improve patient understanding and information retention.

In this study, the web-based educational program was delivered in stages over period of two weeks. The modality of this educational content is anticipated to result in appropriate information retention, allowing patients to apply this knowledge to their self-care behavior. Based on the results of meta-analysis studies, the duration of electronic educational interventions ranged from 1 month to 28 months and showed a significant increase in self-care behavior among patients in the electronic education intervention group compared to the control group.<sup>[51]</sup>

In this study, web-based education used an audiovisual content, but face-to-face education utilized only passive visual means (leaflets). Compared to visual-only education, audiovisual education engages additional sensory modalities, particularly the aural, visual, kinesthetic, and tactile senses.<sup>[52]</sup> The utilization of audiovisual education will further improve patient understanding of health

information provided. This increase in patient understanding will in turn lead to modifications in the patient's attitude and conduct toward self-care.<sup>[53]</sup> Therefore, the provision of educational programs utilizing audiovisual content via a web-based platform will further improve the patient's self-efficacy and capacity for self-care.

Various educational interventions using different techniques have been tested to improve self-care behaviors in heart failure patients, such as traditional nurse education, using eHealth tools, use of symptom diaries, and home-based telemonitoring.<sup>[54-56]</sup> Most of these studies report that patients' self-care behaviors and attitudes improve after the intervention, but decline in the long term unless they receive continuing self-care education.<sup>[57,58]</sup> In this study, a web-based educational intervention was administered for two weeks, followed by two weeks of evaluation, in order to develop adequate self-efficacy and self-care. However, a continuous educational program is required to improve or maintain adequate self-efficacy and self-care.

The limitation in this study is that there are differences in the method of evaluating the success of educational programs. In the control group, evaluations were conducted via telephone instead of during poly visits. This is due to the fact that people with heart failure have monthly checks. In the control group, participants were only exposed to an educational program for one day, whereas those in the intervention group were exposed to an educational program for two weeks. Hence, the evaluation of the control group was conducted via telephone.

## Conclusion

Web-based education has a significant positive impact on the self-efficacy and self-care abilities of heart failure patients. Nurses also have an important role in providing health education to patients. This study suggests that patients' education can be enhanced when presented via a web-based platform as this provides gradual and continuous education, promotes information retention and facilitates the development of healthy behaviors.

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## Conflicts of interest

Nothing to declare.

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