

SYSTEMATIC REVIEW

## Effectiveness of self care intervention electronic based for improving quality of life and health outcomes in patients with heart failure: a systematic review of randomized controlled trials

## Efectividad de la intervención de autocuidado basada en dispositivos electrónicos para mejorar la calidad de vida y los resultados de salud en pacientes con insuficiencia cardíaca: una revisión sistemática de ensayos controlados aleatorios

Ani Widiastuti<sup>1,2</sup> , Elly Nurachmah<sup>1</sup> , Rita Sekarsari<sup>3</sup> , Indra Budi<sup>4</sup> , Santi Herlina<sup>2</sup> 

<sup>1</sup>Faculty of Nursing, University of Indonesia.

<sup>2</sup>Faculty of Public Health University of Pembangunan Nasional Veteran Jakarta.

<sup>3</sup>National Cardiac Centre Harapan Kita Jakarta.

<sup>4</sup>Faculty of Computer, University of Indonesia.

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Corresponding author: Ani Widiastuti 

### ABSTRACT

**Introduction:** heart failure is a chronic disease with the highest readmission duration. Increased health costs due to heart failure also continues to increase every year. The inability to take care of self-care and non-adherence to treatment programs are the causes of high readmissions. This study aims to identify the effectiveness of electronic-based self-care on engagement, adherence, readmission, and quality of life and also aims to identify types of self-care intervention and electronic methods or applications used in self-care.

**Method:** the research method is a systematic review of RCT (randomize control trial) research through systematic searches in 6 English-language databases, which were published from 2019 to 2023. Of the 134 journals identified self-care, engagement, adherence, quality of life and readmission, there are 114 articles were eliminated because they did not match the title, and of the 20 articles whose abstract results were identified as appropriate, there were 8 research references that met the inclusion and exclusion criteria, where the articles contained self-care electronic methods that were relevant to the variables in this systematic review. Data sources were taken from six data bases, namely PMC, Pubmed, Scopus, Proquest, ScienceDirect and ResearchGate.

**Results:** the results show that the self-care intervention model electronic based has increased patient engagement ( $p < 0,05$ ), increasing adherence ( $p < 0,03$ ), improved the quality of life of patients ( $p < 0,05$ ) and reduced readmissions ( $p < 0,03$ ) in heart failure patients.

**Conclusions:** the conclusion is that electronic-based self-care can improve patient engagement, adherence with treatment programs, quality of life and reduce readmissions in heart failure patients.

**Keyword:** Heart Failure; Self Care; Adherence; Engagement; Readmission; Quality of Life.

### RESUMEN

**Introducción:** la insuficiencia cardíaca es una enfermedad crónica con mayor duración de reingreso. El aumento de los costes sanitarios debido a la insuficiencia cardíaca también sigue aumentando cada año. La incapacidad para cuidar de sí mismo y la falta de adherencia a los programas de tratamiento son las causas

de los elevados reingresos. Este estudio tiene como objetivo identificar la eficacia del autocuidado electrónico sobre el compromiso, la adherencia, la readmisión y la calidad de vida y también tiene como objetivo identificar tipos de intervención de autocuidado y métodos o aplicaciones electrónicos utilizados en el autocuidado.

**Método:** el método de investigación es una revisión sistemática de investigaciones RCT (ensayo de control aleatorio) mediante búsquedas sistemáticas en 6 bases de datos en idioma inglés, que se publicaron entre 2019 y 2023. De las 134 revistas identificadas, autocuidado, compromiso, adherencia, calidad de vida y reingreso, Se eliminaron 114 artículos por no coincidir con el título, y de los 20 artículos cuyos resultados abstractos se identificaron como apropiados, hubo 8 referencias de investigación que cumplieron con la inclusión y criterios de exclusión, donde los artículos contenían métodos electrónicos de autocuidado que eran relevantes para las variables de esta revisión sistemática. Las fuentes de datos se tomaron de seis bases de datos, a saber, PMC, Pubmed, Scopus, Proquest, ScienceDirect y ResearchGate.

**Resultados:** los resultados muestran que el modelo de intervención de autocuidado basado en medios electrónicos ha aumentado el compromiso del paciente ( $p < 0,05$ ), ha aumentado la adherencia ( $p < 0,03$ ), ha mejorado la calidad de vida de los pacientes ( $p < 0,05$ ) y ha reducido los reingresos ( $p < 0,03$ ) en pacientes con insuficiencia cardíaca.

**Conclusiones:** la conclusión es que el autocuidado electrónico puede mejorar la participación del paciente, la adherencia a los programas de tratamiento, la calidad de vida y reducir los reingresos.

**Palabras clave:** Insuficiencia Cardíaca; Autocuidado; Adherencia; Compromiso; Reingreso; Calidad de Vida.

## INTRODUCTION

Heart failure is a major public health problem that affects around 26 million people worldwide.<sup>(1)</sup> Heart failure is a chronic condition that occurs when the heart muscle weakens or becomes stiff, making it unable to pump oxygen-rich blood to meet the body's needs effectively. The heart's pumping ability is reduced, causing blood and fluid to accumulate in the lungs or other parts of the body, which can cause symptoms such as shortness of breath and swelling.<sup>(2)</sup> AHA (American Heart Association) reports in 2017, there were 1,2 million hospitalizations for heart failure out of 924 000 patients with heart failure in the United States. This represents a 26 % increase in hospitalizations for heart failure.<sup>(3)</sup> Research in the United States shows that the risk of developing heart failure is 20 % at ages over 40 years with the incidence of more than 650 000 new cases diagnosed with heart failure.<sup>(4)</sup> The prevalence of heart failure in Southeast Asia is 3 times higher than in European and American countries, namely 4,5-6,7 %.<sup>(5)</sup> Data from the Indonesian Ministry of Health's Basic Health Research, the prevalence of heart failure in Indonesia based on doctor's diagnosis is estimated at 1,5 % or around 29 550 people.<sup>(6)</sup> Indonesia is ranked second in Southeast Asia with the number of deaths due to heart failure of 371 thousand people. Heart failure is a progressive health problem with high mortality and morbidity rates in developed and developing countries, including Indonesia, with treatment costs continuing to increase.<sup>(2)</sup>

The high cost of care cannot be separated from the high rate of rehospitalization of heart failure patients. Readmission data in the United States in heart failure patients reached 55,9 % after hospital treatment. In Indonesia itself, according to data from several hospitals, readmissions for heart failure patients reached 44 to 52 %. The incidence of death in heart failure is very high within 5 years after the first treatment at the hospital, reaching 25 %.<sup>(7)</sup> Other research explains that the common reasons for re-hospitalization for heart failure are delays in symptom recognition, non-compliance with medication and diet, lack of knowledge and incompetence in caring for oneself.<sup>(8)</sup>

Despite technological advances in the treatment of heart failure patients, the large information gap on heart failure creates a lack of understanding among patients and families.<sup>(9)</sup> The addition of new cases and readmissions to hospitals also continues to increase. In the European Society of Cardiology guidelines, adequate patient self-care education is essential in the effective management of heart failure patients. Self-care education allows patients to understand things that are beneficial to themselves, monitor their health, and plan for further care management. Patients with more effective self-care have a better quality of life, as well as a reduced incidence of death from heart failure.<sup>(5)</sup> Other research also states the same thing that the patient's ability to carry out self-care is also a supporting factor in the treatment process, reducing readmissions and increasing the patient's quality of life.<sup>(10)</sup>

Due to the complexity and chronicity of heart failure, tools are needed that can help patients manage their independent care in an interesting but simple way by utilizing modern electronic or internet-based

technology. The American Heart Association (AHA) even encourages the use of Telehealth in health services, especially during the Covid 19 pandemic.<sup>(11)</sup> A report from Stock Apps explains that the number of cellphone users in the world reached 5,3 billion in July 2021. Based on data from Kominfo, Indonesia is the country with the 4th largest internet users in the world and 3rd in Asia, with internet users reaching 212,35 million people in March 2021. However, in practice, the use of electronic methods, whether using telehealth, applications, or smartphones, has not been widely used in Indonesia as a medium for health services, especially in self-care for heart failure patients, so that it can reduce the information gap between patients and health workers.

In accordance with the AHA recommendation that encourages electronic systems in health services, and the types of electronic methods used are still very varied, it is important to carry out this systematic review to identify what types of applications or electronic methods are effective in improving self-care for heart failure patients. Apart from that, it is also to see what types of self-care are facilitated for patients to carry out at home through this application, then what factors can influence the implementation of self-care and how effective it is in improving engagement, adherence, readmission, and quality of life of failing patients, so that an effective method can be obtained to help heart failure patients carry out independent care at home after hospital treatment.

## METHOD

Searching for journal articles is done electronically. The author identified studies related to self-care, compliance, quality of life, readmission and heart failure. To maximize the sensitivity of the search, the author used a combination of terminology on the substance that the author wanted to explore, namely, the effectiveness of the self-care model on compliance, readmission, and quality of life. The electronic search produced 8 studies related to self-care, quality of life, engagement, compliance (adherence), readmission and heart failure. Literature selection was determined based on the following inclusion criteria: (1) Research conducted on patients with heart failure who were treated in hospital; (2) an electronic-based self-care model is applied to patients; (3) Years of scientific publication range from 2019 to 2023; (4) The article search includes quantitative research. The exclusion criteria include (1) articles about self-care not in hospital care; (2) self-care without impact on quality of life or readmission.

## Study Design

The study design used in this article uses a Systematic Review. We included RCT studies published in the English language in this review. Selected articles used PRISMA guideline standards to control review and study selection. It consists of seven steps, including writing a review question, determining appropriate criteria, conducting a thorough search of various sources of information, identifying relevant literature sources, and synthesizing these literature sources. The study includes primary research peer review articles that investigate the effectiveness of electronic-based self-care education methods on compliance, engagement, readmission and quality. Articles published in international journals for at least the last 10 years and in English.

## Study Selection

Electronic searches were carried out systematically through 6 databases including Scopus, PMC, Pubmed, Proquest, ResearchGate and ScieceDirect. The auxiliary words AND/OR are used to combine the search keywords: "Self care", "Heart Failures", "electronic", "adherence", "Engagement", "Readmission", and "Quality of life". The search strategy focused on articles published in English. All search results are identified through the title and abstract first. Then screening and assessment is carried out based on inclusion and exclusion criteria. Appropriate articles were downloaded for further review.

## Data Extraction

In the data extraction process, the author does it in a systematic and standardized way. Data extraction can be carried out if all data that meets the requirements has been classified for all existing data. After the screening process is carried out, the results of this data extraction can be known for certain how many still meet the requirements for further analysis. Extract data from individual studies to obtain important findings. In this systematic review, data extraction is carried out by looking at all 8 published articles that have been selected and then writing down the year of publication, journal, and database recorded along with methodological characteristics such as type of design, size used, and sample achieved (for example, sample size and demographics). In addition, the important findings of the article, the units of measurement used, and the characteristics of the statistical analysis are evaluated so that the extraction results can then proceed to the final stage.

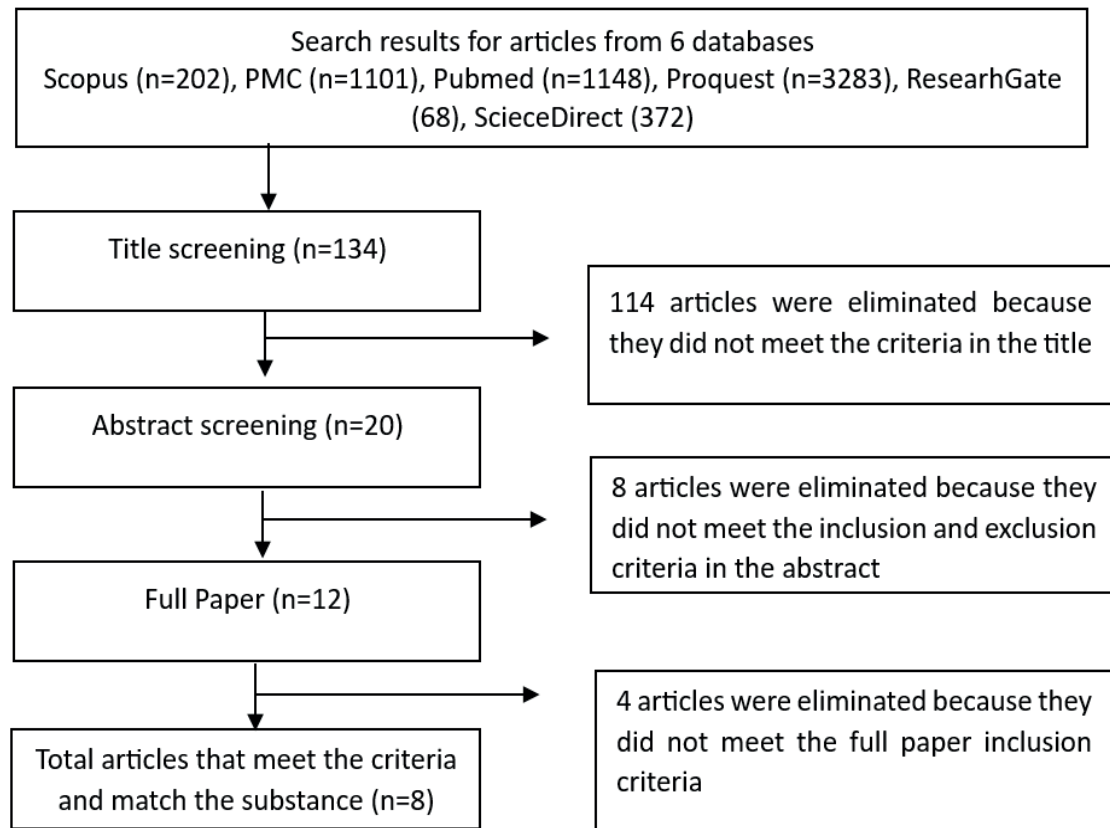


Figure 1. PRISMA flow diagram

Table 1. The characteristics of selected articles

Authors (Year)	Educational Method	N	Self-Care Interventions	Follow Up	Outcome	P Value/ Result
Dorsch MP et al. (2021)	Mobile app	83	Self-management Self-monitoring	6 weeks 12 weeks	MLHQOL Readmission	0,04 (26 % vs 29 %)
Pekmezaris al. <sup>(11)</sup> (2019)	Telehealth self-monitoring (TSM)	104	Self-monitoring	90 days	QOL Readmission	>0,05 0,03
Kitsiou S et al. <sup>(26)</sup> (2021)	Heart Failure Storylines mobile app (iCardia4HF) motivational text-messages, and notifications/reminders messages	92	Self-management Self-monitoring Motivational behavior	30 days 12 weeks	Adherence Engagement QOL	<0,05 <0,05 <0,05
Yanicelli LM et al. <sup>(32)</sup> (2020)	Home telemonitoring system	104	Self-monitoring treatment adherence	90 days	Adherence Readmission	0,03 potential to avoid
Cui X et al. (2019)	Nurse lead education program (thelepone &face to face)	96	Self-management Self-monitoring	8 weeks, then every 4 weeks to 12 months	Adherence Readmission	<0,01 0,036
Dessie G et al. <sup>(23)</sup> (2021)	By phone or in person at educational sessions &educational leaflet	186	Management guidelines (AHA)	Every 4 month to 1 year	Adherence Readmission	0,024 <0,05
Clements L et al. <sup>(22)</sup> (2023)	Educational intervention with telephone follow-up	37	Self-management Self-maintenance	30 days	Readmission	0,003
Oliveira et al. <sup>(12)</sup> (2023)	Psychoeducational intervention, guidance, booklet, telephonecalls.	142	Self-monitoring	3 months 6 months 12 months	WHOQOL Readmission	0,031 0,018

**Note:** MLHQOL: Minnesota Living with Heart Failure Questionnaire Quality of Life; WHOQOL: World Health Organisation Quality of Life

## RESULTS

A total of 6174 or five thousand nine hundred and eighteen articles appeared in the search process in 6 databases, and 114 were deleted due to the screening process. All articles were screened based on the title and abstract and 134 articles were found to be suitable, while 64 articles were excluded because they did not match the research objectives. Next, an assessment was carried out based on the inclusion criteria. There were 8 articles that were excluded because they did not meet the objectives, did not use an RCT or CT design, and were published more than 5 years ago. Finally, eight RCTs met the selection criteria and were included in this study. So that 8 articles underwent an extraction and analysis. The entire process of selecting the studies is illustrated in the PRISMA Flow diagram (figure 1).

### Study characteristics

The summary of study characteristics are summarized in table 1. Eight RCTs were published from 2019 to 2023. A total of 844 heart failure patients were from United States, New York, Michigan, Argentina, China and Ethiopia. The sample size for each study ranged from 37 to 186 participants. The mean age of the participants ranged from 18 to 85 years. All heart failure patients in this study received electronic self-care educational interventions both while still in the hospital and after returning home from the hospital. According to the table, there are several methods or media for education, follow up and monitoring used by researchers, including 4 studies using mobile apps, 2 studies using telemonitoring and text messages and 4 studies using telephone and some of them include booklets and guides.

In terms of self-care interventions that are educated to patients, there are 3 studies using self-monitoring and self-management, one study using self-monitoring, self-management, and motivation behaviour, two studies using self-monitoring, one study using self-monitoring and adherence treatment and one study using management guidelines by AHA. Motivational Behavior according to the study aims to increase adherence to recommended heart failure self-care, thereby improving outcomes by identifying appropriate behavior change techniques to improve heart failure self-care by engaging experts to further reduce and refine potential behavior change techniques.

### Effects of self care intervention electronic based for improving quality of life in patients with heart failure.

In four literatures obtained from research results in several countries, the implementation of electronic-based self-care models can increase quality of life heart failure patients with  $p < 0,05$ .

### Effects of self care intervention electronic based for reducing readmission in patients with heart failure.

In seven studies <sup>(1,2,4,5,6,7,8)</sup> participants who received the electronic self-care education intervention reported reduced readmission compared to participants in the control group ( $p < 0,03$ ).

### Effects of self care intervention electronic based for improving adherence in patients with heart failure.

In four studies <sup>(3,4,5,6)</sup> participants who received the electronic self-care education intervention reported improve medication, diet and activities adherence compared to participants in the control group ( $p < 0,03$ ).

### Effects of self care intervention electronic based for improving engagement in patients with heart failure.

In four literatures obtained from research results, the implementation of electronic-based self-care models can increase engagement of heart failure patients with  $p < 0,05$ .

## DISCUSSION

This study was a systematic review and meta-analysis of RCTs to examine the effectiveness of electronic based education intervention for improving quality of life, readmission, adherence, and engagement patient with heart failure. The education model includes using mobile apps, telemonitoring or telehealth, text messages, telephone and some of them using booklets and guides. the electronic educational intervention program significantly improves the quality of life of heart failure patients, number of readmissions, medication and diet adherence and also showed positive effects on heart failure patient engagement.

Education about self-care is one strategy that can be used as an intervention to encourage and empower patients to choose a healthier lifestyle by promoting better condition management. <sup>(12,13,14,15,16)</sup>

Of the 8 articles synthesized, using the RCT method which discussed self-care management, engagement, quality of life, clinical outcomes and health status of heart failure patients. Self care provides knowledge and efforts to improve five core skills which include problem solving abilities, decision making, resource utilization, communication with health professionals and planning or setting treatment goals to manage physical and psychosocial aspects of chronic illness. <sup>(13,17,18,19)</sup>

Orem's theory believes that all humans have self-care needs and the right to obtain these needs themselves, unless they are unable to. Self care is used to control external and internal factors that influence a person's



activities to carry out their functions and roles to achieve prosperity.<sup>(14,20,21,22)</sup>

Health-Related Quality of Life (HRQoL) is a key target for therapeutic management of patients with heart failure to prolong their life. The occurrence of worsening HRQoL in heart failure patients is related to functional limitations and has an impact on mobility in carrying out daily activities.<sup>(23,24,25)</sup>

Engagement can be measured with the Patient Activation Measure (PAM) which was discovered by Hibbard in 2004.<sup>(15)</sup> Measuring patient activity or involvement involves four stages: (1) believing that the patient's role is important, (2) having the confidence and knowledge necessary to take action, (3) taking concrete action to maintain and improve one's health and (4) sticking to the plan even under pressure.<sup>(26,27,28,29)</sup>

A self-care program is said to be successful if it is accompanied by good self-management from the patient. Self-management is an individual's ability to recognize symptoms and changes that occur so that they can make the right decisions.<sup>(16)</sup> The success of self-management is supported by the individual's understanding of the education provided as well as regular monitoring by medical personnel.<sup>(14,30,31)</sup>

Monitoring patients at home can be done using several methods, including telemonitoring, telephone and home visits.<sup>(11,32)</sup> Educational programs in heart failure care include understanding the causes of CHF, symptoms, salt and fluid restriction diet, therapeutic regimen, compliance, physical activity, lifestyle changes.

Medication scheduling can be in the form of a diary or check list attached to the medicine box. Fluid and weight management needs to be carried out routinely by heart failure patients a maximum of once a week, while for fluid management patients need to limit sodium consumption to 2-3 grams per day. This is done to prevent sudden weight gain of > 2 kg in one week, because sudden changes in body weight can make it difficult for the patient to breathe.<sup>(17)</sup>

### Limitation of the Study

In this literature review we take all the articles related to electronic self care heart failure education without specifying the type of electronic self care education or intervention used in the article so as to allow differences in the results from one article to another

### CONCLUSION

The electronic-based self-care intervention model aims to improve quality of life, prevent and control risk factors for recurrence or readmission, increase patient adherence and engagement. The electronic educational intervention program significantly improves the quality of life of heart failure patients, reduce the number of readmissions, improves medication and diet adherence and also showed positive effects on heart failure patient engagement.

Electronic based intervention for self care education helping patients to manage their life and treatment and help of their families and make it easier for health workers to carry out monitoring and evaluation. This application has been proven to increase heart failure patient compliance with treatment programs, increase patient involvement, improve quality of life and reduce readmission rates in the hospital. Involving patients to actively participate in self-care needs to improve patient engagement. The Electronic-Based Self-Care intervention model is effective in improving Engagement, adherence, Readmission, and Quality of Life for Heart Failure Patients.

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## CONFLICT OF INTEREST

The authors report that they have no conflicts of interest for this study.

## AUTHORSHIP CONTRIBUTION

*Conceptualization:* Ani Widiastuti, Elly Nurachmah, Rita Sekarsari, Indra Budi, Santi Herlina.

*Data curation:* Ani Widiastuti, Elly Nurachmah, Rita Sekarsari, Indra Budi, Santi Herlina.

*Formal analysis:* Ani Widiastuti, Rita Sekarsari, Indra Budi, Santi Herlina.

*Research:* Ani Widiastuti, Elly Nurachmah, Rita Sekarsari, Indra Budi, Santi Herlina.

*Methodology:* Ani Widiastuti, Elly Nurachmah, Rita Sekarsari, Indra Budi, Santi Herlina.

*Project management:* Ani Widiastuti, Elly Nurachmah.

*Resources:* Ani Widiastuti, Rita Sekarsari, Indra Budi, Santi Herlina.

*Software:* Ani Widiastuti, Indra Budi.

*Supervision:* Ani Widiastuti, Elly Nurachmah, Rita Sekarsari, Indra Budi, Santi Herlina.

*Validation:* Ani Widiastuti, Elly Nurachmah, Rita Sekarsari, Indra Budi, Santi Herlina.

*Display:* Ani Widiastuti, Elly Nurachmah, Rita Sekarsari, Indra Budi, Santi Herlina.

*Drafting - original draft:* Ani Widiastuti, Elly Nurachmah, Rita Sekarsari, Indra Budi, Santi Herlina.

*Writing - proofreading and editing:* Ani Widiastuti, Elly Nurachmah, Rita Sekarsari, Indra Budi, Santi Herlina.