ORIGINAL ARTICLE

Impact of a Specialized Heart Failure Unit on Patients Hospitalized for Acute Heart Failure: A 10-Year Experience

Impacto de una unidad especializada en insuficiencia cardíaca en pacientes hospitalizados por insuficiencia cardíaca aguda: análisis de una década de experiencia

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ABSTRACT

Background: Acute heart failure (HF) remains one of the leading causes of hospitalization, morbidity, and mortality worldwide. The implementation of specialized HF units has been shown to improve the quality of care and clinical outcomes; however, there is limited evidence about their sustained impact in Latin America.
Objective: The aim of this study is to evaluate the impact of a specialized HF unit on quality-of-care measures in patients hospitalized for acute heart failure.
Methods: We conducted a retrospective cohort study that included consecutive patients admitted with a primary diagnosis of acute HF between January 2014 and December 2024. The HF program included a critical path method, structured discharge checklist, full-time physicians, specialized nurses, dedicated administrative staff, discharge education with written instructions, structured post-discharge follow-up, priority consultations, periodic presentation of indicators, grand rounds for advanced management decisions, lung ultrasound-guided decongestion, telemonitoring, and a day hospital. Over the last two years, patients selected as low-risk and treated exclusively in the day hospital were excluded. The endpoints analyzed included annual in-hospital mortality, 30-day hospital readmission, and length of hospital stay. Two periods were analyzed: the initial phase (2014–2019) and the consolidation phase (2020–2024).
Results: A total of 3368 hospitalizations for acute HF were analyzed. The annual volume of hospitalizations increased from 260 in 2014 to 463 in 2024 ($p = 0.002$). In-hospital mortality exhibited a slight, non-significant falling trend (from 5.0% to 3.9%). The 30-day hospital readmission rate remained stable, with less variability in the most recent years. Mean length of hospital stay decreased significantly from 9.3 days to 2.8 days ($p < 0.001$) and was significantly shorter during the consolidation phase (median 3.6 vs. 6.8 days; $p = 0.004$).
Conclusion: The implementation and consolidation of a specialized HF unit was associated with an increase in patient volume and sustained improvements in hospital efficiency, reflected in a significant reduction in length of hospital stay. The greater stability in mortality and hospital readmission rates during the consolidation phase suggests a sustained improvement in the quality of care, supporting the development of structured care models in Latin American health systems.

Key words: Acute heart failure - Decompensated heart failure - Heart failure units - Quality of health care

RESUMEN

Introducción: La insuficiencia cardíaca (IC) aguda continúa siendo una de las principales causas de hospitalización y morbimortalidad a nivel mundial. La implementación de unidades especializadas en IC ha demostrado mejorar la calidad asistencial y los resultados clínicos; sin embargo, la evidencia sobre su impacto sostenido en América Latina es limitada.
Objetivo: Evaluar el impacto de una unidad especializada en IC sobre métricas de calidad asistencial en pacientes hospitalizados por IC aguda.
Material y métodos: Se realizó un análisis retrospectivo de una cohorte consecutiva de pacientes hospitalizados con diagnóstico principal de IC aguda entre enero de 2014 y diciembre de 2024. El programa de IC incluyó manejo basado en caminos críticos, checklist estructurado al alta, médicos con dedicación exclusiva, enfermeros especializados, personal administrativo dedicado, educación al alta con indicaciones escritas, seguimiento posalta estructurado, consultas prioritarias, presentación periódica de indicadores, ateneos para decisiones de manejo avanzado, descongestión guiada por ultrasonido, telemonitoreo y hospital de día. En los últimos dos años, pacientes seleccionados de bajo riesgo tratados exclusivamente en hospital de día no fueron incluidos. Los puntos finales

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analizados anualmente fueron mortalidad intrahospitalaria, rehospitalización por IC a 30 días y duración de la estadía hospitalaria. Se compararon dos períodos: etapa inicial (2014–2019) y etapa de consolidación (2020–2024).
Resultados: Se analizaron 3368 hospitalizaciones por IC aguda. El volumen anual de internaciones aumentó de 260 en 2014 a 463 en 2024, con una tendencia creciente significativa (p=0,002). La mortalidad intrahospitalaria mostró una leve tendencia descendente (5,0% a 3,9%), sin significación estadística. La rehospitalización a 30 días se mantuvo estable, con menor variabilidad en los años más recientes. La duración de la estadía hospitalaria se redujo progresivamente de 9,3 a 2,8 días (p<0,001), siendo significativamente menor en la etapa de consolidación (mediana 3,6 vs. 6,8 días; p=0,004).
Conclusión: La implementación y consolidación de una unidad especializada en IC se asoció con un aumento del volumen asistencial y mejoras sostenidas en la eficiencia hospitalaria, reflejadas en una reducción significativa de la duración de la estadía. La mayor estabilidad de la mortalidad y la rehospitalización durante la etapa de consolidación sugiere una mejora sostenida en la calidad de la atención, apoyando el desarrollo de modelos estructurados de atención en sistemas de salud de Latinoamérica.

Palabras clave: Insuficiencia cardíaca aguda - Insuficiencia cardíaca descompensada - Unidades de insuficiencia cardíaca - Calidad de atención médica

INTRODUCTION

Heart failure (HF) is one of the leading causes of morbidity and mortality worldwide and represents a significant public health problem. This disease has a dynamic risk profile: risk is particularly high at the time of diagnosis, tends to decrease with the implementation of guideline-directed medical therapy, and increases significantly again with each episode of decompensation. (1)

Approximately one out of six patients with HF with reduced ejection fraction (HFrEF) develops worsening HF within the first 18 months of follow-up, resulting in the need for hospitalization or treatment with intravenous diuretics. These patients also present high hospital readmission rate as early as the first month following the index event, reflecting the recurrent and complex nature of the disease. (2)

In recent decades, HF has evolved into a global epidemic, with a lifetime risk estimated at up to 25% (3,4) and a cumulative mortality rate reaching 30–50% at 3 years and up to 75% at 5 years. (5) This impact is magnified in Latin America, where the burden of disease and structural constraints underscore the need for structured care strategies tailored to the local context.

Acute HF remains one of the leading causes of hospitalization and mortality, particularly in subjects older than 65 years. Not only does it have a profound individual impact, but it also poses a significant burden on health care systems, given the vast resources required for its management. Despite the advances achieved in the armamentarium and prevention strategies, the rate of mid-term adverse events remains alarmingly high in patients hospitalized for acute HF. The probability of hospital readmissions within six months reaches approximately 50%, with annual mortality ranging between 12% and 20% according to various international registries. (6-8) These figures, consistent across different regions and settings, demonstrate that hospitalization for HF remains an adverse risk marker.

Reducing readmissions for HF is a strategic goal, as it can simultaneously lower healthcare costs and improve the quality of care provided. However, achieving this goal poses a complex challenge for healthcare systems, particularly in countries with structural and budgetary constraints. In this context, the increasing complexity of HF and the expansion of therapeutic options have given rise to new care requirements, including specialized units, multidisciplinary teams, trained personnel, adequate infrastructure, and integrated care networks across different levels and centers. (9-11)

In this scenario, specialized heart failure units have emerged as an innovative organizational model of care, integrating trained multidisciplinary teams, standardized protocols, educational strategies, and structured monitoring. In developed countries, various programs of this type have been shown to reduce hospital readmissions, improve adherence to guideline-directed medical therapy, and optimize the quality of healthcare quality measures, with a favorable impact on mortality and long-term costs. (12-16)

However, there is still limited and fragmented evidence regarding the implementation, sustainability, and adaptation of these models in the Latin American context, particularly in Argentina. In low- and middle-income countries, the limitations in access to timely diagnosis, prognosis-modifying therapies, and organized models of care create a significant gap between guideline recommendations and real-world practice, resulting in high rates of rehospitalization and mortality. (17-20)

OBJECTIVE

Within this framework, the primary objective of this study is to evaluate the impact of a specialized heart failure unit on quality-of-care measures in patients hospitalized for acute heart failure at a high-complexity center in Latin America. To this end, the program's development was examined in two stages: the initial phase (2014–2019) and the consolidation phase (2020–2024). The indicators analyzed included in-hospital mortality, 30-day hospital readmission, and length of hospital stay, with the aim of assessing the program's development over a 10-year period.

METHODS

Study design

We conducted a retrospective observational cohort study that included consecutive patients admitted with a primary

diagnosis of acute HF between January 2014 and December 2024. The study was conducted at a leading cardiology center in Argentina, which implemented a structured program for the management of HF.

Inclusion and exclusion criteria

Patients diagnosed with primary acute HF were included in the study.

Those patients with HF secondary to infective endocarditis, severe organic valvular heart disease requiring intervention, myocarditis, acute myocardial infarction, or pulmonary thromboembolism were excluded, as well as those undergoing invasive procedures during hospitalization, such as cardiovascular surgery, percutaneous coronary intervention, pacemaker implantation, or heart transplantation.

Patient identification and data collection

Heart failure patients were identified based on the diagnoses recorded using the International Classification of Diseases (ICD) coding system. The discharge diagnosis was recoded and verified by a trained nurse. In cases of inconsistencies, the final decision was made by consensus between two heart failure specialists.

The variables analyzed included in-hospital mortality, length of hospital stay, 30-day hospital readmission for HF, documented education at discharge, prescription of beta-blockers and renin-angiotensin system inhibitors or angiotensin receptor-neprilysin inhibitors (ARNIs) in recent years, and assignment of a follow-up appointment at discharge.

In 2023, the Institute for Clinical Effectiveness and Health Policy (IECS) conducted an external audit to assess the methods used for analyzing the indicators.

The collected data was updated monthly, with the cutoff date set at the end of each month. Based on this data, graphs and reports were prepared and presented at the institutional regular review meetings. The Annual Indicators Report served as the systematic synthesis of all the information.

Specialized HF management program

The specialized HF management program implemented in the unit consisted of a multidisciplinary and comprehensive approach, with the following key characteristics (Figure 1):

Critical path method: Standardized protocols for the management of acute HF, including decongestion strategies, titration of prognostic-modifying medication, early mobilization, identification of barriers to discharge, and structured discharge planning.

Structured hospital discharge checklist: Assessment of the implementation of pharmacological treatment, scheduled post-discharge follow-up appointment, need for devices, patient education, and prognosis-modifying strategies (vaccination, smoking cessation counseling).

Dedicated heart failure physicians: A dedicated team of HF-specialist cardiologists leading patient care with full-time commitment and involvement in the training of future HF specialists.

Specialized HF nurses: Advanced practice nurses specialized in HF management who performed periodic clinical assessments, follow-up, and continuous monitoring of treatment response.

Dedicated administrative staff: Efficient coordination of hospital discharges, outpatient follow-up tracking, and post-discharge clinic scheduling.

Discharge education with written instructions: Provision of comprehensive patient education materials detailing HF management, medication adherence strategies, and warning signs via educational booklets, a dedicated website, and pre-discharge nurse counseling.

Written patient instructions: Grid with drug names, specific dosages, and timing/administration schedules.

Structured post-discharge follow-up: Active follow-up through in-person and virtual consultations, with an initial post-discharge follow-up scheduled within 14 days of discharge. High-risk patients were scheduled for appointments at the day hospital.

Priority consultations: Provision of urgent, rapid-access consultations at the day hospital for complex and high-risk patients.

Grand rounds for advanced management: Periodic multidisciplinary case discussions for complex clinical decision-making, including advanced HF, cardiogenic shock, pulmonary hypertension, cardiomyopathies, and cardiac transplantation.

Ultrasound-guided lung decongestion: Use of ultrasound to assess response to diuretics and optimize congestion management.

Urinary sodium measurement: to systematically adjust the diuretic algorithm in the day hospital and in selected cases during hospitalization.

Telemonitoring: Progressive implementation over the past three years of technology for remote monitoring of vital signs and clinical parameters following hospital discharge.

Day hospital: Outpatient management of selected patients with low-risk acute heart failure and intensive follow-up of higher-risk patients, thereby avoiding unnecessary hospitalizations.

Regular presentation of quality indicators: Analysis and regular presentation of care measures as part of an institutional program for continuous quality improvement.

Invasive testing: In patients with heart failure, pulmonary hypertension, and post-heart transplantation

Definition of variables

The following endpoints were defined:

In-hospital mortality: Percentage of patients who died during the index hospitalization.

30-day hospital readmission: Percentage of patients who were readmitted within 30 days following discharge due to acute heart failure.

Length of hospital stay: Total number of days of hospitalization per patient.

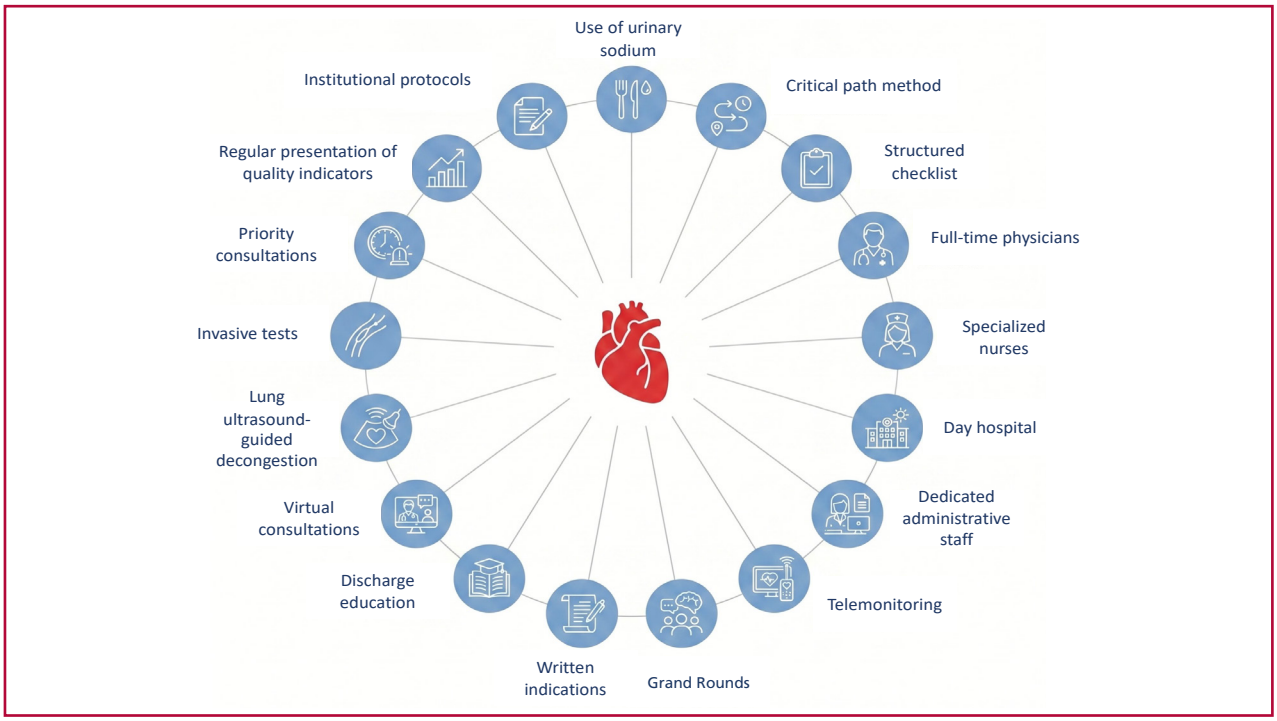
Statistical analysis

Descriptive statistics were used to characterize the study population and the results of the quality measures. Qualitative variables are presented as frequency and percentage, and quantitative variables are expressed as mean and standard deviation (SD) or median and interquartile range (IQR) according to their distribution. Linear regression analysis was performed to evaluate temporal trends in mortality, hospital readmission, and length of hospital stay. Results were compared between the two periods using the Student's t-test for continuous variables and the chi-square test for categorical variables. Additionally, the coefficient of variation (CV) was calculated for in-hospital mortality and 30-day hospital readmission in each period, as a measure of the stability and consistency of care performance over time. A p-value < 0.05 was considered statistically significant.

Ethical considerations

The study was approved by the institutional review board

Fig. 1. Components of the comprehensive heart failure care program



and registered on the PRIISA.BA platform of the Ministry of Health of the City of Buenos Aires. All the patients signed an informed consent form authorizing the transfer of their personal data for scientific purposes. The study was conducted following national and international ethical standards for research on human subjects, as the Declaration of Helsinki, (21) National Ministry of Health resolution 1480/20011, Act 3301 of the city of Buenos Aires, and ANMAT regulation 6677/10 with amendments 4008 and 4009.

RESULTS

Demographic and clinical characteristics

A total of 3368 hospitalizations for acute HF between 2014 and 2024 were analyzed. Mean age was 72±10 years and 60% were men.

Hospitalization volume and trends

The annual volume of hospitalizations for acute HF increased significantly over the years, rising from 260 in 2014 to 463 in 2024 ($p = 0.002$) (Figure 2).

In-hospital mortality

In-hospital mortality exhibited a slight decrease across the study period, falling from 5.0% in 2014 to 3.9% in 2024, although this reduction was not statistically significant ($p = 0.648$). However, there was a trend toward lower in-hospital mortality and greater stability with a lower coefficient of variation (Figure 3).

Length of hospital stay

The length of hospital stay showed a progressive and sustained reduction over the analyzed period (2014–2024), with a significantly downward trend over time ($p < 0.001$).

Mean length of hospital stay decreased significantly from 9.3 days in 2014 to 2.8 days in 2024 ($p < 0.001$). Median length of stay was significantly shorter during the program consolidation phase compared to the initial period: 3.6 (IQR 0.7) vs. 6.7 (IQR 1.9); $p = 0.004$ (Figure 4).

30-day hospital readmission

30-day hospital readmission rate for HF did not show statistically significant differences between the program initial period (2014–2019) and the consolidation phase (2020–2024). However, there was a significant shift in the temporal pattern of the indicator. During the initial phase, annual hospital readmission rates showed marked inter-annual variability, with values ranging approximately from 6% to 21%. In contrast, during the consolidation phase, 30-day hospital readmission rate remained within a narrower range, with values consistently around 13–14%. This finding was reflected in a substantial reduction in the CV of this indicator during the consolidation phase compared to the initial period, suggesting more stable and consistent care performance over time (Figure 5).

DISCUSSION

The results suggest that the implementation of a specialized heart failure unit was associated with a positive impact on multiple healthcare quality measures, particularly in terms of hospital efficiency. The sus-

tained reduction in length of hospital stay observed over the decade analyzed constitutes the most robust finding of the study and reflects more effective clinical management. This is likely related to optimized lung decongestion, earlier initiation of prognosis-modifying therapies, and the structured organization of the discharge and post-discharge follow-up processes. These findings are consistent with international experiences that have demonstrated that specialized heart failure units improve efficiency and clinical outcomes, especially in middle-income health systems. (10)

In-hospital mortality presented an absolute reduction, from 5.0% in the initial phase to 3.9% in the consolidation phase; yet this difference was not statistically significant. International registries such as ADHERE (22) and ESC-HF Pilot (23) have reported similar rates, while national and regional studies have described higher in-hospital mortality rates, ranging from 7% to 11%. (17,20,24) The lack of statistical significance in our analysis may be attributed to the clinical heterogeneity of the patients and the inherent complexity of acute HF, a condition that remains associated with high mortality, even under optimal management. However, the observed reduction in absolute terms, along with greater inter-annual stability of the indicator, suggests a possible beneficial effect of the implemented care model.

The 30-day hospital readmission rates for HF were not significantly different between the two periods. However, during the consolidation phase, there was a marked reduction in the inter-annual variability of the indicator, as reflected in a lower CV. This finding suggests more consistent and predictable care performance, which may be linked to the implementation

Fig. 2. Trend in the annual number of acute heart failure hospitalizations during the implementation of the program and consolidation phase

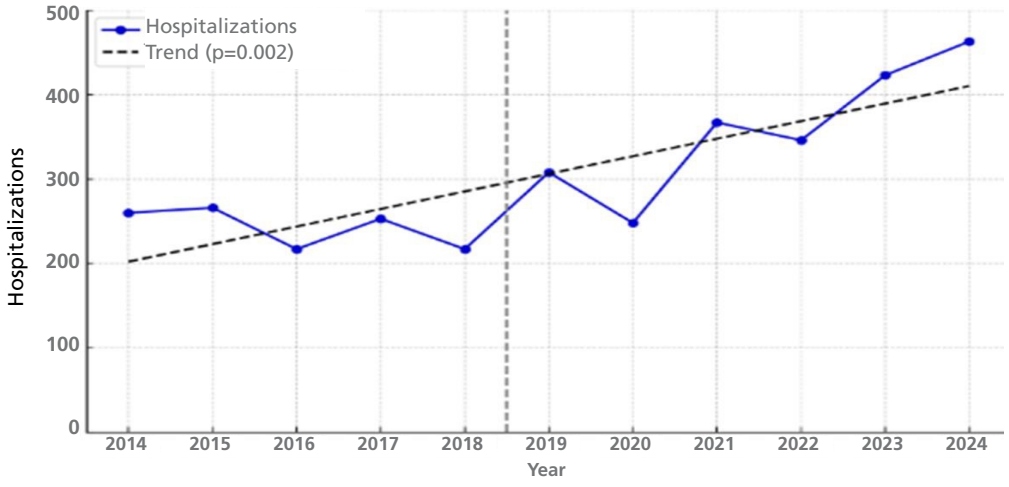
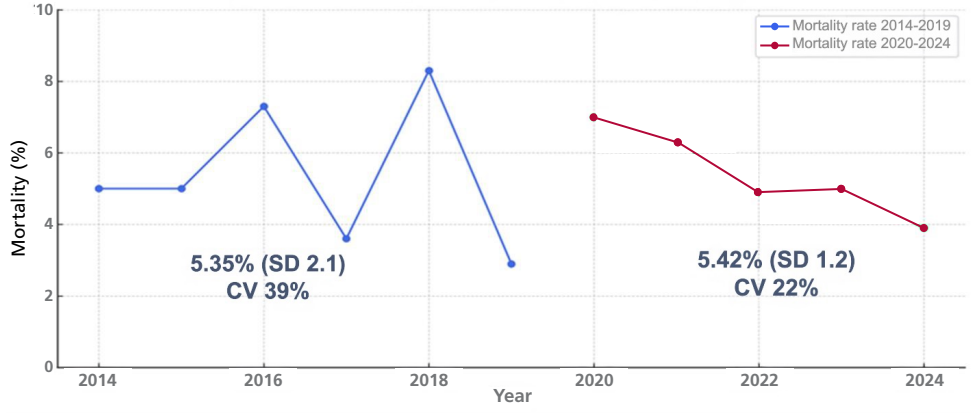
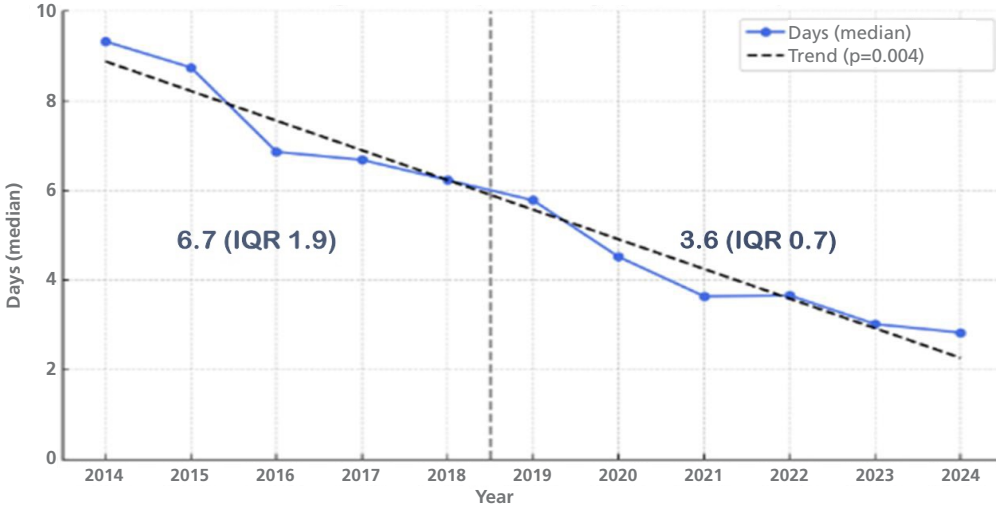


Fig. 3. In-hospital mortality in patients hospitalized for acute heart failure by program phase



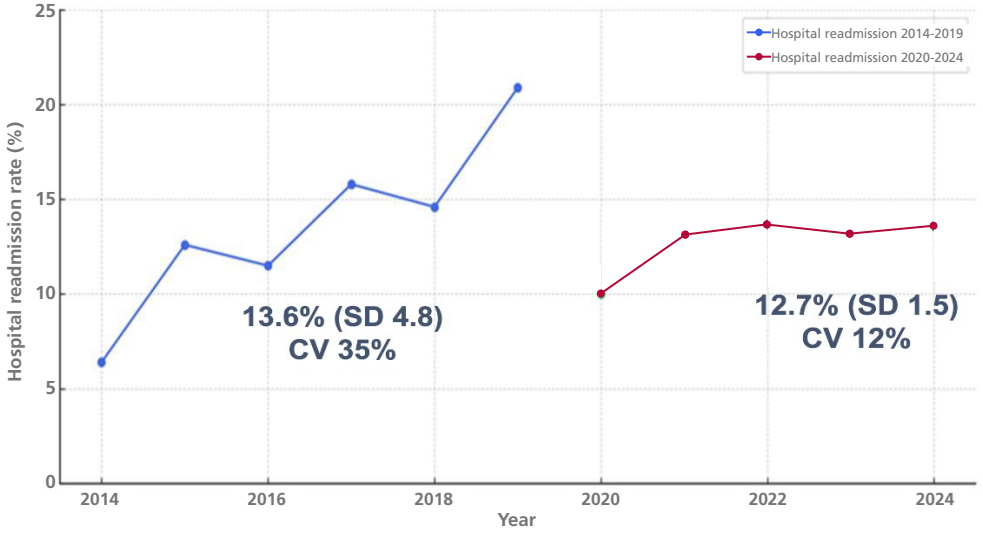
CV: coefficient of variation; SD: standard deviation

Fig. 4. Length of hospital stay for acute heart failure by program phase



IQR: Interquartile range

Fig. 5. Hospital readmission for heart failure at 30 days by program phase



CV: coefficient of variation; SD: standard deviation

of standardized processes, structured follow-up, discharge education, and the use of a day hospital for selected high-risk patients.

From the perspective of continuous quality improvement, stability of results constitutes a relevant indicator of care performance. (25) In this regard, even in the absence of significant reductions in hard events, the lower variability observed in mortality and hospital readmission during the consolidation phase can be interpreted as a sign of the program's maturity and greater consistency in the care provided.

The literature has reported that a multidisciplinary approach in HF clinics reduces hospitalizations, improves adherence, and optimizes the use of guideline-directed medical therapy, with an impact on clinical outcomes and costs, particularly in high-income countries. (10,17-20,26)

The prevalence of heart failure and its associated burden continue to rise, driven by population aging and increased survival among patients with cardiovascular disease. (27) In this context, there are still significant challenges related to structural limitations, heterogeneity in the quality of care, and restricted access to specialized care models, particularly in low- and middle-income countries, which is associated with worse clinical outcomes and inefficient use of health-

care resources. (18,28) Our results show that, even in this scenario, the implementation of a structured, specialized care program is feasible and can generate sustained improvements in key care quality measures.

It is important to note that, although the impact on in-hospital mortality and 30-day hospital readmissions did not show statistically significant differences between the two periods analyzed, the progressive and sustained reduction in length of hospital stay constitutes a relevant indicator of improvement in the efficiency and quality of care. Length of hospital stay has been recognized as a measure sensitive to the organization of care and the coordination of care processes. Its reduction, when achieved without an increase in adverse events, reflects more efficient and patient-centered care. (29) In this regard, integrating strategies such as structured discharge education, telemonitoring, and day hospital for selected patients could have contributed to the observed results. (30)

This study provides local evidence on the feasibility and impact of a specialized heart failure unit in a Latin American setting, facilitating comparison of these results with those from national multicenter registries. The ARGEN-IC registry, which included patients from 18 Argentine provinces, reported longer length of hospital stay, high in-hospital mortality, and limited access to early outpatient follow-up. (20) In comparison, our experience shows shorter length of hospital stay rates and greater stability in clinical outcomes over time, suggesting the positive impact of a structured and sustained care model.

The study has several limitations that should be considered. First, it is a single-center, retrospective study, with the biases inherent in this type of design. No analysis was performed adjusted for clinical severity, comorbidities, or other relevant prognostic predictors, which limits the causal interpretation of the results. Furthermore, in recent years, the hospital has established itself as a high-complexity referral center for advanced diseases and as a heart transplant center, which likely increased the proportion of more critically ill patients during the consolidation phase. This might have attenuated the observed impact on some outcomes. Finally, the absence of an external control group limits the possibility of making direct comparisons with other care models, and it was not possible to ensure full adherence to the program's various interventions by all patients.

CONCLUSION

The implementation and consolidation of a specialized HF unit at our institution was associated with significant improvements in hospital efficiency, reflected primarily in a progressive and sustained reduction in length of hospital stay over a decade of experience.

It is important to note that, although the impact on in-hospital mortality and 30-day hospital readmissions did not show statistically significant differences between the two periods analyzed, the greater stability and lower variability of these indicators during the consolidation phase suggest a sustained improvement in the quality of care provided.

These findings provide evidence about the feasibility and impact of structured specialized care programs with standardized processes for heart failure patients in Latin America. The observed success in reducing the length of hospital stay and the lower variability in clinical outcomes suggest that this type of model could be replicated in other regional settings, contributing to more effective, predictable, and sustainable care for this vulnerable population.

Conflicts of interest

None declared.

(See authors' conflict of interests forms on the web).

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