

Impact of Cellphone-Based Tele-Education “*Germas Jantungku*” On Quality of Life of Patients with Heart Failure Reduced Ejection Fraction in Makassar, Indonesia: A Quasi-randomised Trial

Idar Mappangara^{*1}, Jaka Eka Yuianto², Akhtar F. Muzakkir³, Peter Kabo⁴, Pendrik Tandean⁵, Robertus Setiadji⁶, Andriany Qanitha⁷

^{1,2,3,4,5,7}Department of Cardiology and Vascular Medicine, Faculty of Medicine, Hasanuddin University, Makassar 90245, Indonesia

^{4,6}Department of Pharmacology, Faculty of Medicine, Hasanuddin University, Makassar 90245, Indonesia

⁵Department of Internal Medicine, Faculty of Medicine, Hasanuddin University, Makassar 90245, Indonesia

⁷Department of Physiology, Faculty of Medicine, Hasanuddin University, Makassar 90245, Indonesia

*e-mail: a.qanitha@unhas.ac.id

Received: 11 August 2025, Revised: 12 September 2025, Accepted: 2 October 2025

Abstract

Improving quality of life remains a central goal in the management of heart failure (HF). This pilot study aimed to evaluate the effectiveness of tele-education delivered through the Germas Jantungku mobile application, a telemedicine initiative launched in Makassar, Indonesia. A quasi-randomised trial was conducted between May and October 2020 at Wahidin Sudirohusodo Hospital, Makassar. A total of 106 patients with heart failure with reduced ejection fraction (HFrEF) were enrolled. Of these, 53 participants installed the Germas Jantungku application and received tele-education, while 53 participants served as the control group. The primary outcome was quality of life, assessed using the HeartQoL questionnaire one month after the intervention. Participants in the tele-education group demonstrated significantly higher HeartQoL scores compared with the control group (2.31 vs. 1.94, $p = 0.01$). Within the tele-education group, the mean increase in HeartQoL score from baseline to one month was greater among patients aged <60 years than those aged ≥60 years (0.98 vs. 0.42), females than males (0.85 vs. 0.75), patients with higher education levels than those with mid-to-low education (0.96 vs. 0.66), and NYHA class III–IV than class I–II (0.90 vs. 0.31). A one-month tele-education intervention using the Germas Jantungku mobile application significantly improved HeartQoL scores among patients with HFrEF, with the greatest benefits observed in younger, female, higher-educated patients and those with advanced functional class (NYHA III–IV).

Keywords: Telemedicine, Heart Failure, Quality of Life

INTRODUCTION

According to the 2018 Indonesian Basic Health Research Survey, the prevalence of heart failure (HF) in Indonesia is estimated at 1.5% of the general population [1]. Therapeutic strategies for heart failure with reduced ejection fraction (HFrEF) are well established, supported by a robust body of clinical evidence. The overarching goals of HF management are to enhance clinical stability, functional capacity, and quality of life (QoL), while simultaneously reducing hospitalisations and mortality [2].

Assessment of QoL in patients with HF is commonly performed using the HeartQoL questionnaire, a validated instrument comprising 14 items—10 assessing physical domains and 4 assessing emotional well-being. Each item is rated on a 4-point Likert scale (0–3), with higher scores reflecting fewer symptoms and better perceived health status [3].

Continuous follow-up and monitoring are critical to ensuring treatment adherence and the early detection of complications or disease progression. Such surveillance may be conducted through home-based assessments, community or hospital visits, structured telephone support, or remote patient monitoring systems. The integration of telemedicine, or remote patient management, into HF care has demonstrated promise; however, clinical outcomes have remained inconsistent across studies [2].

A tele-education application was recently launched for the first time in Makassar, Indonesia, to facilitate public access to information on heart disease through patients' smartphones [4]. This initiative was developed as part of the Indonesian Ministry of Health's national program to promote cardiovascular health literacy. The application integrates the Heart Failure Zone concept—an established educational framework that classifies symptoms into colour-coded zones to aid early recognition of decompensation and prompt medical consultation when necessary [5].

To date, however, no studies have evaluated the effectiveness of this tele-education platform in improving the quality of life among patients with heart failure.

METHODS

Study Design

This randomised controlled trial (RCT) was conducted between May and October 2020 at the Cardiac Centre, Wahidin Sudirohusodo Hospital, Makassar, Indonesia. All patients diagnosed with heart failure with reduced ejection fraction (HFrEF) who were either hospitalised in the general ward or attended the outpatient clinic were screened for eligibility. The study protocol was approved by the Health Research Ethics Committees of both Hasanuddin University and Wahidin Sudirohusodo Hospital, Makassar.

Inclusion criteria were: (1) age >18 years; (2) diagnosis of HF with left ventricular ejection fraction (LVEF) <40% by the biplane method (based on medical records); (3) ownership of and ability to operate a smartphone; and (4) provision of written informed consent. Exclusion criteria included patients with neurological, musculoskeletal, or psychiatric disorders that could interfere with HeartQoL assessment, as well as those who were lost to follow-up or died during the study period. Written informed consent was obtained from all participants prior to enrollment.

The sample size was determined using a t-test to detect the mean difference in HeartQoL scores between two independent groups. A minimum of 51 participants per group (total $n = 102$) was required. Eligible participants were randomly assigned to either the tele-education group or the control group using simple randomization. All participants completed the HeartQoL questionnaire and received guideline-directed medical therapy for HF.

Participants in the tele-education group had the Gernas Jantungku mobile application installed on their smartphones and received instructions on its operation. The application integrates the Heart Failure Zone system, enabling users to recognize and categorize daily symptoms. It also provided automated notifications prompting patients to record body weight, report symptoms, take prescribed medications, and access educational materials. Additionally, participants received personalized messages and could contact a call center for teleconsultation.

Participants in the control group received standard education on medication adherence, fluid intake management, and were advised to attend monthly outpatient visits.

Data Collection and Follow-up

Baseline data were obtained from medical records and structured patient interviews. Sociodemographic variables included age, sex, and educational level. Clinical data, including New York Heart Association (NYHA) functional class, were collected through history taking and physical examination. Echocardiographic parameters were retrieved from medical records or obtained via direct echocardiographic assessment at admission.

Baseline quality-of-life data were collected using the HeartQoL questionnaire administered during the initial encounter with the research team. After one month of follow-up, all participants completed a second interview to assess post-intervention HeartQoL scores. The HeartQoL score was calculated as the mean of 14 items, each rated on a 4-point scale (0–3), with higher scores indicating better quality of life.

Study Outcomes

Outcomes of our study were patient's quality of life defined as HeartQoL questionnaire score after one month follow-up in both groups.

Statistical Analysis

Baseline characteristics were compared between the tele-education group and the control group. Continuous variables (age, ejection fraction, and pre- and post-intervention HeartQoL scores) were expressed as mean $\pm$ standard deviation (SD) along with their minimum and maximum values. Categorical variables (sex, educational level, and NYHA functional class) were summarized as percentages.

Group comparisons for continuous variables were performed using the independent sample t-test, while comparisons for categorical variables were conducted using logistic regression analysis. A p-value < 0.05 was considered statistically significant. All analyses were performed using SPSS software, version 22.0 (IBM Corp., Armonk, NY, USA).

RESULTS

A total of 110 patients with heart failure with reduced ejection fraction (HFrEF) were enrolled. Participants were randomized into two groups: tele-education (n = 55) and control (n = 55). At the one-month follow-up, 53 participants in each group completed the study, with two patients in each group lost to follow-up.

The mean age of participants in the tele-education group was slightly higher than that of the control group (57.5 ± 13.0 vs. 56.0 ± 12.9 years), though this difference was not statistically significant ($p = 0.50$). The majority of participants were male in both groups (73.5% vs. 26.5% in the tele-education group; 72% vs. 28% in the control group; $p = 0.91$). Most participants had a low-to-middle educational level in both the tele-education (60.4%) and control (66%) groups, with no significant difference between them ($p = 0.39$).

The mean left ventricular ejection fraction (LVEF) was higher in the tele-education group compared with controls ($28.7 \pm 6.5\%$ vs. $26.6 \pm 7.3\%$), though the difference did not reach statistical significance ($p = 0.08$). A greater proportion of patients were classified as NYHA class III–IV compared with NYHA class I–II in both the tele-education (80% vs. 20%) and control (90% vs. 10%) groups, with the difference approaching but not reaching statistical significance ($p = 0.07$). Baseline characteristics of both groups are summarized in **Table 1**.

Table 1. Baseline Characteristics of Study Participants

Variable	Tele-education Group (n=53)	Control Group (n=53)	p-value ^a
Age			
Min/max	19/80	33/80	0.500
Mean $\pm$ SD	56.02 $\pm$ 12.9	57.5 $\pm$ 13	
Gender			
Male	39(73.5%)	38 (72%)	0.907
Female	14 (26.5%)	15 (28%)	
Educational Level ^b			
Mid-Low Education	32 (60.4%)	35(66%)	0.394
High Education	21 (39.6%)	18 (34%)	
Ejection Fraction ^c			
Min/max	17.6/39.7	14/40	0.080
Mean $\pm$ SD	28.8 $\pm$ 6.6	26.4 $\pm$ 7.3	
NYHA Class I and II	11(20%)	5(10%)	0.068
NYHA Class III and IV	42(80%)	48(90%)	

^a Comparison of baseline characteristics was performed using unpaired two-sample t-test for continuous variables and logistic regression for categorical variables. ^b Mid-low education means educational level below senior high school, and high education means educational level above senior high school. ^c EF calculate by biplane method Min =minimal, Max=maximal, SD = Standard Deviation, NYHA = New York Heart Association.

The mean pre-intervention HearQoL score was slightly higher in the tele-education group compared to the control group (1.51 vs 1.44), but this difference was not found statistically significant ($p=0.478$). After one-month follow-up, heartQoL scores in both groups increased. The

mean post-intervention HearQoL score was significantly higher in the tele-education group compared to the control group (2.31 vs 1.94, $p=0.01$), as depicted in **Figure 1**. HeartQoL pre and post follow-up in both groups are listed in **Table 2**. During the beginning of this study, both groups showed no significant difference in terms of quality of life. After one-month follow-up, both groups had an increased quality of life, but those who received tele-education had a higher increase of quality of life compared to the control group.

Table 2. HeartQoL Score Pre and Post Intervention

	Tele-education Group (n=53)	Control Group (n=53)	p-value ^a
HeartQoL Pre Intervention	1.51 ± 0.703	1.44 ± 0.60	0.478
HeartQoL Post one month intervention	2.31 ± 0.55	1.94 ± 0.55	0.01*

^a Comparison of mean HeartQoL score between two group performed using unpaired two-sample *t*-test. * $p<0.05$

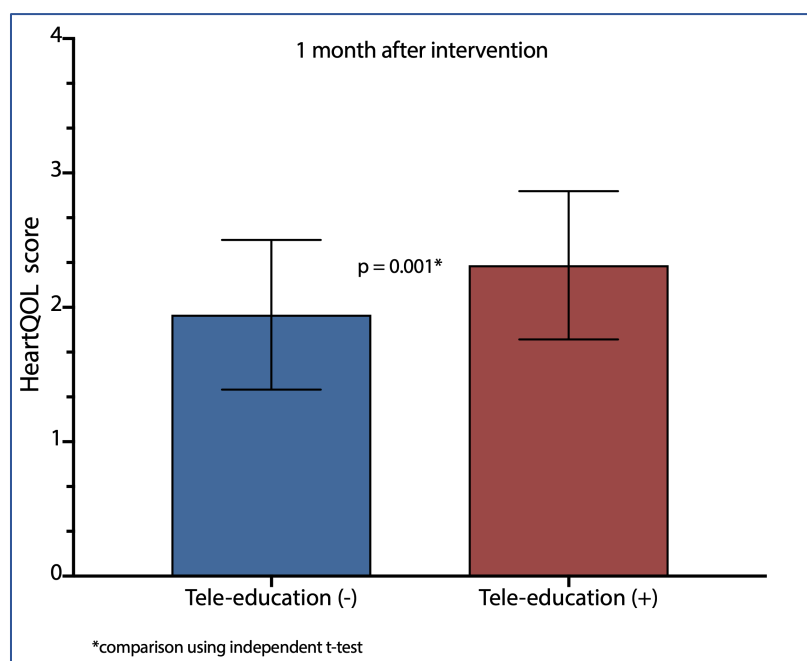


Fig. 1. Mean difference of HeartQoL score between with and without tele-education groups

* $p<0.05$, analysis using independent *t*-test

We evaluated the effectiveness of tele-education in particular subgroups divided based on age, gender, educational level and NYHA class. The mean difference between HeartQoL scores post-intervention and pre-intervention in the tele-education group was 0.78. These scores were higher in participants aged <60 than compared to those aged >60 years-old (0.98 vs 0.42), higher in females compared to males (0.85 vs 0.75), higher in those with a high education level compared to those with a mid-low education (0.96 vs 0.66), and higher in NYHA class III-IV than NYHA class I-II (0.31 vs 0.90). The mean difference between HeartQoL scores post-intervention and pre-intervention in the tele-education group is listed in **Table 3**. In multivariable analysis, age ($p=0.007$) and NYHA class ($p=0.044$) are independent determinants for significant difference between HeartQoL score before and after tele-education (**Figure 2**).

Table 3. Characteristic of HeartQoL Score Changes between Post-Pre Intervention in Tele-education Group

SubGroup	Number	Mean (HeartQoL post- HeartQoL pre) ^a
Age		
<60 years	34	0.98
>60 years	19	0.42
Gender		
Male	39	0.75
Female	14	0.85
Educational Level		
Mid-Low Education	21	0.96
High Education	32	0.66
NYHA I-II	11	0.31
NYHA III-IV	42	0.90
Total	53	0.78

^a Mean (HeartQoL post- HeartQoL pre) determined from mean HearQoL psot intervention subtract with mean heartQoL pre intervention. NYHA = New York Heart Association

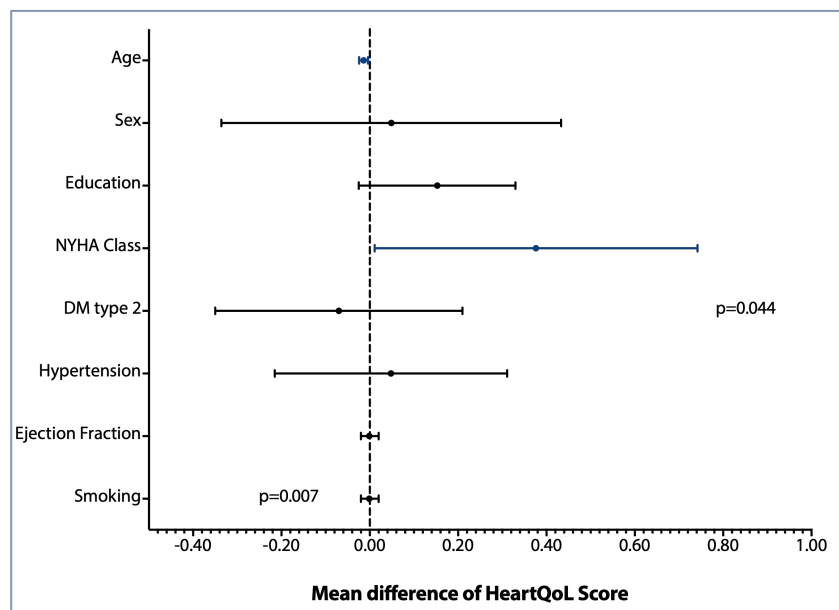


Fig. 2. Multivariable analysis for the mean difference of HeartQol score.

DISCUSSION

Our study aimed to evaluate the effectiveness of tele-education using the newly developed mobile application, Germas Jantungku, in improving quality of life (QoL) among patients with heart failure with reduced ejection fraction (HFrEF), compared with standard pre-discharge patient education. This pilot study was conducted in Makassar, Indonesia, targeting the HFrEF population. Assessment of patient-reported QoL is critical in HF management, as it has been shown to correlate significantly with hospital readmission and mortality rates [6].

In our study, no participants achieved the maximum HeartQoL score, comparable to that of healthy individuals, reflecting the persistent impairment of QoL in HF patients, which cannot be fully restored by any intervention. Nonetheless, QoL typically improves within the first month post-admission and tends to stabilize over the subsequent year [7].

Previous studies on telemedicine in HF have reported mixed outcomes. Some investigations found that intervention intensity did not correlate with HF outcomes, while others demonstrated that intensive monitoring improved outcomes by facilitating early detection of vital sign changes. Rapid intervention is critical for preventing readmission and reducing mortality. Tele-monitoring appears most effective in newly diagnosed patients or those requiring closer follow-up, with diminishing effectiveness beyond six months [8]. Our findings indicate that tele-education via Gernas Jantungku can improve QoL within a one-month period compared with standard pre-discharge education. However, further studies are warranted to evaluate the long-term effectiveness of tele-education in this patient population.

Another short-term telehealth study demonstrated improvements in self-awareness, self-management, and assistance-seeking behaviours following participation in a telehealth program. After just 42 days of tele-monitoring, patients exhibited increased awareness of the importance of actively managing their condition. Daily weighing and fluid intake were identified as particularly significant behaviours during the monitoring period. The study suggested that such behavioural changes may influence physiological outcomes, with weight fluctuations better controlled when patients adhered to daily self-weighing and fluid restriction. Consequently, telehealth interventions are expected to reduce heart failure decompensation events [9]. Consistent with these findings, our study observed that routine self-weighing combined with fluid intake restrictions, reinforced through tele-education, significantly improved quality of life (QoL) one-month post-discharge. The observed behavioural changes were corroborated by improvements in patients' HeartQoL scores, indicating a direct link between tele-education and enhanced self-management.

Notably, participants younger than 60 years derived greater benefit from tele-education compared with those aged over 60 years. This difference may be attributable to age-related comorbidities and declines in physical and cognitive function. Older patients often encounter challenges in using internet-based platforms and tend to prefer face-to-face consultations over remote interactions. Barriers to telemedicine in this population may include perceived reductions in social interaction, concerns regarding security and confidentiality, and unfamiliarity with digital technology [10].

Average usage of the application was similar in both males and females. But females tend to contact the call centre more frequently than males [11]. Our study showed that the mean difference between post and pre-intervention HeartQoL scores was higher in females. Females experienced more benefit from tele-education than males, with better QoL scores probably due to their tendency to use tele-education in a more intense manner compared to males. Participants with a high educational level had higher QoL improvements than those with a low-middle educational level. Well-educated patients had a better understanding in health issues, and could use the tele-heart failure application more easily than less educated patients [12]. Therefore, high educated patients tend to receive greater benefit from tele-education.

Patients with more severe disease burden, with NYHA class III and IV, got greater benefit from tele-education compared with NYHA I and II. Many RCTs showed superiority of telehealth over standard care in severe and unstable heart failure. This superiority applies in conditions where usual optimal care can be provided, and telehealth provides more intensive care. The TIM-HF trial reported that there were no significant differences between tele-monitoring compared to usual standard care in patients with stable, well-controlled HF [13]. Another study revealed that patients with HF preferred tele-monitoring via smartphone when they experience a new onset of symptoms or when their symptoms worsen [12].

CONCLUSIONS

Tele-education using the mobile application Gernas Jantungku in patients with HFrEF is associated with improved 30-day quality of life post-discharge, as measured by HeartQoL scores, compared with standard post-discharge patient education. The intervention appears particularly effective in younger patients (<60 years), females, individuals with higher educational attainment,

and those with NYHA class III–IV heart failure, who demonstrated greater improvements in HeartQoL scores.

ACKNOWLEDGEMENT

The abstract of this article had been published and presented in **ESC Heart Failure Congress 2021**. We sincerely thank all participants and their families for their dedicated involvement in this research project, as well as our colleagues at the Cardiac Centre of Dr. Wahidin Sudirohusodo Hospital for their invaluable assistance throughout the study.

REFERENCES

- [1] Riskesdas K. Hasil Utama Riset Kesehatan Dasar (RISKESDAS). J Phys A Math Theor.2018;44(8):1–200.
- [2] Ponikowski, P., Voors, A. A., Anker, S. D., et.al. ESC Guidelines for the Diagnosis and Treatment of Acute and Chronic Heart Failure. *Rev Esp Cardiol (Engl Ed)* 2016a, 69: p1167.
- [3] Smedt DD, Kotseva K, Clays E, Pogosova N et al. The use of HEARTQOL in patient with coronary heart disease: Association with risk factor and european reference. *Eur J Prev Cardiol*.2016.Vol 0(00):p1-13
- [4] Kallo R. Sosialisasi Aplikasi Gernas Jantungku Digelar di Puskesmas Kassi Kassi. *Sorotmakassar*. Accessed at Februari 24th 2020 via <https://sorotmakassar.com/k2-categories/sorot-makassar/1958-sosialisai-aplikasi-germas-jantungku-digelar-di-puskesmas-kassi-kassi>
- [5] Melton M. Evidence-based discharge education guideline to improve adherence to self-care and decrease 30-day readmission for older heart failure patient. *Doctor of Nursing Practice*.2017.Vol 28:p1-96
- [6] Hansen BT, Thygesen LC, Zwisler AD et al. Self-Reported health-related quality of life predicts 5-year mortality and hospital readmission in patients with ischemic heart disease. *Eur J Prev Cardiol*.2015.22(7):p882-9
- [7] Soriano N, Ribera A, Marsal JR et al. Improvement in Health-Related Quality of Life Of Patient Admitted for Heart Failure. The HF-QoL Study. *Rev Esp Cardiol*.2010.Vol 63 Issue 6:p668-676
- [8] Bertoncello C, Colucci M, Baldovin T et al. How does it work? Factors involved in Telemedicine home intervention effectiveness: A review of reviews. *PLoS One*.2018.13(11):e0207332
- [9] Varon C, Alao M, Minter J et al. Effect of Telehealth on Self-Care Behavior of Heart Failure Patients. *Computing in Cardiology*.2014:p473-476
- [10] Fedak M, Borkowska U. Use of telemedicine-based care for aging and elderly: promise and pitfall. *Smart Homecare Technol Telehealth*.2015. Volume 3:p91-105
- [11] Goldstein KM, Gierisch JM, Zullig LL et al. Telehealth service designed for women: An evidence Map. *Departement of Veteran Affairs*.2017
- [12] Albert N, Dinesen B, Spindler H et al. Factor associated with telemonitoring use among patients with chronic heart failure. *J Telemed Telecare*.2017. Vol 32(2):p283-291
- [13] Greenhagh T, A'court C, Shaw S. Understanding heart failure: explaining telehealth-a hermeuneutic systematic review. *BMC Cardiovasc Disord*.2017.Vol 17.