



Original article

Prognosis of acute heart failure in patients followed up in nursing homes in Spain: Results from the RICA registry



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ABSTRACT

Background: Patients with chronic diseases such as heart failure (HF) are at risk of hospital admission. We evaluated the impact of living in nursing homes (NH) on readmissions and all-cause mortality of HF patients during a one-year follow up.

Methods: An observational and multicenter study from the Spanish National Registry of Heart Failure (RICA) was performed. We compared clinical and prognostic characteristics between both groups. Bivariate analyses were performed using Student's *t*-test and Tukey's method and a Kaplan–Meier survival at one-year follow up. A multivariate proportional hazards analysis of [Cox] regression by the conditional backward method was conducted for the variables being statistically significant related to the probability of death in the univariate.

Results: There were 5644 patients included, 462 (8.2%) of whom were nursing home residents. There were 52.7% women and mean age was 79.7 ± 8.8 years. NH residents had lower Barthel (74.07), Charlson (3.27), and Pfeiffer index (2.2), $p < 0.001$). Mean pro-BNP was 6686 pg/ml without statistical significance differences between groups. After 1-year follow-up, crude analysis showed no differences in readmissions 74.7% vs. 72.3%, $p = 0.292$, or mortality 63.9% vs. 61.1%, $p = 0.239$ between groups. However, after controlling for confounding variables, NH residents had a higher 1-year all-cause mortality (HR 1.153; 95% CI 1.011–1.317; $p = 0.034$). Kaplan–Meier analysis showed worse survival in nursing home residents (log-rank of 7.12, $p = 0.008$).

Conclusions: Nursing home residents with heart failure showed higher one-year mortality which could be due to worse functional status, higher comorbidity, and cognitive deterioration.

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Impacto pronóstico en la supervivencia de los pacientes en residencias de ancianos con insuficiencia cardíaca en España: Resultados del Registro RICA

R E S U M E N

Palabras clave:

Insuficiencia cardíaca
Residente en hogar de ancianos
Mortalidad

Introducción: Los pacientes con enfermedades crónicas como la insuficiencia cardíaca (IC) presentan mayor riesgo de ingreso. Se evaluó el impacto sobre los reingresos y la mortalidad por todas las causas de los pacientes con IC respecto a vivir o no en residencias de ancianos durante un año de seguimiento.

Métodos: Estudio observacional y multicéntrico a partir del Registro Nacional de Insuficiencia Cardíaca (RICA). Se compararon las características clínicas y pronósticas entre ambos grupos. Se realizó un análisis bivariable mediante el método de t de Student y Tukey y un análisis de supervivencia mediante Kaplan-Meier al año de seguimiento, así como un análisis multivariante de riesgos proporcionales de regresión (Cox) por el método de retroceso condicional para las variables que se relacionaban de forma estadísticamente significativa con la probabilidad de muerte en el univariante.

Resultados: Fueron incluidos 5.644 pacientes; 462 (8,2%) de ellos estaban en residencias, el 52,7% eran mujeres y la edad media era de $79,7 \pm 8,8$ años. Los pacientes en residencias tenían menor Barthel (74,07), Charlson (3,27) y Pfeiffer (2,2) ($p < 0,001$). El pro-BNP medio era de 6.686 pg/ml sin diferencias significativas. Tras un año de seguimiento, el análisis bruto no mostró diferencias en los reingresos (74,7 vs. 72,3%; $p = 0,292$) ni en mortalidad (63,9 vs. 61,1%; $p = 0,239$) entre ambos grupos. Tras controlar las variables de confusión, los pacientes en residencias presentaron una mayor mortalidad por todas las causas a un año (*hazard ratio* 1,153; IC 95%: 1,011–1,317; $p = 0,034$) así como peor supervivencia en el análisis de Kaplan-Meier (*log-rank* 7,12; $p = 0,008$).

Conclusiones: Los pacientes con IC en residencias de ancianos mostraron una mayor mortalidad a un año, que podría deberse a un peor estado funcional, a mayor deterioro cognitivo y a más comorbilidad.

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Introduction

Patients with chronic diseases such as heart failure (HF) are at a considerable risk of hospital admission and death.¹ Chronic conditions such as heart failure are related to worsening of quality of life and a decrease in the ability to perform activities of daily living. Heart failure tends to worsen over time and may lead to loss of independence and the need for support in the community or residential care. Thus, some patients are no longer able to carry out normal activities of daily living and they need to be placed in nursing homes.^{2,3}

As a result, nursing home (NH) residents with heart failure (HF) are a growing and particularly vulnerable group of older adults. This population usually presents an important burden of comorbidities, higher symptom burden, and higher rates of hospitalization. Comorbidities are already known to play a key role in heart failure.⁴ Early detection of HF worsening could help improving symptom management and outcomes of patients specifically in nursing homes. Heart failure disease management includes monitoring of body weight and HF related signs and symptoms, adequate medication administration, and a sodium restricted diet.

Evidence suggests that following clinical guidelines can decrease hospital admission and mortality rates and improve quality of life for HF patients.^{5,6} Nevertheless, it has been reported that the frequency of monitoring body weight and HF-related signs and symptoms are below recommended guidelines in nursing homes.⁷ This could be due to different elements: patients are older and more medically complex often with cognitive impairment which makes symptoms identification difficult; lack of local specific disease management programs and protocols to follow or lack of enough paramedical/medical personnel; and others.⁸ Dementia and delirium are highly prevalent among people with HF and are independently associated with increased readmission and mortality.⁹ In addition, delivery of care is highly variable among nursing homes.¹⁰

Considering the characteristics of the population in Spain, with a high number of elderly people, the network of homes for the elderly is numerous and extensive. However, the provision of medical and paramedical resources is not uniform across the country. Although

there is standardization of some disease care protocols, no specific action protocols have been established for patients with heart failure.

The aim of this study was to compare the clinical characteristics and the prognostic impact on hospital readmissions and all-cause mortality in patients with heart failure living in nursing homes (NH) with those not living in nursing homes in Spain during one year of follow up.

Methods

An observational study from a prospective registry was carried out. The sample included patients from the National Registry of Heart Failure (RICA) belonging to the Working Group on Heart Failure and Atrial Fibrillation of the Spanish Society of Internal Medicine (SEMI). This is a prospective, multicenter registry actively recruiting since 2008. Patients over 65 years of age with a diagnosis of HF at hospital discharge (acute decompensated or new-onset HF) according to European cardiology guidelines are consecutively enrolled. Subjects are included in the registry after hospital discharge and followed for at least one year.

In the present analysis, we included patients older than 65 years registered from March 2008 to December 2020. Patients were assigned to two groups, specifically whether they were nursing home residents or not. Data about previous medical history, physical examination, and clinical analysis records were collected and analyzed. Laboratory data, left ventricular ejection fraction (LVEF), Charlson comorbidity index, Pfeiffer test, Barthel scale, treatment at discharge, mortality, and readmissions at one year were collected for the analysis of the study. The Charlson comorbidity index predicts the one-year mortality for a patient who may have a range of comorbid conditions such as heart disease, AIDS, or cancer (a total of 22 conditions). Each condition is assigned a score of 1, 2, 3, or 6, depending on the risk of dying associated with each one. Scores are summed to provide a total score to predict mortality. Pfeiffer test was used to assess cognitive impairment and to determine the degree. The Pfeiffer scale, also known as SPMSQ (Short Portable Mental Status Questionnaire) is a short screening cognitive impairment questionnaire composed of ten questions. The areas

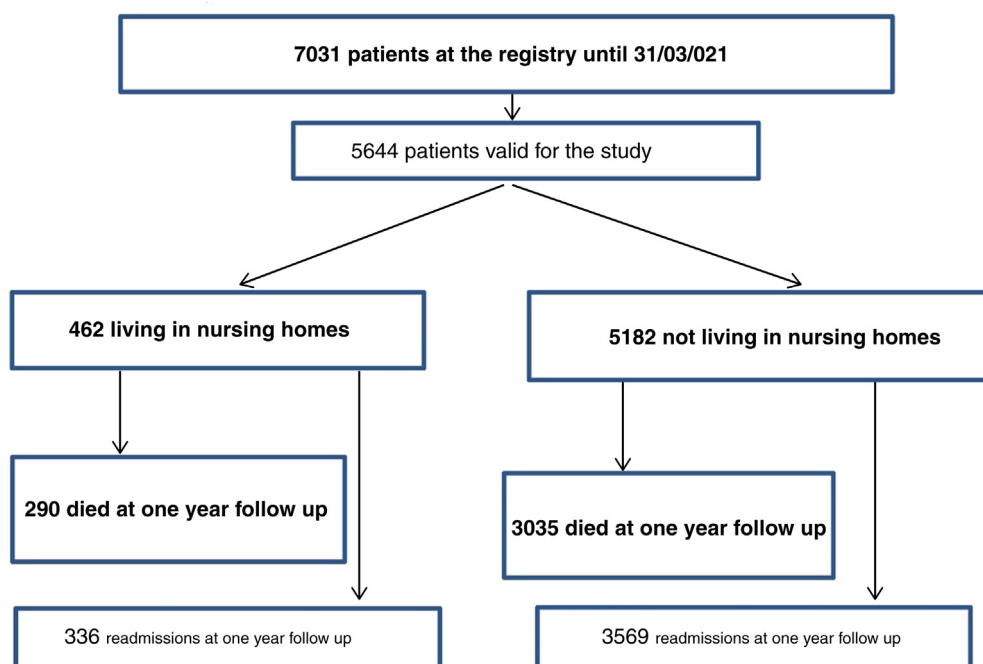


Fig. 1. Flow chart.

evaluated are short- and long-term memory, information about everyday events, calculation capacity, and orientation. The Barthel scale is an ordinal scale used to measure performance in activities of daily living (ADL). Each performance item is rated on this scale with a given number of points assigned to each level or ranking. It uses ten variables describing ADL and mobility. A higher number is associated with a greater likelihood of being able to live at home with a degree of independence following discharge from hospital.

Quantitative variables are expressed as mean (standard deviation) and qualitative variables as absolute values (percentages). Student's *t*-test is used for normally distributed variables and Tukey's method for nonparametric variables. Kaplan–Meier curves were constructed, comparing the groups using the log-rank test. A bivariable analysis was performed between the clinical, analytical, therapeutic, and prognostic characteristics between the different groups. The outcomes analyzed were all-cause mortality and readmissions for any cause at one year of follow-up. For mortality and readmissions at 1 year, a multivariate Cox regression analysis was performed using the stepwise method after conditional regression. In the Cox regression analysis, information from censored subjects, and those missing subjects who have not experienced the event of interest during the observation time, contributes usefully to the estimation of the model. To control for confounding of the variable of interest, the study included variables with statistical significance when comparing living versus not living in a residence. In all cases, the level of statistical significance was set at $p < 0.05$. Statistical analysis was performed using the IBM Statistical Package for Social Sciences (version 22.0, SPSS Inc., Chicago, IL, USA).

The registry protocol was initially approved by the Ethics Committee of the Hospital Universitario Reina Sofía de Córdoba and was subsequently approved by each of the committees of the participating hospitals code 18/349-E with last update approved by the CEIC on August 9, 2018. All patients signed an informed consent form prior to inclusion in the registry. The data were collected from a web page (www.registrorica.org, accessed on March 1, 2008) containing the anonymized database and accessed by each investigator through a personalized password.

Results

A total of 5644 patients were included in this study. Of the 5644 valid study patients, 3325 (61.3%) died within 1 year of follow-up, of whom 290 (63.9%) had lived in a nursing home vs. 3035 (61.1%) who did not live in a nursing home, $p = 0.239$. There were 220 patients lost at 1-year follow-up. Of the 5644 valid study patients, we noted 3905 (72.5%) readmissions at 1-year follow-up, of whom 336 (74.7%) corresponded to patients having lived in a nursing home vs. 3569 (72.3%) readmissions in the non nursing homes resident, $p = 0.292$. There were 261 patients lost to 1-year follow-up. Of 1419 patients for whom information on mortality was available, 510 (35.9%) died of heart failure, of whom 45 (36.9%) had lived in a nursing home and 465 (35.9%) did not live in a nursing home (Fig. 1).

Women represented 52.7% of sample and there were no significant differences in sex in nursing home residents versus no residents. Mean age was 79.7 ± 8.8 years; 462 (8.18%) patients were nursing home residents. The mean Barthel index was 81.9 ± 22.8 , and the mean Charlson score was 3.04 ± 2.5 . As observed in Table 1, nursing home residents had lower Barthel scale (74.07), and higher Charlson score (3.27) and Pfeiffer index (2.2), $p < 0.05$. The mean left ventricular ejection fraction was 51.3 ± 15.7 and was more frequently reduced in nursing home residents (46.2 ± 17.03) ($p < 0.001$). Mean pro BNP in the study population was 6686.62 pg/ml; in resident home patients the mean was 8080 pg/ml versus 6599 in non-residents without reaching statistical significance. Most patients were on beta blockers and ACE/ARA-2 inhibitors or anti-aldosterone agents without any statistical significance differences between groups. Nursing home residents received less sacubitril–valsartan (0.1%). There were no statistically significant differences in relation to low sodium diet and weight monitoring regimens between groups in contrast with water restriction, which was higher in nursing home residents (Tables 1 and 2).

In the bivariate analysis, we found no differences between the groups in relation to 30-day, 6-month, and 1-year mortality.

Table 1
Baseline characteristics of patients with HF according to caregiver.

Variable	All (n = 5644)	Nursing home (n = 462)	No nursing home (n = 5182)	p-Value
Age (years) median (SD)	79.7 (8.8)	79.9 (8.93)	79.7 (8.7)	0.603
Sex: female, N (%)	2974 (52.7)	237 (51.3)	2737 (52.8)	0.56
Comorbidities				
Hypertension, N (%)	4866 (86.2)	369 (79.9)	4497 (86.7)	<0.001
T2DM, N (%)	2614 (46.3)	193 (41.7)	2421 (46.7)	0.041
COPD, N (%)	1320 (20.9)	101 (21.8)	1219 (23.5)	0.419
Atrial fibrillation, N (%)	3005 (53.2)	228 (49.4)	2777 (53.6)	0.080
Ischemic heart disease, N (%)	1339 (23.7)	115 (24.9)	1224 (23.6)	0.538
Pfeiffer index (points) median (SD)	1.5 (2.03)	2.2 (2.4)	1.5 (1.9)	0.00
Barthel scale (points) median (SD)	81.9 (22.8)	74.07 (26.9)	82.6 (22.3)	0.00
Charlson score, median (SD)	3.04 (2.5)	3.27 (2.8)	3.02 (2.4)	0.041
LVEF, median (SD)	51.3 (15.7)	46.2 (17)	51.8 (15.5)	0.00
Laboratory, N (%)				
Hemoglobin, (g/dL), median (SD)	12.05 (2.03)	12.01 (2.14)	12.06 (2.02)	0.0663
Creatinine (mg/dL), median (SD)	1.33 (1.72)	1.34 (0.74)	1.33 (1.78)	0.935
NT-proBNP (pg/ml), median (SD)	6686 (±12,527)	8080 (±9563)	6599 (±12,685)	0.159
Non-pharmacological treatment				
Fluid restriction, N (%)	3598 (67)	332 (74.4)	3266 (66.3)	0.00
Weight monitoring, N (%)	3955 (73.5)	338 (75.4)	3617 (73.3)	0.333
Low-sodium diet, N (%)	5017 (93.1)	421 (93.6)	4596 (93.1)	0.072
Pharmacological treatment, N (%)				
Beta blockers, N (%)	3867 (68.5)	315 (68.2)	3552 (68.5)	0.872
ACE inhibitors/ARA-2, N (%)	3550 (62.9)	277 (60)	3273 (63.2)	0.172
Sacubitril valsartan, N (%)	149 (2.6)	5 (1.1)	144 (2.8)	0.029
Anti-aldosterone agents	1303 (23.1)	106 (22.9)	1197 (23.1)	0.939

Legend: T2DM: type 2 diabetes mellitus; COPD: chronic obstructive pulmonary disease; LVEF: left ventricular ejection fraction; NT-proBNP: N-terminal pro b-type natriuretic peptide; ACE inhibitors: angiotensin-converting enzyme inhibitors; ARA-2: angiotensin II receptor antagonists.

Table 2
Outcomes of patients with HF according to care setting.

Variable	All (n = 5644)	Nursing home (n = 462)	No nursing home (n = 5182)	p-Value
Endpoints, N (%)				
Mortality at 30 days, N (%)	1611 (29.7)	140 (30.8)	1471 (29.8)	0.580
30-Day readmission, N (%)	1226 (22.8)	110 (24.4)	1116 (22.6)	0.378
Mortality at 6 months, N (%)	1827 (33.7)	165 (33.6)	1662 (33.4)	0.210
6 months readmission, N (%)	2120 (39.4)	198 (44)	1922 (39)	0.036
One-year all-cause mortality, N (%)	3325 (61.3)	290 (63.9)	3035 (61.1)	0.239
One-year readmission, N (%)	3905 (72.5)	336 (74.7)	3569 (72.3)	0.292

Table 3
Univariate and multivariate Cox analysis of risk for 1-year mortality.

Variable	Univariate analysis		Multivariate analysis	
	HR (95% CI)	p	HR (95% CI)	p
LVEF	0.993 (0.991–0.996)	<0.001	0.993 (0.991–0.996)	<0.001
Hypertension	1.024 (0.916–1.144)	0.679	N.S.	
Barthel index	0.996 (0.994–0.998)	<0.001	0.996 (0.994–0.998)	<0.001
Pfeiffer index	1.037 (1.016–1.059)	0.001	1.037 (1.016–1.058)	0.001
T2DM	1.034 (0.951–1.124)	0.435	N.S.	
Charlson score	1.035 (1.019–1.052)	<0.001	1.033 (1.018–1.048)	<0.001
Nursing home residents	1.147 (1.004–1.309)	0.043	1.153 (1.011–1.317)	0.034
Fluid restriction	0.963 (0.888–1.044)	0.359	N.S.	
Sacubitril valsartan	0.930 (0.699–1.239)	0.621	N.S.	

Legend: T2DM: type 2 diabetes mellitus; LVEF: left ventricular ejection fraction.

However, in the Kaplan–Meier survival analysis we observed a decrease in survival at one year in the group of patients in nursing homes (log-rank of 7.12 with $p = 0.008$) (Fig. 2). The table below shows the number of patients at risk entering each time interval and the cumulative proportion surviving in each interval. It can be seen that in the 270–360-day interval the number of patients decreases significantly, and it is not that they die but that they are

lost to follow-up (censored). The Cox regression analysis performed is shown in Tables 3 and 4. This analysis identifies that the variable of interest (living in nursing home) is a significant variable independently controlled by the rest of the variables. Table 3 shows univariate and multivariate Cox analysis of risk for 1-year all-cause mortality. Table 4 shows the univariate and multivariate analysis for readmissions at one year.

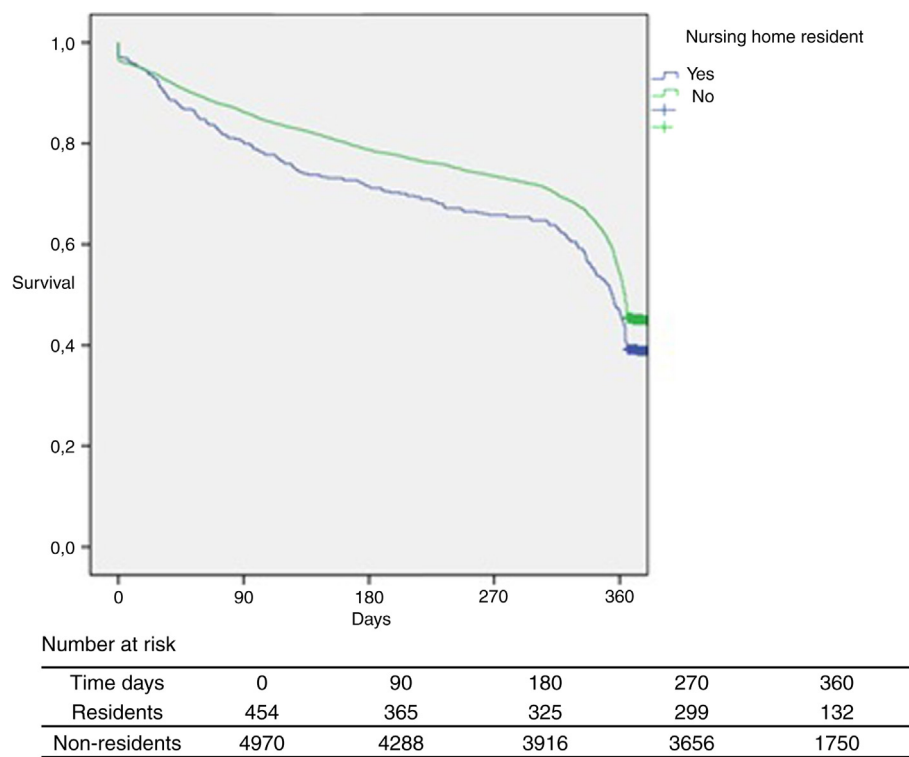


Fig. 2. Kaplan–Meier survival analysis at one year.

Table 4
Univariate and multivariate Cox analysis of risk for 1-year readmission.

Variable	Univariate analysis		Multivariate analysis	
	HR (95% CI)	p	HR (95% CI)	p
LVEF	0.997 (0.995–0.996)	0.011	0.997 (0.995–0.999)	<0.01
Hypertension	0.878 (0.992–1.100)	0.878	N.S.	
Barthel index	0.996 (0.994–0.998)	<0.001	0.996 (0.994–0.998)	<0.01
Pfeiffer index	1.031 (1.011–1.051)	0.002	1.032 (1.013–1.052)	0.001
T2DM	1.008 (0.933–1.088)	0.848	N.S.	
Charlson score	1.046 (1.031–1.061)	<0.001	1.044 (1.031–1.058)	<0.001
Nursing home residents	1.076 (0.950–1.217)	0.248	N.S.	
Fluid restriction	1.065 (0.989–1.147)	0.095	N.S.	
Sacubitril valsartan	0.728 (0.549–0.966)	0.028	0.720 (0.543–0.954)	0.022

Legend: T2DM: type 2 diabetes mellitus; LVEF: left ventricular ejection fraction.

Discussion

The results of our study show a lower survival in nursing home residents in our country. As previously reported, nursing home patients with HF are at high risk of poor outcomes despite the intensive care received.^{6,10–12} Our results may result from various factors. Patients followed up in a nursing home facility may have had more comorbidity, worse functional status, and cognitive deterioration. These factors may have influenced the unfavorable prognosis observed in terms of survival and readmissions. Cognitive impairment, as previously stated, has a negative impact on self-care skills acquisition and symptom reporting, and predisposes patients to delirium.

Functional status plays an important role in heart failure. The relationship between heart failure and physical disability is bidirectional, since not only can the presence of HF generate disability, especially in advanced stages or after hospitalization for decompensation, but also the presence of disability, even mild, can act as a risk factor for the development of HF.^{13–15} The presence of physical disability is also a risk factor for poor outcome. Low Barthel scale values are predictors of both in-hospital and short- and long-term

mortality in the elderly population with HF requiring hospitalization for acute decompensation. Patients who are in a better functional and cognitive condition have a greater capacity for self-care and have more access to heart failure care units that have demonstrated a greater benefit in terms of readmissions and mortality from this disease compared to conventional follow-up.¹⁶

Regarding treatment, some of the patients presented heart failure with reduced ejection fraction. However, many of these patients did not receive all the therapy recommended by clinical practice guidelines, such as sacubitril–valsartan. Therapeutic optimization of HF can be partially achieved during hospitalization, but the follow-up of this patient profile is usually carried out in the HF units in our country, both those belonging to cardiology and internal medicine (UMIPIC).¹⁷ In addition, patients attending these units are usually in a better functional condition and more often have a primary caregiver.

The poorer prognosis observed may be due to the patient's baseline condition rather than to the intervention performed in the nursing home, but we should point out that some nursing homes in our country are not fully medicalized and we do not know the degree of training of health care personnel related to

heart failure. Better outcomes and readmission rates have been reported in medicalized nursing homes facilities but these results are controversial.^{10–12} Heart failure in nursing homes is garnering significant interest, because annual mortality and hospitalization rates among NH residents range from 42% to 76%, and 31% to 53%, respectively.^{6,18,19} Jujo et al. reported that, during the 1-year follow up after discharge, the rates of the combined end point and all-cause mortality were significantly higher in patients with social frailty than in those without social frailty.²⁰ Yamamoto et al. performed a subanalysis of FRAGILE-HF and found that 23% of elderly patients with HF had cognitive frailty, which was associated with a 1.55-fold greater risk for combined events within 1 year compared with patients without cognitive frailty.²¹ As this is a retrospective study, it is difficult to know whether care planning in nursing home residents has worse outcomes than conventional clinical follow-up.

Our study seems to demonstrate, as previously reported,¹⁸ the need to improve coordination between the different medical care levels of conventional hospitalization and nursing homes. In our setting, there is little coordination between them, although the interventions that have been carried out in the field of internal medicine and geriatrics in coordination with the nursing home have shown a positive impact on the readmissions of chronically ill patients. We believe that multidisciplinary HF care programs should also be extended to nursing homes, improving training in this disease for health care personnel in these centers and improving communication between hospital HF units and nursing homes to better optimize the pharmacological treatment of these patients. Interventional studies are needed to evaluate the impact on the improvement of the health of patients with HF in nursing homes. In the light of our results and regarding the high mortality of patients in nursing homes, it is also urgent to consider whether these patients were in a palliative situation given their advanced age, comorbidity, and functional and cognitive deterioration. In this sense, it is also necessary to carry out a comprehensive assessment beyond the disease itself, such as the nutritional, rehabilitation, and psycho-affective evaluations.

This study has some limitations and strengths. As limitations we should mention: (1) This is a retrospective study, in which the variable living in a nursing home was collected as an antecedent and, therefore, we do not know the prognosis of patients with HF who were discharged from hospitals and admitted to a nursing home de novo. (2) We should point out the great variability in the number and location of residencies in the national setting, which may have influenced the results observed. Some are private, others are public or subsidized, some are medicalized and others are not. All these factors have not been evaluated. (3) The degree of coordination between the two levels of care (nursing homes and hospitals) has also not been evaluated, a key factor in the management of hospital readmissions. In this regard, it would be interesting to develop studies that investigate coordinated interventions from the heart failure units or programs with the residences in our setting and evaluate their impact on prognosis. As strengths we should mention: (1) the large number of patients included, (2) this was a multicenter study, and (3) there was 1-year follow-up.

Conclusions

Nursing home residents with heart failure showed higher one year mortality which could be due to worse functional status, more comorbidity, and cognitive deterioration. More studies are needed regarding coordination between hospital and nursing home facilities as well as heart failure protocol implementation.

Ethical considerations

Written informed consent was obtained.

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Conflict of interest

The authors declare no conflict of interest.

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