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Survival probability during one-year follow-up after index hospitalization for heart failure: an Italian retrospective study

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Parole chiave: Scompenso cardiaco, Mortalità, Registri ospedalieri, Studio retrospettivo, Modelli assistenziali

Abstract

Background. *Heart failure affects about 64 million people worldwide, and despite the economic resources employed to improve its prognosis, mortality is still alarming. The aim of this study was to investigate the impact of patients' characteristics on survival probability during one-year follow-up after an index hospitalization for heart failure.*
Study design. *A three-year retrospective study was conducted on the records of the Hospitals belonging the Local Health Unit of L'Aquila, a Healthcare Facility located in the centre of Italy.*
Methods. *Patients admitted to hospital with a heart failure event as main diagnosis were selected and followed up for one year after their discharge to obtain data for survival analysis.*
Results. *During the observational period for 1,929 patients hospitalized with a Heart failure index event, 1,655 (85.8%) of them were discharged alive and followed up for one year after the discharge. Fourteen percent of patients (n = 232) died for reasons related to Heart failure during the follow-up period. Fifty percent of them (n = 116), died within three months from the index hospitalization discharge.*
Age ≥75 years (HR 3.192, 95% CI 1.964–5.188), discharging to home (HR 0.399, 95% CI 0.297–0.536), length of stay ≥8 days during the index hospitalization (HR 1.533, 95% CI 1.163–2.019), and high education level (HR 0.517, 95% CI 0.273–0.977), were found to be associated with the survival probability.
Conclusion. *Study results indicate that older patients, especially those with a low educational level, those with longer index hospitalization, and those not sent directly to home, deserve more care and attention after discharge.*

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Introduction

Heart failure (HF) is a heterogeneous syndrome characterized by distinctive signs and symptoms derived from cardiac dysfunctions or abnormalities that could result in reduced cardiac output at rest or during efforts. In this regard, HF patients can be classified based on left-ventricular ejection fraction (LVEF) that could be preserved (≥50% LVEF), mid-range ejection fraction (40–49% LVEF) and reduced ejection fraction (<40% LVEF) (1). Despite heterogeneity in definitions and classifications of HF, about 64 million people are suffering from this condition worldwide. In general and aged (>65 years) populations of developed countries, its prevalence reaches 2% and 11.8% respectively (2, 3), and it is increasing due to constant aging of population and improvement in prognosis after diagnosis (4).

In Western Countries, the economic burden of this syndrome accounts for about 2% of all healthcare costs, amounting to about € 29 billion in Europe (5, 6). Despite the economic resources employed to deal with HF and improve its prognosis, concerns about HF remain relevant from a public health point of view, not only due to its serious impact on patients' Activities of Daily Living, working abilities, and Quality of Life, but also because of its alarming mortality. In fact, in Europe, the documented in-hospital mortality of patients hospitalized for acute HF ranges between 1.2% and 22.0%, according to their clinical profile at admission (7), while the overall mortality at 1 year of patients with acute HF ranges between 13.0% and 24.7% (8). Data available for Italy showed an in-hospital mortality ranging between 6.0% and 6.9% in patients with chronic and acute HF, while 1-year overall mortality was found to be 24.0% (9). To promote long-term health and reduce the risk of mortality in HF patients, evidence-based care models tailored to patient's characteristics need to be developed for in-hospital and out-of-hospital care (1, 10-12). For this reason, this study was carried out to investigate the characteristics of a homogeneous population of Central Italy inhabitants suffering from HF, in order to detect the probability of survival after one year of discharge following index hospitalization.

Methods

Study design, setting, and population

This study is part of a larger retrospective study conducted in a Central Italy area with a population of about 300,000 citizens.

Data were gathered from the records of the Local Health Units of L'Aquila district and covered the period from 1st January 2016 to 31st December 2018.

According to the ICD-9-CM classification, all patients admitted to the hospital with an HF index event as main diagnosis were selected and followed up for one year after their discharge to obtain data for survival analysis.

HF diagnosis was identified with the DRG number 127 under the 428, 402, and 785 codes.

The HF hospitalization was defined as index event when it was not preceded by any HF hospitalization for at least one year.

Both in-hospital and out-of-hospital deaths occurred after the index hospitalization represented the study endpoints during the follow-up period.

Patients who died from non-heart failure causes were excluded.

Variables and data analysis

Descriptive analyses were performed on all the data. Patient subgroups were defined based on homogeneous socio-demographic (gender, age, marital status, and education) and hospitalization-related (admission hospital unit, discharge hospital unit,

length of stay, and discharge modalities) characteristics.

The survival analysis was performed using the Kaplan–Meier estimator and the log-rank test was used for group comparison.

The Cox proportional-hazards model was used to investigate the association between the survival time of patients and socio-demographic characteristics, and the survival time of patients and clinical independent variables.

For all analyses, a bidirectional test was used with a significance level of 0.05. All data were analysed using IBM SPSS version 25.0 (IBM Corp., Armonk, NY, USA).

Ethical considerations

Research ethics approval was obtained from the Health Facility Internal Review Board. The Ethics Committee was consulted, who noted that their ethical approval was not required for this type of study because it did not interfere with patient care.

Table 1 - Descriptive characteristics of the enrolled population (n = 1,655)

		n	%
Gender	Male	764	46.2
	Female	891	53.8
Age (year)	mean ±SD	79.9 ±10.3	
	Range	35–103	
	≤ 74	398	24.0
	≥ 75	1,257	76.0
Marital status	Single	618	37.3
	Married	772	46.7
	Missing data	265	16.0
Educational Level	Primary school	1,153	69.7
	Lower secondary school	236	14.3
	Upper secondary school	115	6.9
	Academic instruction	37	2.2
	Missing data	114	6.9
Admitting ward on index hospitalization	Cardiology	478	28.9
	Geriatrics	215	13.0
	Medicine	547	33.0
	Intensive care unit	189	11.4
	Others	226	13.7
Discharging ward on index hospitalization	Cardiology	698	42.2
	Geriatric	214	12.9
	Medicine	521	31.5
	Intensive care unit	43	2.6
	Others	179	10.8
Discharging modality on index hospitalization	Home	1,425	86.1
	Nursing Home/Home care/ Other ward/ healthcare facility	230	13.9
Length of stay on index hospitalization (Days)	mean ±SD	8.9 ±6.9	
	Range	1–68	

Table 2 - Circumstances in which deaths occurred within one year following the HF index event

	n	%
Out-of-hospital deaths without any HF re-hospitalization following the index event	139	8.40
Out-of-hospital deaths after at least one HF re-hospitalization following the index event	37	2.24
In-hospital deaths during HF re-hospitalization after the index event	56	3.38
In-hospital deaths during non-HF re-hospitalization after the index event	77	4.65
Survived beyond the follow-up period	1,346	81.33
tot	1,655	100

Results

Overall, during the observational period for the 1,929 patients hospitalized with an HF index event, 1,655 (85.8%) of them were discharged alive and followed up for one year after the discharge to detect their probability of survival.

As shown in Table 1, the mean age of these patients was 79.9 ±10.3 years (median = 82; IQR = 12), and most of them were female (53.8%).

During the follow-up period, 309 of them died (18.7%), mostly at home (57.0%) (Table 2).

Fifty percent (116) of 232 patients, who died for reasons related to HF during the follow-up period, died within three months from the index hospitalization discharge.

The survival analysis performed on 1,578 patients discharged alive after the HF index hospitalization (77 patients were excluded because they died during non-HF re-hospitalization) showed that 1,346 of them (85.3%) survived at the end of the follow-up period (Figure 1).

Statistically significant differences in survival analysis were found according to age, educational level, LOS, and discharging modality on index hospitalization (Figure 2).

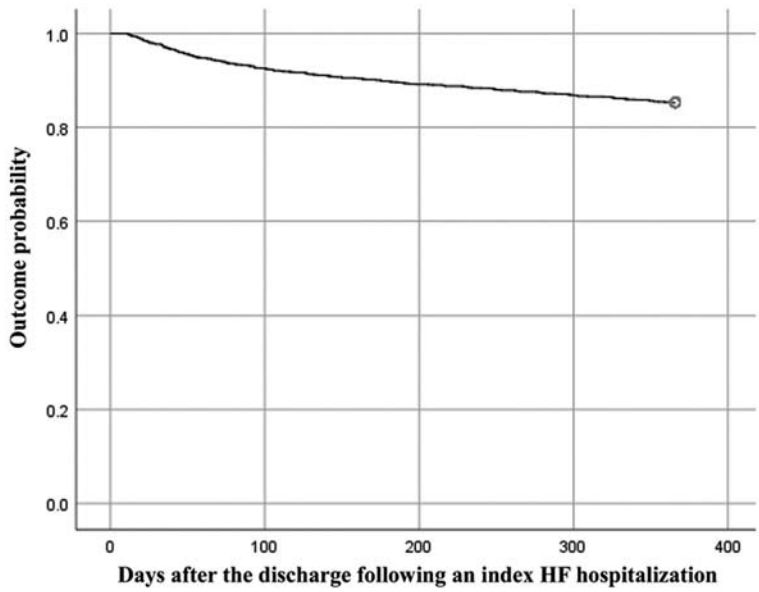

Figure 1 - Survival probability within one year following the HF index event

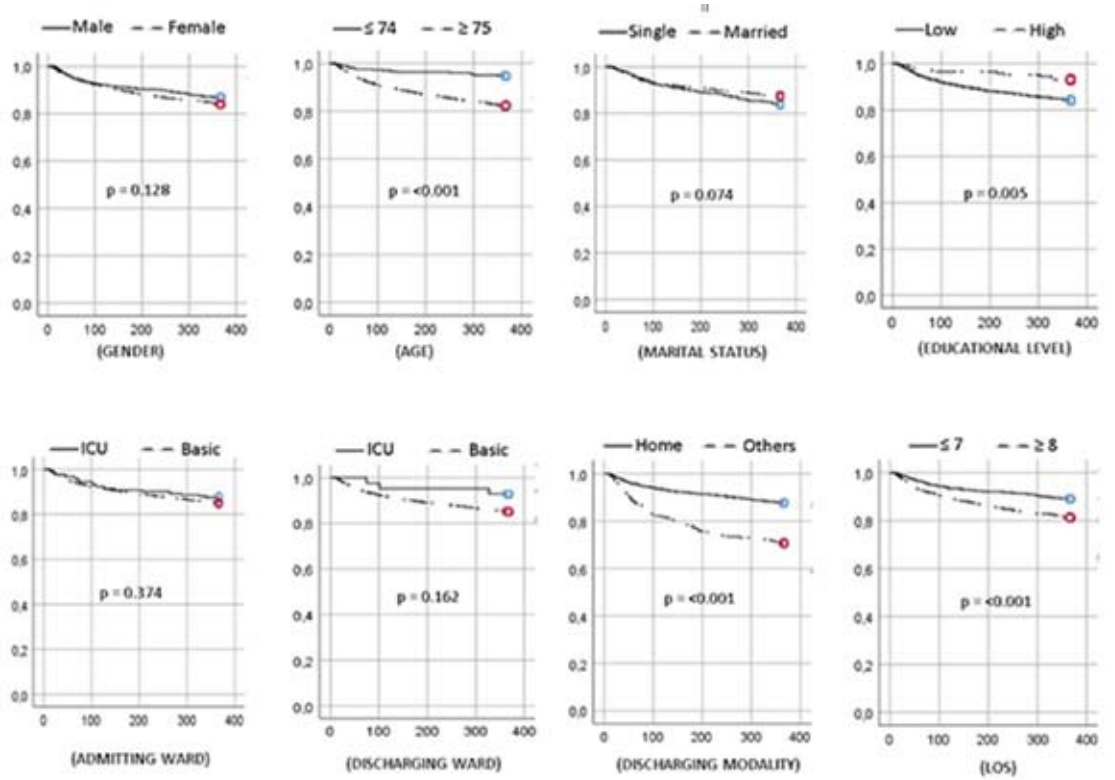

Figure 2 - Subgroup Kaplan–Meier survival analysis.
X axis: days after the discharge following an index HF hospitalization
Y axis: outcome probability

As confirmed by the multivariate analysis (Table 3), being older than 74 years and having had a length of stay (LOS) >7 days during the index hospitalization could increase the risk of dying within one year from discharge by up to 3 times compared to the opposite conditions. Conversely, a high level of education, as well as being

Table 3 - Cox regression model for factors associated with probability of dying within one year following the HF index event

		Exp β	95% CI		p-value
			Lower	Upper	
Age	≥75	3.192	1.964	5.188	<0.001
	≤ 74	Ref.*			
Discharging modality on index hospitalization	Home	0.399	0.297	0.536	<0.001
	Others	Ref.			
Length of stay on index hospitalization	≥8	1.533	1.163	2.019	0.002
	≤ 7	Ref.			
Educational level	High	0.517	0.273	0.977	0.042
	Low	Ref.			

* Ref. = Reference

discharged directly to home (instead of to other healthcare facilities) after the index hospitalization, turned out to be factors that reduced this risk.

Discussion and conclusions

This study was carried out to perform survival analysis on patients discharged alive after HF index hospitalization. Descriptive analysis showed that in a homogeneous population of about 300,000 citizens, 1,929 of them were hospitalized for a first episode of HF during the three-year observational period. We know from the percentage of patients discharged alive (85%) that exactly 274 (15%) of the hospitalized patients died during the index hospitalization. Since the study's results showed that 232 of 1,655 patients discharged alive died during the 1-year follow-up, adding index deaths to after-index hospitalization deaths and assuming that the target population of the study was representative of the national population, it can be estimated that on average about 93 patients die per day in Italy from HF. For this reason, the topic investigated in this study can be considered a public health issue.

Mean age and gender distribution of patients enrolled in this study are similar to those of other cohorts investigated at national level (13, 14).

When compared with other similar research at the European level, slight differences emerged alternately in gender distribution or mean age (15-17). Overall, 309 (18.7%) of 1,655 patients died in the hospital or elsewhere during the one-year follow-up after discharge following HF index hospitalization, although only 232 (14.02%) died exclusively for HF reasons, mostly not in the hospital and without any previously HF re-hospitalization.

The availability of data on deaths due to all causes, including accidents, made it possible to perform an analysis that would return a probability of survival conditioned by the non-occurrence of events not related to HF.

Even considering small methodological differences in the conduction of the study, data about both overall and one-year follow-up in-hospital mortality are quite similar to those in the literature on Italian and European contexts (8, 9). When compared with English data, the general global mortality rate was fairly lower, while mortality rates due to HF were similar (16). Considering that half of the patients with a HF index event died within three months after the discharge, it is advisable that the role of comorbidity and other clinical variables in short-term mortality should be better understood. To reduce the short-term mortality, it may be useful to improve multidisciplinary caring, monitoring activities, telemedicine, self-care promotion, medication compliance, and organizational efforts in the first few follow-up months that seem to be critical (1, 11). However, a worsening in the prognosis of HF patients after hospitalization can be also due to a suboptimal adherence to the international guidelines, especially to recommendations related to the pharmacological treatment, patients' education, and their self-care behaviours (18, 19). In the first three months after discharge, patients are particularly vulnerable and require regular clinical follow-up and an easy access to structured multidisciplinary care. In this regard, a close collaboration between General Practitioners and Community Nurses could be useful to ensure deeper and more frequent monitoring of clinical parameters aiming at early detecting the progression of disease, promote self-care behaviours, and ensure the optimal dosing of medicines (1).

In this study, age ≥75 years and LOS ≥8 were found to be associated with increased mortality, while direct discharge to home and higher educational levels seemed to be associated with a lower mortality rate.

While age and educational level cannot be modified, discharging modalities and LOS depend on patient's clinical characteristics. It is likely that clinically more complex patients need longer hospitalization to face the first HF manifestations and, after that, to be sent to other health facilities instead of directly home.

Unfortunately, the lack of clinical data, due to the administrative source of the data and the retrospective nature of the study, makes it difficult to specify how much the presence of comorbidities and other clinical features affected the survival of the investigated patients, and, for this reason, represents the main limitation of this study. Therefore, to have a clearer depiction of the phenomenon, data reported need to be integrated with other studies analysing the comorbidities and clinical conditions of the included patients.

The limitation notwithstanding, the results clearly indicate that older patients with a low educational level, as well those with longer index hospitalization and not sent directly home, deserve more care and attention, especially in the first months after discharge.

In a homogeneous central Italy population of about 300,000 inhabitants, 14.02% of patients discharged alive after HF index hospitalization died during the one-year follow-up exclusively for HF reasons, with half of the deaths occurring within three months of discharge and most of them not in the hospital. Age, educational level, LOS during the index hospitalization, and discharging modalities were found to be associated with the survival probability within one year of discharge.

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Riassunto

Probabilità di sopravvivenza ad un anno dal ricovero indice per scompenso cardiaco: studio retrospettivo su una provincia dell'Italia centrale

Background. Lo scompenso cardiaco colpisce circa 64 milioni di persone nel mondo e, nonostante le risorse economiche impiegate per migliorarne la prognosi, il livello di mortalità resta allarmante. L'obiettivo dello studio era valutare l'impatto delle caratteristiche dei pazienti sulla probabilità di sopravvivenza ad un anno dall'ospedalizzazione indice per scompenso cardiaco.

Disegno dello studio. È stato condotto uno studio retrospettivo su un periodo di tre anni attraverso i registri ospedalieri dell'Azienda Sanitaria Locale della provincia dell'Aquila (centro Italia).

Metodi. I pazienti ricoverati in ospedale con diagnosi principale di scompenso cardiaco sono stati selezionati e seguiti per un anno dopo la dimissione al fine di ottenere dati utili per l'analisi di sopravvivenza.

Risultati. Durante il periodo di osservazione dei 1.929 pazienti ospedalizzati per un evento indice di scompenso cardiaco, 1.655 (85,8%) sono stati dimessi vivi e seguiti per un anno dopo la dimissione. Il 14,0% di questi pazienti (n = 232) è deceduto durante il periodo di follow-up per ragioni legate allo scompenso cardiaco, con una percentuale del 50,0% (116 pazienti) di deceduti entro tre mesi dalla dimissione.

L'età ≥75 anni (HR 3,192; 95% IC 1,964–5,188), la dimissione a casa (HR 0,399; 95% IC 0,297 –0,536), la lunghezza della degenza dell'ospedalizzazione indice ≥8 giorni (HR 1,533; 95% IC 1,163 – 2,019) e un alto livello di istruzione (HR 0,517; 95% IC 0,273 – 0,977), sono risultati associati alla probabilità di sopravvivenza.

Conclusioni. I risultati dello studio indicano che i pazienti più anziani, quelli con un basso livello di istruzione, quelli che hanno avuto una degenza ospedaliera più lunga durante il ricovero indice e quelli non dimessi direttamente al domicilio, necessitano di maggiore attenzione assistenziale dopo la dimissione.

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