Self-Care Interventions That Reduce Hospital Readmissions in Patients With Heart Failure; Towards the Identification of Change Agents

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ABSTRACT: Unplanned hospital readmissions are the most important, preventable cost in heart failure (HF) health economics. Current professional guidelines recommend that patient self-care is an important means by which to reduce this burden. Patients with HF should be engaged in their care such as by detecting, monitoring, and managing their symptoms. A variety of educational and behavioural interventions have been designed and implemented by health care providers to encourage and support patient self-care. Meta-analyses support the use of self-care interventions to improve patient self-care and reduce hospital readmissions; however, efficacy is variable. The aim of this review was to explore methods to achieve greater clarity and consistency in the development and reporting of self-care interventions to enable 'change agents' to be identified. We conclude that advancement in this field requires more explicit integration and reporting on the behaviour change theories that inform the design of self-care interventions and the selection of behaviour change techniques. The systematic application of validated checklists, such as the Theory Coding Scheme and the CALO-RE taxonomy, will improve the systematic testing and refinement of interventions to enable 'change agent/s' to be identified and optimised.

KEYWORDS: self-care, heart failure, readmission, adherence, change agent

Introduction

Heart failure (HF) is a global epidemic with significant morbidity and mortality risks.[1] HF is defined as a complex clinical syndrome characterised by typical symptoms (eg, breathlessness, ankle swelling, and fatigue) that may be accompanied by signs (eg, elevated jugular venous pressure, pulmonary crackles, and peripheral oedema) that result from structural and/or functional cardiac abnormality, resulting in reduced cardiac output and/or elevated intracardiac pressures at rest or during stress.[2,3] Over 23 million people worldwide have HF,[4] with the annual risk increasing tenfold between the ages of 60 and 90,[5] and a 50% risk of death within 5 years of diagnosis[6] While the incidence of HF is thought to have declined in recent years, the true burden is likely under-reported in mortality and self-report data,[7] particularly from non-western nations.[8]

HF is usually secondary to coronary artery disease (CAD) and, potentially, the 'common final pathway' for surviving patients.[8] Disease progression in HF is unpredictable but commonly characterised by a downwards trajectory of functional decline with stable periods punctuated by acute decompensation.[9,10] As an age-related illness, patients with HF tend have a high burden of comorbid illness (such as diabetes mellitus and renal failure) and cognitive decline, both of which explain a large proportion of hospital readmissions and the concomitant trajectory for HF.[11] Care planning and delivery in HF is thus complex, multidisciplinary, and resource intensive.

Unplanned 30-day all-cause readmissions in the setting of HF remain high,[12,13] with 1 million HF admissions[14] resulting in a total expenditure for HF exceeding US$30 billion in the United States alone.[15] Nearly a quarter of patients admitted to hospital with acute HF will be readmitted within 30 days of discharge[16,17] with the majority of these occurring within the first 14 days.[17] Looking beyond 30 days post-discharge, readmission rates increase to 30% at 60 days and 60% at 1 year.[18] Readmissions <90 days in patients with HF tend to be attributable to cardiovascular disease (CVD) factors,[11] whereas readmissions beyond this timeframe are more likely to be attributable to comorbidities.[19] In recent years, there have been significant reductions in hospital readmissions greater than 30 days post-discharge, length of stay, and in-hospital mortality for HF. However, progress has been negligible with regard to reductions in 30-day readmissions. It is unclear if this is due to inherent problems with the clinical indicator or inadequate progress with improving discharge planning and transitional care.

Given that more than half of HF-related readmissions are preventable, with most attributed to poor adherence to a HF

Table 1. Meta-analyses of randomised controlled trials of self-care interventions and clinical outcomes in patients with HF.

STUDY	SAMPLE SIZE	OUTCOMES	TREATMENT EFFECT (95% CI)
McAlister et al[34]	5039	HF-related readmissions	RR = 0.66 (0.52-0.83)
		All-cause readmissions	RR = 0.73 (0.57-0.93)
		Mortality	RR = 1.14 (0.67-1.94)
Gonseth et al[36]	6772	HF/CVD-related readmissions	RR = 0.70 (0.62-0.79)
		All-cause readmissions	RR = 0.88 (0.79-0.97)
		Readmissions/mortality	RR = 0.82 (0.72-0.94)
Jovicic et al[33]	857	HF-related readmissions	OR = 0.44 (0.27-0.71)
		All-cause readmissions	OR = 0.59 (0.44-0.80)
		Mortality	OR = 0.93 (0.57-1.51)
Jonkman et al[35]	5624	HF-related readmissions/ mortality	HR = 0.80 (0.71-0.89)
		HF-related readmissions	HR = 0.80 (0.69-0.92)

Abbreviations: CI, confidence interval; CVD, cardiovascular disease; HF, heart failure; OR, odds ratio; RR: relative risk.

management plan,[20] there appears to be a significant role for patient self-care in secondary management. In this review, we consider the impact of self-care interventions on clinical outcomes in patients with HF. We explore contemporary research relating to 'change agents' in self-care interventions and identify the need for more explicit use and reporting of theoretical frameworks to guide the future development of self-care interventions. Finally, we consider the utility of Behaviour Change Technique (BCT) checklists to enable 'change agents' in self-care interventions to be identified and optimised.

Patient Self-Care

The complex care needs of patients with HF are resource intensive and dynamic, requiring regularly updated care plans[3] and a strong patient-practitioner alliance.[21] Current guidelines for HF management recommend a 'seamless system' of coordinated care that integrates the full scope of multidisciplinary services relevant to the HF 'health care journey'[2,3] and tailored to the needs of individual patients and their local context.[22] The guidelines emphasise the importance of patient self-care, which is broadly defined as a process of maintaining health through health-promoting practices and managing illness via maintenance, monitoring, and management behaviours.[23,24] Self-care thus emphasises behaviours related to adherence (eg, maintaining lifestyle and medication regimens) and risk assessment (eg, recognition, evaluation, and appropriate action on signs and symptoms of HF).[24,25] There is Class I, Level A evidence to support a prognostic benefit of patient self-care behaviours such as regular exercise,[2,26] but less certainty as to the benefits of sodium and fluid restriction.[22,27,28]

The Effects of Self-Care Interventions on Clinical Outcomes

Interventions designed to equip patients with the knowledge and skills needed to monitor and manage their condition and to optimise modifiable risk factors are widely used by health care providers involved in HF management.[29] There is evidence from randomised controlled trials (RCTs) to suggest that self-care interventions can improve clinical outcomes in patients with HF, such as by reducing hospital readmissions. For example, Boyde et al[30] found that self-care education reduced the risk of unplanned hospital readmissions at 12 months by 30% in patients with HF (relative risk [RR] 0.703; 95% confidence interval [CI], 0.55, 0.90). However, trial data are perhaps most notable for their inconsistency; poor patient adherence to self-care interventions likely explains some of these inconsistencies.[31] Meta-analyses and systematic reviews have helped clarify clinical outcomes. For example, Ruppar et al's[32] recent meta-analysis found that self-care interventions that emphasised medication adherence achieved a significant reduction in mortality risk (RR 0.89, 95% CI, 0.81, 0.99) and reduced the odds of hospital readmissions (odds ratio (OR) 0.79; 95% CI, 0.71, 0.89) in patients with HF. Meta-analyses generally report a benefit of self-care interventions on all-cause and HF-related readmissions,[33-35] but less consistency in reducing mortality risk (Table 1).

Change Agents in Self-Care Interventions

One of the challenges faced by healthcare practitioners working in HF management is that while there is general consensus regarding the importance of patient self-care, there is less agreement with regard to how it can best be facilitated. Notwithstanding efforts to operationalise the composition of

self-care interventions,[29] there remains considerable variation in program composition (eg, skills and support-seeking training), intensity (eg, the number of planned contacts), duration (eg, number of weeks/months for program implementation), and delivery (eg, multidisciplinary vs single interventionist).[37] This diversity, alongside limited reporting of interventional content, has made it difficult to identify the change agents to which benefits in HF clinical endpoints, such as reduced hospital readmissions, can be attributed,[37-39] although several efforts have been made.[34,37,40] In their meta-analysis of 20 self-care trials involving 5624 patients, Jonkman et al[37] examined whether specific program characteristics related to the implementation (such as the intensity, duration, training and type of interventionist, and group vs individual treatment) and content of self-care interventions (including goal-setting and problem-solving skills, support-seeking skills, and log keeping) predicted better clinical outcomes. Jonkman et al[37] was unable to link specific program 'change agents' to better self-care outcomes, but found that longer interventions yielded greater benefits. This may suggest that the 'mechanism of action' in self-care interventions is multi-factorial.[41] For instance, although health literacy (including HF knowledge) is necessary, it is not sufficient to enable self-care.[41-43] However, it is also possible that effective program characteristics have not yet been identified and tested; the use of theoretical frameworks to inform the development of self-care interventions will enhance treatment efficacy and systematic evaluation.[44,45]

Behaviour modification: theoretical frameworks

Behaviour modification theories provide a useful framework for understanding and predicting responses to behavioural interventions, such as those addressing self-care. For example, Bandura's influential theory of self-efficacy proposes that patient expectations and experiences of mastery in self-care activities are fundamental to behaviour change and maintenance.[46] These concepts are integrated into the Health Belief Model (HBM) which proposes that engagement in health-promoting behaviour is more likely if programs emphasise the risks of noncompliance, the benefits of the health behaviour, and ensure that patients possess the knowledge and skills required to successfully enact those behaviours.[44] Six key components of the HBM predict engagement in prevention, screening, and management of illness. These include one's perceived susceptibility to, and the perceived severity of, illness; perceived benefits of action; perceived costs of action relative to benefits; cues to action (such as education), and; self-efficacy to perform health-promoting actions.[44]

Interventions that are driven by theory target the antecedents of behaviour, such as self-efficacy, and are thus more likely to be effective.[47] Behavioural theories are widely used to inform disease management (DM) programs and often appear to have been applied to self-care interventions for patients with HF.[48-50] For example,

patients with HF assigned to an educational intervention reported significant improvements in HBM elements of self-care.[51,52] No changes were observed in controls. However, explicit information that describes how theory was used in the design of interventions and that links intervention techniques to theory is often lacking,[45] despite the availability of frameworks that can be implemented to assist in this process. For example, the Theoretical Domains Framework (TDF) provides a theory driven approach to designing and evaluating behavioural interventions that is derived from the synthesis of 83 theories of behaviour and behaviour change.[47] One means of improving the systematic development and evaluation of self-care interventions for patients with HF would be to report on the use of theory in the design of interventions, whether and how the intervention tests theory, and how findings inform theory development[45,53] together with taxonomic evaluations of behaviour, the application of the TDF and related approaches can be used to systematically advance understanding of behavioural change agents.

Taxonomic evaluation of program attributes

Alongside the use and application of health promotion and behaviour modification theories to inform the development and refinement of self-care interventions, greater effort to standardise reporting is also needed to enable the identification of 'change agents'. The AHA Taxonomy advocates reporting across eight domains of DM to improve comparisons between interventions and uniformity in their design and implementation.[54] With regard to program attributes, the AHA Taxonomy recommends reporting on the inclusion of patient education, medication management, peer support, and post-acute care in DM interventions. The AHA Taxonomy provides a useful benchmark by which to systematise reporting on critical components of DM interventions, but lacks a comprehensive checklist of generic BCTs that have been shown to effect change in disease contexts.

With the exception of published intervention protocols, published studies seldom include sufficient detail of interventions to readily enable replication and identification of change agents.[55] The use of standardised definitions and reporting protocols is needed to enable the scientific study and development of interventions designed to improve health behaviours.[47,55] In one such example, Abraham and Mitchie's[56] 26-item taxonomy designed to evaluate the composition of health-promoting interventions, enabled systematic reviews to identify the benefits of self-monitoring as a change agent.[55] The 'Coventry, Aberdeen & London – Refined' (CALO-RE) taxonomy is a refinement of this work and offers a 40-item index of BCTs that provides a standardised method for describing and evaluating behavioural interventions.[55] The CALO-RE is useful in the current context as it indexes BCTs used to encourage health-promoting behaviours such as physical exercise and healthy diet. To illustrate the utility of this approach, we have applied the CALO-RE taxonomy to index the

Table 2. CALO-RE taxonomy.[55]

CALO-RE TAXONOMY	SELF-CARE INTERVENTIONS FOR PATIENTS WITH HF																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Information on the consequences of behaviour — 1. In general	✓	✓	?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2. To the individual	✓	✓	?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3. Normative approval	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗
4. Normative behaviour	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	?	✗
Goal setting — 5. Behavioural goals	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✓	✓	✗	✗	?	✓
6. Outcome goals	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✓	?	✗	✗	?	✗
7. Action planning	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	?	✓	✓	✓
8. Barriers and problem-solving	✓	✓	?	?	✓	✓	?	✓	?	?	?	?	✓	✓	✓	✓	?	?	✓	?
9. Stepped tasks	✗	✗	?	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
Review goals — 10. Behavioural goals	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✓	?	✗	✗	?	✓
11. Outcome goals	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✓	?	✗	✗	?	✗
12. Reward for progress	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓
13. Reward for successful behaviour	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
14. Shaping	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
15. Generalisation of behaviour	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
16. Self-monitoring of behaviour	✓	?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
17. Self-monitoring of behavioural outcome	✓	?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
18. Reflection on past success	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
19. Feedback on performance	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	?	✓	✓	✓	?	?	✓	✓	✓	✓
Advice on behaviour performance — 20. When and where	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
21. How	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
22. Model the behaviour	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗
23. Teach environmental prompts/cues for behaviour	✗	✗	✓	✗	?	✗	✗	✗	?	✓	✗	✗	?	✗	✗	✗	✗	✗	✗	✗

Table 2. (Continued)

CALO-RE TAXONOMY	SELF-CARE INTERVENTIONS FOR PATIENTS WITH HF																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
24. Environmental restructuring	✓	✗	?	✗	?	✗	✗	✗	✗	?	✗	✗	?	✓	✗	✗	✗	✗	✗	✗
25. Behavioural contract	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
26. Prompt practice	✓	✗	✗	✗	?	✗	✗	✗	✗	✓	✗	?	✗	?	?	?	✗	?	✗	✗
27. Low-intensive follow-up	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✓	✗	✗	✗
28. Social comparison	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✓	✓
29. Plan social support	✓	?	✓	✓	✓	✓	✓	✓	✗	✓	✗	✓	✓	✓	✓	✓	✗	✗	✓	✓
30. Identify role model	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗
31. Reflection: regret for failure	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
32. Initiate fear arousal through risk awareness	✗	✓	✗	✗	✓	✗	✓	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
33. Promote self-talk	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
34. Reflection: successful performance of behaviour	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗
35. Behaviour maintenance	✗	?	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
36. Stress management	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗
37. Motivational interviewing	✗	✗	✗	✗	✗	✗	✗	✗	✗	?	✗	✗	✗	✗	✗	✗	✗	✗	✓	✓
38. Time management	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
39. Communication skills training	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✓	✗
40. Anticipation of future rewards	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
Clinical outcomes in treatment arm	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Reduced HF-related readmissions	✓	✗	✓	–	✓	–	✓	✗	–	✓†	–	×†	✗	–	–	–	✗	✗	–	✗
Reduced all-cause readmissions	✗	–	✓	✓	✗	✓	✓	✗	–	–	×†	–	✗	–	–	–	–	×†	×†	–
Reduced mortality	✗	–	✗	✓	–	✗	✓	–	–	✓	×†	✗	✗	–	✗	–	✗	×†	×†	✗

Abbreviation: (CALO-RE), Coventry, Aberdeen & London – Refined; HF, heart failure.

1, Rich and colleagues[57,58]; 2, Jaarsma et al[59]; 3, Blue et al[60]; 4, Stromberg et al[61]; 5, Riegel et al[62]; 6, Sisk et al[63]; 7, Atienza et al[38]; 8, Tsuyuki et al[64]; 9, Martensson et al[65]; 10, Bruggink-Andre et al[66]; 11, Aldamiz-Echevarria Iraurgui et al[67]; 12, Jaarsmwa et al[49]; 13, Riegel et al[68]; 14, Leventhal et al[68]; 15, Smeulders et al[50]; 16, Agren et al[70]; 17, Peters-Klimm et al[71]; 18, DeWalt et al[48]; 19, Heisler et al[72]; 20, Otsu and Moriyama.[73]

✓ this element appears to have been included/clinical outcomes were significant; ✗ this element appears not to have been included/clinical outcomes were not significant; ? it is unclear whether this element was included; † composite endpoint: readmissions and/or mortality; - not assessed.

program composition of self-care interventions reported in Jonkman et al[37] (Table 2). One of the challenges, which speaks to the problem at hand, is that few published studies provide sufficient detail to enable full indexation of self-care interventions as per the CALO-RE.

As shown in Table 2, all self-care interventions included an educational component that provided disease-specific information and addressed the importance of self-care behaviours. This is consistent with Riegel et al's[23] suggestion that improving patient knowledge of their condition is fundamental for the development of self-care skills, which has been linked to reduced HF hospitalizations (RR 0.60; 95% CI 0.41-0.88; McAlister et al[34]). Most interventions appeared to incorporate action planning as to what the patient will do to monitor and maintain optimal health (ie, such as how to recognise and respond to signs and symptoms of HF) and many interventions appeared to address barriers to self-care and ways of overcoming them. Most interventions appeared to prompt monitoring of self-care behaviour (ie, such as through the use of weight charts and diaries) and behavioural outcomes (ie, changes in weight) and provided feedback on self-care performance. All interventions provided information on when and how to perform self-care behaviours (eg, instructions regarding medications) and most interventions included low-intensity follow-up (eg, such as telephone calls provided at increasing time intervals) and incorporated carers/relatives of patients into social support planning. In general, interventions did not appear to incorporate rewards for progress towards or achievement of self-care behaviour, although verbal praise may have been a component of follow-up monitoring. Outwardly, these data suggest a relatively consistent approach to self-care interventions, perhaps illustrating the application of a common theoretical framework; however, clinical outcomes were highly variable. To enable the identification of change agents, researchers are encouraged to provide details of the theoretical framework that guided the development of the intervention, a checklist of content (such as using the CALO-RE taxonomy), and procedural details (such as the duration and mode of delivery of the intervention).

Summary and Conclusions

Taken together, the literature suggests that self-care interventions for patients with HF have potential to improve self-care and to improve clinical endpoints (including lower risk of unplanned hospital readmissions, but perhaps not mortality).[35,74] However, efficacy is variable; determining how and why this is the case remains a contemporary challenge. Recent attempts to systematise nomenclature[29] and identify 'change agents'[37] in self-care interventions seek to address these issues; however, insufficient reporting of interventional components undermines these efforts. The application of, and reporting on, behaviour change theories in the design of self-care interventions is needed to progress this field. The Theory Coding Scheme[45] provides one such checklist that has been used successfully in the design of behaviour change inventions in other chronic disease populations.[53]

Alongside the integration of theory, explicit reporting of BCTs is needed to enable more systematic testing of interventional elements and the identification of change agents. The CALO-RE[55] is a 40-item taxonomy of BCTs that can be used as a checklist to improve reporting on the content of self-care interventions and, subsequently, enhance future replication and evaluation. Advancement in this field thus requires (1) clear and explicit integration of behaviour change theory to the design of self-care interventions, (2) a structured approach to reporting on BCTs. The combination of these approaches will enhance the systematic design, development, and refinement of self-care interventions towards the identification of change agents to which clinical benefits may be attributed.

Author Contributions

All authors contributed towards the content, drafting and revisions of this manuscript and have approved the final version.

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