FACULTY OF HEALTH AND OCCUPATIONAL STUDIES
Department of Caring Sciences

NURSING DEPARTMENT,
MEDICINE AND HEALTH COLLEGE
Lishui University, China

Physical activity interventions for patients with heart failure

A descriptive review

Lei Yinzhen (August) & Yan Zhenzhong (Dominic)

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Supervisor: Li Xiaoyan(Kate)
Examiner: Maria Engström

Abstract

Background:Heart failure is one of the most important causes of death, and the incidence of heart failure (HF) increases year by year. In the United States alone, over 4 million patients with congestive heart failure each year, and over 550,000 new cases are reported each year. Traditional treatments, such as medical and surgical treatments, have the disadvantages of multiple side effects and high treatment costs. In addition to calling for people to receive treatment, regular physical activity can improve the metabolic and hemodynamic status of asymptomatic risk factors in patients with cardiac disease. Studies have shown that exercise training is not only an effective treatment for HF patients, but also an important prognostic parameter for future outcomes in HF patients.

Objective: To describe physical activity interventions for patients with HF.

Design: A descriptive review

Methods: A review was conducted on PubMed and CINAHL using search terms such as "Heart Failure/legacy", "physical activity", "intervention", and "number". We systematically searched 10 articles on the impact of physical exercise interventions on patients with heart failure to address research issues.

Result: Physical activity intervention for heart failure patients has a positive impact on their treatment. Compared with traditional drug intervention, Physical activity intervention has the advantages of smaller side effects, lower cost, and a wide range of applications. This research summarizes the following four physical activity interventions: 1)Physical Activity 2) Home-based intervention 3) Exercise counseling intervention. They can significantly improve the quality of life and exercise endurance of patients.

Conclusion: Although Physical activity interventions for heart failure patients have been proven to effectively improve their quality of life, exercise endurance, etc., nursing staff need to develop corresponding exercise plans based on the patient's different conditions. Patients should receive appropriate Physical activity interventions under the guidance of professional personnel to maximize the patient's sense of happiness.

Keywords: physical activity intervention, nursing intervention, heart failure, patients.

摘要

背景：心力衰竭是导致死亡的重要原因之一，心力衰竭的发病率呈逐年上升趋势。仅在美国，每年就有 400 多万充血性心力衰竭患者，每年报告的新病例超过

55 万例。药物和手术等传统方法存在多种副作用和高治疗成本等缺点。除了呼吁治疗外，有规律的体育活动可以改善心脏病患者无症状危险因素的代谢和血液动力学状态。研究表明，运动训练不仅是 HF 患者的有效治疗方法，也是未来 HF 患者的重要预后参数。
目的：描述 HF 患者的体育活动干预措施。
设计：描述性综述
方法：使用“心力衰竭/遗留”、“体力活动”、“干预”和“数量”等搜索词，对 PubMed 和 CINAHL 进行系统综述。我们系统地检索了 10 篇关于体育锻炼干预对心力衰竭患者影响的文章，以解决研究问题。
结果：体育活动干预对心力衰竭患者的治疗有积极影响。与传统的药物干预相比，体育活动干预具有副作用小、成本低、应用范围广的优点。本研究总结了以下四种体育活动干预措施：1）体育和康复活动 2）家庭干预 3）运动训练干预它们可以显著提高患者的生活质量和运动耐力。
结论：尽管对心力衰竭患者的体育活动干预已被证明可以有效提高他们的生活质量、运动耐力等，但护理人员需要根据患者的不同情况制定相应的运动计划。患者应在专业人员的指导下接受适当的身体活动干预，以最大限度地提高患者的幸福感。
关键词：体育活动干预，护理干预，心力衰竭，患者。

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1. Introduction

Heart failure is one of the important causes of mortality (Chaudhry, 2019). According to the American Heart Association, the prevalence of heart failure (HF) is increasing year by year. In the United States alone, the number of patients with congestive HF exceeds 4 million every year, and more than 550000 new cases are reported every year (Chaudhry, 2019). By 2030, the incidence rate of HF is expected to increase by 46%, affecting more than 8 million people (Bozkurt &Khalaf, 2017). With the progress of medical technology, the treatment level of patients with HF has been significantly improved. But pharmacological interventions also have adverse effects, in the study of side effects of β receptor impedance for heart failure, 49.4% of patients had side effects in use (Vargas, Ringel, Yum, 2023).Diuretics are the main drugs in the treatment of hyperlipidemia in patients with heart failure, and different diuretics have different side effects, including humoral electrolyte, abnormalities and acid-base disorders (Eid, Ibrahim, Zayan, 2021).Use of angiotensin in patients with HF showed worsened renal function and a higher incidence of hypotension and angioedema among side effects (Solomon, McMurray, Anand, Lam, Maggioni, Lefkowitz, 2019). The high cost of drugs used in heart failure management can reduce access to essential medicines and increase out-of-pocket expenses, which can lead to non-adherence to therapy and worse clinical outcomes(MacDonald, Hawwa, Cassie, 2019). So joint interventions are still needed to reduce decompensation, hospitalization and mortality in patients with HF. In addition to medication, regular physical activity can also improve the metabolic and hemodynamic status of asymptomatic risk factor for patients with heart disease (Gregorio, 2018). Studies have shown that exercise training is not only an effective treatment for patients with HF, but also an important prognostic parameter for patients with HF in the future (Cattadori, Segurini, Picozzi, Padeletti&Anzà, 2018).

1.1 Heart failure——definition

Heart failure refers to a syndrome in which the heart pumping function is impaired and the cardiac output cannot meet the basic metabolic needs of the whole body. The main features are hyperemia and fatigue, which are usually divided into two categories according to systolic function, decreased systolic function and maintained diastolic function (Snipelisky, Chaudhry, &Stewart, 2019). Heart failure is a complex clinical syndrome that results from any structural or functional impairment of ventricular filling

or ejection of blood (Badano *et al*., 2020). Heart failure occurs when the heart is no longer able to pump blood effectively, resulting in symptoms such as shortness of breath, fatigue, and swelling in the legs and abdomen(American Heart Association, 2021).Heart failure is a chronic condition that occurs when the heart cannot pump enough blood to meet the body's needs (National Heart, Lung, and Blood Institute, 2021). Heart failure is a clinical syndrome characterised by symptoms of breathlessness, fatigue, and fluid retention, caused by structural or functional abnormalities of the heart (Baldasseroni *et al*., 2020).

1.2 Physical activity interventions ——definition

Properties of physical activity, such as planning, organization, repetition, and design to achieve physical health (Dasso, 2019). Dasso (2019) mentioned in the study that planned exercise can increase physical health and reduce the risk of not exercising. Structured exercises mean that the parts reinforce each other well (Dasso, 2019). Rerepetition of physical activity refers to repetitive exercise to achieve physical fitness, which is established over time (Dasso, 2019). Exercise requires a physical fitness goal, often to improve cardiovascular health, strength, and flexibility, balance, or agility (Dasso, 2019). Heath *et al.*,(2012) define physical activity interventions as systematic efforts aimed at promoting physical activity and reducing sedentary behaviors among individuals or populations. Physical activity interventions are intentional efforts to increase physical activity and reduce sedentary behavior through a variety of approaches, such as providing access to facilities and programs, promoting active transportation and workplace strategies, and using innovative technology solutions (Hekler *et al*., 2021). Physical activity interventions may include multidimensional strategies to promote behavior change, such as environmental modifications, social support, self-monitoring, feedback and goal setting, and individualized counseling(Lee *et al*., 2020).Physical activity interventions delivered through online platforms have the potential to reach large, diverse audiences and facilitate sustained behavior change (Ding *et al*., 2020).

1.3 The nurse's role

Heart failure nurses work in both primary and secondary care settings, and many nurses are involved in clinical research trials (Blue & McMurray, 2005). Patient management requires clinical assessments by nurses and decision on management plans without immediate access to other members of the health care team.Information about the patient's condition was based on the nurses' assessment and communication (Blue *et al*.,

2005). Therefore, HF nurses in this role must be properly trained and educated and competent, aware of the limitations and boundaries of the role and easy access to clinical advice (Blue *et al*., 2005). It is very important for nurses to educate patients about their ability of self-care for HF. Patients' HF knowledge is an important factor affecting the overall self-care compliance (Albert, Cohen, Liu, Aspinwall & Pratt, 2015). Designing a comprehensive patient education is also very effective, focusing on self-management, identifying and tracking patients with HF, and establishing good communication between nurses and patients. Heart failure is a chronic disease, in the management of chronic diseases, self-care is very important, the improvement of self-care has reduced the mortality and incidence rate (Albert, 2008).Cardiology nurse working under medical supervision have extensive knowledge and expertise in patient management and support that can have a significant impact on meeting many needs of HF patients, improve life satisfaction and improve quality of life (Grange, 2005).
Nurses play a key role in promoting physical activity in patients with heart failure, by providing education and support, assessing barriers to exercise, and tailoring interventions to patients' individual needs (Hwang & Luttik, 2018).Nurses who are trained in delivering physical activity interventions can improve patients' exercise capacity and quality of life, as well as reduce their hospital readmission rates and mortality" (Liu *et al*., 2019).Nurses can use motivational interviewing techniques to promote physical activity in patients with heart failure, by exploring patients' own reasons for change and helping them identify and overcome barriers to exercise (Heo *et al*., 2018).

1.4 Self-Care Deficit Nursing Theory

The self-care deficit nursing theory (SCDNT) is a synthesis of knowledge about eight entities, which include self-care (and dependent care), self-care agency (and dependent-care agency), therapeutic self-care demand, self-care deficit, nursing agency, and nursing system (Raile &Marriney *et al*., 2014). The individual is the focus of nursing care. Nursing care is designed to meet the self-care needs of the individual (Orem, 1995, p. 34). Self-care is the activities that individuals perform on their behalf in maintaining their own health and well-being (Orem, 1991, p. 159). The self-care deficit is an excess of demand over ability to provide self-care (Orem, 1991, p. 163). Self-care is a learned behavior influenced by cultural, developmental, and environmental factors (Orem, 1991, p. 165). Self-care activities are those that regulate a person's life processes to

maintain life and functional stability (Orem, 1995, p. 34). Self-care is picked up in living situations through contact and interaction with others who are performing self-care activities (Orem, 1995, p. 136). Self-care agency (the individual's ability and willingness to perform self-care) is the ability for self-care (Orem, 2001, p. 49). It is a general theory composed of the following four related theories: The theory of self-care, which describes why and how people care for themselves; The theory of dependent-care, which explains how family members and/or friends provide dependent-care for a person who is socially dependent; The theory of self-care deficit, which describes and explains why people can be helped through nursing; The theory of nursing systems, which describes and explains relationships that must be brought about and maintained for nursing to be produced (Raile & Marriney, 2014). The theory of self-care deficit develops the reason why a person may benefit from nursing, the concepts of the theory are abstractions of the entities that represent the proper object of nurses in concrete nursing practice situations and presented a visionary view of contemporary nursing practice, education, and knowledge development expressed through the general theory (Raile & Marriney, 2014). The program based on orem's self-care deficiency theory produced favorable results in caring for adults with chronic conditions (including heart failure) (Nasiri *et al*.,2023). The training program developed by Orem's theory improved self-care capacity as well as disease specificity and overall quality of life in HF, nurses should use Orem's theory to enhance self-care for these patients, improving the quality of life and the effectiveness of related educational efforts (Yildiz & Kaşikçi, 2020).Using Orem's self-care theory as a basis for nursing interventions can effectively improve the self-care capacity and quality of life of patients with heart failure" (Wu & Chang, 2019).The application of Orem's self-care theory in the care of patients with heart failure can help develop their ability to manage their disease, reduce their re-admission rate, and improve their quality of life (Chen, Huang, & Hu, 2017).

1.5 Problem description

HF is one of the most serious health problems in the world. Drug therapy has greatly reduced the mortality of patients, and is accompanied by numerous side effects. In recent years, it has been gradually recognized by the society that sports can improve the physical condition of patients with heart failure. Earlier reviews focused on diet and mental care, However, there is no clinical research on how nurses guide and educate patients to

improve their physical condition through exercise. The current review will increase the research results in this area.

1.6 Aim and research questions

The aim of the narrative review was to describe physical activity interventions for patients with HF.

What physical activity interventions can promote the health of patients with heart failure and what impact do these physical activity interventions have on the health of patients with heart failure?

2. Method

2.1 Design

The authors were conduct a descriptive review.

2.2 Search strategy

Article was found by searching in the databases PubMed, with ceratin limits, see Table 1. The search terms that will be used are heart failure, physical activity, interventions, nurse, Heart failure /nursing [Mesh], exercise, Heart Failure/therapy [Mesh] and Motor Activity/therapeutic use [Mesh]. Searching for them together yielded different results. The search terms were taken from MeSH in PubMed. In the search (see Table 1), we used the limitations 10 years and English. Finally selected 75 articles from a large number of articles, after the exclusion of the qualitative literature, 10 of these cases were considered as potential objects of interest in the review.

Table 1. Results of database searches.

Database + Date of search	Limits	Search terms	Number of hits	Potential articles (excluding doubles)

Medline through PubMed 2022-05-12	English, 10 years	Heart failure	78740	
Medline through PubMed 2022-05-12	English, 10 years	Heart failure AND physical activity	7826	
Medline through PubMed 2022-05-12	English, 10 years	Heart failure AND physical activity AND intervention	5173	
Medline through PubMed 2022-05-12	English, 10 years	Heart failure AND physical activity AND intervention AND nurse	68	23
Medline through PubMed 2022-05-12	English, 10 years	“Heart failure /nursing” (Mesh) AND “Exercise”(Mesh)	2	1
Medline through PubMed 2022-05-12	English, 10 years	("Heart Failure/therapy"[Mesh]) AND "Motor Activity/therapeutic use"[Mesh]	5	4
			Total:75	28

2.3 Selection criteria

The inclusion criteria were: the article published within 10 years, quantitative approach, empirical study, English literature on physical activity interventions for patients with HF. There were no restrictions on the age of the participants in the included studies (see Table 2).

Exclusion criteria were: studies of pharmacological interventions in patients with HF, review studies, and non-HF patients.

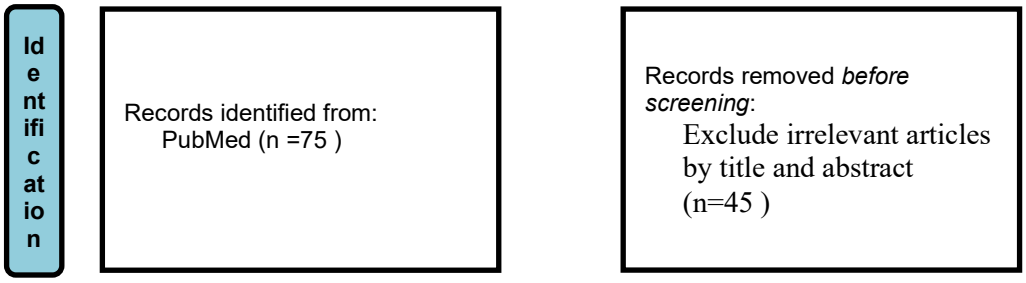
Table 2 Selection criteria for the included studies in the review

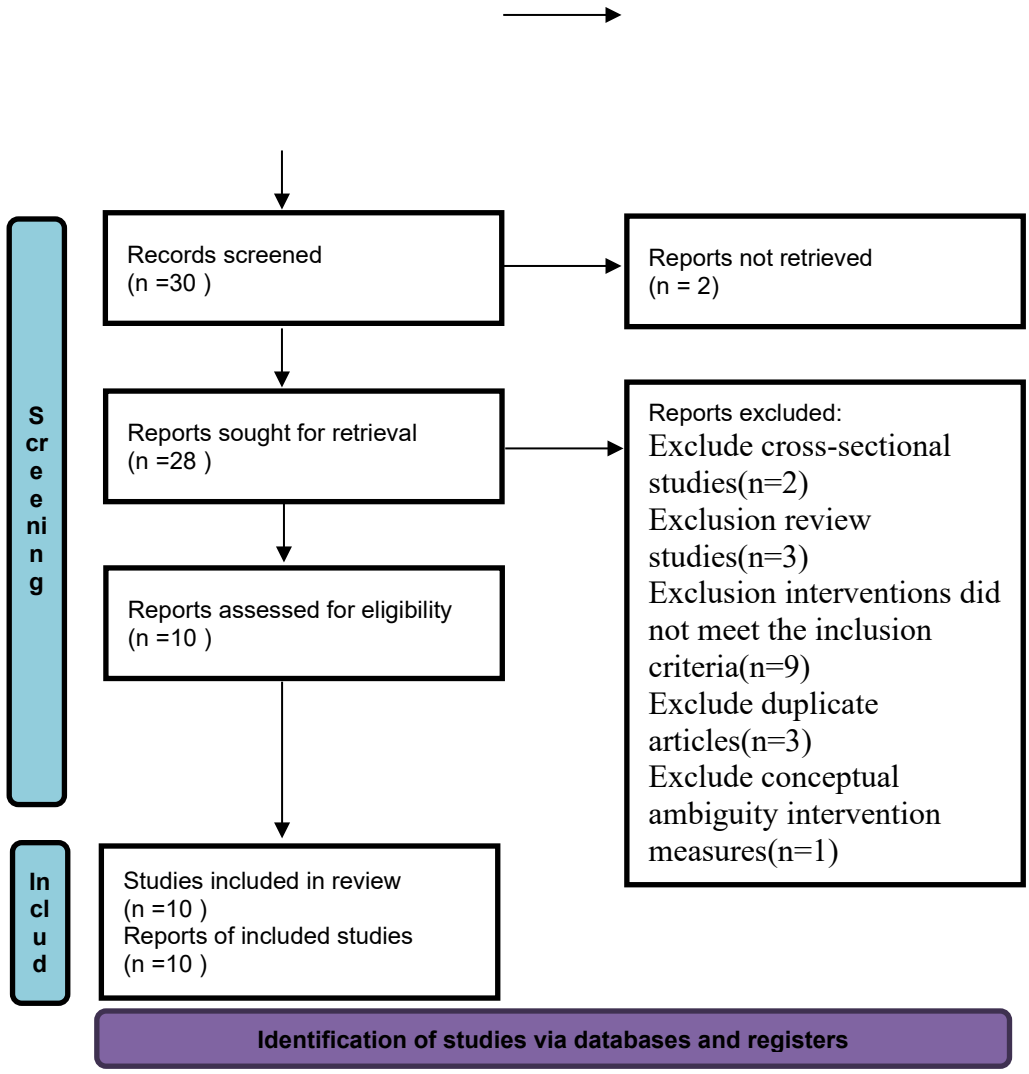
Criteria	Inclusion	Exclusion
Population	Patients with heart failure, regardless of age.	Heart failure patients who are too ill to participate in physical exercise interventions, Heart failure patients who are unwilling to participate in sports intervention.
Exposure	Working in hospital,Contact with heart failure disease	
Outcomes	Physical activity intervention of heart failure	
Study design	Quantitative studies	Review, protocol, systematic review, commentaries， case study, qualitative studuies
Year of publition	2012-2022	

2.4 Selection process and outcome of potential articles

First, read the title and abstract of the search articles roughly, then look at the title and abstract section to remove any inappropriate articles. Finally read the main content of the articles in detail to determine whether the article conforms to the research topic. Refer to Table 2 Selection criteria for the included studies in the review and select articles that can support descriptive reviews. The detailed screening process is shown in the figure below (Figure 1 The selection process of articles), The process of selecting articles involves two authors working together to verify the availability of each other's literature.

Figure 1 The selection process of articles





2.5 Data analysis

The author carefully read the 10 selected articles and listed their main content in Appendix 1, Appendix 2, and Appendix 3. Appendix 1 includes specific exercise intervention measures and the categories of results. Appendix 2 includes the author, purpose of the article, design, participants, data collection methods, and data analysis methods. Appendix 3 includes intervention measures and results.

2.6 Ethical considerations

The article was presented from an objective and rigorous perspective, without adding the author's subjective ideas, and there was no phenomenon of plagiarism, fabrication and tampering with data.

3. Results

The results of this study are based on 10 quantitative studies of physical activity interventions in patients with HF. Summarize the 4 Physical activity intervention: 1) Physical and Rehabilitation Activity 2)Home-based intervention 3)Exercise counseling intervention.

3.1 Physical Activity

Among the 10 pieces of studies we searched, physical Activity were used in 6 studies to guide patients with heart failure.

3.1.1 Exercise training

It was a prospective cohort observational study that clarified the effects of exercise training on physical activity, 6-minute walking distance (6MND), and all-cause hospitalization rates in patients with chronic heart failure and evaluated factors that influence changes in physical activity. This study enrolled 62 patients who were completing an exercise training program after receiving an implantable cardioverter defibrillator or cardiac resynchronization therapy between May 2017 and May 2018. As assessed by the International Physical Activity Questionnaire, patients exercised more than 10 min per day, 20 – 50 min per week for 3 months and were assigned to the intervention group based on the change in baseline and 3-month walking time, and the control group exercising less than 10 min days based on the change in walking time between baseline and 3 months.The data were collected by questionnaire form, and finally the effect of exercise training was evaluated from the aspects of 6MND, exercise endurance, all-cause hospitalization rates and depression.

This study showed an improvement in the 6MND in the intervention and control groups ($p < 0.01$). Despite improvements in exercise tolerance, exercise activity levels did not increase in some patients (Yanagi, Konishi, Yamad, Kitagaki, Nakanishi, Harada, & Kohzuki, 2020). Depression was significantly improved in the active group (($p < 0.01$)), but was not associated with physical activity. Factors leading to changes in physical

activity have not yet been identified. All-cause hospitalization rates were lower in the active group during the follow-up period (mean 10.5 months)(Yanagi *et al*., 2020).

3.1.2 Guideline-Based Physical Activity

In this study, the effect of different intensity exercise programs on the rehabilitation of patients with heart failure was studied. The control group was given a suggestion of physical activity according to the guidelines. The high-intensity interval training group was planned to warm up three times a week for 38 minutes each time (10 minutes, heart rate reserve 35% - 50%, 4 × 4 minute interval, heart rate reserve of 80% - 90%, and active recovery of 3 minutes interval), while the moderate intensity continuous training group was planned to take 5 times a week, 40 minutes each time (heart rate reserve of 35% - 50%). There were no specific requirements for movement mode.

Final result displayed that, after 3 months of intermittent training, the change of O2 was significantly different between the two groups (P=0. 002). The change of high intensity interval training was significantly higher than that of guidance control (P=0.01) and medium continuous training compared with guidance control (P=0. 001). There was no significant difference between high intensity interval training and medium continuous training (P=0. 41). After 12 months, the peak V between the two groups.There was no significant difference in the change of O_2 (P=0.11)(Mueller, Winzer, Duvinage, Gevaert, Edelmann, Haller, Pieske-Kraigher, Beckers, Bobenko, Hommel Heyning, Esefeld, von Korn, Christle, Haykowsky, Linke, Wisløff, Adams, Pieske, Craenenbroeck, Halle, Optim, 2022).

3.1.3 Physical Activity

This was a prospective cohort observational study examining whether total physical activity and different types of physical activity were associated with risk of heart failure, where participants were asked to report their work activity level, family / household chores, walking / cycling, and exercise level in the year before and at 30 years before study enrollment (Rahman, Bellavia, Wolk, & Orsini, 2015). The questionnaire also included questions about inactivity (watching TV or reading) and open-ended questions about daily sleeping, sitting or lying time. The study used the International Classification of Diseases-10 codes I50 (HF) and I11.0 (hypertensive heart disease with heart failure) to identify heart failure events (Rahman *et al*, 2015).

The results showed that walking/cycling for more than 20 minutes per day can effectively reduce the risk of heart failure compared to those who are less than 20 minutes per day ($p \leqslant 0.01$), and exercising for more than 1 hour per week can effectively reduce the risk of hunger in heart failure patients, with an HR of 0.86 ($p=0.001$) (Rahman *et al*, 2015).

3.1.4 Physical Activity and 30-Day Rehospitalization

This study was a single center prospective study aimed at investigating the impact of physical activity in the first month after discharge on readmission in HF patients. Participants in the control group and experience group are required to wear a specially designed bracelet and belt, which is used to calculate the amount of exercise they exercise one month after discharge. The members of the experience group need to achieve ≥ 60 minutes of high-intensity exercise per day, while the control group does not need to complete a 60 minute high-intensity exercise program. Exercise is not limited, but it needs to reach the intensity threshold of the sum of motion (vmu) on three planes per minute using 3000 devices of the wrist device (Waring, Gross, Soucier, &Wallack, 2017).

The results showed that among the 50 participants in the study, 33 (66%) patients had an average of ⩾ 60 minutes of high-intensity physical activity per day after discharge. Compared to patients with lower activity time and intensity, patients with high intensity physical activity had an all-cause readmission rate of 5/33 (15%) over the next 30 days, while patients with lower activity levels had a readmission rate of 8/17 (47%) (P=0.01)(Waring, Gross, Soucier,&Wallack, 2017).

3.1.5 Physical Rehabilitation

This study was a randomized, attention controlled, single blind trial, with interventions starting as early as possible while the patient was still in the hospital and being transferred to the outpatient department as soon as possible after discharge. All members received routine treatment for heart failure. In addition to basic outpatient treatment, participants in the intervention group received a designated home exercise plan (low intensity walking and intensive exercise, gradually increasing to a daily goal of 30 minutes of exercise). After a 3-month visit, personalized exercise plans were developed for the participants within 4-6 months by evaluating their home environment. The control group only

received routine therapy and did not receive specific advice on exercise; But encouraged to adhere to prescribed treatment and follow-up.

The result showed that Short Physical Performance Battery (SPPB) score at 3-months showed a large improvement in Rehabilitation Intervention relative to Attention Control ($p<0.0001$) , which was relatively uniform across a wide variety of pre-specified subgroups. There were large improvements in all SPPB components (Kitzman, Whellan, Duncan, Pastva, Mentz, Reeves, Nelson, Chen, Upadhya, Reed, Espeland, Hewston, & O'Connor, 2021). There was no significant difference in the secondary outcome, all-cause re-hospitalization rate at 6-month follow-up. There were large improvements in the Intervention versus Control group in 6MWD, gait speed, number of Modified Fried Frailty Criteria, quality-of-life, and depression . The rate of overall falls was nominally lower ($p=0.09$), in the rehabilitation intervention group. Cognition was unchanged. There were 37 on-trial deaths, none related to intervention or study procedures.There were no significant differences in deaths or other clinical event outcomes (Kitzman *et al*, 2021).

3.2 Home-based intervention

Among the 10 pieces of studies we searched, Home-based intervention were used in 4 studies to guide patients with heart failure.

3.2.1 Home-based telehealth exercise training program

This study was mainly about the impact of home tele-health exercise on Chinese patients with heart failure. The participants were divided into two groups. The control group (n=49) received routine treatment for heart failure. The experimental group (n=49) received an eight-week family tele-health exercise program. After 1-4 weeks of discharge, the participants received walking and jogging training three times a week for 20 minutes each time. After 5-8 weeks of discharge, the participants received jogging and weight-bearing exercise five times a week for 30 minutes each time (Peng, Su, Hu, Sun, Li, Dolansky, Qu, & Hu,2018).

The results indicate that home remote health therapy has a positive impact on the quality of life of Chinese heart failure patients. The Minnesota Heart Failure Patients Questionnaire (MLHFQ) scores were significantly higher in the experimental group

compared to the control group, with a significant difference (P=0.005). The higher the score, the better the health status of the subjects, and a significant interaction was observed between the groups and the time of MLHFQ scores (P=0.001). In addition, there was a significant statistical difference in 6MWD and resting HR between the two groups (P=0.046). After 4 weeks of intervention, the six-minute walking distance of the experimental group was significantly higher than that of the control group ($p<0.01$), and the resting heart rate was lower than that of the control group ($p<0.05$) (Peng et al., 2018).

3.2.2 home-based walking

In this study, the main research was the effect of family walking exercise (activity log) for 30 minutes a day, 3 days a week and 8 weeks on patients with heart failure. The detailed method included three parts: (i) warm-up period (5 minutes), (ii) walking period (20 minutes, two 10-minute series, 5-minute rest interval), and (iii) cooling period (5 hours). In the whole study, subjects were divided into experimental group and control group, and the experimental group need to receive a designed exercise plan for 8 weeks, while the control group did not receive any intervention.

The results showed that, significant differences existed between mean QOL total scores at entry and after 8 weeks in the training group ($p < 0.001$), after family walking exercise, there was a significant difference in the average walking distance of the 6-minute walking experiment in the experimental group ($p<0.001$). The average exercise time of the experimental group from the first week to the eighth week increased, and the repeated measurement test showed a significant difference ($p<0.001$)(Fayazi, Zarea, Abbasi & Ahmadi, 2013)

3.2.3 Home-Based Physical Activity Intervention

This was a preliminary study, the intervention measures in the study tended to be free living sports activities, without mentioning specific sports activities. The subjects were supported by telephone for about 10 minutes every week to start and maintain their activity level. At the end of each day's exercise, the goal was to increase the average number of steps per day by at least 2000 steps compared with the baseline displayed on the pedometer. In the study, the author did not mention the experimental group and the control group, but used a pre-and post-control method to demonstrate whether sports activities had an impact on patients with heart failure.

The final results showed that after physical exercise intervention, the workload and oxygen consumption of the second largest exercise (i.e., anaerobic threshold) increased by 20% (P=0.01) and 11% (P=0.39), and the number of steps per day was positively correlated with the peak oxygen consumption after intervention (P=0.01), but not with the peak oxygen consumption before intervention (P=0.08). The daily physical activity of patients with chronic heart failure activity but not sedentary was positively correlated with functional ability (exercise tolerance)(Okwose, Avery, O'Brien, Cassidy, Charman, Bailey, Velicki, Olivotto, Brennan, MacGowan, Jakovljevic, 2019).

3.2.4 Home-Based Mobile Health App Intervention

In this study, Samsung Mobile Health App was used to monitor the level of physical activity during the 2-week and 8-week intervention before the intervention. The researchers sent exercise guidance suggestions through the app on the participants' mobile phones every week. The experimental group carried out regular physical exercise according to the suggestions on the app, while the control group did not deal with it. The burden of heart failure symptoms and health-related quality of life were assessed at baseline, 2 weeks after baseline assessment and immediately after intervention.

The results showed that there was a significant inter-group time interaction (P<0.001) in the average daily steps from the second week to the eighth week of the intervention, indicating that the daily steps of the intervention group had a greater improvement during the intervention period. The participants in the intervention group improved their scores of fatigue and shortness of breath burden, total score of HF symptoms burden and health-related quality of life after intervention compared with those at baseline and at the time point before intervention (P<0.01), indicating that the intervention group had a greater reduction in fatigue and shortness of breath burden scores and total score of HF symptoms burden after intervention, Health-related quality of life is better(Saleh, Elshatarat, Elhefnawy, Helmi Elneblawi, Abu Raddaha, Al-Za'areer, Mofdy Almarwani, Alzahrani, Aqel, Shawashi, Tayeh, 2022).

3.3 Exercise counseling intervention

This was an experimental, prospective longitudinal cohort study and the primary objective of this study is to evaluate the feasibility of an exercise counseling intervention

for adults with heart failure of different racial / ethnic groups and to assess its potential to improve overall physical activity, functional capacity, and self-care for heart failure.20 participants. The intervention included three parts: an initial exercise counseling session at the time of enrollment, a weekly telephone follow-up and the use of a daily diary to record self-care behaviors. The three components of this intervention were to improve self-care maintenance (doing exercise), manage behaviors (learning how to identify and respond with symptoms such as shortness of breath or fatigue), and improved confidence in self-care (by strengthening their progress weekly). Participants were encouraged to use naturalistic decision-making in trying, incorporating exercise into their lives (deciding how and when to exercise based on their health status, weather, family obligations, or work schedules).

Results indicated this intervention was feasible for most participants, and resulted in improvements in physical activity, functional capacity, and self-care behaviors (McCarthy, Dickson, Katz, & Chyun, 2017). At 12 weeks, there was significant improvement in physical activity as measured by weekly step-counts ($p = 0.03$). There was also significant improvement in the International Physical Activity Questionnaire (IPAQ) walking score ($p = 0.04$). However, there were no significant improvements in moderate ($p = 0.12$) or vigorous activity ($p = 0.43$). The self-care maintenance score (SCHFI) improved significantly ($p = 0.03$), but there were no significant improvements in self-care management ($p = 0.47$) or self-care confidence ($p = 0.93$)(McCarthy et al., 2017).

4. Discussion

4.1Main result

This study mainly studies the influence of nursing intervention of physical activities on patients with heart failure. Three main intervention measures for sports activities are summarized: physical activities, home-based intervention and exercise counseling intervention. Physical activity intervention can significantly improve cardiac ejection fraction, quality of life, health level and activity tolerance of patients with heart failure.

4.2Result discussion

4.2.1 exercise training

In two studies on the effect of exercise training on patients with HF, Yanagi *et al.,* (2020)'s results showed that patients with exercise training improved exercise tolerance, but some patients did not increase their exercise activity level, and patients with exercise training intervention significantly improved depression. Factors leading to changes in physical activity have not been identified. The exercise training intervention reduced the all-cause hospitalization rates to some extent. We searched for other reviews, the effect of physical exercise on improving exercise tolerance in patients with heart failure was similarly mentioned in the study of Hayes *et al*., (2014), Keteyian *et al*., (2016) &McMurray *et al.*, (2019)'s finding. Exercise training interventions have been shown to be effective in improving exercise tolerance, quality of life, reducing hospitalization rates and mortality in patients with heart failure (Hayes *et al*., 2014). Exercise training interventions have been shown to improve exercise tolerance, quality of life, and other important outcomes in patients with heart failure, and should be recommended as an integral component of heart failure management (Keteyian *et al*., 2016). Exercise training interventions for patients with heart failure produce significant improvements in exercise tolerance, quality of life, and other outcomes, with minimal risks and good adherence rates (McMurray *et al*., 2019). We searched for other reviews, the beneficial effect of physical exercise intervention on the depressive situation in patients with heart failure was similarly mentioned in the review by Chen *et al.*, (2019), Jolly *et al*., (2016) & Kalogeropoulos *et al.*, (2014). Exercise training interventions have been shown to reduce depression and anxiety symptoms in patients with heart failure, improving quality of life and other health outcomes (Chen *et al*., 2019). Exercise-based rehabilitation is associated with reduced hospitalization rates in patients with heart failure, independent of other treatments. Exercise training may also reduce the risk of depression and improve other psychosocial outcomes (Jolly *et al*., 2016). Exercise training interventions have been shown to reduce depressive symptoms and decrease hospitalization rates in patients with heart failure. Such interventions may also improve adherence to medications and lifestyle changes (Kalogeropoulos *et al*., 2014). We searched for other reviews, different from the results of Yanagi *et al*., (2020) , the study of Austin, Bauersachs, Piepoli *et al*., (2014) showed the positive result of exercise intervention on improving exercise activity level in patients with heart failure. Exercise training interventions, particularly those that involve aerobic and resistance exercise, are effective in improving exercise capacity and peak oxygen consumption in patients with

heart failure (Austin *et al*., 2014). Exercise training programs improve exercise capacity and functional status in patients with heart failure. Such programs should be tailored to the individual patient's needs and should involve both aerobic and resistance exercises (Bauersachs *et al*., 2018). Exercise training interventions have been shown to improve exercise capacity and quality of life in patients with heart failure, with benefits that may persist for up to 12 months after the intervention (Piepoli *et al*., 2014).

4.2.2physical activities

In four studies on the effect of physical activity intervention on patients with HF, four all mentioned the beneficial effects of physical activity intervention on the physical health of patients with HF, but with different emphasis. Rahman *et al*., (2015) concluded focusing on concluding that physical activity interventions are effective in reducing the risk of heart failure. Waring *et al*., (2017) studied the effect of different levels of physical activity on patients with heart failure and concluded that all-cause hospitalizations with high physical activity levels were lower in patients with heart failure. Mueller *et al*., (2022) concluded that moderate and high intensity physical exercise benefits the recovery of patients with heart failure, and there is no significant difference in the degree of moderate and high intensity on the recovery of patients with heart failure. Kitzman *et al*, (2021) clarified that physical activity intervention significantly improved the health of the physical activity of patients with heart failure, physical activity intervention can improve the quality of life, improve depression and reduce the probability of falling, but has no significant effect on all-cause rehospitalization rate and reduce mortality rate. Compared with the study of Mueller *et al*., (2022), the study that we searched by Aune *et al.,* (2021) yielded different results, for overall strength activity, leisure time activity, and vitality activity, the inverse association was most pronounced at lower activity levels, and increased adherence to leisure activity recommendations was also associated with reduced risk of heart failure (Aune, Schlesinger, Leitzmann, Tonstad, Norat, Riboli, & Vatten, 2021). In addition, the study that we new searched on the degree of physical activity, Belardinelli *et al*., (2012) mentioned that Physical activity interventions can help improve functional capacity, quality of life, and symptoms in patients with heart failure, but further research is needed to determine the optimal type and intensity of exercise. We searched for other reviews, Gielen *et al*., (2015), Taylor *et al*., (2015), and Kitzman *et al*, (2021)'s study had the same results in quality of life, had different results in terms of hospitalization

rate. Physical activity interventions, including both exercise training and physical therapy, have been shown to improve quality of life, reduce hospitalizations, and enhance physical and emotional well-being in patients with heart failure (Gielen *et al*., 2010). Physical activity interventions for patients with heart failure can improve exercise capacity, functional status, and quality of life, while reducing hospitalizations and the risk of mortality (Taylor *et al*., 2015).

4.2.3 home-based intervention

This research had adopted four studies on the impact of home based intervention on heart failure patients. Peng and Saleh's study reflected the effectiveness of home-based intervention through its impact on the quality of life of subjects. Fayazi *et al.,* (2013)'s study showed that home-based intervention can enhance patients' exercise endurance, thereby improving their quality of life; Okwose *et al.,* (2019)'s research demonstrates the positive significance of the research results by reducing myocardial oxygen consumption. The research results of Hower, Floegel & Perez *et al.,* (2018) show that physical activities such as low-intensity physical activity, mainly at home, can effectively improve the physical function and quality of daily life of heart failure patients (Floegel & Perez, 2018). The sports activities involved include 60 minutes of walking, aerobic exercise, and anaerobic exercise every day. Long's study included a total of 44 studies comparing informal exercise training interventions with exercise interventions. The results showed that short-term exercise intervention (<6 months) had no effect on the readmission rate of heart failure patients, while long-term exercise intervention (>12 months) significantly reduced the readmission rate (Long, Mordi, Bridges, Sagar, Davies, Coats, Dalal, Rees, Singh & Taylor, 2019). Compared to Long's research, our review has the disadvantage of insufficient sample size. In addition, all authors of the appeal conducted their own research through controlled trials. Although the data and methods of data collection were different, they all proved that home-based intervention has positive significance in improving the quality of life of heart failure patients. The author suggests that in future treatment plans for heart failure patients, physical activity can be promoted, which not only reduces treatment costs but also increases patients' sense of participation.

4.2.4exercise counseling intervention

In our result, only one studies on the effect of exercise counseling intervention on patients with HF: McCarthy *et al*., (2017)'s findings showed that the exercise

psychological counseling intervention was feasible for most participants and resulted in improved physical activity, functional capacity and self-care behavior, with no significant improvement in moderate activity or vigorous activity areas, and significant improvement in SCHFI (self-care maintenance score), but not in self-care management or self-care confidence. We searched for other three reviews, Koliaki *et al*., (2021), Koukouvou *et al*., (2017), &Zhang *et al*., (2015)'s studies had similar results in physical activity and functional capacity. Exercise counseling interventions can be effective in increasing physical activity in patients with heart failure, with modest improvements seen in exercise capacity and quality of life. Multimodal interventions that target individual barriers to exercise and incorporate behavior change techniques may be most effective (Koliaki *et al*., 2021). Exercise counseling interventions for heart failure patients can improve exercise capacity, functional status, and symptoms, with benefits seen across a range of patient populations. Such interventions should be tailored to individual patients' needs and preferences (Koukouvou *et al*., 2017). Exercise counseling interventions can help promote physical activity and improve outcomes in patients with heart failure, although they may be less effective in patients with advanced heart failure. Effective interventions should use multiple modes of communication and incorporate motivational interviewing and goal-setting techniques (Zhang *et al*., 2015). In addition, the following five reviews we new searched yielded different results regarding the exercise-counseling intervention on self-care management and self-care confidence in HF patients. Participants have improved in self-care capacity after receiving the exercise counseling intervention, and an intervention combined with core elements of motivational interviewing may be effective in improving self-care for HF (Riegel, Dickson, Hoke, Mcmahon, Reis, & Sayers, 2006). Exercise counseling interventions can improve self-care management and self-care confidence in patients with heart failure, with benefits seen across a range of patient populations. Multimodal interventions that incorporate education, counseling, and support may be most effective (Cajita *et al*., 2018). Exercise counseling can promote physical activity and improve self-care behaviors in patients with heart failure, with benefits observed in exercise capacity, quality of life, and clinical outcomes. Individualized counseling approaches that target barriers to exercise may be most effective (Moser *et al*., 2012). Exercise counseling interventions for patients with heart failure can improve self-care management and self-care confidence, with benefits seen across a range of patient populations. Such interventions should be tailored to individual patients' needs and

preferences (Pattenden *et al*., 2017). Exercise counseling can promote physical activity and improve self-care behaviors in patients with heart failure, although more research is needed to identify optimal modes and intensity of exercise for individual patients. Effective counseling interventions should incorporate behavior change techniques and address individual barriers to exercise (Gallagher *et al*., 2016).

4.3Method discussion

4.3.1The relationship between result and self-care theory

The application of Orem's self-care theory in the context of physical activity interventions for patients with heart failure can be greatly enhanced by the involvement of nurses. Nurses can use Orem's theory as a foundation for nursing interventions aimed at promoting self-care behaviors in patients with heart failure, while also providing education and support on physical activity interventions. Nurses can assess patients' individual needs and tailor physical activity interventions accordingly to help improve their exercise capacity, quality of life, and decrease re-hospitalizations. Moreover, by using motivational interviewing techniques, nurses can help patients overcome barriers to regular physical activity by exploring their reasons for change and working with the patients to develop plans to engage in regular physical activity. This approach is supported by recent research studies that have demonstrated the effectiveness of nurse-led physical activity interventions in improving exercise capacity and outcomes in patients with heart failure. Therefore, integrating Orem's self-care theory into physical activity interventions for patients with heart failure through the involvement of nurses has the potential to improve outcomes for these patients by promoting self-care behaviors, enhancing patient education and support, and improving adherence to physical activity interventions. As for the exercise therapy mentioned in this study, including jogging, family walking exercise, moderate intensity continuous exercise and high intensity intermittent exercise therapy, all the therapies are based on the self-care theory. They guide patients to carry out physical exercise through QQ, WeChat or telephone and questionnaire every week, assist patients to develop appropriate exercise methods and monitor cardiac ejection fraction, activity tolerance, heart rate, etc. to determine the exercise effect. The researchers will follow up and summarize these results to prove that

Orem's self-care theory is closely related to physical activity therapy for patients with heart failure.

4.3.2 Strengths

The source of literature included in this study is PubMed search engine, and the reliability and availability of literature can be guaranteed; We have sorted, classified and comprehensively analyzed all the documents, and displayed 10 articles in the form of tables, so that readers can better understand the significance of these documents and the research topics; In addition, in the results section, the results of each article use p value to ensure the credibility of the literature.

4.3.3 Limitations

1. The authors of the included articles used different research scales to reflect the impact of nursing intervention of exercise therapy on patients with heart failure, and the impact of different aspects (quality of life, cardiac ejection fraction, etc.).
2. The author used the restrictive words "English" and "Ten Years (2012-2022)" when searching for articles, which may have excluded some available articles.
3. Due to the limited number of articles collected, there are few literature used to demonstrate some of the results, such as the Exercise counseling intervention, which only has one article. At the same time, some exercise intervention measures were not mentioned.

4.4 Clinical Significance - Implications for Nursing

Self-care is an essential component of HF management, and increasing self-care has been shown to have a positive impact on patients' health outcomes. Self-care interventions can take many forms, including educational programs, counseling sessions, and technology-assisted self-monitoring. The aim of these interventions is to empower patients to take an active role in their care and to support them in making the necessary lifestyle changes to manage their condition effectively. Physical activity interventions are an important part of self-care, physical activities interventions, also known as medical sports, refers to the use of sports as a means, according to the characteristics of different populations and diseases, select appropriate exercise methods, determine the appropriate amount of exercise, and carry out targeted treatment. Its purpose is to strengthen the physique, prevent the occurrence of various secondary dysfunction, treat various dysfunction

caused by various diseases, improve and promote the recovery of various functions of patients as soon as possible, and improve the quality of life. Although there have been a large number of articles on drug intervention and diet intervention to nourish and improve myocardial metabolism, sports therapy for patients with heart failure has received increasing attention in recent years. Sports therapy has the characteristics of low cost, easy acceptance, side effects and low risk. Timely physical exercise therapy can not only shorten the recovery period, but also give full play to the patient's active role in regulating the body function, and eliminate or alleviate the obstacles harmful to the body, emotion, society and employment ability brought by the process of disease trauma. Self-care interventions can take many forms, including educational programs, counseling sessions, and technology-assisted self-monitoring. The aim of these interventions is to empower patients to take an active role in their care and to support them in making the necessary lifestyle changes to manage their condition effectively.

For clinical nurses, the physical activity intervention of patients with heart failure has enriched the nursing intervention measures, which is conducive to expanding the professional knowledge of clinical nurses, accumulating experience and improving professional nursing ability. Looking at the current nursing, the sports intervention nursing measures for patients with heart failure are a new concept, breaking the traditional drug intervention concept, broadening the development prospects of nursing profession, providing professional guidance for patients, and shortening the treatment process for patients with heart failure. Overall, this study has important clinical significance for nursing.

4.5 Suggestions for future research

Although physical activity intervention measures are increasingly valued by people, according to the ten articles we included, the currently known exercise methods are limited, the applicable population is uncontrollable, and heart failure is more likely to occur in the elderly. The majority of the research population we included in the article is the elderly people over 60 years old, but the incidence of heart failure in infants, children and young people is not zero, which makes the sports intervention of heart failure patients at the level of low and middle age patients vacant. Future research can strengthen the study of low and middle age patients. With regard to data analysis and data collection, we have adopted different scales and data analysis methods to prove the feasibility of the

data, which undoubtedly makes the final result lack of reliability and credibility. In future research, more authoritative scales will be applied to enhance the availability of data. In view of the small sample size, a reasonable sample size is adopted to increase the reliability of the collected data. Many articles have mentioned the impact of low, medium and high levels of physical activity on patients with heart failure. The results of each researcher are not completely consistent. Therefore, the relationship between the level of physical activity of patients with heart failure and the impact on patients with heart failure will be further explored in future studies.

5 Conclusion

This review describes how physical exercise therapy can improve the quality of life and cardiac function of patients with heart failure, Some of these limitations require us to use a unified and reliable scale by increasing the sample size to study diversified sports methods and deeply explore the impact of different intensity of sports on patients with heart failure. Clinical workers can provide professional exercise guidance to patients through various ways, develop unique exercise programs for each patient, and minimize the rehabilitation process of patients. In addition, in recent years, sports therapy for patients with heart failure has developed more and more rapidly, and has become a rapidly developing branch of medical science, which helps to promote more medical staff to participate in relevant research and provide better care for patients.

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Table 1 Result of the selected articles

Categories	Themes	Specific method	result	Other positive results	No effect results
Exercise training	exercise training	walking, bicycle ergometer, and low-intensity resistance training	Positive result in reducing readmission rates through regular exercise programs under professional guidance	Depression improved	No significant differences in all-cause hospitalizations
	Physical Rehabilitation	Focus on four areas: strength, balance, flexibility, and endurance, stratified from levels 1 to 4 at each stage	Positive result in reducing the risk of death	6 MWD, and showed substantial improvements in gait speed, number of modified fried frailty criteria, quality of life, and depression.	There was no significant difference in the all-cause re-hospitalization rate
.Physical Activity	Physical Activity	Home / housework, walking / cycling，Heavy manual work	Some had positive result in reducing readmission rates through regular exercise programs under professional guidance	/	/
	Physical Activity and 30-Day Rehospitalizatio n	Physical activity was recorded with a wrist device	Positive result in reducing the risk of death	/	/
	Guideline-Based Physical Activity	High intensity interval training program and medium intensity continuous training program	Positive result for improving peak oxygen uptake (VO2max) in patients	/	/
Home-based intervention	Home-based telehealth exercise training program	8-week home health exercise training program with 32 exercise training sessions and regular telephone or instant messaging follow-up and consultations	Positive result for improving patients' quality of life and increasing their 6-minute walking distance	/	no signifificant improvements were observed regarding the New York Heart Association （NYHA） classifification,left ventricular ejection fraction (LVEF), anxiety, and depression
	home-based walking	8-week family walking exercise program	Positive result for improving patients' quality of life and increasing their 6-minute walking distance	/	Socio-economic and psychological impact of the training group
	Home-Based Physical Activity Intervention	Increase the total daily physical activity level of subjects by at least 2000 steps from the baseline level by telephone	Positive result for improving patients' quality of life and increasing their 6-minute walking distance	/	/
	Home-Based Mobile Health App Intervention	moderate intensity continuous training, high intensity interval training and physical activity health training.	Positive result for improving patients' quality of life and increasing their 6-minute walking distance	/	/
Exercise counseling intervention	Exercise counseling intervention	an initial exercise counseling session at the time of enrollment, a weekly telephone follow-up and the use of a daily diary to record self-care behaviors,	Positive result for improving physical activity, functional ability, and self-care behavior	resulted in improvements in physical activity, functional capacity, and selfcare behaviors.	There was no significant improvement in self-care management or self-care confidence

Table 2 Authors, title, design, participants, data collection methods and data analysis methods

Author(s) Year of publication Country	Study code	Title	Design(approach)	Participants	Data collection method(s)(time / methods / other scales)	Data analysis method(s)
Yanagi, H., Konishi, H., Yamada, S., Kitagaki, K., Nakanishi, M., Harada, T., & Kohzuki, M. Year:2020 **Country:Japan**	a	effects of exercise training on physical activity in heart failure patient treated with cardiac resynchrionzation therapy devices or implantable cardioverter defibrillators	Design: A randomized controlled trial A quantitative approach	**Total: 62** **Gender:** female and male **Age**: 42-70 (average age: 56.63) **Inclusion criteria:** 1）Patient that completed a 3-month ET（exercise training） programme after ICD（Implantable cardioverter-defibrillator ）, CRT（cardiac resynchronization therapy） 2）pacemaker (CRT-P) or CRT-D treatment at our institution between May 2017 and May 2018. 3）Patients were eligible for the ET programme if they met any of 3 criteria (LVEF ≤40%, percent predicted peak oxygen uptake ≤80%, and B-type natriuretic peptide level ≥80pg/ml) and had been referred to the programme at their physicians' discretion. **Exclusion criteria:** Patients who died from baseline to three months and could not be contacted on the occasion	**Data collection time:** May 2017 and May 2018 **Data collection scale:** 1)International Physical Activity Questionnaire (IPAQ) 2)Patient Health Questionnaire-9 (PHQ-9) 3)Medical Outcomes Study 36-Item Short-form Health Survey (SF-36) questionnaire (25–27).	1)Categorical variables: Fisher's exact test. 2)Comparisons between groups : unpaired Student's t-test or Wilcoxon rank-sum test, depending on normality of distribution 3)Analysis of covariance (ANCOVA) 4)Spearman's rank correlation coefficients 5)Kaplan–Meier survival curves 6)log-rank test 7)JMP Pro version 14.2.0 (SAS Institute, Cary, NC, USA)
Rahman, I., Bellavia, A., Wolk, A., & Orsini, N. Year：2015 **Country:** Sweden	b	Physical Activity and Heart Failure Risk in a Prospective Study of Men.	Design: A randomized controlled trial A quantitative approach	**Total: 33012** **Gender:**male **Age**: average age: 60± 9 **Inclusion criteria:** 1）the men born between 1914 and 1948 residing in Örebro and Västmanland counties in Sweden **Exclusion criteria:** 1）with prevalent HF or myocardial infarction 2）with missing information on total PA	**Data collection time:** beginning of 1998 until the end of 2012 **Data collection scale:** through linkage to the Swedish National Patient Register and Cause of Death Register. A study population of 33,012 men was followed	1）SAS (version 9.2, SAS Institute, Inc, Cary, North Carolina) 2）Stata software version 12.1 (StataCorp LP, College Station, Texas) 3）Cox proportional hazards regression models
Waring, T., Gross, K., Soucier, R., & Wallack, R. Z. Year：2017 **Country:** American	c	Measured physical activity and 30-day rehospitalizatio n in heart failure patients.	Design: A single-center, prospective study, A quantitative approach	**Total: 61** **Finally included：13** **Gender:** female and male（Forty-six percent were male） **Age**: average age:71 ± 15 years **Inclusion criteria:** 1）clinical diagnosis of decompensated heart fail ure leading to that hospitalization. **Exclusion criteria:** (1) the clinical judgment that participating in this study might pose risk to the patient; (2) anticipated cognitive or psychological conditions that might interfere with activity measurement; (3) a significant movement disorder (such as hemiplegia or Parkinson disease) that would independently and substantially affect physical activity. Discharge disposition, home versus extended care facility (skilled nursing facility or rehabilitation center), was also recorded.	**Data collection time:** between October 2014 and March 2015 **Data collection scale:** 1）measured following hospital discharge using an accelerometer on the wrist. 2)Data collected at the time of the index hospitaliza tion included demographics, estimated left ventricular ejection fraction (LVEF) and pulmonary artery systolic pressure from echocardiography, electrolytes (last available measurement), and comorbid conditions.	1）Logistic regression 2）Kaplan-Meier survival analyses
Peng, X., Su, Y., Hu, Z., Sun, X., Li, X., Dolansky, M. A., Qu, M., & Hu, X. Year:2018 **Country:** China	d	Home-based telehealth exercise training program in Chinese patients with heart failure A randomized controlled trial	Design: A randomized controlled design with repeated measures	**Total: 98** **Gender:** female and male **Inclusion criteria:** 1) a primary diagnosis of chronic HF for at least 3 months; 2) New York Heart Association (NYHA) classifification I to III; 3) more than 18 years of age; 4) a clinically stable condition with a regular medication regimen for at least 4 weeks before enrolment in the study; 5) the ability to use Wechat or QQ software via a smart phone; 6) discharged to home; and the ability to understand and speak Chinese.	**Data collection time:**from January 2014 to February 2015 Data were collected at baseline, post-test (2 months after discharge), and 4 months post-test (6 months after discharge) **Data collection scale:** 1）Data were collected by blinded independent collectors. Data analysts and outcome assessors were blinded to the group assignments.	1)SPSS 17.0 Statistical Analysis software package 2)descriptive statistics. The x2 analysis and the Fischer. 3)General Linear Model (GLE) for repeated measurements (ANOVA)

				Exclusion criteria: myocardial infarction within the last month, unstable angina, uncontrolled hypertension, severe respiratory diseases, decompensated non-cardiac disease, malignancy, physical disability, mental disease, or other contraindications that affected participation in this study surgical treatment within the last month; and previous participation in exercise cardiac rehabilitation programs.	2）The baseline data were collected at the hospital prior to discharge, including patients' demographic characteristics, QOL, 6MWD, resting HR, LVEF, NYHA classifification, and levels of anxiety and depression.	
McCarthy, M. M., Dickson, V. V., Katz, S. D., & Chyun, D. A. Year:2017 **Country:** United States	e	An exercise counseling intervention in minority adults with heart failure.	Design: Quasi-experimental, prospective, longitudinal cohort design. Quantitative approach	**Total: 20** **Gender:** female and male **Inclusion criteria:** 1) stable New York Heart Association class I, II or III; 2) age 18–65 years; 3) diagnosed with systolic HF (EF <40%) for at least 3 months; 4) able to perform exercise; 5) English speaking; 6) cleared by HF provider to participate. Cognitive screening was accomplished with the use of the Mini Mental Status Exam (Folstein, Folstein, & McHugh, 1975), with a score of ≥24 needed to participate. **Exclusion Criteria:** 1) cardiac event within previous 3 months to assure adequate recovery time prior to engaging in exercise; 2) unstable arrhythmias or valvular disease; 3) chronic pulmonary disease; 4) severe psychiatric disorders and cognitive impairment that would interfere with individuals ability to engage in the intervention; 5) planned major surgery in next 3 months; 6) physical inability to do any exercise; 7) current participant in any regularly struc tured exercise program.	Demographic information (e.g., age, income) and clinical characteristics including current medications, ejection fraction and comorbid conditions were collected using a medical record review. The Charlson Comorbidity Index (Peterson, 2012) was used to calculate comorbidity cate gory as low, medium or high.	Statistical Analysis Software (SAS 9.1.3)
Fayazi S, Zarea K, Abbasi A, Ahmadi F. Year: 2013 Country: Scand	f	Effect of home-based walking on performance and quality of life in patients with heart failure	design: A quasi-experimental trial A quantitative approach	**Total:** 60 **Age:** 40-75 **Inclusion criteria:** 1)Age 40-75, 2)HF duration>6 months, left ventricular ejection fraction (LVEF) £ 40%, 3)Participants received cardiac drug treatment at least 6 months before study enrollment, and stabilized mild to moderate heart failure NYHA Class II and III **Exclusion criteria:** subjects had chronic obstructive pulmonary disease , documented exercise-induced ischaemia or ventricular tachycardia, uncontrolled hypertension and diabetes, orthopaedic or neurological disease, renal insufficiency (serum creatinine >2.5), psychotropic use and psychiatric disorder.	Data collection method: patients were asked to walk in a corridor of patients home from end to end at their own pace while attempting to cover as much ground as possible in the allotted period of 6 minutes . At the completion of the 6-minute period, the participants were instructed to stop walking, and the distance was recorded. Physical symptoms were observed by the investigator or reported by the participants, and time stopped during the walk test was recorded. **Data collection time:** Eight-week data collection time **Data collection scale:** six-point Likert scale (0–5)	SPSS software version 11
Okwose NC, Avery L, O'Brien N, Cassidy S, Charman SJ, Bailey K,	g	Acceptability, Feasibility and Preliminary Evaluation of a Novel, Personalised, Home-Based	Design: A Pilot Study A quantitative approach	**Total:** 20 **Age:** 68±7 **Inclusion criteria:** 1) patients with a left ventricular ejection fraction ⩽ 40% and diagnosed for at least 3 months.	Subjects will be supported by telephone for about 10 minutes every week to start, increase and maintain their activity level. Subjects will set physical activity goals under the guidance and support of well-trained research team members. The total daily physical activity level of subjects needs to increase by	Pearson's coefficient of correlation: SPSS version 24.0 (SPSS, Chicago, IL, USA): All statistical analyses

Velicki L, Olivotto I, Brennan P, MacGowan GA, Jakovljevic DG 2019 Nov 27 Year: 2019 **Country:** England		Physical Activity Intervention for Chronic Heart Failure (Active-at-Home-HF): a Pilot Study.		2) Patients have no contraindications to physical activity and had to be capable of performing activities of daily living independently. **Exclusion criteria:** 1) Too sick to participate (NYHA IV) or recently hospitalized. 2) Refuse to participate due to personal reasons, time commitment, "feeling unable to participate due to age" or being too nervous to participate in sports intervention.	at least 2000 steps from the baseline level. **Data collection time:** 12 weeks **Data collection scale:** 1) Collect average steps per week using pedometer 2) Complete cardiopulmonary exercise test through non-invasive gas exchange and hemodynamic measurement. Complete the quality of life survey by questionnaire.	
Saleh ZT, Elshatarat RA, Elhefnawy KA, Helmi Elneblawi N, Abu Raddaha AH, Al-Za'areer MS, Mofdy Almarwani A, Alzahrani NS, Aqel AA, Shawashi TO, Tayeh M **Country:**	h	Effect of a Home-Based Mobile Health App Intervention on Physical Activity Levels in Patients With Heart Failure: A Randomized Controlled Trial	Design: A nonprobability convenience sampling design A quantitative approach	**Total:** 127 **Age:** 60.8±10.47 **Inclusion criteria:** 1) Have a smartphone. 2) have been in a stable drug treatment regimen for at least 3 months before recruitment. 3) have not been referred for heart transplantation or coronary artery bypass grafting. 4) have the ability to read and speak Arabic. **Exclusion criteria:** 1) There are medical suggestions for bed rest related to health conditions, such as end-stage lung disease, liver disease or kidney disease. 2) Participated in a gym project. 3) He was hospitalized again for cardiovascular disease within the first 3 months. 4) Have coexisting diseases known to be associated with physical disability or weight loss.	Physical activity levels were monitored using the Samsung mobile health app during the 2-week and 8-week interventions before the intervention. Heart failure symptom burden and health-related quality of life were assessed at baseline, 2 weeks after baseline assessment, and immediately after intervention.	SPSS softare (version 21.0): for analysis
Mueller S, Winzer EB, Duvinage A 2021 Feb 9 the United States **Country:** Jama	i	Effect of High-Intensity Interval Training, Moderate Continuous Training, or Guideline-Based Physical Activity Advice on Peak Oxygen Consumption in Patients With Heart Failure With Preserved Ejection Fraction:l	Design: A Randomized Clinical Tria A quantitative approach	**Total：** 180 **Age：** 70 **Inclusion criteria**：Patients with HFPEF (sedentary patients with exercise dyspnea, LVEF of 50% or higher, estimated left ventricular filling pressure increase, signs and symptoms ≥ 15], or E / E ′ median value greater than or equal to 8, and increased natriuretic peptide [NT proBNP ≥ 220 pg / ml or BNP ≥ 80 pg / ml]). **Exclusion criteria:** Does not meet the HFpEF standard	A total of 180 subjects meeting the inclusion criteria were recruited, and the subjects were equally divided into three groups, with 60 people in each group. One group is the control group, which accepts one suggestion of sports activities according to the guidelines. The other group carries out random high-intensity exercise three times a week for 38 minutes each time (10 minutes warm-up, heart rate reserve is 35% - 50%, 4 × 4 minute interval, heart rate reserve of 80% - 90%, active recovery of 3 minutes interval), a group of random moderate intensity exercise, 5 times a week, 40 minutes each time (heart rate reserve of 35% - 50%). Data collection time： July 2014 to September 2018	R Statistical Software (Version 3.6.0; Foundation for Statistical Computing)
Kitzman, D. W., Whellan, D. J., Duncan, P., Pastva, A. M., Mentz, R. J., Reeves, G. R., Nelson,	j	Physical Rehabilitation for Older Patients Hospitalized for Heart Failure.	Design: A multi-center, randomized, attention-controlled trial A quantitative approach	**Total: 349** **Gender:** female and male （52% women, 49% non-white） **Age**:60–99 **Inclusion criteria:** The trial included 60-year-old patients who were admitted to ADHF, with reduced or preserved ejection fraction (HFrEF, HFpEF), walked 4 meters with assistive devices, had	Short Physical Performance Battery (SPPB) score	1) SAS Enterprise Guide version 7.11 and SAS 9.4 (Cary, NC) 2) Baseline characteristics 3) Analyses of covariance 4) Poisson regression with adjustment 5) negative binomial regression

M. B., Chen, H., Upadhya, B., Reed, S. D., Espeland, M. A., Hewston, L., & O'Connor, C. M. Year：2021				function independent before admission, and were expected to discharge home. **Exclusion criteria:** End-stage heart failure or kidney disease, inability to participate due to dementia, stroke or other diseases, and already participating in regular exercise.		

Table 3 Aims and results of selected articles

Authors	Study code	Aim	Intervention	Outcome	Results
Yanagi, H., Konishi, H., Yamada, S., Kitagaki, K., Nakanishi, M., Harada, T., & Kohzuki, M.	**a**	To clarify the effects of exercise training on physical activity, 6-minute walking distance, and all-cause hospitalization rates in patients with chronic heart failure, and to assess the factors affecting the changes in physical activity.	1) **Intervention content:** ***Intervention group*** ***1***)Patients (n=62) who completed an exercise training programme after implantable cardioverter-defibrillator or cardiac resynchronization therapy treatment between May 2017 and May 2018 were included.As assessed by the International Physical Activity Questionnaire, patients exercised 20-50 min weekly for 3 months and were assigned to the activity group (10 min / day) based on changes in baseline and 3-month walking time ***Control group*** Patients had exercise time <10 min / day, based on the change in walking time between baseline and 3 months.**Intervention time:** 3 months	1) The 6-min walk distance improved in both groups with exercise training($p<0.01$). Physical activity level did not increase in some patients, despite improvements in exercise tolerance. Depression improved significantly in the active group($p<0.01$), but no correlation was found with physical activity. Factors contributing to physical activity changes were not identified. The all-cause hospitalization rate was lower in the active group during follow-up (mean 10.5 months).the PHQ-9 score significantly improved only in the active group ($p<0.01$). 2) The active group also showed significant improvement in IKEMS, sedentary time, walking according to the IPAQ, walking time, step count, PCS, and RCS ($p<0.01$) In the non-active group, walking according to the IPAQ and walking time decreased significantly . However, RCS improved significantly. Significant differences were found between the groups. 3) The sedentary time, walking, walking time according to the IPAQ, active step count, PHQ-9, and PCS were better in the active group than in the nonactive group .	Postive result
Rahman, I., Bellavia, A., Wolk, A., & Orsini, N.	**b**	To investigate whether total physical activity, and also the different types of physical activity, is associated with the risk of heart failure.	**1）Intervention content:** 1.Patients completed the questionnaire, which included information about the parameters Pant education, smoking and drinking Consumption, whether there is hypertension, the family has his hypertension Myocardial infarction diagnosis, diabetes mellitus diagnosis, weight, and height 2.Study participants were asked to report their activity levels at work, family / household chores, walking / cycling, and exercise during the year before study enrollment and at age 30 years. The questionnaire also included	1）a U-shaped association between total physical activity and heart failure risk was detected, with both extremely high (57 metabolic equivalent MET h/day) and extremely low (38 MET h/day) levels of total physical activity associated with an increased risk of heart failure. 2） walking/bicycling at least 20 min/day was associated with 21% lower risk of heart failure (95% confidence interval: 0.72 to 0.87); corresponding to a the median age at heart failure 8 months later for those who had actively walked or biked daily.	A certain extent of the positive impact

			questions about inactivity (watching TV or reading), and open-ended questions about sleeping, sitting, or lying time per day。 3.HF events were identifified by using International Classifification of Diseases-10 codes I50 (HF) and I11.0 (hypertensive heart disease with HF).	3）rend toward more recent active behavior being more related to heart failure protection than past physical activity levels.	
Waring, T., Gross, K., Soucier, R., & Wallack, R. Z.	**c**	To measure the relationship between physical activity and 30 days of rehospitalization in patients with HF	***Intervention group*** 1)Patients with high intensity activity (i. e. 3000 vmu) for 60 minutes per day, ***Control group*** Patients with <60 min per day for this high level of activity	1) The 30-day all-cause hospitalization rate was 26%, compared to 18% for heart failure admissions. 2) Sixty-six percent and 34% were dichotomized into the higher and lower physical activity groups, respectively, over the first week; the latter were more likely to be readmitted within 30 days, with an OR = 5.0 (95% CI, 1.3-19.1), P = .02. 3) Physical inactivity is related to 30-day all-cause readmissions for heart failure.	A certain extent of the positive impact
Peng, X., Su, Y., Hu, Z., Sun, X., Li, X., Dolansky, M. A., Qu, M., & Hu, X.	**d**	To examine the effect of our telehealth exercise training program on health outcomes in patients with HF in China.	**Experimental group:** Participants received an 8-week home health exercise training program with 32 exercise training sessions and regular telephone or instant messaging follow-up and consultations. (n=49) **Control group:** Participants received the usual treatment.(n=49)	1）Statistically signifificant improvements were observed in the experimental group regarding quality of life (QOL) and 6MWD 2）compared to the control group post-test. Signifificant improvements in QOL, 6MWD, and resting HR were sustained for 4 months post-test. 3）However, no signifificant improvements were observed regarding the NYHA classifification, LVEF, anxiety, and depression at either the post-test or 4-month post-test follow-ups. 4)No patients experienced any signifificant complications or adverse outcomes during the program.	Postive result
McCarthy, M. M., Dickson, V. V., Katz, S. D., & Chyun, D. A.	**e**	The purpose is to study the feasibility of exercise intervention on rehabilitation for heart failure patients of different races/ethnicities under the guidance of nurses.	**Experiment group：** 1. Conduct an initial exercise consultation meeting during registration to develop an appropriate exercise plan based on the progress of the participants' condition. 2. Participants need to undergo weekly telephone follow-up for 12 weeks; 3. Participants will receive a diary recording their daily steps, Borg exercise scale, weight, and hand weight used during upper body movements. **Control group：**	1）Results indicate this intervention was feasible for most participants, and resulted in improvements in physical activity, functional capacity, and selfcare behaviors. 2）At 12 weeks, there was signifificant improvement in physical activity as measured by weekly step-counts (p = 0.03). There was also signififi- cant improvement in the IPAQ walking score (p =0 .04). However, there were no signifificant improvements in moderate (p = 0.12) or vigorous activity (p = .43). The SCHFI self-	positive effects

			Participants participate in routine treatment other than exercise therapy.	care maintenance score improved signififi-cantly (p = 0.03), but there were no signifificant improvements in self-care management (p = 0.47) or self-care confifidence (p =0 .93).	
Fayazi S, Zarea K, Abbasi A	f	Obtain reliable and precise estimates of waking exercise on the quality of life and performance of heart failure patients.	**Control group:** No intervention. **Experimental group:** Receiving a designed Exercise programme For 8 weeks.	1) Before intervention, there was no significant difference between the control group and the experimental group in quality of life (p>0.95), six-minute walking test (p=0.764) and training time. 2)After intervention, there was a significant difference between the total score of average quality of life in the training group (52.32 to 43.80, p<0.001) and the average walking distance in the 6-minute walking test in the training group 1 and group 2 (373.86 ± 71.67 to 412.30m, p<0.001), while there was no significant difference between the control group before and after the test (376.70 ± 58 to 377.63m ± 72.55, p=0.351), The average exercise time of the training group increased from the first week to the eighth week. Repeated measurement test showed significant difference (19.96 minutes to 23.10 minutes, p<0.001).	There are positive effects in the results.
Okwose NC, Avery L, O'Brien N, Cassidy S, Charman SJ, Bailey K, Velicki L, Olivotto I, Brennan P, MacGowan GA, Jakovljevic DG	g	The present pilot study evaluated feasibility, acceptability and physiological effects of a novel, personalised, home-based physical activity intervention in chronic heart failure.	**Control group:** No control group **Experimental group:** Support is provided by telephone for about 10 minutes every week, aiming to start, increase and maintain their activity level and maintain the activity volume in a specific range.	1) There was no statistically significant change in exercise tolerance with peak oxygen consumption and peak workload increasing post-intervention by 4.8% and 11% respectively. However, workload and oxygen consumption at submaximal exercise (i.e. anaerobic threshold) increased by 20% (49 ± 16 vs. 59 ± 14 watts, P = 0.01) and 11% (11.5 ± 2.9 vs. 12.8 ± 2.2 ml/kg/min, P = 0.39) post-intervention. **2)** The completion of the intervention resulted in significant improvements in peak exercise stroke volume (126.5 ± 33.8 vs. 150.8 ± 33.5 ml/beat, P = 0.05) and stroke volume index (64.6 ± 14 vs. 75.2 ± 17 ml/beat/m2, P = 0.04). There was also a 10–15% improvement in peak exercise cardiac output and cardiac index.	There are positive effects in the results.
Saleh ZT, Elshatarat RA, Elhefnawy KA, Helmi Elneblawi N, Abu Raddaha AH, Al-Za'areer MS, Mofdy Almarwan	h	To determine the impact of an 8-week home mobile health app intervention on physical activity levels and evaluate its impact on symptom burden and health-related quality of life.	**Control group:** Routine nursing group (n = 67) **Experimental group:** 8-week home mobile health application intervention group (n = 65). This intervention is aimed at reducing the time of sedentary behavior and increasing the time of physical activities carried out under mild or higher intensity.	1) Physical activity: The outcome variable was considered as the average number of daily steps per week during the 8-week intervention period compared to participants in the baseline and routine care groups. The daily steps are determined using the Samsung mobile health app. 2) Symptom burden: The symptom load of heart failure was measured using the memory symptom assessment scale - heart failure. The tool consists of 32 items, reflecting three aspects of HF symptoms: psychological (6 items), physical (21 items) and HF specific (5 items)	There are positive effects in the results.

i A, Alzahrani NS, Aqel AA, Shawashi TO, Tayeh M				symptoms. Each symptom was evaluated with 3 scales, indicating that the frequency of symptoms ranged from 1 to 4 (rarely to almost persistent), the severity of symptoms ranged from 1 to 5 (mild to acute), and the pain of symptoms ranged from 0 to 4 (completely not serious to very serious). The 3 scores were added to obtain the burden score for each symptom. The higher the total score, the higher the frequency, severity and pain of symptoms. **3)** Health-related quality of life: The assessment of health-related quality of life used a special health tool, the Arabic version of the 36 item short form health survey (SF-36). The tool uses 36 questions to assess patients' cognition of 8 aspects of how current health problems affect their daily living functions.	
Mueller S, Winzer EB, Duvinage A	i	To determine whether high-intensity interval training, moderate continuous training, and guideline based physical activity recommendations have an impact on peak V in HFPEF patients · The change of O2 has different effects	**Control group**：The patients did not receive moderate intensity continuous training, high intensity interval training and physical activity health training. **Experimental group**： Patients (1:1:1; n = 60 in each group) received 12 months of high-intensity interval training (3 × 38 min / week), moderate intensity continuous training (5 × 40 minutes / week) or guideline control (providing one physical activity suggestion according to the guideline) (3 months in clinical, 9 months in home exercise under telemedicine supervision).	The primary end point was the change in peak V˙ O2 after 3 months. Secondary end points included changes from baseline to 3 and 12 months for echocardiographic measures of diastolic function (E/e' medial, e' medial, left atrial volume index), NT-proBNP, cardiopulmonary exercise testing parameters (peak V˙ O2, V˙ E/V˙ CO2 slope, submaximal workload at VT1)	There are positive effects in the results.
Kitzman, D. W., Whellan, D. J., Duncan, P., Pastva, A. M., Mentz, R. J., Reeves, G. R., Nelson, M. B., Chen, H., Upadhya, B., Reed, S. D., Espeland, M. A., Hewston, L., & O'Connor, C. M.	j	To address these important gaps in ADHF management, we conducted a randomized, attention-controlled, single-blind trial of a novel, transitional, tailored, progressive, multi-domain physical rehabilitation intervention.	**Control group :** received usual care as recommended by their medical providers, which could include inpatient or outpatient physical therapy and standard cardiac rehabilitation. Participants received bi-monthly telephone contacts and in-person clinic visits every 1 and 3 months after discharge without specific advice on exercise; but were encouraged to adhere to the prescribed treatment and follow-up appointments. ***Intervention group*** ***1***).The intervention focused on 4 domains: strength, balance, mobility, and endurance which were stratified at every session from a level of 1–4.Advances in exercise intensity and pattern were individualized according to the level of performance within each domain. A key goal is to increase endurance (walking time), but to do so safely, it first needs to address deficiencies in balance, strength, and mobility. 2)The intervention was started in the hospital whenever possible and transferred to the outpatient facility as soon as possible after discharge. If needed, home sessions were initially provided by the therapist until participants were able to attend facility-based outpatient sessions. The clinic lasts 60 minutes, 3 days per week for 12 weeks or 36 visits. After the researcher visit to assess the participants' home environment, facility-based outpatient activities supplemented home exercise (low-intensity walking and strengthening exercise, gradually reaching the goal of 30 minutes per day). One key goal addressed in the earlier days and during the first 3	1) SPPB score at 3-months showed a large (1.5 units; CI:0.9–2.0) improvement in Rehabilitation Intervention relative to Attention Control ($p<0.0001$) , which was relatively uniform across a wide variety of pre-specified subgroups . 2） There were large improvements in all SPPB components .There was no significant difference in the secondary outcome, all-cause re-hospitalization rate at 6-month follow-up . 3） There were large improvements in the Intervention versus Control group in 6MWD, gait speed, number of Modified Fried Frailty Criteria, quality-of-life, and depression . The rate of overall falls was nominally lower (−33%; p=0.09), in the rehabilitation intervention group. Cognition was unchanged. 4） There were 37 on-trial deaths, none related to intervention or study procedures. Causes of death are in Table S6. There were no significant differences in deaths or other clinical event outcomes.	There are positive effects in the results.

			months of the one-on-one supervised sessions is to prepare patients for the transition to an independent maintenance phase at 4–6 months. During the 3-month visit, participants were transitioned to the maintenance phase with a personalized exercise prescription and then called. 3） received usual care as recommended by their medical providers, which could include inpatient or outpatient physical therapy and standard cardiac rehabilitation.		