Management in health
XXVIII/1/2024; pp.15-19

HEART FAILURE - DESCRIPTIVE STUDY ON HOSPITALIZATION EPISODES IN ROMANIA, 2014–2023

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Heart failure (HF) is a major public health issue that requires specific policies addressing its management in an integrated manner. DRG analysis provides a robust foundation for understanding the costs and complexity associated with HF and can support policymaking by delivering scientific evidence. These data can be used to identify areas in need of improvement, such as reducing hospital stays and preventing readmissions.

A multidisciplinary approach that includes patient education, cardiac rehabilitation, remote monitoring, and the involvement of primary care physicians can reduce recurrent hospitalizations and improve long-term outcomes.

Integrated information systems, supported by in-depth analyses and telemedicine tools, can facilitate patient monitoring, risk prediction, and efficient resource allocation. Future research should focus on developing predictive models based on artificial intelligence to identify patients at high risk of readmission and implementing regional pilot programs for HF management.

Keywords: heart failure, hospitalization, Romania

I. INTRODUCTION

Heart failure (HF) is one of the most prevalent and significant public health challenges worldwide, affecting millions of people and exerting a major socio-economic impact. This progressive chronic condition, characterized by the heart's inability to pump blood efficiently to meet the body's needs, has a high prevalence, particularly among the elderly, and is a leading cause of hospitalization, disability, and mortality.

According to data from the European Society of Cardiology (ESC), heart failure affects 1-2% of the general population, with prevalence rising exponentially with age to nearly 10% among individuals over 70 years old. Each year, over 3.6 million new cases of HF are diagnosed in Europe. Moreover, HF accounts for 3-5% of all hospitalizations across Europe, representing one of the primary causes of admission among elderly patients. Mortality statistics reveal a grim picture: studies estimate a 5-year mortality rate of approximately 50% after diagnosis, placing HF on par with many forms of cancer [1].

In Romania, cardiovascular disease (CVD) remains one of the leading causes of morbidity and mortality. According to the 2022 report *Give Your Loved Ones a Healthy Heart! Know and Prevent Your Cardiovascular Risk!* published by the National Institute of Public Health (INSP) [2], the burden of CVD is staggering:

- **Estimated incidence of CVD:** Approximately 4,660.9 per 100,000 population, representing nearly 1,000,000 patients. New cases of CVD account for 6.66% of all newly diagnosed conditions.
- **CVD prevalence:** In 2021, 1 in 4 individuals in Romania was registered with a cardiovascular disease in primary care. Together with diabetes and chronic obstructive pulmonary diseases, CVD ranks among the top five chronic conditions.
- **CVD burden:** The latest available data indicate that ischemic heart disease (5,636 DALYs per 100,000 population) and ischemic stroke (2,867 DALYs per 100,000 population) are the most burdensome in terms of disability-adjusted life years [3].

Heart failure imposes a substantial burden on healthcare systems due to:

- **Frequent and costly hospitalizations:** HF patients are hospitalized 2-3 times more frequently than those with other chronic cardiovascular conditions.
- **Case complexity:** The presence of comorbidities such as diabetes, chronic kidney disease, or hypertension significantly complicates patient management.

High readmission rates: Approximately 20-25% of HF patients are readmitted within 30 days, reflecting the severity of the condition and challenges in outpatient management.

From an economic perspective, HF is not only a major cause of hospitalizations leading to direct costs for patients and their families, but also drives increased hospital resource utilization and costs. Identifying effective interventions to reduce recurrent hospitalizations and optimize costs is an essential priority for improving the management of this condition.

II. OBJECTIVE

The identification of the national, regional, and local geographic distribution of hospitalization episodes among patients classified under diagnostic groups associated with Heart Failure (HF), as well as the temporal evolution of their number during the period 2014–2023.

III. METHODOLOGY

This study is a descriptive and retrospective analysis based on data reported by hospitals in Romania and included in the National DRG Database. It encompasses all continuous hospitalization episodes reported by Romanian hospitals under contractual agreements with the National Health Insurance House (CNAS) between 2014 and 2023. In accordance with *Order no. 1782/576/2006*, regarding the registration and statistical reporting of patients receiving continuous and day hospitalization services, with subsequent amendments, the National Institute for Health Services Management (INMSS) collects and processes the minimum dataset at the patient level for cases treated in continuous and day hospitalization settings.

The data were selected using the ICD-10-AM classification and the Romanian DRG grouper,

Graph 1: Number of Hospitalization Episodes by ICD-10 Code for Heart Failure (2014–2023, National Level)

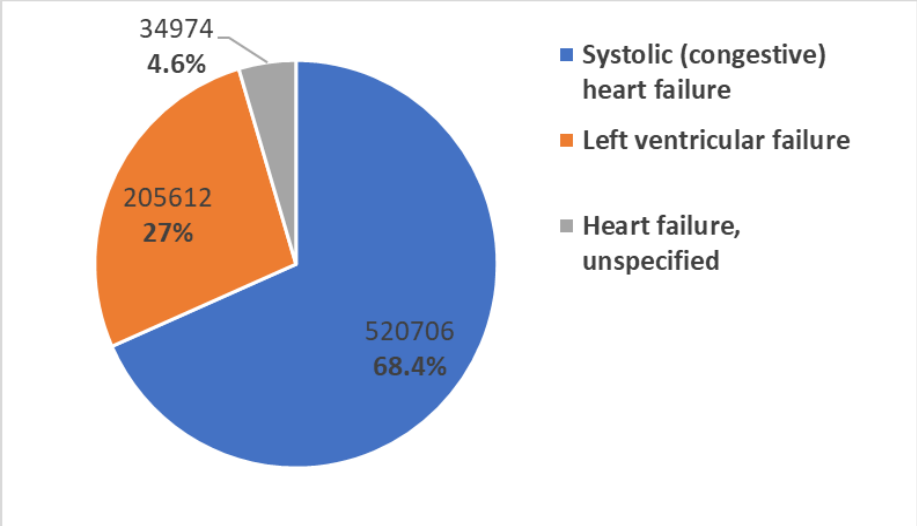
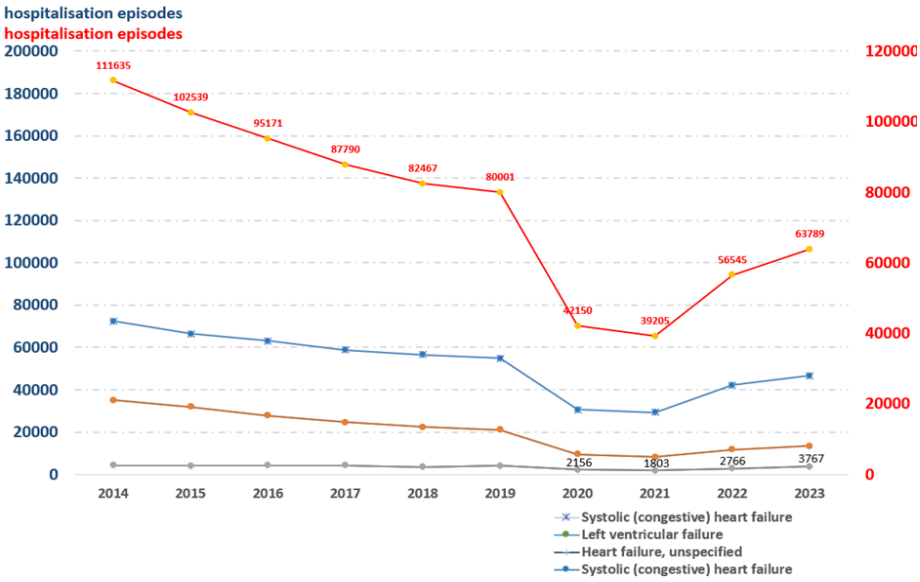


Figure 2. Evolution of the total number of episodes reported as continuous care hospitalizations for patients with Heart Failure, recorded during the period 2014–2023, at the national level



RODRGv1.1. Records from patient observation sheets grouped under three relevant DRG codes were extracted and analyzed:

- *I50.0* (Congestive heart failure),
- *I50.1* (Systolic heart failure),

I50.9 (Unspecified heart failure).

The DRG classification considers severity and the presence of comorbidities (e.g., hypertension, diabetes mellitus, chronic kidney disease). Based on these factors, hospitalization episodes with a primary diagnosis of HF are grouped into related diagnostic groups such as: *F3031* (Heart failure and shock with catastrophic CC), *F3032* (Heart failure and shock without catastrophic CC).

In compliance with the provisions of *Law 190/2018 and Article 13 of EU Regulation no. 679/2016*, personal data is anonymized upon transmission to INMSS, and individual identification for analytical purposes is performed using encrypted personal identification numbers (CNP).

Patient age was calculated in completed years, based on the difference between the admission date and birth date. Data processing was carried out using *SQL Server Management Studio Express 2005*, while subsequent analysis and interpretation were conducted using *SPSS* 20.0 and Microsoft Office Excel software.

The analysis considered a range of demographic and socioeconomic variables, such as age, length of hospitalization, discharge status, and others included in the minimum dataset reported by hospitals within the DRG system. The findings are presented in tables and graphical representations.

IV. RESULTS

OVERVIEW OF THE NATIONAL AND TEMPORAL TRENDS IN HEART FAILURE HOSPITALIZATIONS

The overall landscape of **heart failure hospitalizations** in Romania between 2014 and 2023 was analyzed by examining key indicators, both territorially and over time, for a comprehensive understanding of trends.

TEMPORAL EVOLUTION OF HOSPITALIZATIONS CLASSIFIED AS "HEART FAILURE"

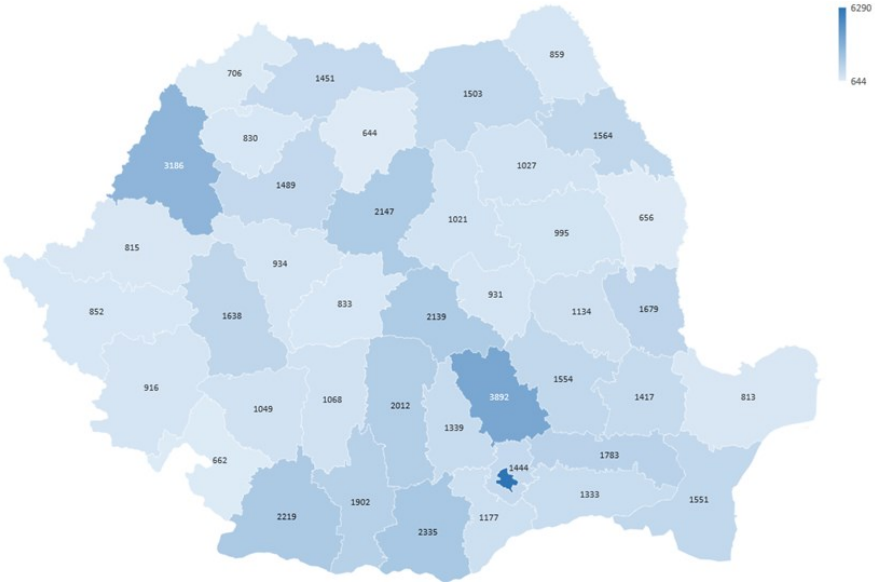
Total Hospitalization Episodes:

The total number of hospital episodes reported as continuous care for patients classified under diagnostic groups related to "Heart Failure" during the 2014–2023 period was 761,292 episodes. Of these, the majority (68.4%) were coded as Congestive Heart Failure, over a quarter (27%) as Left Ventricular Failure, and only 4.6% were grouped as Unspecified Heart Failure – see Graph 1.

Temporal evolution of hospitalization episodes, Heart Failure, in Romania, during the period 2014–2023

The trend over the last 10 years is somewhat downward, interrupted by an abrupt decrease during the COVID-19 pandemic, followed by a gradual recovery in the number of hospitalizations, without yet (as of 2023) reaching pre-pandemic levels.Thus, at the onset of the pandemic, the level was at 70% of the level recorded in the first year of the analyzed period (2014), while in 2023, it can be estimated that the level is slightly above (56%) the level recorded in 2014 – see Figure 2.

Figure 3. Cartogram. Distribution of hospitalization episodes with a diagnosis of Heart Failure at the county level in Romania, in 2023



Distribution of hospitalization episodes at the county level in 2023

At the territorial level, the analysis highlights differences based on the residence of the patient. Thus, at the county level, Bucharest stands out with the highest number of hospitalizations (6,290 continuous care hospitalizations in 2023) for patients with heart failure, while at the opposite end is Bistrița-Năsăud County (644 hospitalizations in 2023).

The highest number of hospitalizations in 2023 was reported for patients from the South-Muntenia region of the country, compared to the western part of the country, although no statistically significant differences between regions were observed (Figure 3).

Demographic Aspects

- *Patient Gender*

Women had 14% more hospitalizations during the analyzed period (2014-2023).

The evolutionary trend by gender follows the general trend, with a general decrease in hospitalizations and a sharp decline during the pandemic period – Table 1.

- *Patient Occupation*

Nearly four out of five (77.4%) of the hospitalizations with a diagnosis of heart failure during the 2014-2023 period belong to retirees, followed by unemployed individuals and those without occupation (10.8%), while employees had a much smaller share (7.4%) – Table 2.

- *Average Age of Hospitalized Patient*

The average age at admission did not vary over time or between genders. The average age at which patients sought hospital care for specific treatments was 70 years – Table 3. In general, women were 3 years older than men. The differences recorded are not statistically significant, neither for gender comparison, by year, nor by DRG group (t-test; p-value > 0.05).

Clinical Aspects

Discharge Status

In-hospital deaths among patients with heart failure diagnosis, continuous hospitalizations

In 2023, between 85-95% of patients with a diagnosis of heart failure hospitalized under continuous care were discharged in an improved condition, with less than 1% being discharged with a "cured" status. The hospital mortality rate among heart failure patients was 5%.
The highest hospital mortality rate was observed among patients with congestive heart failure (5.7%), while for patients with left ventricular failure, the rate was 2.4%, with no significant differences between the two sexes – Table 4 and Graph 4.

Rehospitalizations for the Same Heart Failure Diagnosis

The 761,292 continuous hospitalization episodes from 2014 to 2023 correspond to hospitalizations of 511,892 patients, with the number of readmissions ranging from 1 to 53 hospitalizations. Approximately 1% of patients have more than 20 hospitalizations.

Average Length of Stay

On average, from 2014 to 2023, a continuous hospitalization episode for patients with heart failure lasted 6.5 days (DMS = average length of stay).
The evolution of DMS in recent years has been around 6.5 days, with minor fluctuations in 2019, and then in 2020, followed by slight decreases in DMS from 2021 to 2023. The lowest average was recorded in 2023 – **Graph 5**.

V. DISCUSSIONS

During the analyzed decade (2014-2023), the records highlight territorial and evolutionary variations, as well as variations based on clinical and demographic aspects for the hospitalizations of these patients.

Heart failure continues to represent a significant challenge for healthcare systems worldwide, including Romania, and the analysis of DRG data can highlight several key aspects, such as:

- *High frequency of hospitalizations and associated costs* – Heart failure is a major cause of hospitalization, with a direct impact on the allocation of resources and health budgets. The complexity of cases, associated with the presence of comorbidities, contributes to the high costs per hospitalization episode;
- *High readmission rates* – The large proportion of readmissions, mainly within the first 30 days, reflects difficulties in post-discharge

Table 1. Number of hospitalizations for patients with Heart Failure in Romania, 2014-2023 evolution

DenDiagnostic	Sex	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Grand Total
IC congestiva	Femei	37989	34895	33074	30416	29473	28606	15003	14193	21179	24149	268977
	Bărbați	34323	31572	30088	28397	27123	26270	15549	15015	20906	22486	251729
	Total	**72312**	**66467**	**63162**	**58813**	**56596**	**54876**	**30552**	**29208**	**42085**	**46635**	**520706**
IC ventriculara stanga	Femei	19804	18069	15953	14224	12900	12097	5197	4296	6496	7669	116705
	Bărbați	15238	13862	11880	10468	9412	8988	4245	3898	5198	5718	88907
	Total	**35042**	**31931**	**27833**	**24692**	**22312**	**21085**	**9442**	**8194**	**11694**	**13387**	**205612**
IC, nespecificata	Femei	2231	2233	2261	2316	1915	2238	1094	913	1455	2023	18679
	Bărbați	2050	1908	1915	1969	1644	1802	1062	890	1311	1744	16295
	Total	**4281**	**4141**	**4176**	**4285**	**3559**	**4040**	**2156**	**1803**	**2766**	**3767**	**34974**
INSUFICIENȚA CARDIACĂ -	Femei	60024	55197	51288	46956	44288	42941	21294	19402	29130	33841	404361
	Bărbați	51611	47342	43883	40834	38179	37060	20856	19803	27415	29948	356931
	Total	**111635**	**102539**	**95171**	**87790**	**82467**	**80001**	**42150**	**39205**	**56545**	**63789**	**761292**

Table 2. Occupation of patients with a heart failure diagnosis, Romania, 2014-2023 evolution

Occupation	An 2014	An 2015	An 2016	An 2017	An 2018	An 2019	An 2020	An 2021	An 2022	An 2023	Total	% Total
Retired	89691	81251	74548	68471	64364	61839	31541	28483	41595	47375	589158	77,39%
Unemployed	9927	9742	10001	9211	8807	8303	5136	4896	6735	6998	79756	10,48%
No occupation	667	465	287	249	222	217	110	129	127	158	2631	0,35%
Employee	7537	6902	6600	6365	5861	6111	3331	3423	4871	5519	56520	7,42%
Student/Schoolboy	192	153	165	219	175	248	135	196	321	469	2273	0,30%
Self-employed worker	253	214	224	237	206	185	120	105	130	178	1852	0,24%
Farmer	146	75	51	44	33	22	7	6	18	18	420	0,06%
Employer	56	36	54	93	50	57	18	27	29	43	463	0,06%
NULL	3166	3701	3241	2901	2749	3019	1752	1940	2719	3031	28219	3,71%
Total	111635	102539	95171	87790	82467	80001	42150	39205	56545	63789	761292	100,00%

Table 3. Average age at admission, hospitalizations of patients with Heart Failure, Romania, 2014-2023 evolution

Diagnosis	An 2014	An 2015	An 2016	An 2017	An 2018	An 2019	An 2020	An 2021	An 2022	An 2023	Total
Congestive Heart Failure	70	71	71	71	71	71	71	70	71	71	71
Unspecified Heart Failure	67	66	66	67	67	69	67	68	67	67	67
Left Ventricular Failure	67	68	68	69	69	69	69	69	69	69	68
Total	69	69	70	70	70	70	70	70	70	70	70

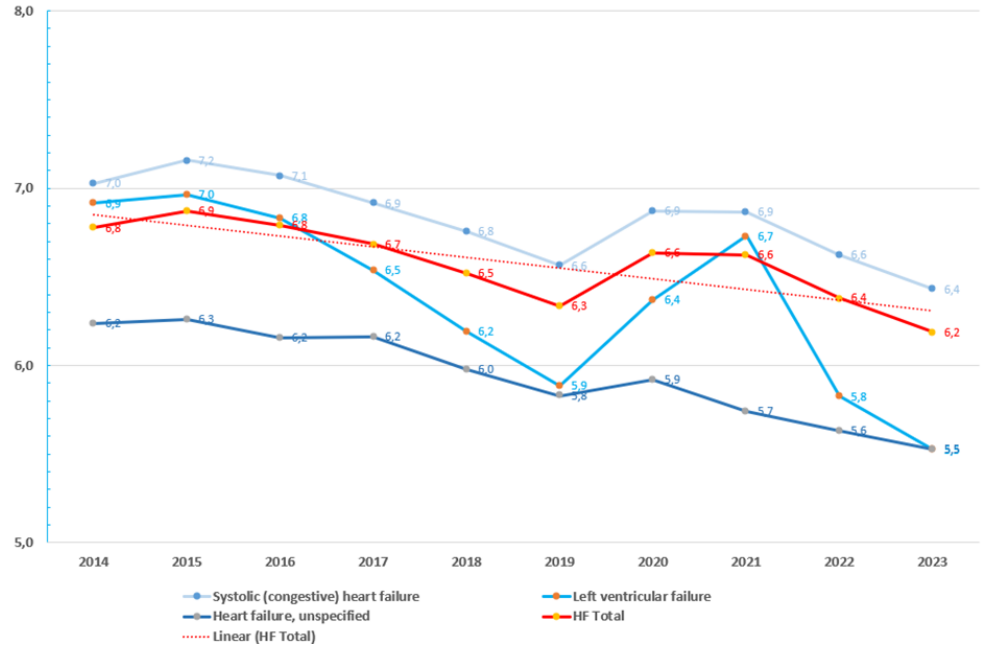
Table 4. Discharge status of patients with heart failure diagnosis, Romania, 2023. Numeric and percentage data by gender.

Numerical situation	Diagnosis	Gender	Recovered	Improved	Unchanged	Worsened	Deceased	Total
Congestive Heart Failure		Femei	99	21883	662	115	1390	24149
		Bărbați	144	20139	801	125	1277	22486
		Total	243	42022	1463	240	2667	46635
Unspecified Heart Failure		Femei	11	1796	110	16	90	2023
		Bărbați	7	1480	143	10	104	1744
		Total	18	3276	253	26	194	3767
Left Ventricular Failure		Femei	43	7218	222	28	158	7669
		Bărbați	25	5316	193	25	159	5718
		Total	68	12534	415	53	317	13387
	HF- Total	Femei	153	30897	994	159	1638	33841
		Bărbați	176	26935	1137	160	1540	29948
		Total	329	57832	2131	319	3178	63789

Percentage situation	Diagnosis	Gender	Recovered	Improved	Unchanged	Worsened	Deceased	Total
Congestive Heart Failure		Femei	0,4%	90,6%	2,7%	0,5%	5,8%	100,0%
		Bărbați	0,6%	89,6%	3,6%	0,6%	5,7%	100,0%
		Total	0,5%	90,1%	3,1%	0,5%	5,7%	100,0%
Unspecified Heart Failure		Femei	0,5%	88,8%	5,4%	0,8%	4,4%	100,0%
		Bărbați	0,4%	84,9%	8,2%	0,6%	6,0%	100,0%
		Total	0,5%	87,0%	6,7%	0,7%	5,1%	100,0%
Left Ventricular Failure		Femei	0,6%	94,1%	2,9%	0,4%	2,1%	100,0%
		Bărbați	0,4%	93,0%	3,4%	0,4%	2,8%	100,0%
		Total	0,5%	93,6%	3,1%	0,4%	2,4%	100,0%
	HF- Total	Femei	0,5%	91,3%	2,9%	0,5%	4,8%	100,0%
		Bărbați	0,6%	89,9%	3,8%	0,5%	5,1%	100,0%
		Total	0,5%	90,7%	3,3%	0,5%	5,0%	100,0%

Graph 4. Percentage structure of hospitalizations for patients with a heart failure diagnosis based on discharge status, Romania, 2023 (in black, „Deceased")

Graph 5. Average Length of Stay (days), Heart Failure, Evolution 2014-2023



management. The lack of coordination between hospitals and outpatient or community services exacerbates this issue. It is essential to implement interventions that ensure continuity of care and patient education.

Although there have been advances in the use of technology for monitoring heart failure patients, the integration of IT solutions, such as telemedicine and data analysis through DRG systems, remains limited. These tools can significantly contribute to optimizing treatment and reducing readmissions.

Beyond the direct economic costs, heart failure has a major impact on patients' quality of life, including limiting daily activities, the burden of complex treatments, and the intensive involvement of family members in care.

VI. CONCLUSIONS

Heart failure (HF) is a major issue both in terms of prevalence and its economic and social impact. It requires specific policies that address its management in an integrated manner.

The DRG analysis provides a solid foundation for understanding the costs and complexity associated with heart failure. The data can be used to identify areas that need improvement, such as reducing hospitalization duration and preventing readmissions.

A multidisciplinary approach, including patient education, cardiac rehabilitation, remote monitoring, and the involvement of primary care physicians, can reduce repeated hospitalizations and improve long-term prognosis. Integrated IT systems, based on DRG data analysis and telemedicine tools, can facilitate patient monitoring, risk prediction, and efficient resource allocation.

Future research should focus on developing predictive models based on artificial intelligence to identify patients at high risk of readmission and implementing regional pilot programs for heart failure management.

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