

The effect of health literacy promotion through virtual education on the self-care behaviors in patients with heart failure: A Clinical Trial

ABSTRACT

Background and Objective: Paying due attention to educational intervention based self-care skills in patients with chronic diseases, especially cardiovascular patients, can predispose them to improve their condition. This study investigates the effect of promotion of health literacy through virtual education on the self-care behaviors in patients with heart failure.

Materials and Methods: This clinical trial was conducted on 56 heart failure patients. The participants were selected using the convenience sampling method and then randomly assigned into two groups (28 in the experimental group and 28 in the control group). The experimental group received a health literacy promotion program via the iSpring Play app. The intervention consisted of four major topics on self-care issues in the form of text, photos, animation, and short videos. Each week, a topic link was made available to participants. After sending the link, through the cyberspace system, the necessary follow-ups on accessing and understanding the information and its application and emphasizing the correct points of self-care were performed and the participants' questions were answered. Data were collected with demographics questionnaire and Riegel et al.'s Self-care Index before and after the intervention. The collected data were analyzed with SPSS19 using descriptive and inferential statistics.

Results: The overall self-care mean score increased in both groups after intervention compared to before the intervention indicating a significant difference on the basis of results of paired t-test ($P < 0.05$). The mean score of overall self-care was greater in the experimental group (48.75 ± 5.5) after the intervention compared to the control group (39.96 ± 6.16). Independent t-test showed a significant difference between the two groups ($P < 0.05$).

Conclusion: The results demonstrated a significant increase in the mean score of overall self-care in patients undergoing health literacy promotion programs with virtual education. Hence, innovative methods based on virtual education could be considered to improve self-care behaviors in cardiac failure patients.

Paper Type: Research Article

Keywords: Health literacy, heart failure, self-care, virtual education.

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Introduction

Cardiovascular diseases are the leading cause of mortality around the globe with heart failure being the most common complication of these conditions. Heart failure is rendered as the final common path of cardiovascular diseases (1). The prevalence of these disorders is statistically increasing around the world (2). About 5.1 million Americans and more than 37 million people in other parts of the world are affected by heart failure (3). In Iran, this disorder afflicts 3500 individuals per 100,000 people serving as the main cause of disability and mortality (4).

Patients with heart failure will face changes in their care needs due to the consequences of the disease and treatment; so, dealing with disease problems requires knowledge of self-care behaviors. The issue of adherence to self-care behaviors in these patients is very important, and acquiring self-care skills affects their comfort, functional abilities, and disease processes (5). On the basis of some studies, lack of self-care in chronic diseases is the most important factor that can predispose to patient mortality (6-8). Moreover, other studies have demonstrated that at least %50 of heart failure patients do not adhere to their therapeutic advice (9, 10). The accurate performance of self-care demands that patients acquire awareness and skills pertaining to the disease and method of doing the necessary care. They should also be able to benefit from their knowledge in various situations (11, 12). Thus, awareness and health literacy are essential for self-care and health literacy is one of the most influential factors in disease control and prevention (5). The prevalence of low health literacy in the literature varies widely from 17.5% to 97% for heart failure patients (13), and from 14.3% to 49.6% for coronary heart disease (14). The results of researches in Iran also show an insufficient level of health literacy

of patients with chronic diseases (5, 15, 16). Because health literacy is a determinant of health in cardiovascular diseases (17), nurses should encourage the patients to perform self-care behaviors through educating them and increasing their self-confidence. Nurses ought to help these patients to take over their own responsibility of self-care (18).

Investigations indicate that new information technologies have a high potential for enhancing individuals' health knowledge (19). Teaching self-care strategies via these innovative technologies can predispose to patients' increased knowledge more than ever (20, 21). The main advantages of virtual education over direct conventional education include faster accessibility, quick data and education transmission, saving time, and avoiding unnecessary transportation. This is more noticeable with patients that cannot attend the direct conventional education programs. On the other hand, virtual education is available at any time anywhere compared to conventional direct education with no need to regulate time or place. This permanent availability enables individuals to have access to education at any time and use the pedagogic files repeatedly (22-25). Some studies have suggested that the speed of learning is greater in virtual education compared to conventional teaching with at least %50 improvements in speed of learning (26).

Consequently, considering the increasing significance of patient education and updating of pedagogy towards e-learning and identification of factors that affect self-care, this study investigated the effect of promotion of health literacy using virtual education on heart failure patients' self-care.

Material and Methods

This interventional study was a randomized clinical trial registered in www.irct.ir with code

no.: IRCT20190311043021N1. The study population consisted of all heart failure patients presenting to hospitals affiliated to Gachsaran University of Medical Sciences and Healthcare Organization of Gachsaran Petroleum Company, Iran. Patients were in grade two or higher who were being treated with common heart medications. The sample size was estimated 28 people per group based on CI of %5, power test of %80, and SD of self-care score of 14.5 given in Moradi et al.'s study (27), to arrive at a difference of means equal to 11 between the experimental and control groups.

Eligible patients were enrolled in the study using convenience sampling method and then randomly assigned into two groups of 28. A random number table was used for random assignment. Thus, from top to bottom, even numbers were considered for the experimental group and odd numbers for the control group were. The inclusion criteria were: age of 35-70 years, the ability to speak in Persian, being literate on the basis of results of echocardiography in the patient's file, consent for voluntary participation, access to mobile phone, and the ability to use the cyberspace. The exclusion criteria were: affliction with other underlying diseases, inability for self-care, and mental disorders such as depression and psychosis.

Both groups completed questionnaires before and after the intervention. Then, the experimental patients were asked to attend a direct face-to-face session. The iSpring software was installed on their cell phone and they were oriented about how to use the software, and how to study the pedagogic materials and act in question-answer sessions. Besides, the patients that were absent from these sessions, received the software and explanations at their home.

The iSpring Play is one of the instruments designed for e-learning(28). The iSpring Play presents a software that aids the instructors to explain teaching materials better and more easily.

This software converts the power point files into flash format and presents the teaching materials in slides including pictures, animations, clips, and voices in a more ideal and attractive manner leading to a positive effect on the learning process (29).

The intervention lasted for one month. Educational materials in the form of text, photos, animation and short videos were prepared by the researcher (second author) under the supervision of a group of cardiologists, with the help of a software and information technology specialist. This researcher was an MSc. of Critical Care Nursing and had 22 years of experience working in various units, including CCU. The training materials were designed in such a way that patients could understand it. Each week, a topic link, according to Table 1, was made available to participants through WhatsApp or SMS. After sending the link through the same cyberspace system the necessary follow-ups on accessing and understanding the information, and its application and emphasizing the correct points of self-care were performed according to the educational subject on a daily basis by the second author and, if necessary, the participants' questions were answered.

Table 1: Main points of educational program for cardiac failure patients under intervention

Topic 1	Definition of cardiac failure, mechanism and causes of incidence of symptoms of heart failure and the time when the patient should see the doctor.
Topic 2	General principles of treatment of failure including medicinal and surgical treatment, non-pharmaceutical management of heart failure, and factors increasing the risk.
Topic 3	Activity and rest for heart failure patients, contacting with or seeing the physician, and method of daily weight control.
Topic 4	Nutritional diet for heart failure patients, controlling obesity, smoking abstinence, and time of injecting influenza vaccine.

The control group received these teaching materials during physician's visit in the medical office or on discharge. Data were gleaned with two questionnaires:

1. Demographic questionnaire including personal information and disease such as age, gender, marital status, frequency of hospitalizations, and history of disease on the basis of patient's self-report and hospitalization file.
2. Self-care and Heart Failure Index (SCHFI): This checklist was developed by Riegel et al. (2003) and was psychometrically validated (30). It consisted of 15 items with three subscales. There are 4-point and 5-point Likert scale items scored 1-4 and 0-4, respectively. The subscales are:
 1. Maintenance of self-care (items 1-5) as 4-point Likert scale (never/rarely=1, sometimes=2, often=3, and always=4).
 2. Management of self-care (items 6-11): obtaining 0-4 points in the Likert scale. For this part, item 6 was scored in this way: I did not distinguish it=0, I did not distinguish it quickly=1, I distinguished it rather quickly=2, I distinguished it quickly=3, and I distinguished it very quickly=4. Items 7-10 were scored in this way: It is not possible=1, It is relatively possible=2, It is possible=3, It is highly possible=4. Also, item 11 was scored like this: I've taken no measure=0, I'm not sure=1, I'm relatively sure=2, I'm sure=3, I'm very sure=4.
 3. Confidence in self-care (items 12-15): These items obtained 1-4 points: I'm not sure=1, I'm relatively sure=2, I'm very sure=3, I'm extremely sure=4.

Riegel et al. used construct validity (Exploratory and Confirmatory Factor Analysis, i.e., EFA & CFA) to investigate validity and Cronbach's α coefficient for establishing reliability. Their results indicated model fit and validity of the questionnaire. Cronbach's α was 0.56, 0.70, and 0.82 for the subcategories "maintenance of self-

care", "management of self-care" and "confidence in self-care", respectively, and 0.76 for the whole questionnaire indicating the reliability of the instrument (30). The checklist has been used in numerous studies in the country and abroad and its reliability has been investigated (31, 32). In Iran, Moaddab et al. (2014) investigated the content validity of the questionnaire and reported its reliability with Cronbach's α of %80 (33).

The present study has been derived from a research project approved by the Ethics Committee of Isfahan (Khorasgan) Branch, Islamic Azad University, with the code No. IR.IAU.KHUISF.REC.1398.062. All research goals and procedures were elucidated for the patients and they were assured of observation of principles of patient anonymity and information confidentiality. Also, informed written consent was obtained from each patient. They were informed about their voluntary participation and could leave the study at any stage.

The culled data were analyzed with SPSS19 using descriptive statistics (mean, SD, absolute frequency, and relative frequency) and also inferential statistics (independent t-test, paired t-test, Chi-square test, and Fisher's exact test).

Results

In the present study, 28 patients in each group were investigated with no subject attrition. The two experimental and control groups were not statistically significantly different in demographic variables ($P>0.05$) (Table 1).

As it is displayed in Table 2, independent T-test showed that the mean scores of overall self-care behavior and its aspects were not significantly different between the two groups in the pretest ($P>0.05$); yet, the difference was significant in the post-test one month after intervention ($P<0.05$). Moreover, the findings indicated that the mean score of overall self-care behavior

Table 1: Demographics of the experimental and control groups

Variables	Experimental Group (28 patients)		Control Group (28 patients)		P-value
	Mean±SD	N (%)	Mean±SD	N (%)	
Age	56.50±10.12		56.61±9.06		0.96
Gender					1.00
Male		21 (75)		21 (75)	
Female		7 (25)		7 (25)	
Marital Status					1.00
Married		100 (100.00)		100 (100.00)	
Single		0 (0.00)		0 (0.00)	
Frequency of Hospitalization	4.79±5.70		7.43±7.92		0.15
Hospital Stay	5.32±4.56		8.04±7.70		0.11

and its aspects in the experimental and control groups increased after intervention compared to before intervention and the difference was

significant on the basis of the results of paired t-test ($P < 0.05$) (Table 2).

Table 2: Comparison of self-care behavior and its aspects in the experimental and control groups before and one month after intervention

Variables	Experimental Group (28 patients)	Control Group (28 patients)	Independent T-test
	Mean±SD	Mean±SD	
Maintenance of self-care			
Pretest	10.28±2.41	11.37±3.57	t =1.23, P=0.19
Post-test	15.53±2.51	13.07±3.25	t =3.17, P=0.003
Paired t-test	t =12.06, P<0.001	t =7.90, P<0.001	
Management of self-care			
Pretest	11.89±4.56	13.60±4.84	t=1.30, P=0.20
Post-test	19.58±3.78	15.50±3.01	t=4.75, P<0.001
Paired t-test	t =12.37, P<0.001	t =7.33, P<0.001	
Confidence in self-care			
Pretest	8.75±3.01	8.85±3.15	t=1.30, P=0.89
Post-test	13.35±1.96	11.44±2.54	t=3.12, P=0.003
Paired t-test	t =10.53, P<0.001	t=10.80, P<0.001	
Overall self-care behavior			
Pretest	30.92±8.09	33.63±8.95	t=1.12, P=0.26
Post-test	48.75±5.5	39.96±6.16	t=5.48, P<0.001
Paired t-test	t=15.89, P<0.001	t=9.98, P<0.001	

Discussion

This study investigated the effect of promotion of health literacy using virtual education on self-care behaviors in patients with heart failure.

The findings indicated that the mean score of overall self-care behavior and its dimensions increased significantly in both experimental and control groups after intervention compared to before intervention. Consistent with our results, other related studies have demonstrated the improvement of self-care behaviors through increasing awareness via various educational interventions (34-41). A review study reported that conventional teaching methods, teach back, visiting at home with follow-up on the phone, collective teaching, and e-learning have improved heart failure patients' self-care behaviors (42). In the present study, the increase in the control group was due to education given to patients by nurses and physicians at hospitalization and their frequent presentations and also due to individual's own experience induced by frequent hospitalizations. Treatment of heart failure patients is not effective without teaching self-care skills to them. Training with a focus on self-care makes it possible for patients to create the best possible condition for them with the least amount of probable complications in their lives. Their awareness of their current capabilities may lead to greater hope for future, increased self-confidence, absence of seclusion, and finally, increased quality of life (43). Efforts are made to increase the level of health literacy in patients, especially in chronic diseases, with the main goal of empowering them to acquire self-care skills; in this regard, the results of this study showed that improving health literacy is an effective factor on self-care behaviors in patients with heart failure.

Another point to be kept in mind is that a self-care score less than 70 indicates the patient's

insufficient level of self-care (44, 45). The mean score of self-care in the present study was less than 70 despite improvement after intervention. This finding is consistent with the results obtained by Tung et al. (32) and Liou et al. (46). These studies, too, revealed the significant effect of education on enhancing self-care score of heart failure patients, though the mean score after intervention was less than 70. Similar studies have attributed the low score of self-care despite educational program to patient's forgetting to observe their pharmaceutical regimen that can influence the score of maintenance of self-care and, on the whole, the overall score of self-care. Improving self-care behaviors is one of the goals of disease management programs for patients with heart failure. It is essential that self-care behaviors be evaluated while caring for the patient and search for barriers to appropriate behavior. Planned trainings should be developed according to the information obtained from the factors affecting the implementation of self-care behavior.

The findings also suggested that the mean score of self-care and its aspects after intervention was greater in the experimental group compared to the control group and the observed difference was statistically significant. Consistent with our results, other studies have demonstrated that the use of educational technologies (laptop, DVD, and power point), follow-up on the phone, cell phone virtual system, and e-mail have been effective in improving heart failure patients' self-care (23, 47-58). The findings of these studies show that the use of e-learning and educational technology has resulted in increased knowledge and awareness of self-care, improved self-care behavior, decreased cognitive impairment, diminished depression, improved quality of life, increased compliance

with nutritional and pharmaceutical regimens, reduced hospital stay, increased contribution to self-care, and management of self-care (23, 47-58). Nevertheless, not consistent with our findings, some studies have indicated that the use of multimedia has not been effective in patients' self-care (48, 59-64). This may be due to differences in the media used, study population, research instruments, time of investigation, and follow-up. For instance, Boyde (2018) (61), reported no significant differences in any aspects of heart failure self-care through multimedia education compared to routine care. The study by Boyde used DVD, one-to-one discussion, and guidebook with colorful illustrations; although these strategies induced no effect on self-care, they reduced rehospitalization. The study by Wonggom (2020) also found no significant difference in self-care between training group through Avatar software and control group (65).

In the present study, all subscales of self-care behavior indicated separately a significant increase in the experimental group compared to the control group. This finding was not consistent with Liou et al. (46) in the "management of self-care". Their study revealed that the increase in self-care score in "management of self-care" was not significantly different between the two groups. Of course, the intervention in Liou et al.'s study (46) to teach self-care included educational sessions plus pedagogic booklet, video cassettes, daily recording of blood pressure, weight, etc. However, both studies suggested that, totally, the educational program provided, improved patients' self-care significantly.

Promotion of health literacy using virtual education has advantages such as the ability to repeat training, reminder of schedules, personal training, flexibility of time and place and reducing social barriers to face-to-face training and as this study found it, the ability to play an effective role

in helping patient's self-care. This approach, which has many strengths, is significantly easier and cheaper than educating patients in medical and educational care settings and can be used with different methods to suit the target community. Of course, it should be noted that this requires the creation of the necessary infrastructures and tools. Issues such as internet access and its speed and cost should be considered by managers and policymakers.

One limitation of the present study was lack of correct use of the provided education or deficient use of provided virtual education programs. These shortcomings were overcome as far as possible by the researcher's persistence. Another limitation was the short interval of time (one month intervention) used to investigate the effect of education on self-care behavior. Future investigations are advised to use longer periods of time to confirm the effects of interventions.

Conclusion

On the basis of our findings, the mean score of overall self-care increased significantly in patients who underwent education through virtual education. This increase was significant both after intervention compared to before intervention and in the experimental group compared to the control group. Hence, innovative methods based on virtual education can be applied to enhance heart failure patients' self-care behaviors.

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References

- Rafii F, Shahpoorian F, Naasher Z, Azarbaad M, Hosseini F. The importance of learning needs of CHF patients from patients' and nurses' perspective. *Iran Journal of Nursing*. 2009;22(57):19-30.
- Del Gobbo LC, Kalantarian S, Imamura F, Lemaitre R, Siscovick DS, Psaty BM, et al. Contribution of major lifestyle risk factors for incident heart failure in older adults: the Cardiovascular Health Study. *JACC: Heart Failure*. 2015;3(7):520-8. <https://doi.org/10.1016/j.jchf.2015.02.009> PMID:26160366 PMCID:PMC4508377
- Heidenreich PA, Trogon JG, Khavjou OA, Butler J, Dracup K, Ezekowitz MD, et al. Forecasting the future of cardiovascular disease in the United States: a policy statement from the American Heart Association. *Circulation*. 2011;123(8):933-44. <https://doi.org/10.1161/CIR.0b013e31820a55f5> PMID:21262990
- Hekmatpou D, Mohammadi E, Ahmadi F, Arefi SH. Termination of professional responsibility: Exploring the process of discharging patients with heart failure from hospitals. *International journal of nursing practice*. 2010;16(4):389-96. <https://doi.org/10.1111/j.1440-172X.2010.01856.x> PMID:20649671
- Sheikh Sharafi H, Seyed amini B. Assessment of health literacy and self-care in heart failure patients. *Journal of Health Literacy*. 2017;1(4):203-19. <https://doi.org/10.22038/jhl.2017.10854>
- Gholian-Aval M, Tehrani H, Esmaily H. Evaluation of Self-Care Status and Its Relationship with Self-Efficacy of Patients with Hypertension. *Iranian Journal of Health Education and Health Promotion*. 2021;8(4):336-47. <https://doi.org/10.29252/ijhehp.8.4.336>
- Cameron J, Worrall-Carter L, Page K, Stewart S. Self-care behaviours and heart failure: Does experience with symptoms really make a difference? *European Journal of Cardiovascular Nursing*. 2010;9(2):92-100. <https://doi.org/10.1016/j.ejcnurse.2009.10.004> PMID:20441991
- Nichols GA, Brown JB. Unadjusted and adjusted prevalence of diagnosed depression in type 2 diabetes. *Diabetes care*. 2003;26(3):744-9. <https://doi.org/10.2337/diacare.26.3.744> PMID:12610032
- Nieuwenhuis MM, Jaarsma T, van Veldhuisen DJ, Postmus D, van der Wal MH. Long-term compliance with nonpharmacologic treatment of patients with heart failure. *The American journal of cardiology*. 2012;110(3):392-7. <https://doi.org/10.1016/j.amjcard.2012.03.039> PMID:22516525
- Cocchieri A, Riegel B, D'Agostino F, Rocco G, Fida R, Alvaro R, et al. Describing self-care in Italian adults with heart failure and identifying determinants of poor self-care. *European Journal of Cardiovascular Nursing*. 2015;14(2):126-36. <https://doi.org/10.1177/1474515113518443> PMID:24366984
- Buck HG, Mogle J, Riegel B, McMillan S, Bakitas M. Exploring the relationship of patient and informal caregiver characteristics with heart failure self-care using the actor-partner interdependence model: implications for outpatient palliative care. *Journal of palliative medicine*. 2015;18(12):1026-32. <https://doi.org/10.1089/jpm.2015.0086> PMID:26540092
- Lin C-Y, Dracup K, Biddle M, Moser D. Heart Failure Symptom Knowledge Improves Heart Failure Self-Care in Rural Patients with Heart Failure. *Journal of Cardiac Failure*. 2016;22(8):S6. <https://doi.org/10.1016/j.cardfail.2016.06.028>
- Cajita MI, Cajita TR, Han H-R. Health literacy and heart failure: a systematic review. *The Journal of cardiovascular nursing*. 2016;31(2):121-30. <https://doi.org/10.1097/JCN.0000000000000229> PMID:25569150 PMCID:PMC4577469
- de Melo Ghisi GL, da Silva Chaves GS, Britto RR, Oh P. Health literacy and coronary artery disease: A systematic review. *Patient education and counseling*. 2018;101(2):177-84. <https://doi.org/10.1016/j.pec.2017.09.002> PMID:28899710
- Kazemi M, Barkhordari-Sharifabad M, Nasiriani K, Fallahzadeh H. The Correlation of Health Literacy with Quality of Life in Asthmatic Patients. *Iran Journal of Nursing*. 2019;32(121):50-62.
- Rezaee N, Seraji M. Relationship Between Health Literacy and Self-Care in Heart Failure Patients. *Journal of Health Literacy*. 2019;4(1):18-24. <https://doi.org/10.22038/jhl.2019.39135.1044>
- Perrin A, Abdalla G, Viprey M, Delahaye F, Mewton N, Ovize M, et al. Prevalence of low health literacy levels in decompensated heart failure compared with acute myocardial infarction patients. *ESC Heart Failure*. 2021;8: 1446-59. <https://doi.org/10.1002/ehf2.13230> PMID:33544458 PMCID:PMC8006735
- DeWalt DA, Hink A. Health literacy and child health outcomes: a systematic review of the literature. *Pediatrics*. 2009;124(Supplement 3):S265-S74. <https://doi.org/10.1542/peds.2009-1162B> PMID:19861480
- Dervin B, Nilan M. Information needs and uses. *Annual review of information science and technology*. 1986;21:3-33.
- Bowles KH, Dykes P, Demiris G. The use of health information technology to improve care and outcomes for older adults. *Research in gerontological nursing*. 2015;8(1):5-10. <https://doi.org/10.3928/19404921-20121222-01> PMID:25625621 PMCID:PMC4431690
- Alotaibi YK, Federico F. The impact of health information technology on patient safety. *Saudi medical journal*. 2017;38(12):1173-80. <https://doi.org/10.15537/smj.2017.12.20631> PMID:29209664 PMCID:PMC5787626
- Howie-Esquivel J, Bibbins-Domingo K, Clark R, Evangelista L, Dracup K. A culturally appropriate educational intervention can improve self-care in Hispanic patients with heart failure: a pilot randomized controlled trial. *Cardiology research*. 2014;5(3-4):91-100. <https://doi.org/10.14740/cr346w> PMID:28348704 PMCID:PMC5358169
- Clark AP, McDougall G, Riegel B, Joiner-Rogers G, Innerarity S, Meraviglia M, et al. Health status and self-care outcomes following an education-support intervention for people with chronic heart failure. *The Journal of cardiovascular nursing*. 2015;30(4 0 1):S3-S13. <https://doi.org/10.1097/JCN.0000000000000169> PMID:24978157 PMCID:PMC4276559
- Longo DL, Fauci AS, Kasper DL, Hauser SL, Jameson JL, Loscalzo J. *Harrison's principles of internal medicine*. 18 ed. New York: McGraw-hill New York; 2012.
- Radović-Marković M. Advantages and disadvantages of e-learning

- in comparison to traditional forms of learning. *Annals of the University of Petroșani, Economics*. 2010;10(2):289-98.
26. Salehmoghaddam AR, Khosravi Bonjar A, Karimi Moonaghi H, Gholami H. An investigation of the Effect of E-learning education method on dietary regimen in type 2 diabetic patients. *Evidence Based Care*. 2013;3(3):51-8.
 27. Moradi Y, Aghakarimi K, Rahmani A, Sheikhy N. Effect of applying follow-up care model on self-care management in heart failure patients: a randomized clinical trial. *The J Urmia Nurs Midwifery Fac*. 2017;15(3):208-17
 28. Lopes AP, Soares F, Teles C, Rodrigues A, Torres C, Lopes IC. Creating interactive learning materials to promote statistical skills in higher education *Proceedings of INTED2020 Conference; Valencia, Spain2020*. p. 4160-6. <https://doi.org/10.21125/inted.2020.1155>
 29. Anwar MS, Choirudin C, Ningsih EF, Dewi T, Maselena A. Developing an Interactive Mathematics Multimedia Learning Based on Ispring Presenter in Increasing Students' Interest in Learning Mathematics. *Al-Jabar: Jurnal Pendidikan Matematika*. 2019;10(1):135-50. <https://doi.org/10.24042/ajpm.v10i1.4445>
 30. Riegel B, Carlson B, Moser DK, Sebern M, Hicks FD, Roland V. Psychometric testing of the self-care of heart failure index. *Journal of cardiac failure*. 2004;10(4):350-60. <https://doi.org/10.1016/j.cardfail.2004.06.409> <https://doi.org/10.1016/j.cardfail.2003.12.001> PMID:15309704
 31. Riegel B, Moser DK, Anker SD, Appel LJ, Dunbar SB, Grady KL, et al. State of the science: promoting self-care in persons with heart failure: a scientific statement from the American Heart Association. *Circulation*. 2009;120(12):1141-63. <https://doi.org/10.1161/CIRCULATIONAHA.109.192628> PMID:19720935
 32. Tung HH, Lin CY, Chen KY, Chang CJ, Lin YP, Chou CH. Self-management intervention to improve self-care and quality of life in heart failure patients. *Congestive Heart Failure*. 2013;19(4):E9-E16. <https://doi.org/10.1111/chf.12014> PMID:23279120
 33. Moadab F, Ghanbari A, Salari A, Kazemnejad E, Sadaghi Sabet M, Pariad E. Study status of self-care behaviors and gender differences in patients with heart failure. *Journal of Payavard Salamat*. 2014;8(3):220-34.
 34. Wu J-R, Moser DK, DeWalt DA, Rayens MK, Dracup K. Health literacy mediates the relationship between age and health outcomes in patients with heart failure. *Circulation: Heart Failure*. 2016;9(1):e002250. <https://doi.org/10.1161/CIRCHEARTFAILURE.115.002250>
 35. Seraji M, Tabatabaie P, Rakhshani F, Shahrakipour M. The Effect of educating self-care behaviors to patients with heart failure in hospitals of Zahedan. *Health Scope*. 2013;2(1):104-9. <https://doi.org/10.17795/jhealthscope-11414>
 36. Krumholz HM, Amatruda J, Smith GL, Mattera JA, Roumanis SA, Radford MJ, et al. Randomized trial of an education and support intervention to prevent readmission of patients with heart failure. *Journal of the American College of Cardiology*. 2002;39(1):83-9. [https://doi.org/10.1016/S0735-1097\(01\)01699-0](https://doi.org/10.1016/S0735-1097(01)01699-0)
 37. Artinian NT, Magnan M, Sloan M, Lange MP. Self-care behaviors among patients with heart failure. *Heart & Lung*. 2002;31(3):161-72. <https://doi.org/10.1067/mhl.2002.123672> PMID:12011807
 38. Strömberg A, Mårtensson J, Fridlund B, Levin L-Å, Karlsson J-E, Dahlström U. Nurse-led heart failure clinics improve survival and self-care behaviour in patients with heart failure: results from a prospective, randomised trial. *European heart journal*. 2003;24(11):1014-23. [https://doi.org/10.1016/S0195-668X\(03\)00112-X](https://doi.org/10.1016/S0195-668X(03)00112-X)
 39. Navidian A, Yaghoobinia F, Ganjali A, Khoshsimae S. The effect of self-care education on the awareness, attitude, and adherence to self-care behaviors in hospitalized patients due to heart failure with and without depression. *PLoS one*. 2015;10(6):e0130973. <https://doi.org/10.1371/journal.pone.0130973> PMID:26091101 PMCID:PMC4475047
 40. Gheiasi SF, Roohani M, Hanifi N, Kamali K. The impact of a training program based on learning needs on self-care behaviors among patients with Heart failure. *Evidence Based Care*. 2017;7(1):15-24.
 41. Hwang B, Pelter MM, Moser DK, Dracup K. Effects of an educational intervention on heart failure knowledge, self-care behaviors, and health-related quality of life of patients with heart failure: Exploring the role of depression. *Patient Education and Counseling*. 2020;103(6):1201-8. <https://doi.org/10.1016/j.pec.2020.01.007> PMID:31964579 PMCID:PMC7253326
 42. Salahodinkolah MK, Ganji J, Moghadam SH, Shafipour V, Jafari H, Salari S. Educational intervention for improving self-care behaviors in patients with heart failure: A narrative review. *Journal of Nursing and Midwifery Sciences*. 2020;7(1):60-8. https://doi.org/10.4103/JNMS.JNMS_19_19
 43. Riegel B, Driscoll A, Suwanno J, Moser DK, Lennie TA, Chung ML, et al. Heart failure self-care in developed and developing countries. *Journal of cardiac failure*. 2009;15(6):508-16. <https://doi.org/10.1016/j.cardfail.2009.01.009> PMID:19643362 PMCID:PMC2745342
 44. Riegel B, Dickson VV, Faulkner KM. The situation-specific theory of heart failure self-care: revised and updated. *Journal of Cardiovascular Nursing*. 2016;31(3):226-35. <https://doi.org/10.1097/JCN.0000000000000244> PMID:25774844
 45. Cené CW, Haymore LB, Dolan-Soto D, Lin F-C, Pignone M, DeWalt DA, et al. Self-care confidence mediates the relationship between perceived social support and self-care maintenance in adults with heart failure. *Journal of cardiac failure*. 2013;19(3):202-10. <https://doi.org/10.1016/j.cardfail.2013.01.009> PMID:23482082 PMCID:PMC3596888
 46. Liou H-L, Chen H-I, Hsu S-C, Lee S-C, Chang C-J, Wu M-J. The effects of a self-care program on patients with heart failure. *Journal of the Chinese Medical Association*. 2015;78(11):648-56. <https://doi.org/10.1016/j.jcma.2015.06.004> PMID:26190378
 47. Baert A, Clays E, Bolliger L, De Smedt D, Lustrek M, Vodopija A, et al. A personal decision support system for heart failure management (heartman): study protocol of the heartman randomized controlled trial. *BMC cardiovascular disorders*. 2018;18(186):1-9. <https://doi.org/10.1186/s12872-018-0921-2> PMID:30261836 PMCID:PMC6161437
 48. Boyde M, Peters R, Hwang R, Korczyk D, Ha T, New N. The self-care educational intervention for patients with heart failure: A study protocol. *Journal of Cardiovascular Nursing*. 2017;32(2):165-70.

- <https://doi.org/10.1097/JCN.0000000000000318>
PMid:26696034
49. Cameron J, Rendell PG, Ski CF, Kure CE, McLennan SN, Rose NS, et al. PROspective MEMory Training to improve HEart failUre Self-care (PROMETHEUS): study protocol for a randomised controlled trial. *Trials*. 2015;16(196):1-14. <https://doi.org/10.1186/s13063-015-0721-2> PMid:25927718 PMCID:PMC4419391
 50. Dunbar SB, Reilly CM, Gary R, Higgins MK, Culler S, Butts B, et al. Randomized clinical trial of an integrated self-care intervention for persons with heart failure and diabetes: quality of life and physical functioning outcomes. *Journal of cardiac failure*. 2015;21(9):719-29. <https://doi.org/10.1016/j.cardfail.2015.05.012> PMid:26028261 PMCID:PMC4554817
 51. Köberich S, Lohrmann C, Mittag O, Dassen T. Effects of a hospital-based education programme on self-care behaviour, care dependency and quality of life in patients with heart failure—a randomised controlled trial. *Journal of clinical nursing*. 2015;24(11-12):1643-55. <https://doi.org/10.1111/jocn.12766> PMid:25661470
 52. Smith CE, Piamjariyakul U, Dalton KM, Russell C, Wick J, Ellerbeck EF. Nurse-led multidisciplinary heart failure group clinic appointments: methods, materials and outcomes used in the clinical trial. *The Journal of cardiovascular nursing*. 2015;30(4 0 1):S25-S34. <https://doi.org/10.1097/JCN.0000000000000255> PMid:25774836 PMCID:PMC4464953
 53. Stamp KD, Dunbar SB, Clark PC, Reilly CM, Gary RA, Higgins M, et al. Family partner intervention influences self-care confidence and treatment self-regulation in patients with heart failure. *European Journal of Cardiovascular Nursing*. 2016;15(5):317-27. <https://doi.org/10.1177/1474515115572047> PMid:25673525 PMCID:PMC4532663
 54. Taylor RS, Hayward C, Eyre V, Austin J, Davies R, Doherty P, et al. Clinical effectiveness and cost-effectiveness of the Rehabilitation Enablement in Chronic Heart Failure (REACH-HF) facilitated self-care rehabilitation intervention in heart failure patients and caregivers: rationale and protocol for a multicentre randomised controlled trial. *BMJ open*. 2015;5(12):e009994. <https://doi.org/10.1136/bmjopen-2015-009994> PMid:26700291 PMCID:PMC4691763
 55. Boyne JJ, Vrijhoef HJ, Spreeuwenberg M, De Weerd G, Kragten J, Gorgels AP, et al. Effects of tailored telemonitoring on heart failure patients' knowledge, self-care, self-efficacy and adherence: a randomized controlled trial. *European Journal of Cardiovascular Nursing*. 2014;13(3):243-52. <https://doi.org/10.1177/1474515113487464> PMid:23630403
 56. Dasky KH, Vasey J, Bowles K. Use of telehealth by older adults to manage heart failure. *Research in Gerontological Nursing*. 2008;1(1):25-32. <https://doi.org/10.3928/19404921-20080101-01> PMid:20078015
 57. Shively MJ, Gardetto NJ, Kodiath MF, Kelly A, Smith TL, Stepnowsky C, et al. Effect of patient activation on self-management in patients with heart failure. *Journal of Cardiovascular Nursing*. 2013;28(1):20-34. <https://doi.org/10.1097/JCN.0b013e318239f9f9> PMid:22343209
 58. Boyde M, Song S, Peters R, Turner C, Thompson DR, Stewart S. Pilot testing of a self-care education intervention for patients with heart failure. *European Journal of Cardiovascular Nursing*. 2013;12(1):39-46. <https://doi.org/10.1177/1474515111430881> PMid:22357784
 59. Srisuk N, Cameron J, Ski CF, Thompson DR. Randomized controlled trial of family-based education for patients with heart failure and their carers. *Journal of advanced nursing*. 2017;73(4):857-70. <https://doi.org/10.1111/jan.13192> PMid:27779768
 60. Cockayne S, Pattenden J, Worthy G, Richardson G, Lewin R. Nurse facilitated self-management support for people with heart failure and their family carers (SEMAPHFOR): a randomised controlled trial. *International Journal of Nursing Studies*. 2014;51(9):1207-13. <https://doi.org/10.1016/j.ijnurstu.2014.01.010> PMid:24508285
 61. Boyde M, Peters R, New N, Hwang R, Ha T, Korczyk D. Self-care educational intervention to reduce hospitalisations in heart failure: a randomised controlled trial. *European Journal of Cardiovascular Nursing*. 2018;17(2):178-85. <https://doi.org/10.1177/1474515117727740> PMid:28832179
 62. Smeulders ES, van Haastregt JC, Ambergen T, Stoffers HE, Janssen-Boyne JJ, Uszko-Lencer NH, et al. Heart failure patients with a lower educational level and better cognitive status benefit most from a self-management group programme. *Patient education and counseling*. 2010;81(2):214-21. <https://doi.org/10.1016/j.pec.2010.01.003> PMid:20153132
 63. Veroff DR, Sullivan LA, Shoptaw E, Venator B, Ochoa-Arvelo T, Baxter JR, et al. Improving self-care for heart failure for seniors: the impact of video and written education and decision aids. *Population health management*. 2012;15(1):37-45. <https://doi.org/10.1089/pop.2011.0019> PMid:22004181
 64. Ross A, Ohlsson U, Blomberg K, Gustafsson M. Evaluation of an intervention to individualise patient education at a nurse-led heart failure clinic: a mixed-method study. *Journal of clinical nursing*. 2015;24(11-12):1594-602. <https://doi.org/10.1111/jocn.12760> PMid:25753064
 65. Wonggom P, Nolan P, Clark RA, Barry T, Burdeniuk C, Nesbitt K, et al. Effectiveness of an avatar educational application for improving heart failure patients' knowledge and self-care behaviors: A pragmatic randomized controlled trial. *Journal of advanced nursing*. 2020;76(9):2401-15. <https://doi.org/10.1111/jan.14414> PMid:32395836