

Original Article

Hospital Facilities at Home for Heart Failure Patients

Shiva Khaleghparast, PhD¹; Alireza Maleki, MD^{2*}; Sepideh Taghavi, MD¹;
Ahmad Amin, MD¹; Majid Maleki, MD³; Mehrdad Oveisi, PhD¹;
Behrooz Ghanbari, PhD⁴; Zahra Hanifi, BS¹; Nasim Naderi, MD¹

ABSTRACT

Background: Heart failure is a complex syndrome and also one of the common reasons for readmission following discharge. This condition imposes an enormous economic burden on healthcare sectors. The present research aimed to study the establishment of a home care system for patients with heart failure in order to evaluate the cost-effectiveness of this system and patient satisfaction.

Methods: The present health system research selected 40 patients as the sample with eligible criteria. Care was provided by nurses based on physicians' instructions. In the first visit at home, a questionnaire on the quality of life was filled out by the patients or the nurses. The financial data of the medical records of the patients constituted the reference for the analysis of cost. After the intervention, the questionnaire on the quality of life was filled out by the patients once again and their satisfaction was measured. The data were statistically analyzed using the Python programming language and SPSS-16 at the 0.05 level of significance.

Results: The length of stay in the hospital for each patient decreased from 2.1 days to 0.9 days per month. The number of annual hospitalizations also decreased from 5 to 3, and the number of annual outpatient visits showed a reduction from 46 to 38 for each patient. The results of the patient satisfaction assessment also indicated that most of the patients were satisfied with the services provided to them.

Conclusions: The results showed that our study was cost-effective. We suggest that interventions be performed on larger scales so that the results can be used in the future as services available to patients with heart failure. (*Iranian Heart Journal 2020; 21(1): 34-44*)

KEYWORDS: Home care, Heart failure, Hospital facilities

¹ Rajaie Cardiovascular, Medical, and Research Center, Iran University of Medical Sciences, Tehran, IR Iran.

² Department of Anesthesiology, Hazrat Rasool Akram Hospital, Iran University of Medical Sciences, Tehran, IR Iran.

³ Cardiovascular Intervention Research Center, Rajaie Cardiovascular, Medical, and Research Center, Iran University of Medical Sciences, Tehran, IR Iran.

⁴ Gastrointestinal and Liver Disease Research Center, Iran University of Medical Sciences, Tehran, IR Iran.

*Corresponding Author: Alireza Maleki, MD; Hazrat Rasool Akram Hospital, Iran University of Medical Sciences, Tehran, IR Iran.

Email: alireza_maleki15@yahoo.com

Tel: 02123922192

Received: February 12, 2019

Accepted: April 26, 2019

Hear failure (HF) is a complex, chronic, and debilitating clinical syndrome and also one of the common reasons for readmission following discharge.¹⁻⁵ This condition not only increases complications and mortality while reducing the quality of life in the process⁶ but also imposes an enormous economic burden on the healthcare sector. The insufficient attention of patients to the recommendations made by the treatment team is a contributing factor for a 50% rate of readmission in patients with HF.^{7,8} The statistics show that approximately 5.1 to 5.8 million individuals in the United States and 26 million worldwide suffer from HF, accounting for 1%–3% of the general population.⁹ In Iran, 3.3% of adults are afflicted with HF.¹⁰ The prevalence of HF increases with age, reaching 8.4% and 17.4% among people aged 75 and 85 years, respectively. This disease is the most common reason for hospitalization of individuals aged over 65 years in the United States and Europe. In addition, it is the cause of 18%–27% of readmissions within the first month and 50% of readmissions during the first 6 months following discharge.⁹ Although the mortality rate of this disease has decreased overall, its 5-year mortality rate is still equal to that of most cancers,¹¹ accounting for its description as a malignancy and its very difficult prognosis. The signs and symptoms increase as the disease progresses, and patients exhibit symptoms such as pain, dyspnea, and fatigue. Moreover, this disease negatively affects the quality of life and the psychosocial status of patients.² The high complications and mortality of this disease can lead to an increase in treatment costs. Approximately 1%–2% of national health costs in the United States and Britain are spent on patients with HF, 80% of which is related to hospitalization costs.⁹ These patients do not adhere to their medical

treatment plan according to the guidelines. Therefore, they need a complex and multidisciplinary care program. Without periodic interventions and follow-ups, they will need emergency hospitalization or readmission. This indicates the importance of continuous care and the expansion of professional services at home. Home care, remote monitoring, outpatient clinics, communications, and follow-ups by professional team members can increase the safety, satisfaction, and quality of life of these patients after discharge.^{1-3, 12, 13} Quality of life, as a quality index for health systems, decreases in chronic patients after discharge.¹⁴ Hence, these patients need an emotional system that not only saves medical costs but also improves their clinical outcomes and quality of life.^{2, 15, 16} Recent studies have shown that home care interventions reduce mortality up to 34% and readmission by 30%–56% in patients with HF.⁸ However, there are still doubts with regard to the cost-effectiveness of this system¹⁵ and there is a need for the development of evidence to back this approach.² To the best of our knowledge, no study has been conducted in Iran about the establishment of this system for patients with HF. Hence, the present research aimed to study the establishment of a home care system for patients with advanced HF referred to the Heart Failure Department of Rajaie Cardiovascular, Medical, and Research Center (RCMRC), tertiary center for HF programs in Iran, in order to evaluate the cost-effectiveness of this system and patient satisfaction.

METHODS

Design

The present research was aimed at studying satisfaction with regard to the cost-effectiveness of a health system. To begin, a home care center was established for patients with HF at RCMRC. Manpower,

equipment, and appropriate physical space were provided in accordance with the instructions set out by Iran's Ministry of Health and Medical Education (139/d/672-2016 July 25).

Data Collection

The statistical population comprised all patients with HF hospitalized at RCMRC from August 2017 to March 2018. Based on the convenience sampling method, 40 patients were selected as the sample group consecutively. The inclusion criteria were those with advanced HF¹⁷ aged over 18, residing in Tehran, an ejection fraction < 30%, a history of frequent hospitalization, at least on rehospitalization within 6 months, no history of surgery in the last 2 months, and willingness to obtain home care services. Patients with severe cognitive impairment or those who needed dialysis during the intervention were excluded from the study.

Ethical Considerations

First, a workshop consisting of a briefing session was scheduled for the staff where they were provided with necessary explanations on communication with patients/families; professional code of conducts and dress codes; ethical principles; and principles of HF management including guideline-directed medical therapies, self-care measures, and HF nursing roles and strategies. The study protocol was approved by the ethics committee of RCMRC (IR.RHC.REC.1397.001).

Investigation

When patients with advanced HF were being discharged, their medical records were reviewed by an HF specialist for the eligibility of enrollment. Finally, 40 patients were enrolled in this study. An informed

consent form was obtained, and the patients' basic information was recorded. Care was provided by a nurse holding at minimum a bachelor's degree and based on the instructions made by the physician. In the first visit at home, a questionnaire on the quality of life was filled out by the patients themselves or with help from the nurses. The care provided at home included control of vital signs; physical examination; diet and medication training; weight control; absorption and excretion control through training and documentation; the administration of necessary medications such as diuretics; and blood sampling for blood chemistry, electrolytes, and coagulation status based on the patients' condition and physician's preference. Self-care was taught to the patients and monitored. In addition, phone follow-ups involved answering the patients' questions, clearing any ambiguities, and emphasizing compliance with the instructions.

The financial data of the medical records of the patients constituted the reference for the analysis of hospitalization and outpatient service cost. The visitation costs consisted of staff costs, supplies and equipment, and personnel transfer and phone follow-up costs included the cost of phone calls and the wage of experts calling the patients. Patients' quality of life was the criteria for measuring the effectiveness of the study. Moreover, the number of readmissions, the length of stay at the hospital, man-hour (the amount of work performed by the average worker in 1 hour), and patient satisfaction with both the system and the provided care were also determined.

Analysis

Cost-effectiveness analysis was performed in 3 stages. In the first stage, all costs consisting of nursing care, telephone follow-ups, referrals to the clinic, hospital

admissions, laboratory and pharmaceutical services, and personnel costs during the 6 months before and after the implementation of the study were calculated and compared with each other. In the second stage, the number of readmissions, the length of stay at the hospital, and the patients' quality of life were compared before and after the intervention. The required data were collected using a 3-part questionnaire, consisting of the personal information of the patients (14 items), disease-related factors (15 items), and quality of life¹⁸ (13 items: physical dimension, 14 items: psychological dimension, 9 items: socioeconomic dimension, and 4 items: general health dimension). The items were scored based on a 5-point Likert scale from "very much"⁵ to "not at all".¹ Higher scores indicate a higher quality of life. The minimum and maximum scores on this questionnaire were 40 and 200, respectively. The quality of life scores of 200 and 40 were determined as the highest level of effectiveness (with a mean of 5) and a lack of effectiveness (a mean of 1), respectively. This questionnaire was used by Rezaei in 2006, and its validity has been confirmed by experts. In addition, the reliability of this questionnaire has been reported to be 91%.¹⁸ In the third stage, a cost-effectiveness analysis was done in 3 steps consisting of the comparison of cost-effectiveness before and after the intervention, the determination of the incremental cost-effectiveness ratio (ICER), and a sensitivity analysis. The sensitivity analysis itself was performed in 3 stages as follows: the identification of non-deterministic parameters, including the cost of treatment and patient recovery; the determination of the acceptable range for changing the non-deterministic parameters by making a change of 5% in treatment costs; and the calculation for the ratio of incremental cost-effectiveness using new values of the parameters.

The quality of life questionnaire was refilled out by all the study population after completing the home care course, and their satisfaction was measured. The satisfaction form measured the patients' satisfaction in 4 areas of admission, physician, nurse, and equipment and facilities based on a 3-point Likert scale from "Yes" (2) to "No" (0). The data were statistically analyzed using the Python programming language and SPSS-16 at the 0.05 level of significance.

RESULTS

Out of 40 patients participating in the study, 21 (52%) patients were male and the educational attainment of half of these individuals was at an elementary school level. The demographic information of the participants is shown in Table 1. Since the patients were added to the home care project on different days, the mean and standard deviation of the number of study days before and after the implementation of the plan was 96.25 ± 35.80 and 97.75 ± 35.80 , respectively.

During the implementation of this plan, a total of 138 home visits and 473 phone consultation sessions were provided to the patients. The total number of patients' referrals for admission before and after the implementation of the study was 54 and 34, respectively. Table 2 shows all the treatment costs by services before and after the implementation of the home care (for 40 patients for 6 months).

The results of the cost analysis also indicated that the mean total finished cost per patient was reduced by 50% after the study. In addition, the total monthly cost paid by the patients showed a reduction of about 61%. The finished cost for the implementation of home care in our study was considered by adjusting the number of service providers from 2 to 1 while

considering one-tenth of the equipment cost as wear and tear.

Figure 1 shows the finished costs for each patient per month in payment systems.

Table 1. Demographic characteristics of the patients participating in the study

		Frequency	Percentage
Sex	Male	21	52.5
	Female	19	47.5
Age	>=51	36	90
	41-50	2	5
	31-40	2	5
Marital status	Married	29	72.5
	Single	11	27.5
Education	Elementary	20	50
	Diploma	10	25
	High school	7	17.5
	Bachelor's degree	2	5
	Postgraduate	1	2.5
Jobs	Housewife	14	35
	Retired	9	22.5
	Unemployed	9	22.5
	Worker	5	12.5
	Freelance	2	5
	Employee	1	2.5

Table 2. Treatment costs by services before and after the implementation of the home care

	Type	Inpatient	Outpatient	Visits	Calls	Total
	Stage					
Pt_Fee	Before	15,411	7,717	0	0	23,127
	After	3,055	5,914	0	0	8,969
Ins_Fee	Before	203,997	13,675	0	0	217,672
	After	78,040	10,006	0	0	88,047
Other_Fee	Before	20,506	3,092	0	0	23,598
	After	19,930	2,426	0	0	22,356
Home care_Fee	Before	0	0	0	0	0
	After	0	0	11,532	2,659	14,192
Total	Before	239,913	24,484	0	0	264,398
	After	101,026	18,346	11,532	2,659	133,563
	All	340,939	42,830	11,532	2,659	397,961

*All fees are in 10,000 Rials.

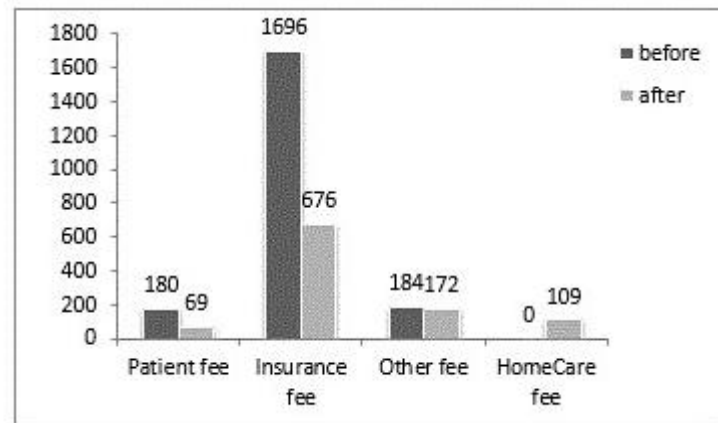


Figure 1. Finished costs for each patient per month in payment systems
 * All fees are in 10,000 Rials.

By adding the cost spent on the implementation of the home care to the costs paid by insurance companies, we observed a 32% reduction in the insurance costs. In

addition, reducing the number of service providers and equipment led to a 54% reduction in costs (Fig. 2).

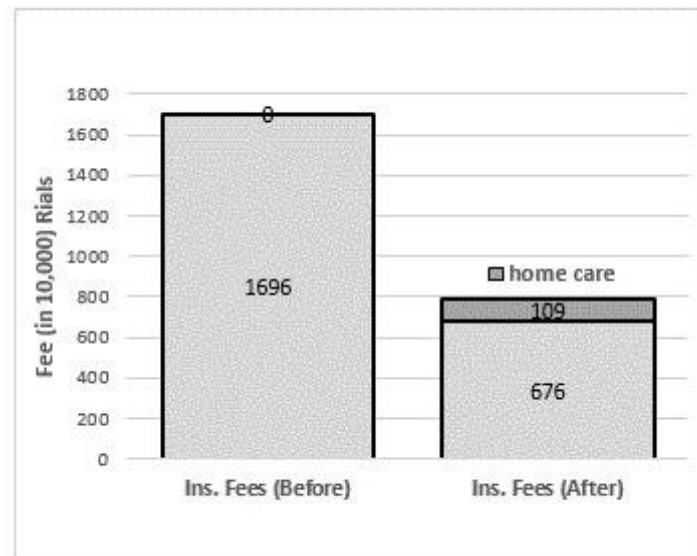


Figure 2. Comparison of the finished cost of insurance companies before and after the implementation of the study

The mean quality of life score among the studied patients before and after the implementation of the home care was 2.4 ± 0.39 and 2.9 ± 0.39 , respectively.

Accordingly, there was a significant difference between the quality of life before and after the intervention ($P < 0.001$) (Table 3).

Table 3. Comparison of the mean quality of life before and after the home care intervention

Variable \ Index		Mean	Standard deviation	Paired t-statistic	Degree of freedom	Probability value	95% confidence interval	
							Lower limit	Upper limit
Quality of life	Before the intervention	2.4	0.39	-17.44	62	<0.001	-0.52	-0.41
	After the intervention	2.9	0.39					

Based on the study results, the length of stay at the hospital for each patient decreased from 2.1 days to 0.9 days per month. The number of annual hospitalization also decreased from 5 to 3, and the number of annual outpatient visits showed a reduction from 46 to 38 for each patient. The results of the patient satisfaction assessment also indicated that 94% of the patients were satisfied with the services provided. Figure 3 shows the outcomes of the home care intervention.

Considering the cost-effectiveness ratio data, the cost for each unit of increase in the quality of life score after the intervention was less than that before the intervention. Given that medical prices varied during the

6 months before and after the intervention, the incremental cost-effectiveness ratio determined a total reduction in medical costs with 1 unit of increase in the mean quality of life after the home care intervention.

After the completion of the sensitivity analysis with a 5% change in medical costs and the recalculation of incremental cost-effectiveness, this ratio was not significantly different from the main findings without any change in medical costs. Therefore, it can be stated that the study findings are of acceptable strength. In addition, the man-hour for physician and nurse was equal to half an hour and 4 hours for each patient during a day, respectively.

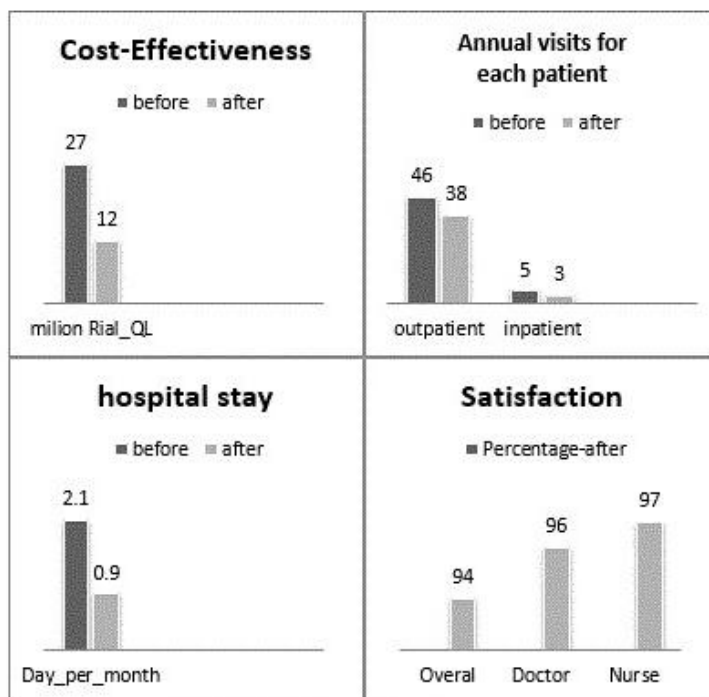


Figure 3. Outcomes of the home care intervention

DISCUSSION

The study results showed that the home care intervention significantly reduced the mean monthly cost of home care for each patient. In addition, the length of stay at the hospital and the annual number of admissions showed a reduction after the intervention. The results also indicated that the quality of life significantly increased after the home care intervention and the patients were greatly satisfied with the services provided to them.

In a study conducted by Maru et al¹ (2015), home care intervention led to a higher quality of life and lower medical costs for patients with chronic HF in a 3.2-year follow-up period. They also illustrated that home care interventions significantly reduced the length of stay at the hospital. Finally, their findings suggested that home care interventions were more cost-effective than hospital interventions for old patients with HF.

Alina et al² (2018) reported a significant difference in the mean score of quality of life between 2 groups of patients with HF who received home care intervention and conventional treatment. However, they observed no significant difference between the 2 groups in terms of distress symptoms or performance status during a 12-week follow-up period. Patient satisfaction was higher and the working pressure of nurses was lower in the intervention. In addition, the home care intervention reduced some of the disease symptoms.

Cowie et al³ (2010) reported a study conducted by Tibaldi in Italy, in which 2 interventions consisting of home care without a cardiologist and hospital intervention (physicians and nurses) were compared with each other. The home care and hospital interventions lasted 21 and 12 days, respectively. The home care services included the establishment of the venous

route, blood pressure check, and the administration of intravenous drugs. In the present study, the home care services also consisted of vital signs control, training, and intravenous injections of necessary drugs. The readmission rate was reported the same in both groups by Cowie and colleagues, while the readmission rate showed a reduction after the home care intervention in the present study. This difference may be due to the shorter duration and lower number of visits at home in the study by Cowie and coworkers. By contrast, the cost of home care was lower than hospitalization, which is consistent with the findings of the present study. It is noteworthy that part of the home care intervention in the present study was related to training and telephone follow-ups.

Hugylund et al⁸ (2015) emphasized the significance of training patients with HF and its impact on the improvement of their quality of life. Additionally, training reduced the hospitalization days of the patients,¹⁹⁻²¹ which is consistent with the findings of the present study. Baglimeyhem et al¹⁰ (2013) showed that training was effective in promoting the health behavior of their patients with HF. In this regard, Chen et al¹⁵ (2010) stated that telephone counseling by trained nurses significantly reduced the hospitalization rate (all-cause admission). In addition, it reduced the hospitalization days by 8 days and the 6-month medical expenses by 2682 dollars for each patient.

In the present study, the quality of life score presented a significant increase after the home care intervention. This is consistent with the results of many previous studies.^{1, 8, 16} The reduced length of stay and readmission rate after the home care intervention in the present study are also consistent with many previous studies.^{3, 7-9, 12, 15, 22}

Overall, the study findings indicated the cost-effectiveness of home care intervention

for patients with HF. Ottawa²³ (2015) reported that the use of telehealth services such as telephone support or telemonitoring reduced the rate of hospitalization and mortality and improved the quality of life and lifestyle of patients. Telemonitoring reduces hospitalization and death due to HF and all other causes. However, the use of telemonitoring in the hospitals of the Netherlands made no significant difference in the annual medical costs of patients. Cost-effectiveness indicated the high level of uncertainty in decision-making. Another study conducted in the Netherlands also showed that telemonitoring failed to cause a significant difference in patients' quality of life and their annual costs. The results of a study conducted in Canada in 2013 showed no significant difference between 3 groups of conventional care, telephone intervention, and telemonitoring intervention in terms of medical costs.¹³

Kendall Ho¹² (2016) showed that the telemonitoring of patients with HF at home was a cost-effective strategy to reduce the rate of revisits and readmissions and it was able to improve their comfort and quality of life in a 90-day period. This difference can be due to the non-provision of home care services by expert personnel and the mere provision of telemonitoring and telephone follow-ups for patients in previous studies.

CONCLUSIONS

In summary, the present study suggested the cost-effectiveness of the home care intervention for patients with HF. Sahlen et al¹¹ (2016) also indicated that home care was a cost-effective strategy for patients insofar as it saved resources. Reduced medical costs through home visitations have been also reported in many other studies.^{2, 3, 7, 9, 11, 12, 15, 24}

Undoubtedly, modern home care systems for patients with HF require multidisciplinary services so that patients and their families can have access to various specialties at the required time. Many patients may need to be hospitalized for these reasons, but many of these cases can be potentially prevented through the proper management of chronic diseases, effective communication, and the correct monitoring of conditions by patients and medical teams. If such an intervention is performed on larger scales, the results can be used in the future as services available to patients suffering from HF.

REFERENCES

1. Maru S, Byrnes J, Carrington MJ, et al. Cost-effectiveness of home versus clinic-based management of chronic heart failure: Extended follow-up of a pragmatic, multicentre randomized trial cohort—The WHICH? study (Which Heart Failure Intervention Is Most Cost-Effective & Consumer Friendly in Reducing Hospital Care). *International journal of cardiology*. 2015;201:368-75.
2. Ng AYM, Wong FKY. Effects of a Home-Based Palliative Heart Failure Program on Quality of Life, Symptom Burden, Satisfaction and Caregiver Burden: A Randomized Controlled Trial. *Journal of pain and symptom management*. 2018;55(1):1-11.
3. Cowie MR. "Hospital at home" care shows similar mortality and subsequent hospital admissions to hospital care for older patients with acutely decompensated chronic heart failure. *Evidence-based medicine*. 2010;15(1).
4. Amin A, Chitsazan M, Shiukhi Ahmad Abad F, Taghavi S, Naderi N. On admission serum sodium and uric acid levels predict 30 day rehospitalization or death in patients with acute decompensated heart failure. *ESC heart failure*. 2017;4(2):162-8.

5. Haghjoo M, Bagherzadeh A, Fazelifar AF, et al. Prevalence of mechanical dyssynchrony in heart failure patients with different QRS durations. *Pacing and clinical electrophysiology*. 2007;30(5):616-22.
6. Haghighi ZO, Naderi N, Amin A, et al. Quantitative assessment of right atrial function by strain and strain rate imaging in patients with heart failure. *Acta cardiologica*. 2011;66(6):737-42.
7. Stewart S, Carrington MJ, Marwick TH, et al. Impact of home versus clinic-based management of chronic heart failure: the WHICH?(Which Heart Failure Intervention Is Most Cost-Effective & Consumer Friendly in Reducing Hospital Care) multicenter, randomized trial. *Journal of the American College of Cardiology*. 2012;60(14):1239-48.
8. Hägglund E, Lyngå P, Frie F, et al. Patient-centred home-based management of heart failure: Findings from a randomised clinical trial evaluating a tablet computer for self-care, quality of life and effects on knowledge. *Scandinavian Cardiovascular Journal*. 2015;49(4):193-9.
9. Punchik B, Komarov R, Gavrikov D, et al. Can home care for homebound patients with chronic heart failure reduce hospitalizations and costs? *PloS one*. 2017;12(7):e0182148.
10. Baghianimoghadam MH, Shogafard G, Sanati HR, Baghianimoghadam B, Mazloomi SS, Askarshahi M. Application of the health belief model in promotion of self-care in heart failure patients. *Acta Medica Iranica*. 2013;51(1):52.
11. Sahlen K-G, Boman K, Brännström M. A cost-effectiveness study of person-centered integrated heart failure and palliative home care: based on a randomized controlled trial. *Palliative medicine*. 2016;30(3):296-302.
12. Kendall H. Supporting Heart Failure Patient Transitions From Acute to Community Care With Home Telemonitoring Technology: A Protocol for a Provincial Randomized Controlled Trial (TEC4Home). *JMIR research protocols*. 2016;5(4).
13. Ottawa O. Telehealth for Patients with Heart Failure: A Review of the Clinical Effectiveness, Cost-effectiveness and Guidelines. Canadian Agency for Drugs and Technologies in Health. 2015;Dec 21.
14. Khaleghparast S, Ghanbari B, Kahani S, Malakouti K, SeyedAlinaghi S, Sudhinaraset M. The effectiveness of discharge planning on the knowledge, clinical symptoms and hospitalisation frequency of persons with schizophrenia: a longitudinal study in two hospitals in Tehran, Iran. *Journal of clinical nursing*. 2014;23(15-16):2215-22.
15. Chen Y-H, Ho Y, Huang H, et al. Assessment of the clinical outcomes and cost-effectiveness of the management of systolic heart failure in Chinese patients using a home-based intervention. *Journal of International Medical Research*. 2010;38(1):242-52.
16. Mehralian H, Salehi S, Moghaddasi J, Amiri M, Rafiei H. The comparison of the effects of education provided by nurses on the quality of life in patients with congestive heart failure (CHF) in usual and home-visit cares in Iran. *Global journal of health science*. 2014;6(3):256.
17. Ponikowski P, Voors AA, Anker SD, et al. 2016 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure: The Task Force for the diagnosis and treatment of acute and chronic heart failure of the European Society of Cardiology (ESC). Developed with the special contribution of the Heart Failure Association (HFA) of the ESC. *European journal of heart failure*. 2016;18(8):891-975.
18. Rezaei-Louyeh H, Dalvandi A, Hosseini M-A, Rahgozar M. The Effect of Self Care Education on Quality of Life among Patients with Heart Failure. *Archives of Rehabilitation*. 2009;10 (2):6-21
19. Shojaee A, Nehrir B, Naderi N, Zareyan A. Assessment of the effect of patient's

education and telephone follow up by nurse on readmissions of the patients with heart failure. 2013.

20. Sahebi A, Mohammad-Aliha J, Ansari-Ramandi M, Naderi N. Investigation the relationship between self-care and readmission in patients with chronic heart failure. *Research in cardiovascular medicine*. 2015;4(1).
21. Abotalebidariasari G, Memarian R, Vanaki Z, Kazemnejad A, Naderi N. Self-Care Motivation Among Patients With Heart Failure: A Qualitative Study Based on Orem's Theory. *Research and theory for nursing practice*. 2016;30(4):320-32.
22. Klersy C, De Silvestri A, Gabutti G, Regoli F, Auricchio A. A meta-analysis of remote monitoring of heart failure patients. *Journal of the American College of Cardiology*. 2009;54(18):1683-94.
23. Naderi N, Bakhshandeh H, Amin A, Taghavi S, Dadashi M, Maleki M. Development and validation of the first Iranian questionnaire to assess quality of life in patients with heart failure: IHF-QoL. *Research in cardiovascular medicine*. 2012;1(1):10.
24. Shepperd S, Doll H, Angus RM, et al. Avoiding hospital admission through provision of hospital care at home: a systematic review and meta-analysis of individual patient data. *Canadian Medical Association Journal*. 2009;180(2):175-82.