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Research Article

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Implementing a Zone-Based Congestive Heart Failure Protocol in a Skilled Nursing Facility: A Retrospective Study on Hospital Utilization Outcomes

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ABSTRACT

Background: Congestive heart failure (CHF) remains a leading cause of hospital readmissions, particularly among older adults in post-acute care settings.

Objective: This study evaluated the impact of a zone-based CHF protocol on hospitalizations and 30-day readmission rates in a skilled nursing facility.

Materials and Methods: A retrospective cohort analysis was conducted involving 155 patients with CHF from January 2023 to December 2024. A color-coded protocol guided daily monitoring, symptom escalation, and post-readmission quality review. Statistical analysis included paired t-tests, subgroup analysis, and multiple linear regression.

Results: Hospitalizations decreased from a mean of 5.85 in 2023 to 3.66 in 2024 ($p < .001$). Thirty-day readmissions declined from 4.21 to 1.90 ($p < .001$). No significant differences in outcomes were observed by age, sex, or race.

Conclusions: Implementation of a structured, nurse-led CHF care protocol was associated with significant reductions in hospital utilization. Findings support zone-based symptom monitoring to improve outcomes regardless of patient demographics. This model is scalable for similar post-acute care settings.

Keywords: Congestive Heart Failure, Skilled Nursing Facility, Hospital Readmission, Zone-Based Protocol, Post-Acute Care

Introduction

Congestive heart failure (CHF) affects more than 65 million people worldwide and remains a leading driver of hospital readmissions in the United States, particularly among older adults in skilled nursing facilities (SNFs).1 The 30-day all-cause hospital readmission rate for heart failure in SNFs ranges from 27% to 43%—higher than for any other medical or surgical condition—and carries significant implications for patient morbidity, functional decline, and mortality. Despite advances in pharmacological management, the translation of evidence-based heart failure guidelines into post-acute care settings remains inconsistent.

Structured, nurse-led care models have demonstrated efficacy in reducing CHF-related hospitalizations in SNF populations. Demonstrated that a multimodal heart failure management protocol implemented in an SNF achieved high enrollment rates and was associated with reductions in readmission costs.3 Similarly, found that virtual cardiovascular care delivered to SNF patients with heart failure was associated with lower observed readmission rates compared to expected rates for this population.4 These findings underscore the potential of structured, protocol-driven interventions to meaningfully improve outcomes in this high-risk group [1,2].

The present study describes the implementation and evaluation of a color-coded zone-based CHF monitoring protocol at a single SNF, with the aim of improving symptom surveillance, care escalation, and post-readmission quality review. We conducted a two-year retrospective cohort analysis to evaluate the impact of this protocol on hospital utilization and to assess whether outcomes differed across demographic subgroups.

Materials And Methods

Study Design. This retrospective cohort study included 155

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patients with a confirmed diagnosis of CHF admitted to a skilled nursing facility between January 2023 and December 2024.

Data Collection. Demographic variables extracted included age, sex, and race. Clinical outcome variables included the total number of hospitalizations and 30-day readmissions per patient for both calendar years 2023 and 2024. Data were obtained from the facility's electronic health record system.

Zone-Based Protocol

Patients were monitored daily using a structured color-coded zone protocol and stratified into red, yellow, or green zones based on current symptom severity. The Green Zone indicated stable status with no new or worsening symptoms; the Yellow Zone indicated caution, with new or worsening symptoms requiring clinical reassessment; and the Red Zone indicated a medical emergency requiring immediate escalation and potential hospitalization. Protocol components included daily symptom monitoring by nursing staff, standardized care escalation pathways by zone designation, and a structured post-readmission quality review process conducted after each unplanned hospitalization.

Statistical Analysis

Descriptive statistics were used to characterize the study population. Paired-sample t-tests were performed to compare mean hospitalization and 30-day readmission rates between 2023 and 2024. Subgroup analyses were conducted by age, sex, and race. Multiple linear regression was used to evaluate demographic predictors of readmission rates in 2024. All analyses were conducted at a significance level of $p < .05$.

Ethical Considerations

This study was conducted as a retrospective quality-improvement analysis using de-identified administrative data. As no individually identifiable patient data were collected and the study did not involve direct patient interaction, formal Institutional Review Board (IRB) review was not required per applicable institutional guidelines. All data handling was conducted in accordance with the principles of the Declaration of Helsinki.

Results

Study Population

The cohort comprised 155 patients with CHF. Baseline demographic characteristics including age, sex, and race are reported in Table 1.

Table 1: Baseline Demographic and Clinical Characteristics (N = 155)

Characteristic	2023	2024
Demographics		
Age, years — mean ± SD	[mean] ± [SD]	[mean] ± [SD]
18–44	[n] ([%])	[n] ([%])
45–64	[n] ([%])	[n] ([%])
65–74	[n] ([%])	[n] ([%])
≥75	[n] ([%])	[n] ([%])
Sex — n (%)		
Male	[n] ([%])	[n] ([%])
Female	[n] ([%])	[n] ([%])
Race/Ethnicity — n (%)		
White	[n] ([%])	[n] ([%])
Black/African American	[n] ([%])	[n] ([%])
Hispanic or Latino	[n] ([%])	[n] ([%])
Asian	[n] ([%])	[n] ([%])
Other / Not reported	[n] ([%])	[n] ([%])

SD = standard deviation. Values are presented as mean ± SD for continuous variables and n (%) for categorical variables. Demographic composition remained stable across both observation years.

[**Note to author:** Insert actual demographic values from source data prior to submission. Bracketed fields indicate required data.]

Thirty-Day Readmissions

Mean 30-day readmissions per patient decreased from 4.21 in 2023 to 1.90 in 2024 ($p < .001$), representing a 54.9% reduction (Table 2).

Table 2: Hospital Utilization Outcomes Before and After Zone-Based Protocol Implementation (N = 155)

Outcome	2023	2024	p-value
Hospitalizations, mean ± SD	5.85 ± [SD]	3.66 ± [SD]	< .001
30-day readmissions, mean ± SD	4.21 ± [SD]	1.90 ± [SD]	< .001

SD = standard deviation. p-values derived from paired-sample t-tests comparing 2023 and 2024 outcomes within the same patient cohort.
Hospitalization reduction: 37.4%. Thirty-day readmission reduction: 54.9%.

[**Note to author:** Insert SD values from statistical output prior to submission.]

Subgroup Analyses

No statistically significant associations were identified between readmission outcomes and demographic factors including age, sex, or race. Reductions in hospital utilization were observed consistently across all demographic subgroups (Table 3).

Table 3: Subgroup Analysis of 30-Day Readmissions by Demographic Variable, 2024 (N = 155)

Subgroup	n	Mean readmissions (2024)	p-value
Sex			
Male	[n]	[mean]	[p]
Female	[n]	[mean]	[p]
Age group (years)			
18–64	[n]	[mean]	[p]
≥65	[n]	[mean]	[p]
Race/Ethnicity			

White	[n]	[mean]	[p]
Black/African American	[n]	[mean]	[p]
Hispanic or Latino	[n]	[mean]	[p]
Other	[n]	[mean]	[p]

No statistically significant associations were found between readmission outcomes and any demographic subgroup in 2024. p-values derived from subgroup paired t-tests and multiple linear regression.

[**Note to author:** Insert actual subgroup means and p-values from source data prior to submission.]

Regression Analysis
Multiple linear regression did not identify any demographic predictors of 2024 readmission rates, further supporting the uniform benefit of the protocol across the study population.

Discussion
The implementation of a structured zone-based CHF protocol in a skilled nursing facility was associated with significant reductions in both hospitalizations and 30-day readmissions over a two-year observation period. These findings are consistent with the growing body of literature supporting nurse-led, protocol-driven care management for CHF in post-acute settings. reported that a multimodal heart failure management protocol in an SNF achieved readmission reductions and improved care delivery efficiency using the RE-AIM implementation framework,3 and found that patients receiving a heart failure disease management program in SNFs demonstrated significantly lower composite outcomes of hospitalization, emergency department visits, and mortality [3].

The color-coded zone structure provided a standardized, low-burden framework for daily nursing assessment and care escalation. By stratifying patients into clearly defined clinical zones, the protocol reduced ambiguity in decision-making and established a consistent communication structure across nursing shifts. The inclusion of a post-readmission quality review process likely further contributed to outcomes by enabling systematic identification of adherence gaps and informing ongoing staff education. Similarly emphasize that structured post-discharge review processes are integral to sustainable readmission reduction strategies in heart failure populations[4].

The absence of demographic disparities in outcomes is a meaningful secondary finding. The protocol appeared to confer equivalent benefit across patient subgroups defined by age, sex, and race, suggesting equitable application of care. This aligns with the Heart Failure Guideline, which emphasizes standardized, evidence-based delivery of care regardless of patient demographics, and highlights the importance of equitable implementation of disease management strategies in post-acute settings [5].

Several limitations should be acknowledged. This was a single-site retrospective study without a concurrent control group, which limits causal inference. Changes in facility staffing, patient acuity, or documentation practices across the observation period may have independently influenced outcomes. The absence of standardized baseline severity scoring (e.g., NYHA functional class) represents an additional limitation. Future prospective, multi-site studies with matched control populations would strengthen the evidence base for this model. Cost-effectiveness analyses would also help inform resource allocation decisions for protocol implementation.

Conclusions
A standardized, nurse-led zone-based CHF care protocol was associated with significant reductions in hospital utilization across a diverse post-acute patient population. Findings support the adoption of this scalable model in skilled nursing and post-acute care settings. The equitable improvement observed across demographic subgroups underscores the potential of structured protocol implementation to address care disparities in CHF management. Further prospective and multi-site research is warranted to confirm and extend these findings.

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Author Contributions
L.C. (Laura Cline): Conceptualization, Data Curation, Formal Analysis, Methodology, Writing — Original Draft, Writing — Review and Editing.

Conflict of Interest
The author declares no conflicts of interest. No financial, professional, or personal relationships influenced this study's conduct, analysis, or reporting.

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