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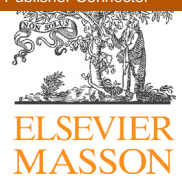

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CLINICAL RESEARCH

First hospitalization for heart failure in France in 2009: Patient characteristics and 30-day follow-up

Première hospitalisation pour insuffisance cardiaque en France en 2009 : caractéristiques des patients et suivi à 30 jours

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KEYWORDS
Heart failure;
Incidence;
Hospitalization;
France;
SNIIRAM

Summary
Background. — The incidence of heart failure (HF) is stable in industrialized countries, but its prevalence continues to increase, especially due to the ageing of the population, and mortality remains high.
Objective. — To estimate the incidence in France and describe the management and short-term outcome of patients hospitalized for HF for the first time.

Abbreviations: ACEI, angiotensin-converting enzyme inhibitor; AD, associated diagnosis; ALD, affections de longue durée; ARB, angiotensin II receptor blocker; BNP, brain natriuretic peptide; HF, heart failure; ICD 10, International Classification of Diseases; PD, principal diagnosis; RR, relative risk; SLM, local mutualist sections; SNIIRAM, Système National d'Information Inter-Régimes de l'Assurance Maladie.

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Method. — The study population comprised French national health insurance general scheme beneficiaries (77% of the French population) hospitalized in 2009 with a principal diagnosis of HF after exclusion of those hospitalized for HF between 2006 and 2008 or with a chronic disease status for HF. Data were collected from the national health insurance information system (SNIIRAM).
Results. — A total of 69,958 patients (mean age 78 years; 48% men) were included. The incidence of first hospitalization for HF was 0.14% (≥ 55 years, 0.5%; ≥ 90 years, 3.1%). Compared with controls without HF, patients more frequently presented cardiovascular or other co-morbidities. The hospital mortality rate was 6.4% and the mortality rate during the 30 days after discharge was 4.4% (3.4% without readmission). Among 30-day survivors, all-cause and HF 30-day readmission rates were 18% (< 70 years, 22%; ≥ 90 years, 13%) and 5%, respectively. Reimbursements among 30-day survivors comprised at least a beta-blocker in 54% of cases, diuretics in 85%, angiotensin-converting enzyme inhibitors (ACEIs) or angiotensin receptor blockers (ARBs) in 67%, a diuretic and ACEI/ARB combination in 23% and a beta-blocker, ACEI/ARB and diuretic combination in 37%.
Conclusion. — Patients admitted for HF presented high rates of co-morbidity, readmission and death at 30 days, and there remains room for improvement in their drug treatments; these findings indicate the need for improvement in return-home and therapeutic education programmes.

MOTS CLÉS
Insuffisance cardiaque ;
Incidence ;
Hospitalisation ;
France ;
SNIIRAM

Résumé
Contexte. — L'incidence de l'insuffisance cardiaque (IC) est stable dans les pays industrialisés mais sa prévalence continue d'augmenter, en partie face au vieillissement de la population, et la mortalité reste élevée.
Objectif. — Cette étude a pour but d'estimer l'incidence et de décrire la prise en charge et le devenir à court terme des patients hospitalisés une première fois pour IC en France.
Méthode. — Parmi les bénéficiaires du régime général de l'Assurance maladie (77 % de la population française) hospitalisés en 2009 avec un diagnostic principal d'IC, ont été exclus ceux hospitalisés pour IC entre 2006 et 2008 ou avec une affection de longue durée pour IC et les informations recueillies à partir du système d'information de l'Assurance maladie (SNIIRAM).
Résultats. — Au total, 69 958 patients ont été inclus (âge moyen 78 ans, 48 % d'hommes). L'incidence était de 0,14 % (≥ 55 ans : 0,5 % ; ≥ 90 ans : 3,1 %). Par rapport à des témoins assurés sans IC et avec prise en compte de l'âge, les malades présentaient plus souvent des comorbidités cardiovasculaires ou non. Un décès était retrouvé chez 6,4 % des patients lors de l'hospitalisation et 4,4 % d'entre eux 30 jours après leur sortie (3,4 % sans réhospitalisation). Pour les survivants à 30 jours, 5 % ont été réhospitalisés avec un diagnostic principal d'IC et 18 % tous diagnostics inclus (22 % pour les < 70 ans et 13 % pour les ≥ 90 ans). Parmi les survivants à un mois, 54 % avaient au moins un remboursement d'un médicament de la classe des bêtabloquants, 85 % d'un diurétique, 67 % d'un inhibiteur de l'enzyme de conversion (IEC) ou d'un antagoniste des récepteurs de l'angiotensine 2 (ARA2) et 23 % avaient une association bêtabloquant et IEC/ARA2 et 37 % une telle association avec un diurétique.
Conclusion. — Les patients avec une première hospitalisation pour IC ont une fréquence élevée de comorbidités, de réhospitalisations et de décès à 30 jours et l'utilisation des médicaments indiqués pourrait être améliorée. Cela est en faveur d'une réflexion sur la promotion de programmes de retour à domicile et d'éducation thérapeutique.

Background

Heart failure (HF) is a common and disabling syndrome. The incidence of HF is stable in industrialized countries, but its prevalence continues to increase, especially due to the ageing of the population. The incidence of HF is currently estimated to be between 5 and 10 per 1000 subject-years, depending on the cohorts studied; the prevalence is estimated to be between 1% and 3% in industrialized countries [1,2]. The incidence and prevalence of HF markedly increase with age. For example, the Framingham study reported a prevalence of clinical HF of 0.8% in subjects aged 50—59 years and of 9.1% in those aged 80—89 years in 1993 [3]. The mortality of patients with HF has decreased over the past two decades, but remains high, with a standardized mortality rate in Europe of 32.6/100,000 in 2008 [4].

HF accounts for 1—2% of all healthcare expenditure and represents the leading cause of hospitalization after the age of 65 years in industrialized countries [2,5]. This syndrome is characterized by a high rate of hospitalizations, especially for acute decompensation. In France, among all patients hospitalized for HF in 2008, 7.5% died during their

hospitalization and 21% were readmitted for HF during the same year [6]. A high readmission rate is observed during the 30 days after discharge; for example, 5.6% of veterans in the USA were readmitted for a diagnosis of HF and 22% for all diagnoses combined between 2002 and 2006 [7]. Sixty-one percent of patients hospitalized for HF in the USA presented at least one factor of decompensation [8]. Based on these findings, disease management programmes before and after hospital discharge, comprising healthcare organization, patient education, training of healthcare professionals and/or home surveillance, have been demonstrated to be effective in many trials and have consequently been included in guidelines [9—11].

This study was designed to estimate the incidence and describe the clinical characteristics, treatment and 30-day outcome of patients presenting a first hospitalization for HF in France among national health insurance general scheme beneficiaries, representing 77% of the French population.

Methods

Information system and population

In France, the Système National d'Information Inter-Régimes de l'Assurance Maladie (SNIIRAM; French national inter-regime health insurance information system) comprises an individual and anonymous database concerning the beneficiaries of the various schemes. The database comprehensively records all outpatient prescriptions, services and procedures performed and reimbursed, together with their dates, with historical data limited to a period of 3 years plus the current year. Medications are identified according to Anatomical Therapeutic Classification Code, laboratory tests are identified from the French National Laboratory Test Coding Table and the procedures performed on an outpatient basis or in private institutions are identified according to the Classification Commune des Actes Médicaux (French medical classification for clinical procedures). The SNIIRAM does not contain any clinical information concerning results related to prescriptions or examinations. Nevertheless, it indicates the presence of any 'affections de longue durée' (ALD; chronic diseases), such as cardiovascular diseases, which are eligible for 100% reimbursement of healthcare expenditure after application by the attending physician and approval by the national health insurance consultant physician. These chronic diseases are coded according to the International Classification of Diseases (ICD 10). An anonymous unique identification number for each subject links this information to data collected by the Programme de Médicalisation des Systèmes d'Information (national hospital discharge database) in healthcare institutions. During the patient's stay, principal diagnoses (PDs), related diagnoses and associated diagnoses (ADs) are coded according to ICD 10 and the procedures performed are coded according to the Classification Commune des Actes Médicaux. In 2009, the national health insurance general scheme covered about 77% of the 64 million inhabitants in France, excluding the 13% covered by local mutualist sections (SLM: students, civil servants, etc.). One of the reasons for limiting the study to this population was the availability of vital status and date of death from the National Institute for Statistics and Economic Studies (INSEE). The rest of the French population is covered by the Mutualité Sociale Agricole, the Régime Social des Indépendants and other specific health insurance schemes.

This study was based on the subpopulation covered by the national health insurance general scheme because, at the present time, the patient's survival status is not precisely indicated in the SNIIRAM for the other health insurance schemes. The first hospitalization in 2009 with a PD of HF (ICD code I50 heart failure) was selected to identify eligible patients. Hospitalizations with the following PDs were not included: I11.0 hypertensive heart disease; I13.0 hypertensive heart and renal disease with (congestive) heart failure; I13.2 hypertensive heart and renal disease with (congestive) heart failure and renal failure; I13.9 hypertensive heart and renal disease, unspecified; K76.1 chronic passive congestion of liver; and J81 pulmonary oedema. Eligible patients hospitalized with a PD of HF between 2006 and 2008, an AD of HF in 2008 and/or ALD chronic disease status for HF before the index hospitalization were then excluded.

Definitions

The search for co-morbidities before the first hospitalization for HF took into account the presence of specific chronic diseases and the presence, during the previous year, of at least one hospitalization with a PD for hypertensive disease, coronary heart disease or cardiomyopathy. 'Tumour' chronic diseases were subdivided into tumours of haematopoietic tissues (ICD codes C81 to C96) and breast tumours (C50).

Data reported for the index hospitalization for HF included the number and types of medical units coded in the Programme de Médicalisation des Systèmes d'Information (intensive care, cardiac intensive care, palliative care, etc.). Readmissions were taken into account whatever the reason for admission, when they occurred between 7 and 30 days after discharge, in order to eliminate early transfers. Readmissions were classified according to the presence of a PD or AD code for HF.

Drug treatments were identified by the presence of at least three reimbursements during the 6 months preceding the index hospitalization and by a single reimbursement during the 30 days following discharge. Beta-blockers with marketing authorization for the treatment of HF were grouped under the term 'specific'. Potassium-sparing diuretics combined with another diuretic in fixed-combination medicinal products were distinguished. Patients with no medicinal product reimbursement, all classes combined, during the 6 months preceding and/or the 30 days following hospitalization (mainly patients living in an institution directly dispensing medicinal products) were excluded from the comparative study of treatments before and after hospitalization.

Echocardiographs were identified by the presence of a specific code, whether they were performed in hospital or on an outpatient basis. Reimbursements for cardiology hospital outpatient and office visits were taken into account. Echocardiography was not systematically coded during a cardiology visit, as the levels of reimbursement may be similar for a visit with or without echocardiography. To compensate for this missing coding, a variable was constructed by

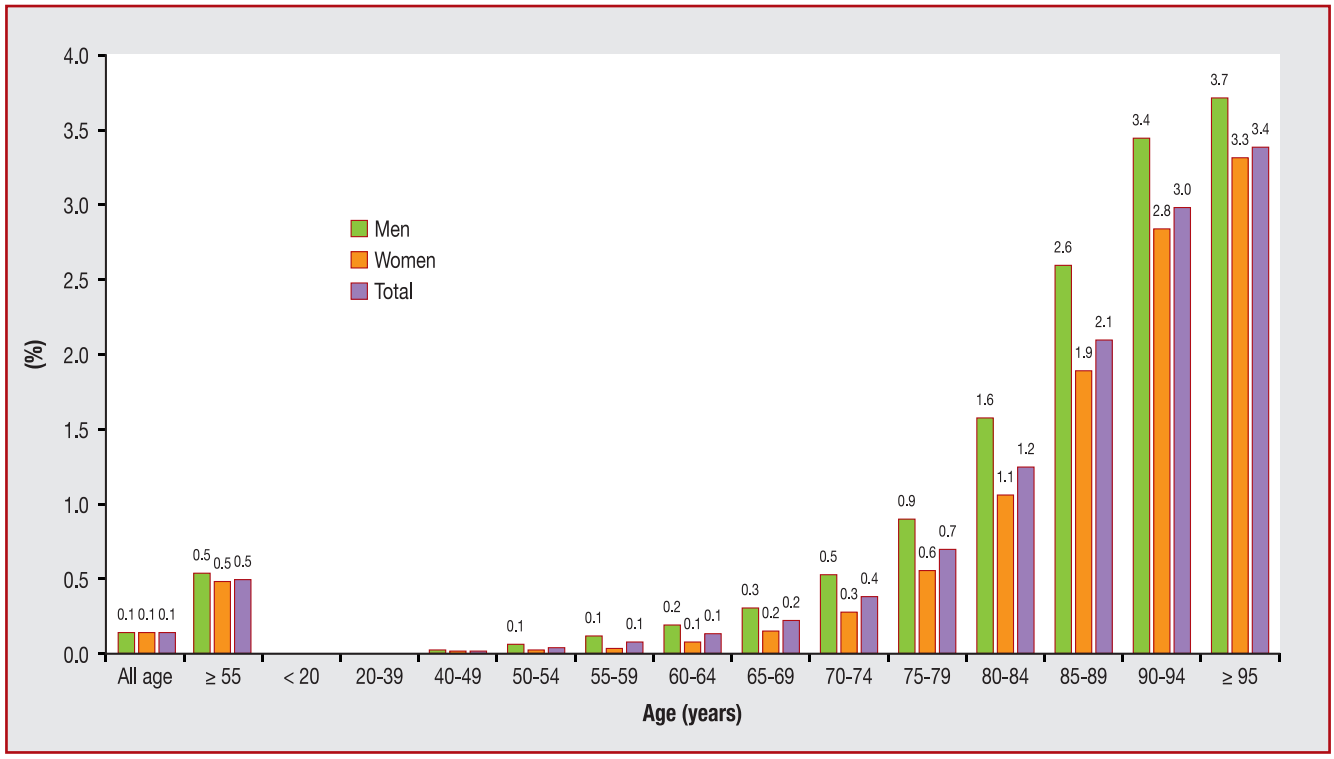

Figure 1. Incidence rate of a first hospitalization for heart failure by age and sex among subjects covered by the general scheme in France in 2009 ($n = 69,958$).

combining the existence of at least one visit to the cardiologist or echocardiography.

Laboratory assays such as brain natriuretic peptide (BNP) could not be identified when they were performed in a public hospital, as they are not reimbursed individually.

Statistical analysis

The incidence of a first hospitalization for HF was calculated from all patients selected in 2009 divided by the number of individuals covered by the national health insurance general scheme, apart from SLM, at 31 December 2009, according to age and sex. Regional incidence rates were standardized for age and sex of the general scheme population.

The mortality rate was calculated during hospitalization, during the 30 days after admission and during the 30 days after discharge. Readmissions were expressed as patients with at least one readmission with a diagnosis of HF (as PD and PD or AD) or for all diagnoses combined.

Patient and management characteristics were studied among those patients still alive at 30 days and compared with those of all patients hospitalized. The frequencies of co-morbidities and the consumption of certain medicinal products were compared between these patients and the other subjects covered by the general scheme. A frequency ratio (relative risk [RR]) was calculated according to age for the two groups, with a 95% confidence interval. This ratio was also standardized for age and sex among subjects aged ≥ 55 years.

Statistical analyses were performed with SAS Enterprise Guide software, version 4.3 (SAS Institute Inc., Cary, NC, USA).

Results

In 2009, for 152,601 patients, 200,412 hospital stays with a principal diagnosis of HF were recorded for all of France. Among them, 98,124 patients and 130,333 hospitalizations concerned people covered by the general scheme, excluding SLM. After exclusion of patients previously hospitalized for HF between 2006 and 2008 ($n = 24,047$) and the remaining patients with an ALD chronic disease status before hospitalization ($n = 4119$), a total of 69,958 patients with a first hospitalization with a PD of HF in 2009 were included in the study. Forty-eight percent of these patients were men; the mean age was 78 years. The mean length of stay was 9 days and the median length of stay was 8 days. Patients with a first hospitalization in 2009 totalled 1.2% of all patients hospitalized in 2009 (1.3% for men and 1.2% for women), 2.6% of those aged 70—79 years, 6.2% of those aged 80—89 years and 10.9% of those aged ≥ 90 years.

Incidence of first hospitalization for heart failure

The incidence of a first hospitalization for HF was 0.14% for the whole population (all ages combined) and 0.5% for patients aged ≥ 55 years (Fig. 1). This incidence increased considerably after the age of 70 years and was > 3% after the age of 90 years. Men presented a slightly higher incidence than women for all age groups considered (0.55% vs. 0.48% for patients aged ≥ 55 years). The age- and sex-standardized incidence according to region ranged between 0.11% and 0.18% (Fig. 2); it was higher in northern and north-western

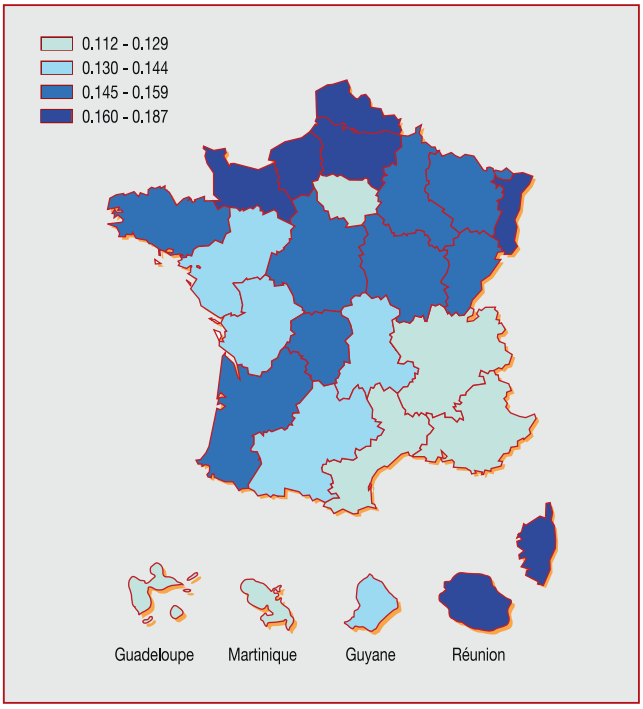

Figure 2. Age- and sex-standardized regional incidence rates of a first hospitalization for heart failure per 100 general scheme beneficiaries in France in 2009 ($n = 69,958$).

regions, Corsica and Réunion, and lower in south-eastern and Île-de-France regions.

Outcome of hospitalized patients: death and readmissions

The hospital mortality rate was 6.4% (Table 1). After standardization for age, this rate was slightly higher in men than in women (6.7% vs. 5.9%). The hospital mortality rate was 2.0% in patients aged < 55 years and 12.8% in patients aged ≥ 90 years. The mortality rate during the 30 days after discharge was 4.4%, without readmission for three-quarters of cases.

For patients surviving 30 days after discharge, at least one readmission (all diagnoses combined) was reported within 30 days for 18% of patients, with HF as the PD or AD in 9% of patients and HF as the PD in 5% of patients. Among patients readmitted, more than half had a cardiovascular disease as a PD, 12% had a factor influencing health status and contact with health services, 7% had a pulmonary disease and 4% had cancer. These readmission rates were higher among the youngest patients, especially for all-cause readmissions (21.7% for patients aged < 69 years and 12.7% for patients aged ≥ 90 years).

Pre- and post-hospitalization management of patients surviving 30 days after discharge

During the year preceding hospitalization, almost 46% of patients had undergone at least one echocardiography or had consulted a cardiologist, and at least one BNP assay had been reimbursed for 40% of them (Table 2). Eighteen percent of these patients were hospitalized in a private hospital, 21% in a university hospital (36% of patients aged < 55 years) and 61% in a public hospital. More than one quarter of patients were admitted to an intensive care unit or intermediate care unit (almost 40% of patients aged < 55 years). At the time of discharge, 79% of patients returned home and 21% were transferred to another unit, including a rehabilitation unit in one half of cases. Thirty days after discharge from hospital, 29% of patients had had at least one echocardiography or had attended a cardiology follow-up visit; 16% had had at least one BNP assay. No medicinal product reimbursement (all classes combined) was observed for 4.9% of patients during the year preceding hospitalization (5.2% for patients aged ≥ 90 years) and for 12.7% of patients during the 30 days after discharge (19.7% for patients aged ≥ 90 years).

Co-morbidities of patients surviving 30 days after discharge

These patients had a chronic disease recognized as an ALD in 71% of cases (Table 3). Over the age of 55 years, the prevalence of chronic diseases was significantly higher for each form of cardiac disease, such as hypertension (RR 1.5), coronary heart disease (RR 1.7), arrhythmias (RR 2.0), valvular heart disease (RR 3.1), but also for other co-morbidities such as diabetes (RR 1.9), chronic respiratory failure (RR 1.6), chronic kidney disease (RR 2.2), chronic liver disease (RR 1.6) and psychiatric diseases (RR 1.2). Only Alzheimer's disease was less common among these patients (RR 0.6). These patients also more frequently presented ALD status for a tumour of haematopoietic tissue (RR 1.3) or breast cancer in women (RR 1.1). The RR values for these tumours and psychiatric illness and reimbursements for antipsychotic drugs were inversely correlated with patient age.

Drug treatments

A total of 53,168 patients (85% of survivors at 30 days) receiving at least one drug reimbursed 1 year before and 30 days after their first hospitalization for heart failure were selected for a comparison of the time-course of reimbursement of the main drugs (Table 4). The use of beta-blockers increased after hospitalization from 40% to 54%; the use of specific beta-blockers increased from 14% to 31%. Although 60% of patients were being reimbursed at least a diuretic before their hospitalization, this frequency was 85% during the month following hospitalization (loop diuretic, increase from 46% to 81%; potassium-sparing diuretic, 10% to 17%; fixed combination of a potassium-sparing diuretic and another diuretic, 9% to 16%). Prescription of angiotensin-converting enzyme inhibitors (ACEIs) increased from 32% to 47%, while prescription of angiotensin II receptor blockers (ARBs) decreased from 26% to 21% and prescription of either an ACEI or an ARB increased from 56% to 67%. Prescription of a beta-blocker, diuretic and ACEI/ARB combination increased from 21% to 37% and prescription of a diuretic and ACEI/ARB combination increased from 21% to 23%. These frequencies and their variations after hospitalization were higher among the youngest patients. Younger patients more frequently benefited from an implantable cardioverter-defibrillator either during initial hospitalization or within the following month (3%).

Table 1 Mortality rates among 69,958 patients with a first hospitalization for heart failure in 2009, during hospitalization and 30 days after discharge, according to the presence of at least one readmission and, for the 62,417 survivors at 30 days, at least one readmission between 7 and 30 days after discharge, by age and sex.

	< 55 years	55—69 years	70—79 years	80—89 years	≥ 90 years	Women[a]	Men[a]	Total
First hospitalization (*n*)	4005	10,731	17,600	28,888	8734	33,408	36,550	69,958
Death (%)								
During and 30 days after hospitalization	3.7	5.1	7.3	12.7	21.6	10.1	11.8	10.8
During hospitalization	2.0	2.9	4.3	7.6	12.8	5.9	6.7	6.4
During the 30 days after discharge	1.7	2.2	3.0	5.1	8.8	4.2	5.1	4.4
With readmission for HF as PD	0.1	0.1	0.2	0.3	0.4	0.2	0.3	0.3
With readmission for HF as PD or AD	0.1	0.3	0.4	0.7	0.7	0.5	0.6	0.5
With readmission: all diagnoses	0.2	0.7	0.8	1.3	1.2	0.9	1.2	1.0
Without readmission	1.4	1.5	2.2	3.8	7.6	3.2	3.9	3.4
Survivors at 30 days (*n*)	3858	10,184	16,309	25,225	6841	32,365	30,052	62,417
Readmission (%)								
With HF as PD	5.0	5.6	5.2	5.1	4.5	4.8	5.4	5.1
With HF as PD or AD	9.9	10.1	9.6	8.8	7.4	8.3	9.8	9.1
All diagnoses	21.7	21.7	19.8	16.3	12.7	16.7	19.5	18.0

AD: associated diagnosis; HF: heart failure; PD: principal diagnosis.
[a] Adjustment for age.

Table 2 Characteristics history and management of 62,417 patients surviving at least 30 days after discharge after a first hospitalization for heart failure in 2009, by age and sex, compared with the characteristics of all patients hospitalized for heart failure.

	Survivors at 30 days								Hospitalized
	< 55 years	55—69 years	70—79 years	80—89 years	≥ 90 years	Women[a]	Men[a]	Total	
Number of patients (*n*)	3858	10,184	16,309	25,225	6841	32,365	30,052	62,417	69,958
Mean age (years)	—	—	—	—	—	80.1	73.7	77.0	77.7
Men (%)	65.4	67.7	56.4	41.4	24.3	—	—	49.4	47.8
One year before hospitalization (%)									
At least one reimbursement									
Echocardiography	35.5	42.5	45.0	38.9	25.9	37.6	42.1	39.4	38.4
Cardiologist visit or echocardiography	44.1	50.3	52.5	44.3	30.0	43.3	49.5	45.9	44.6
BNP assay	27.1	36.7	42.7	42.5	38.3	38.5	42.5	40.2	40.0
Hospitalization with a PD									
Hypertensive disease	1.1	1.0	0.9	1.0	0.9	1.2	0.7	1.0	1.0
Coronary heart disease or cardiomyopathy	11.0	10.3	8.8	5.9	2.7	5.9	8.7	7.4	7.2
Chronic disease (ALD)									
No chronic disease	52.2	32.4	23.8	25.7	33.0	29.8	26.6	28.7	28.2
Severe hypertension	4.5	12.2	16.5	18.8	19.6	17.9	14.0	16.3	16.4
Coronary heart disease	7.1	13.7	15.8	16.8	15.8	10.4	20.4	15.3	15.3
Serious arrhythmias	1.2	2.8	5.1	6.1	5.0	5.2	4.7	4.9	4.8
Serious valvular heart disease	3.3	4.0	4.0	3.7	2.8	4.3	3.5	3.7	3.7
Diabetes	10.5	25.7	26.9	17.7	8.9	20.6	19.8	20.0	19.8
Chronic respiratory failure	1.9	3.7	4.4	3.4	2.0	2.9	4.1	3.5	3.6
Serious chronic kidney disease	2.9	2.0	1.5	0.9	0.7	1.3	1.5	1.3	1.3
Malignant tumour	4.7	9.2	13.0	12.7	9.6	10.2	13.6	11.4	11.7
Haematopoietic tissues	1.4	1.3	1.3	1.0	0.6	1.2	1.1	1.1	1.1
Breast (women)	4.3	6.8	5.7	4.7	3.4	5.1	—	4.9	4.8
Alzheimer's disease	0.0	0.1	1.0	3.2	5.5	2.6	1.3	2.2	2.5
Parkinson's disease	0.0	0.3	0.8	1.0	1.2	0.8	0.8	0.8	0.9
Chronic liver disease	1.5	1.3	0.9	0.4	0.1	0.7	0.7	0.7	0.7
Psychiatric illness	6.0	4.3	2.8	1.9	1.5	3.8	1.8	2.7	2.7
Antipsychotics reimbursed	4.8	3.6	3.0	2.9	4.6	4.2	2.5	3.3	3.5
No medicinal product reimbursed	12.5	7.5	3.7	3.5	5.2	4.5	4.8	4.9	5.0
Index hospitalization (%)									
Hospital category									
Private hospital	15.2	20.0	19.9	18.4	14.9	17.3	19.9	18.4	18.1
University hospital	35.7	24.6	20.5	18.9	20.5	21.5	21.1	21.5	21.2
General hospital	49.1	55.5	59.6	62.7	64.6	61.2	58.9	60.1	60.8
Medical units frequented									
1	57.4	56.9	58.6	59.8	65.7	58.6	60.3	59.5	59.6
2	29.2	31.5	30.8	31.7	29.2	31.6	30.4	31.0	30.6
≥ 3	13.5	11.6	10.6	8.4	5.1	9.8	9.4	9.5	9.8

Table 2 (*Continued*)

	Survivors at 30 days								Hospitalized
	< 55 years	55–69 years	70–79 years	80–89 years	≥ 90 years	Women[a]	Men[a]	Total	
Stay in									
Intensive care unit	5.3	4.0	2.9	1.5	0.6	2.4	2.3	2.4	2.8
Cardiac intensive care unit	27.9	26.8	21.5	16.8	9.1	18.8	20.5	19.5	19.5
Intermediate care unit	5.4	5.2	5.4	5.0	3.9	5.0	5.2	5.0	5.2
Palliative care unit	1.1	2.0	2.4	2.6	3.0	2.4	2.3	2.4	2.5
Length of stay (nights)									
< 2	15.8	10.2	7.2	6.4	8.4	7.9	7.9	8.0	9.1
2–5	33.3	30.7	25.9	21.9	21.9	23.1	26.9	25.1	24.9
6–10	29.1	34.2	36.9	36.6	34.7	36.0	35.5	35.6	34.3
11–15	12.5	14.4	16.7	19.5	19.3	18.4	16.5	17.5	17.2
≥ 16	9.3	10.5	13.2	15.6	15.7	14.5	13.2	13.8	14.5
Mean (days)	7.4	8.2	9.0	9.8	9.6	9.4	8.9	9.2	9.2
Mode of discharge									
Home	79.0	82.0	81.9	77.1	73.6	77.6	81.0	78.9	
Transfer	21.0	18.0	18.1	22.9	26.4	22.3	18.9	21.1	
To a rehabilitation unit	3.9	4.0	6.3	11.7	14.8	10.0	7.3	8.9	
30 days after hospitalization (%)									
At least one reimbursement									
Echocardiography	15.1	14.5	12.4	9.4	6.1	10.7	11.6	11.0	
Cardiology visit or echocardiography	29.9	34.0	32.1	27.1	18.5	27.5	30.7	28.8	
GP visit	62.3	68.3	74.0	72.5	70.5	71.9	71.7	71.4	
BNP assay	12.8	15.6	16.5	16.7	15.6	15.5	17.0	16.1	
Serum creatinine	38.9	48.1	51.3	49.4	44.3	46.7	50.4	48.5	
Potassium	22.6	27.2	29.0	29.7	27.6	28.8	28.2	28.5	
No medicinal product reimbursed (%)	10.9	8.4	9.8	14.7	19.7	13.9	10.8	12.7	

ALD: affections de longue durée; BNP: brain natriuretic peptide; PD: principal diagnosis.
[a] Adjustment for age.

Table 3 Frequency of certain chronic diseases (ALD) among general scheme beneficiaries who survived 30 days after a first hospitalization for heart failure in 2009 over the frequency among other beneficiaries in 2009, by age group.

	< 40 years	40—54 years	55—69 years	70—79 years	80—89 years	≥ 90 years	Total ≥ 55 years[a]
	(*n* = 830)	(*n* = 3028)	(*n* = 10,184)	(*n* = 16,309)	(*n* = 25,525)	(*n* = 6491)	
No chronic disease	0.6 [0.6—0.7]	0.6 [0.5—0.6]	0.5 [0.4—0.5]	0.4 [0.4—0.5]	0.7 [0.6—0.7]	1.2 [1.2—1.3]	0.6 [0.6—0.6]
Hypertension	44.5 [25.9—76.3]	6.3 [5.4—7.3]	3.0 [2.9—3.2]	1.9 [1.8—1.9]	1.4 [1.4—1.5]	1.2 [1.1—1.2]	1.5 [1.5—1.6]
Coronary heart disease	87.7 [53.9—142.6]	10.5 [9.4—11.8]	4.3 [4.1—4.5]	2.4 [2.3—2.5]	1.8 [1.7—1.8]	1.3 [1.3—1.4]	1.7 [1.7—1.8]
Arrhythmias	108.7 [58.6—201.5]	15.2 [11.1—21.0]	5.4 [4.8—6.1]	2.9 [2.7—3.1]	1.8 [1.8—1.9]	1.4 [1.2—1.5]	2.0 [1.9—2.0]
Valvular heart disease	119.8 [76.7—187.0]	28.9 [24.0—34.7]	9.3 [8.5—10.3]	3.9 [3.7—4.3]	2.5 [2.3—2.6]	2.2 [1.9—2.5]	3.1 [2.9—3.2]
Diabetes	12.7 [8.9—18.2]	5.3 [4.8—5.8]	3.3 [3.2—3.4]	2.3 [2.2—2.3]	1.6 [1.6—1.7]	1.2 [1.1—1.3]	1.9 [1.9—2.0]
Chronic respiratory failure	4.3 [2.0—9.6]	5.8 [4.6—7.4]	3.5 [3.1—3.8]	2.1 [2.0—2.3]	1.3 [1.3—1.4]	0.9 [0.7—1.0]	1.6 [1.5—1.6]
Chronic kidney disease	41.2 [27.0—62.8]	19.2 [15.7—23.5]	7.4 [6.5—8.5]	3.4 [3.0—3.9]	1.5 [1.3—1.7]	1.0 [0.8—1.3]	2.2 [2.0—2.3]
Malignant tumours	12.1 [8.5—17.4]	2.3 [2.0—2.7]	1.3 [1.3—1.4]	1.0 [1.0—1.1]	1.0 [0.9—1.0]	0.9 [0.8—1.0]	1.0 [0.9—1.0]
Haematopoietic tissues	26.1 [15.8—43.0]	7.2 [5.3—9.8]	2.9 [2.5—3.4]	1.5 [1.3—1.7]	1.0 [0.9—1.1]	0.8 [0.6—1.1]	1.3 [1.2—1.4]
Breast cancer (women)	14.1 [6.1—43.1]	2.1 [2.6—4.4]	1.7 [1.5—1.9]	1.1 [1.0—1.2]	1.1 [1.0—1.2]	1.0 [0.9—1.2]	1.1 [1.1—1.2]
Alzheimer's disease	—	—	1.0 [0.7—1.6]	0.9 [0.8—1.0]	0.6 [0.6—0.7]	0.5 [0.5—0.5]	0.6 [0.6—0.6]
Parkinson's disease	—	—	1.3 [0.9—1.9]	1.0 [0.8—1.2]	0.7 [0.7—0.8]	0.8 [0.6—1.0]	0.9 [0.8—1.0]
Chronic liver disease	15.3 [8.0—29.4]	2.8 [2.1—3.8]	2.2 [1.8—2.6]	1.6 [1.4—1.9]	1.2 [1.0—1.5]	1.0 [0.5—2.1]	1.6 [1.5—1.8]
Psychiatric illness	4.7 [3.4—6.3]	2.3 [2.0—2.6]	1.5 [1.4—1.6]	1.2 [1.1—1.4]	0.9 [0.8—1.0]	0.7 [0.6—0.8]	1.2 [1.1—1.2]
Reimbursement of antipsychotics	6.2 [4.5—8.4]	2.4 [2.1—2.8]	1.6 [1.4—1.8]	1.3 [1.2—1.5]	0.9 [0.9—1.0]	0.8 [0.7—0.9]	1.1 [1.0—1.1]

Data are presented as frequency ratio (i.e. relative risk) [95% confidence interval]. ALD: affections de longue durée.

[a] Sex- and age-standardized.

Table 4 Comparison of treatments 6 months before hospitalization and 30 days after discharge among patients surviving at least 30 days after a first hospitalization for heart failure in 2009.

	< 55 years	55—69 years	70—79 years	80—89 years	≥ 90 years	Women[a]	Men[a]	Total
Number of patients (*n*)	3122	8810	14,444	21,317	5475	27,086	26,082	53,168
Mean age (years)	—	—	—	—	—	79.8	74.0	77.0
Men (%)	63.7	66.5	55.6	41.5	24.8	—	—	49.1
6 months before (%)								
Beta-blockers	29.6	42.5	44.7	39.3	28.7	39.2	39.7	39.6
Specific beta-blocker	14.6	15.5	16.0	13.8	10.5	12.1	16.4	14.4
ARB	11.1	23.9	29.2	27.3	20.6	28.3	22.9	25.6
ACEI	25.0	33.8	35.0	31.9	27.1	27.6	36.7	32.2
ACEI or ARB	34.9	55.1	61.9	57.9	46.9	54.3	57.7	56.0
Diuretics (at least one)	31.8	50.8	61.9	65.5	62.6	60.6	59.4	59.8
Loop diuretic	25.2	37.2	45.8	50.6	51.6	44.3	47.7	45.7
Thiazide	6.3	15.6	19.2	17.6	12.9	18.9	14.0	16.5
Potassium-sparing	10.0	11.2	10.4	10.2	8.7	10.9	9.6	10.3
Potassium-sparing combination	8.3	9.8	9.2	8.9	7.5	9.5	8.3	8.9
Potassium	6.7	11.0	12.6	15.3	15.5	13.6	13.1	13.4
Calcium channel blocker	9.8	24.5	30.1	29.6	27.8	27.7	27.2	27.6
30 days after (%)	5.2	4.4	4.1	2.7	1.6	2.3	4.3	3.4
Beta-blockers	65.2	64.1	57.7	49.2	36.3	52.4	53.9	53.6
Specific beta-blocker	46.0	38.6	32.9	27.6	20.6	28.5	33.2	31.2
ARB	13.1	21.5	24.3	21.3	15.3	23.7	18.6	21.1
ACEI	61.6	55.4	48.9	42.9	36.3	43.0	50.5	47.0
ACEI or ARB	72.5	74.6	71.4	63.1	51.0	65.0	67.7	66.6
Diuretics (at least one)	75.5	82.8	86.4	86.8	85.1	85.0	85.6	85.2
Loop diuretic	70.4	77.4	81.5	83.0	82.9	80.2	81.8	80.9
Thiazide	5.4	9.2	9.3	7.3	4.6	8.8	6.9	7.8
Potassium-sparing	30.3	24.7	18.4	14.1	9.4	16.7	17.9	17.5
Potassium-sparing combination	27.7	23.1	17.3	13.3	9.0	15.8	16.7	16.4
Potassium	25.6	29.5	31.7	34.2	33.6	32.9	31.3	32.2
Calcium channel blocker	13.4	22.1	25.5	23.9	22.4	24.4	22.0	23.3
Pacemaker (hospital and 30 days)	0.7	1.3	2.3	2.5	1.6	1.7	2.5	2.0
ICD (hospital and 30 days)	4.5	3.1	1.7	0.2	0.0	0.6	1.8	1.3
Beta-blocker, diuretic, ACEI/ARB combinations								
6 months before (%)								
ACEI/ARB only	5.6	7.8	7.5	8.0	8.6	7.6	7.9	7.7
Beta-blocker only	4.8	5.5	5.3	5.5	4.5	5.6	5.1	5.3

Table 4 (*Continued*)

	< 55 years	55—69 years	70—79 years	80—89 years	≥ 90 years	Women[a]	Men[a]	Total
Diuretic only	30.9	19.4	11.0	3.7	11.6	11.4	10.2	10.7
ACEI/ARB + diuretic	8.1	15.4	21.6	23.9	22.5	20.7	21.2	20.8
ACEI/ARB + beta-blocker	6.8	8.1	7.2	5.1	3.3	5.2	6.6	6.1
Beta-blocker + diuretic	3.5	5.1	6.5	7.9	8.4	7.7	6.0	6.8
Beta-blocker + diuretic + ACEI/ARB	14.4	23.8	25.6	20.9	12.5	20.7	22.0	21.4
30 days after (%)								
ACEI/ARB only	2.9	2.9	2.5	2.6	3.0	2.7	2.7	2.7
Beta-blocker only	3.1	2.6	2.2	1.8	1.7	2.3	2.0	2.1
Diuretic only	8.7	8.6	11.0	16.3	25.6	14.7	13.8	14.1
ACEI/ARB + diuretic	13.4	18.8	23.8	25.7	26.6	23.6	23.7	23.4
ACEI/ARB + beta-blocker	8.8	6.1	3.9	2.6	1.6	3.5	3.9	3.8
Beta-blocker + diuretic	6.0	8.6	10.4	12.6	13.2	11.5	10.7	11.0
Beta-blocker + diuretic + ACEI/ARB	47.3	46.9	41.2	32.2	19.8	35.1	37.4	36.7
6 months before (%)								
Cardiotonic steroid	3.3	6.0	8.6	10.5	10.6	9.4	8.3	8.8
Class III antiarrhythmic	6.3	12.7	16.3	16.8	13.2	14.1	15.9	15.0
Nitrate	1.2	6.2	10.2	15.2	21.2	11.4	12.9	12.2
Oral anticoagulant	13.0	23.1	29.7	28.4	15.9	24.5	27.0	25.7
Platelet aggregation inhibitor	21.4	38.8	43.7	43.0	44.8	35.9	46.7	41.4
Aspirin	18.0	30.0	33.0	32.6	35.5	28.1	35.0	31.7
Clopidogrel	9.0	16.5	17.5	15.1	11.3	11.8	18.6	15.2
Lipid-lowering agents	23.2	46.3	50.8	38.4	17.4	36.0	44.1	40.0
Statins	21.2	41.9	44.8	32.7	14.7	30.3	39.8	35.0
Fibrates	1.6	3.6	5.4	5.3	2.7	5.4	3.7	4.6
Other	2.3	3.4	2.5	1.0	0.2	1.3	2.2	1.8
Antidiabetics	15.3	35.2	35.3	22.2	10.5	26.6	26.4	26.3
Insulin	7.2	14.9	13.5	7.9	3.5	11.6	9.0	10.1
Biguanide	7.9	19.0	16.5	7.0	2.3	10.9	11.5	11.1
Sulphonamides	4.7	12.7	13.6	8.9	4.5	9.5	10.8	10.1
Glinide	1.2	3.7	4.2	3.0	1.4	3.0	3.3	3.2
Thyroxin	5.0	8.3	11.2	12.1	11.5	16.0	5.6	10.7
Non-steroidal anti-inflammatory drug	5.8	7.7	8.1	7.7	5.2	9.4	5.7	7.5
Steroidal anti-inflammatory drug	6.2	5.7	5.8	5.1	4.3	5.5	5.3	5.3
Class I antiarrhythmic	1.2	2.7	3.8	3.7	2.6	4.0	2.6	3.3
30 days after (%)								
Cardiotonic steroid	8.1	10.3	11.5	13.5	14.2	13.7	10.4	12.2
Class III antiarrhythmic	15.0	24.2	27.0	24.7	20.0	23.2	24.8	24.2
Nitrate	5.1	11.0	15.2	18.5	25.3	15.1	17.3	16.3
Oral anticoagulant	28.0	36.6	43.2	41.0	23.0	37.8	38.5	38.3

Table 4 (*Continued*)

	< 55 years	55—69 years	70—79 years	80—89 years	≥ 90 years	Women[a]	Men[a]	Total
Platelet aggregation inhibitor	37.1	50.9	48.9	45.3	49.8	41.5	52.5	47.2
Aspirin	33.8	43.8	40.8	36.9	41.7	35.1	43.2	39.4
Clopidogrel	14.5	21.9	20.7	16.7	12.0	14.4	21.4	18.0
Lipid-lowering agents	33.1	54.2	52.9	37.8	16.3	37.1	47.0	42.1
Statins	31.8	51.3	49.4	34.8	15.0	33.9	44.5	39.3
Fibrates	0.8	2.3	2.9	2.7	1.2	2.8	2.0	2.4
Other	3.6	3.6	2.3	1.1	0.2	1.3	2.4	1.9
Antidiabetes treatments	16.8	34.9	33.2	20.8	10.2	25.5	25.2	25.2
Insulin	8.6	16.4	14.9	9.8	5.3	13.3	10.5	11.7
Biguanide	6.8	14.5	11.1	4.2	1.1	7.4	7.9	7.6
Sulphonamides	5.2	11.7	10.6	6.7	3.3	7.6	8.7	8.2
Glinide	1.9	5.0	5.4	3.5	1.7	3.7	4.3	4.0
Thyroxin	6.2	8.8	11.4	12.1	11.3	15.9	6.1	10.9
Non-steroidal anti-inflammatory drug	4.5	5.0	4.0	3.2	2.5	4.5	3.1	3.7
Steroidal anti-inflammatory drug	7.3	6.8	6.8	6.2	6.0	6.8	6.3	6.5
Class I antiarrhythmic	1.2	1.5	1.5	1.3	0.8	1.8	1.0	1.4

In patients with at least one medicinal product reimbursement during these two periods. ACEI: angiotensin-converting enzyme inhibitor; ARB: angiotensin II receptor blocker.
[a] Age-standardized.

In addition, the use of potassium supplements increased from 13% to 32% after hospitalization and the use of class III antiarrhythmics increased from 15% to 24%. Increased use was also observed for oral anticoagulants (26% to 38%) and, to a lesser degree, platelet aggregation inhibitors (41% to 47%). The frequencies of use of antidiabetes treatments (26% to 25%) and lipid-lowering drugs (40% to 42%) remained relatively stable. The frequencies of use of non-steroidal and steroidal anti-inflammatory drugs were 7% and 5% before hospitalization and 4% and 6% after hospitalization, respectively.

Discussion

This study demonstrated a high incidence of first hospitalization for heart failure, especially in older patients, with a higher incidence in the northern regions, Corsica and Réunion. These patients, especially the youngest, presented a high co-morbidity rate compared with the other beneficiaries. The hospital mortality rate was 6%. The mortality rate during the 30 days following discharge was 4% and the all-cause readmission rate was 18% (5% for HF) for patients who survived at least 30 days. The frequency of the beta-blocker, diuretic and ACEI/ARB combination during the 30 days after discharge was 37% overall, but 47% in the 55—69 years age group.

Epidemiology

Many epidemiological studies have been conducted on HF, but with various objectives, methodologies and sociodemographic and clinical inclusion criteria, making it difficult to compare their results. Higher incidences of HF have been reported in studies including all hospitalized patients (first hospitalization and rehospitalizations). In 2008, in France, the crude hospitalization rate for all patients was 0.23%, regardless of age, and 1.2% for patients aged $\geq$ 65 years (vs. 0.14% and 0.78% in our study on first hospitalizations for HF) [6]. In 1994, a hospitalization rate of 0.22% was reported in the French Lorraine region among all patients aged 20—80 years hospitalized presenting with clinical and echocardiographic criteria of advanced HF vs. 0.1% in this study for the same age group [12]. In Scotland, in 2000, a physician-based survey reported an outpatient incidence of HF of 0.2% among patients aged $\geq$ 45 years and 5.0% among patients aged $\geq$ 75 years (vs. 1.2% in the age group in our study) [13]. The first hospitalization rate for HF in Scotland in 2003 was 0.12% in men and 0.1% in women, close to the rates observed in our study [14].

The regional disparity observed in the present study can be explained by variations in the distribution of risk factors, aetiology, diagnosis, clinical practice and indications for hospitalization. The national study on patients hospitalized for HF in 2008 also reported higher standardized hospitalization rates in northern regions of France [6]. The observed geographical distribution is similar to that of standardized regional hospitalization rates for myocardial infarction (higher in the northern, north-eastern and south-eastern regions) and stroke (higher in the northern and north-eastern regions and in Brittany) [15]. In 2010, the regional rates of treatment for hypertension or diabetes were also higher in the northern and north-eastern regions and in French overseas departments [16].

The French national HF hospitalization study reported a growth in the crude hospitalization rate of 14.4% between 2002 and 2008, while the age-standardized rate slightly decreased (2.5%) [6]. Nevertheless, a significant increase in the hospitalization rate for HF was observed in women aged 45—54 years and in the hospitalization rate for myocardial infarction or stroke in women aged < 55 years [17,18]. Studies in other countries, such as the USA, Canada and Scotland, have also reported a variable reduction in standardized hospitalization rates for HF [19—22]. Among hospitalizations for HF, a growth in the relative proportion of systolic HF has also been reported in the USA (33% in 2005 and 39% in 2010) [22].

Patient clinical characteristics

According to the mode of patient selection in this study, the hospitalization had to correspond to the first episode of decompensation in patients with previously known or unknown HF. However, 40% of the patients included in this study had had at least one BNP assay during the previous year, suggesting screening for chronic HF. Furthermore, almost 20% of patients were already being treated with a beta-blocker, diuretic and ACEI/ARB triple combination, suggesting that the diagnosis of HF had already been established.

Data in the literature indicate a proportion of 35—50% of diastolic HF, depending on the study and the age of the patients included, and this proportion increases with age [22,23]. The two forms of HF cannot be distinguished in the present study due to the lack of clinical data. The relatively high mean age of patients in this study (77 years) would favour a higher proportion of diastolic HF. However, analysis of the ALD status for chronic diseases revealed a relatively high rate of diseases responsible for systolic HF, such as coronary heart disease (15%), diabetes (20%), arrhythmias (4.9%) and valvular heart disease (3.7%), but also severe hypertension (16.3%). Hospitalizations for coronary heart disease or cardiomyopathy were also more frequent among younger patients, who were more frequently hospitalized in university hospitals and in intensive care units due to differences in their clinical state or the clinical setting.

This study found a large proportion and a higher frequency of ALD chronic disease status for tumours of haematopoietic tissue among the youngest patients hospitalized for HF. Anthracyclines, used in the treatment of these tumours, have been reported to induce irreversible and sometimes late deleterious effects on cardiac function [24]. Adjuvant radiotherapy used in the 1980s for the treatment of breast cancers and, more recently, anthracyclines and trastuzumab have also been associated with the development of HF [25,26]. However, these hypotheses could not be confirmed, as information on medicinal products in the SNIIRAM database is only available for the previous 3 years plus the current year.

A higher frequency of reimbursement for antipsychotics was also observed among the youngest patients hospitalized for HF, which may reflect risk behaviour, and a higher rate of cardiovascular risk factors, which can also be related to the use of antipsychotics, as some of them have been reported

to be associated with hypotension, diabetes, arrhythmias, cardiomyopathies and sudden death [27].

Treatment and management

Recent European guidelines concerning the treatment of systolic HF recommend first-line prescription of an ACEI, or an ARB when the ACEI is not well tolerated, followed by introduction of a beta-blocker. When the New York Heart Association score is still III or IV, it is recommended to add an aldosterone antagonist. If no improvement in left ventricular ejection fraction (< 35%) is observed, ivabradine can be used and, if still no improvement is obtained, placement of a cardiac resynchronization device and the use of digoxin. Diuretics are recommended to decrease symptoms or signs of congestion. No specific guidelines have been proposed for diastolic HF apart from symptomatic treatment and treatment of the underlying cardiovascular disease [10]. The French FUTURE study (2007—2008) failed to demonstrate any significant differences in treatment frequencies on hospital discharge and at outpatient visits between patients with a left ventricular ejection fraction > 40% (44% of patients) or < 40% (56% of patients) [23]. Among the 1137 patients (mean age 72 years) followed by an office cardiologist, 83% were treated with an ACEI/ARB, 74% with beta-blockers, 31% with an aldosterone antagonist and 86% with a loop diuretic. The French IMPACT RECO study, in 2005, comprising 2000 patients (mean age 70 years) with New York Heart Association grade III and IV systolic HF followed by office cardiologists, reported fairly similar treatment frequencies: 68% for ACEIs and 30% for ARBs (i.e. 91% for an ACEI/ARB, 70% for beta-blockers [the highest increase], 35% for aldosterone antagonists and 85% for loop diuretics) [28]. The EuroHeart Failure Survey II in 2004—2005 reported that 71% patients (mean age 70 years) were treated with an ACEI and 80% with an ACEI/ARB, 61% of patients were treated with a beta-blocker on discharge from hospital, 41% with an aldosterone antagonist and 90% with a diuretic [29]. In the present study, the frequencies of drug treatments 30 days after hospitalization were much lower than those reported above (beta-blocker 54%, ACEI 47%, ACEI/ARB 67%, diuretic 85%, aldosterone antagonist 33%). However, patients in our study were older (mean age 77 years) and probably more frequently presented contraindications to the use of drugs such as ACEIs and beta-blockers. This is illustrated by higher prescriptions of beta-blockers in more than 60% of cases and ACEIs/ARBs in about 75% of cases in patients aged < 80 years. Some treatments, such as beta-blockers, may also have been introduced subsequently, after the first month.

About 30% of patients attended a visit with a cardiologist or were assessed by echocardiography at the first month after hospitalization, with higher rates for the youngest patients, and at least one BNP assay was performed in 16% of cases. French guidelines for the management of systolic HF after hospitalization recommend at least a follow-up visit by a cardiologist to adapt treatment according to the New York Heart Association stage, BNP assay in the presence of a suspicion of decompensation and echocardiography in the presence of symptoms or deterioration [10]. Early medical management after discharge from hospital and regular follow-up by a cardiologist have been identified as factors associated with a lower readmission rate [30,31].

Mortality and readmission

There is an ongoing debate concerning the impact of early discharge from hospital, as the reduction in mean length of hospital stay could result in higher early mortality and 30-day readmission rates [7]. In 2008, the mean length of hospital stay for HF in France was 9.9 days, higher than the mean stay of 9.2 days in our study, which was limited to first hospitalizations [6]. For comparison, the mean length of hospital stay for all patients with HF is shorter in the USA than in France (8.8 days in 1993 and 6.3 days in 2006) and is tending to decline [20].

The hospital mortality rate was 6.4% in our study vs. 7.5% in the study on all hospitalizations for HF in France in 2008 [6]. A similar hospital mortality rate of 6.7% was observed in the European EuroHeart Survey II, comprising a younger survey population (mean age 70 years vs. 77 years in our study) with a median length of stay of 9 days [31]. In the USA, the hospital mortality rate decreased from 8.5% in 1993 to 4.3% in 2006 among Medicare beneficiaries [32]. However, the 30-day post-hospital mortality rate, although it also decreased from 17% to 13%, was higher than that reported in our study (11%), which was limited to incident cases of hospitalization. Thirty-day all-cause and HF readmission rates in our study were 18% and 5.1%, respectively. The 2008 national study reported a 20% readmission rate for HF during the first year and 75% of these readmissions occurred during the first 3 months after discharge [6]. Similar 30-day all-cause and HF readmission rates of 22% and 6.1% were reported in veterans covered by Medicare in 2008 in the USA [7].

Strengths and limitations

On the basis of available data, this study tried to identify and give the characteristics of the first hospitalizations for HF in France. The possibility of first hospitalizations before 2006 (i.e. > 3 years before the inclusion period of this study) cannot be eliminated. One-year and 5-year mortality rates of 20—30% and 45—60%, respectively, have been reported [1]. The bias is therefore limited. Certain groups of the French population were not included in this study due to their occupation, such as civil servants, liberal professionals and farmers, as they are covered by other health insurance schemes. These groups may differ in terms of their age structure and other sociodemographic characteristics, their exposures and their management and access to healthcare. Institutionalized subjects (e.g. in an Établissement d'Hébergement pour Personnes Âgées Dépendantes [EHPAD; accommodation facility for dependent elderly]) were not included in this analysis, especially concerning their individual medicinal product consumption, which is included in the accommodation costs. The data used in this study were derived from medical and administrative databases that collect only limited clinical information, such as those necessary for the distinction between systolic and diastolic HF, which is one of the major limitations of this study. These databases also have the classical limitations concerning the validity of data collection and data coding, such as coding of diagnoses and chronic

disease. Estimation of chronic disease status using ALD could be underestimated because the 100% reimbursement of healthcare expenditure is not useful for institutionalized people, those with mutual insurance or those with a pre-existing ALD. Some frequencies could be underestimated, especially for laboratory assays performed in public hospitals, or reimbursement of certain medicinal products when they are dispensed during a stay in an institution.

Conclusion

This study revealed a high incidence of first hospitalization for HF, especially among very elderly patients presenting high rates of co-morbidity. The study also demonstrated a high mortality rate and a high early readmission rate. Finally, despite the limitations of the databases used for this study, there still appears to be room for improvement in the drug treatment prescribed on discharge, in terms of frequency and combination therapies, in order to lower the readmission rate. As mentioned in the introduction, disease management programmes have been demonstrated to be effective in many trials, in terms of readmission rates and quality of life, and are therefore now included in clinical practice guidelines. The French national health insurance fund (CNAMTS) is currently developing a return-home and follow-up management programme (PRADO) for patients hospitalized for HF in partnership with general practitioners.

Disclosure of interest

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