

Patients' Experiences of Nurse-Led eHealth Interventions for Chronic Heart Failure: A Qualitative Systematic Review and Meta-synthesis

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Patients' Experiences of Nurse-Led eHealth Interventions for Chronic Heart Failure: A Qualitative Systematic Review and Meta-synthesis

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Abstract

Background: Chronic heart failure (CHF) is an increasingly prominent chronic condition in the context of global aging, characterized by high morbidity, rehospitalization, and mortality rates. Self-management ability is widely recognized as a key determinant of improved prognosis and quality of life in CHF patients. In recent years, nurse-led electronic health (eHealth) interventions have been increasingly applied in post-discharge CHF management, showing significant potential in improving treatment adherence and promoting healthy behaviors. However, existing research has primarily focused on objective outcomes, lacking a systematic synthesis of patients' subjective experiences, thereby limiting the individualization and sustainable implementation of such interventions.

Objective: This study aimed to conduct a systematic review and meta-synthesis of qualitative research to explore the subjective experiences of CHF patients receiving nurse-led eHealth interventions, identify facilitators and barriers within the intervention process, and enhance the adaptability and patient-centeredness of intervention design.

Methods: This qualitative systematic review and meta-synthesis was conducted in accordance with the Joanna Briggs Institute methodology. Eight databases including PubMed, Web of Science, Embase, Cochrane Library, CINAHL, CNKI, WanFang, and VIP were systematically searched up to July 31, 2025. Grey literature and reference lists of included studies were also manually searched. Eligible studies were appraised for quality and thematically synthesized.

Results: A total of 20 studies were included, involving 322 CHF patients. Among them, 16 were qualitative studies and 4 were mixed-methods studies. Four overarching themes and 12 subthemes were identified: (1) Patient Empowerment and Enhanced Self-Management; (2) Sense of Security and Continuity of Care Under Professional Support; (3) Variations in Acceptance and Emotional Responses; (4) Barriers and Challenges in Implementing eHealth Interventions.

Conclusions: Conclusion: Nurse-led eHealth interventions enhance CHF patients' self-management abilities and sense of security while extending care beyond the hospital setting. Their effectiveness depends largely on sustained nursing guidance and emotional support, yet remains constrained by patient variability, technological limitations, and resource insufficiencies. Future intervention design should emphasize personalized adaptation and technological refinement to improve accessibility and sustainability, thereby strengthening the clinical utility of remote nursing in chronic disease management.

Conclusion: Nurse-led eHealth interventions enhance CHF patients' self-management abilities and sense of security while extending care beyond the hospital setting. Their effectiveness depends largely on sustained nursing guidance and emotional support, yet remains constrained by patient variability, technological limitations, and resource insufficiencies. Future intervention design should emphasize personalized adaptation and technological refinement to improve accessibility and sustainability, thereby strengthening the clinical utility of remote nursing in chronic disease management.

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Original Manuscript

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Keywords: Chronic heart failure; Nurse-led; Electronic health; eHealth; Qualitative research; Systematic review; Meta-synthesis

Introduction

Amid the accelerating trend of population aging and the rising burden of chronic diseases, chronic heart failure (CHF) has emerged as a major global public health concern [1]. As a complex clinical syndrome resulting from structural or functional cardiac abnormalities, the prevalence of CHF increases markedly with advancing age [2]. According to the 2021 Global Burden of Disease (GBD) study, the global number of individuals living with CHF has surpassed 64 million, with both prevalence and mortality rates continuing to rise annually [3]. CHF is not only characterized by high incidence and mortality but also by its progressive nature—once diagnosed, the condition typically worsens over time, with a five-year survival rate comparable to certain malignancies [4]. Recurrent episodes of acute decompensation frequently lead to hospital readmissions, severely impairing patients'

quality of life and functional capacity while imposing a substantial burden on healthcare systems [5–7]. Consequently, identifying effective strategies to slow disease progression, reduce acute exacerbations, and sustain functional status post-discharge has become a pressing clinical imperative.

In the management of CHF, patients' self-management capacity is widely recognized as a pivotal determinant of clinical outcomes [8]. Effective self-management encompasses consistent medication adherence, dietary and sodium intake control, appropriate physical activity, daily monitoring of body weight and symptom fluctuations, as well as timely recognition and response to warning signs [9,10]. However, in practice, many patients struggle to perform these complex self-care tasks independently due to limited disease-related knowledge, low self-efficacy, and the absence of ongoing professional support—factors that collectively compromise their clinical prognosis [1].

To enhance patients' self-management capabilities, nurse-led interventions have increasingly become a vital component of chronic disease management [11–14]. Nurses possess both professional expertise and accessibility in areas such as health education, medication guidance, symptom monitoring, and follow-up support, enabling them to deliver personalized health instruction and psychological assistance that strengthen patients' self-care skills and adherence [9,13]. With the rapid advancement of information technology, electronic health (eHealth) interventions have created new avenues for empowering nurses in chronic care delivery [14]. eHealth generally refers to the use of digital tools and telecommunication technologies to deliver healthcare services—such as remote monitoring, mobile health applications, online education, and telephone follow-ups [15]—which transcend the time and space constraints of traditional face-to-face care. This enables patients to continue receiving professional support after discharge [14,16], thereby improving self-management adherence and implementation, reducing the risk of rehospitalization, and enhancing overall quality of life [17].

In recent years, the application of electronic health technologies in chronic heart failure (CHF) management has emerged as a prominent area of research interest [18]. A growing body of randomized controlled trials and prospective cohort studies has demonstrated that nurse-led interventions delivered through digital platforms can significantly improve treatment adherence and disease-related knowledge, foster the adoption of healthy behaviors, and facilitate early detection of clinical deterioration, thereby reducing rates of rehospitalization and mortality [16,19–21]. Within these interventions, nurses typically serve as key implementers and coordinators, integrating multidisciplinary resources and leveraging digital tools to provide individualized nursing guidance and health management services—forming a technologically integrated model of “nurse-led care with technological support” [20,21]. However, current research predominantly focuses on objective clinical outcomes, with comparatively limited attention to patients' subjective experiences. Many studies overlook critical aspects of the user perspective, such as acceptance of remote monitoring tools, ease or difficulty of technology use, and the emotional impact of the intervention, including feelings of security or anxiety [22,23]. In reality, even if an intervention yields favorable clinical results, its long-term adherence and feasibility for broader implementation may be significantly compromised if patients report poor experiences or struggle to maintain engagement [24].

Qualitative research offers critical insights into patients' subjective experiences with electronic health interventions. A number of studies have explored the emotional and behavioral responses of individuals with chronic heart failure during nurse-led remote care, revealing a spectrum of patient experiences [25–27]. For instance, while many participants reported enhanced feelings of safety and psychological reassurance through remote monitoring, others encountered initial difficulties with technology use, leading to anxiety or apprehension [25]. These findings suggest that nurse-led eHealth interventions can empower patients and strengthen their self-efficacy, yet may also introduce adaptation challenges due to technological barriers or insufficient support [27]. Despite the valuable

perspectives these qualitative studies provide, their limited sample sizes and varied research settings constrain the generalizability and applicability of their conclusions. Currently, a systematic synthesis and refinement of these empirical insights is lacking, hindering the development of universally applicable, patient-centered strategies to optimize intervention design and delivery.

Therefore, this study adopts a qualitative systematic review and meta-synthesis approach to comprehensively examine and integrate the subjective experiences of patients with chronic heart failure undergoing nurse-led electronic health interventions. By systematically identifying and synthesizing existing qualitative studies from the patient perspective, the review aims to distill patients' perceptions, attitudes, and feedback throughout the intervention process, and to uncover key facilitators and barriers to implementation. The findings will provide evidence-based guidance for the development of more adaptive and individualized intervention strategies, thereby supporting the continuous refinement of patient-centered remote nursing care.

Methods

Study Design

This study employed a qualitative meta-synthesis approach [28] to systematically consolidate the subjective experiences and key perspectives of patients with chronic heart failure undergoing nurse-led electronic health interventions. The review was conducted in strict accordance with the methodological guidelines of the Joanna Briggs Institute (JBI), ensuring a systematic and transparent process of evidence generation [29].

Search Strategy

A comprehensive literature search was conducted across eight databases: PubMed, Web of Science, Embase, Cochrane Library, CINAHL, CNKI, WanFang, and VIP, covering all available records up to July 31, 2025. To enhance completeness, grey literature was also retrieved through the OpenGrey database, and reference lists of all included studies were hand-searched. The detailed search strategy used for PubMed is presented in Table 1.

Inclusion and Exclusion Criteria

Based on the PICO framework—Population, Phenomenon of Interest, Context, and Study Design—this review established explicit inclusion and exclusion criteria, detailed in Table 2.

Study Selection

All retrieved records were imported into EndNote 21 for de-duplication. To ensure transparency and accuracy in the analysis process, study selection and quality appraisal were independently conducted by two reviewers. Initially, the reviewers screened titles and abstracts against the inclusion criteria, excluding studies irrelevant to the research focus. Subsequently, full texts of potentially eligible articles were assessed for final inclusion. Any discrepancies in quality appraisal were resolved through discussion or adjudication by a third reviewer. To ensure methodological rigor, all procedures—including study selection, data extraction, and synthesis—were subjected to dual verification by the research team.

Quality Appraisal

The methodological quality of all included studies was systematically assessed using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Qualitative Research [30]. This tool comprises 10 items evaluating key methodological domains, including philosophical underpinnings, researcher influence, participant recruitment, transparency in data collection and analysis, and ethical considerations. Each item is rated as "Yes," "No," "Unclear," or "Not Applicable."

The appraisal was independently conducted by two researchers with experience in systematic reviews. Any discrepancies were resolved through discussion, with arbitration by a third reviewer if necessary. Following JBI guidelines, studies with all items rated as “Yes” were classified as Grade A (high quality, low risk of bias); those with several “Yes” ratings were graded as B (moderate quality, acceptable risk of bias); and studies with most items rated “No” were classified as Grade C (low quality, high risk of bias) and excluded from the review. Only studies rated as Grade A or B were included to ensure the credibility and interpretability of the synthesized evidence.

Data Extraction

Data extraction was independently performed by two researchers following a thorough reading of the full texts to ensure systematicity and consistency. A predefined data extraction form was used to systematically collect relevant information from each included study, including: author(s), year of publication, country or region, study setting, sample size and participant characteristics, study design, research objectives, data collection methods, data collection modalities, duration of interviews or data gathering, data analysis approach, and key findings reported.

Following the initial comparison of extracted data, any discrepancies were reviewed and resolved by a third researcher to ensure accuracy and completeness. The finalized dataset served as the foundation for subsequent quality appraisal and thematic synthesis.

Meta-Synthesis

This review employed a combination of data aggregation and thematic analysis to systematically synthesize existing qualitative evidence on the experiences and perceptions of patients with chronic heart failure receiving nurse-led electronic health interventions. Two researchers independently conducted repeated readings of all included studies, identifying author-reported findings and supporting participant quotations to assess the initial credibility of each result.

Findings with similar meanings were grouped into descriptive categories, which were further refined through team discussions into overarching themes that captured the core content and underlying structure of patient experiences. The synthesis emphasized the conceptual coherence and interconnections among findings, aiming to faithfully reflect patients’ shared experiences and practical challenges from their own perspectives.

Throughout the synthesis process, analytical transparency and traceability were maintained, with all stages of interpretation rigorously discussed among team members to ensure analytical rigor and explanatory validity.

Confidence Assessment of Meta-Synthesis Findings

The quality of the synthesized findings in this review was evaluated using the Confidence in the Qualitative Evidence (ConQual) approach, developed by the Joanna Briggs Institute (JBI) [31]. This framework begins with a baseline rating of “High” and applies a stepwise downgrading process based on two key dimensions: the methodological dependability of the included studies and the credibility of the synthesized findings. The final confidence levels are categorized as high, moderate, low, or very low.

Methodological dependability was assessed using five critical items from the JBI Critical Appraisal Checklist for Qualitative Research, reflecting the overall rigor and execution quality of each included study. If four or five of these items were rated “Yes,” no downgrading was applied; if two or three were rated “Yes,” the evidence was downgraded by one level; if only one or none were rated “Yes,” it was downgraded by two levels.

Credibility of findings focused on the alignment between the researchers' interpretations and the original participant quotations across the synthesized themes. Findings were categorized as "Unequivocal," "Equivocal," or "Unsupported." No downgrading was applied for themes supported solely by unequivocal data; findings supported only by equivocal data were downgraded two levels; and those lacking data support entirely were downgraded by four levels.

Each synthesized theme was evaluated using the ConQual framework to clearly present the strength and trustworthiness of the qualitative evidence, facilitating a reasoned understanding of the robustness and applicability of the review findings.

Ethical Considerations

As this study is a systematic review and meta-synthesis that does not involve the collection of primary data, ethical approval was not required. All included studies had received prior ethical clearance and obtained informed consent from participants.

Results

Study Selection

A total of 3,803 records were identified through database searches. After duplicate removal and title/abstract screening using EndNote 21, 63 articles were selected for full-text review. Ultimately, 20 studies met the inclusion criteria and were included in the synthesis [25-27, 32-48] (Figure 1).

The included studies were conducted in the United States (n=5), China (n=3), Sweden (n=3), Canada (n=3), Singapore (n=1), South Korea (n=1), Japan (n=1), Italy (n=1), Australia (n=1), and Lithuania (n=1), encompassing a total of 322 patients with chronic heart failure. Of these, 16 were purely qualitative studies and 4 employed mixed-method designs. Detailed study characteristics are presented in Table 3.

Quality Appraisal Results

According to the JBI Critical Appraisal Checklist for Qualitative Research, the overall methodological quality of the included studies was high, though certain limitations were observed in specific domains. Specifically, five studies did not clearly articulate the congruity between their stated philosophical perspective and chosen methodology; one study failed to specify the researcher's positioning within the cultural or theoretical context; and eighteen studies did not address the influence of the researcher on the research process or the nature of researcher-participant interactions. Detailed quality appraisal results are presented in Table 4.

Themes

Through iterative reading and comparative analysis, four overarching themes and twelve subthemes were synthesized (Table 5): (1) Patient Empowerment and Enhanced Self-Management; (2) Sense of Security and Continuity of Care Under Professional Support; (3) Variations in Acceptance and Emotional Responses; (4) Barriers and Challenges in Implementing eHealth Interventions. The mapping between themes/subthemes and the included studies is detailed in Table 6.

Theme 1: Patient Empowerment and Enhanced Self-Management

Subtheme 1: Improved Health Literacy and Disease Awareness

eHealth interventions enabled patients to develop a deeper understanding of disease mechanisms, symptom management, and necessary lifestyle modifications. This enhanced

awareness empowered them to more effectively recognize abnormalities in their condition and adhere to medical advice in daily self-care routines.

Patient: "...[the programme] is really very good, because I have learnt a lot of things that I did not know last time, like how to read the sodium amount in the food label..."[25]

Patient: "With that medication reminder and then weighing myself every day to see if I was retaining water, it helped me a lot because I was really scared at first. But now that I've taken my meds the same time and took everything more seriously and learned everything that I got - everything that I know about heart failure and heart disease, I learned it from that app because of those little questionnaires you got."[26]

Patient: "I sometimes feel symptoms like my heart rate slowing down, difficulties in breathing, my heart pounding, or feeling dizzy. I know these are heart failure-related symptoms because I've experienced these before. I can't go to the hospital whenever I have these symptoms. When these symptoms appear, I often don't know what to do, other than going to the hospital. Thus, I think it is helpful to have information on how to respond when symptoms occur."[45]

Patient: "I know a lot more about heart failure now compared to before. That's part of the follow-up ... and soon I'm going to this 'heart school' and I will start working out twice a week ... this group thing for people with the same illness."[48]

Subtheme 2: Strengthened Self-Efficacy and Confidence

With continuous feedback and guidance from nurses, patients gradually developed a stronger sense of confidence and responsibility in managing their condition. This shift was reflected in their transition from passive dependence to active engagement in self-care and health management.

Patient: "I can control my condition more easily because I have more knowledge about how my condition is right now...I am quite confident..."[25]

Patient: "It's good to be able to input data consciously, when done every day."[26]

Patient: "I was able to, like, you know, better myself. My heart was only working at a 25% when I first started the app and now...my heart is improved to a 45% strength then."[45]

Subtheme 3: Behavioral Change and Health Improvement

The intervention facilitated positive behavioral adjustments in areas such as diet, physical activity, self-monitoring, and medication adherence, which were accompanied by symptom relief and improvements in overall quality of life.

Patient: "...[the most helpful aspects] are weight monitoring, coz it tells me if I have water retention...also controlling my water intake and diet...I try to keep my water intake to 1L/day, and eat less oily and salty food..." [25]

Patient: "...the doctors kept saying to me that you can self-medicate with fluid tablets. And I would think 'oh no [laugh], I don't know what I'm doing here, so I'm not going to do that...' But then the [telemonitoring staff] at the other end said take another fluid tablet... And then gradually, I started to realise that when I felt unwell I was able to think 'oh, you know, take another tablet or half a tablet.'"[36]

Patient: "Yes, it seems to me that nurses have helped me to manage health

problems better... yes... in the measurements of blood pressure, blood sugar, weight. I do more regularly and write in the diary.” [41]

Patient: “Yes, it is, kind of, a good reason to make, or maybe get help to make these changes that... And maybe I can get some advice that I hadn’t thought of myself... Kind of like someone taking one’s hand and saying: Let’s do it this way.” [42]

Patient: “It felt so safe. I monitored my blood pressure and pulse. In addition, I observed myself and how my body reacted. When I walked the dog, I would watch how my body handled the strain. I have been walking further and further each day.” [48]

Theme 2: Sense of Security and Continuity of Care Under Professional Support

Subtheme 1: Sense of Security from Remote Monitoring

Continuous data transmission and timely feedback gave patients a sense of being under ongoing medical supervision, which reduced uncertainty and anxiety outside the hospital setting. Potential abnormalities could be identified and addressed at an early stage, enhancing patients' sense of safety.

Patient: “I like that I can call someone and see them. I don’t feel alone. This is easier than waiting for a nurse to come.” [32]

Patient: “Yes, they are probably keeping an eye on me. If something happens there is somebody on the other end that will see that; aha, something’s happening here.” [43]

Patient: “I feel secure knowing that people at the hospital are observing my condition through this tool.” [44]

Subtheme 2: Continuity of Care and Collaborative Engagement

Remote follow-ups and personalized feedback helped bridge the “care gap” after discharge, enabling ongoing assessment and real-time guidance. This approach also fostered a partnership-based interaction between patients and healthcare professionals, reinforcing a sense of continuous and coordinated care.

Patient: “I hope that whatever you saw during home visit, [you] can let my doctor know too...my problems...because doctor’s consultation is very short, only have 10 minutes...but during home visit, I can tell you more...” [25]

Patient: “First of all, I used to have a nurse and other people that would come in and check on me but that was right after I was in the hospital. Well, I don’t know how long it lasted. I don’t know. It was great and I wish I could have something like that now.” [35]

Patient: “It keeps you in the picture... And you know exactly what’s going on from day to day... And it also lets [the telemonitoring nurse] know exactly what’s going on...” [36]

Patient: “We were keeping a log book and it wasn’t consistent but we were still trying to do that and we’re going to have to go back to that unfortunately after this... Having this was better for us and at least for the hospitals because they could see live data right there in their systems.” [37]

Patient: “Because it [FCNs’ clinic] was the only service still active during pandemic, you could not go to the hospital... all the difficulties... so in short, it will remain only the nurses.”

Patient: “What bothered me the most was that I couldn’t get rid of the dizziness, so I thought it would be best to contact the out-patient clinic ... but

before I could do that the nurse contacted me because she saw I had been reporting dizziness. She discussed it with a supervising doctor and some of my medications were changed. That was really an improvement ... a total change to my everyday life.”[48]

Subtheme 3: Communication and Relationship Building

Timely, personalized, and respectful communication fostered patients’ trust and adherence, allowing the nurse-patient relationship to be strengthened even within the context of remote care.

Patient: “Yes, yes I do. And I really appreciate that because you took your time to come to my home, be there. It wasn’t a very formal meeting. It’s like talking to friends. So, it is good...we can just talk, not just about medical advice. We can sit down and talk, and have a good conversation.”[25]

Patient: “When the nurse comes in the house, she can see for herself what is going on. I don’t have to worry about making sure I am telling the right thing and remembering things.”[32]

Patient: “The nurses are aware of my condition and they are helpful. This is important.” [44]

“Yeah, I would love that. Just to come and make sure I’m alright...This beats having to wait for an appointment.”[47]

Theme 3: Variations in Acceptance and Emotional Responses

Subtheme 1: Positive Acceptance and Motivation

Some patients embraced the intervention with enthusiasm, driven by a desire for health improvement, prior experience with smart devices, and encouragement from healthcare professionals. Facilitating measures—such as device training and free provision of equipment—further enhanced their willingness to participate.

Patient: “It helped me in the sense that I was weighing myself almost every day, I know my pressure. I have statistical data. If it increases a lot, I try to find out why. Yes, it forces me to be more vigilant.” [27]

Patient: “Yeah, I’d definitely be willing to learn, you know, even at my age, I would still like to learn.”[34]

Patient: “Well it’s . . .nothing I’ve ever done before but it sounds like something that would be helpful – I’ll try anything that can help me.”[35]

Subtheme 2: Negative Attitudes and Psychological Resistance

Some patients exhibited reluctance toward the intervention due to perceived clinical stability, a self-assessed lack of need, unfamiliarity with technology, or concerns about being monitored. These factors led to limited engagement or premature withdrawal from the program.

Patient: “Uh, probably fear of not being able to do it and the fact that these technologies were not available (clearing throat) when an older person was younger. They have to learn something new, and I think it scares them. Like they’re gonna, you know, like I remember when we started getting computers, older people would be afraid they’d do something to ruin the computer.”[34]

Patient: “I can’t; I already suffer from heart failure, my memory is failing, I’m little educated, and I don’t think about these things (mHealth), I just think about living a few more years, and that’s just fine.”[38]

Patient: “I don’t know if it’s useful or not. I think with this illness, I just need to take medication and diuretics. Using some kind of management software might not be of much help.”[39]

Patient: "It feels like being tracked by someone — I find it quite off-putting." [40]

Subtheme 3: Individual Differences and Applicability

Variations in acceptance were associated with factors such as age, educational background, personality traits, health management beliefs, and digital literacy. Younger or more highly educated patients tended to be more receptive, while older individuals or those reliant on traditional care models were generally more cautious.

Patient: "As I get older and more technology comes out, you know, you sort of start falling behind. I try to keep up but..." [34]

Patient: "Sigh! I only went to school up to the third grade. How could I possibly keep using this kind of high-tech app? I just can't stick with it—I don't know how to use it." [39]

Patient: "So even now, I still have doubts. It's like—after being deceived the first time, it's hard to trust again the second time." [40]

Patient: "Yeah, but, it's been like... I've gotten help with that information too, you know. I don't understand all the words, so that's like ... my wife has to help me with that. She is everything, you know. Yeah, that's... I have trouble coming up with any examples, to be honest (laughing). It might be something that I don't really understand, that she can understand better, and then she'll explain it to me." [46]

Theme 4: Barriers and Challenges in Implementing eHealth Interventions

Subtheme 1: Technological Usability and User Experience

The effectiveness of the intervention was closely tied to the usability of the devices and platforms. Intuitive interfaces and age-friendly designs significantly enhanced ease of use and user confidence, particularly among older patients.

Patient: "I think the best is simple and useful...yes...because we need to work, if it is too complex, we feel very troublesome. So, I think the simpler the better...And also, we are not that young now, sometimes we cannot remember so many things." [25]

Patient: "No, initially, [it was hard] as I am not as tech savvy, but after 2 or 3 days it was really easy ." [33]

Patient: "I like it, it's easy (laughs). It doesn't have many steps to it," in reference to the mHealth monitoring system. " [34]

Patient: "If I wanted to sit down and do it at two in the night or five in the morning or in the middle of the day then this was fine I could choose when to carry out my exercises [...] it is an advantage to be able to do it at a time of my choice." [42]

Subtheme 2: Technical Issues and Usage Barriers

Patients frequently encountered challenges such as device malfunctions, unstable data transmission, and software lag. These issues were particularly burdensome for older adults, who struggled with complex interfaces or unclear prompts, leading to increased dependence on others and heightened frustration.

Patient: "I think it would have been nice if it worked, but every time I went to log on it kept bringing up 'system error' or something like that and it was

frustrating. I just put it back in the box and said, I'm gonna write things down and that will be good enough.”[33]

Patient:“I'm old. I can't see well, I can't read much, I can't type, and it's too difficult to use (mHealth) .”[38]

Patient:Yes, I had to wait, repeat and try again. Yes, now and then I contacted [name of feedback provider] for assistance. [...] I sat there and explored the software by myself.” [42]

Patient:“I think the app would help Diane (persona), but only if it was really simple. A lot of apps have too many things going on, so I get lost.”[47]

Subtheme 3: Concerns About Sustainability

Patients commonly expressed concerns regarding the long-term feasibility of the intervention, including device costs, ongoing technical support, and availability of personnel. Some offered suggestions for improvement, such as enhancing system personalization, improving platform stability, and reducing financial barriers to access.

Patient:“Because most of the people who would be in this situation have had problems normally at their age when they are on a fixed income or retirement or something. So it depends, unless a person is really wealthy. Because it used to be paycheck to paycheck, and now you're in retirement and now you have to take care of additional medical bills, this extra addition of expenditure could be a factor.”[34]

Patient:“It is best to have a way to allow me to identify the true and false, such as official channels.”[38]

Patient:“I think we need something to tell us that hey you won't be charged later, and if you are you get a refund or something.”[47]

Discussion

This study found that nurse-led electronic health interventions significantly enhanced self-management capabilities among patients with chronic heart failure. Throughout the intervention process, patients gradually adopted proactive health behaviors—such as monitoring vital signs, recording symptoms, and responding actively to changes—demonstrating a notable shift from passive dependence to active participation [25]. This behavioral transformation extended beyond mere knowledge acquisition and was reflected in tangible improvements in medication adherence, exercise routines, and lifestyle regulation. Most participants, under the continuous feedback and guidance of nurses, developed clearer understanding of their condition and a heightened awareness of health risks, fostering a strong sense of responsibility and initiative in self-care [26]. Notably, this positive change was not limited to younger or highly educated individuals. Even older patients or those with lower educational backgrounds exhibited marked improvements in self-management when provided with personalized technical support and nursing guidance, indicating strong adaptability across age and cultural groups. Therefore, nurse-led digital interventions should be integrated into routine CHF management as a key strategy to slow disease progression, reduce rehospitalization rates, and improve quality of life. The leading role of nurses in these interventions not only enhances the professionalism and accessibility of care but also ensures more continuous and context-sensitive support for patients [12,13]. Moving forward, nurse-led eHealth support programs should be systematically incorporated into heart failure care, particularly in primary care settings and underserved areas

with limited access to remote healthcare resources, offering a sustainable pathway to improved outcomes [49].

Nurse-led electronic health interventions were found to significantly enhance patients' sense of security during the post-discharge recovery phase at home [32]. Compared to the conventional "care ends at discharge" model, remote interventions offered sustained and stable professional support [22]. Most patients perceived remote monitoring not merely as data transmission but as symbolic of a responsive nursing team operating behind the scenes, providing invisible yet reliable support [43]. This "unseen safeguard" reinforced patients' expectations of nurse accessibility, effectively alleviating post-discharge uncertainty and anxiety. Several participants reported that regular data feedback and ongoing communication reduced their feelings of isolation, embedding them within a dynamic care network where they received continuous guidance for health management [32]. Far from diminishing the depth of the nurse-patient relationship, this form of technology-supported care—when delivered through consistent communication and team continuity—actually deepened trust over time. Patients commonly expressed greater willingness to engage and communicate when interventions were consistently led by familiar nurses. eHealth interventions thus extend the temporal and spatial boundaries of nursing services while substantively enhancing the integration of chronic care systems. More importantly, the experience of "uninterrupted care" fostered patients' motivation for behavioral change. Those who felt continuously supported by professional care teams were more inclined to adhere to self-monitoring, adjust their lifestyles, and proactively report health status. This perceived psychological safety is gradually being internalized as an intrinsic driver of self-management behaviors [50]. Therefore, the "continuity of care" enabled by eHealth interventions represents more than just a technological linkage—it constitutes a dual transformation at both psychological and behavioral levels. In conditions like chronic heart failure, which demand long-term follow-up and support, nurse-led remote care should be regarded as a core element of future management models. To optimize intervention outcomes, close coordination among nurse leadership, digital platforms, and patient engagement is essential to ensure professional continuity and timely responsiveness of care services [2]. Moreover, intervention design must account for patient diversity, offering intensified follow-up and emotional support to vulnerable groups such as those who are elderly, live alone, or have lower educational levels. By establishing a positive feedback loop between psychological safety and care effectiveness, such strategies will facilitate the broader adoption and clinical integration of nurse-led eHealth interventions.

In nurse-led electronic health interventions, patients with chronic heart failure exhibit substantial individual variation in both their willingness to engage and their overall intervention experience—particularly in relation to their attitudes toward technology, underlying motivations, and emotional responses. While some patients actively embraced the intervention, viewing it as a valuable tool for enhancing health management and self-care capabilities, others initially demonstrated notable fear of technology and emotional resistance. For some, the constant monitoring served as a persistent reminder of their illness, contributing to psychological distress. In certain cases, abnormal data triggered feelings of lost control and heightened anxiety [27,34]. These divergent experiences are not incidental; rather, they reflect the cognitive and emotional tensions patients face in response to the redistribution of perceived control over their health brought about by technological integration. A multitude of factors—such as age, educational background, cognitive function, prior exposure to technology, and interface usability—interact to shape patients' receptiveness to eHealth interventions. Importantly, patient acceptance is not static. Many individuals who were initially hesitant reported increased engagement over time after recognizing tangible benefits, illustrating a gradual "experience-trust-participation" trajectory. This finding underscores the need to shift from a "one-size-fits-all" approach to a "stratified support" model in eHealth design—one that aligns intervention intensity and format with patients' technological capacity and psychological readiness [51]. For tech-savvy individuals, interventions may incorporate more autonomy and interactive features to harness their self-management potential. For those less comfortable with

technology, early-stage support should focus on intensive nurse-led training and emotional scaffolding, possibly supplemented by family involvement, to lower entry barriers and boost adherence. Furthermore, care teams should proactively assess for psychological barriers—such as information anxiety, technophobia, or disease-related stigma—and adapt intervention strategies accordingly to ensure emotional friendliness and cognitive accessibility throughout the process. The effectiveness of eHealth interventions depends not only on the functionality of digital tools, but also on the strength of the triadic relationship between technology, nursing, and the patient. Technology alone cannot replace the irreplaceable role of nurses in adjusting for individual differences, providing emotional support, and delivering sustained empowerment—especially in the care of older adults with heart failure, a population often marked by complexity and vulnerability [52]. Therefore, future interventions should adopt nurse-led, emotionally attuned, and individually adaptive eHealth models that account for varying levels of technological literacy. Such models will ensure that all patients—regardless of their digital readiness—can benefit fully within a safe, continuous, and inclusive care environment.

Despite the promising potential of nurse-led electronic health interventions in the management of chronic heart failure, this study also identified several multidimensional barriers that may hinder their broader implementation. These challenges span technological usability, individual patient differences, nursing resource allocation, and systemic coordination. Technical malfunctions emerged as a central concern among patients, with frequent reports of device failures such as connectivity disruptions, data upload errors, bulky hardware, and complex wiring. Such issues compromised the convenience and adherence to the intervention, disrupted data continuity and accuracy, and undermined patients' trust in the system [53]. In addition, financial barriers—such as the cost of purchasing devices or covering data usage fees—posed further obstacles for economically disadvantaged patients. These findings underscore the necessity of incorporating human-centered design principles into eHealth intervention development. A robust technical support infrastructure should ensure that devices are functionally reliable, safe, and accessible, with features tailored to older adults' physical capacities, financial limitations, and daily routines [54]. The "digital divide" remains a major barrier to equitable intervention uptake [55]. Older adults, individuals with lower educational attainment, or those with limited digital literacy frequently encountered operational difficulties, error-related anxiety, and psychological resistance during the early stages of intervention. Previous studies have shown that seniors are particularly sensitive to complex interfaces, high learning curves, and the frustration of technological failure—all of which substantially reduce their willingness to participate [38]. While continuous nurse support can help alleviate these challenges to some extent, eHealth delivery remains constrained in areas with limited network infrastructure or among populations with visual, auditory, or cognitive impairments. To promote more inclusive adoption of eHealth interventions, future implementation efforts must emphasize stratified technological adaptation. For patients with lower digital readiness, simplified devices and one-on-one training should be provided, alongside enhanced family involvement and remote assistance mechanisms. Additionally, improving internet accessibility and incorporating intuitive design features—such as voice guidance, image recognition, and interactive feedback—can reduce technological barriers and improve user experience. By doing so, eHealth programs can expand their reach and ensure that the benefits of nurse-led interventions are equitably distributed. Promoting accessibility, usability, and continuity across diverse patient populations is essential to achieving sustainable integration of digital health in chronic care management.

Although nurse-led electronic health interventions have demonstrated significant value in the management of chronic heart failure, their implementation also presents novel challenges to nursing workload and professional competencies. Nurses are no longer confined to traditional roles of bedside monitoring; instead, they must now simultaneously manage data collection and analysis, facilitate remote communication, and guide patients in the use of digital devices [56]. Without adequate staffing or streamlined workflows, the high frequency of data processing and patient interactions may substantially increase the burden on nurses, thereby compromising the long-term sustainability of their involvement

[57]. In addition, these interventions introduce new issues such as false alerts, ambiguous data, and increased patient psychological dependence—factors that demand a broader interdisciplinary skill set from nurses. Specifically, greater proficiency in digital health technologies and advanced psychosocial support strategies are increasingly required [56,58]. To meet these demands, structured training programs should be implemented to equip nurses with the competencies necessary to navigate complex remote care environments. Establishing dedicated telehealth nursing teams may further enhance the responsiveness and professional execution of these interventions [58]. Privacy and ethics are also central concerns shared by both patients and healthcare providers [59]. The continuous collection and transmission of personal health data pose potential risks of data breaches and misuse if robust safeguards are lacking, thereby undermining patient trust. To address this, intervention systems must implement end-to-end encryption, tiered access controls, and secure, compliant data storage. Institutional policies should promote transparent data usage practices and ensure patients are fully informed prior to participation, safeguarding their rights and fostering a sense of security. Moreover, the degree of integration between eHealth systems and existing healthcare infrastructure is a critical determinant of clinical effectiveness. When systems operate in silos, they produce "data islands" that limit the clinical utility of collected information and disrupt the continuity of patient care [60]. Patients often prefer receiving care from familiar nurses or original care teams who understand their health history, which enhances communication consistency and professional trust. To support the successful adoption of eHealth interventions, healthcare institutions must establish cross-level collaboration and accountability mechanisms. These interventions should be embedded into routine chronic disease management workflows, supported by interoperable data systems, feedback loops, and standardized procedures. For nurse-led eHealth models to achieve broader and sustainable implementation, future efforts must prioritize differentiated patient support and nurse capacity building, optimize resource allocation and workflow efficiency, and develop standardized care pathways and data governance frameworks. Multidimensional system integration will be essential to ensuring the long-term stability and full potential of this innovative care model.

Limitations

This study has several limitations. First, although a comprehensive search of multiple databases and grey literature was conducted, the included studies were limited to published qualitative research, primarily in English and Chinese. This may have introduced publication and language bias, potentially affecting the completeness of the evidence base. Second, most study participants were older adults with basic cognitive and communication abilities. The findings may not be generalizable to more vulnerable populations, such as the very elderly, those with severe cognitive impairments, or individuals with strong resistance to technology. Third, the majority of included studies were conducted in high- and middle-income countries, particularly in Europe, North America, and East Asia. The scarcity of evidence from under-resourced regions and diverse cultural contexts limits the cross-cultural applicability of the findings. Fourth, the included studies varied in terms of intervention formats and application settings—ranging from remote monitoring and telephone follow-ups to mobile health applications. Although the meta-synthesis identified common themes, nuanced differences across intervention types may have been diluted during the synthesis process. Lastly, as a qualitative meta-synthesis, this study is inherently subject to researcher interpretation. Moreover, many of the original studies lacked detailed reporting on researcher reflexivity, which may affect the credibility of the synthesized results. Additionally, this review focused solely on patients' subjective experiences and did not directly assess objective clinical outcomes, which warrants caution when inferring relationships between patient experiences and clinical effectiveness.

Conclusion

This study systematically synthesized the experiences of patients with chronic heart failure undergoing nurse-led electronic health interventions from a patient-centered perspective.

The findings indicate that such interventions can enhance self-management capabilities and foster a greater sense of security, effectively extending care beyond the hospital setting. However, variations in technology acceptance, limited digital literacy, and inconsistent adherence remain significant barriers. Technical issues such as device malfunction, unstable connectivity, and constrained nursing resources also affect implementation feasibility. Nurses play a pivotal role in these interventions, with their ongoing professional guidance and emotional support serving as critical determinants of success. Moving forward, intervention design should prioritize individualized adaptation and technological simplification, while improving human-technology interaction and support systems. These efforts are essential to enhancing accessibility and sustainability, and to realizing the broader clinical value of remote nursing in chronic disease management.

Implications for Clinical Practice and Research

Nurse-led electronic health interventions demonstrate significant clinical value in the management of chronic heart failure; however, their effective implementation requires careful alignment with patient characteristics, technological adaptability, and supportive nursing infrastructure. Intervention tools should be designed to be simple, user-friendly, and accessible—particularly for older adults—and should be accompanied by adequate training and individualized adjustments to enhance patients' confidence and acceptance of technology. In remote care delivery, nurses must prioritize continuity, personalized engagement, and empathetic communication. Strategies such as consistent team-based follow-ups, proactive feedback, and relational trust-building are essential to improving patient adherence. At the organizational level, dedicated remote nursing roles should be established, supported by structured training programs and adequate resource allocation. Clear role delineation is needed to ensure nurses can effectively manage data monitoring, provide psychological support, and deliver timely intervention feedback. Additionally, robust interdisciplinary collaboration and data security frameworks are critical to enabling nurses to lead remote care initiatives effectively. Future research should explore culturally and contextually tailored intervention strategies, mechanisms for sustaining long-term adherence, and the relationship between patient experiences and clinical outcomes. These efforts will contribute to the ongoing refinement and broader adoption of patient-centered remote nursing models in chronic disease management.

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Supplementary Files

Table.

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Cover Letter.

URL: <http://asset.jmir.pub/assets/5266673aed9734afe5f0e51e120beb59.docx>

Figures

Search flow diagram.

