

Rationale and Design of Different Self-care Models for Adults With Heart Failure: a Systematic Review and Network Meta-analysis

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Protocol

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Abstract

Background: Active self-care improves quality of life, lowers hospital readmission risks, and decreases mortality from heart failure. Different self-care intervention models for these patients involve a variety of care contributions from healthcare professionals and caregivers, and little is known about which self-care intervention model is the most effective.

Methods: We will search the MEDLINE/PubMed, the Cochrane Library, CINAHL, ClinicalTrials.gov, Embase and PsycINFO databases from January, 2000 to April, 2021. The gray literature will also be searched to ensure randomized controlled trials are included as comprehensively as possible. Summary standardized mean differences and 95% credible intervals will be calculated via Bayesian random-effects network meta-analysis. Heterogeneity will be evaluated, and risk of bias will be assessed using the Cochrane Risk of Bias tool.

Discussion: This network meta-analysis will analyze outcomes including quality of life, healthcare use, readmission rate, and mortality to identify the most effective intervention model.

Impact: We will analyze self-care interventions and determine which is most effective through this meta-analysis.

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Introduction

Heart failure (HF), also known as congestive HF, is a complex clinical syndrome that results from structural or functional ventricular dysfunction of the heart. HF is a rapidly growing public health issue, affecting more than 37.7 million patients globally¹. It causes tremendous economic losses, currently estimated at 108 billion US dollars per year². Despite the recent discovery of angiotensin–neprilysin inhibition on top of the traditional pharmacological treatment [e.g., angiotensin-converting enzyme (ACE) inhibitors and beta-blockers] and other non-pharmacological approaches (e.g., left ventricular assist device, implantable ventricular defibrillator, cardiac angioplasty or coronary artery bypass graft), the prognosis of patients with HF in general has not been improved, as reflected in its high readmission and mortality rates^{3,4}. Patients diagnosed with HF have a high risk of death, up to 54.5% within 5 years, and 75.5% die within 10 years⁵. The goal of increasing survival, decreasing nursing burden, and improving outcomes for patients with HF has led to a call for human-oriented and evidence-based actions⁶. Under this circumstance, a self-care model, especially as a non-pharmacological approach, is critical to the effective management of HF⁷, because non-adherence to self-management remains the most common cause of HF-related readmissions, which accounts for 50%^{8,9}.

According to the World Health Organization (WHO), self-care is defined as the capabilities of individuals, households, and communities to develop fitness, prevent disease, and fight against diseases with or

without the support of healthcare providers¹⁰. In patients with chronic disease, self-care is defined as the patient's ability to solve problems, set priorities, and establish goals by creating treatment plans. Poor self-care, such as low medication compliance, can result in potential serious complications, including microvascular or macrovascular disease in patients with diabetes¹¹. Similarly, self-care is also vital in the long-term management of HF. In patients with HF, poor self-care increases risks for HF exacerbations, debility, and hospital admissions and mortality. Previous guidelines for HF have emphasized the importance of health education for patients¹², including treatment compliance, lifestyle modifications, syndromic surveillance, and adequate responses to probable aggravation. The European Society of Cardiology recommends multidisciplinary models to improve self-care and compliance with guideline-recommended medicines to reduce hospital re-admissions and HF-related mortality¹³, yet details of the construct and effects of self-care remains to be better defined. In the literature, various self-care intervention models have been reported. In this study, we mainly focus on three self-care intervention models, namely multidisciplinary case management, self-care and dyadic self-care intervention. Different models are appropriate for different types of patients with HF, this needs to take into account severity of HF and healthcare use. For general self-care interventions for HF, the latest ESC guidelines has a clear-cut definition¹⁵. Meanwhile, a reduction in self-care ability for some patients may lead to caregivers' assistance. This kind of dependent self-care model did not conform to general self-care, so we need a clear understanding of the relative advantages of different models. And for those with more serious symptoms, multidisciplinary case management might be more suitable. The protocol for a meta-analysis comparing outcomes among self-care behaviors must include definitions of self-care interventions¹⁴. On the basis of the practical management recommendations from the Heart Failure Association of the European Society of Cardiology, we further define self-care as follows: (i) self-care maintenance (e.g., taking medication as prescribed), (ii) self-care monitoring (e.g., regular weighing), and (iii) self-care management (e.g., changing diuretic dose in response to symptoms)¹⁵. Many patients with HF depend on informal support from their spouses, families, friends, and neighbors to provide assistance in managing their chronic diseases. We define this type of management intervention model as dyadic (patient and informal carer) self-care interventions. Multidisciplinary case management emphasizes a coordinated, all-inclusive care, across the healthcare delivery system, using multidisciplinary approach with self-care as one component of it¹⁶. Most HF guidelines are indistinctly when referencing self-care behaviors. This is because we do not have enough proof of the validity of independent self-care behaviors or the effects of very concrete proposals. Previous meta-analyses of self-care for HF share similar aforementioned limitations, and there has been no network meta-analysis on the impact of self-care in patients with HF. By distinguishing the effects of different self-care intervention models accurately, we will acquire a more comprehensive understanding of how self-care or other relevant interventions (e.g., multidisciplinary case management and dyadic self-care intervention) can influence outcomes in HF.

Materials And Methods

2.1 Aims

Our study is designed to compare the effects of different intervention models on the self-care ability of patients with HF and to determine which model is the most suitable for broad implementation. We will attempt to answer the following questions: (a) How does self-care affect clinical outcomes including readmission rate, mortality, quality of life, and healthcare use? (b) When can multidisciplinary case management improve outcomes and reduce healthcare use in comparison with self-care? (c) What is the effect of dyadic self-care intervention? and (d) Does self-care play a stronger role in specific subgroups (e.g., according to disease severity, gender, race or age)?

2.2 Methodology

2.2.1 Criteria for study selection

The main inclusion criteria for patients will be as follows: (1) adults, age ≥ 18 years; and (2) diagnosed with HF. The exclusion criteria for patients will be as follows: (1) history of cardiogenic arrest or cardiogenic shock; and (2) diagnosis of depression¹⁷ or cognitive functioning disorder¹⁸. The groups will be usual care with or without education as compared to those with self-care interventions. We will include randomized controlled trials evaluating the effects of self-care intervention models and observational studies, and qualitative studies and duplicate reports will be excluded.

2.2.2 Search strategy

We will search the following databases from January, 2000 to June, 2021 (with the language restricted to English): MEDLINE/PubMed, Embase, the Cochrane Library, CINAHL, ClinicalTrials.gov, and PsycINFO. MeSH terms will be combined with text words in the literature retrieval related to self-care (as defined above) and "heart failure". To find additional studies, we will screen the relevant reference lists of the included studies and previous literature reviews including systematic reviews and meta-analyses. We will also search for studies by searching the literature published by the first and senior authors of eligible studies. Given that many studies may be unpublished, we will also search the clinical trial registries to identify any ongoing or unpublished trials. All search results will be imported to an Endnote (version X9) tool to facilitate the screening of titles and abstracts.

2.2.3 Data collection and extraction

Two independent reviewers will work together to screen eligible studies. In the initial screening, they will read titles and abstracts to include studies containing one or more intervention models. All potentially relevant studies will be retrieved for full-text screening. A full-text review of potentially eligible studies will then be conducted, and the reasons for exclusion after full-text screening will be recorded in the Endnote database. After screening, data will be extracted independently by the reviewers using a data extraction form. The extraction form will consist of the following categories: characteristics of studies (e.g., years, time of publication, title), characteristics of participants, and characteristics of interventions and controls,

outcomes, and others. Discrepancies will be resolved through discussions until reaching consensus between reviewers.

2.2.4 Risk of bias assessment

The same investigators will assess the risk of bias for all qualifying studies based on the Cochrane risk of bias assessment tool. This tool consists of seven parts, namely random sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessors, incomplete outcome data, selective outcome reporting for each outcome, and other potential threats to validity. The investigators also will independently assess and rank the risk of bias for every eligible study as low, medium, or high¹⁹.

2.2.5 Outcomes

The four primary outcomes of interest will be as follows: quality of life assessed by the Kansas City Cardiomyopathy Questionnaire (KCCQ), the Minnesota Living with Heart Failure questionnaire (MLHFQ), and other validated questionnaires; mortality (all-cause, HF-related); hospital admission/readmission (all-cause, HF-related); and healthcare use.

2.2.6 Data synthesis

Because of complexities in the process of statistical analysis, there may be modifications of certain aspects during the network meta-analysis.

Nonetheless, as the first step, a DerSimonian-Laird random effects model will be used for the conventional pairwise meta-analysis. Standardized mean difference (SMDs) and 95% confidence intervals (CIs) will be calculated for continuous data measures by Hedges' g and interpreted according to Cohen's criteria²⁰. For dichotomous outcomes, the relative risks of each study will be calculated. We will present pooled effect results with 95% CIs and use forest plots with I^2 (test based on 95% CIs)²¹ to investigate heterogeneity. Then, the study effect sizes will be synthesized using random effects, network meta-analysis in a Bayesian framework. We will utilize the heterogeneity variance to measure the degree of the effects of variability across and within studies on the effects of intervention models. To estimate and present the likelihood of each rank order, we will use Stata (version 16.0) to obtain the surface under the cumulative ranking curve (SUCRA). The consistency will be tested by Cochran's Q.

To evaluate and adjust the effects of covariates (i.e., duration of intervention, provider, healthcare setting, age, gender, and HF severity during baseline period), meta-regressions will be conducted. The goodness-of-fit between models will be evaluated by comparing deviance information criterion (DIC); the lowest DIC indicates the best model fit. Based on the optimal fitting model, we will conduct a network meta-analysis

after adjusting for covariates. We will fit all models in WinBUGS (version 1.4.3) and assume uninformative priors for all meta-regression coefficients. After considering the Brooks-Gelman-Rubin diagnostic and autocorrelation plots, Markov Chain Monte Carlo chains will be visually checked to ensure the convergence of the model. Publication bias will be investigated with comparison adjusted funnel plots. We will use R (version 1.3.1093) and Stata (version 16.0) to evaluate the inconsistency and produce the network graphs and result figures. The GRADE tool will be used to assess the strength of the body of evidence.

2.3 Validity, reliability and rigor

We have registered this meta-analysis on the International Prospective Register of Systematic Reviews (PROSPERO). We will follow the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statements for reporting our systematic review²².

Discussion

Hospitalization from HF causes significant socio-economic burden on patients, families, and societies. A substantial part of this healthcare resource use is thought to be preventable through patient engagement in consistent self-care²³. This study will allow us to determine which is the most effective self-care intervention model for patients with HF. Meanwhile, through specific subgroup analysis, we will identify how self-care interventions produce effects on different patient populations. This analysis will be limited by the quantity, quality, and bias risk of the available studies on the subject. We will try our best to collect all the eligible literature and strictly control the inclusion and exclusion criteria to reduce the risks of bias.

3.1 Network meta-analysis rational

The concrete effects of self-care interventions are still indistinct, although most guidelines recommend relevant self-care actions. A meta-analysis of 20 studies, including 5624 patients with HF, found self-care interventions reduced HF-related hospitalization and all-cause hospitalization²⁴. Yet, the definition of self-care was general in the study, and it did not provide valid information about specific self-care behaviors. Furthermore, since its publications in 2004, additional randomized controlled or cohort trials about self-care interventions for patients with HF have been reported. However, there hasn't been a network meta-analysis to pool these data in recent years. Additionally, on top of self-care interventions, the proposed network meta-analysis will also analyze multidisciplinary case management and dyadic self-care intervention. Compared with the conventional meta-analysis, a network meta-analysis has an obvious advantage: it permits evaluation of different intervention models directly and indirectly. This will allow us to obtain more comprehensive conclusions.

3.2 Rational for interventions

Current research indicates that multidisciplinary case management is likely to reduce overall mortality, HF- readmission and all-cause readmission²⁵. At the same time, in the long-term follow-up of patients

practicing self-care, researchers found that self-care intervention models often resulted in non-sustained effects²⁶. One explanation is that the previous self-care interventions have missed a critical component, which is the informal caregiver. A recent systematic review found dyadic self-care intervention plays a role in cognitive, behavioral, affective and medical services utilization outcomes²⁷. However, self-care intervention including informal caregiver is still a recent and growing area of exploration, and findings across studies were inconclusive because of methodological limitations. Self-care is absolutely necessary in the management of HF over the chronic disease course of HF. Previous investigations have had distinct definitions of self-care, but the concept was still general (see Table 1). Therefore, we divided self-care into three concepts (self-care maintenance, self-care monitoring, and self-care management) on the basis of the practical management recommendations from the Heart Failure Association of the European Society of Cardiology¹⁵. More detailed and precise definitions of self-care will yield more convincing results.

Table 1
Classification and definition of self-care in previous studies

Author	Year	Title	Classification	Definition of interventions
Aleksandra Jovicic	2006	Effects of self-management intervention on health outcomes of patients with heart failure: a systematic review of randomized controlled trials ²⁸	Self-management and control group	Decisions and actions taken by someone who is facing a health problem or issue in order to cope with it and improve his or her health no restriction on the method of communication exchange or education (in person, telephone, email, written, verbal, visual, electronic or audio)
Nini H. Jonkman	2016	Do Self-Management Interventions Work in Patients With Heart Failure? An Individual Patient Data Meta-Analysis ²⁹	Self-management and control group(usual care)	interventions were defined as interventions providing information to patients and at least 2 of the following components: (1) stimulation of sign/symptom monitoring, (2) education in problem-solving skills, and enhancement of (3) medical treatment adherence, (4) physical activity, (5) dietary intake, or (6) smoking cessation.
Todd M. Ruppar	2018	Self-care interventions for adults with heart failure: A systematic review and meta-analysis protocol ¹⁴	Self-care and control group	(a)taking medication; (b)monitoring symptoms (daily body weight, dyspnoea, oedema, etc.);(c)eating a low-salt diet; (d) restricting fluids; (e) performing regular physical activity; (f) restricting alcohol intake; (g)managing body mass/weight; (h) stopping smoking or other tobacco use; (i) obtaining regular preventive care (e.g., influenza and pneumonia vaccinations,dental care and avoiding infection); (j) addressing changes in mood,depression or anxiety; (k) keeping appointments with healthcare providers and (l) recognizing and addressing changes in symptoms such as taking an additional diuretic in response to increased oedema

Author	Year	Title	Classification	Definition of interventions
Qiuge Zhao	2020	Effects of self-management interventions on heart failure: Systematic review and meta-analysis of randomized controlled trials ³⁰	Self-management and control group(usual care)	Self-management interventions based on self-efficacy theory, cognitive behavioral therapy, disease management, self-management or self-care education, conducted face-to-face, by phone or through a website

3.3 Rational for outcomes

The outcomes in this study include quality of life, mortality, hospital admission/readmission, and healthcare use. The quality of life of patients with HF is influenced strongly by self-care³¹. Meanwhile, reducing HF mortality and the rate of readmission from HF are always major objectives in clinical practice for both patients and clinicians³². In a controlled pilot trial including patients with COPD, researchers found self-care interventions reduced healthcare use and improved quality of life³³. Therefore, we will try to collect and pool data regarding healthcare use for patients with HF to elucidate the relationship between them.

Conclusion

Unlike previous studies, this network meta-analysis will compare the effects of different self-care intervention models on patients with HF. The results obtained from the data will provide practitioners and policy makers with customized evidence to guide their decision-making.

Abbreviations

HF: heart failure; CVD: cardiovascular disease; ACE: angiotensin-converting enzyme; WHO: World Health Organization; SMD: standardized mean difference; CI: confidence interval; SUCRA: surface under the cumulative ranking curve; DIC: deviance information criterion; PROSPERO: Prospective Register of Systematic Review; PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses

Declarations

Ethics approval and consent to participate

This study will not involve the patients' individual information or compromise their privacy. Ethics committee approval will not be required for this research.

Consent for publication

Not applicable

Availability of data and materials

Not applicable

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

All the authors contributed to the development of the protocol. YL and HS conceptualized the study. MH drafted the original manuscript. HD, KZ, HD provided critical revisions of the manuscript. The other authors were involved in the formulation of the inclusion/exclusion criteria. All authors have read and approved the final manuscript.

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