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REVIEW ARTICLE

Health technologies used by nursing in the care of patients with heart failure

Tecnologías sanitarias utilizadas por el personal de enfermería en el cuidado de pacientes con insuficiencia cardíaca

As tecnologias em saúde utilizadas pela enfermagem no cuidado aos pacientes com insuficiência cardíaca

Gabriella Campião de Cerqueira[1]
ORCID: 0009-0009-7445-448X
Agnes Luiza dos Santos Andrade Silva[2]
ORCID: 0009-0006-6456-0893
Verônica Caé da Silva Moura[2*]
ORCID: 0000-0003-3720-6136
Vera Lúcia Freitas[1]
ORCID: 0000-0003-1324-5640

[1]Universidade Federal do Estado do Rio de Janeiro. Rio de Janeiro, Brazil.
[2]Universidade Federal do Rio de Janeiro. Rio de Janeiro, Brazil.

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***Corresponding author:**
vcaesilva@gmail.com

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Abstract

The aim was to identify, based on available scientific evidence in the literature, the health technologies used in nursing care for patients with heart failure. An integrative, qualitative, and descriptive literature review was conducted, encompassing scientific articles published between 2020 and 2025. The findings revealed that effectiveness stems from how technologies are organized in the care process: a structured collection of clinical data sensitive to decompensation, triage, and prioritization by the nursing team, two-way communication with the patient, and devices to support daily decisions. This shifts the intervention from a one-off event to longitudinal follow-up, enabling early adjustments and promoting the therapeutic co-responsibility of the user and their family network. For the practical implementation of these technologies, it is necessary to incorporate the mapped technologies into care pathways with agreed-upon goals and indicators, such as readmission rates at 30 and 90 days, length of stay, medication adherence, proportion of users with regular weight and symptom monitoring, activations resolved within predefined windows, and variations in quality of life scores. It also requires standardization of minimum data sets, integration with medical records, nursing staff training, and information security guidelines, ensuring interoperability and protection of personal data.

Descriptors: Nursing; Health Technologies; Heart Failure; Telemonitoring; Cardiology.

Resumén

El objetivo fue identificar, con base en la evidencia científica disponible en la literatura, las tecnologías sanitarias utilizadas en el cuidado de enfermería de pacientes con insuficiencia cardíaca. Se realizó una revisión bibliográfica integradora, cualitativa y descriptiva, que abarcó artículos científicos publicados entre 2020 y 2025. Los hallazgos revelaron que la efectividad radica en cómo se organizan las tecnologías en el proceso de atención: recopilación estructurada de datos clínicos sensibles a la descompensación, triaje y priorización por parte del equipo de enfermería, comunicación bidireccional con el paciente y dispositivos para apoyar las decisiones diarias. Esto transforma la intervención de un evento puntual a un seguimiento longitudinal, lo que permite ajustes tempranos y promueve la corresponsabilidad terapéutica del usuario y su red familiar. Para la implementación práctica de estas tecnologías, es necesario incorporar las tecnologías identificadas en las vías de atención con objetivos e indicadores acordados, tales como tasas de reingreso a los 30 y 90 días, duración de la estancia, adherencia a la medicación, proporción de usuarios con control regular de peso y síntomas, activaciones resueltas dentro de plazos predefinidos y variaciones en las puntuaciones de calidad de vida. También requiere la estandarización de conjuntos mínimos de datos, la integración con los historiales médicos, la formación del personal de enfermería y las directrices de seguridad de la información, garantizando la interoperabilidad y la protección de los datos personales.

Descriptores: Enfermería; Tecnologías de la Salud; Insuficiencia Cardíaca; Telemonitorización; Cardiología.

Resumo

Objetivou-se identificar nas evidências científicas disponíveis na literatura as tecnologias em saúde utilizadas no cuidado de enfermagem aos pacientes com insuficiência cardíaca. Foi realizada uma Revisão Integrativa de Literatura, qualitativa e descritiva, abrangendo artigos científicos publicados entre 2020 e 2025. Os achados revelaram que a efetividade decorre do modo como as tecnologias são organizadas no processo assistencial: coleta estruturada de dados clínicos sensíveis à descompensação, triagem e priorização pela equipe de enfermagem, comunicação bidirecional com o paciente e dispositivos de apoio às decisões cotidianas, o que causa o deslocamento da intervenção do ato pontual para um acompanhamento longitudinal, viabilizando ajustes precoces e promovendo a corresponsabilidade terapêutica do usuário e de sua rede familiar. Para a implementação prática destas tecnologias, requer-se a incorporação das tecnologias mapeadas a linhas de cuidado com metas e indicadores pactuados, como taxas de readmissão em 30 e 90 dias, tempo de permanência, adesão farmacológica, proporção de usuários com monitorização regular de peso e sintomas, acionamentos resolvidos em janelas pré-definidas e variações em escores de qualidade de vida. Requer, ainda, padronização de conjuntos mínimos de dados, integração com prontuários, capacitação da enfermagem e diretrizes de segurança da informação, assegurando interoperabilidade e proteção de dados pessoais.

Descritores: Enfermagem; Tecnologia em Saúde; Insuficiência Cardíaca; Telemonitoramento; Cardiologia.

Introduction

Heart failure (HF) is a major public health problem within the context of cardiovascular diseases, the leading cause of global mortality, with approximately 17.9 million deaths. This situation puts pressure on healthcare systems and demands innovative strategies for care and secondary prevention[1]. According to the Ministry of Health[2], heart failure affects approximately 26 million people worldwide, with about 2 million cases in Brazil, and approximately 240,000 new cases per year.

Characterized as a clinical syndrome resulting from structural and/or functional alterations of the myocardium that reduce cardiac output and/or impose elevated filling pressures, heart failure evolves progressively and heterogeneously, requiring continuous clinical stratification and therapy[3]. The categorization by stages (A-D) helps to identify individuals ranging from those at risk, focusing on prevention and management of modifiable factors, to those with refractory symptoms, candidates for advanced therapies and palliative care, defining care priorities and prognosis[4].

Heart failure (HF) expresses an imbalance between circulatory supply and demand due to ventricular dysfunction, remodeling, and congestion, manifesting as dyspnea, orthopnea, fatigue, and edema, often preceded by subclinical signs of fluid retention[5]. Therapeutic education should emphasize self-monitoring for warning signs, such as weight gain of ≥2 kg/week, worsening nocturnal dyspnea, sodium and fluid control, and home measurement of weight and blood pressure, as these measures allow for early intervention on episodes of decompensation[6].

The high burden of cardiovascular disease in Brazil and worldwide, still the leading cause of global mortality, necessitates action focused on secondary prevention and rehabilitation of patients with heart failure[4]. Interventions focused on risk factors and lifestyle changes form the basis of longitudinal care and should be integrated into nursing actions[6].

Among infectious and neglected etiologies, Chagas cardiomyopathy is distinguished by its late onset, symptoms appearing on average two decades after infection, a higher risk of arrhythmias, and a worse prognosis compared to other causes[7]. Pharmacological management follows general IC guidelines, although meticulous data collection and an individualized approach are necessary, given the context of under-investigation and unequal access[1].

The increase in the prevalence of heart failure is associated with the aging population and improvements in healthcare[2]. The epidemiological transition demonstrates the need for interventions focused on health education and the management of modifiable risk factors, with a prominent role for nursing in care coordination, therapeutic education, and support for self-care[8].

In this context, health technologies, particularly digital ones, are increasingly being incorporated into nursing practices with heart failure patients to expand access, standardize guidelines, monitor clinical parameters, and support behavioral changes[9]. These technologies constitute a set of procedures and resources useful for planning, executing, and evaluating teaching-learning processes in health, promoting therapeutic adherence and self-care[10].

Within the scope of the Brazilian Unified Health System (SUS), the Ministry of Health defines health technology as the application of knowledge aimed at promoting health, preventing illnesses, treating diseases, and rehabilitating people, including medicines, health products, procedures, and also organizational, educational, informational, and support systems, as well as care programs and protocols that guide the provision of care[2].

Health technologies are defined as a concept that goes beyond the idea of electronic equipment and machines, being understood as the application of knowledge, methods, and ways of producing care, based on applied scientific knowledge that organizes work according to previous accumulations and allows the articulation of theory and practice in care. Within this framework, technologies act as toolboxes of knowledge and its unfolding, both material and non-material, organized into three complementary categories: soft technologies, focused on welcoming and interpersonal relationships; soft-hard technologies, associated with care theories and structured materials; and hard technologies, linked to equipment, regulations, and organizational structures, composing a repertoire that supports clinical decisions, health education, and the organization of the care process[9].

Within the framework of digital technologies, they are primarily situated in the domain of hard technologies, insofar as they materialize in electronic devices and technological resources that standardize and support care, intersecting with soft-hard technologies when they incorporate structured protocols and instruments that guide conduct and record-keeping[9].

The use of technological equipment linked to structured protocols is a component of interventions aimed at patient safety and improving the quality of medication administration, demonstrating how technological resources and regulations work together to increase the accuracy and safety of care[9].

In this context, instruments and protocols appear as soft-hard technologies aimed at standardizing and streamlining processes, while taking care to avoid decontextualized uses that impoverish the individuality of care. As an example of a digital tool applied to healthcare work, there is the use of Rayyan software for screening and organizing titles and abstracts in databases, indicating the incorporation of computational resources to support the systematization of evidence[9].

Heart failure (HF) is a condition with a high recurrence rate of decompensation and early readmissions; it is estimated that about one-fifth of patients are readmitted within 30 days of discharge, highlighting a window of opportunity for structured follow-up interventions. Recent evidence supports the value of mobile health (mHealth) and telemonitoring strategies in which nursing plays a central role. In this sense, the study by Indraratna et al.[11] indicates that interventions via mobile phone in patients with HF reduce hospitalizations compared to usual care.

The literature links the automatic transmission of physiological data, alert routines, and integration with the care team, as advocated by health technologies focused on patients with heart failure, to a reduction in days lost due to unplanned hospitalizations and may impact mortality, suggesting that decision-making processes and clinical monitoring are as relevant as the devices themselves[8,12,13].

In the field of nursing, telemonitoring, medication reminders, weight/symptom tracking, and educational content are employed, comprising feasible strategies within the Brazilian Unified Health System (SUS) and aligned with safe post-discharge care[12].

Furthermore, educational interventions during follow-up consultations, mostly conducted by nurses, are associated with a reduction in readmissions and length of hospital stay, reinforcing the leading role of this professional in therapeutic adherence and the continuity of care[9].

Although the overall results are promising, there is heterogeneity in technologies, contexts, and outcomes, as well as gaps in subpopulations, which require further analysis. Considering this panorama, this article aims to identify, in the scientific evidence available in literature, the health technologies used in nursing care for patients with heart failure.

Methodology

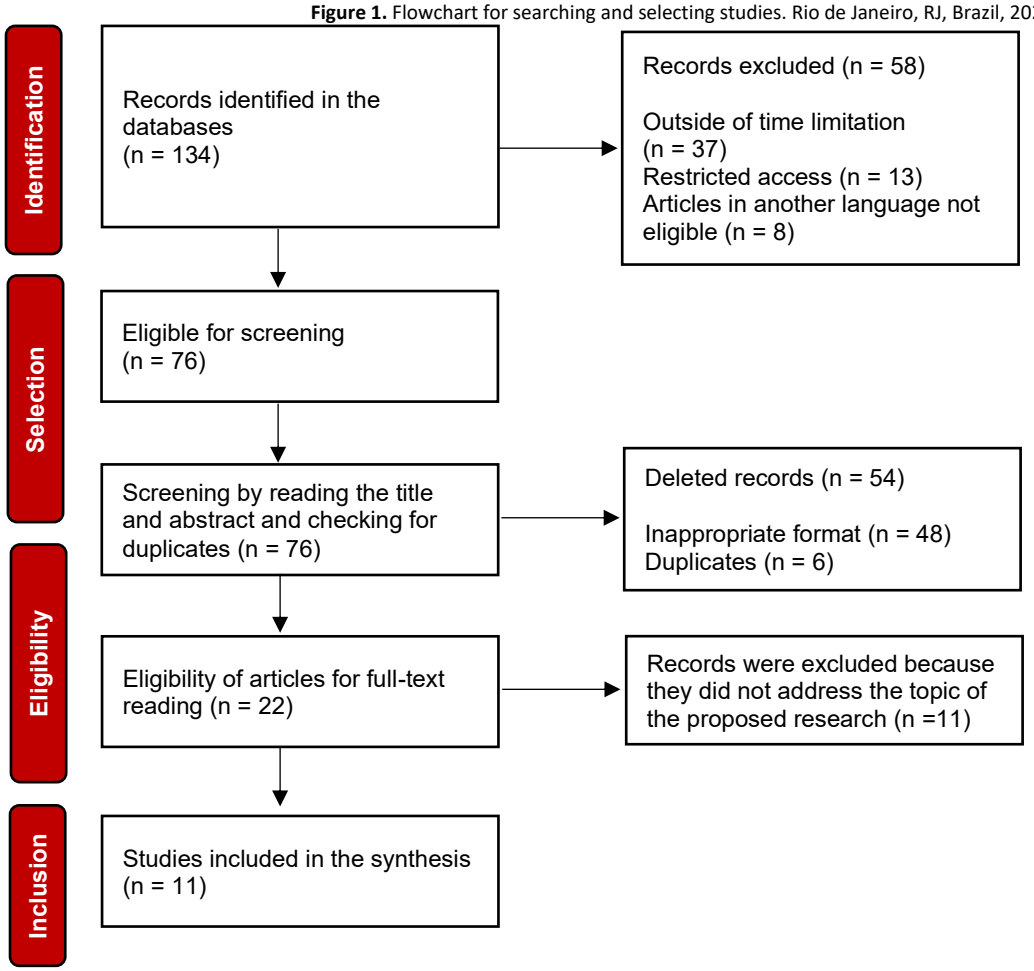
For the present study, an integrative literature review was conducted, using a qualitative and descriptive approach, encompassing scientific articles published between 2020 and 2026 (the last 5 years).

The searches were conducted in the SciELO, BDENF, BVS, and LILACS databases, using the following Health Sciences Descriptors (DeCS/MeSH): “Nursing”; “Health Technologies”; “Heart Failure”; and “Telemonitoring”. The Boolean operators “AND” and “OR” were used. The inclusion criteria were complete scientific articles, in Portuguese or English, published between 2020 and 2025, focusing on health technologies used by nursing in the care of people with heart failure.

Chart 1. PICo Strategy. Rio de Janeiro, RJ, Brazil, 2026

Element	Definition
P (Population)	Adults and elderly patients with heart failure under nursing care.
I (Intervention)	Nursing-led health technologies: synchronous/asynchronous telemonitoring; mobile education and self-management applications; digital care management platforms; clinical decision support systems.
Co (Context)	Hospital, outpatient, home, remote, and transitional care settings.

Figure 1. Flowchart for searching and selecting studies. Rio de Janeiro, RJ, Brazil, 2026



The exclusion criteria were opinion articles, commentaries, essays, preliminary notes, duplicates, dissertations, theses, and productions that do not present a relationship with the studied theme and the research objective

The selection process occurred in two stages: screening of titles and abstracts according to predefined eligibility criteria, and full reading of potentially relevant texts, with a record of the reason for exclusion when necessary. Quality assessment, extraction, and synthesis were conducted objectively: application of checklists to the study model, extraction of central variables (sample characteristics, type of technology, mode of use by nursing staff, indicators, and results). For transparency, a flowchart was included in accordance with the PRISMA checklist guidelines, in an adapted form.

This study was guided by the PICo strategy, suitable for formulating research questions in reviews with an emphasis on population, phenomenon of interest, and context. This strategy structured the guiding question, guided the eligibility criteria, and supported the extraction and organization of the analyzed data (Chart 1).

Based on these parameters, the following question was formulated: "What health technologies used by nursing staff in patients with heart failure are described in the literature of the period, and what effects are reported on clinical, operational, educational, and self-care outcomes?".

The data analysis was performed using a qualitative approach, with the data presented in tables summarizing the variables: "title," "author and year," "objective," "methods," and "results." The main findings were organized into categories that meet the research objectives and discussed descriptively (Figure 1).

Results and Discussion

After entering the search terms into the selected databases, 134 initial results were found: 30 in the LILACS repository, 66 in SciELO, and 38 in the BVS digital repository.

Applying the inclusion criteria, 76 texts remained. The titles and abstracts were read, and the exclusion criteria were applied. At this stage, 48 works that were not scientific articles and 6 duplicates were excluded, leaving 22 works, which were read in full. 11 articles were excluded because they were incomplete, had restricted access, or were outside the research topic. The final sample consisted of 11 articles.

The characteristics of the selected articles are presented in Chart 2, by the variables: Author/Year and digital repository where the article was found, title, type of study, and the type of technology analyzed.

Chart 2. Characteristics of the selected articles. Rio de Janeiro, RJ, Brazil, 2026

Author/Year Digital Repository	Title	Objective	Type of Study	Type of Technology
Gorodeski et al. (2020)[20] BVS	Virtual Visits for Care of Patients with Heart Failure in the Era of COVID-19: A Statement from the Heart Failure Society of America	Test the feasibility and safety of replacing in-person consultations with in-person medical consultations for patients transitioning from hospital to home after hospitalization for heart failure.	Guide to scientific societies (HFSA)	Synchronous audio-video teleconsultation/televisit.
Indraratna et al. (2020)[11] BVS	Mobile Phone Technologies in the Management of Ischemic Heart Disease, Heart Failure, and Hypertension: Systematic Review and Meta-Analysis	Identify all relevant randomized clinical trials that presented a mobile phone intervention used in the management of chronic CVD.	Systematic review and meta-analysis	Remote monitoring, SMS, mobile applications, and telerehabilitation.
Rebolledo Del Toro (2023)[18] BVS	Effectiveness of mobile telemonitoring applications in heart failure patients: systematic review of literature and meta-analysis	Evaluate the impact of mobile telemonitoring applications on mortality, hospitalization, and quality of life in patients with heart failure.	Systematic review of the literature with meta-analysis of randomized clinical trials	Mobile applications for telehealth monitoring, aimed at remote follow-up, self-management, and clinical monitoring of patients with heart failure.
Araújo et al. (2021)[21] BVS	Tecnologias educacionais duras no cuidar de pacientes com insuficiência cardíaca	Identify in the literature the hard educational technologies used in the care of patients with heart failure.	Integrative review	Apps, phone calls, SMS, games, digital media.
Paz; Teixeira (2021)[23] BVS	Tecnologia educacional sobre viver melhor com insuficiência cardíaca: estudo de validação	Build and validate an educational technology to mediate the educational actions of nurses with patients and their families upon hospital discharge.	Technology validation	Printed educational technology.
Brandão et al. (2022)[26] SciELO	Estratégias terapêuticas utilizadas na consulta de enfermagem a pacientes com insuficiência cardíaca de etiologia chagásica	Describe the therapeutic strategies used in nursing consultations for patients with heart failure of Chagas disease etiology.	Experience report	Telemonitoring, telephone support, home visits, and educational activities conducted by nursing staff.

Cestari et al. (2022)[16] BVS	Mapeamento dos aplicativos móveis para o cuidado na insuficiência cardíaca: revisão de escopo	Mapping mobile applications for heart failure care.	Scope review	Mobile applications; telemedicine; data management.
Gray et al. (2022)[17] BVS	Digital health technology in the prevention of heart failure and coronary artery disease	Critically analyze crucial clinical trials and discuss examples of mobile digital technology successfully deployed in the prevention of hospitalizations for heart failure and in the primary and secondary prevention of coronary artery disease.	Descriptive	Teleconsultations, SMS systems, apps, wearables, remote monitoring, and predictive analytics.
Sousa et al. (2022)[19] SciELO	Desenvolvimento e validação de aplicativo móvel para o autocuidado de pessoas com insuficiência cardíaca	Develop and verify evidence of content and appearance validity for a prototype mobile application for self-care in patients with heart failure.	Validation study	Educational and self-monitoring mobile application.
Santana et al. (2024)[13] LILACS	Tecnologias educacionais em saúde para pacientes com doenças cardiovasculares: revisão integrativa	Identify the educational technologies in health used in the health education process for patients with cardiovascular diseases.	Integrative review	Applications, social networks, digital educational programs, health record tools, and telephone support.
Amalia; Said; Nambiar (2024)[24] BVS	Utilizing Heart Failure Digital Education Media (HF-DEM) Intervention on the Quality of Life among Heart Failure Patients	Identify the effect of Digital Educational Media on Heart Failure (HF-DEM) on the quality of life of heart failure patients at Dustira Hospital in Bandung, Indonesia.	Quasi-experimental	Nursing-led digital educational technology for education and self-care in heart failure.

Heart failure (HF) is a common outcome of multiple structural or functional heart diseases that reduce cardiac output or increase filling pressures, reflecting etiological heterogeneity with prognostic and therapeutic implications. In the ischemic spectrum, coronary heart disease and previous myocardial infarction determine myocardial loss and remodeling, being the most prevalent etiology in elderly patients with chronic HF[12,14].

A IC decorre com frequência do controle Inadequate management of hypertension and diabetes, conditions that accelerate hypertrophy, fibrosis, and ventricular dysfunction; obesity and coronary artery disease reinforce this ischemic-metabolic axis[1]. In the valvular region, rheumatic heart disease remains relevant in vulnerable scenarios, with stenotic or regurgitant lesions sustaining hemodynamic overload and progression to heart failure[15].

The collected literature points to a convergence regarding the structuring role of health technologies in nursing care for heart failure, with emphasis on mHealth (applications, SMS), telemonitoring/remote monitoring, teleconsultations/televisits, wearables, and educational technologies (digital and printed). These modalities broaden access, standardize guidelines, support self-management, and promote timely responses to signs of decompensation[13,16].

In terms of comprehensiveness, the findings of Gray et al.[17] stand out, ao sintetizar teleconsultas, aplicativos, SMS, vestíveis, monitorização remota e analítica preditiva como formas de intervenção capazes de reduzir readmissões quando associadas a registro estruturado de dados, feedback clínico e seguimento programado.

Indraratna et al.[11] They also affirm the clinical potential of mobile interventions when structured with professional "back-end" feedback and continuous monitoring, noting that a meta-analysis review of 26 studies demonstrated a lower hospitalization rate in the mHealth group compared to usual care (244/792 vs. 287/803; OR 0.77; 95% CI 0.62–0.97; I^2 = 0%). This effect aligns with the findings of Gray et al.17, which reveal consistent benefits of non-invasive modalities, such as teleconsultations, apps, wearables, remote monitoring, and predictive analytics, when incorporated into scheduled follow-up and clinical feedback.

In the mHealth domain, Cestari et al.[16] mapped 39 CI applications (47 studies, four continents), predominantly featuring co-management and data management functionalities and focusing on daily care. However, 58.9% of the analyzed applications did not use a theoretical framework in their construction, which was understood as a "gap in several themes involving the individual and their environment, essential for comprehensive care".

Medication adherence is a sensitive outcome to interventions via apps, particularly when personalized telemonitoring is available, which facilitates follow-up by nursing staff in elderly populations[18]. In national technological development, Sousa et al.[19] validated the “Tum Tum” prototype, designed for education and self-management in heart failure, with evaluation by six specialist nurses using SAM and face validation with 13 patients using IVC (criterion ≥ 0.78 for items and ≥ 0.80 for global score). The application integrates an educational mosaic, early recognition of signs of decompensation, daily weight record, medication reminders, and appointment and examination schedule, being considered suitable by specialists and the target audience.

Non-invasive digital interventions with a data collection structure, plus clinical feedback and follow-up, are

the ones that perform best[17], while mHealth is considered a cross-cutting strategy for heart failure, coronary artery disease, and hypertension, it reinforces the likelihood of clinical gains when the educational component and professional feedback are systematic[11].

In this context, synchronous telecare became established during the COVID-19 pandemic, which saw the emergence of several guidelines for televisits in heart failure by the Heart Failure Society of America. These guidelines detail benefits, challenges, reimbursement policies, platforms, care models, and clinical workflows, providing practical guidance for organizing nursing work in hybrid settings[20].

The review by Gray et al.[17] engages with widely cited telemedicine and remote monitoring trials, such as the telemedicine interventional treatment management applications in heart failure patients TIM-HF2 and BEAT-HF, highlighting that effectiveness depends on the combination of data collection efficiency, team integration, and clinical response flows, which supports nursing practice in therapeutic adjustments, management of warning signs, and care coordination.

In the field of educational technologies, also widely cited in the literature analyzed, digital solutions (apps, SMS, games, websites) and printed technologies (notebooks/guides) coexist, both mediated by nurses. In this sense, apps were identified as the dominant modality, given their ease of use, as well as the automation of certain routines[21]. Despite this, hard technologies, such as telephone calls, are also important for encouraging self-care and adherence and reducing rehospitalizations of cardiac patients. According to these authors, "hard" health technologies, aimed at patients with heart failure, seek to encourage the individual's protagonism in their daily care and treatment, one of the guidelines of modern medicine, as advocated by Ordinance GM/MS No. 2,436/2017, which establishes the National Primary Care Policy, focusing on the patient's active participation in the care process, promoting autonomy and co-responsibility in the management of their own health[22].

At the Chagas Disease Outpatient Clinic/IC of PROCAPE-UPE, there is a nursing consultation routine that prioritizes comprehensive anamnesis and standardized educational interventions, with systematic guidance for patients and families to support self-care and adherence. The care context is one of high social vulnerability, with a predominance of users from endemic areas, low education, and income, which reinforces the need for meticulous data collection and an individualized plan[9].

As technological components, the authors' study[9] adopts telemonitoring combined with home visits and post-discharge phone calls (HELLEN-II: four visits at 10, 30, 60, and 120 days associated with four follow-up calls). Furthermore, the feasibility and benefit of the telemonitoring model for the Brazilian Unified Health System (SUS) highlight the educational role of nurses in adults with heart failure and recommend monitoring for signs of decompensation, including weight variations ≥ 2 kg/week associated with dyspnea, orthopnea, and paroxysmal nocturnal dyspnea (PND).

Furthermore, the authors emphasize that technologies focused on patient education are responsible for greater adherence and lower hospitalization rates, indicating that, in Chagasic heart failure, effectiveness depends on a combination of high-quality education, remote follow-up, and timely responses from the nursing team[9].

Paz and Teixeira[23] developed and validated a hospital discharge guide for heart failure (HF), designed as a printed/illustrated educational technology to facilitate nurse-patient-family communication during the transition. Validation with 24 expert judges achieved a global Content Validity Index (CVI) of 91.1%, demonstrating adequacy in objectives, structure, language, and clinical relevance. The material, developed and made available to patients after hospital discharge, addresses the definition of HF, warning signs, medication regimen, daily weight, diet/fluid intake, physical activity, vaccination, and when/to seek care, providing a standardized roadmap for discharge guidance. The authors acknowledge the lack of validation with the target audience as a limitation, but maintain the immediate applicability of the instrument in discharge plans conducted by nursing staff.

In a quasi-experimental outpatient trial, Amalia, Said, and Nambiar[24] tested the HF-DEM (*Heart Failure Digital Education Media*), a package of educational videos ("Meet and Greet Your Heart"), and a self-care e-booklet were distributed for one week to adults with heart failure followed up at a university hospital. In the study, 30 participants were allocated to intervention and control groups. Quality of life (MLHFQ[1]) improved substantially in the intervention group (87% "good" vs. 0% before; p = 0.000 in the comparison between groups), while the control group maintained worse scores. The study therefore demonstrated the effectiveness of short digital media, accessible via smartphone, for rapid gains in QoL and self-care skills when integrated into nursing follow-up; limitations include a small sample size and short follow-up period.

The HFSA[20] scientific statement systematizes the evidence and operational guidelines for synchronous virtual visits in cardiac rehabilitation, emphasizing feasibility, safety, and policy/reimbursement conditions that enabled telehealth during COVID-19. The guidance proposes practical workflow models, integration with wearables/remote monitoring, and the active role of nursing in education, medication reconciliation, and screening for warning signs, especially for the elderly and people with access barriers.

However, some usability and data consumption barriers still exist, even though the benefits in speed, storage, and information sharing have been recurring,

[1]The Minnesota Living with Heart Failure Questionnaire (MLHFQ) is an important tool for assessing quality of life in patients with heart failure. Despite its widespread use in our setting, we lacked a Portuguese translation and validation[25].

indicating that materials and media need to be calibrated to the health literacy and technological reality of users[21].

The HFSA position paper details the operational and clinical benefits of televisits, with evidence of feasibility and safety in hospital-to-home transition[20]. In the pilot trial conducted by Gorodeski et al.[20], the no-show rate tended to be lower in the virtual arm compared to the in-person arm (34.6% vs. 50%; RR 0.69; 95% CI 0.44–1.09), with no evidence of harm, supporting the adoption of hybrid models with active nursing participation.

From an implementation standpoint, the developers of "Tum Tum" themselves acknowledge limitations in generalization, with the sample consisting of a single service and above-average education levels within the Brazilian Unified Health System (SUS), as well as cost barriers for mHealth. They recommend subsequent usability and effectiveness steps with less educated populations, a fundamental aspect for equity strategies and for planning nursing staff training. Implementing these technologies requires considering equitable access, integration with workflows and systems, and costs - conditions identified as limiting factors for widespread adoption in digital cardiology and directly related to the feasibility of nursing work, such as time, training, and interoperability[19,21].

In the integrative review, Santana et al.[24] identified five families of educational technologies applicable to CVD/HF: (1) social networks for ongoing support and education; (2) mobile applications focused on self-care; (3) digital programs structured for symptom and lifestyle management; (4) digital tools used in health records during hospitalization; and (5) protocol-based telephone support.

The authors[13] classified the studies by levels of evidence and argued that "technology" should be understood as an organized pedagogical process, not as a mere device, with direct implications for the pedagogical planning of materials, integration into care flows, and the training of nurses. Furthermore, in pedagogical planning, the accessible incorporation of these technologies into education and follow-up plans is recommended, to promote patient autonomy and informed decision-making[13, 26].

Final Considerations

This review achieved its objective of identifying, within the 2020-2025 timeframe, the set of health technologies used by nursing in the care of heart failure and the effects associated with clinical, operational, educational, and self-care outcomes. Four recurring technological fronts emerged: synchronous/asynchronous telemonitoring, televisits/teleconsultations, self-management mobile applications with signal recording and therapeutic reminders, and validated educational technologies (digital and printed materials) integrated into the discharge plan and follow-up. In the included studies, these fronts are linked to a reduction in rehospitalizations and length of stay, improved medication adherence, increased self-care practices, greater early recognition of signs of decompensation, and better quality of life, whenever coupled with timely clinical feedback and clearly defined response routines.

The findings revealed that effectiveness stems from how technologies are organized in the care process and showed that validated educational materials and applications with clinical content promote measurable pedagogical gains when constructed with explicit didactic-pedagogical modeling, language compatible with health literacy, and integration into the discharge and follow-up flow.

For the practical implementation of these technologies, it is necessary to incorporate the mapped technologies into care pathways with agreed-upon goals and indicators. It also requires standardization of minimum datasets, integration with medical records, ongoing training for nursing staff, and information security guidelines, ensuring interoperability and protection of personal data. Finally, the methodological heterogeneity and variability of observed metrics dictate that future investigations should prioritize pragmatic studies in real-world settings, economic evaluations, and implementation research with equity considerations, including in elderly populations and in contexts with low levels of education.

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