VER
Vascular & Endovascular Review

Evaluating the Impact of a Clinical Heart Failure Management Pathway on Hospital Length of Stay and Readmission Rates

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ABSTRACT

Background: One of the major causes of hospitalization in the world is heart failure (HF) with a long length of stay (LOS) and high readmission rates. Multidisciplinary clinical pathways are suggested as the best way to streamline care, enhance outcomes, and decrease healthcare use, but their effect in practice has not been studied in detail.

Aim: To compare the impact of a multidisciplinary heart failure management pathway on hospital LOS and 30-day and 60-day readmission rates.

Materials and Methods: A retrospective observational study was carried out in King Fahd Armed Forces Hospital, Jeddah, in 86 adult patients with HF (43 pre-implementation in 2023 and 43 post-implementation in 2024). Demographic, comorbidity, ejection fraction, LOS, readmissions, and compliance with pathway elements data were gathered. Statistical analysis involved Wilcoxon signed-rank tests of LOS, chi-square tests of readmission rates, and multivariate regression to determine outcome predictors. A p-value of ≤ 0.05 was considered significant.

Results: Median LOS was reduced after implementation, from 7 days (IQR 510) to 5days ($p = 0.001$). The readmission rates decreased as the 30-day rate dropped to 11.6% ($p = 0.042$), and the 60-day rate dropped to 18.6% ($p = 0.023$).

Conclusion: A structured multidisciplinary HF management pathway proved to be effective in patient outcome optimization and utilization of healthcare resources by leading to a significant decrease in hospital LOS and readmission rates.

KEYWORDS: Heart failure, Multidisciplinary pathway, Length of stay, Readmission.

How to Cite: Dr Muhammad Sohaib Ejaz Khan, Dr Alia Abutalib, Dr. Abdulrahman Ghazi Bazi, Dr. Rahaf Khalid Mubarak AL-Zahrani, Dr. Dheyya Faiez alnajar, Dr. Rinad Saad Al Malki, (2025) Evaluating the Impact of a Clinical Heart Failure Management Pathway on Hospital Length of Stay and Readmission Rates, Vascular and Endovascular Review, Vol.8, No.19s, 400-405

INTRODUCTION

Heart failure (HF) is a significant and increasing global health issue.[1] According to recent statistics, it is estimated that there are about 64 million individuals with HF in the world today.[2] With the growing age of the population and increasing survival of people following acute cardiac events, the prevalence of HF keeps increasing and has a huge implication on the morbidity, mortality, quality of life, and utilization of healthcare resources.[3] The complex care requirements of patients with HF make hospitalization with this condition one of the most frequent causes of admission in high-income as well as low- to middle-income nations.[4] Despite the current progress in guideline-based medical treatment and the improvement of outpatient control, HF proves to be a significant burden on healthcare systems because of frequent decompensations that are treated in hospitals.[5]

The rates of readmission among HF hospitalized patients are unacceptably high.[6] The chronic and recurrent nature of HF was signaled by a recent worldwide meta-analysis on more than 1.4 million patients with a pooled 30-day readmission rate of 13.2% and a 1-year all-cause readmission rate of 35.7%.[7] Parallel to this, all-cause 30-day mortality was high at 7.6%, and 1-year mortality was 23.3%.[7]

With these bleak statistics, there has been increased concern with care-delivery models that transcend the traditional physician-led management. The multidisciplinary method, which includes cardiologists, internists, pharmacists, nurses, dieticians,

physiotherapists, etc., and allied health practitioners, is designed to deliver comprehensive and coordinated care, enhance treatment adherence and self-management, manage comorbidities, and facilitate discharge planning and follow-up.[8, 9] In fact, current research studies have depicted encouraging outcomes. An example is a retrospective study that involved an inpatient multidisciplinary educational model where the number of patients with HF hospitalized in 30 days had significantly reduced.[10] Another quality-improvement program decreased the 30-day readmission rates, which were 25.5% in 2019 and 5.6% in 2021, following a thorough care pathway.[11] In addition, improved care coordination has been linked to the reduction of 30-day readmissions, mortality, and HF care expenses.[12]

Other than minimizing readmission, structured care pathways have also been linked to shortened hospital stays. A systematic review of the use of care-paths in HF (as well as other conditions) reported that care pathways decreased in-hospital length of stay on average by approximately 1.9 days (mean difference -1.89 days).[13] This implies that a multidisciplinary pathway could also reduce the strain on hospital resources in addition to the better outcomes, which is crucial to health-system planning and cost management.

Nonetheless, with this positive sign, clinical management pathways of HF are not fully implemented in practice, particularly in non-high-resource situations. The geographic differences in readmission and mortality are significant and cannot be attributed to socioeconomic factors or spending on healthcare in general.[1,7] It is urgently needed that further data, particularly in settings and hospitals in which such pathways are newly implemented, are measured to determine their true effect on patient outcomes and resource use.

Since hospital readmissions and repeat hospitalizations among HF patients are high and persistent, and multidisciplinary care pathways may be effective in improving outcomes and reducing hospital stay, it is necessary to determine how effective a multidisciplinary care pathway can be in a real-world hospital environment. This study aims to address knowledge gaps of crucial importance regarding the actual advantages and practicability of pathway-based care by comparing hospital length of stay (LOS) and readmission rates prior to the implementation of a structured HF management pathway. The research question was to assess the effects of a multidisciplinary clinical pathway of heart failure management on length of stay and 30-day and 60-day readmission in adult heart failure patients.

MATERIALS AND METHODS

This retrospective cross-sectional research was done at King Fahd Armed Forces Hospital, Jeddah, to compare the results of heart failure patients prior to and after the introduction of a multidisciplinary Clinical Heart Failure Management Pathway. The period of the study was months, from 1st April 2025 to 31st September 2025. The Research Ethics Committee (REC) of King Fahd Armed Forces Hospital provided ethical approval to the study under REC 787, dated 20 March 2025.

The OpenEpi Version 3.0 was used to calculate the sample size. Based on a prior study, which indicated the reduction of 30-day readmission rates from 32% to 18% after the multidisciplinary heart failure interventions. with a 95% confidence interval and a power of 80%. The sample of 86 patients was obtained using these proportions.[14]

Non-probability consecutive sampling was employed, and all the eligible patients were enrolled up to the required sample size. The population under study comprised adult patients aged 18 years or above who were admitted with a primary diagnosis of heart failure and who were identified using ICD-10 codes I50.x. The inclusion of only patients with at least one hospital admission in 2023 and one admission in 2024 allowed conducting a paired comparison of pre-implementation and post-implementation outcomes of the clinical heart failure management pathway. Medical records were reviewed, and all eligible cases were included consecutively until the required sample size was reached. The exclusion criteria were incomplete or missing vital clinical data required to analyze the medical records of patients. Deceased patients in the hospital were also not included, since their results would not be available to make readmission determinations. In addition, the patients whose \stay in hospital was considerably extended because of the presence of acute illnesses, e.g., sepsis, severe infections, or significant trauma, were excluded because of confounding, as such factors may affect length of stay without regard to heart failure severity.

A Clinical Heart Failure Management Pathway was introduced in 2024 to provide all eligible participants with a standardized and optimized care of patients with congestive heart failure (CHF).[15] The pathway was developed as a multidisciplinary model with early specialist consultation by cardiologists, 24 hours of admission, introduction and optimization of guideline-directed medical therapy (GDMT), and daily interdisciplinary meetings of cardiologists, dietitians, physiotherapists, and nursing personnel.[16] The care plan of every patient involved personalized counselling on medication adherence, diet and fluid management, smoking quit, and follow-up clinic visits. A checklist was used to prepare for the post-hospital discharge by using the structured discharge planning checklist. Compliance with every element of the pathway was highly observed and recorded in the electronic health records to ensure a uniform application by all subjects. This approach aimed to make CHF patients experience coordinated, evidence-based, and holistic care during their hospitalization and transition to outpatient follow-ups.

Data were obtained from the hospital electronic health record system. Demographic data (age, sex, ethnicity, etc.) were gathered on each patient, as well as clinical data (ejection fraction, comorbidities, including hypertension, diabetes, and chronic kidney disease, and smoking). Hospital length of stay, 30-day readmission, and 60-day readmission results were measured on each admission of both years. In the post-implementation group, pathway-related factors such as cardiology, dietary services, physiotherapy, and smoking-cessation counseling were also recorded. Data analysis was conducted anonymously to ensure confidentiality.

The analysis of statistics was conducted through SPSS version 26. Continuous variables, including length of stay, were summarised with the mean and standard deviation of normally distributed data and median and interquartile range of skewed data. The Shapiro-Wilk test was used to identify the right statistical tests since it was used to test the normality of continuous variables. The Wilcoxon signed-rank test was applied to compare LOS, 30-day readmission, and 60-day readmission rates before and after implementation of the heart failure management pathway. The chi-square test was applied to categorical variables such as readmission outcomes, pathway components adherence. Multivariate regression analysis was used to determine predictors of lower length of stay and readmission rates that were independent of demographic and clinical factors. A p-value of at most 0.05 was regarded as statistically significant.

RESULTS

The demographic features of the research group, including 86 participants, 43 in the pre-implementation (2023) and 43 in the post-implementation (2024) cohorts, were overall similar. The average age of the pre-implementation group was 67.8 ± 10.5 years old, with 58.1% men. The prevalence of hypertension was 72.1 and the prevalence of diabetes mellitus was 41.9, and ischemic cardiomyopathy was 67.4%. The average ejection fraction ranged from 32.5 ± 7.4%. The mean age of the participants in the post-implementation group was 68.1 ± 9.8 years, and 55.8 percent of the cohort comprised males. Hypertension was noted in 69.7% of the participants, diabetes mellitus in 46.5% and ischemic cardiomyopathy in 65.1% with the mean ejection fraction being 33.0 ± 6.9. Age, gender distribution, comorbidities, and baseline cardiac functioning did not show statistically significant differences between the two groups, which shows that the cohorts were matched well to compare the outcomes after the implementation of the clinical pathway of heart failure management. (Table 1)

Table 1: Baseline Characteristics of Participants (n = 86)

Variable	Pre-implementation (2023) n = 43	Post-implementation (2024) n = 43	p-value
Age (years), Mean ± SD	67.8 ± 10.5	68.1 ± 9.8	0.881
Male, n (%)	25 (58.1%)	24 (55.8%)	0.823
Hypertension, n (%)	31 (72.1%)	30 (69.7%)	0.801
Diabetes Mellitus, n (%)	18 (41.9%)	20 (46.5%)	0.672
Ischemic Cardiomyopathy, n (%)	29 (67.4%)	28 (65.1%)	0.823
Ejection Fraction (%), Mean ± SD	32.5 ± 7.4	33.0 ± 6.9	0.725

The comparative results of the main outcomes demonstrated a considerable improvement after the introduction of the clinical pathway of heart failure management. The median length of stay reduced in the pre-implementation group from 7 days (IQR 5-10) to 5 days (IQR 3-7) in the post-implementation group, which was statistically significant (p = 0.001, Wilcoxon signed-rank test). Also, the 30-day readmission rate dropped to 11.6% in 2024 compared to 27.9% in 2023 (p = 0.042, chi-square test), and the 60-day readmission rate dropped to 18.6% in 2024 compared to 41.9% in 2023 (p = 0.023). (Table 2)

Table 2: Primary Outcomes Before and After Pathway Implementation (n = 86)

Outcome	Pre-implementation (2023) (n = 43)	Post-implementation (2024) (n = 43)	Test Used	p-value
Length of Stay (days), Median (IQR)	7 (5–10)	5 (3–7)	Wilcoxon signed-rank	0.001
30-day Readmission, n (%)	12 (27.9%)	5 (11.6%)	Chi-square	0.042
60-day Readmission, n (%)	18 (41.9%)	8 (18.6%)	Chi-square	0.023

The compliance with the heart failure management pathway was high after implementation of the program in all critical elements. In 81.4% of patients, early specialist assessment during the 24 hours of admission was accomplished, and in 74.4% of those involved, optimized guideline-directed medical therapy (GDMT) initiation. Multidisciplinary rounds were done on 88.4% of the patients daily, and a discharge planning checklist was done on 93.0% of the patients. (Table 3)

Table 3: Adherence to Heart Failure Pathway Components (Post-implementation Only, n = 43)

Pathway Component	Achieved n (%)
Early Specialist Review (≤24 hours)	35 (81.4%)
Optimized GDMT Initiation	32 (74.4%)
Daily Multidisciplinary Rounds	38 (88.4%)
Discharge Planning Checklist Completed	40 (93.0%)

The multivariate regression analysis revealed a number of factors to have an impact on hospital length of stay (LOS) in heart failure patients. Belonging to the post-implementation group corresponded to the substantial decrease in LOS of 1.8 days (p = 0.004), which indicates the success of the clinical pathway. LOS did not significantly correlate with older age and b coefficients of +0.03 (p = 0.142) and -0.4 (p = 0.341), respectively. The trend of higher ejection fraction had statistical significance for shorter LOS, but was not statistically significant (p = 0.085). A positive albeit minor effect of diabetes mellitus on LOS was observed (p = 0.031). (Table 4)

Table 4: Multivariate Regression Predicting Length of Stay (LOS)

Predictor	β Coefficient	95% CI	p-value
Post-implementation group	–1.8	–3.0 to –0.6	0.004
Age (years)	+0.03	–0.01 to 0.07	0.142
Male sex	–0.4	–1.2 to 0.5	0.341
Ejection fraction (%)	–0.06	–0.12 to 0.01	0.085
Diabetes Mellitus	+0.9	0.1 to 1.7	0.031
(Dependent variable: LOS in days)			

Multivariate logistic regression analysis of 30-day readmission showed that post-implementation patients were much less likely to be readmitted than pre-implementation patients, with an adjusted odds ratio of 0.32 (95% CI: 0.11–0.92; p = 0.032). The age, ejection fraction, and diabetes mellitus were not significantly related to 30-day readmission (p=0.321, 0.102, 0.451, respectively). (Table 5)

Table 5: Multivariate Logistic Regression for 30-day Readmission

Predictor	Adjusted OR	95% CI	p-value
Post-implementation group	**0.32**	0.11–0.92	**0.032**
Age (years)	1.02	0.98–1.07	0.321
EF (%)	0.96	0.91–1.01	0.102
Diabetes Mellitus	1.5	0.52–4.30	0.451
(Outcome: 30-day readmission yes/no)			

DISCUSSION

Among 86 heart failure (HF) patients (43 pre-implementation and 43 post-implementation) in the current study, hospital length of stay (LOS) was significantly reduced (7 days IQR 5-10 decrease to 5 days IQR 3-7), as were 30 day and 60 day readmission rates (27.9 to 11.6 and 41.9 to 18.6 pre-implementation and post-implementation, respectively). These results endorse the usefulness of a regulated team-based care route in enhancing the outcomes of HF care.

Our findings are similar to those of the recent regional analysis in the Middle East-North Africa (MENA) region, in which the introduction of a specific HF multidisciplinary team (HF MDT) was linked to a significant decrease in the median LOS (8 days to 5 days) and a decrease in 30-day readmission (26.5% to 11%).[17] Likewise, a retrospective study in the United States (2021) showed that an inpatient multidisciplinary educational intervention, which involves pharmacy and allied health, was linked to lower 30-day readmission rates among patients with HF.[10,17] These similarities support the applicability of multidisciplinary HF pathways: in a variety of geographies and healthcare environments, the coordinated care appears to produce better results.

Further, our findings are supported by meta-analytic and systematic review data. An overview of nursing care provided holistically in HF patients indicated that the number of readmissions due to HF has been significantly reduced (OR = 0.77) relative to ordinary care.[8] A different older but more powerful meta-review regarding care pathways in HF showed a decrease in LOS of approximately 1.9 days (mean difference -1.89 days) and a decrease in readmission rates in some, but not all, of the studies.[13] It may be because our data indicate relatively larger relative improvements, potentially indicative of the maturity of the pathway, strong compliance with pathway components, or the current innovations in HF therapy and discharge management.

A recent 2025 study also lends credence to our intervention: an academic medical Centre with a multidisciplinary intervention where transition of care was the central element (inpatient education, pharmacist involvement, post-discharge follow-up up and early outpatient clinic follow-up) found a 4.3% absolute change in 30-day readmissions (p = 0.0325).[18] Though the amount of decrease in that large cohort was not as substantial as our own, probably because of disparities in baseline readmission risk, patient population, and the degree of intervention, the direction is the same.

Nonetheless, the recent data does not support dramatic readmission reductions across the board. An extensive database analysis of HF hospitalizations revealed that 30-day all-cause readmission in HFpEF patients was still high (18.4%) and even rising (to 19.9%) during that time frame.[19] The growing trend of readmissions highlights the difficulty of managing readmissions in real-world care of HF and hints that readmission reduction might not be achieved spontaneously unless systemic measures are taken, such as care pathways. Our post pathway 11.6% 30-day readmission rate is notable, especially compared to that trend.

Our results are also aligned with the overall trend in HF management of early, aggressive, and coordinated management. In a 2025 meta-analysis of more recent HF therapies (e.g., SGLT2 inhibitors, ARNI, iron therapy), the authors discovered that early initiation of such therapies in hospitalized or so-called vulnerable phase patients lowered the risk of rehospitalization by a significant margin.[20] Although in our study we did not specifically compare new pharmacotherapies, the high percentage of patients undergoing optimized guideline-directed medical therapy (GDMT) and early specialist review could have been a factor in better results, a trend also observed in facilities adopting comprehensive inpatient care.

Conversely, at least one recent study in a UK heart center sounded a warning bell: patients assessed by the inpatient heart failure team (HFT) demonstrated more successful initiation of all four pillars of HF therapy but paradoxically increased median LOS (5.5 days vs. 3.0 days) than those who were not assessed by HFT.[20] This is unlike the current study results, which emphasize the fact that pathway implementation does not always result in decreased LOS. The difference can be explained by differences in

healthcare system limitations, discharge preparedness, or local practice: in our pathway, the primary focus on early discharge planning and multidisciplinary rounds was prioritized, whereas in the UK study, the priority on the initiation of therapy might have been more important than on the timing of discharge. This highlights the need to make HF pathways institution-specific to workflows and available resources.

Our study has the following strengths: it used a well-defined pre vs. post implementation cohort, balanced baseline constraints, and high compliance of major pathway elements (early review, GDMT initiation, multidisciplinary rounds, and discharge checklists). The statistically significant decrease in the LOS and readmission rates complements a growing body of evidence in support of structured HF care pathways.

However, the present study has limitations. The findings of the current research are representative of ideal conditions; a real-life application can be faced with variations in compliance, complexity of patients, or external limitations like staffing, post-discharge support. In addition, although we were able to account for predictors in regression models, unmeasured confounders, including socioeconomic status, home support, and quality of post-discharge outpatient care, can affect readmission.[21] The current literature suggests social determinants, health literacy, and access to resources (such as post-discharge follow-up, transport, and home care) are predictors of readmissions. In addition, the changing HF treatment options (e.g., SGLT2i, ARNI, and iron) and outpatient management patterns may have an independent effect on the outcomes regardless of inpatient routes.

These results endorse the wider adoption of multidisciplinary HF pathways, particularly in environments where conventional care is disjointed. Hospitals ought to contemplate organizing specific HF multidisciplinary groups, early specialist assessment, and enhanced initiation of GDMT, systematic discharge planning, and post-discharge follow-up. Future studies are required to assess sustainability in longer follow-up periods (6-12 months), cost-efficacy, and investigate newer treatment methods and telemedicine/remote monitoring devices.

CONCLUSION

A multidisciplinary clinical heart failure management pathway implementation was correlated with significant patient outcomes, such as a significant decrease in hospital length of stay, a significant decrease in 30 and 60-day readmission rates. These findings underscore the importance of team-based care, which is organized, coordinated, and includes an early review by specialists, maximized guideline-based medical treatment, and staged discharge planning. This study can be of great benefit since it can illustrate the feasibility of implementing the same routes in other healthcare facilities, ultimately improving the quality of care that patients with heart failure receive, as well as decreasing the medical cost of treating them, which in turn would diminish the financial burden of healthcare systems.

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