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## ORIGINAL ARTICLE

### Trends and predictors of hospitalization, readmissions and length of stay in ambulatory patients with heart failure

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#### Abstract

**Objectives:** Little is known on predictors of hospitalisation in ambulatory patients with chronic heart failure, and known predictors may not apply to Mediterranean countries. Our aim was to document longitudinal trends in hospitalisations and identify patient-related predictors of hospital admission, re-admission and length of stay in the targeted population.

**Methods:** Population-based retrospective cohort study in Catalonia (North-East Spain), including 7196 ambulatory patients (58.6% women; mean age 76 years). Eligible patients were selected from the electronic patient records of primary care practices, and followed for 3 years.

**Results:** At 3 years of follow up overall 645 (9.0%) patients had cardiovascular hospitalisation, 37% were readmitted, and median length of stay was 9 (interquartile range 5–17) days. Chronic kidney disease [odds ratio (OR) = 1.98 (1.62–2.43)], IHD [OR = 1.72 (1.45–2.04)], DM [OR = 1.50 (1.27–1.78)] and chronic obstructive pulmonary disease [OR = 1.43 (1.16–1.77)] increased the risk for hospitalisation. DM [OR = 1.70 (1.22–2.38)], IHD [OR = 1.85 (1.33–2.58)] and HTA [OR = 1.66 (1.11–2.46)] increased the risk for readmissions. Chronic kidney disease [OR of 2.21 (1.70–2.90)], IHD [OR of 2.19 (1.73–2.77)], DM [OR = 1.70 (1.34–2.15)], HTA [OR = 1.51 (1.13–2.01)], chronic obstructive pulmonary disease [OR = 1.37 (1.02–1.83)] increased the risk for long length of stay in hospital.

**Conclusions:** Our study identified predictors of hospitalisation, readmissions and long length of stay which can help clinicians and managers to identify high risk patients which should be targeted on service planning and when designing preventive actions.

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**PALABRAS CLAVE**

Insuficiencia  
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estancia hospitalaria;  
Epidemiología

## Tendencias y variables predictoras de hospitalización, reingreso y duración de la estancia hospitalaria en los pacientes ambulatorios con insuficiencia cardíaca

**Resumen**

**Objetivos:** En los pacientes ambulatorios con insuficiencia cardíaca crónica apenas se conocen las variables pronósticas de hospitalización, y es posible que las variables conocidas no sean aplicables a la población de los países mediterráneos. El objetivo del presente estudio es documentar las tendencias longitudinales en las hospitalizaciones e identificar las variables predictoras de ingreso, reingreso y duración de la estancia hospitalaria en la población objeto del estudio.

**Métodos:** Estudio de cohorte retrospectivo, poblacional, efectuado en Cataluña (noreste de España). Se incluyeron a 7.196 pacientes ambulatorios (58,6% mujeres, edad media: 76 años). Se seleccionaron los pacientes elegibles a partir de la historia clínica electrónica de los centros de atención primaria y se les controló durante 3 años.

**Resultados:** A los 3 años del seguimiento, en conjunto, 645 (9,0%) pacientes fueron ingresados por una causa cardiovascular, el 37% presentó un reingreso, y la duración mediana de la estancia hospitalaria fue de 9 (límites intercuartil: 5-17) días. La insuficiencia renal crónica (*odds ratio* [OR]: 1,98 [1,62-2,43]), la cardiopatía isquémica (OR: 1,72; intervalo de confianza [IC] del 95%: 1,45-2,04), la diabetes mellitus (DM) (OR: 1,50; IC 95%: 1,27-1,78) y la enfermedad pulmonar obstructiva crónica (OR: 1,43; IC 95%: 1,16-1,77) aumentaron el riesgo de hospitalización. La DM (OR: 1,70; IC 95%: 1,22-2,38), la cardiopatía isquémica (OR: 1,85; IC 95%: 1,33-2,58) y la hipertensión arterial (OR: 1,66; IC 95%: 1,11-2,46) aumentaron el riesgo de reingreso. La insuficiencia renal crónica (OR: 2,21; IC 95%: 1,70-2,90), la cardiopatía isquémica (OR: 2,19; IC 95%: 1,73-2,77), la DM (OR: 1,70; IC 95%: 1,34-2,15), la hipertensión arterial (OR: 1,51; IC 95%: 1,13-2,01) y la enfermedad pulmonar obstructiva crónica (OR: 1,37; IC 95%: 1,02-1,83) aumentaron el riesgo de duración prolongada de la estancia hospitalaria.

**Conclusiones:** El presente estudio identificó las variables predictoras de hospitalización, los reingresos y la duración prolongada de la estancia hospitalaria que pueden ayudar a los médicos y gestores hospitalarios a identificar a los pacientes en alto riesgo, que deben ser los destinatarios de la planificación de los servicios y de las acciones preventivas establecidas.

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Hospitalisations for chronic heart failure (CHF) have major impact on patient's quality of life and imply high costs for societies'. In many industrialised countries management of CHF represents 1–2% of total healthcare expenditure and up to two-third of this cost is in relation with hospitalisations.<sup>1–4</sup> Although recent reports suggest that CHF has probably reached its peak, it remains a highly prevalent cause of hospitalization.<sup>5,6</sup> CHF accounts for 5% of acute hospital admissions and rises in patients older than 65 years.<sup>7,8</sup> Despite so, there is a surprising lack of epidemiological prospective studies identifying potential prognostic predictors.<sup>6</sup> A better insight into these predictors may help to identify patients with increased risk at an early stage for preventive actions.

CHF is a condition mostly managed in primary care.<sup>9,10</sup> Family physicians (FPs) play an important role in the early and accurate initial diagnosis, risk factors identification and disease monitoring.<sup>11</sup> But this is a complex condition with patients who are often elderly and frail, with co-morbidity and polypharmacy.<sup>12</sup> This complexity is not always represented in clinical trials; thus, research with "real world patients" registered in primary care would be applicable to their everyday practice. Factors such as age, gender, diabetes, respiratory disease and renal failure have been associated by several studies to hospitalisation,<sup>13,14</sup> re-admissions<sup>15</sup> and length of stay.<sup>5,16,17</sup> Nevertheless, these

studies are mainly hospital based, and epidemiological studies with ambulatory patients are scarce.<sup>6,13</sup> In addition, in Mediterranean countries, cardiovascular patients tend to have better outcomes than similar patients in other countries, so predictors of hospitalisation may be different as well.

In Spain, Health Care System is strongly primary care-based<sup>18</sup> acting as a first point of contact for patients and as a gatekeeper to specialist care. On the other side, it has a strong interface with specialist care. Nevertheless, hospitalisation trends are mainly reported from National Hospital database registry<sup>8</sup> and clinical trials<sup>19</sup> and large prospective community-population based studies reporting on readmission, length of stay and prognostic factors are lacking. The aim of this study was to document longitudinal trends in hospitalisations and identify patient-related predictors of hospital admissions, re-admissions and length of stay among ambulatory CHF patients in Catalonia (north-eastern Spain).

## Participants and methods

### Study design and setting

We performed a population-based retrospective cohort study using the resources of a project published in

## What we know

Hospitalizations for chronic heart failure have major impact on patient's quality of life and imply high costs for societies. There are few prospective studies identifying potential prognostic predictors. This study pretended to document longitudinal trends in hospitalisations and identify patient-related predictors of hospital admissions, re-admissions and length of stay among ambulatory CHF patients.

## What this article provides

In three years of follow up 9.0% of patients had an admission to hospital due to cardiovascular reasons. During that period the number of hospitalisations decreased and readmissions increased. The presence of chronic kidney disease, ischaemic heart disease, diabetes mellitus and chronic obstructive pulmonary disease behaved as strong predictors of hospitalization.

*Clinical Trials database* (NCT00792402). Briefly, this project used a non-equivalent controlled, before and after, quasi-experimental design with a population based approach to evaluate the impact of a clinical practice guideline on CHF in Catalonia (population of 7,210,508).<sup>20</sup> Primary care practices (PCPs) from urban (intervention group) and rural (control group) setting were included. PCPs of the intervention group were randomised and half were exposed to usual care plus a clinical practice guideline on CHF and the other half to a disease management intervention (which did not participate in our project). For the purpose of this study, data from both regions were combined. Despite urbanisation differences, both regions shared same organisational features<sup>21</sup> (Table 1). The ethics committee of the Catalan

Primary Care Research Institute "IDIAP Jordi Gol", overseen by the Spanish Ministry of Health approved this study.

## Participants

We selected patients from PCPs and followed them for 3 years, from January 2005 to December 2007. PCPs of the rural area were all included. In the urban area we included those PCPs exposed to usual care plus a clinical practice guideline on CHF and excluded the rest of PCPs exposed to a disease management intervention which was not targeted by our project as described above. At patient level, we included patients over 30 years old attending PCPs, with a diagnosis of CHF (I11.0, I13.0, I13.2, I50, I50.0, I50.0 I50.1, I50.9, P29.0 according to the International Classification of Diseases Tenth Revision used in primary care) registered by their FP during the period of our study (incident cases).

## Measures

Our primary measures were hospitalisation, readmissions, length of stay and long length of stay. We defined hospitalisation as any cardiovascular admission between 2005 and 2007 as primary diagnosis at discharge (398-39899, 402-40291, 428-4289, 9971, 40390-40391, 404-40493, 411-41189, 414-4149 according to the International Classification of Diseases Ninth Revision used by hospitals); re-admissions as more than one cardiovascular admission between 2005 and 2007, length of stay as total number of days spent in hospital per year and long length of stay as days above the median spent in hospital over the follow up period. Potential co-morbidity associated to primary measures were included according to the review of the literature, clinical relevance and availability and were defined on the basis of the International Classification of Diseases Tenth Revision codes registered in the primary care electronic patient records (Table 2). We included hypercholesterolemia (HCL), arterial hypertension (HTA), diabetes mellitus (DM), ischaemic heart disease (IHD), chronic obstructive pulmonary disease (COPD), and

**Table 1** Organisational features.

Features	Urban region	Rural region
Health care provider	"Catalan Health Institute" care provider for the 80% of the population in the Autonomous Community of Catalonia (population of 7,210,508). Belongs to the Spanish National Health System.	
Coverage	Universal coverage for either primary and secondary care	
Funding	State funded through general taxes. Co-existence with private sector	
Access to care	Every citizen is registered with a family physician who acts as a gatekeeper to specialised care	
Medical records	Electronic patient records system	
Provision of care	Network of practices that behave as geographical and administrative units were physicians are part of the staff (from 4 to 36 physicians per practice depending on population attended)	
	Single health care centres	Single health care centres and satellite offices
Diagnosis process/ Integrated care	Cardiologists and other specialised services attending practices weekly since 1990, to support physicians on the diagnosis process, management and training	

**Table 2** ICD10 Codes related to co-morbidity included.

<b>Hypercholesterolemia (E78).</b>
<b>Hypertension (O10–O10.4; O11, O13, O14, O16; I10, I11, I11.9, I12, I12.0, I12.9; I13, I13.1, I13.9; I15–I15.2, I15.8, I15.9).</b>
<b>Diabetes mellitus (E10–E10.9; E11–E11.9; E12–E12.9; E13–E13.9; E14–E14.9; P70.2; N08.3; O24–O24.4, O24.9).</b>
<b>Ischaemic heart disease (I20–I20.1; I20.8, I20.9; I21–I21.4, I21.9, I21.11; I22–I22.1, I22.8; I23–I23.6, I23.8; I24.1, I24.8, I24.9; I25–I25.6, I25.8; I40–I40.1, I40.8, I40.9; I41–I41.2, I41.8; I42–I42.9; I43–I43.2, I43.8; I51–I51.9; I52–I52.1, I52.8).</b>
<b>Chronic kidney disease (CKD) (N13.2; N15.8; N16, N16.0, N16.2–N16.4; N17–N17.2, N17.8, N17.9; N18, N18.0, N18.8, N18.9; N19; N20.1; N02.3–N02.5; N07–N07.9; O90.4; Q27.1, Q27.2; Q61.4; P96.0; N25, N25.0; N14.1–N14.4; N15–N15.1, N15.9; I70.1; I72.2; M10.3; A98.5; Y84.1; R39.2; I82.3; Z99.2; K76.7).</b>
<b>Chronic obstructive pulmonary disease (COPD) (J43–J43.2, J43.8, J43.9; J44–J44.1, J44.8, J44.9; J47).</b>

chronic kidney disease (CKD). We also included age and gender. We obtained age by calculating the difference of initial date of our study (1st January 2005) and date of birth and considered two categories such as less than 65 and  $\geq 65$  years old. Also we considered region and time since onset of CHF as covariate variables. Time since onset of CHF was calculated as the time (years) from date of diagnosis registration in primary care electronic clinical records to the final date of our study (31st December 2007) or dead. Mortality from any cause was included. Diagnosis of CHF was made after hospital confirmation, cardiologist advice or echocardiography (Table 1). We also collected patients on diuretics, angiotensin-converting enzyme, angiotensin II receptor blockers and beta-blockers.

## Data sources

We obtained primary care information from the central database of "Catalan Health Institute", by one of their informatics officer with access to electronic patient records. Data from hospital admissions were collected from the Division of Demand and Activity Registries (Minimum Basic Data Set for Acute-care Hospitals-MBDS), of the Catalan Health Service, where Catalan hospitals are committed to send in their data for reimbursement. Information on mortality was abstracted from the Mortality Register of Catalonia where fatalities must be notified and added to the information held by primary care electronic patient records on patient status. We were able to link all the information from the three database sources because every Catalan citizen has a unique and anonymous identification number for health care use. The informatics officers responsible for data abstraction were not involved in the subsequent data analysis.

## Statistical methods

Descriptive data for age, gender and co-morbidities are presented for all patients. For categorical variables frequencies

**Table 3** Patients' characteristics.

	All (N = 7196)
Age (available for 7173), mean (SD)	76 (10)
Age < 65, N (%)	973 (13.5)
Age $\geq 65$ , N (%)	6200 (86.2)
Sex – women, N (%)	4214 (58.6)
Cardiovascular admissions during the follow up, N (%)	645 (9.0)
Patients on diuretics, N (%)	5659 (78.6)
Patients on ACE/ARB, N (%)	5539 (77)
Patients on beta blockers, N (%)	1638 (22.8)
Hypercholesterolemia, N (%)	644 (8.9)
Hypertension, N (%)	5061 (70.3)
Diabetes mellitus, N (%)	2184 (30.4)
Ischaemic heart disease, N (%)	1941 (27.0)
CKD, N (%)	925 (12.9)
COPD, N (%)	1067 (14.8)

N – number of patients; SD – standard deviation; ACE – angiotensin-converting enzyme. ARB – angiotensin II receptor blockers; CKD – chronic kidney disease; COPD – chronic obstructive pulmonary disease.

were reported. For continuous variables, mean and standard deviation (SD) were calculated. Median and interquartile range (IQR) were calculated for the variables time since onset of CHF and length of hospital stay. Candidate variables (measures) significantly ( $p < 0.05$ ) associated with primary measures in the bivariate analysis were included as potential covariates in logistic regression models. *Chi-Square* and *Student-Fisher* test for categorical and continuous variables, respectively, were used at bivariate analysis. Forward step technique with likelihood ratio test was used. Multivariate adjusted odds ratios and accompanying 95% confidence intervals were calculated. Discrimination of the model was assessed by the area under the receiver operating characteristic (ROC) curve. *Hosmer and Lemeshow* goodness of fit test was used for calibration of the model. All tests were 2-tailed and significant at 5% level ( $\alpha = 0.05$ ). Multivariable analyses were performed considering all patients and also excluding fatalities. All analyses were undertaken with use of SPSS Inc v18 software.

## Results

### Study population

We initially identified 20,576 potentially eligible patients with the diagnosis of CHF from 68 PCPs, covering a population of 1,522,564 listed citizens. According to our inclusion criteria we excluded 25 PCPs from the urban setting and 5812 patients with prevalent CHF. Our final sample was 7196 patients with incident CHF from 43 PCPs: 4750 from urban (covering 558,515 inhabitants) and 2446 from rural (covering 480,827 inhabitants). The median follow up for the entire cohort was 1095 days with a minimum of 31 and a maximum of 1095 days. Patients' characteristics are presented in Table 3. In the bivariate analysis, we found that HTA was significantly more prevalent in patient's  $\geq 65$  years and women while CKD, COPD and IHD were more



**Table 4** Hospitalisation, readmission and length of stay trends over the follow up.

	2005	2006	2007	Follow up period (2005–2007) N = 7196
Patients alive, N	7196	7143	6688	6055
Deceased patients, N	53	455	623	1131
Patients admitted to hospital, N	435	194	153	645
>1 admission, N (%)	99 (22.8)	54 (27.8)	44 (28.8)	238 (37.0)
Length of stay (days), median (IQR: P25–P75)	8 (5–15)	7 (3–14)	8 (4–13)	9 (IQR 5–17)

N – number of patients; IQR – interquartile range: percentile 25, percentile 75.

prevalent in men. HCL, HTA, CKD, IHD and COPD were significantly ( $p < 0.001$ ) more prevalent in the urban setting than in the rural although. No significant differences were found according to age, sex and DM.

### Hospitalisation trends

In three years of follow up overall 645 (9.0%) patients had an admission to hospital due to cardiovascular reasons. Along the follow up period the number of hospitalisations decreased from 435 in 2005 to 153 in 2007 (Table 4). Multivariate modelling identified four predictors of hospitalisation at three years of follow up (Table 5). CKD was the strongest predictor of hospitalisation (OR = 1.98; 95% confidence interval [95%CI] 1.62–2.43), followed by IHD with (OR = 1.72; 95%CI 1.45–2.04), DM (OR = 1.50; 95%CI 1.27–1.78) and COPD (OR = 1.43; 95%CI 1.16–1.77). For this explanatory model the area under the ROC curve was 0.627, and the maximum difference between observed and predicted hospitalisation was 2%.

### Re-admissions

Among the 645 patients with any hospitalisation due to cardiovascular reasons along the follow up period, 37% were readmitted. Percentage of readmissions increased from 22.8% in 2005 to 28.8% in 2007 (Table 4). Range of admissions for the follow up period was 1–9. After three years of follow up, multivariate modelling identified three predictors for readmissions (Table 5): DM (OR = 1.70; 95%CI 1.22–2.38), IHD (OR = 1.85; 95%CI 1.33–2.58) and HTA (OR = 1.66; 95%CI 1.11–2.46). For this explanatory model the area under the ROC curve was 0.633. For this model the maximum difference between observed and predicted re-admission was 14.5%.

### Length of stay

Median length of stay per patient in hospital after the follow up period was nine days (IQR 5.17) (Table 4). Multivariate modelling for the whole follow up period (Table 5) identified five predictors for long length of stay (>9 days): CKD (OR = 2.21; 95%CI 1.70–2.90), IHD (OR = 2.19; 95%CI 1.73–2.77), DM (OR = 1.70; 95%CI 1.34–2.15), HTA (OR = 1.51; 95%CI 1.13–2.01) and COPD (OR = 1.37; 95%CI 1.02–1.83). Patients from urban region were associated to longer length of stay (OR = 1.63; 95%CI 1.23–2.14). For this explanatory model the area under the ROC curve was 0.675

and the maximum difference between observed and predicted long length of stay was 0.68%. Multivariable models did not provide substantially different results when excluding fatalities from the analysis, except for readmissions (ROC curve of 0.643) and long length of stay (ROC curve of 0.688), which became more discriminative.

### Discussion

In our cohort of ambulatory patients with CHF only 9.0% of patients were admitted to hospital due to cardiovascular reasons during three years of follow up. During that period we found that while the number of admissions and length of stay decreased, the number of readmissions increased. We also provided a risk profile for each of our main measures, hospitalisation, readmission and long length of stay in hospital, according to co-morbidities that were found to be associated to increase such risk. We found that despite we had a low prevalence of IHD (27%), this still was associated with an increased risk of hospital events. In contrast with previous studies, that were done in hospital-based cohorts or selected patients from clinical trials, we evaluated trends and predictors of hospitalisation, readmission and length of stay for ambulatory patients in a Mediterranean community-based cohort.

### Hospitalisations

No previous data from a community perspective confirmed the decrease on hospitalisation trends found also in national hospital surveys either from United States,<sup>13</sup> North<sup>5</sup> or Central Europe.<sup>22</sup> Our admission rates due to cardiovascular reasons were lower compared to those previously reported from the United States<sup>23</sup> or United Kingdom.<sup>24</sup> Reasons for that may remain in the organisation of provision of care. We have a strong primary care management of chronic conditions in the community, with specialists supporting FPs and home care that could explain this result. Our risk profile for admissions was in line with what is reported by hospital-based studies.<sup>13,14</sup> Also Dunlay et al.<sup>23</sup> from a community perspective found DM and creatinine clearance as predictors for CHF hospitalisation.

### Readmissions

Little is known on studies analysing high-risk profile for readmissions due to CHF from a wide pool of patients from primary care. Most of the studies are hospital-based or have

**Table 5** Multivariable models.

Variables	Hospitalisations N = 7196		Re-admissions N = 7196		Long length of stay N = 7196	
	OR	95%CI	OR	95%CI	OR	95%CI
Diabetes mellitus	1.50	1.27–1.78	1.70	1.22–2.38	1.70	1.34–2.15
Ischaemic heart disease	1.72	1.45–2.04	1.85	1.33–2.58	2.19	1.73–2.77
CKD	1.98	1.62–2.43	<sup>a</sup>	<sup>a</sup>	2.21	1.70–2.90
COPD	1.43	1.16–1.77	<sup>a</sup>	<sup>a</sup>	1.37	1.02–1.83
Region (urban)	<sup>a</sup>	<sup>a</sup>	<sup>a</sup>	<sup>a</sup>	1.63	1.23–2.14
Diagnosis of hypertension	<sup>a</sup>	<sup>a</sup>	1.66	1.11–2.46	1.51	1.13–2.01

<sup>a</sup> No association was found. CKD – chronic kidney disease. COPD – chronic obstructive pulmonary disease.

used government administrative data.<sup>25</sup> Despite that these results do not bring a unique risk model for readmissions which to compare to, we confirmed the effect of DM and IHD similarly to what some of them reported.<sup>26</sup> Despite our hospitalisation rate being low, we found a high readmission rate, increasing over the period of our study. A similar finding has also been reported in hospital-based studies.<sup>5,15</sup> A reason for that may be that management of CHF in the community may delay patient hospitalisation up to a more severe stage when hospitalisations are more frequent.

### Length of stay

Understanding which patients managed in the community are at higher risk to increase their stay in hospital can be an aid to clinicians and managers on health care planning nevertheless this is yet to be elucidated. In our cohort, co-morbidities associated to increase the risk to stay longer time than the median in hospital were CKD, IHD, DM, HTA and COPD. We observed a decrease over time in the median of length of stay in hospital as reported by hospital-based studies.<sup>5,16</sup>

### Limitations of the study

We did not capture admissions to private hospitals or outside of targeted setting. However, we included listed patients of PCPs with a hospital assigned. These patients rarely would go to private hospital or attend other PCPs or public hospital because of our continuum of care model. Data from the Catalan government show that about 90% of patients use their assigned hospital.<sup>27</sup> We were not able to report on the New York Heart Association classification and the Left Ventricular Ejection Fraction that would provide clinically important information on the severity and type of CHF and might have clarified the effect of an earlier onset of CHF on hospitalisations and our higher readmission rates. We identified CHF patients through their FPs' electronic patient records and could not have access to the number and echocardiography results performed in each patient. However, in our setting, usually FPs register a CHF diagnosis or any other co-morbidity diagnosis after specialist confirmation, who is involved in the diagnosis process and management of these patients in the community, providing support to FPs in their setting, as this is part of our integrated care programme since 1990<sup>28</sup> (Table 1). As a

measure of accuracy of the diagnosis we reported a high percentage of patients on diuretics. We did not analyse variability between FPs; nonetheless, our objective was to report trends of hospitalisation for the CHF disease rather than primary care professional's performance. Anyway, all FPs participating in this study belonged to the same primary care provider and had the same electronic patient record system, which makes easily available all the International Classification of Diseases Tenth Revision diagnosis codes when the FPs need to record a diagnosis. We did not analyse separately hospitalisations due to CHF or other cardiovascular conditions that could have provided more clinical information about the physiopathology of the CHF. In addition, we used the date of CHF onset registered by FPs which do not necessarily reflect the date when the diagnosis was made. The exclusion of some PCPs in the urban region may explain differences in hospitalisation trends found in the two settings analysed. Nonetheless, we expected that any other ethnic or socioeconomic effect on outcomes would have been minimised by our selection process that started off from a previous randomisation done by a concomitant disease management intervention in the former setting.

### Conclusions

Our study identified predictors of hospitalisation, readmissions and long length of stay which can help clinicians and managers to identify high risk patients which should be targeted on service planning and when designing preventive actions. Nevertheless, future research should study more in depth how severity of associated co-morbidity can have an effect on hospital events for CHF patients and so modify their risk profile.

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### Conflict of interest

None declared. The funding body was neither involved in the design, data collection, data analysis and its interpretation, elaboration of this manuscript nor with the decision to send it for publication.

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