Original Article

Key factors associated with self-care among patients with heart failure: A scoping review of cross-sectional studies

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Abstract

Heart failure is a life-threatening condition with increasing prevalence and mortality rate worldwide, often resulting in frequent hospitalizations and reduced quality of life. Effective self-care behaviors are essential for minimizing adverse health effects among patients with heart failure. The aim of this study was to identify and synthesize factors influencing self-care among individuals with heart failure. Articles published in English between 2017 and 2022 were retrieved from Google Scholar, PubMed, and ScienceDirect using predefined Boolean search terms, including 'self-care', 'factors', 'influence', 'heart failure patients', and 'cross-sectional study'. Of 740 records screened, 21 studies met the inclusion criteria. The identified factors were thematically categorized into sociodemographic, psychological, cognitive, and social domains. Sociodemographic factors (age, education, marital status, and New York Heart Association (NYHA) class), health literacy, self-efficacy, depression, and family support were consistently identified as critical determinants. Self-efficacy emerged as a central factor, influencing the relationship between depression and knowledge of self-care performance. Family support proved to be a significant facilitator of effective self-care. These findings suggest that multiple interrelated factors contribute to suboptimal self-care among patients with heart failure. Addressing these determinants may inform the development of effective, culturally sensitive self-care interventions and guide nursing practice and health policy aimed at improving heart failure management.

Keywords: Heart failure, self-care, determinants, self-efficacy, family support

Introduction

Heart failure is a major global health concern due to its increasing prevalence and substantial negative effects on morbidity and mortality [1]. It is estimated to affect approximately 64.3 million individuals worldwide [2]. The annual incidence of heart failure varies between 0.1 %, 0.9 %, and 6.7 % in Europe, the United States, and Asia [3,4]. Heart failure significantly impairs patients' quality of life and is associated with high rates of rehospitalization and mortality [5]. Inadequate patient self-care behaviors further contribute to poor clinical outcomes, including reduced quality of life, increased rehospitalization, and premature death among patients with heart failure [6]. Consequently, effective self-care practices are essential for mitigating adverse health outcomes and improving long-term disease management in this population [7].

Self-care has been found to reduce mortality, prevent hospital readmissions, and improve quality of life among individuals with heart failure, and it is a crucial part of a multidisciplinary

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disease management program [8,9]. Adequate engagement in self-care behaviors is essential for maintaining a high quality of life and avoiding hospitalization [10]. In the context of heart failure, self-care encompasses behaviors that support symptom monitoring, symptom recognition, and maintenance of physiological stability [11]. Inadequate self-care among patients with heart failure is impacted by multiple factors, including limited knowledge and insufficient access to self-care information [12]. Understanding the factors that contribute to self-care behaviors can serve as a foundation for developing culturally relevant and effective strategies to support long-term disease management and control in patients with heart failure [13].

Despite numerous studies investigating factors affecting self-care in heart failure, synthesis of recent evidence grounded in a clear theoretical framework remains limited. This review adopts Riegel's Middle-Range Theory of Self-Care in Chronic Illness (2012) as a guiding framework, emphasizing self-care maintenance, monitoring, and management [14]. The scoping review approach enables the systematic mapping and categorization of determinants influencing self-care among individuals with heart failure, thereby providing direction for the development of future interventions. Therefore, the aim of this study was to identify and synthesize factors affecting self-care in patients with heart failure.

Methods

Review framework and protocol registration

A review protocol was developed before the search, following the frameworks from preferred reporting items for systematic reviews and meta-analyses extension for scoping reviews (PRISMA-ScR) and Joanna Briggs Institute (JBI). The protocol included the search strategy, eligibility criteria, screening procedures, and data extraction plan. The protocol was retrospectively registered with the Open Science Framework (OSF) and is available at: https://osf.io/tk2uz/overview.

Databases and search strategy

A systematic search was conducted in PubMed, ScienceDirect, and Google Scholar to identify relevant studies published between January 2017 and December 2022. The search was limited to English-language articles and was conducted on January 15, 2023, by RAV and KRP. The search strategy used combinations of the following keywords and Boolean operators: "self-care", "heart failure", "factors", "influence", and "determinants". Complete search strings for each database are provided in **Table 1**.

Table 1. Search strings used to identify eligible studies across databases

Database	Search strategy
Google Scholar	"self-care" AND "heart failure" AND (factors OR determinants OR influence) AND "cross-sectional" AND 2017-2022
PubMed	("self care"[MeSH Terms] OR "self-care"[Title/Abstract]) AND ("heart failure"[MeSH Terms] OR "heart failure"[Title/Abstract]) AND ("factors"[Title/Abstract] OR "determinants"[Title/Abstract] OR "influence"[Title/Abstract]) AND ("cross-sectional studies"[MeSH Terms] OR "cross-sectional"[Title/Abstract]) AND ("2017/01/01"[Date - Publication] : "2022/12/31"[Date - Publication])
ScienceDirect	("self-care" AND "heart failure" AND (factors OR determinants OR influence) AND "cross-sectional") AND pub-date > 2016 AND pub-date < 2023

Eligibility criteria

Eligibility criteria were defined using a modified population, intervention, comparison, outcomes, and study design (PICOS) framework. Studies were included if they involved adults diagnosed with heart failure and examined factors influencing self-care, including behavioral, adherence, knowledge, literacy, or psychological determinants. Eligible studies reported factors associated with self-care in heart failure, employed a cross-sectional observational design, were published in English as peer-reviewed full-text articles, and were published between January 1, 2017, and December 31, 2022. Studies were excluded if they involved patients with comorbid conditions such as diabetes or chronic obstructive pulmonary disease (COPD), caregivers of

patients with stroke, or employed experimental, quasi-experimental, mixed-methods, or review designs. Opinions, editorials, conference abstracts, and grey literature were also excluded. Additionally, studies that did not report self-care outcomes specific to heart failure were also excluded.

Study selection process

All retrieved records were exported into EndNote 20 (version 20.1), and duplicates were removed through both automatic and manual checks. Study screening was conducted in three stages: title and abstract screening performed independently by two reviewers (HW and AH), followed by full-text assessment based on the eligibility criteria. Any discrepancies between the reviewers were resolved through discussion or consultation with a third reviewer (KRP).

Data extraction

Data extraction was performed using a standardized form designed to capture key study characteristics and findings. The extracted variables included the author and year of publication, study design, country, main findings related to factors influencing self-care among patients with heart failure, and the categorization of each factor into conceptual domains. Two reviewers (HW and AH) independently extracted the data, and any differences were resolved through consensus.

Data synthesis

A descriptive thematic synthesis was conducted to organize and interpret the findings from the included studies. The extracted data, consisting of each study's main findings and the corresponding category of influencing factors, were reviewed and coded manually using an inductive approach. Similar factors were grouped and classified into four domains that reflected the patterns observed in the extracted data: sociodemographic, psychological, cognitive, and social factors. These domains were derived directly from the categories reported in the included studies. During the synthesis process, studies with similar statistical conclusions were examined together to determine whether they consistently supported the same type of influencing factor. The recurrence of similar statistical results across multiple studies strengthened the justification for grouping these findings into shared domains. This consistency informed the thematic decision-making process, ensuring that each domain reflected robust and repeatedly observed evidence. Given that the included studies employed cross-sectional designs and exhibited substantial heterogeneity in populations, measurement instruments, and analytical methods, a meta-analysis was not performed.

Results

Search results

The database search identified a total of 740 records from PubMed, ScienceDirect, and Google Scholar. After removal of 38 duplicates, 702 records remained for title and abstract screening, of which 603 articles were excluded for not meeting the eligibility criteria. The full texts of 99 articles were subsequently assessed for eligibility, and 78 were excluded due to ineligible populations, non-heart failure self-care outcomes, or study designs that did not meet the inclusion criteria. Ultimately, 21 cross-sectional studies fulfilled all eligibility criteria and were included in this review. The study selection process is presented in **Figure 1**.

Characteristics of included studies

Twenty-one included studies were conducted across multiple regions, including Asia (China [15-17], South Korea 18], Singapore [18], Indonesia [19-21], Iran [22], Japan [23], Nepal [13]), Africa (Ethiopia [24-28]), North America (the United States [29-32]), and South America (Brazil [33]). A total of 3,919 patients with heart failure were included across the 21 studies. All studies employed cross-sectional designs, were published between 2017 and 2022, and examined factors associated with self-care among adult patients with heart failure.

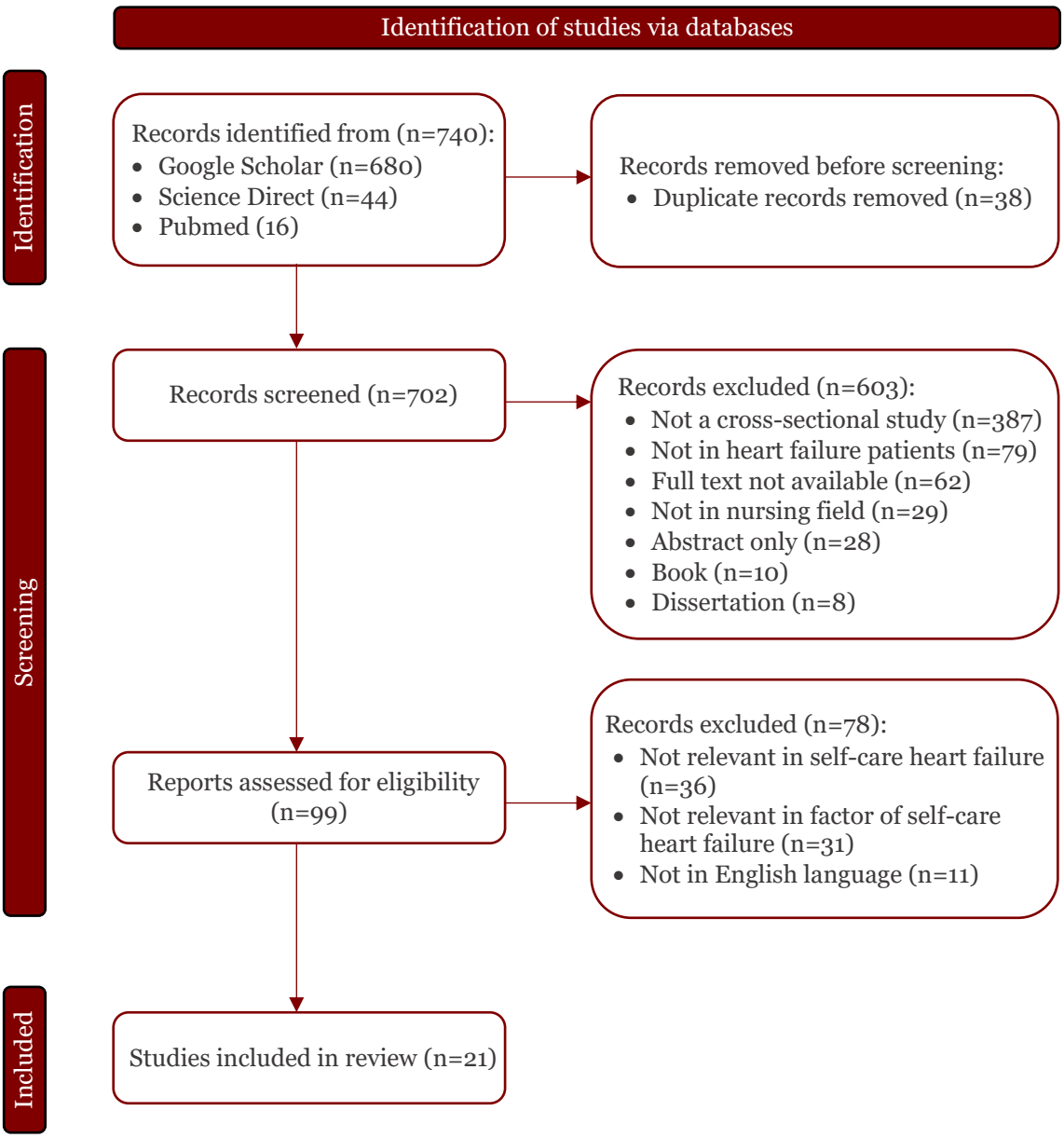

Figure 1. Flowchart of article selection process using PRISMA-ScR.

Factors associated with self-care

Sociodemographic factors

Sociodemographic determinants were the most commonly reported (**Table 2**). Factors such as age [27,28,32,33], sex [16,24,25,32,33], comorbidity [24], marital status [32,33], education level [13,22,27,32,33], ethnicity [13,32], New York Heart Association (NYHA) functional class [13,26-28], duration of heart failure [19,26,27], and prior receipt of heart failure information [18,19,22] were associated with variations in self-care behaviors. Findings from Nepal [13], Brazil [33], Singapore [18], Indonesia [19], Ethiopia [24-28], China [16], Iran [22] and the United States [32] showed that lower education, advanced NYHA class, and shorter illness duration were consistently linked to poorer self-care. Several studies also identified sex-specific differences in self-care performance.

Table 2. Findings from cross-sectional studies on factors associated with self-care among heart failure patients

Author	Country	Instrument used	Associated factors	Domain(s)
Koirala *et al.* (2018) [13]	Nepal	SCHFI; ESSI	Self-care was associated with education level, ethnicity, living arrangement, NYHA class, and family support.	Sociodemographic; social
Cavalcante *et al.* (2018) [33]	Brazil	EAAPIC	Self-care was associated with sex, age, education level, and marital status.	Sociodemographic
Hany *et al.* 2021 [19]	Indonesia	SCHFI V6.2	Self-care was associated with education level, heart failure duration, and prior heart failure information.	Sociodemographic
Seid *et al.* (2019) [24]	Ethiopia	Revised Heart Failure Compliance Scale; Japanese Heart Failure Knowledge Scale	Self-care was associated with sex, comorbidity, and heart failure knowledge.	Sociodemographic; cognitive
Son *et al.* (2018) [34]	South Korea	EHFScBS-9; Health Literacy Scale	Self-care was associated with health literacy.	Cognitive
Chen *et al.* (2020) [29]	The United States (Pennsylvania)	S-TOFHLA; SCHFI V6.2; PHQ-9	Self-care was associated with self-efficacy and depression; self-efficacy mediated the effect of depression on self-care.	Psychological
Zeng *et al.* (2017) [18]	Singapore	DHFKS	Self-care was associated with heart failure knowledge and prior heart failure education.	Sociodemographic; cognitive
Yazew *et al.* (2019) [25]	Ethiopia	PHQ-9; EHFScBS; DHFKS; Mini Social Support screening tool	Self-care was associated with depression, sex, smoking, social support, and heart failure knowledge.	Psychological; cognitive; social
Fivecoat *et al.* (2018) [30]	Unites States of America	MSPSS; SCHFI V6.2	Self-care was associated with emotional and instrumental family support.	Social
Hudiyawati *et al.* (2021) [20]	Indonesia	EHFScBS-9; Cardiac Self-Efficacy Scale; MSPSS	Self-care was associated with self-efficacy and family support.	Psychological; social
Hany *et al.* (2022) [21]	Indonesia	SCHFI V6.2; Family Empowerment Scale	Self-care was associated with family empowerment	Social
Chuang *et al.* (2019) [15]	China	PHQ-9); MSPSS; e Health Literacy Scale; DHFKS; SCHFI V6.2	Self-care was associated with depression, social support, health literacy, and heart failure knowledge.	Psychological; cognitive; social
Patrick *et al.* (2022) [31]	Unites States of America	SCHFI V6.2; PROMIS.	Self-care was associated with depression and anxiety.	Psychological
Cao *et al.* (2019) [16]	China	C-SCHFI; C-HFKT; MOS-SSS-C	Self-care was associated with sex differences, heart failure knowledge, self-care confidence, and social support.	sociodemographic; cognitive; social
Yazew *et al.* (2019) [26]	Ethiopia	EHFScBS; PHQ-9	Self-care was associated with NYHA class, heart failure duration, heart failure knowledge, and depressive symptoms	Sociodemographic; Cognitive; psychological
Wang *et al.* (2020) [17]	China	The Chinese version HADS; The Chinese version of Health Literacy Scale; C-SCHFI	Self-care was associated with health literacy and self-care confidence, mediating depression.	Cognitive; psychological
Juárez-Vela *et al.* (2019) [27]	Ethiopia	SCHFI V6.2	Self-care was associated with age, education level, heart failure stage, heart failure duration, heart failure knowledge, and social support.	Sociodemographic; cognitive; social

Author	Country	Instrument used	Associated factors	Domain(s)
Moaddab *et al.* (2020) [22]	Iran	SCHFI V6.2; MMSE	Self-care was associated with education level, cognitive function, and prior heart failure information.	Sociodemographic; cognitive
Sitotaw *et al.* 2020 [28]	Ethiopia	EHFScBS; Heart failure knowledge scale	Self-care was associated with age, NYHA class, and heart failure knowledge.	Sociodemographic; cognitive
Graven *et al.* 2021 [32]	United States of America	SCHFI V6.2	Self-care was associated with sex, ethnicity, age, education level, and marital status.	Sociodemographic
Yoshinaga *et al.* (2020) [23]	Japan	EHFScBS	Self-care was associated with family support in medication management.	Social

C-HFKT: Chinese version of the Heart Failure Knowledge Test; C-SCHFI: Chinese version of the Self-Care of Heart Failure Index; DHFKS: Dutch Heart Failure Knowledge Scale; EAAPIC: Scale of Evaluation of Self-Care of Patients with Heart Failure (Escala de Avaliação do Autocuidado do Paciente com Insuficiência Cardíaca); EHFScBS: European Heart Failure Self-Care Behavior Scale; ESSI: ENRICHD Social Support Instrument; HADS: Hospital Anxiety and Depression Scale; MMSE: Mini-Mental State Examination; MOS-SSS-C: Medical Outcomes Study Social Support Survey–Chinese version; MSPSS: Multidimensional Scale of Perceived Social Support; NYHA: New York Heart Association; PHQ-9: Patient Health Questionnaire-9; PROMIS: Patient-Reported Outcomes Measurement Information System; SCHFI: Self-Care of Heart Failure Index; SCHFI V6.2: Self-Care of Heart Failure Index version 6.2; S-TOFHLA: Short Test of Functional Health Literacy in Adults.

Psychological factors

Psychological determinants included depression [15,17,25,26,29,31], anxiety [31], and self-efficacy [16,17,20,29]. Depression was one of the strongest negative predictors of self-care across studies from Ethiopia [25], Indonesia [20], the United States [29], China [15-17], and the United States of America [31] (Pennsylvania) [29]. Self-efficacy emerged as a critical facilitator and frequently acted as a mediator between knowledge, depression, and self-care behaviors, highlighting its central role in self-management.

Cognitive factors

Cognitive determinants consisted of health literacy [15,17,34], cognitive function [22] and disease-specific knowledge [15,16,18,24-28]. Studies from South Korea [34], Singapore [18], China [15-17], Iran [22] and Ethiopia [24-28] reported that adequate health literacy and stronger heart failure knowledge were associated with better self-care maintenance and management. Knowledge was commonly influenced by educational level and exposure to heart failure related information. Several studies demonstrated interactions among health literacy, self-confidence, and psychological factors.

Social factors

Social determinants of self-care were predominantly related to family support [13,15,16,20,23,25,27,30] and family empowerment [21]. Evidence from the United States [30], Indonesia [20], Ethiopia [25,26], China [15,16], Japan [23], and Nepal [13] showed that emotional support, assistance with medication adherence and symptom monitoring, and active family involvement in care significantly improved self-care behaviors. In addition, family empowerment interventions were consistently associated with better treatment adherence.

Discussion

Findings from the present study reveal that self-care is a multifaceted process influenced by individual, psychological, and social-contextual elements. In accordance with Riegel's Middle-Range Theory of Self-Care in Chronic Illness (2012), self-care encompasses three interconnected processes: maintenance, monitoring, and management, each shaped by a dynamic interplay of knowledge, motivation, self-efficacy, and social support [14]. Comparatively, findings from the present study align with those reported in previous meta-analysis [35]. Previous meta-analyses specifically identified self-efficacy, depression, and literacy as consistent determinants of self-care adherence [36-38]. These findings collectively underscore that self-efficacy acts as a central mediator linking knowledge and emotional regulation to self-care performance [35,39]. Knowledge and health literacy provide the cognitive foundation for patients to understand their illness, while self-efficacy transforms this understanding into behavioral execution [40]. Depression, on the other hand, disrupts this mechanism by diminishing motivation and perceived control [37,41].

The examination of causal pathways and potential confounding variables indicates a bidirectional and interconnected relationship: psychological distress and depressive states can be exacerbated by inadequate self-care, while depressive symptoms reduce self-efficacy, resulting in inferior self-care engagement [17,42]. This circular pathway (depression ↔ self-efficacy ↔ self-care) suggests that psychological well-being directly influences behavioral outcomes, while self-efficacy functions as both a mediator and a buffer [43]. Family support functions as a contextual moderator, attenuating the detrimental effects of depression and reinforcing the relationship between self-efficacy and behavior [43,44]. Multiple determinants should be addressed simultaneously, rather than in isolation, as evidenced by these interactions.

Across included studies, sociodemographic characteristics that influence self-care in heart failure patients include age, sex, marital status, ethnicity, and severity [13,32,33]. Low self-care behaviors among heart failure patients significantly increased all-cause mortality in men but not in women [45]. Self-care maintenance was related to heart failure knowledge among men, whereas self-care management was associated with social support. In contrast, among women, self-care maintenance was related to self-care confidence, while self-care management was related to both self-care confidence and heart failure knowledge [16]. According to the findings

in previous studies, individuals with heart failure who were between the ages of 30 and 50 and had NYHA class III or IV function had better self-care practices [46]. Other factors influencing self-care among patients with heart failure included level of education, duration of heart failure, and prior exposure to heart failure related information [19,24,27]. Patients with heart failure for less than a year had poorer self-care compared to those with a longer duration of heart failure [26]. Sociodemographic characteristics identified as determinants impacting self-care abilities might be a crucial consideration in the development of self-care interventions [47]. These findings suggest that the sociodemographic factors provide the contextual base within which psychological and cognitive factors operate. Demographic determinants indirectly influence self-care by influencing health literacy and self-efficacy, as outlined in Riegel's Self-Care Theory [14].

Cognitive factors, including health literacy and heart failure related knowledge, also play a critical role in shaping self-care behaviors. Health literacy is the information, skills, and health-related experience that enables people to identify their health status and take responsibility for their own health treatment [48]. Patients with heart failure who have high or adequate health literacy tend to practice self-care more consistently [34,49]. However, individuals with low health literacy may worsen their own self-care, leading to a rise in rehospitalizations, morbidity, and mortality [50-52]. To ensure quality care, it is essential to understand the specific informational needs of patients with heart failure and identify appropriate sources of information as they transition from the hospital to home. Developing personalized educational strategies based on patients' level of health literacy is crucial for promoting effective self-care behaviors [53]. Although previous studies have reported that health literacy is not directly related to heart failure self-care, these findings suggest that appropriately designed educational interventions can be undertaken to improve health outcomes across varying levels of health literacy [29,54]. Health literacy serves as the cognitive basis that enhances knowledge and strengthens self-efficacy, which encourages self-care maintenance and management behaviors [36].

Patient participation is also a factor that affects self-care, including knowledge to participate in carrying out effective self-care [55]. Inadequate knowledge about heart failure leads to poor engagement rates in self-care practices [46]. Knowledge of heart failure is a predictor that affects the practice of adequate self-care behavior in patients with heart failure [27,56,57]. Knowledge related to heart failure self-care is closely associated with patient education, which serves as a primary determinant of disease-specific knowledge among individuals with heart failure [15,18]. Appropriate educational interventions aimed at enhancing disease-related knowledge have been shown to improve self-care behaviors among patients with heart failure [58,59]. Current heart failure management guidelines emphasize the importance of structured education for both patients and their families [8]. Self-care education enables individuals with heart failure to better manage their condition, adapt to changing symptoms, and actively participate in treatment decisions [60,61]. Accordingly, effective educational strategy programs should be developed to expand patient knowledge. In addition, various platforms for interaction and follow-up with health professionals, including digital and community-based approaches, may be utilized to support patients in gaining a clearer understanding of their condition [62].

Self-efficacy consistently emerged as one of the strongest predictors of self-care. Patients' confidence in their ability to perform self-care influences decision-making, behavioral consistency, and overall treatment engagement [63,64]. Self-efficacy has been connected with adverse outcomes and is seen as an acceptable alternative for predicting hospitalization for heart failure [65]. Heart failure patients' decisions and actions about their own treatment are significantly influenced by their level of self-efficacy [66]. Increasing patient self-efficacy is a crucial component in improving heart failure self-care [29,67]. Patients' self-efficacy in performing self-care plays a critical role in shaping self-care behaviors and the decision-making processes involved in managing heart failure [68]. Self-efficacy is therefore a key consideration in the design of health education interventions, as it is closely related to self-care among individuals with heart failure [29].

Psychological distress, particularly depression, was found to have a detrimental impact on self-care. In patients with heart failure, depression is a very common and problematic psychiatric comorbidity [69]. Patients frequently express mental distress, including anxiety and depression, due to the stressful and difficult nature of living with heart failure [70]. Patients with

psychological issues, such as depressive symptoms, may demonstrate self-care challenges related to heart failure more frequently than other patients, which might increase their risk of hospitalization [71]. Previous studies found a continuous link between depression and self-care among people with heart failure [15,25,72]. Depression in heart failure patients has a negative relationship with self-care practices [29,31,73]. Depression was significantly associated with sex, self-care behavior, current smoking, social support, knowledge, health literacy, and duration of heart failure in patients with heart failure [17,25]. Reducing psychological distress, such as depressive symptoms, may improve self-care and health-related quality of life in heart failure patients [74]. Increased social support, optimal depression screening, and management for heart failure patients are recommended by guidelines [8]. Depression not only impairs emotional well-being but also weakens self-efficacy and self-care adherence. This interaction (depression ↔ self-efficacy ↔ self-care) highlights a causal pathway that influences behavioral outcomes in heart failure patients.

Social and contextual influences, especially family support, further shape self-care behaviors. Family members have a significant influence on enhancing heart failure patients' adherence to self-care [15,75-77]. Patients with heart failure who engage in poor self-care are affected not just on an individual level but also on a family level [23]. Family members may support a patient's participation in self-care [14]. Family support was the primary factor influencing heart failure patients' self-care [20,30]. Greater exposure to family support is associated with improved self-care behaviors among patients with heart failure [78]. The presence of family support and family empowerment may improve the family's capacity to provide self-care for people with heart failure [21]. Family support plays a critical role in the management of heart failure, and health-care providers should maintain ongoing engagement with patients and their families to develop and reinforce effective self-care strategies [79]. Family support acts as a protective moderator by mitigating the adverse effects of depression and strengthening self-efficacy and adherence to self-care behaviors. These findings are consistent with the conceptual model presented in **Figure 2**.

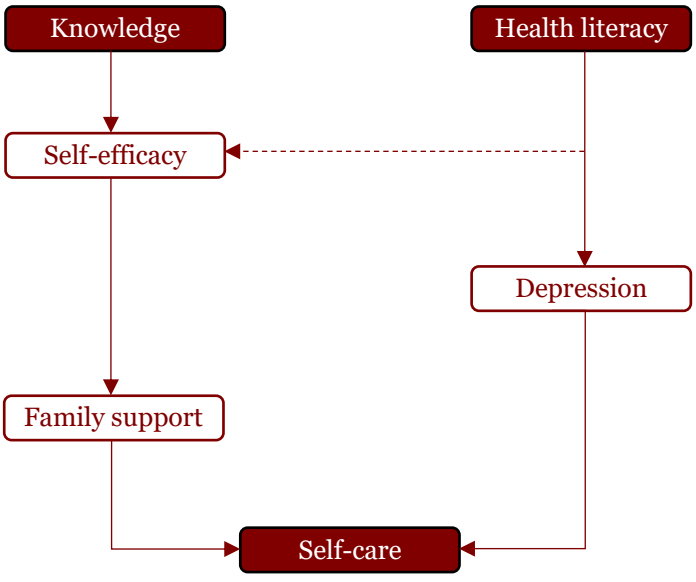

Figure 2. Conceptual interaction model of self-care determinants. Self-efficacy is directly promoted by knowledge and health literacy, which consequently enhances self-care behavior. Depression has a negative effect on both self-efficacy and self-care, whereas family support mitigates the effects of depression and enhances adherence.

This review underscores the importance of nurse-led interventions that prioritize the enhancement of self-efficacy and health literacy while integrating psychosocial support to address depression. Several limitations should be acknowledged. First, the exclusion of grey literature may have resulted in the omission of relevant unpublished or non-peer-reviewed studies. Second, the inclusion of only cross-sectional studies limits the ability to infer causal relationships between

identified factors and self-care behaviors. Third, the restriction to English-language publications may have introduced language bias. Additionally, variability in measurement instruments, sample sizes, and cultural contexts across included studies may have contributed to heterogeneity in the reported findings. Finally, most included studies relied on self-reported measures, which are subject to recall and social desirability bias. Despite these limitations, this scoping review provides a comprehensive synthesis of existing evidence that may inform future research, policy development, and nursing education.

Conclusion

Self-care among patients with heart failure is influenced by socio-demographic, psychological, cognitive, and social factors. Self-efficacy, depression, and family support emerged as the most consistent determinants of self-care behaviors. Understanding these factors may help explain persistently low levels of self-care and inform the design of targeted interventions aimed at enhancing the knowledge and self-care skills of patients with heart failure to support effective disease management. Health care professionals should incorporate family empowerment and self-care education into their routine clinical practice. Future interventional and longitudinal studies are needed to establish causal relationships and to develop contextually appropriate self-care frameworks.

Ethics approval

Not required.

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Competing interests

All authors declare that there are no conflicts of interest.

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Underlaying data

Derived data supporting the findings of this study are available from the corresponding author on request.

Declaration of artificial intelligence use

This study used artificial intelligence (AI) tools for language refinement and formatting purposes; all conceptual content, data interpretation, and conclusions were authored independently. We confirm that all AI-assisted processes were critically reviewed by the authors to ensure the integrity and reliability of the results. The final decisions and interpretations presented in this article were solely made by the authors.

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