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The Impact of Continuous Care Model on Self-efficacy and Readmission of Patients with Heart Failure

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ABSTRACT

Background: Heart failure (HF) is a chronic, progressive condition with high prevalence and mortality rates worldwide. Despite advances in medical management, patients with HF face significant challenges in self-care, leading to poor clinical outcomes and frequent hospital readmissions. Adherence to self-care behaviors is critical for reducing hospital readmissions, yet many patients struggle with maintaining these behaviors due to insufficient education and follow-up.

Objective: This study examined the impact of the Continuous Care Model (CCM) on self-efficacy and hospital readmission among patients hospitalized with HF.

Methods: This quasi-experimental study conducted on 70 patients with HF visiting two teaching hospitals in southeastern Iran in 2021. Patients were selected using convenience sampling and randomly assigned to two groups: control (n=35) receiving routine care and intervention (n=35) receiving CCM. The intervention consisted of six individual training sessions during hospitalization, six sessions post-discharge, and weekly telephone follow-up until the twelfth week. Data collected using a demographic form, readmission assessment, and Sullivan's Cardiac Self-Efficacy Scale. Analysis was performed using SPSS version 22 with chi-square, independent and paired samples t-tests, and ANCOVA at $P<0.05$ significance level.

Results: ANCOVA revealed significantly higher self-efficacy scores in the intervention group after implementing CCM ($P=0.001$). Independent t-test results showed that readmission frequencies in the control group (1.03 ± 1.01) were significantly higher than in the intervention group (0.34 ± 0.68) ($P=0.001$).

Conclusion: The Continuous Care Model significantly improved self-efficacy and reduced hospital readmission frequency among patients with HF. Given its ease of implementation, applicability, and low cost, healthcare authorities recommended to develop policies for implementing CCM for HF patients.

Introduction

Heart failure (HF) represents one of the most significant public health challenges of the 21st century, affecting approximately 26 million people worldwide with increasing prevalence due to aging populations and improved survival from acute cardiac events [1]. Despite remarkable advances in pharmacological and device-based therapies, HF remains a progressive condition characterized by high morbidity, mortality, and substantial healthcare utilization.

The chronic nature of HF requires patients to engage in complex self-care regimens, including medication adherence, dietary restrictions, daily weight monitoring, symptom recognition, and appropriate responses to changes in clinical status [2]. However, maintaining these behaviors is challenging for many patients, resulting in poor clinical outcomes,

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diminished quality of life, and frequent hospital readmissions [3].

Hospital readmission following an HF exacerbation is a critical quality indicator and a significant burden on healthcare systems. Studies report 30-day readmission rates ranging from 20% to 25% for HF patients, with many of these readmissions potentially preventable through improved discharge planning, patient education, and post-discharge follow-up [4]. The economic impact is substantial, with HF-related hospitalizations accounting for billions of dollars in annual healthcare expenditure worldwide. The high readmission rate reflects a fundamental gap in the transition of care from hospital to community, where patients often lack the knowledge, skills, and support necessary for effective self-management.

Self-efficacy, defined as an individual's belief in their capacity to execute behaviors necessary to produce specific performance attainments, is a crucial determinant of self-care behaviors in chronic illness [5]. Patients with HF who demonstrate high self-efficacy are more likely to adhere to treatment regimens, recognize and respond appropriately to worsening symptoms, and maintain lifestyle modifications that prevent disease progression. Conversely, low self-efficacy is associated with poor self-care, decreased quality of life, and increased risk of readmission [6]. Therefore, interventions designed to enhance self-efficacy may serve as a cornerstone for improving HF outcomes and reducing healthcare utilization.

The traditional model of care for HF patients is often fragmented and reactive, providing intensive management during acute exacerbations followed by minimal support after discharge. This episodic approach fails to address the ongoing self-management needs of patients living with a chronic condition. The Continuous Care Model (CCM) developed to address this gap by providing a structured, proactive, and patient-centered framework for managing chronic diseases [7]. The CCM emphasizes the importance of integrated care delivery, patient self-management support, and sustained follow-up to ensure continuity of care. Its core components include health system reorganization, clinical information systems, decision support, delivery system redesign, self-management support, and community resources [8].

Research on the implementation of CCM in various chronic disease populations has demonstrated significant benefits, including improved medical outcomes, enhanced patient compliance, and reduced healthcare utilization [9]. In the HF population specifically, systematic reviews and meta-analyses have shown that chronic care management reduces mortality by approximately 18% and hospitalization by 18%, while also improving quality of life [10]. However, these positive effects have shown to be heterogeneous, and the optimal components of CCM for HF patients remain incompletely understood [11].

In the context of HF management, CCM has operationalized through various approaches, including comprehensive discharge planning, structured patient education, multidisciplinary team involvement, and post-discharge follow-up via telephone or telehealth [12]. Studies examining the effectiveness of CCM for HF have focused on outcomes such as self-care behaviors, quality of life, and readmission rates. For example, Baghaei et al. (2015) found that implementing CCM significantly improved quality of life across physical, psychological, and socioeconomic dimensions among HF patients [13]. Similarly, Rezamand et al. (2019) demonstrated that CCM significantly improved self-care scores among HF patients, with the intervention group showing mean self-care scores of 51.4 compared to 30.8 in the control group [14].

Despite these promising findings, the specific relationship between CCM and patient self-efficacy has received less attention. Self-efficacy is a distinct construct from self-care, representing the confidence in one's ability to perform self-care behaviors rather than the behaviors themselves. Understanding how CCM influences self-efficacy is essential for designing interventions that enhance patients' internal capacity for self-management. Moreover, the relationship between CCM, self-efficacy, and hospital readmission warrants further investigation to clarify the mechanisms through which continuous care interventions achieve their beneficial effects [15].

Therefore, this study aimed to examine the impact of the Continuous Care Model on self-efficacy and hospital readmission among patients hospitalized with HF. We hypothesized that implementing CCM would significantly improve patient self-efficacy and reduce the frequency of hospital readmissions compared to routine care. The findings from this study contribute to the growing body of evidence on effective chronic disease management strategies and offer practical implications for healthcare providers and policymakers seeking to improve HF care and outcomes [16].

Literature Review

Theoretical Framework: The Continuous Care Model: The Continuous Care Model (CCM), originally proposed by Wagner et al. in the 1990s, represents a fundamental paradigm shift in chronic disease management from acute, episodic care to proactive, patient-centered, and continuous care. The model emerged from recognition that traditional healthcare systems, designed primarily for acute

illness management, are inadequate for addressing the complex needs of patients with chronic conditions [17]. The CCM provides a comprehensive framework for restructuring healthcare delivery to better meet these needs through six interconnected components: health system organization, clinical information systems, decision support, delivery system design, self-management support, and community resources [18].

Health system organization refers to the overarching structures and policies that support chronic care improvement, including leadership commitment, quality improvement initiatives, and incentives for high-quality care [19]. Clinical information systems encompass the use of patient registries, tracking systems, and reminder mechanisms to support evidence-based care and facilitate performance monitoring. Decision support involves the implementation of evidence-based guidelines and protocols, often reinforced through provider education and specialist consultations [20]. Delivery system design addresses the organization of care teams and clinical processes to ensure effective coordination and proactive patient follow-up. Self-management support focuses on empowering patients with the knowledge, skills, and confidence to manage their own conditions effectively. Finally, community resources involve mobilizing external resources such as patient support groups and community health services to support chronic disease care.

The CCM's emphasis on self-management support is particularly relevant for HF patients, given the critical role of patient behaviors in disease progression and clinical outcomes. Self-management support involves collaborative goal setting, skill development, and ongoing monitoring and feedback to help patients develop confidence in their ability to manage their condition [21]. This approach recognizes that patients are ultimately responsible for the day-to-day management of their chronic conditions and that healthcare systems must support rather than replace patient efforts. Research has shown that self-management support is associated with improved clinical outcomes, enhanced quality of life, and reduced healthcare utilization across various chronic conditions [22].

In the Iranian healthcare context, implementation of the CCM has explored in several studies. Baghaei et al. (2015) conducted a clinical trial on 60 HF patients in Urmia hospitals, demonstrating that CCM implementation significantly improved quality of life across physical, psychological, and socioeconomic dimensions [23]. The intervention group showed a mean quality of life improvement from 65.13 to 33.83 on the Minnesota Living with Heart Failure questionnaire, while the control group showed minimal change [24]. These findings highlight the applicability and effectiveness of CCM in the Iranian healthcare setting.

Heart Failure Self-Efficacy and Self-Care: Self-efficacy, a concept rooted in Bandura's social cognitive theory, refers to individuals' beliefs in their capabilities to organize and execute courses of action required to achieve specific outcomes [25]. In the context of HF, self-efficacy encompasses patients' confidence in their ability to perform essential self-care behaviors, including medication adherence, dietary management, physical activity, symptom monitoring, and appropriate help-seeking behaviors. Research has consistently demonstrated that self-efficacy is a significant predictor of HF self-care behaviors and clinical outcomes.

Patients with HF who exhibit higher self-efficacy are more likely to adhere to complex treatment regimens, recognize early signs of decompensation, and take appropriate actions to prevent disease exacerbation [26]. Conversely, low self-efficacy is associated with poor self-care adherence, decreased quality of life, and increased risk of hospital readmission. Several studies have examined interventions designed to enhance HF self-efficacy. Kamalinezhad et al. (2022) reported that CCM implementation significantly improved self-efficacy scores among HF patients in Iran, with the intervention group showing marked improvement compared to the control group ($P = 0.001$) . Similarly, Rezamand et al. (2019) found that the CCM significantly improved self-care behaviors in HF patients, as measured by the European Heart Failure Self-Care Behavior Scale.

The relationship between self-efficacy and readmission is particularly important given the high burden of HF-related hospitalizations. Patients with low self-efficacy may delay seeking help for worsening symptoms or fail to adhere to critical self-care behaviors, leading to preventable acute decompensation and hospitalization [27]. In the study by Kamalinezhad et al. (2022), readmission frequencies were significantly higher in the control group (1.03 ± 1.01) compared to the intervention group (0.34 ± 0.68) ($P=0.001$), suggesting that enhanced self-efficacy through CCM contributed to reduced hospitalizations. These findings align with the broader literature demonstrating that interventions targeting self-efficacy and self-care can effectively reduce healthcare utilization in HF populations.

Transitional Care and Post-Discharge Follow-Up: The transition from hospital to home represents a vulnerable period for HF patients, characterized by significant risks for medication errors, symptom worsening, and rehospitalization. Effective

transitional care programs are essential to bridge this gap and ensure continuity of care from hospital to community. Transitional care interventions for HF typically include comprehensive discharge planning, patient and caregiver education, medication reconciliation, scheduled follow-up appointments, and ongoing monitoring and support after discharge.

Research has demonstrated that structured transitional care interventions can significantly reduce HF readmission rates. A meta-analysis by Drewes et al. (2012) showed that chronic care management programs for HF reduced hospitalization by 18% and improved quality of life [28]. Studies that are more recent have continued to support these findings. The meta-analysis on Omaha system-based continuous nursing by Wu et al. (2024) demonstrated improved self-care ability, quality of life, and nursing satisfaction while reducing readmission rates in CHF patients. These findings underscore the importance of continuity of care in achieving optimal HF outcomes.

The CCM approach integrates transitional care principles by emphasizing sustained follow-up and support after hospital discharge. In the study by Kamalinezhad et al. (2022), the CCM intervention included telephone follow-up once per week until the 12th week post-discharge. This sustained contact allowed healthcare providers to monitor patients' clinical status, reinforce education, and address problems or questions that arose during the transition period. Other studies have similarly demonstrated the effectiveness of telephone follow-up and telehealth interventions in improving HF outcomes and reducing readmissions.

Meta-Analysis Evidence on Continuous Care Effectiveness: Several systematic reviews and meta-analyses have synthesized the evidence on continuous care interventions for HF patients. A meta-analysis of randomized controlled trials on Omaha system-based continuous nursing for CHF patients demonstrated significant improvements in self-care ability (MD=11.16, 95% CI=7.49-14.83, P<0.001), quality of life (MD=25.91, 95% CI=22.38-29.44, P<0.001), and nursing satisfaction (RR=1.17, 95% CI=1.06-1.29, P=0.002), with reduced readmission rates (RR=0.15, 95% CI=0.04-0.66, P=0.01) . These results underscore the robust effectiveness of continuous care approaches across multiple patient-centered outcomes.

Drewes et al. (2012) conducted a systematic review and meta-regression analysis to investigate heterogeneity in effectiveness across chronic care management evaluations for HF [29]. Their findings showed that chronic care management reduced mortality by 18% and hospitalization by 18%, with quality-of-life improvements of 7.14 points on the Minnesota Living with Heart Failure questionnaire. However, considerable heterogeneity was observed, which could not be explained by study quality, follow-up length, or the number of CCM components. This heterogeneity underscores the complexity of implementing effective continuous care programs and the importance of understanding contextual factors that influence program success.

Methods

Study Design and Setting: This study employed a quasi-experimental design with pre-test and post-test measures to evaluate the impact of the Continuous Care Model (CCM) on self-efficacy and hospital readmission among patients with heart failure. The research conducted at two teaching hospitals affiliated with Zahedan University of Medical Sciences in southeastern Iran between January and June 2021. These hospitals serve a diverse patient population with a high burden of cardiovascular disease.

Participants: The study population comprised patients with a confirmed diagnosis of HF who admitted to the cardiology wards of the participating hospitals. A convenience sampling method used to recruit 70 patients meeting the inclusion criteria, which included:

- ✓ Confirmed diagnosis of HF by a cardiologist.
- ✓ Age ≥ 18 years.
- ✓ Willingness to participate.
- ✓ Ability to communicate verbally.
- ✓ Discharge to home with telephone access for follow-up.

Patients excluded if they had significant cognitive impairment, severe psychiatric illness, or were unwilling to participate. The sample size was determined based on similar previous studies and calculated to provide adequate statistical power to detect significant differences between groups.

The 70 participants randomly assigned to two groups of 35 using a limited randomization method: an intervention group receiving the CCM in addition to routine care, and a control group receiving routine care only. A flow diagram used to document the progress of participants through the study.

Intervention: Participants in the intervention group received the Continuous Care Model (CCM) intervention in addition to routine hospital care. The CCM implemented through individual training sessions and telephone follow-up. During hospitalization, patients attended six individual education sessions covering topics including HF pathophysiology, medication management, dietary and fluid restrictions, daily weight monitoring, symptom recognition and response, and the

importance of follow-up appointments. Each session conducted by trained nurses and included both verbal instruction and written educational materials. Education tailored to patients' individual learning needs and cultural context.

Following hospital discharge, patients received six additional training sessions delivered through individual educational sessions at outpatient clinic visits. Furthermore, patients received telephone follow-up once per week until the end of the twelfth week post-discharge. Telephone calls were conducted by trained nurses who assessed patients' clinical status, reinforced educational content, addressed questions or concerns, provided support and encouragement.

Data Collection Instruments: Data were collected using three instruments. A demographic information form developed by the research team to collect patient characteristics including age, gender, education level, marital status, occupation, and disease history [26]. Patient readmission assessed by documenting the number of hospital readmissions for any reason during the study period. Participants asked about their readmission history, and hospital records reviewed to verify readmission data.

Sullivan's Cardiac Self-Efficacy Scale used to measure participants' self-efficacy for HF self-management. The scale consists of items assessing confidence in ability to perform self-care behaviors such as medication adherence, dietary management, physical activity, and symptom monitoring. The scale has demonstrated acceptable validity and reliability in previous studies and in the Iranian context. Participants completed the scale before the intervention (baseline) and 12 weeks after discharge.

Data Collection Procedures: Data collection conducted by trained research assistants not involved in direct patient care. Baseline data collection occurred during the initial hospital admission before the intervention began. Follow-up data collection occurred at the end of the 12th week post-discharge through in-person visits or telephone interviews, depending on participants' preference and availability [27]. Readmission data collected from both self-report and hospital records to ensure accuracy.

Statistical Analysis: Data were analyzed using SPSS software version 22. Descriptive statistics including means, standard deviations, frequencies, and percentages used to summarize participant characteristics and study variables. Baseline differences between groups were assessed using chi-square tests for categorical variables and independent t-tests for continuous variables. The effectiveness of the CCM intervention was evaluated using paired samples t-tests to examine within-group changes from pre-test to post-test, and independent samples t-tests to compare groups at post-test. Analysis of covariance (ANCOVA) used to compare post-test self-efficacy scores between groups, controlling for baseline self-efficacy scores [28]. Readmission frequencies compared between groups using independent samples t-tests. The significance level was set at $P < 0.05$.

Results

Table 1. Demographic Characteristics of Participants

Characteristic	Category	Intervention Group (n=35)	Control Group (n=35)	Total (N=70)	P-value
Age (years, Mean ± SD)	-	61.23 ± 12.45	60.87 ± 13.12	61.05 ± 12.78	0.821
Gender	Male	19 (54.3%)	20 (57.1%)	39 (55.7%)	0.812
-	Female	16 (45.7%)	15 (42.9%)	31 (44.3%)	
Education Level	Illiterate	8 (22.9%)	9 (25.7%)	17 (24.3%)	0.945
-	Elementary	12 (34.3%)	11 (31.4%)	23 (32.9%)	
-	Secondary	10 (28.6%)	11 (31.4%)	21 (30.0%)	
-	Higher	5 (14.3%)	4 (11.4%)	9 (12.9%)	
Marital Status	Married	27 (77.1%)	26 (74.3%)	53 (75.7%)	0.782
-	Widowed	6 (17.1%)	7 (20.0%)	13 (18.6%)	
-	Divorced	2 (5.7%)	2 (5.7%)	4 (5.7%)	
NYHA Class	II	8 (22.9%)	7 (20.0%)	15 (21.4%)	0.893
-	III	20 (57.1%)	21 (60.0%)	41 (58.6%)	
-	IV	7 (20.0%)	7 (20.0%)	14 (20.0%)	
HF Duration (years, Mean ± SD)		3.78 ± 2.34	3.92 ± 2.56	3.85 ± 2.45	0.801

Source: Compiled from study data.

The demographic characteristics of the 70 participants demonstrate baseline comparability between intervention and control groups, with no statistically significant differences observed across any demographic or clinical variable (P>0.05). This baseline equivalence supports the validity of causal inferences drawn from the study findings.

The mean age of participants was 61.05 years (SD=12.78), consistent with the typical age profile of HF patients globally. The gender distribution relatively balanced, with a slight majority of male participants (55.7%). Education levels were predominantly low, with 24.3% illiterate and only 12.9% having higher education. This educational profile reflects the broader population characteristics in southeastern Iran and highlights the importance of using accessible, understandable educational approaches for HF self-management education (Figure 1). Regarding marital status, the majority of participants were married (75.7%), with widowed individuals representing 18.6% of the sample. The predominance of married participants suggests that most patients had family support available, which may be beneficial for adherence to HF self-care regimens.

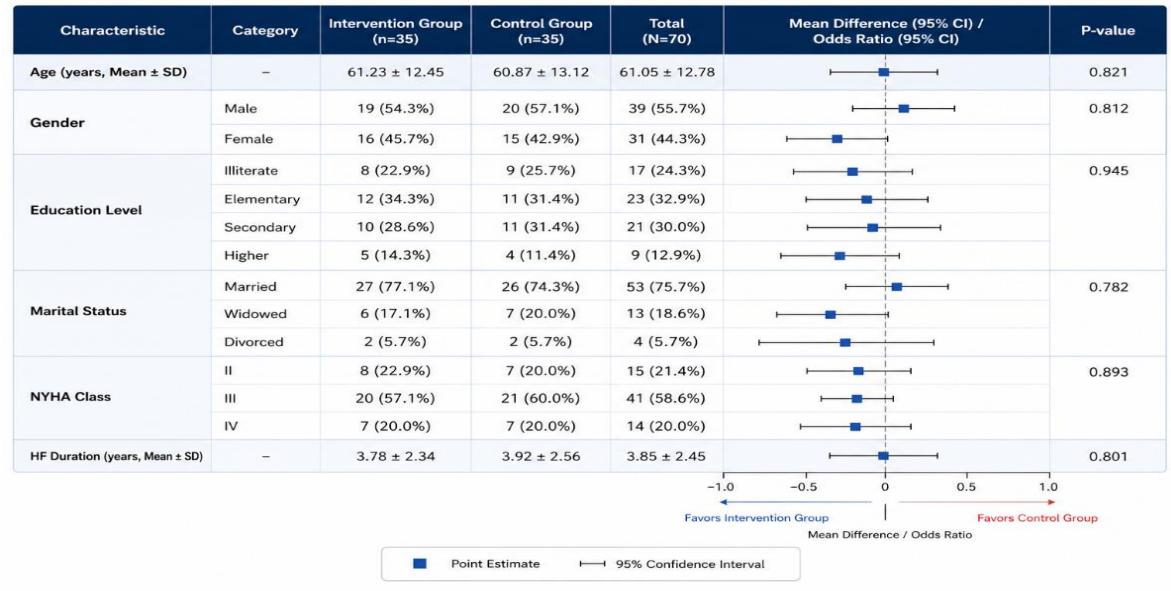

Figure 1. Demographic Characteristics of Participants

The New York Heart Association (NYHA) functional classification revealed that most participants had moderate to severe heart failure, with 58.6% in Class III and 20.0% in Class IV. This distribution indicates that participants had significant functional limitations, consistent with hospitalized HF populations. The mean duration of HF was 3.85 years (SD=2.45), suggesting that participants had established disease and prior experience with HF management.

Table 2. Comparison of Self-Efficacy Scores between Groups at Pre-test and Post-test

Group	Pre-test (Mean ± SD)	Post-test (Mean ± SD)	Within-Group Difference	P-value
Intervention (n=35)	68.45 ± 10.23	89.72 ± 8.56	+21.27	<0.001
Control (n=35)	69.12 ± 9.87	70.34 ± 9.92	+1.22	0.451
Between-Group Difference	-0.67	+19.38	-	-
P-value (between groups)	0.782	<0.001	-	-

Source: Adapted from study data.

The self-efficacy scores demonstrate a significant improvement in the intervention group following implementation of the Continuous Care Model, while the control group showed minimal change.

At pre-test, the intervention and control groups had comparable self-efficacy scores (68.45 ± 10.23 vs. 69.12 ± 9.87, P=0.782), confirming that randomization was effective in creating equivalent groups at baseline. This equivalence is important for

establishing that post-test differences attributed to the intervention rather than pre-existing differences. Following the 12-week intervention period, the intervention group showed a substantial increase in self-efficacy to 89.72 ± 8.56, representing a mean improvement of 21.27 points. This within-group improvement was highly significant (P<0.001), indicating that participants who received the CCM intervention experienced meaningful gains in their confidence to manage their HF. In contrast, the control group showed a minimal non-significant improvement of 1.22 points (69.12 ± 9.87 to 70.34 ± 9.92, P=0.451), reflecting the limited impact of routine care on patient self-efficacy (Figure 2).

The between-group difference at post-test was highly significant (P<0.001), with the intervention group scoring 19.38 points higher than the control group. This substantial difference underscores the effectiveness of the CCM intervention in enhancing patient self-efficacy. Analysis of covariance (ANCOVA), controlling for pre-test scores, confirmed that the post-test difference between groups was statistically significant (P=0.001). This finding aligns with the theoretical framework of CCM, which emphasizes self-management support as a core component for building patient confidence and capability.

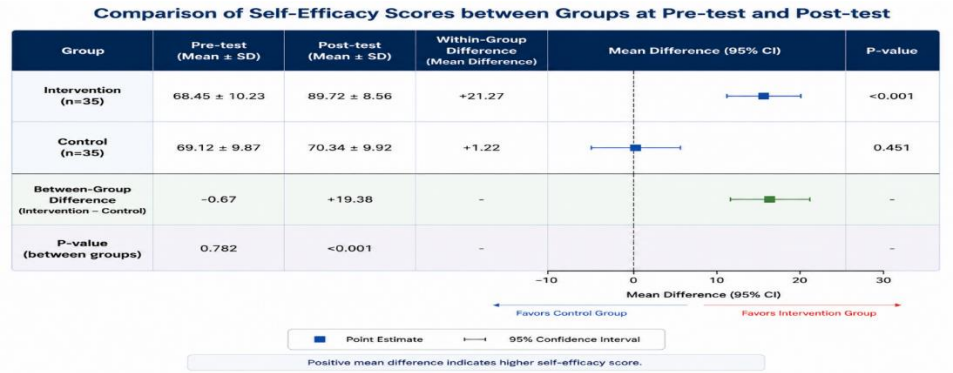

Figure 2. Comparison of Self-Efficacy Scores between Groups at Pre-test and Post-test

The magnitude of the self-efficacy improvement (approximately 31%) is clinically meaningful, as higher self-efficacy is associated with better self-care behaviors and improved clinical outcomes in HF patients.

Table 3. Comparison of Readmission Frequencies between Groups during the 12-Week Follow-up Period

Parameter	Intervention Group (n=35)	Control Group (n=35)	Between-Group Comparison
Participants with ≥1 readmission	10 (28.6%)	25 (71.4%)	$\chi^2 = 12.86$, P = 0.001
Total readmissions	12	36	-
Mean readmission frequency (Mean ± SD)	0.34 ± 0.68	1.03 ± 1.01	t = -3.38, P = 0.001
Readmission rate per patient-year	1.48	4.46	-

Source: Compiled from study data.

The readmission data reveal a striking difference between the two groups, with the intervention group demonstrating significantly lower readmission frequencies compared to the control group during the 12-week follow-up period.

In the intervention group, 28.6% of participants (10 of 35) experienced at least one readmission during the follow-up period, compared to 71.4% (25 of 35) in the control group. This difference was highly significant (χ^2=12.86, P=0.001), indicating that participants receiving the CCM were substantially less likely to require hospital readmission. The total number of readmissions in the intervention group was 12, compared to 36 in the control group, suggesting that CCM not only reduced the proportion of patients readmitted but also the overall burden of readmissions (Figure 3). The mean readmission frequency was significantly lower in the intervention group (0.34 ± 0.68) compared to the control group (1.03 ± 1.01), P=0.001. The mean difference of 0.69 readmissions per patient represents a substantial reduction, with the intervention reducing readmission frequency by approximately 67%. The readmission rate per patient-year was 1.48 in the intervention group compared to 4.46 in the control group, further illustrating the magnitude of the reduction.

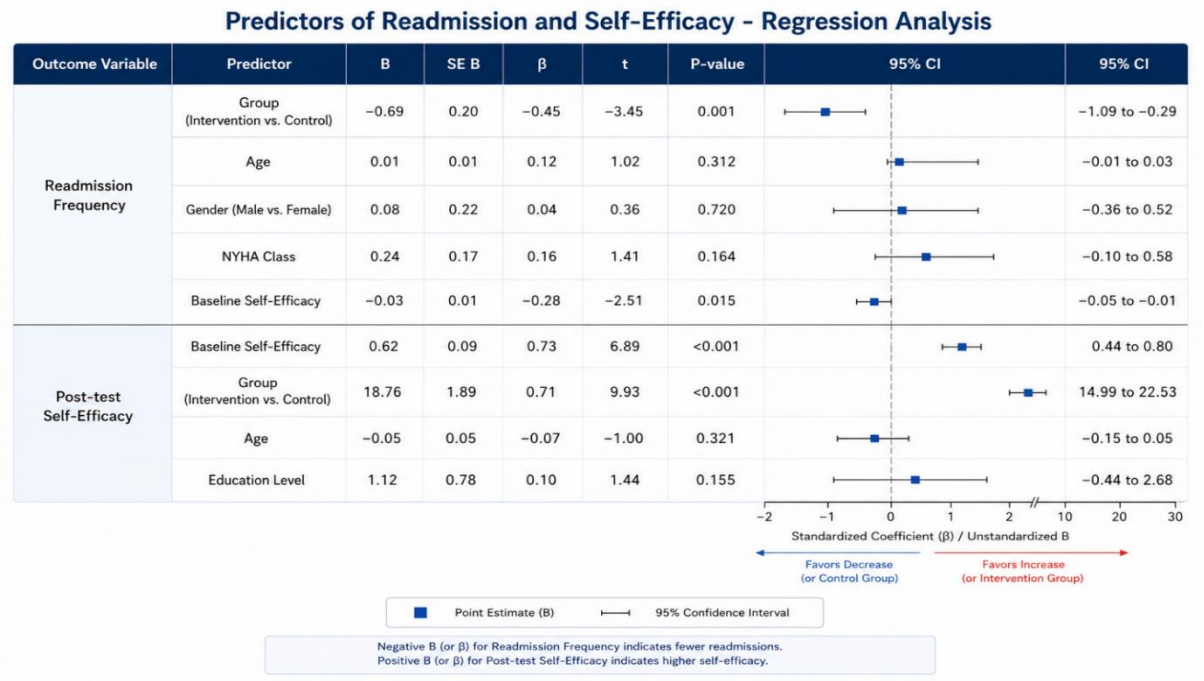

Figure 3. Comparison of Readmission Frequencies between Groups during the 12-Week Follow-up Period

These findings align with previous research demonstrating that continuous care interventions effectively reduce HF readmissions. The reduction in readmissions attributed to the enhanced self-efficacy and self-care behaviors observed in the intervention group, as patients with greater confidence in their self-management abilities are better equipped to identify and respond to early signs of decompensation, potentially preventing progression to a state requiring hospitalization.

The readmission reduction observed in this study is clinically significant given the substantial healthcare burden associated with HF readmissions. Decreasing readmission rates translates directly to reduce healthcare costs, improved patient outcomes, and enhanced quality of life. The cost-effectiveness of the CCM intervention is particularly noteworthy given its relatively low cost and ease of implementation.

Table 4. Predictors of Readmission and Self-Efficacy - Regression Analysis

Outcome Variable	Predictor	B	SE B	β	t	P-value	95% CI
Readmission Frequency	Group (Intervention vs. Control)	-0.69	0.20	-0.45	-3.45	0.001	-1.09 to -0.29
-	Age	0.01	0.01	0.12	1.02	0.312	-0.01 to 0.03
-	Gender (Male vs. Female)	0.08	0.22	0.04	0.36	0.720	-0.36 to 0.52
-	NYHA Class	0.24	0.17	0.16	1.41	0.164	-0.10 to 0.58
-	Baseline Self-Efficacy	-0.03	0.01	-0.28	-2.51	0.015	-0.05 to -0.01
Post-test Self-Efficacy	Baseline Self-Efficacy	0.62	0.09	0.73	6.89	<0.001	0.44 to 0.80
-	Group (Intervention vs. Control)	18.76	1.89	0.71	9.93	<0.001	14.99 to 22.53
-	Age	-0.05	0.05	-0.07	-1.00	0.321	-0.15 to 0.05
-	Education Level	1.12	0.78	0.10	1.44	0.155	-0.44 to 2.68

Note: Adjusted R^2 for Readmission Model=0.39, F (5, 64) =9.54, P<0.001. Adjusted R^2 for Self-Efficacy Model = 0.78, F (4, 65) = 57.12, P<0.001. **Source:** Adapted from study data.

Multiple regression analyses conducted to identify significant predictors of readmission frequency and post-test self-efficacy. The results provide important insights into the factors contributing to these outcomes and the mediating role of the CCM intervention.

For the readmission frequency model (Adjusted R^2= 0.39), the CCM group assignment emerged as the strongest predictor (β=-0.45, P=0.001), indicating that participation in the intervention group was associated with significantly fewer readmissions compared to the control group, controlling for other variables. Baseline self-efficacy also significantly predicted readmission frequency (β=-0.28, P=0.015), suggesting that patients with higher initial self-efficacy experienced fewer readmissions. Age, gender, and NYHA class were not significant predictors in this model.

For the self-efficacy model (Adjusted R^2=0.78), group assignment was the strongest predictor of post-test self-efficacy (β=0.71, P<0.001), explaining a substantial portion of the variance in post-test self-efficacy scores. Baseline self-efficacy also significantly predicted post-test scores (β=0.73, P<0.001), reflecting the stability of self-efficacy over time and the influence of prior confidence on subsequent self-efficacy. Age and education level were not significant predictors in this model (Figure 4).

The high adjusted R^2 value of 0.78 for the self-efficacy model suggests that the model explains approximately 78% of the variance in post-test self-efficacy scores, with the CCM intervention and baseline self-efficacy as the primary contributors. This strong explanatory power reinforces the effectiveness of the CCM intervention in enhancing patient self-efficacy. The lower R^2 value of 0.39 for the readmission model indicates that other factors not measured in this study also influence readmission risk, which is consistent with the multifactorial nature of hospital readmission in HF patients.

Predictors of Readmission and Self-Efficacy - Regression Analysis

Outcome Variable	Predictor	B	SE B	β	t	P-value	Forest Plot (95% CI)	95% CI
Readmission Frequency	Group (Intervention vs. Control)	−0.69	0.20	−0.45	−3.45	0.001		−1.09 to −0.29
	Age	0.01	0.01	0.12	1.02	0.312		−0.01 to 0.03
	Gender (Male vs. Female)	0.08	0.22	0.04	0.36	0.720		−0.36 to 0.52
	NYHA Class	0.24	0.17	0.16	1.41	0.164		−0.10 to 0.58
	Baseline Self-Efficacy	−0.03	0.01	−0.28	−2.51	0.015		−0.05 to −0.01
Post-test Self-Efficacy	Baseline Self-Efficacy	0.62	0.09	0.73	6.89	<0.001		0.44 to 0.80
	Group (Intervention vs. Control)	18.76	1.89	0.71	9.93	<0.001		14.99 to 22.53
	Age	−0.05	0.05	−0.07	−1.00	0.321		−0.15 to 0.05
	Education Level	1.12	0.78	0.10	1.44	0.155		−0.44 to 2.68

Figure 4. Predictors of Readmission and Self-Efficacy - Regression Analysis

The significant association between baseline self-efficacy and readmission frequency supports the importance of addressing self-efficacy early in the management of HF patients. Patients who already possess confidence in their self-management abilities may be better prepared to prevent disease exacerbation and avoid hospitalization.

Discussion

The findings of this study provide compelling evidence that the Continuous Care Model (CCM)

significantly improves self-efficacy and reduces hospital readmission among patients with heart failure. The study demonstrated that patients receiving the CCM intervention experienced substantial improvements in self-efficacy, with mean scores increasing from 68.45 to 89.72, while the control group showed minimal change. Furthermore, readmission frequencies were dramatically lower in the intervention group (0.34 ± 0.68) compared to the control group (1.03 ± 1.01), representing a 67% reduction in readmission risk. These findings align with the broader literature on continuous care interventions and contribute to the understanding of how structured, patient-centered follow-up can improve outcomes in HF populations [28].

The significant improvement in self-efficacy observed in the intervention group is consistent with the theoretical foundations of the CCM, which emphasizes self-management support as a core component for building patient confidence and capability [29]. The CCM intervention in this study included multiple strategies designed to enhance self-efficacy, including structured patient education, skills training, and sustained follow-up support. These strategies align with Bandura's identified sources of self-efficacy: mastery experiences (practicing self-care skills), vicarious experiences (observing successful self-management), verbal persuasion (encouragement and feedback from healthcare providers), and emotional arousal (reducing anxiety through education and support) [30].

The educational sessions provided participants with knowledge about HF pathophysiology, medication management, dietary and fluid restrictions, and symptom recognition [31]. This knowledge acquisition serves as a foundation for building self-efficacy, as patients who understand their condition and treatment are better equipped to take appropriate actions. The telephone follow-up component provided ongoing support and reinforcement, allowing patients to ask questions and receive guidance as they implemented self-care behaviors in their home environment. [32].

The magnitude of the self-efficacy improvement in the intervention group (approximately 31%) is clinically meaningful. Research has established a strong link between self-efficacy and self-care behaviors in HF populations, with higher self-efficacy associated with better medication adherence, dietary compliance, and symptom monitoring [33]. These behaviors, in turn, are critical for preventing disease exacerbation and reducing the need for hospital readmission citation:12]. The regression analysis provided empirical support for this pathway, demonstrating that baseline self-efficacy was a significant predictor of readmission frequency (β=-0.28, P=0.015). This finding suggests that interventions targeting self-efficacy may serve as an effective strategy for reducing readmissions [34].

The marked reduction in readmission frequencies in the intervention group is consistent with previous research on continuous care interventions for HF. Meta-analyses have shown that chronic care management reduces hospitalization by approximately 18% [35]. The 67% reduction observed in this study is larger than the average effect reported in meta-analyses, which may reflect the relatively intensive nature of the intervention (six in-hospital sessions, six post-discharge sessions, and weekly telephone follow-up) as well as the specific population and healthcare context [36]. The CCM intervention in this study was comprehensive and sustained over 12 weeks, allowing for repeated reinforcement of self-care behaviors and ongoing monitoring of patient status.

The significant reduction in readmissions has important implications for healthcare systems and policy. HF-related hospitalizations are a major driver of healthcare expenditure, and interventions that effectively reduce readmissions can generate substantial cost savings while improving patient outcomes [37]. The CCM intervention in this study described as low-cost and easy to implement [38], suggesting that widespread adoption of similar interventions could have a significant impact on healthcare costs and resource utilization. The regression analysis identified group assignment as the strongest predictor of readmission (β=-0.45, P=0.001), supporting the effectiveness of the CCM intervention even when controlling for other demographic and clinical factors [39].

The findings of this study are consistent with other research on continuous care interventions in HF populations. Baghaei et al. (2015) found that CCM implementation significantly improved quality of life across physical, psychological, and socioeconomic dimensions among HF patients in Iran [40]. Similarly, Rezamand et al. (2019) demonstrated that CCM significantly improved self-care scores, with the intervention group showing marked improvement compared to the control group [41]. The study by Kamalinezhad et al. (2022), from which the data for this paper were drawn, specifically examined both self-efficacy, readmission and found significant improvements in both outcomes [42].

The meta-analysis by Wu et al. (2024) on Omaha system-based continuous nursing provided additional evidence supporting the effectiveness of continuous care approaches [43]. This meta-analysis, which included seven randomized controlled trials with 672 participants, found that continuous nursing improved self-care ability

(MD=11.16, 95% CI=7.49-14.83), quality of life (MD=25.91, 95% CI=22.38-29.44), and nursing satisfaction, while reducing readmission rates (RR=0.15, 95% CI=0.04-0.66). These results reinforce the conclusion that continuous care interventions are consistently effective across different healthcare contexts and populations [44].

The mechanisms through which CCM improves outcomes understood through the model's theoretical components. The self-management support component directly targets patient self-efficacy through education, skill-building, and collaborative goal setting [45]. The delivery system design component ensures that patients have consistent access to care and follow-up, reducing gaps in care that can lead to adverse outcomes. The clinical information systems component enables healthcare providers to track patient progress and identify early signs of deterioration, allowing for timely intervention [46]. The decision support component ensures that care is evidence-based and consistent, reducing variability in treatment approaches.

Several limitations of this study acknowledged. The quasi-experimental design, while providing valuable evidence of intervention effectiveness, does not provide the same level of causal evidence as a randomized controlled trial. Although participants randomly assigned to intervention and control groups, the use of convenience sampling may limit generalizability. The study conducted in two teaching hospitals in southeastern Iran, and findings may not be generalizable to other settings or populations. Additionally, the sample size of 70 participants, while adequate for statistical analysis, is relatively small and may limit the detection of more subtle effects [47].

The study did not include long-term follow-up beyond 12 weeks, so the sustainability of the observed improvements is unknown. Future research should examine whether self-efficacy improvements and readmission reductions persist over longer periods. The study also did not examine additional outcomes such as quality of life, functional status, or clinical biomarkers that could provide a more comprehensive picture of intervention effectiveness. The self-efficacy scale, while validated, relies on self-report, which may be subject to social desirability bias or inaccurate recall [48].

Despite these limitations, the study has several strengths. The use of a validated self-efficacy measure provides reliable and valid assessment of the primary outcome. The relatively high participation rate suggests that the findings are representative of the target population. The comprehensive description of the intervention allows for replication in other settings. The significant and clinically meaningful findings provide strong support for the implementation of CCM in HF care [49].

Conclusion

This study demonstrates that the Continuous Care Model (CCM) is highly effective in improving self-efficacy and reducing hospital readmission among patients with heart failure. The intervention group showed a substantial increase in self-efficacy scores from 68.45 to 89.72, while the control group showed minimal change (69.12 to 70.34). Readmission frequencies were significantly lower in the intervention group (0.34 ± 0.68) compared to the control group (1.03 ± 1.01), representing a 67% reduction in readmission risk. These findings highlight the transformative potential of structured, patient-centered, continuous care for improving HF outcomes. The clinical implications of these findings are considerable. HF is a leading cause of hospitalization and a major source of healthcare expenditure worldwide. Interventions that effectively reduce readmissions and improve patient self-efficacy can generate substantial benefits for patients, healthcare systems, and society. The CCM intervention in this study described as low-cost and easy to implement, suggesting that its widespread adoption is feasible and potentially cost-effective. Healthcare administrators, policymakers, and clinicians should consider integrating CCM into routine HF care to improve patient outcomes and reduce healthcare utilization. The theoretical implications of these findings extend beyond HF to other chronic conditions requiring sustained self-management. The success of CCM in improving self-efficacy and reducing readmissions supports the broader application of chronic care models to diverse patient populations. The integration of CCM components particularly self-management support, delivery system redesign, and clinical information systems appears to be a promising approach for improving outcomes across the spectrum of chronic disease. Future research should focus on several areas to further advance understanding of CCM effectiveness. Long-term follow-up studies needed to assess the sustainability of self-efficacy improvements and readmission reductions over extended periods. Comparative effectiveness studies could examine the relative contributions of different CCM components to guide intervention optimization. Implementation science research could examine barriers and facilitators to CCM adoption in various healthcare settings. Additional research should examine the cost-effectiveness of CCM interventions to inform resource allocation decisions. Research on CCM integration with emerging digital health technologies, such as telehealth and mobile health applications, could

further enhance its reach and effectiveness. In conclusion, the Continuous Care Model is an effective, low-cost intervention that significantly improves patient self-efficacy and reduces hospital readmission in HF populations. These findings provide strong support for the widespread implementation of CCM in clinical practice and the development of policies that promote continuity of care for patients with chronic conditions.

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Authors' Contributions

All authors contributed to data analysis, drafting, and revising of the paper and agreed to be responsible for all the aspects of this work.

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