





Comparative Systematic Review of Telehealth Delivery Models, Intervention Content, and Outcomes in Heart Failure Care

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Background: Heart failure management remains challenging due to limited self-care and prevalent depressive symptoms, with telehealth emerging as an effective approach to strengthen disease management and enhance patients' quality of life. However, studies that specifically explore models, intervention content, and the broader benefits of telehealth in HF management are still limited.

Purpose: This systematic review aimed to compare and synthesize different telehealth delivery models, intervention content, and associated outcomes in the management of patients with heart failure.

Methods: A systematic review was conducted in accordance with Cochrane and PRISMA guidelines. A comprehensive search was conducted across multiple databases, including PubMed, Scopus, EBSCOhost, Taylor & Francis, and Springer Nature, with a focus on randomised controlled trials (RCTs) published in English. The article selection process is based on title, abstract, full text, and eligibility criteria, including quality appraisal. Data analysis employed thematic synthesis and descriptive qualitative approaches to categorize interventions, content, and outcomes.

Results: The review included 28 studies, evaluating three main telehealth intervention models: (1) telemonitoring, (2) phone call support, and (3) smartphone and web-based applications. Intervention content included symptom and medication monitoring, patient education, empowerment for self-management, reminders and feedback, psychological and social support, and healthcare communication. The study outcomes were categorized into four themes, including clinical outcomes, physical and mental health outcomes, behavioral outcomes, and quality of life. Among these models, phone call support and reminder interventions were most often recommended as practical and feasible approaches, as they are easy to implement, and flexible.

Conclusion: This review highlights that while telehealth interventions consistently improve quality of life, their impact on mental health and long-term clinical outcomes remains variable. Integrating support models with phone calls and reminders into routine heart failure management may improve accessibility and continuity of care, particularly for patients requiring ongoing behavioral and emotional support.

Keywords: heart failure, telehealth, telemonitoring, telenursing, patient outcomes

Introduction

Heart failure (HF) is a global pandemic affecting approximately 64 million people worldwide.¹ In the United States and Europe, >1 million hospitalizations are due to HF.² In addition, a previous study reported that the combined average 30-day readmission rate from 18 countries was 13% (95% CI: 10%–16%) worldwide.³ HF is not only a health problem, but also a significant economic burden on the global health system.⁴ This condition reflects the significant challenges in managing HF, which not only increases the burden on global healthcare systems, but also worsens patients' quality of life.

Higher hospitalisation, readmission, and mortality rates in HF patients are associated with poor levels of patient self-care.^{5–7} In addition, another challenge that also arises in HF patients is the high level of depressive symptoms. Depression is consistently associated with a poorer quality of life (QoL) in HF patients.^{8–10} Depression is common in



HF patients and is closely associated with poor health-related quality of life (HRQoL). Depression affects a significant proportion of HF patients, with prevalence rates ranging from 21.5% to 65% across various studies and populations.^{9–11}

Telehealth plays a crucial role in the management of HF patients. The American Heart Association (AHA) reported that telehealth has proven effective in enhancing the efficiency of information delivery, diagnosis, disease monitoring, and follow-up care conducted remotely, leading to significant advancements in cardiovascular disease management.¹² In addition, telehealth innovations are an effective strategy for addressing depression and improving QoL in HF patients.^{13–17} Collaborative care models such as the Hopeful Heart Trial, which combines HF management with telephone depression care, significantly improve patients' mood and QoL.^{18,19} Previous studies have used interactive tools and video-based CBT modules that can help patients change negative thought patterns, build self-efficacy, and adhere to treatment plans, directly addressing the impact of depression,¹⁸ which indirectly reduces the symptoms of depression.^{20–22} Additionally, telehealth facilitates regular communication between patients and healthcare providers, ensuring continuity of care.²³ This approach not only improves clinical outcomes but also expands access to services, especially for patients and families living in remote areas, making it a practical and patient-centred strategy in managing heart failure.^{12,20}

Although the effectiveness of telehealth in reducing hospitalisations, mortality, and improving self-care among HF patients has been widely demonstrated, existing reviews remain limited in scope. Previous reviews have focused on the benefits of telehealth for self-care in HF patients,²⁴ as well as a nurse-led telecoaching intervention,²⁵ without exploring existing models and content in telehealth.^{26,27} A comprehensive synthesis comparing these dimensions is still lacking. Addressing this gap, the present review aims to analyse and compare various telehealth delivery models, intervention contents, and their associated outcomes to provide a more integrated understanding of how telehealth can optimise HF management.

Exploring the various models and content used in telehealth is a crucial component in identifying best practices that can be applied in the care of HF patients. Without a thorough understanding of the telehealth models being implemented and the content being delivered, optimizing the use of telehealth to improve the quality of care and reduce readmission and mortality rates will be challenging to achieve. Although several studies have explored the specific benefits of telehealth, systematic reviews that provide a comprehensive analysis of the various approaches and types of content used in telehealth remain limited. This review aims to fill this gap by comparing and analyzing various telehealth interventions that have been implemented, as well as evaluating relevant content used to support HF patient management.

Materials and Methods

Study Design

This study employed a systematic review approach, following the Cochrane Handbook for Systematic Reviews of Interventions and conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.^{28,29} This review has been registered in PROSPERO with the ID number CRD420251050361.

Eligibility Criteria

In this review, three independent reviewers selected relevant articles according to the PRISMA guidelines (see [Figure 1](#)). The development of research questions and eligibility criteria was based on the PICOT framework. The population (P) of interest consisted of heart failure. The intervention (I) studied was telehealth, encompassing telemedicine and telenursing. The comparator (C) was standard care or usual care; the outcome (O) focused on health outcomes, including readmissions, mortality, self-efficacy, self-care, quality of life, knowledge, depression, anxiety, and other relevant measures. The study type (T) included in this review was restricted to randomized controlled trials (RCTs).

Studies were eligible for inclusion if they were full-text, published in English, and employed an RCT design to evaluate the effectiveness of telehealth in managing patient with heart failure. Publications were excluded if the full text was unavailable, if the language was not English, or if the study was secondary research. No publication year limits were applied in this review to ensure a comprehensive inclusion of all relevant randomized controlled trials on telehealth interventions for heart failure patients. This approach was chosen to capture the evolution and longitudinal trends of

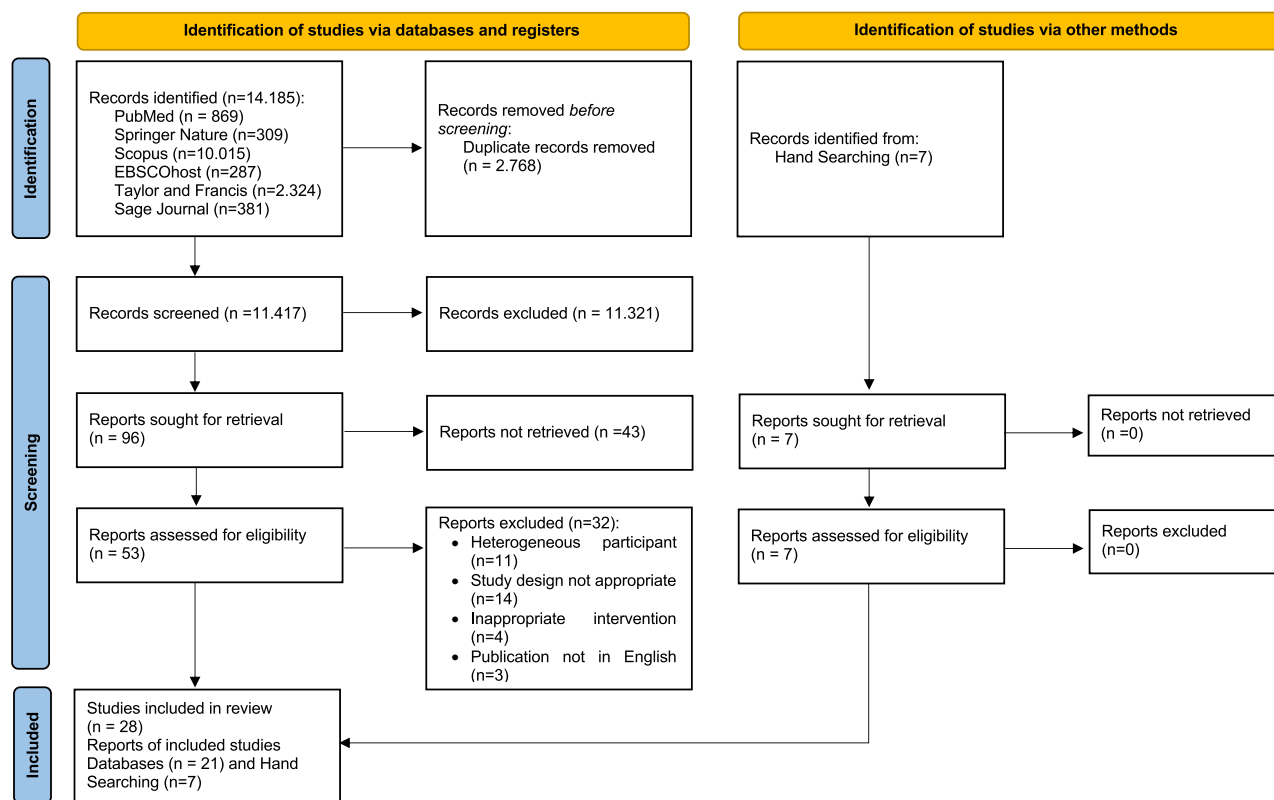


Figure 1 PRISMA Flow Diagram adapted from Page MJ, McKenzie JE, Bossuyt PM et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ*. 2021;372:n71. Creative Commons.²⁸

telehealth technologies and intervention designs over time, considering the rapid and continuous advancement of digital health innovations in HF management.

Search Strategy

Identification of articles was conducted systematically through six main databases and search engine: EBSCOhost, PubMed, Scopus, Taylor and Francis, Springer Nature, and Sage Journal. The keywords used in the search process included: “heart failure or cardiac failure or CHF or chronic heart failure or congestive heart failure AND telenursing or telehealth or e-nursing or digital nursing AND clinical outcomes or patient outcomes or client outcomes”. The Boolean operators “AND” and “OR” were used to refine or broaden the search results and effectively capture relevant literature across various databases.

In addition to database searching, hand searching was also conducted. Hand searching refers to the manual process of reviewing reference lists of relevant articles, journals, or conference proceedings to identify additional studies that may not have been retrieved through electronic databases. This approach was used to ensure a more comprehensive identification of eligible studies for inclusion in the review.

Study Selection and Quality Appraisal

The authors (FS and AN) independently screened the studies according to the predefined eligibility criteria. During the initial selection phase, duplicates were identified and removed using Mendeley Reference Manager. Next, the titles, abstracts, and full texts of the articles were evaluated for their relevance to the research topic, with the inclusion and exclusion criteria applied. In the final stage, all authors conducted a detailed review of each selected article using the Joanna Briggs Institute (JBI) critical appraisal checklist to evaluate the quality of the studies.³⁰ This tool was selected because it is a globally recognized instrument specifically designed for evaluating RCTs, and its standardized framework promotes consistency across reviewers, thereby enhancing the transparency of the appraisal process.

For quality assessment, articles with a RCT design were evaluated using 13 criteria. Each item provided four response options: Yes, No, Not Applicable, and Unclear. A score of 1 was assigned for each “Yes” response, while all other responses received a score of 0. Studies that obtained a JBI score below 75% were excluded from the review. Discrepancies in the assessment results were discussed among the authors. However, no disagreements occurred regarding the suitability of the selected studies for inclusion.

Assessment of Risk of Bias in Included Studies

Two reviewers (FS and AN) independently assessed the Risk of Bias (RoB) for RCT studies included in this review analysis using the Cochrane Risk of Bias (RoB) 2.0 tool. RCTs consist of five RoB domains, including (1) randomisation process, (2) deviation from the intended intervention, (3) missing outcome data, (4) outcome measurement, and (5) selection of reported outcomes.³¹ RoB is defined as “high”, “low”, or “some concern”, or “no information” for each domain. Discrepancies in the assessment results were then discussed, and a review by all authors determined the decision.

Data Extraction and Analysis

In this review, data from the selected studies were extracted and examined using tables that consolidated all relevant findings related to the research topic. Data extraction was performed by two reviewers (FS and AN) and subsequently reviewed by others reviewers (YT and KLA). The extraction table contained important study characteristics and interventions, and the data were analyzed thematically through an exploratory descriptive approach. The analysis process started with organising and presenting the extracted data in a table format based on the reviewed articles. Each finding was then thoroughly analysed and described in accordance with the extracted information. To ensure accuracy and minimise the risk of errors during data extraction, the authors conducted a final review of all included studies.

Results

Study Selection

The study selection process adhered to the PRISMA 2020 guidelines. An initial search across six major databases (PubMed, Springer Nature, Scopus, EBSCOhost, Taylor and Francis, and Sage Journal) yielded 14,185 records. Following the removal of 2,768 duplicates, 11,417 studies remained for title and abstract screening. Of these, 11,321 were excluded for not meeting the predefined eligibility criteria. Consequently, 96 full-text articles were retrieved for further assessment. Forty-three articles could not be accessed in full, leaving 53 for eligibility evaluation. At this stage, 32 studies were excluded due to heterogeneous study populations, inappropriate study designs, irrelevant interventions, or publication in languages other than English. In parallel, manual hand searching identified seven additional studies, all of which met the eligibility criteria. In total, 28 studies were included in the final systematic review.

Quality Appraisal and Risk of Bias of Included Studies

The results of the article quality analysis using the JBI showed that almost all the analysed studies had a good methodology (see [Table S1](#)). This is evidenced by the majority of studies scoring 13/13, indicating that they met almost all the criteria for reducing the risk of bias. However, several aspects were answered with “No” or “Unclear” in several studies, indicating potential methodological issues. An aspect that showed uncertainty was participant blinding (participants were blind to treatment assignment), where several studies did not provide clear information about whether participants were aware of the treatment they received.^{17,32–40} Additionally, one study also showed an “Unclear” response to the outcome assessors’ blindness to treatment assignment criteria.³⁷

The risk of bias analysis also found that almost all studies were classified as low-risk (see [Figure 2](#)). Overall, although most studies scored high with a low risk of bias, it is important to pay attention to studies that show concerns in several domains. Domains such as deviation from the intended intervention and inconsistent outcome measurements warrant further scrutiny, as these may indicate issues with intervention implementation or the validity of the outcomes being measured. Therefore, although the majority of these studies demonstrated high quality and reliability, a more in-depth

Study	Risk of bias domains					Overall
	D1	D2	D3	D4	D5	
Asch et al. (2020)53	+	+	+	+	+	+
Athilingam et al. (2017)42	+	+	+	+	+	+
Bakitas et al. (2020)14	+	+	+	+	+	+
Bashi et al. (2016)33	+	-	+	+	+	-
Boriani et al. (2017)34	+	-	+	+	+	-
Chandhry et al. (2010)35	+	-	+	+	+	-
Clays et al. (2021)13	+	+	+	+	+	+
Davoudi et al. (2020)17	+	-	+	+	+	-
Ding et al. (2020)43	+	+	+	+	+	+
Dorsch et al. (2021)36	+	-	+	+	+	-
Ferrante et al. (2010)38	+	-	+	+	+	-
Galinier et al. (2020)37	+	-	+	+	+	-
Gallagher et al. (2017)45	+	+	+	+	+	+
Hale et al. (2016)39	+	-	+	+	+	-
Hwang et al. (2017)46	+	+	+	+	+	+
Kitsiou et al. (2025)51	+	-	+	+	+	-
Koehler et al. (2024)15	+	+	+	+	+	+
Mirshahi et al. (2024)47	+	+	+	+	+	+
Peng et al. (2018)50	+	+	+	+	+	+
Piette et al. (2015)55	+	+	+	+	+	+
Piotrowicz et al. (2020)40	+	+	+	+	+	+
Piotrowicz et al. (2024)66	+	-	+	+	+	-
Rahimi et al. (2020)44	+	+	+	+	+	+
Ribeiro et al. (2025)48	+	+	+	+	+	+
Scherr et al. (2009)54	+	+	+	+	+	+
Seto et al. (2012)16	+	+	+	+	+	+
Victoria-Castro et al. (2024)49	+	+	+	+	+	+
Vourinen et al. (2014)41	+	-	+	+	+	-

Domains:
D1: Bias arising from the randomization process.
D2: Bias due to deviations from intended intervention.
D3: Bias due to missing outcome data.
D4: Bias in measurement of the outcome.
D5: Bias in selection of the reported result.

Judgement
- Some concerns
+ Low

Figure 2 Risk of Bias Assessment.

evaluation of studies with concerns in specific domains is crucial to ensure the credibility and relevance of their findings in a broader context.

Characteristics of Studies

The studies analyzed had various characteristics, including location, design, population, and participant demographics of the HF studies. Studies were conducted in various countries, including the United States, Australia, Germany, Poland, Iran, Canada, and several other countries (see Figure 3). All study designs used were RCTs, which are considered the most credible method for evaluating medical interventions.

The sample sizes in these studies varied, ranging from studies involving as few as nine participants in each group to those with more than 800 participants. The study with the largest sample size was conducted in the United States, with 826 participants in the intervention group and 827 in the control group.³⁴ This large study allows for greater insight into the effectiveness of the intervention in a larger and more diverse group of patients. In addition, the study with the smallest sample size was conducted in the USA, with only 9 participants per group in a pilot study focused on heart failure patients with NYHA II–III.⁴¹

Characteristics of Participants

Most of the studies involved patients with NYHA stage II–IV heart failure, which includes moderate to severe conditions (See Table 1). In these studies, participants were mostly elderly patients, with many studies involving an average age of between 60 and 70 years, which is representative of the typical heart failure population worldwide. For example, a study in Australia involved participants with an average age of 69.5 years,⁴² while a study in Poland had an average age of 62.6 years.³⁹ The gender distribution in most of these studies showed a preponderance of males, although there was variation between studies. For example, in a US study, the proportion of males reached 100%, while in some other studies in the USA and Canada, the percentage of males was around 50–75%.

Analysis of Delivery Models in Telehealth

Thematic analysis approach was used to categorize the delivery methods. First, descriptions of intervention delivery across all included RCTs were extracted into a data matrix. Two of the researchers (FS and AN) coded the descriptions according to mode of delivery (eg, remote monitoring devices, telephone, mobile applications). Codes with conceptual overlap were then clustered together by the two researchers and any disagreement was resolved by discussion. Lastly through iterative comparison of delivery characteristics to ensure the themes emerged inductively from the data. Three

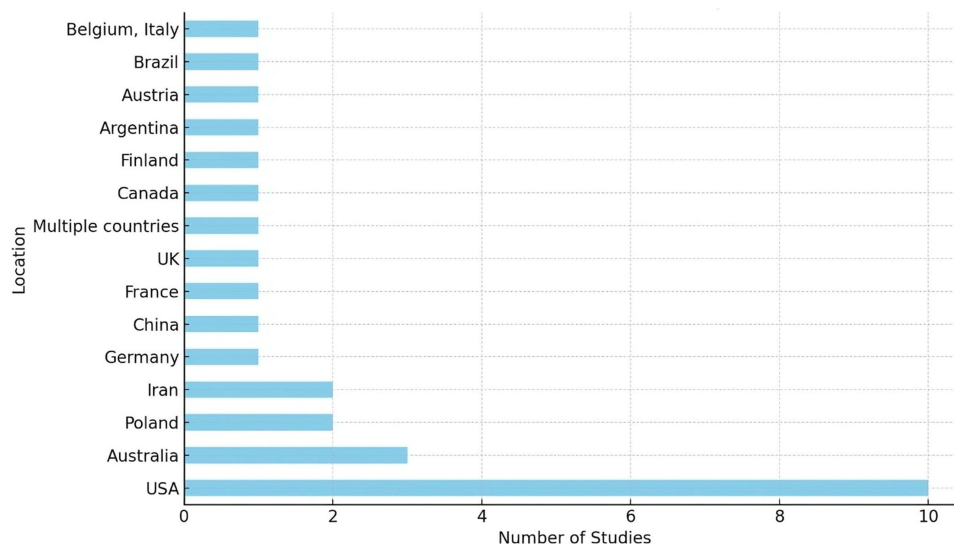


Figure 3 Number of Studies Based on Country.

Table 1 Characteristics of Studies

Study	Location	Design	Population	Sample Size	Age (Mean, SD)	Male (%)
Bakitas et al (2020) ¹⁴	USA	RCT	HF NYHA III/IV	IG: 208 CG: 207	63.8 (8.5)	53.4
Ding et al (2020) ⁴²	Australia	RCT	CHF LVEF ≤40%	IG: 91 CG: 93	69.5 (12.3)	73
Koehler et al (2024) ¹⁵	Germany	RCT	HF NYHA II/III	IG: 765 CG: 773	71 (9.4)	70
Piotrowicz et al (2020) ³⁹	Poland	RCT	HF NYHA I–III LVEF ≤40%	IG: 425 CG: 425	62.6 (10.8)	88.7
Mirshahi et al (2024) ⁴³	Iran	Pilot RCT	HF NYHA II/III	IG: 25 CG: 25	44.68 (11.90)	52
Victoria-Castro et al (2024) ⁴⁴	USA	RCT	HFpEF and HFrEF patients	IG: Bodyport: 46 Conversa: 46 Noom: 46 CG: 44	59–62	62.1
Gallagher et al (2017) ⁴⁵	USA	Pilot RCT	HF patients with CFH post-hospital discharge	IG: 20 CG: 20	68 (49–79)	75
Asch et al (2020) ⁴⁶	USA	RCT	HF patients post-discharge	IG: 272 CG: 280	64.86 (12.39)	48.9
Peng et al (2018) ⁴⁷	China	RCT	HF patients NYHA I–III	IG: 49 CG: 49	>60 years old (71.4%)	57.1
Kitsiou et al (2025) ⁴⁸	USA	RCT	HF NYHA I–III	IG: 11 CG: 14	55.4 (9.17)	46
Galinier et al (2020) ³⁶	France	RCT	HF hospitalized ≤12 months	IG: 482 CG: 455	60 to <80 years (55.6%)	73.4
Piotrowicz et al (2024) ⁴⁹	Poland	RCT	HF patients NYHA III–IV	IG: 302 CG: 306	67 (±14)	79
Rahimi et al (2020) ⁵⁰	UK	RCT	Chronic HF NYHA II–IV	IG: 101 CG: 101	72.8 (11.1)	74
Boriani et al (2017) ³³	Multiple countries (Europa and Israel)	RCT	HF patients had received a de novo implant of a Medtronic CRT-D	IG: 437 CG: 428	66 (11)	78.8
Chaudhry et al (2010) ³⁴	United States	RCT	Patients recently hospitalized for HF	IG: 826 CG: 827	61 (51–73)	56.5
Piette et al (2015) ⁵¹	United States	RCT	Patients with NYHA II–III and LVEF <40%	IG: 166 CG: 165	67.6 (10.3)	100
Seto et al (2012) ¹⁶	Canada	RCT	Patients with LVEF <40%	IG: 50 CG: 50	55.1 (13.7)	82
Vourinen et al (2014) ⁴⁰	Finland	RCT	HF patients LVEF<35%, NYHA ≥2	IG: 47 CG: 47	58.3 (11.6)	83
Ferrante et al (2010) ³⁷	Argentina	RCT	HF patients	IG: 760 CG: 758	64.8 (13.9)	72.6
Scherr et al (2009) ⁵²	Austria	RCT	Patients with NYHA II–IV	IG: 54 CG: 54	65 (62–72)	74

(Continued)

Table I (Continued).

Study	Location	Design	Population	Sample Size	Age (Mean, SD)	Male (%)
Davoudi et al (2020) ¹⁷	Iran	RCT	Patients with HF hospitalized in cardiac care units	IG: 55 CG: 56	50.07 (11.77)	62
Dorsch et al (2021) ³⁵	USA	RCT	CHF	IG: 42 CG: 41	60.2 (9)	57
Ribeiro et al (2025) ⁵³	Brazil	RCT	HF Patients	IG: 70 CG: 57	63.6 (10.7)	50
Athilingam et al (2017) ⁴¹	USA	Pilot RCT	HF Patients, NYHA II–III	IG: 9 CG: 9	53.06 (4.02)	44.4
Clays et al (2021) ¹³	Belgium, Italy	RCT	HF Patients with NYHA II–III and LVEF <40%	IG: 34 CG: 22	61.8 (11.0)	76.5
Bashi et al (2016) ³²	Brisbane, Australia	RCT	HF Patients with LVEF <40%, NYHA I–III	IG: 14 CG: 14	61.7 (9.9)	79
Hale et al (2016) ³⁸	USA	RCT	Patients with HF	IG: 11 CG: 14	68.4 (11.8)	64
Hwang et al (2017) ⁵⁴	Australia	RCT	Patients with CHF with reduced or preserved ejection fraction	IG: 24 CG: 29	68 (14)	79

Abbreviations: CHF, Congestive Heart Failure; CG, Control Group; HF, Heart Failure; HFpEF, Heart Failure with Preserved Ejection Fraction; HFrEF, Heart Failure with Reduced Ejection Fraction; IG, Intervention Group; LVEF, Left Ventricular Ejection Fraction; NYHA, New York Heart Association; RCT, Randomized Controlled Trial; USA, United States of America.

recurring themes were identified: (1) telemonitoring, (2) phone call support and reminders, and (3) mobile applications and web-based systems.

Telemonitoring is a remote health monitoring method that enables medical personnel to continuously monitor a patient's condition in real-time using technological devices. In addition, telephone calls in the context of telehealth are an approach in which communication between the patient and the healthcare provider is conducted via telephone. Finally, mobile applications and web-based systems serve as telehealth platforms, enabling patients to monitor their health conditions independently. An application installed on a smartphone or internet-based web portal allows patients and healthcare workers to monitor patients.

Theme I: Telemonitoring

In the context of telemonitoring, more than half of the reviewed studies (n=10) have been conducted using technology to remotely monitor patient health conditions.^{15,16,33,36,38,39,42,45,50,54} The technologies used vary, including Bluetooth scales, tablets, Android apps, mobile phones, ECG devices, and wireless sensors. Systems used typically involve devices connected to a cellular network or the internet, allowing patient health data to be sent in real-time to healthcare providers for further monitoring. Monitoring is carried out on various aspects of the patient's health to ensure their condition remains under control. Aspects that are monitored include body weight, vital signs (blood pressure, heart rate, breathing, and SpO₂), ECG (Electrocardiogram), daily symptoms experienced by the patient, as well as medication compliance and reminders with a wireless system.

Theme II: Phone Call Support and Reminders

On the theme of telephone calls, five studies have utilised telephone technology to provide support and monitor patient health.^{14,34,37,43,53} Some aspects that are monitored include coping, namely the patient's ability to deal with stress and their health problems. Bakitas et al (2020) utilised telephone calls to support patients in self-care, symptom management, and making critical life decisions in challenging situations.¹⁴ In addition, Mirshahi et al (2024) expanded the use of technology by combining phone calls, WhatsApp, and SMS for case discussions and providing palliative care education,

allowing for more flexible communication between patients, families, and medical staff.⁴³ The use of phone calls is also for symptom monitoring, including weight reporting and depression monitoring in patients with a telephone-based interactive voice response system.³⁴ This system provides automated support, providing feedback based on patient-reported data.³⁴ Two other studies used this phone call system as a medication reminder, self-care, and lifestyle instructions related to managing patient conditions effectively.^{37,53}

Theme III: Smartphone App and Web-Based

The majority of studies (n=13) utilized iOS- and Android-based mobile applications, as well as web-based platforms, to support patient health monitoring.^{13,17,32,35,40,41,44,46–48,51,52,55} This technology allows patients to independently monitor their health and connect with medical providers. Furthermore, these apps enable patients to receive reminders, education, and support directly from medical professionals.

Several studies have used iOS and Android-based mobile applications. Previous studies have developed iOS/Android-based mobile applications to record biometrics and support patient-doctor communication, education, monitoring, live coaching, and peer support groups.⁴⁴ WeChat and QQ have been utilised for physical exercise programs and health education,⁴⁷ as well as for vital signs monitoring and lifestyle management in heart failure patients.^{51,48} Other studies have developed applications for symptom monitoring, reminders, and physical exercise for heart failure patients^{17,35,41} Clays et al (2021) developed a web-based application that utilises wearable sensors to monitor physical health and provide psychological support.¹³

On the other hand, web-based systems are also used for patient health monitoring.^{32,46,51,55} Piotrowicz et al (2024) and Bashi et al (2016) used a web-based platform for specialist doctor consultations, symptom monitoring, and education for heart failure patients.^{32,55} Asch et al (2022) used a web-based system to support patient behaviour and ensure daily adherence,⁴⁶ while Piette et al (2015) developed mobile and web applications for self-management, alerts, and automated feedback.⁵¹ These systems demonstrate how mobile applications and web-based platforms can be used in an integrated manner to improve patient health management.

Analysis of Content in Telehealth

An analysis of various studies found six categories of content in telehealth. These categories include (I) daily monitoring of symptoms and medication adherence,^{15–17,32–35,37,39–42,44–46,48,50–53} (II) Patients education,^{13,14,17,35–37,41,43,44,47,50,54,55} (III) Patient empowerment for self-management,^{13,14,32,38,39,41,46,47,53} (IV) Reminders and feedback,^{17,36,38,51,52} (V) Psychological and social support,^{16,43,46,54} and (VI) Communication with health workers.^{32,33,40,44} For more details, see [Figure 4](#) and [Table 2](#).

The Outcomes of Telehealth in Managing Heart Failure

Telehealth interventions have been shown to provide benefits in managing patients with heart failure, particularly in terms of remote monitoring and support for self-management (see [Table 2](#) and [Figure 4](#)). General outcomes of implementing telehealth in patients with heart failure are categorised into four themes: (I) clinical outcomes, (II) physical and mental health outcomes, (III) behavioural outcomes, and (IV) quality of life. In clinical outcomes, telehealth can reduce mortality and readmission rates^{15,37–39,52,53} Additionally, in physical and mental health outcomes, the use of telehealth can improve physical function,⁴⁴ knowledge,^{32,41} and reduce anxiety and depression.¹³ Then, on the behavioural outcomes theme, telehealth can improve self-care,^{16,32,41,55} compliance in monitoring symptoms and medications,^{42,48,51,54} self-efficacy and health belief.^{32,48} Lastly, the use of telehealth can also improve quality of life.^{14–17,35,38,39,43,47,55}

Based on the studies analyzed, several also reported insignificant outcomes. Several studies also reported that the use of telehealth did not significantly reduce readmission, mortality, and emergency department visit rates,^{16,33–36,46} no change in self-care,^{13,40} QoL and physical well-being,^{13,35,41,44} cannot reduce anxiety and depression,^{14,41,47} and compliance in HF patient restrictions.⁴⁵

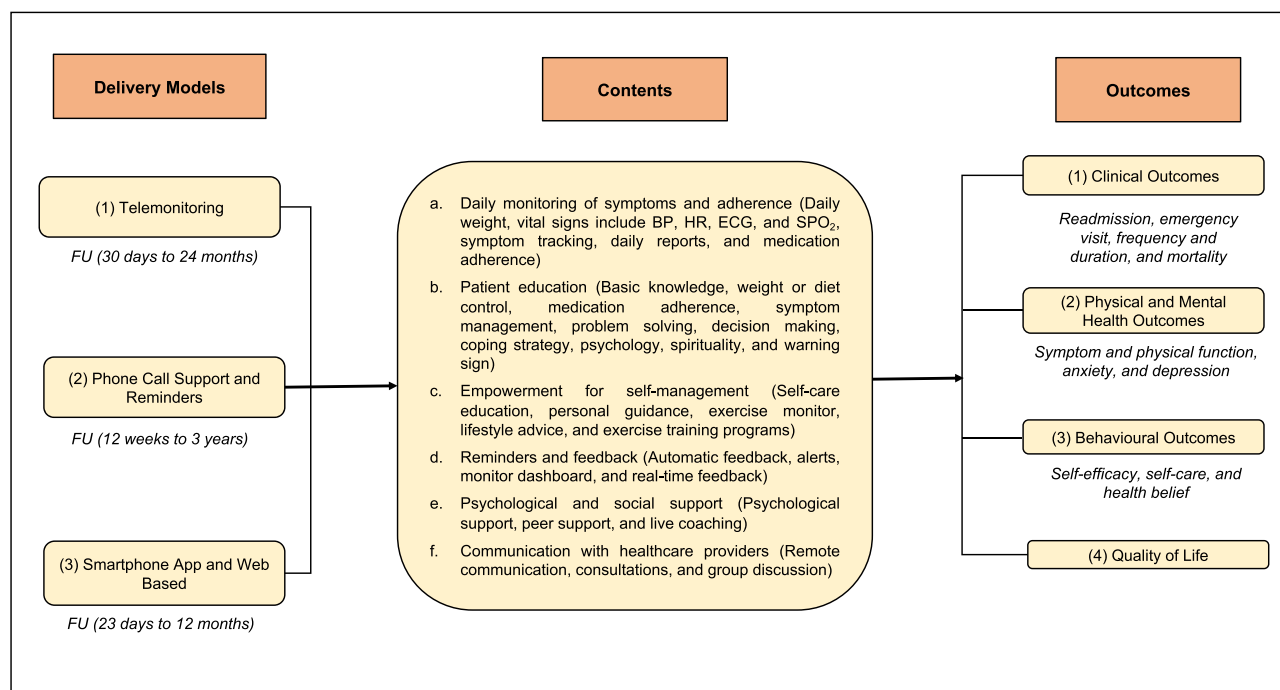


Figure 4 Delivery Models, Contents, and Outcomes of Telehealth.

Abbreviations: HF, Heart Failure; FU, Follow-Up; BP, Blood Pressure; HR, Heart Rate; ECG, Electrocardiogram; SpO₂, Peripheral Capillary Oxygen Saturation.

Discussion

HF management remains a significant challenge in healthcare globally.^{56,57} Although conventional medical care plays an important role, many HF patients still face difficulties in monitoring their condition, adhering to treatment, and self-managing symptoms. In this context, telehealth interventions offer an innovative and promising approach to addressing these problems.^{15,50,51}

Based on the results of this review, it is evident that telehealth interventions have significant potential to improve the health outcomes of HF patients, with a focus on enhancing self-care, reducing hospitalisation rates, and enhancing the quality of life for patients. From the 28 studies analysed, there were three themes of telehealth interventions: telemonitoring, phone call support, and technology-based mobile/web applications. These three categories offer distinct yet complementary benefits in patient management. Thematic analysis revealed that all three telehealth models have significant potential to improve clinical outcomes, physical and mental health, behavioral outcomes, and quality of life among HF patients.

Telemonitoring, as one of the main models, has shown high effectiveness in monitoring patient conditions in real-time.^{15,16,33,36,38,39,42,45,50,54} The technology used allows for the direct transmission of biometric data such as blood pressure, weight, and blood oxygenation level (SpO₂) to healthcare providers, allowing for immediate intervention in the event of any irregularities in the patient's vital signs or symptoms. The use of this technology also provides benefits in detecting changes in patient conditions earlier, leading to faster and more appropriate treatment adjustments.⁵⁸ As a result, several studies have shown that telemonitoring can reduce hospitalization rates and improve patients' quality of life.^{15,16,50} In addition, this model also supports increased adherence to self-care, which is an important factor in managing HF effectively.^{16,38} On the other hand, four other studies reported contrasting findings where telemonitoring-based interventions were unable to reduce readmission, hospitalization, and mortality rates in HF patients.^{16,33,36,39} Therefore, although telemonitoring shows great potential in monitoring patient conditions in real-time, the differences in results found in these studies highlight the importance of considering certain factors that may influence the effectiveness of a given intervention including patient characteristics, level of technological literacy, healthcare system support, and integration with multidisciplinary care teams.

Table 2 Characteristics of Intervention, Delivery Model, Content, and Summary of Results

Study	Intervention	Delivery and FU	Content	Results
Telemonitoring Intervention				
Koehler et al (2024) ¹⁵	Remote Patient Management (RPM)	Telemedicine via tablet and cellular network FU (12 months)	Weight, blood pressure, ECG, SpO ₂ , and subjective health score; monthly patient education; management by a 24/7 active telemedicine center	<ul style="list-style-type: none"> Reduced cardiovascular hospitalisation, death, and all-cause mortality. RPM also improved the quality of life.
Ding et al (2020) ⁴²	Weekly weight telemonitoring + nurse support	A Bluetooth-enabled scale, tablet, and Android app FU (6 months)	Weight monitoring, automatic notifications for fluctuations, reminders, follow-up actions by nurses, support via a tablet application, and a 24/7 call centre.	Participant compliance with weight monitoring was high, although the withdrawal rate was high.
Piotrowicz et al (2020) ³⁹	Hybrid tele-rehabilitation (HCTR 9 weeks)	A telemonitoring device with a mobile phone FU (26 months)	Physical exercise (aerobics, light resistance), education, and remote monitoring (ECG, blood pressure, weight, CIED monitoring)	<ul style="list-style-type: none"> The HCTR intervention did not prolong out-of-hospital survival or reduce mortality and hospitalizations. The HCTR improved peak oxygen consumption and quality of life (SF-36 score)
Seto et al (2012) ¹⁶	Mobile phone-based telemonitoring for self-care tracking	Wireless data transmission via mobile phone FU (6 months)	Daily symptom and weight reports, including automated feedback and alerts.	<ul style="list-style-type: none"> Improved quality of life, self-care maintenance (p<0.03). No differences were found in hospitalisation, mortality, or emergency department visits.
Gallagher et al (2020) ⁴⁵	Telemonitoring adherence with feedback and phone calls	Wireless Electronic Adherence Device and telephone FU (30 days)	Monitoring of diuretic adherence using the GlowCap system, telephonic follow-up when nonadherence is detected, and adherence-related education	There was no difference in adherence.
Galinier et al (2020) ³⁶	Telemonitoring weight, symptoms, and education	Daily transmission of biometrics (weight, BP, heart rate, ECG) and telemedicine support (smartphone) FU (12 months)	Educational (basic knowledge, drug information, lifestyle) and health status feedback; used biomarker values for adjusting care and treatment plans.	Telemonitoring did not result in significantly lower rates of death from any cause or unplanned hospitalization in HF patients.
Rahimi et al (2020) ⁵⁰	Home digital monitoring + specialist feedback (SUPPORT- HF 2)	Tablet + Bluetooth BP monitor + Weight scale + App Remote data sharing and feedback to clinicians FU (6 months)	Health monitoring, symptom tracking, educational material, alerts, recommendations for primary care; based on NICE and ESC guidelines	Physical well-being of participants also did not differ significantly between the groups (p=0.84)
Boriani et al (2017) ³³	Remote monitoring with CRT-D devices	CRT-D devices (Cardiac Resynchronisation Therapy with Defibrillator) are implanted in the patient. FU (24 months)	Symptom tracking, alerts and adjustments communicated to cardiologists.	<ul style="list-style-type: none"> No significant difference in the primary endpoint (death, CV, or device-related hospitalisation). Significant reduction in healthcare use, mainly in-office visits
Hale et al (2016) ³⁸	MedSentry Medication Monitoring System	MedSentry device: A remote electronic pillbox with monitoring and alerts for medication adherence. Follow-up calls FU (3 months)	Support for self-management for heart failure patients, medication reminders, alerts for missed doses, and caregiver follow-up.	<ul style="list-style-type: none"> There was a 80% reduction in the risk of hospitalisation for any cause and a significant reduction in the length of stay. Improved adherence to treatment did not result in better cardiac function or HRQoL at baseline, and it was significantly decreased compared to the control group.

(Continued)

Table 2 (Continued).

Study	Intervention	Delivery and FU	Content	Results
Hwang et al (2017) ⁵⁴	Home telerehabilitation	Synchronous video-based telerehabilitation FU (24 weeks)	Exercise and education: Twice-weekly, supervised group exercises and education, real-time adjustments, and peer support.	No significant difference in the 6-minute walk test between home-based and centre-based programs. There was a higher attendance in the telerehabilitation group.
Phone Call Support and Reminders				
Ferrante et al (2010) ³⁷	Telephone intervention	Phone call and brochures FU (3 years)	Patient education and self-management (diet, weight control, medication adherence, and symptom monitoring).	Reduction in death or hospitalization rates for heart failure after 1 and 3 years.
Bakitas et al (2020) ¹⁴	Early tele-palliative care (ENABLE CHF-PC)	Phone call FU (32 weeks)	Cope and problem solving, Self-care, Symptom management, Communication and decision making, Life story, and Building a legacy.	<ul style="list-style-type: none"> ● Improved KCCQ scores, but the difference was not statistically significant. ● Improved FACIT-Pal-14 scores ● There were no relevant differences in mood (HADS-anxiety and HADS-depression).
Mirshahi et al (2024) ⁴³	Nurse-led, twelve-week early tele-palliative care intervention	Phone, WhatsApp and SMS FU (12 weeks)	<ul style="list-style-type: none"> ● SkyRoom® Webinar (introduction to HF & palliative care, symptom management, spirituality, and decision-making) ● WhatsApp Group (Case discussion, peer education, Q&A with nurses, reinforcement of webinar materials) ● Guidebook (Chapters on HF, COPE (problem-solving), diet, medication, psychology, spirituality). 	This intervention demonstrated evidence of feasibility, acceptability, and potential improvement in quality of life.
Chaudhry et al (2010) ³⁴	A telemedicine-based, web-enabled, and voice-response system for telemonitoring	A telephone-based interactive voice-response system FU (180 days)	Patients report symptoms and weight, monthly screening for symptoms of depression, and adherence monitoring.	No significant difference in readmission or mortality ($p>0.05$).
Ribeiro et al (2025) ⁵³	Telemedicine Intervention combining nurse-led telephone support, teleconsultation, and educational texts.	Telephone support FU (180 days)	Monitoring: Weight, blood pressure, heart rate. Signs of decompensation: Regular follow-ups and adjustments in treatment, including adjustments to diuretic doses. Self-care education: Adherence to medication, diet, and recognizing warning signs.	The frequency of HF-related rehospitalisations and readmissions was better in the intervention group.
Smartphone App and Web-Based				
Victorial-castro et al (2024) ⁴⁴	Digital health technology (bodyport, concersa, and noom)	Internet and mobile applications based on iOS/Android FU (90 days)	<ul style="list-style-type: none"> ● Recording weight, heart rate, impedance; dashboard for patients and doctors; self-education. ● Interactive chat module (symptoms, BP, education), monitoring automation, data displayed on the clinic dashboard, ● Live coaching, nutrition tracking, lifestyle education, peer support group. 	<ul style="list-style-type: none"> ● No group had any significant change in KCCQ or improvement relative to usual care. ● Symptoms and physical function at 90 days were significantly improved in the Noom group relative to usual care.
Asch et al (2022) ⁴⁶	Remote monitoring + financial incentives	Web-based application or system (Digital scale and electronic pill bottle) FU (12 months)	Behavioral Support: Daily adherence monitoring, alerts about weight changes or missed doses, financial incentives, and support partners.	There was no significant outcome of all-cause inpatient readmission or death.
Peng et al (2018) ⁴⁷	Home-based telehealth exercise training	Instant messaging platforms such as WeChat and QQ FU (4 months)	Exercise training program (Endurance exercise and muscle strengthening), health education (HF management, recognising symptoms, and coping strategies), consultation and support.	<ul style="list-style-type: none"> ● Significant improvements in QOL, 6MWD, and resting HR were sustained for 4 months post-test. ● No significant improvements were observed regarding the NYHA classification, LVEF, anxiety, or depression.

Kitsiou et al (2025) ⁴⁸	mHealth apps + SMS support	Mobile apps FU (8 weeks)	<ul style="list-style-type: none"> ● Vital signs monitoring (Regular tracking of weight, blood pressure, and symptoms to monitor HF status) ● Active monitoring (Fitbit to encourage and track physical activity) ● Medication adherence, symptom tracking, and lifestyle changes. 	The intervention group showed significant improvements in self-efficacy, health beliefs, and self-monitoring adherence.
Piotrowicz et al (2024) ⁴⁹	Nurse-led telecare with cardiologist support	Web-based telemedicine consultations by cardiologists FU (12 months)	Symptom assessment, hemodynamic monitoring, education (nutrition, medication, self-care), personalized guidance	Improved self-care and QoL subdomains.
Piette et al (2015) ⁵¹	M-Health+CP Care Partners	Mobile phone used for weekly IVR calls FU (12 months)	Self-reporting, Tailored feedback for self-management support, alerts to clinicians, and automated feedback emails sent to CarePartners	Health+CP improved medication adherence, care partner communication, and reported fewer negative emotions.
Vourinen et al (2014) ⁴⁰	A Telemonitoring-Assisted Self-Care Model	Mobile phone app FU (23 days)	Symptom reporting, weight, blood pressure, symptom assessment. Contact the nurse for follow-up as needed.	No difference was found in the number of HF-related hospital days, patients' clinical health status or in their self-care behaviour.
Scherr et al (2009) ⁵²	Mobile phone-based telemonitoring.	Mobile phone and web-based monitoring FU (6 months)	Daily reporting of vital signs, symptoms, and medication use. Automated feedback and clinician alerts.	Reduced the frequency and duration of HF hospitalisations and improve the NYHA class.
Davoudi et al (2020) ¹⁷	A smartphone-based app for heart failure	Smartphone app FU (3 months)	Profiles, reminders, educational content, educational videos, daily messages, pharmacy guides, frequently asked questions, daily recording of physical and psychological symptoms, and vital signs and sending alerts as needed.	Significant improvement in QoL.
Dorsch et al (2021) ³⁵	ManageHF4Life Mobile App for Heart Failure	A mobile app with Fitbit devices FU (12 weeks)	Daily self-monitoring, health status indicators (color-coded), educational content about HF, reminders.	<ul style="list-style-type: none"> ● Improved the MLHFQ at 6 weeks but did not sustain its effects at 12 weeks. ● There was no significant change in self-care or readmission rates.
Athilingam et al (2017) ⁴¹	HeartMapp Mobile App	A mobile app (HeartMapp) installed on smartphones FU (30 days)	Weighing, symptom assessment, responding to tailored alerts, vital sign monitoring, HF education, and performing breathing exercises and walking.	Improved self-care confidence and management, as well as HF knowledge. Does not improve depression or quality of life
Clays et al (2021) ¹³	HeartMan Mobile Health System	A mobile application linked with wearable sensors FU (12 months)	<ul style="list-style-type: none"> ● Healthcare (including personalised exercise regimens, lifestyle advice on nutrition, medication intake notification systems, and self-monitoring). ● Psychological support (including elements of cognitive behavioral therapy and mindfulness exercises) ● The availability of overall disease education about CHF and its treatment. 	<ul style="list-style-type: none"> ● Reduced anxiety, depression, and sexual problems ● No significant effects were observed for HRQoL, self-care confidence, illness perception, or exercise capacity.
Bashi et al (2016) ³²	Web-Based Self-Care Intervention	Web application FU (1 month)	Self-care education, symptom monitoring, and communication with healthcare providers.	Scores and effect size estimates revealed that the mean differences in HF knowledge, self-care, and self-efficacy were minor

Abbreviations: 6MWD, Six-Minute Walk Distance; BP, Blood Pressure; CHF, Congestive Heart Failure; CRT-D, Cardiac Resynchronization Therapy with Defibrillator; ECG, Electrocardiogram; ESC, European Society of Cardiology; FACIT-Pal-14, Functional Assessment of Chronic Illness Therapy–Palliative Care–14; FU, Follow-up; HADS, Hospital Anxiety and Depression Scale; HFpEF, Heart Failure with Preserved Ejection Fraction; HFrEF, Heart Failure with Reduced Ejection Fraction; HR, Heart Rate; HRQoL, Health-Related Quality of Life; IG, Intervention Group; IVR, Interactive Voice Response; KCCQ, Kansas City Cardiomyopathy Questionnaire; MLHFQ, Minnesota Living with Heart Failure Questionnaire; NYHA, New York Heart Association; QoL, Quality of Life; RPM, Remote Patient Management; SF-36, Short Form-36 Health Survey; SMS, Short Message Service; SpO₂, Peripheral Oxygen Saturation.

Another intervention model is phone call support and reminder. This model also makes a significant contribution to improving the management of HF patients.^{14,34,37,43,53} Through phone calls, patients receive not only educational support regarding treatment and symptom management but also much-needed emotional support.^{14,34,37,43,53} However the results of this review found that the outcome of interventions in this category is still controversial. Two studies reported that this telephone-based intervention can reduce readmissions and hospitalisations by 1 to 3 years,^{37,53} However, other studies have shown no significant difference.³⁴ In addition, QoL was also reported in both studies with different results.^{14,43} This may occur due to differences in content and other additional media in the intervention that influence the outcome in each study. Therefore, it is necessary to consider other aspects of content and delivery methods to increase the effectiveness of the intervention.

Mobile applications and web-based platforms have also proven to be beneficial models in the management of HF patients.^{13,17,32,35,40,41,44,46–48,51,52,55} This technology gives patients the opportunity to monitor their condition independently, receive medication reminders, and receive education related to managing their disease.^{17,35,47,51} However, differences in results were also found in studies that implemented interventions with this model. Several studies have reported that mobile and web-based application interventions can improve QoL or HR-QoL,^{17,35,47,48,55} In addition, an increase in patients' self-care abilities was also observed in the studies by Athilingam et al (2017),⁴¹ Bashi et al (2016),³² and Piotrowicz et al (2024).⁵⁵ Meanwhile, the other two studies did not experience any differences in self-care before and after the intervention.^{13,35} Then, the decrease in hospitalisation rates was only in the study of Scher et al (2009), three other studies reported no significant differences in the results of mortality, readmission, and hospitalisation rates of HF patients.^{35,40,46}

The results of the thematic analysis show that the three telehealth models, such as telemonitoring, phone call support and reminders, and smartphone app/web-based, basically have similar core content. The core content of telehealth encompasses symptom monitoring, patient education, empowerment for self-management, provision of reminders and feedback, psychosocial support, and communication with healthcare professionals. These similarities emphasise that telehealth is built on the same foundation, namely, facilitating monitoring, increasing health literacy, strengthening self-care skills, and providing both emotional and clinical support. However, further analysis shows that the telemonitoring model tends to have a broader and more detailed content coverage than the other two models. Under the theme of “daily monitoring of symptoms and adherence,” telemonitoring consistently includes more comprehensive clinical parameters, such as daily weight, vital signs and daily reporting and medication adherence. This may be explained by the differences in the design of telemonitoring systems, and phone-based approaches as phone-based approaches depend on self-reporting while telemonitoring enables more continuous data. The diversity of monitored indicators provides an advantage in the early detection of deterioration in patient conditions, allowing for faster intervention to prevent rehospitalisation.

The phone call support and reminders model offers a simple approach, with a core strength in providing interpersonal support through basic monitoring (weight, symptoms, and medication adherence), education, and follow-up reminders, reinforced by two-way interaction with healthcare professionals or peer support to enhance motivation, adherence, and daily problem-solving.^{37,53} This model is easy to implement, flexible, and low-cost, making it suitable for moderate-risk patients who need behavioral reinforcement and emotional support.^{14,34,37,43,53} Meanwhile, smartphone apps and web-based offer flexibility and personalized interventions with similar content, but with a greater emphasis on self-management aspects.^{32,46,51,55} The content in this model includes digital education features, live coaching, and online peer support; Its advantages lie in easy access, real-time feedback, and integration of lifestyle modules, although its effectiveness is highly dependent on digital literacy and consistency of use, making it more suitable for younger, technology-savvy, and highly motivated patients in self-care.

All three telehealth models have similar core content, but there are important differences in the duration of follow-up use. Studies using the phone call support and reminders model have examined the longest intervention period, ranging between 12 weeks to 3 years, compared to telemonitoring (30 days to 24 months) and smartphone app/web-based (23 days to 12 months). This difference suggests that telephone-based interventions tend to be easier to sustain in the long term because they do not require specialised equipment or high digital literacy, but instead rely on relatively simple, flexible, and low-cost interpersonal communication. This also shows that phone call support is more feasible to

implement widely, especially in the context of health systems with limited resources. Conversely, although telemonitoring and smartphone-based apps have proven effective in the short to medium term, limitations in cost, device availability, and patient adherence to the technology are factors that limit their long-term sustainability. Therefore, this aspect of follow-up duration reinforces the view that phone call support can be a more sustainable telehealth strategy, particularly for patients with chronic monitoring needs and long-term behavioral support requirements.

Despite the overall evidence supporting the benefits of telehealth interventions in HF management, findings across studies remain heterogeneous, with several trials reporting neutral or even negative outcomes. For instance, several RCTs studies reported that no significant differences in mortality, hospitalization, or physical well-being compared with standard care.^{33,39,50} Similarly, Chaudhry et al (2010)³⁴ found that a telemonitoring-based system did not reduce readmission or mortality rates, while Victoria-Castro et al (2024) and Asch et al (2022) also demonstrated limited effects on QoL and readmissions.^{44,46} However, a recent meta-analysis including 17 RCTs reported that telemonitoring was effective in reducing the number of patients readmitted to the hospital compared with usual care strategies.⁵⁹ These variability in outcomes may be due to the differences in patient populations (eg, age, digital literacy, severity of HF), the design of the platforms (such as whether they are interactive feedback versus being primarily self-management tools), and the duration and intensity of the interventions.

The factors supporting the success of telehealth interventions are diverse. Accessibility to technology is crucial, especially for patients living in remote areas or with limited access to technological devices.^{60–62} Studies show that difficulties in accessing or using technology can hinder the effectiveness of telehealth interventions, even though the technology offers many benefits.^{61,63,64} In addition, patient involvement is also a determining factor in the success of this intervention.^{41,44,65} Patients who have high levels of engagement in telehealth programs tend to show better outcomes, both in terms of symptom management and treatment adherence.⁴¹ Therefore, it is important for healthcare professionals to ensure that patients feel supported and involved in their care process, whether through regular communication, reminders, or providing motivation.

Implication for Practice

The results of this review indicate that telehealth interventions have great potential in improving the management of HF patients. Evidence supports the importance of integrating technologies, such as telemonitoring, phone support, and mobile and web-based applications, into daily clinical practice to improve patient self-care, reduce hospitalisations, and enhance patient quality of life. Therefore, healthcare practitioners should consider implementing telehealth interventions tailored to the specific needs of HF patients, particularly for elderly patients and those with multiple comorbidities. In addition, given the positive results related to reduced mortality rates, hospitalisations, and increased self-care behaviour, the integration of telehealth into the HF patient care system is a strategic step that needs to be prioritised.

Strengths and Limitations of the Study

There are several advantages to this review. This study has a significant strength in its application of a rigorous methodology, involving 28 RCTs, which is the most valid research method for assessing the effectiveness of an intervention. Additionally, the diversity of study populations and locations enables these findings to be applied to various groups of HF patients worldwide. Next, this review successfully identified and evaluated various delivery models and content in telehealth interventions, which provided valuable insights for further development in healthcare practice.

This study presents robust findings. However, several limitations should be noted. First, heterogeneity in the types of interventions, as well as the characteristics of the patient population, makes it difficult to generalize the findings to the entire HF patient population. In addition, some of the included studies exhibited methodological weaknesses, such as a lack of clarity regarding blinding procedures, which could introduce bias into the study results. Another limitation is the lack of long-term follow-up in many studies, which reduces understanding of the lasting impact of telehealth interventions on patient clinical outcomes.

Conclusion

Telehealth interventions including telemonitoring, phone call support and reminders, and mobile or web-based applications demonstrate substantial potential in optimizing the management of patients with HF. While telemonitoring appears most effective in comprehensive, high-resource settings where continuous monitoring and data integration are feasible, simpler approaches such as nurse-led phone call support and reminder systems may be more applicable in resource-limited contexts. This review highlights that although many interventions show reductions in hospital readmissions and improvements in self-care and QoL, outcome variability remains evident across different models and populations. These inconsistencies underscore the need for greater standardization of intervention content, sustained engagement strategies, and integration into existing health systems. Future research should prioritize evaluating long-term effectiveness, addressing digital literacy barriers, and exploring scalable, cost-effective models to ensure equitable access and sustainable implementation of telehealth in heart failure care.

Disclosure

The authors report no conflicts of interest in this work.

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