Research Paper

Dyadic intervention to improve heart failure self-care adherence

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Abstract

Objective: To develop a dyadic nursing intervention to promote self-care adherence in adults with heart failure.

Methods: This intervention development study was conducted in three phases: 1) narrative literature review; 2) qualitative interviews with dyads and professionals; 3) theoretical integration with existing models.

Results: In phase one, a literature review identified 11 factors associated with poor self-care adherence, with the most important being sleep problems, limited knowledge, low self-efficacy, mood disorders, and caregiver characteristics. In phase two, eight interviews with health professionals and 15 heart failure patients, plus their family caregivers, were analyzed. Findings suggest that a text-message–based dyadic intervention would be well-received and useful for promoting self-care among both professionals and dyads. Consequently, the intervention's components—objectives, activities, delivery mode, and frequency—were defined. In phase three, a theory was developed by integrating the Theory of Self-Care in Heart Failure and the Theory of Caregiver Contribution to Self-Care, creating a framework that explains how the intervention could improve adherence through educational, motivational, behavioral, and emotional elements.

Conclusion: A dyadic nursing intervention based on text messaging was developed to promote self-care adherence in adults with heart failure. The development included identifying critical factors through a literature review, validating acceptability with dyads and professionals, and integrating theoretical models of self-care. The designed intervention has the potential to improve self-care and health outcomes in dyads. Next steps include developing a structured intervention manual and evaluating it through a clinical trial.

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Intervención diádica para mejorar la adherencia al autocuidado de la insuficiencia cardíaca

Resumen

Objetivo: desarrollar una intervención de enfermería diádica para promover la adherencia al autocuidado en adultos con insuficiencia cardíaca.

Metodología: este estudio de desarrollo de intervención se realizó en tres fases: 1) revisión bibliográfica narrativa; 2) entrevistas cualitativas con díadas y profesionales; 3) integración teórica con modelos existentes.

Resultados: en la primera fase, durante la revisión bibliográfica, se identificaron once factores vinculados a una baja adherencia al autocuidado, entre los cuales destacaron: problemas de sueño, conocimiento limitado, baja autoeficacia, trastornos del estado de ánimo y características del cuidador. En la segunda fase, se analizaron ocho entrevistas con profesionales de la salud y 15 pacientes con insuficiencia cardíaca, así como sus cuidadores familiares. Los hallazgos sugieren que una intervención diádica basada en mensajes de texto sería bien recibida y útil para promover el autocuidado tanto por parte de los profesionales como de las díadas. En consecuencia, se definieron los componentes de la intervención: objetivos, actividades, modo de entrega y frecuencia. En la tercera fase, se desarrolló una teoría que integra la Teoría del Autocuidado en la Insuficiencia Cardíaca y la Teoría de la Contribución del Cuidador al Autocuidado, lo que dio como resultado un marco que explica cómo la intervención podría mejorar la adherencia mediante elementos educativos, motivacionales, conductuales y emocionales.

Conclusión: se desarrolló una intervención de enfermería diádica basada en mensajes de texto para promover la adherencia al autocuidado en adultos con insuficiencia cardíaca. El desarrollo incluyó la identificación de factores críticos mediante revisión bibliográfica, la validación de la aceptabilidad con díadas y profesionales y la integración teórica de modelos de autocuidado. La intervención diseñada tiene potencial para mejorar el autocuidado y los resultados de salud de las díadas. Los próximos pasos incluyen el desarrollo de un manual estructurado de la intervención y su evaluación mediante un ensayo clínico.

Descriptores: Insuficiencia Cardíaca; Autocuidado; Cuidadores; Enfermería; Teléfono Celular; Envío de Mensajes de Texto (fuente: DeCS, BIREME).

Intervenção diádica para melhorar a adesão ao autocuidado na insuficiência cardíaca

Resumo

Objetivo: Desenvolver uma intervenção de enfermagem diádica para promover a adesão para o autocuidado em adultos com insuficiência cardíaca.

Metodologia: Este estudo de desenvolvimento de intervenção foi realizado em três fases: 1. Revisão narrativa da literatura. 2. Entrevistas qualitativas com díades e profissionais. 3. Integração teórica com modelos existentes.

Resultados: A primeira fase identificou, a partir de uma revisão bibliográfica, onze fatores associados à baixa adesão aos autocuidados, sendo o mais importante: problemas de sono, conhecimento limitado, baixa autoeficácia, transtornos do humor e características do cuidador. Na segunda fase, foram analisadas oito entrevistas com profissionais de saúde e 15 pacientes com insuficiência cardíaca, além de seus cuidadores familiares. Os achados sugerem que uma intervenção diádica baseada em mensagens de texto seria bem recebida e útil para promover o autocuidado tanto por parte dos profissionais quanto das díades. Consequentemente, definiram-se os componentes da intervenção: objetivos, atividades, modo de entrega e frequência. Na terceira fase, desenvolveu-se uma teoria que integra a Teoria do Autocuidado na Insuficiência Cardíaca e a Teoria da Contribuição do Cuidador ao Autocuidado, criando um marco que explica como a intervenção poderia melhorar a adesão por meio de elementos educativos, motivacionais, comportamentais e emocionais.

Conclusão: Foi desenvolvida uma intervenção de enfermagem diádica baseada em mensagens de texto para promover a adesão ao autocuidado em adultos com insuficiência cardíaca. O desenvolvimento incluiu a identificação de fatores críticos por meio de revisão bibliográfica, a validação da aceitabilidade com díades e profissionais, e a integração teórica de modelos de autocuidado. A intervenção desenhada tem potencial para melhorar o autocuidado e os resultados de saúde das díades. Os próximos passos incluem o desenvolvimento de um manual estruturado da intervenção e sua avaliação por meio de um ensaio clínico.

Descritores: Insuficiência Cardíaca; Autocuidado; Cuidadores; Enfermagem; Telefone Celular; Envio de Mensagens de Texto (fonte: DeCS, BIREME).

Introduction

People with heart failure (HF) often have reduced health status due to severe symptoms and limited function (1), leading to frequent hospitalizations and long-term, multi-medication regimens and self-care (2). Evidence links self-care to better clinical outcomes, including event-free survival and fewer hospitalizations (3). Nevertheless, HF self-care remains suboptimal worldwide and is difficult to improve. Self-care is the individual's own ability to perform a behavior and achieve a specific result (3).

HF causes physical limitations, leading to increased reliance on family caregivers for assistance and psychosocial support. In this study, a family caregiver is defined as any individual, whether a relative or not, who assists a patient with HF in managing their condition, as perceived by the patient. Therefore, interventions should include family caregivers, as self-care behaviors often occur within families (3).

Disease management is a dyadic process; thus, HF education and chronic care should involve the dyad when a family caregiver is present (4). A recent systematic review shows dyadic care interventions can improve disease management in families, improving outcomes for patients and caregivers and reducing hospitalizations and mortality (5).

In developing countries like Colombia, rural dyads are often far from health services. ICT-based interventions can connect isolated populations, and sustainable, cost-effective self-care interventions for patient–caregiver dyads are needed. Text messages offer instant, low-cost communication, are less invasive than phone calls, and can aid people in remote or low-connectivity settings (6–8).

Interventions based exclusively on text messages have demonstrated significant effectiveness in improving self-care and other health outcomes among patients with HF. A randomized controlled trial conducted by Chen *et al.* involving 767 patients with decompensated chronic HF showed that sending post-discharge text messages for 180 days significantly reduced the composite outcome of all-cause mortality or readmission compared with usual care, with notable improvements in self-care behaviors, including medication adherence and fluid restriction (9). Complementarily, FarzanehRad *et al.* conducted a randomized controlled trial with 189 patients comparing personalized text messages with pill organizers and usual care over 3 months, finding that the text message group had significantly higher medication adherence than the control group and lower hospitalization rates at the first follow-up (10).

These findings suggest that text message-based interventions are an effective strategy for promoting self-care in patients with HF. However, no studies describe a nursing intervention delivered by text messages to HF patient–caregiver dyads to enhance self-care. Therefore, this study aimed to develop a dyadic nursing intervention delivered via mobile text messages to promote self-care adherence in adults with HF.

Methods

This is an intervention development study. Such studies aim to describe the rationale, decision-making processes, methods, and findings involved from the initial conception of an intervention to the point at which it is ready for formal feasibility, pilot, or efficacy testing prior to full-scale evaluation (11). Within this methodological perspective, the present study was structured in three phases following Sidani's (12) nursing intervention development method. This framework proposes a systematic, iterative process comprising three interconnected phases that build on one another to ensure the theoretical grounding, empirical support, and practical relevance of the intervention. Phase 1 (Understanding the problem) establishes the empirical foundation by identifying and synthesizing evidence on the factors associated with the health problem, namely nonadherence to self-care in HF, including its manifestations, consequences, precipitating and perpetuating factors, and the caregiver's contribution to low adherence. Phase 2 (Intervention development) uses both empirical evidence on existing interventions and experiential knowledge from key stakeholders to define the

intervention components. Phase 3 (Intervention theory development) integrates findings from the previous phases with relevant theoretical frameworks to articulate how and why the intervention is expected to produce desired outcomes.

Phase 1. Understanding the problem. A structured narrative review was conducted to conceptualize nonadherence to self-care in HF, including its manifestations, consequences, precipitating and perpetuating factors, and the caregiver's contribution to low adherence. Inclusion criteria were: (a) primary quantitative or qualitative studies, and (b) narrative, scoping, or systematic reviews examining factors associated with nonadherence to self-care in adults with HF. Studies were included if published in English, Spanish, or Portuguese. Exclusion criteria were: (a) conference abstracts or editorials, and (b) studies not available in full text. Literature searches were performed in PubMed, CINAHL, BVS, ProQuest, Scopus, and Web of Science, covering publications from January 2003 to March 2023. The search strategy combined terms related to HF ("heart failure," "cardiac failure," "HF"), self-care ("self-care," "selfcare," "Self Care" [MeSH]), and suboptimal adherence ("poor," "low," "unsatisfactory," "non-adherence," "nonadherence"), using Boolean operators (AND, OR). For example, the PubMed search string was: ((selfcare[Title/Abstract] OR self-care[Title/Abstract] OR "Self Care"[Mesh]) AND (unsatisfactory[Title/Abstract] OR poor[Title/Abstract] OR low[Title/Abstract] OR non-adherence[Title/Abstract] OR nonadherence[Title/Abstract])) AND (("Heart Failure"[Mesh]) OR ("Heart failure"[Title/Abstract] OR "Cardiac failure"[Title/Abstract] OR HF[Title/Abstract])). Similar strategies were adapted for each database.

The studies included in the review did not provide an explicit definition of nonadherence to self-care in people with HF. Therefore, for this intervention development study, nonadherence was operationalized conceptually based on the Situation-Specific Theory of Self-Care in Heart Failure (TSCHF) (13). Specifically, nonadherence was operationally defined as the presence of reported difficulties, failures, or barriers that interfered with the adequate performance of one or more of the three core self-care processes described by the theory: self-care maintenance, self-care monitoring, and self-care management.

During Phase 1, a study was considered to address nonadherence to self-care, noting factors affecting patients' or patient–caregiver dyads' ability to sustain health-promoting behaviors, recognize and interpret symptoms, and/or respond appropriately to symptom exacerbations.

Phase 2. Intervention development. We used empirical and experiential approaches.

Building on the factors associated with nonadherence to self-care identified in Phase 1, Phase 2 focused on developing an intervention to address these barriers that was acceptable and useful to patient–caregiver dyads.

Empirical approaches: We assessed evidence on mobile text-message interventions for HF patient–caregiver dyads via primary studies and systematic reviews in PubMed, CINAHL, BVS, ProQuest, Scopus, Web of Science, JBI, PsycInfo, Cochrane, and Google Scholar, covering publications from January 2003 to March 2023. Inclusion criteria were: (a) primary quantitative or qualitative studies, and (b) systematic reviews evaluating text-message interventions for self-care in patient–caregiver dyads with HF. Studies were included if published in English, Spanish, or Portuguese. Exclusion criteria were: (a) studies focused on individual patients without caregiver involvement, (b) studies focused on pediatric populations, (c) interventions not using text messaging as the primary delivery method, and (d) studies not available in full text. The search strategy combined terms related to

self-care ("self-care," "selfcare," "Self Care" [MeSH]), heart failure ("heart failure," "cardiac failure," "HF"), and text messaging ("text messaging," "SMS," "mobile text," "text message," "text-message"), using Boolean operators (AND, OR). For example, the PubMed search string was: ((selfcare[Title/Abstract] OR self-care[Title/Abstract] OR "Self Care"[MeSH]) AND (("Heart Failure"[MeSH]) OR ("Heart failure"[Title/Abstract] OR "Cardiac failure"[Title/Abstract] OR HF[Title/Abstract]))) AND ((("Text Messaging"[MeSH]) OR ("Text messaging"[Title/Abstract] OR SMS[Title/Abstract] OR "Mobile text"[Title/Abstract] OR "Text message"[Title/Abstract])) OR ("text-message"[Title/Abstract])). Similar strategies were adapted for each database.

Experiential approaches: We conducted semi-structured interviews with patient–caregiver dyads and HF professionals to gauge the acceptability and usefulness of a dyadic nursing intervention delivered by text messages to support self-care adherence.

The study population consisted of patient-caregiver dyads who attended the outpatient clinic at Hospital E.S.E. Centro de Salud Santana, a first-level care facility in the municipality of Santana, Boyacá (Colombia). In addition, health professionals involved in the care, follow-up, or administrative management of HF were included, as were those participating in cardiovascular risk plans or programs at various Colombian healthcare institutions. A convenience sampling strategy was used to recruit dyads; eligible participants were invited in person during their routine outpatient visits. A purposive sampling strategy was employed to recruit nursing professionals, intentionally seeking variation in professional experience. For both groups, recruitment continued until data saturation was achieved. Inclusion criteria for dyads required participants to be over 18 years of age, have a medical diagnosis of HF (for care recipients), and have served as family caregivers for at least 1 month. A family caregiver was defined as any individual who assisted a patient with HF in managing their condition, as perceived by the patient. For professionals, the inclusion criteria required participants to be over 18 years of age, hold a professional degree, and have at least one year of experience in direct care, follow-up, or administrative work related to HF or cardiovascular risk programs. Dyads were invited in person; professionals by email. Interviews were recorded, transcribed, and analyzed thematically with ATLAS.ti to derive categories. Ethical approval was granted by the Research Ethics Committee (Comité de Ética en Investigación Científica – CEINCI) of the Universidad Industrial de Santander; informed consent was obtained from all participants. The interview guide for dyads explored: (a) current self-care practices and challenges, (b) perceived usefulness of receiving health information via text messages, (c) preferred content, format, and frequency of messages, and (d) barriers and facilitators for using mobile technology. For professionals, the guide addressed: (a) common self-care difficulties observed in HF patients, (b) perceived acceptability of text-message interventions, (c) recommended content and strategies, and (d) implementation challenges in clinical practice.

A total of 23 semi-structured interviews were conducted: eight with nursing professionals and 15 with patient–caregiver dyads. Interviews lasted between 10 and 30 minutes (mean: 12 minutes for professionals; 17 minutes for dyads). Thematic saturation was assessed using an inductive approach (14). During the iterative coding process, saturation was considered achieved when no new codes emerged from three consecutive interviews within each participant group. This point was reached after the sixth interview with professionals and the twelfth interview with dyads; however, additional interviews were conducted to confirm the stability of the findings.

Phase 3. Intervention theory development. We provided a dyadic perspective on self-care adher-

ence, building on findings from prior phases, the TSCHF by Riegel *et al.* (13), and the Theory of Caregiver Contribution to Self-Care (TCCSC) by Vellone *et al.* (15). The theoretical integration followed a systematic mapping process. First, modifiable factors identified in Phase 1 (sleep problems, knowledge gaps, low self-efficacy, and mood disorders) were matched with the constructs of the TSCHF and TCCSC frameworks. Second, experiential findings from Phase 2 were examined to validate and contextualize these theoretical links; for instance, professionals' emphasis on disease education aligned with the knowledge construct in TSCHF, while dyads' requests for emotional support reinforced the relevance of addressing mood-related barriers as proposed by both frameworks. Third, intervention propositions were derived by formulating conditional statements (if-then) that linked each intervention component to expected outcomes, grounded in both the literature review and participants' perspectives. Theoretical validation was conducted through a consensus process among the research team. The researchers independently reviewed the proposed intervention components and theoretical propositions, then met to discuss discrepancies and refine the theoretical framework until agreement was reached.

Results

Phase 1. Understanding the Problem

The search identified 2,679 records. After removing duplicates using Zotero, 1,212 potential studies remained. Of these, 1,188 were excluded based on title and abstract screening, and 24 were selected for full-text review. Finally, 18 studies (16–33) met the inclusion criteria and were included in the analysis to inform the understanding of the problem, as described below.

Nonadherence to self-care worsens HF symptoms and raises readmissions and mortality (16). Most HF patients show low adherence, especially to a low-sodium diet, regular exercise, weight monitoring, and fluid restriction (17–19).

Applying the operational definition of nonadherence to self-care described in the Methods section, the analysis of the included studies identified eleven factors that precipitate and perpetuate this phenomenon: sleep problems, knowledge, age, gender, number of medications, disease duration, fatigue, self-efficacy, cognitive impairment, mood, and family caregiver.

Sleep problems. Poor sleep quality and disorders (insomnia, sleep apnea, daytime sleepiness) are linked to poor self-care maintenance (20). Sleep-deprived patients may have reduced information processing, planning, decision-making, and attention, hindering medication taking, low sodium diet, symptom interpretation, and management (21). Thus, inadequate sleep can impair self-care alone.

Knowledge. Many HF patients do not know how to maintain health or respond to worsening symptoms, nor do they recognize disease symptoms (22). Low knowledge correlates with poorer self-care adherence.

Age. Older HF patients perform fewer self-care behaviors (20), likely due to age-related cognitive decline affecting self-care capacity (18).

Gender. Males are more often linked to poorer self-care (18, 19). Compared with women, men show lower adherence to checking for edema, choosing low-salt foods, requesting low-salt options, restricting salt and fluids during symptoms, and assessing treatment effects (18).

Number of medications. One study found that patients taking fewer medications had lower self-care adherence (18). Authors suggest that those who do not feel ill lack motivation to engage in self-care; medications may proxy comorbidity, as multiple illnesses often require more meds, and some researchers report that fewer comorbid conditions relate to poorer self-care maintenance and management (19).

Duration of the disease. A study reported poorer self-care maintenance in patients with shorter HF duration (18). Longer disease experience may lead to better adherence.

Fatigue. General and exertional fatigue are prospectively linked to low self-care adherence, including help-seeking, over time (23). Fatigue is independent of sleep problems, mood, or other factors (23).

Self-efficacy. Self-efficacy directly affects adherence to HF self-care. Those with low self-efficacy are less likely to achieve health behavior changes; higher self-efficacy fosters understanding and control (24).

Cognitive impairment. Common in older HF patients, it disrupts attention, memory, executive function, language, and psychomotor speed, compromising self-care (25) and increasing hospitalization risk (26). Older HF patients may have worse memory recall (e.g., remembering meds) but retain general concepts (27).

Mood. Depression and anxiety are inversely related to HF self-care adherence (28), with depression exerting a stronger effect (28). Depression is linked to higher hospitalization risk and may impair learning, symptom recognition, decision-making, and motivation (28). NYHA III–IV patients show higher depression prevalence than I–II (28).

Gender of the family caregiver. Male caregivers predict poorer patient self-care adherence (29), often providing less time, social, and emotional support than female caregivers (29).

Analysis of the Caregiver's Contribution to Self-Care Adherence Behaviors

Knowledge on determinants of dyadic self-care (patient and caregiver) adherence is limited (29), hindering identification and intervention for low adherence and constraining the development of effective HF self-care interventions for both parties (29).

Regarding caregiver support, one study found that many family caregivers rarely assisted with key self-care activities, such as daily weighing and exercise. Over half failed to promptly recognize signs of HF exacerbation (e.g., dyspnea or ankle edema). When signs were recognized, most advised salt and fluid restriction or contacting a provider for interventions such as diuretic adjustment (29). This indicates insufficient knowledge of optimal maintenance behaviors among caregivers (29).

Symptom evaluation congruence between dyads is moderate to high for edema, concentration problems, dizziness, palpitations, chest pressure, and dyspnea at rest (30). For non-cohabitating dyads, edema and dyspnea at rest were most congruent (30). Disagreement on HF management can negatively affect symptom perception, while caregiver satisfaction with dyad management correlates with better patient self-care (31).

Literature shows spouses with high commitment to a partner and a partner with HF with low self-care have elevated depressive symptoms in caregivers (32). Conversely, high-quality caregiver–patient relationships bolster patients' self-care confidence, and caregivers who perceive high-quality rela-

tionships trust patients' self-care abilities (33).

Modifiable aspects in caring for HF patients:

- Sleep problems
- Dyad knowledge gaps and poor symptom recognition
- Low self-efficacy for self-care
- Mood of the person with HF

Phase 2. Intervention Development

Empirical Approach

Database searches retrieved 612 records. After duplicate removal in Zotero, 218 studies were screened by title and abstract, of which 207 were excluded. A full-text review of the remaining 11 articles confirmed that no studies had evaluated text-message interventions for HF patient–caregiver dyads, underscoring the need for the present intervention.

Experiential Approach

We interviewed eight nursing professionals and 15 dyads (HF patients and family caregivers). Professionals ranged in age from 26 to 58 years, with 3 to 20 years of experience. HF patients were 54–89 years old; caregivers were 29–67 years old, with female predominance in both groups.

Professionals' accounts yielded six categories: acceptance, benefits, content, message characteristics, barriers/limitations, and facilitators. Dyads' accounts yielded four: usefulness, content, format preferences, and frequency.

Appendix I provides participant details and narrative-derived categories/subcategories.

Findings indicate that a dyadic text-message intervention would be well-received and valid for information and self-care adherence. Both groups agreed on including education about the disease, medication management, healthy eating, stress management, and emotional support. Messages should be short and clear for both groups. Barriers to implementation included literacy, technology access, unstable contact information, and motivation. Facilitators included initial training, personalization and follow-up, and incentives. Regarding frequency, most participants preferred frequent messages; some dyads favored daily or more frequent messages.

The transition from narrative categories to intervention components followed an iterative, theory-informed process. First, categories derived from interviews were mapped against the modifiable factors identified in Phase 1 (sleep problems, knowledge gaps, low self-efficacy, and mood disorders). Second, we identified convergent themes across professional and dyad accounts regarding preferred content and delivery characteristics. Third, using the theoretical frameworks (TSCHF and TCCSC) as a lens, we grouped related content areas into four intervention components: (a) sleep hygiene education, addressing sleep-related barriers; (b) disease and self-care education, targeting knowledge gaps; (c) motivational intervention, aimed at improving self-efficacy and shared decision-making; and (d) cognitive-behavioral strategies, addressing emotional barriers such as anxiety

and depression. The specific activities within each component were derived directly from participant suggestions (e.g., "short and clear messages," "tips for daily life") combined with evidence-based practices identified in Phase 1. Table 1 summarizes the mapping between modifiable factors, intervention components, and expected outcomes.

Table 1. Mapping of Nonadherence Factors to Intervention Components

Modifiable factors (Phase 1)	Intervention component	Target outcome
Sleep problems	Sleep hygiene education	Improved sleep quality and energy for self-care
Knowledge gaps	Disease and self-care education	Increased understanding and symptom recognition
Knowledge gaps	Motivational intervention	Enhanced confidence and shared decision-making
Mood disorders (anxiety, depression)	Cognitive-behavioral strategies	Reduced emotional barriers to self-care adherence

Source: Own elaboration.

Based on these findings, the intervention was structured around four elements: objectives, activities, delivery mode, and frequency, as summarized in Table 2.

Table 2. Outline of the Dyadic Intervention

Objectives	Componentes	Activities
Improve sleep in dyads	Sleep hygiene	*Sending text messages addressing:* Educational content • Explanation of sleep hygiene: Define what sleep hygiene is and why it is important for overall health and HF management • Relationship between sleep and heart health: Information on how inadequate sleep can negatively affect heart health and vice versa Practical content: • Tips to improve sleep hygiene • Tips to manage stimuli that affect sleep
		Reminders and follow-up: • Periodic messages to reinforce the importance of maintaining good sleep hygiene practices and follow-up questions on progress or difficulties encountered

Objectives	Componentes	Activities
Increase self-efficacy in dyads for disease management	Motivational intervention	Positive reinforcement messages: • Motivational affirmations reinforce the dyad's ability to manage the disease Promotion of shared decision-making: • Encourage communication within the dyad about health decisions and self-care plans • Emphasize the importance of teamwork in effective disease management
Increase knowledge in dyads about HF and self-care	Education on disease and self-care	*Messages about:* • Definition and causes of HF Key symptoms and warning signs: • Information on common HF symptoms (e.g., fatigue, shortness of breath, swelling in feet and ankles) Basic self-care principles: • Education on the importance of daily weight monitoring • Importance of a low-sodium diet and how to implement it • Importance of adapted physical activity and examples of safe exercises Medication management: • Tips for proper medication management, including adherence and how to handle missed doses • Information on the purpose of common HF medications and possible side effects Strategies to manage symptoms: • Advice on what to do if symptoms worsen • Reminders about the importance of regular medical appointments for disease follow-up
Reduce symptoms of depression and anxiety	Cognitive-behavioral strategies	*Sending text messages addressing:* Identification of negative automatic thoughts: • Educational messages on how to recognize negative automatic thoughts related to the disease and its management Cognitive restructuring: • Brief instructions to challenge and replace negative thoughts with more balanced and realistic ones

Objectives	Componentes	Activities
		Relaxation and breathing techniques: • Simple exercises for diaphragmatic breathing and progressive muscle relaxation to reduce physical and mental tension Behavioral activation: • Encouragement to engage in pleasant or meaningful activities that can improve mood and reduce anxiety Stress management: • Practical strategies to identify and manage stressful situations related to caregiving and disease management • Messages promoting resilience and positive thinking
Frequency	Every other day	

Source: Own elaboration.

Phase 3. Development of the Intervention Theory

To develop a theory of how a text message–based intervention could improve self-care adherence in dyads, we integrated the TSCHF (13) and the TCCSC (15). TSCHF views self-care as a dynamic process of maintenance, monitoring, and management, shaped by knowledge, experience, values, self-efficacy, functioning, mood, and environment. TCCSC posits that chronic-illness self-care is more effective when a prepared caregiver is involved, with the caregiver's practical, emotional, and cognitive contributions influenced by preparation, knowledge, confidence, mutuality, and dyadic communication.

Guided by these frameworks, the intervention uses structured text messages to address barriers to self-care adherence and dyadic collaboration through four components: sleep hygiene, disease and self-care education, motivation, and brief cognitive behavioral therapy. These components target empirically identified barriers such as sleep problems, low knowledge, low self-efficacy, and emotional distress, aiming to improve maintenance, monitoring, and joint disease management.

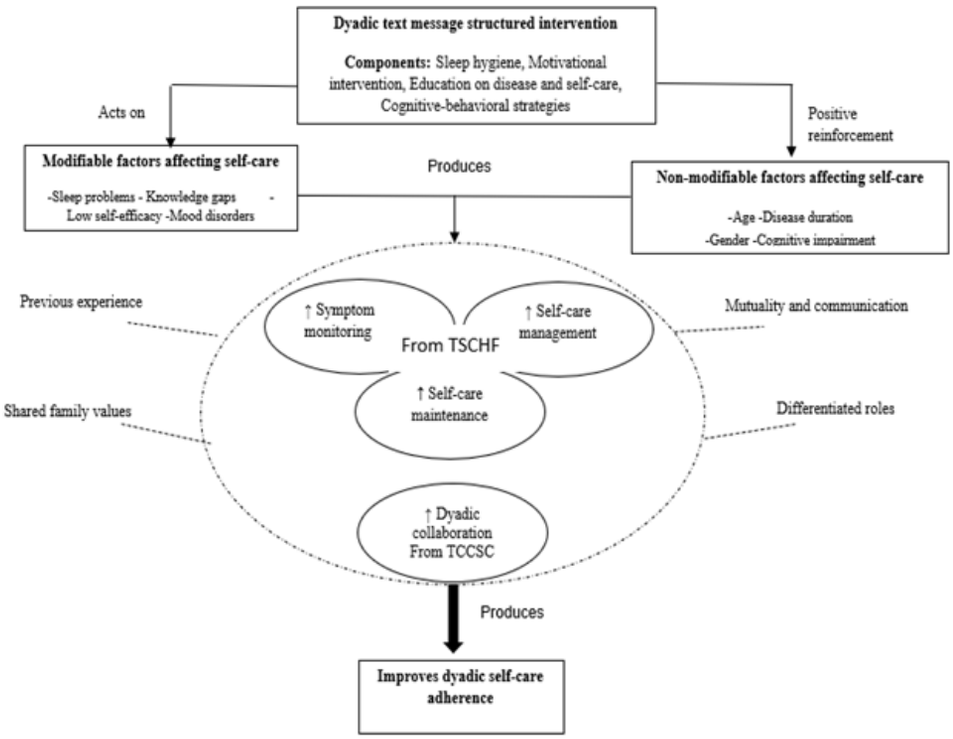
The intervention also recognizes that HF self-care is shaped by prior disease experience, values guiding dyadic motivation, and each member's physical and cognitive functioning. These elements are woven into the message design, with some prompts encouraging recall of past learning to boost confidence, and others linking self-care to meaningful values (e.g., autonomy, family, not being a burden) to deepen motivation. Messages are clear, concrete, and concise to aid understanding and recall. Activity guidance will be tailored to individual capacities. Dyads facing non-modifiable barriers receive more intensive reinforcement. Figure 1 illustrates the dyadic text-message intervention theory.

The following propositions guide the design and evaluation of the intervention:

- If dyads receive clear, repetitive, and adapted education about HF and self-care, then their knowledge, understanding, and ability to recognize warning signs and make informed decisions will increase.
- If the messages promote self-efficacy and shared decision-making, then individual confidence and dyadic coordination in disease management will be strengthened.

- If psycho-emotional factors such as anxiety, stress, or depression are addressed using cognitive behavioral strategies, then emotional barriers interfering with the continuity of self-care will be reduced.
- If sleep hygiene is improved and physical fatigue is managed, then available energy to maintain healthy behaviors will increase in both patients and caregivers.
- If the messages are adapted to the characteristics of each dyad (e.g., higher frequency for dyads facing non-modifiable barriers), then the relevance, effectiveness, and sustainability of the intervention will increase.
- If the content activates past experiences and personal values and is adjusted to the physical and cognitive functioning of participants, then meaningful appropriation of self-care and its incorporation as a daily habit will be facilitated.

Figure 1. Theory of the Dyadic Intervention



Note: The intervention targets modifiable factors identified in Phase 1 through four components derived from Phase 2. Theoretical constructs from TSCHF (self-care maintenance, monitoring, and management) and TCCSC (dyadic collaboration, mutuality) guide the expected mechanisms of change. Contextual factors (previous experience, shared values, communication, differentiated roles) moderate intervention effects. Dyads with non-modifiable factors receive additional reinforcement.
Source: Own elaboration.

Discussion

Disease management is dyadic, so HF education and chronic care should include the dyad when a family caregiver is involved. To ensure intervention acceptance by end users and implementers, this study used a systematic approach: understand the problem, define intervention components from literature and dyad/professional perspectives, and theorize—based on TSCHF (13) and TCCSC (15)—how a text-message–based intervention could improve adherence.

Notably, this is the first study to develop a dyadic nursing intervention delivered via mobile text messages to promote self-care adherence in adults with HF. By conceptualizing the dyad as the primary unit of care, this intervention addresses a gap in the current literature, which has predominantly relied on patient-focused approaches and has insufficiently addressed the relational processes through which patients and family caregivers jointly engage in HF self-care.

Building on the empirical evidence from Phase 1, which identified modifiable and non-modifiable factors affecting self-care adherence, a comprehensive intervention was needed to achieve meaningful outcomes, clarifying the health problem to propose targeted content to improve dyadic self-care knowledge and behaviors. A systematic review (34) indicates that improving dyadic self-care in HF can reduce depressive and anxiety symptoms, increase knowledge, and improve adherence, weight control, and biochemical parameters.

The acceptance and perceived utility of text messaging by both dyads and professionals aligns with prior evidence reporting high willingness rates (95.6%) among hospitalized HF patients (35). The identified barriers—particularly technological literacy and contact stability—underscore the critical importance of initial training and personalized follow-up. Personalization emerged as a key facilitator for self-care adherence, a finding corroborated by the iCardia4HF trial, which reported moderate to large effect sizes for individualized messages, with Cohen's d values of 0.68 for self-efficacy, 0.63 for medication-related health beliefs, and 0.94 for adherence to self-monitoring (36). Similarly, the MESSAGE-HF study implemented adaptive SMS-based algorithms that triggered therapeutic adjustments based on symptom feedback, achieving significant improvements in self-care at 30 days (score difference −2.21; 95% *CI* −3.67 to −0.74; $p = 0.001$) that were sustained at 180 days (difference −2.08; 95% *CI* −3.59 to −0.57; $p = 0.004$) (37).

It is important to note that in the design of this study, SMS text messages were preferred over WhatsApp to address connectivity issues that some dyads may experience. However, some participants preferred WhatsApp as the communication medium. This suggests that alternative platforms warrant exploration in future research. We underscore that, before exploring WhatsApp or integrating mobile apps, telemedicine platforms, or wearable devices, a randomized controlled trial must establish the isolated effectiveness of text-based messaging on dyadic self-care adherence and clinical outcomes. This determines whether text messages alone produce benefits or effects arise from other components. Only then can studies evaluate whether complementary technologies potentiate impact. This stepwise approach prevents confounding and enables cost-effectiveness assessment by component.

mHealth interventions have become particularly salient in low-resource and rural settings because they can partially overcome persistent structural barriers such as long travel distances, shortages of specialists, and fragmented follow-up, which disproportionately worsen HF outcomes in these populations (38). A recent systematic review (38) shows that mobile application–based and broader digital health tools can enhance HF self-care, knowledge, and adherence, including among

underserved rural patients, although effects on hard clinical outcomes remain heterogeneous and long-term sustainability is still under evaluation. In this context, a Dyadic Intervention to Improve Heart Failure Self-Care Adherence, operationalized via mHealth to engage both patients and family caregivers, directly addresses access gaps by shifting part of disease management to the home environment, strengthening caregiver contributions to self-care behaviors, and improving health-related quality of life.

Regarding the design of the intervention, the components, activities, and frequency are derived from the findings of Phase 1 of this study and the experiential insights of Phase 2. The proposed frequency (every other day) is presented as a feasible intermediate solution that may satisfy the varying preferences among dyads. We believe this frequency allows for a steady flow of information and support without being overwhelming for most participants. For dyads with non-modifiable factors, sending two text messages every other day will provide additional reinforcement. However, it is essential to maintain flexibility to adjust the frequency based on each dyad's needs and preferences. This flexibility should be determined by the factors affecting self-care (whether modifiable) and the available resources for evaluating the intervention in a potential experimental study.

The intervention theory combines the TSCHF (maintenance, monitoring, management) with the TCCSC, emphasizing joint dyadic effort, mutuality, trust, and communication. This combination of nursing theories enabled a comprehensive understanding of the dynamic interactions between patients and caregivers in HF management. The use of nursing-specific theories is essential for developing interventions grounded in nursing's disciplinary knowledge and strengthening the profession's theoretical foundation. Nursing theories provide unifying disciplinary structures that organize knowledge and direct practice development (39), with middle-range theories serving as critical bridges linking grand theory, research, and clinical practice (40–42).

Results lay the groundwork for an intervention manual detailing all components, activities, and procedures. The next phase must elaborate on specific message content tailored to these intervention components. Subsequently, a feasibility study should evaluate implementation barriers, technological infrastructure requirements, and personnel capacity in real-world primary care settings. Only after establishing feasibility can cost-effectiveness be rigorously assessed. For resource-limited contexts like Colombia, feasibility evaluations should examine personnel time requirements for dyadic assessment and message delivery, technological infrastructure needs, and potential integration into existing HF programs.

Nursing plays a pivotal role in the design, implementation, and evaluation of digital self-care interventions, given its holistic perspective on patient needs, proximity to families, and leadership in coordinating interprofessional care (42). Recent evidence shows that nurse-led or nurse-developed eHealth and telehealth programs can significantly improve patients' self-care behaviors, knowledge, and clinical management across chronic conditions, underscoring nursing's capacity to translate digital tools into person-centered practice (43). This expanding contribution has exposed a pressing need to strengthen nurses' digital health competencies—ranging from technical and informatics skills to communication, data interpretation, and ethical use of technology—which professional bodies and empirical studies now identify as core requirements for contemporary nursing curricula and continuing education.

Future research directions include developing specific message content aligned with intervention components, creating a structured intervention manual with detailed implementation protocols, evaluating optimal intervention duration through pilot studies, obtaining external expert validation of the theoretical framework, and conducting feasibility testing in diverse healthcare contexts. Subsequently, effectiveness evaluation through randomized controlled trials should assess clinical outcomes, cost-effectiveness, and scalability across different populations and settings.

This study has some limitations. First, the optimal duration (in weeks or months) of the text message intervention was not explored during Phase 2 interviews with professionals and dyads. Second, the intervention theory was only validated through the researcher team's consensus. To address both limitations, future studies should evaluate the optimal duration of message intervention and consider external expert validation to strengthen the theoretical foundation of the intervention. Third, potential selection bias should be acknowledged. Dyads were recruited from a single primary care facility in a municipality using convenience sampling, which may limit the diversity of perspectives captured. Nursing professionals were recruited through purposive sampling, which may have attracted individuals with a particular interest in text-message interventions. Fourth, the generalizability of the findings is limited by the study's specific context. Results may not be directly transferable to major cities, populations with higher educational levels, or technological literacy. Fifth, although data saturation was achieved, the sample size of dyads may not capture the full range of perspectives, particularly from younger patients, male caregivers, or dyads with higher educational levels. Finally, the inherent limitations of qualitative approaches should be considered. Findings reflect participants' perceptions, and social desirability bias may have influenced responses toward more favorable views of the proposed intervention.

Conclusion

A dyadic nursing intervention based on text messaging was developed to promote self-care adherence in adults with HF. The development process systematically integrated evidence from narrative literature review, qualitative interviews with dyads and health professionals, and theoretical frameworks (TSCHF and TCCSC). The intervention comprises four theoretically grounded components—sleep hygiene education, disease and self-care education, motivational strategies, and cognitive-behavioral techniques—delivered every other day via text messaging to both patients and family caregivers. This work contributes to nursing science by operationalizing the dyad as the primary unit of care and establishing theoretical foundations for mHealth-enabled dyadic interventions in chronic disease management.

Conflict of interest statement

The authors declare no conflict of interest.

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