



Determinants of survival and hospitalization in older, heart failure patients receiving home healthcare



M.A. Muñoz^{a,b,*}, J. Real^b, J.L. Del Val^{a,b}, E. Vinyoles^{a,b}, X. Mundet^{a,b}, E. Frigola-Capell^b, M.A. Llauger^{a,b}, F. Orfila^{a,b}, M. Domingo^{b,c}, J.M. Verdú-Rotellar^{a,b}

^a Primary Healthcare Research Unit of Barcelona, Institut Català de la Salut, Barcelona, Spain

^b Primary Healthcare University Research Institute IDIAP-Jordi Gol, Barcelona, Spain

^c Cardiology Service and Heart Failure Unit, Hospital Universitari Germans Trias i Pujol, Badalona, Spain

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ABSTRACT

Introduction: Since reported evidence is both scarce and controversial, the objective of this study is to determine the risk factors involved in the prognosis of older patients with heart failure (HF) receiving home healthcare from primary care professionals.

Methods: Retrospective cohort community study was carried out in 52 primary healthcare centers in Barcelona (Spain). A follow-up was performed between January 2009 and December 2012 with 7461 HF patients aged >64 years. Information was obtained from primary care electronic medical records containing clinical data, functional and cognitive status, total mortality, and hospital admissions for cardiovascular events.

Results: Mortality and hospitalization during follow-up were higher in older, HF patients who received home healthcare than those who did not (HR 1.39, 95% CI 1.22–1.58 and 1.92 95% CI 1.72–2.14, respectively). The most relevant determinants for mortality were male gender (HR 1.40, 95% CI 1.10–1.79), previous hospital admission for HF (HR 1.29 95% CI 1.05–1.60), and severe dependence in activities for daily living (ADL) (HR 1.33, 95% CI 1.06–1.67). In contrast, severely dependent ADL patients were not more frequently hospitalized as a consequence of cardiovascular events (0.97, 95% CI 0.77–1.23).

Conclusions: Due to their greater comorbidity and age, mortality and hospitalization in patients requiring home healthcare were higher than those who did not. Among the HF patients receiving home care, mortality and hospital admissions were higher in men, older patients, and in those previously hospitalized for HF. Severe dependence in ADL determined a higher mortality but was not related to increased hospital admission rates.

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1. Introduction

It is well known that heart failure (HF) prevalence is higher in the elderly, rising to 5% in the population aged 65–75 years and 10–20% in those older than 80 years [1,2]. The causes are progressive population aging, better coronary heart disease and cardiovascular comorbidity survival, and an improvement in HF treatment in recent decades [3].

Over the past 50 years, life expectancy has increased 10 years for both genders in the European Union: in 2013 it was 83.3 years for women and 77.8 years for men. Mortality and morbidity in chronic HF are directly related to age [4]. In fact, this disease represents the first cause of hospital admission in individuals older than 64 years and is the third cause of in-hospital death [5].

In addition, since most patients suffering from HF have other comorbidities, it is expected that many of them will need home healthcare. It has been reported that almost one in ten non-institutionalized individuals aged ≥65 requires assisted personal attention [6]. This is a temporal or permanent situation that can be characterized by difficulties with physical mobility and influenced through adverse social determinants [7].

When, as a consequence of becoming chronically ill or disabled, or recuperating after a recent hospital discharge, older individuals find that outpatient attendance implies considerable effort, home healthcare programs allow those with special needs to remain in their homes [8,9].

It has been reported that elderly people receiving home healthcare have increased mortality [10]. In order to deal with this situation some programs have been carried out with community-dwelling, frail, older people [11] and, specifically, HF patients at hospital discharge [12].

Although the engagement of primary care professionals is relevant in the management of such patients [13], no specific analysis has been carried out to ascertain their prognosis when they receive home care.

* Corresponding author at: Primary Care Research Unit of Barcelona, Institut Català de la Salut, IDIAP-Jordi Gol, Departament de Salut|Generalitat de Catalunya, Sardenya 375, Entlo, 08025 Barcelona, Spain.

E-mail address: mamunoz.bcn.ics@gencat.cat (M.A. Muñoz).

Since the population requiring home health care suffers from a higher comorbidity, it is expected to find higher rates of hospital admissions and mortality in this group.

The aim of our study is to identify the profile of older HF patients receiving homecare from general practitioners and nurses, and to assess the determinants of mortality and hospitalization.

2. Methods

2.1. Study design and population

A retrospective cohort study based on clinical information from the SIDIAP database (Information System for the Development of Research in the Primary Care System) regarding patients attended in the 52 primary healthcare centers of the Institut Català de la Salut in Barcelona (Spain) [14]. Information about hospital admissions was obtained from a specific database known as CMBD-AH (Conjunto Mínimo Básico de Datos de Altas Hospitalarias). The study took place from 1st January, 2009 to 31st December, 2012.

2.2. Inclusion criteria

All adult patients aged >40 years living in Barcelona (Spain) with an HF diagnosis (International Classification Diseases (ICD-10: I50) recorded in their primary electronic medical records on 31st December, 2012, were included, and a sub-population >64 years was selected for the present study.

In order to analyze outcomes among patients attended in home healthcare programs, those registered as Z74 in the ICD-10 (need for assistance at home and no other household member able to render care) were extracted from the database.

2.3. Exclusion criteria

Individuals who had not used the public primary health care services during the period of the study.

2.4. Outcome variables

Between 1st January, 2009, and 31st December, 2012, patients underwent a follow-up to the time of their hospital admission as a consequence of a cardiovascular event (HF decompensation, myocardial infarction or unstable angina) or mortality.

2.5. Other variables

These included socio-demographic variables (age, gender), comorbidity (hypertension, diabetes, coronary heart disease, atrial fibrillation, stroke, depression, chronic obstructive pulmonary disease, renal failure), hospital admission in the year prior to inclusion, participation in homecare health programs, dependence index, cognitive impairment, and HF treatment.

ADL dependence was measured by the Barthel index and categorized as severely dependent if the score was ≤ 60 points [15]. To evaluate cognitive impairment, the Pfeiffer test was considered when the score of mistakes made by the patient was ≥ 3 [16]. A Spanish version of both tests has been previously validated and they are regularly administered to home healthcare populations.

2.6. Sample size

Data were gathered from the registries completed by the general practitioners and nurses from the 52 primary healthcare centers in Barcelona (Spain). Out of an overall population of 1,261,171 individuals attended in these centers, a sample of 8176 HF patients was obtained, 7461 were older than 64 years.

2.7. Statistical analysis

Data are expressed as percentages for categorical variables and median (standard deviation) for continuous ones. Baseline homogeneity of variables according to HF and previous hospital admission was analyzed. Chi square, Student-t test, and ANOVA were employed to analyze the associations at the univariate analysis.

Cumulate incidence was calculated both for mortality and hospital admission as a consequence of a cardiovascular event during follow-up. To evaluate the effect of the different variables on mortality and hospital admission among the population receiving home healthcare, crude and adjusted Cox regression models were performed. Since mortality and hospital admission may preclude each other, competing-risks regression models, according to the method of Fine and Gray (1999), were performed.

p values < 0.05 were considered statistically significant. Statistical analysis was performed with Stata Statistical Package (StataCorp. 2011. *Stata Statistical Software: Release 12*. College Station, TX: StataCorp LP).

2.8. Ethics

The study protocol was approved by the ethics committee of the Primary Healthcare University Research Institute IDIAP-Jordi Gol. Confidentiality of data was guaranteed throughout the study and any data available for research purposes were anonymous.

3. Results

3.1. Patient characteristics

The cohort consisted of 7461 HF patients ≥ 65 years, 58.9% were women. Mean age was 80.6 years (standard deviation 7.1).

Almost one third of the patients were registered as receiving home healthcare ($n = 2211$) (29.6%). Median follow-up was 15.8 months (interquartile range, 6.5–28.9). With respect to outcomes, a total of 1542 patients (20.7%) died during follow-up and 2051 (27.5%) were admitted to hospital as a consequence of cardiovascular events. Comorbidity was present in 92.3% of the patients. Up to 37.8% had three or more concomitant conditions, the most frequent being hypertension (78.6%) and atrial fibrillation (38.2%). History of coronary heart disease was found in 26.2% of the patients.

Patients receiving home healthcare presented a higher probability of dying (Hazard Ratio 1.39, 95% confidence interval 1.22–1.58) and of being hospitalized for cardiovascular events (1.91, 95% confidence interval 1.71–2.14), after adjusting for sociodemographic profile (age, gender), previous HF hospital admission, cardiovascular comorbidity (hypertension, diabetes, coronary heart disease, atrial fibrillation, previous stroke, peripheral artery disease), any other comorbidity (chronic pulmonary obstructive disease, chronic nephropathy, depression), dependency in activities for daily living, and cognitive impairment.

3.2. Characteristics of patients receiving home healthcare

Patients receiving home healthcare were older and more frequently women, ADL dependent, and cognitively impaired. They also had higher comorbidity and had been hospitalized the year prior to inclusion in the study as a consequence of HF (Table 1). Survival curves showed that both mortality and hospital admissions during follow-up were significantly higher in the group of patients receiving home healthcare, after adjusting for potential confounders such as comorbidity, HF treatment, and dependence index (Fig. 1).

Among the cohort of patients receiving home healthcare, subjects were analyzed individually in order to ascertain the determinants of mortality and cardiovascular hospitalization during follow-up.

Multivariate adjusted analyses in this population showed that mortality during follow-up was higher in older men, those who had been

Table 1

Characteristics of elderly patients with heart failure requiring home healthcare. Values are percentages unless stated otherwise.

	Home healthcare		p
	No N = 5250	Yes N = 2211	
Age (mean, standard deviation)	79.1 (6.7)	84.3(6.5)	<0.001
Older than 74 years	75.1	92.8	<0.001
Women	54.8	68.4	<0.001
Comorbidity			
Hypertension	77.5	81.2	<0.001
Diabetes	32.5	35.2	0.021
Coronary heart disease	25.8	27.2	0.197
Atrial fibrillation	37.0	41.0	0.001
Stroke	8.7	14.8	<0.001
Peripheral artery disease	6.0	7.2	0.049
Depression	15.4	20.0	<0.001
Chronic obstructive pulmonary disease	16.0	16.7	.456
Renal failure	17.3	25.2	<0.001
Dependence in activities for daily living	18.8	46.0	<0.001
Cognitive impairment	44.3	56.2	<0.001
Previous hospitalization for heart failure	32.1	46.1	<0.001
Treatments for heart failure			
Beta-blockers	51.0	38.4	<0.001
Furosemide	73.7	85.2	<0.001
Spironolactone	13.2	16.8	<0.001
ACE-inhibitors or ARB ^a	49.2	49.3	0.954
Outcomes during follow-up			
Hospitalization for cardiovascular events	22.7	38.9	<0.001
Death	14.4	35.5	<0.001

^a ACE inhibitors: angiotensin converting enzyme inhibitors; ARB: angiotensin receptor blockers.

previously hospitalized due to HF, and in subjects with severe ADL dependence.

The probability of being admitted to hospital as a consequence of a cardiovascular non-fatal event during follow-up was higher for patients who had been previously hospitalized due to HF, and in those diagnosed with atrial fibrillation.

It is noteworthy that patients receiving home healthcare who had severe ADL dependence, and those with cognitive impairment, were not more frequently admitted to hospital than the rest (Table 2).

4. Discussion

In our study we observed that older HF patients who received home healthcare had worse clinical profiles and prognosis than those who did not. The most powerful predictors for mortality were male gender, recent hospitalization due to HF, and severe ADL dependence. Worse scores in ADL were not linked to a higher rate of hospitalization among this population.

Our study findings require interpretation from an observational point of view. Several trials have shown the efficacy of selected programs to manage HF at the patients' homes [11,12]. The outcomes reported in this study do not derive from a clinical trial; as a consequence, our analysis is not of the efficacy of home healthcare programs, but rather the assessment of a cohort of HF patients, a considerable number of whom receive home care. It is reasonable to find higher comorbidity in these patients attended at home: the primary health care domiciliary program is oriented towards a population with acute, chronic or terminal processes, or to elderly house bound individuals unable to attend a primary healthcare centre.

This kind of attention is usually provided by a multidisciplinary team (general practitioners, nurses, and social workers) and includes palliative care and the follow-up of chronic diseases. In a few cases, patients may also be integrated in hospital-primary care programs such as tele-medicine follow-up managed by specialized units.

Regarding the occurrence of events, bivariate analyses showed that individuals receiving homecare were more frequently admitted to

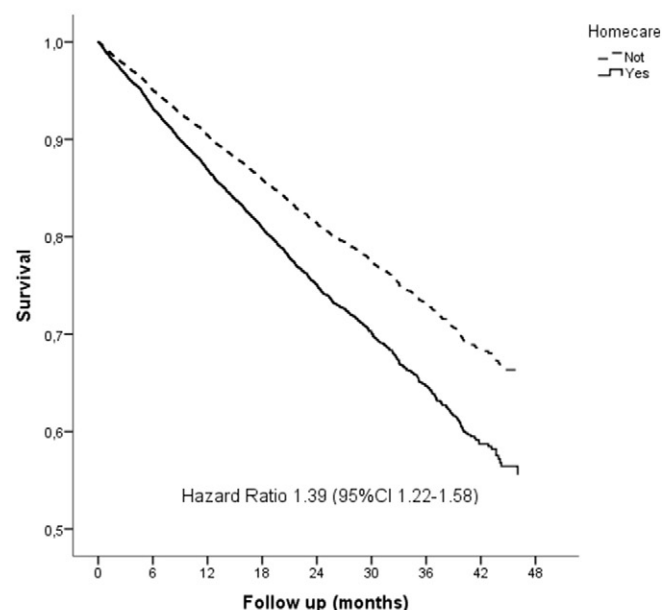
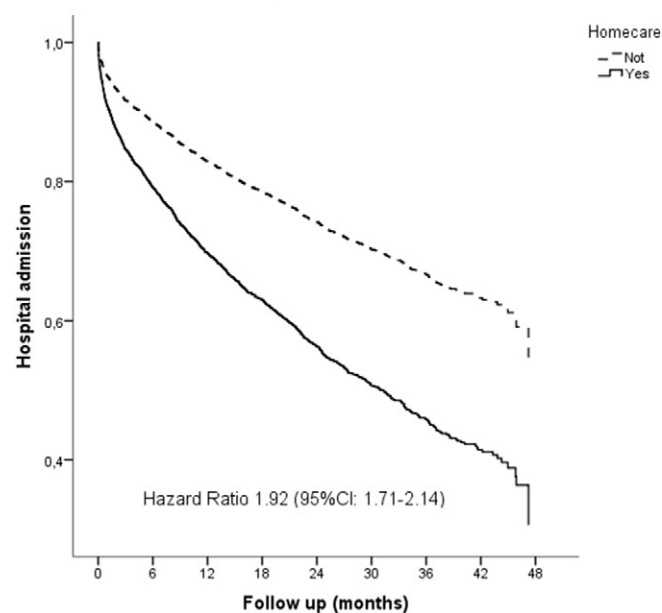
Panel 1: Survival curves for mortality during follow-up.**Panel 2: Survival curves for hospitalization as a consequence of cardiovascular events during follow-up.**

Fig. 1. Survival curves for mortality and hospitalization according to the fact of being included in home healthcare, adjusted by comorbidity, treatment for heart failure, and activities for daily living index. Panel 1: Survival curves for mortality during follow-up. Panel 2: Survival curves for hospitalization as a consequence of cardiovascular events during follow-up.

hospital as a consequence of a cardiovascular event or died during follow-up.

It should be taken into account that the purpose of home healthcare programs is not to extend patients' survival, but to improve their quality of life, enhance their capacity for autonomy, and provide support to families [17]. In fact, there are studies in which home visits have not been associated with a reduction in mortality [18].

According to the guidelines laid down by Cardiology Scientific Associations the percentage of our patients receiving beta-blockers and ACE-inhibitors or ARB should have been higher. Nevertheless, an HF meta-analysis published in 2013 reported an even lower percentage

Table 2

Risk of mortality or hospital admission during follow-up for older patients with heart failure requiring home healthcare.

	Mortality N = 784		Hospital admission N = 861	
	Hazard ratio	95% confidence interval	Hazard ratio	95% confidence interval
Men	1.40 ^a	1.10–1.79	1.10	0.83–1.46
Age (years)	1.03 ^a	1.02–1.05	0.98	0.96–1.00
Previous hospital admission for heart failure	1.29 ^a	1.05–1.60	2.24 ^a	1.76–2.85
Comorbidity				
Hypertension	0.82	0.62–1.06	1.27	0.92–1.77
Type 2 diabetes	1.14	0.91–1.42	0.98	0.77–1.25
Depression	0.80	0.61–1.05	0.85	0.65–1.11
Coronary heart disease	1.19	0.93–1.51	1.24	0.96–1.61
Atrial fibrillation	1.01	0.81–1.26	1.32 ^a	1.05–1.67
Stroke	0.93	0.69–1.26	0.81	0.58–1.15
Chronic pulmonary obstructive disease	0.74	0.54–1.01	1.24	0.92–1.67
Chronic nephropathy	1.22	0.96–1.57	0.90	0.67–1.21
Peripheral artery disease	1.20	0.81–1.76	0.84	0.52–1.38
Dependency in activities for daily living				
Independent or moderately dependent	Reference		Reference	
Severely dependent	1.33 ^a	1.06–1.67	0.97	0.77–1.23
Cognitive impairment				
Unimpaired	Reference		Reference	
Impaired	1.15	0.92–1.44	0.91	0.72–1.16

^a Statistical signification (p-value < 0.05) according to robust standard estimated with multivariate competing-risk regression models.

of beta-blocker utilization than in our study [19]. Regarding the use of ACE-inhibitors and ARB drugs, our figures are slightly lower than the ones stated in the mentioned study, considering the population age group. Another noteworthy finding is that patients at home received more symptomatic treatment (furosemide) and spironolactone, which are recommended in the most advanced stages of HF [20,21], than those without homecare, while no differences were found regarding angiotensin converting enzyme inhibitor use.

After adjusting for HF treatment among the population attended in home healthcare it was observed that male gender and older age were related to higher mortality. It has been shown that the risk of having a fatal event is lower in women with HF than in men although as yet no satisfactory explanation has been found [22].

With respect to age, it has been reported that it is one of the predictive variables for mortality in HF patients [23].

HF patients with greater ADL dependence also had higher rates of mortality. There are several ways to measure this factor; although there are uncertainties concerning the Barthel index validity, it has, however, been shown to be reliable when used with older people [24], and in a Spanish setting it is systematically administered when patients are included in home healthcare programs. It is well-known that functional decline increases with age and can lead to loss of independence and early death [25]; studies performed with HF patients have found an association between the Barthel index and mortality [26].

When analyzing hospitalization due to cardiovascular events, the most powerful predictor was suffering an HF hospital admission in the year prior to study inclusion. In this regard, authors have reported that a previous history of HF hospitalization can identify patients at high risk of recurrent events [27].

A systematic review showed that some home visiting programs offering health promotion and preventive care could reduce death among a general, elderly population. Only one study, however, was able to show a reduction in hospital admissions [28].

We consider that our most relevant finding is the fact that among HF patients receiving home healthcare, those having higher levels of dependence and cognitive impairment were not more frequently hospitalized.

Continuity is one of the essential characteristics of primary healthcare and in many places is performed by general practitioners and nurses [29,30]. Such is the case in Spain where home healthcare is usually provided by general practitioners, nurses and, if necessary, social workers [7]. Patients included in home healthcare are not only attended when they specifically require, but preventive visits are regularly made to check their evolution and needs.

It is well known that hospitalization has an adverse effect on loss of activities of daily living, especially in the elderly [31]. It is, therefore, plausible that general practitioners and nurses may choose to manage, together with caregivers and families, the most dependent patients at home instead of referring them to hospital, thus preventing the adverse effects of possibly needless admissions. On the other hand, it is also the task of emergency room professionals to decide whether the referred patients are really going to benefit from hospitalization. On many occasions, after an HF decompensation it is better for the patient to return home from the emergency room with a therapeutic plan, including, in some cases, short acute day care hospital treatment and telemonitoring follow-up in accordance with the general practitioner.

4.1. Strengths and limitations

We have analyzed a large sample of patients from a clinical database which limits the availability of some measurements, for instance, ejection fraction. The only way to evaluate the patients' functional status was with the Barthel index, and information regarding some prognosis markers of other comorbidities such as glomerular rate and respiratory capacity was lacking. Nevertheless, we believe that the dependence index is an objective and comprehensive measure that summarizes and properly describes the patient's status regardless of the underlying comorbidity. The intensity or the number of homecare visits could not be assessed. We have to assume that the professionals followed the current guidelines which are accessible in the electronic medical records, and that they carried out the usual preventive visits according to the domiciliary programs.

5. Conclusions

Due to their greater comorbidity and age, mortality and hospitalization in patients requiring home healthcare were higher than those who did not. Among the HF patients receiving home care, mortality and hospital admissions were higher in men, older patients, and in those previously hospitalized for HF. Severe dependence in ADL determined a higher mortality but was not related to increased hospital admission rates.

Conflict of interest

The authors report no relationships that could be construed as a conflict of interest.

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