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ORIGINAL ARTICLE

15-Year Trends in Patients Hospitalised With Heart Failure and Enrolled in an Australian Heart Failure Management Program

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Background Heart failure (HF) is associated with high morbidity and mortality, and is a major contributor to health care costs. Since the area continues to be rapidly evolving, the aim of this study was to examine 15-year trends in demographics, precipitants, symptoms and outcomes of patients hospitalised with HF, and consider the individual and societal implications.

Methods Data were prospectively collected by Heart Failure nurses from patients enrolled in the Management of Cardiac Function program (MACARF) in Northern Sydney, Australia. Analyses of trends were performed using Mantel-Hanzel tests and one-way analysis of variance. Multivariate Cox proportional hazard models were used to determine changes in readmission and mortality rates.

Results From 2001 to 2015, 5,588 patients were hospitalised with HF and enrolled in the MACARF program. Over the 15-year period, the average age of enrolled patients increased by a decade (from 74 to 84 years), with an increase in hypertension (52% to 67%), chronic kidney disease (11% to 21%), atrial fibrillation/flutter (29% to 44%), and HF with preserved ejection fraction (24% to 35%) but a decrease in ischaemic heart disease (62% to 47%). Infection and atrial arrhythmias were the two most common precipitants of admission (27% and 18% of patients in 2013–15 respectively), while acute ischaemia became less common, and ''unknown'' precipitant increased to 35%. While increased exertional dyspnoea and peripheral oedema remained the most common presenting symptoms, weight gain, fatigue and chest pain were less frequently identified. Medication trends included an increase in spironolactone use and a decrease in angiotensin converting enzyme inhibitors. Average length of stay reduced while 1- and 3-year mortality rates improved to 11.3% and 26.6% respectively. In contrast, readmission rates have not improved, with current 30-day and 1-year rates of 9.9% and 42.6%.

Conclusions Significant temporal changes have occurred in the characteristics and outcome of patients with HF, which pose a challenge and opportunity to improve management. Although length of stay and mortality have improved, unchanged readmission rates highlight the importance of addressing the implications of the changing nature of patients with HF.

Keywords Heart failure • Trends • Decompensation

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Introduction

Heart failure (HF) is a major contributor to cardiovascular health costs [1,2] and continues to be associated with high mortality and morbidity [3–5]. As HF management continues to evolve, a better understanding of the trends in patient characteristics and outcome is needed in order to highlight areas for optimising care and identifying implications for the individual HF patient and society [6,7].

Prior studies have suggested that HF patients have become older [3], with more renal disease, diabetes and preserved ejection fraction [8,9]. Areas that have not been well studied include trends in precipitants of hospitalisation and presenting symptoms on admission. Although there have been reductions in average length of hospital stay [3,8,10,11] and mortality [3,8], 1-year mortality rates as high as 30% have still been reported [3], with the suggestion that improvements may have plateaued [10].

Temporal trends in readmission rates are inconsistent, with an increase in readmission rates reported in France between 2000–2012 [11], but a reduction in in Canada between 1997–2007 [12] and New Zealand between 1988–2008 [13]. The varying readmission rates may reflect, in part, differences in study cohorts and their comorbidities. Heart Failure Nurse directed programs are increasingly used to assist in optimising patient management, however there are limited data on temporal changes in characteristics and outcomes of patients enrolled in such a program. Such data would have implications for identifying areas requiring focus and new approaches.

The purpose of the present study was to examine temporal trends between 2001–15 in demographics, precipitants, symptoms and outcomes of patients hospitalised with a primary HF diagnosis.

Methods

Study Design and Setting

This study uses prospectively collected data from the Management of Cardiac Function (MACARF) program. MACARF is a Heart Failure Nurse-directed multidisciplinary program based on work by Rich et al. [14]. The MACARF program aims to optimise HF management, providing education through home visits and follow-up phone calls.

All patients >18 years of age hospitalised with a primary diagnosis of HF in the seven participating hospitals in Northern Sydney, Australia were eligible for the MACARF program. The seven hospitals were Hornsby, Manly, Mona Vale, North Shore Private, Royal North Shore, Ryde and Sydney Adventist Hospital. The hospitals range in size from 165 to 600 beds, and comprise secondary and tertiary, public and private hospitals. Patients enrolled in this program are community dwelling residents with HF diagnosed by the attending physician, and corroborated by the MACARF Heart Failure nurse according to the Framingham criteria [15]. For the present analysis, the initial enrolment admission with HF was used. Subsequent hospitalisations were used to calculate rates of hospital readmission.

Patients were excluded if they refused to participate or were unable to consent because they could not speak sufficient English or did not have mental capacity. Patients were also excluded if they had major cognitive or psychiatric disorders or required palliative or end-of-life care, or died during the index hospitalisation. Data was extracted by the HF nurses from the medical records or directly from the patients and entered into a dedicated ACCESS database by the nurse from hard copy forms within 2 weeks of enrolment. Data included sociodemographics, risk factors, comorbid diseases, precipitants of admission, presenting symptoms, serum electrolytes, cardiac function, and discharge medication. Ischaemic heart disease and chronic kidney disease were noted if they were mentioned as part of the patient's medical records. Aortic stenosis was noted if it was considered to be moderate or severe in the clinical record or echocardiogram. Heart failure with reduced ejection fraction (HFrEF) was defined as HF with an LVEF <50% and preserved ejection fraction (HFpEF) with LVEF ≥50%. Readmissions were recorded if the patients were rehospitalised in the seven participating hospitals, and were divided into HF and non-HF causes. Mortality was documented through a combination of hospital records, follow-up phone calls and death notices. For the present analysis, all patients were followed up to 1 year to assess mortality and readmission rates, while the final 3-year period was not considered for the 3-year mortality, since the follow-up was incomplete. Funding of the program and database was through the Northern Sydney Local Health District (G.T, Medical Director of MACARF).

Statistical Analysis

Patient characteristics were described using frequencies and percentages and means and standard deviations. The 15-year period was divided into five, 3-year cohorts from 2001 to 2015 for analysis of temporal trends. Continuous variables were reported as means and standard deviations (SD) and categorical variables were reported as counts and percentages. Differences in baseline demographics, medical history, admission laboratory studies and vital signs, hospital characteristics, and outcomes were compared using Chi-squared test for trend for categorical row variables and a one-way analysis of variance for continuous variables. Adjusted models accounted for age, sex, smoker, hypertension, diabetes, insulin use, chronic kidney disease, ischaemic heart disease, anaemia, ejection fraction, serum creatinine >100 umol/l, hypoalbuminaemia (albumin <35 g/l), atrial fibrillation/flutter, discharge on beta blocker, angiotensin converting enzyme inhibitors (ACEI) and angiotensin receptor blockers (ARB), diuretic, spironolactone and digoxin.

Results

Between January 2001 and December 2015, 5,588 patients were hospitalised in the seven participating hospitals with

a primary diagnosis of HF and enrolled in the MACARF Heart Failure nurse program.

Demographics

The average age of the patients increased by a decade over the 15-year period, from 74 years in 2001–2003 to 84 years in 2013–2015 (Table 1). In particular, the proportion of those aged over 85 years increased from 10% in 2001–2003 to 58% in 2013–2015. The gender distribution did not change significantly, with slightly more men than women in 2013–2015 (54% vs 46%). A high percentage of patients lived alone (42% in 2013–2015), although there was no significant temporal change.

The prevalence of hypertension increased (from 52% to 67%), as did diabetes mellitus (from 25% to 30%), history of chronic kidney disease (from 11% to 21%) and aortic stenosis (from 6% to 11%). Ischaemic heart disease, while still an important contributor, has become less common (from 62% to 47%).

Precipitants and Presenting Symptoms

Infection and atrial arrhythmia are currently the two most commonly identified precipitants of hospitalisation (Table 2). While ischaemia and acute myocardial infarction combined were the most prevalent precipitants in 2001–2003 (33%), they have become less common (8% in 2013–2015). In contrast, the proportion of patients with unknown precipitants has increased to 35% in 2013–2015.

The pattern of presenting symptoms has also shown some temporal change. While worsening exertional dyspnoea (93%) and peripheral oedema (48%) have been consistently the two most common symptoms, other symptoms of cough, paroxysmal nocturnal dyspnoea, fatigue, nausea and anorexia, weight gain, palpitations and chest pain are now less commonly reported.

In-Hospital Data

The proportion of patients with HFpEF has increased from 24% to 35% (Table 3). Anaemia continues to be common (37% in 2013–2015) with no significant temporal change. The proportion of patients with low albumin (<35 g/l) has decreased, as has those with elevated creatinine (>100 μmol/l), although renal impairment is still present in half of the patients. Atrial fibrillation/flutter rates have increased (from 29% to 44%). The proportion of patients with longer length of hospital stay (>7 days) has reduced (from 51% to 36%).

Discharge Medications

Overall, similar trends in medication use have been seen for HFrEF and HFpEF. In HFrEF, the proportion discharged on beta blockers initially increased from 48% in 2001–2003 to a peak of 72% in 2007–2009, but subsequently decreased to 55% in 2013–2015 (Table 4). Angiotensin-converting enzyme (ACE) inhibitor or angiotensin receptor blocker use was highest in 2001–2003

Table 1 Demographic profile of patients hospitalised with heart failure at enrolment admission.

Variable	2001–2003		2004–2006		2007–2009		2010–2012		2013–2015		
	n	%	n	%	n	%	n	%	n	%	P-value
Number of Patients	1211		1407		970		1123		877		
Mean Age[a]	73.9	(10.6)	78.0	(11.3)	83.2	(10.9)	83.9	(9.5)	84.2	(9.4)	<0.001
Age < 75	535	44.2	450	32.0	187	19.3	165	14.7	113	12.9	<0.001
75 ≤ Age ≤ 85	553	45.7	584	41.5	263	27.1	388	34.6	253	28.8	<0.001
Age > 85	123	10.2	373	26.5	520	53.6	570	50.8	511	58.3	<0.001
Male sex	636	52.9	771	55.3	450	46.4	567	50.6	472	54.1	0.385
Lives Alone	463	38.8	485	37.0	311	34.7	390	35.2	363	41.8	0.632
Married	529	53.2	767	56.1	517	53.9	601	53.6	460	52.8	0.601
Non-English Speaker[b]	145	12.0	132	9.4	95	9.8	115	10.2	115	13.1	0.634
Born in Australia	434	36.0	734	52.2	478	49.3	461	41.1	317	36.3	0.066
Private Insurance	564	48.0	718	53.3	502	56.2	558	51.7	424	48.7	0.806
Risk factors											
Aortic Stenosis	66	6.2	106	7.6	106	10.9	117	10.5	72	10.8	<0.001
Alcohol	29	2.7	32	2.3	27	2.8	31	2.8	22	3.3	0.379
Hypertension	542	52.1	814	58.4	583	60.1	683	60.8	588	67.2	<0.001
Ischaemic Heart Disease	646	62.1	928	66.6	575	59.3	586	52.2	415	47.4	<0.001
Smoker	57	5.5	90	6.5	36	3.7	41	3.6	37	4.2	0.005
Diabetes	262	25.2	310	22.3	261	26.9	309	27.5	257	29.5	0.001
On Insulin	63	6.1	74	5.3	42	4.3	77	6.9	54	6.2	0.406
Chronic Kidney Disease	114	11.0	246	17.7	209	21.5	204	18.2	184	21.0	<0.001

[a]mean in years (Standard Deviation).

[b]does not speak English at home.

Table 2 Precipitants and presenting symptoms of hospitalisation.

Variable	2001–2003		2004–2006		2007–2009		2010–2012		2013–2015		
	n	%	n	%	n	%	n	%	n	%	P-value
Precipitants											
Infection	250	22.4	450	32.1	314	32.4	337	30.1	238	27.4	0.058
Arrhythmia	245	22.0	391	27.9	261	27.0	273	24.4	154	17.7	0.010
Acute Myocardial Infarction	107	9.6	135	9.6	55	5.7	25	2.2	25	2.9	<0.001
Ischaemia	262	23.5	474	33.8	196	20.2	213	19.0	40	4.6	<0.001
Poor Diet Compliance	73	6.5	81	5.8	23	2.4	34	3.0	32	3.7	<0.001
Poor Medication Compliance	77	6.9	68	4.9	51	5.3	58	5.2	65	7.5	0.641
Medication Side Effect	30	2.7	54	3.9	17	1.8	24	2.1	8	0.9	<0.001
Change in Medication	54	4.8	73	5.2	47	4.9	61	5.5	58	6.7	0.102
Other	75	6.7	138	9.9	103	10.6	108	9.7	45	5.2	0.406
Unknown	205	18.4	216	15.4	176	18.2	272	24.3	302	34.7	<0.001
Symptoms											
Increasing Exertional Dyspnoea	926	91.0	1296	93.7	891	92.2	1044	94.2	805	92.8	0.102
Peripheral Oedema	471	46.3	674	48.7	490	50.7	495	44.7	413	47.6	0.684
Cough	318	31.2	364	26.3	237	24.5	234	21.1	200	23.1	<0.001
Paroxysmal Nocturnal Dyspnoea	335	32.9	349	25.2	185	19.2	239	21.6	142	16.4	<0.001
Fatigue	426	41.8	401	29.0	252	26.1	229	20.7	169	19.5	<0.001
Weight Gain	155	15.2	124	9.0	85	8.8	69	6.2	59	6.8	<0.001
Nausea/Anorexia	196	19.3	191	13.8	106	11.0	74	6.7	15	1.7	<0.001
Palpitations	138	13.6	154	11.1	92	9.5	102	9.2	37	4.3	<0.001
Chest Pain	281	27.6	299	21.6	159	16.5	159	14.4	135	15.6	<0.001

(82%) and has decreased to 66% in 2013–2015. In HFpEF, beta blocker use has increased, although peak use was in 2007–2009. ACE inhibitor or angiotensin receptor blocker use has overall declined. For both HFrEF and HFpEF, diuretics including spironolactone are increasingly prescribed.

Mortality and Readmission Rates

Figures 1 and 2 show the temporal trends for 1- and 3-year survival rates for patients hospitalised with HF. Both unadjusted and adjusted mortality rates have fallen during the study period (Tables 5 and 6). In contrast, there has been no

Table 3 Admission data of patients hospitalised with heart failure.

Variable	2001–2003		2004–2006		2007–2009		2010–2012		2013–2015		
	n	%	n	%	n	%	n	%	n	%	P-value
Na < 135 mmol/l	203	19.8	277	19.9	166	17.1	195	17.5	172	19.9	0.426
Na > 145 mmol/l	45	4.4	51	3.7	39	4.0	37	3.3	10	1.2	<0.001
K < 3.5 mmol/l	36	3.6	59	4.3	54	5.6	55	5.0	45	5.2	0.055
K > 5 mmol/l	131	12.9	172	12.5	96	10.0	103	9.3	73	8.4	<0.001
Creatinine > 100 umol/l	387	58.8	771	55.9	536	55.5	625	56.2	442	51.0	0.010
Albumin < 35 g/l	257	33.8	306	28.2	314	38.9	378	41.0	138	16.8	<0.001
Haemoglobin < 120 g/l	346	36.7	534	39.2	373	39.0	438	39.6	316	36.9	0.873
LVEF ≥ 50%	235	24.4	350	27.4	343	37.8	408	38.9	290	35.1	<0.001
LOS > 7days[a]	622	51.4	733	52.1	492	50.7	483	43.0	314	35.8	<0.001
Arrhythmias on ECG											
Atrial Fibrillation/Flutter	284	28.9	551	40.6	451	47.2	552	50.2	384	44.2	<0.001
Complete Heart Block	7	0.7	10	0.7	6	0.6	2	0.2	1	0.1	0.011
Pacemaker	93	9.5	171	12.6	115	12.0	145	13.2	92	10.6	0.363

Abbreviations: LVEF, left ventricular ejection fraction; LOS, length of stay; ECG, electrocardiogram.
[a]length of hospital stay.

Table 4 Temporal Trends in Discharge Medications.

Medication	2001–2003		2004–2006		2007–2009		2010–2012		2013–15		
	n	%	n	%	n	%	n	%	n	%	P-value
HFrEF											
Beta blocker	340	48.5	571	63.0	402	71.4	437	68.5	294	55.1	<0.001
ACEI/ARB	572	81.6	727	80.2	426	75.7	456	71.5	352	65.9	<0.001
Diuretic[a]	589	84.0	739	81.5	481	85.4	560	87.8	488	91.4	<0.001
Spironolactone	265	37.8	316	34.8	212	37.7	278	43.6	236	44.2	<0.001
Digoxin	212	30.2	252	27.8	182	32.3	169	26.5	138	25.8	0.101
HFpEF											
Beta blocker	70	32.3	132	38.2	170	49.6	178	43.8	131	45.5	0.002
ACEI/ARB	138	63.6	238	68.8	220	64.1	244	60.1	162	56.3	0.004
Diuretic[a]	165	76.0	277	80.1	307	89.5	347	85.5	266	92.4	<0.001
Spironolactone	44	20.3	78	22.5	92	26.8	121	29.8	88	30.6	0.001
Digoxin	68	31.3	99	28.6	123	35.9	131	32.3	75	26.0	0.493

Abbreviations: HFrEF, heart failure with reduced ejection fraction; HFpEF, heart failure with preserved ejection fraction (EF ≥ 50%).
[a]not including spironolactone.

significant reduction in readmission rates (Tables 5 and 6). During the period of study, the all-cause 30-day readmission rate varied between 8% and 10%, and the 1-year readmission rate remained 42% to 45%. Non-HF readmissions were more common than HF readmissions with neither significantly changing over time.

Discussion

Over the past 15 years, the prognosis for patients hospitalised with HF has improved, with a reduction by a third at 1 year, and by a quarter at 3 years. Despite these improvements, mortality rates remained high (11% at 1 year and 27% at 3 years) and readmission rates have not improved, with over 40% of patients continuing to be rehospitalised within 1 year.

Outcomes

The lower mortality in our study is consistent with reports from other countries [11,8,12,13]. However, readmission trends are inconsistent, with increased readmissions in a French study [11], but a reduction in the Canadian analysis [12]. The varying readmission rates may reflect the comorbidities as well as differences in health care systems.

Demographics

The most striking demographic change in our cohort from 2001 to 2015 has been the 10-year increase in average age of

Table 5 Mortality and Readmission Rates.

Outcome	2001–2003		2004–2006		2007–2009		2010–2012		2013–2015[a]		
	n	%	n	%	n	%	n	%	n	%	P-value
Mortality											
- 30 day	35	3.3	25	2.0	12	1.3	12	1.1	6	0.7	<0.001
- 1 year	217	20.8	225	17.8	133	14.3	174	15.8	70	11.3	<0.001
- 3 year	390	37.3	460	36.4	275	29.6	293	26.6	NA	NA	<0.001
Readmission rates											
30-day – total[b]	94	7.8	131	9.3	93	9.6	106	9.4	86	9.8	0.124
- Heart failure (HF)	38	3.1	54	3.8	38	3.9	47	4.2	42	4.8	0.057
- non-HF	59	4.9	78	5.5	55	5.7	63	5.6	47	5.4	0.595
1 year – total[b]	502	41.5	583	41.4	422	43.5	505	45.0	265	42.5	0.139
- HF	198	16.4	275	19.5	214	22.1	209	18.6	160	18.2	0.350
- non-HF	398	32.9	419	29.8	299	30.8	371	33.0	255	29.1	0.438

[a]1 year readmission/mortality excluded 2015 to allow for 1-year follow-up; 3-year follow-up was not available (NA) for the 2013–2015 period.
[b]30-day and 1-year readmission rates include one or more readmission for either heart failure or non-failure causes.

Table 6 Temporal Trends in Adjusted Risk of Survival and Readmission Rate.

Period	Adjusted 1-Year Mortality[b] HR (95% CI)		P-value	Adjusted 3-Year Mortality[b] HR (95% CI)		P-value	Adjusted 1-Year Readmission[b] HR (95% CI)		P-value
2001-03[a]	1.00			1.00			1.00		
2004-06	0.97	(0.70-1.34)	0.845	1.05	(0.84-1.31)	0.687	1.00	(0.83-1.21)	0.977
2007-09	0.82	(0.58-1.16)	0.270	0.83	(0.65-1.06)	0.138	0.97	(0.79-1.18)	0.734
2010-12	0.86	(0.61-1.20)	0.377	0.72	(0.56-0.91)	0.007	0.97	(0.80-1.19)	0.796
2013-15	0.66	(0.45-0.97)	0.033	NA		NA	0.99	(0.80-1.22)	0.923

[a]this period served as the reference category.

[b]adjusted for age, sex, smoker, and presence of hypertension, diabetes, insulin use, chronic kidney disease, ischaemic heart disease, anaemia, ejection fraction, serum creatinine >100 umol/l, hypoalbuminaemia, atrial fibrillation/flutter, discharge on beta blocker, ACEI/ARB, diuretic, spironolactone and digoxin. 1-year readmission/mortality excluded 2015 to allow for 1-year follow-up.

the HF patients from 74 to 84 years, with a particularly marked increase in those >85 years. Indeed, only 13% in 2013–2015 were currently <75 years of age, a prior cut-off age for many randomised trials. Our finding, that HF has become predominantly a disease of the elderly, is consistent with other large epidemiological studies [3,5,10,11,13,16] and reflects, in part, improved management of risk factors and acute infarction. However, the advanced age of the HF patients, combined with the high proportion who live alone (42%), presents a significant challenge to programs aiming to optimise care. A high proportion of mild cognitive dysfunction has been shown in HF [17,18], with Cannon et al. estimating that 40% have some impairment [18]. Increased age also has a negative impact on the success of self-management interventions suggesting the need for other considered approaches [19].

Presenting Symptoms

Recognising and taking appropriate action for gradual worsening symptoms before the need for hospitalisation is an important component of disease management strategies. While increasing exertional dyspnoea and peripheral oedema remain the most common symptoms of decompensation, weight gain tended to be less commonly identified as did other symptoms. Since there are often several days of progressing symptoms, this represents an opportunity for preventive intervention, as opposed to ischaemic symptoms, which generally results in a more prompt need for admission [20].

Precipitants of Admission

It is increasingly recognised that knowledge of the precipitant of a HF hospitalisation provides an opportunity for prevention as well as prognosis [21–23]. The importance of infection, predominantly respiratory, as a precipitant in our population reinforces the importance of vaccinations, early recognition and treatment of worsening symptoms, and coordination between respiratory and cardiology physicians. In an urban study from the 1980s, infection was a precipitant for only 12% of the admissions and dietary and medication non-compliance were more common [13]. The importance of arrhythmia as a precipitant in our population also emphasises the need for optimising management of atrial fibrillation. The decrease of ischaemia as a precipitant may be due to increased prevalence of HFpEF patients, or possibly a larger proportion of elderly patients in whom myocardial ischaemia may manifest with atypical symptoms [24]. Further investigation is needed into the increased proportion of hospitalisations with an unknown precipitant.

HF Comorbidities

The multiple comorbidities in the HF population contribute to the higher prevalence of readmissions due to non-HF causes than HF. The increasing prevalence of hypertension, diabetes and renal disease contribute to the complexity of management [3,10,12,16,25], while also providing an opportunity for newer therapies such as sodium glucose transporter (SGL2) inhibitors [26].

The increasing prevalence of atrial fibrillation in HF also presents a challenge. Although no advantage has been shown for pharmacologic rhythm control over rate control in HF [27], recent studies suggest benefit for ablation, including in HFpEF [28,29]. Since aortic stenosis increases with age, it is not surprising that a gradual increase in its prevalence is seen in our population. This increase in aortic stenosis is likely to result in an increasing demand for transcatheter aortic valve replacement procedures, and an associated stress on available resources [23,30,31]. Anaemia was present in one third of our cohort with little change in prevalence across the 15 years. Although its cause is often multifactorial, its importance as a predictor of mortality and readmission [32] supports the need for its investigation with suitable patients to receive erythropoietin and iron infusions to improve patient exercise capacity and reduce readmission [33,34].

Medical Therapy

Since beta blocker and ACEI/ARB therapy have become mainstay treatment options for HFrEF [35], it is notable that in our cohort with HFrEF, beta blocker use initially increased from 2001, but this was followed by an unexplained decrease

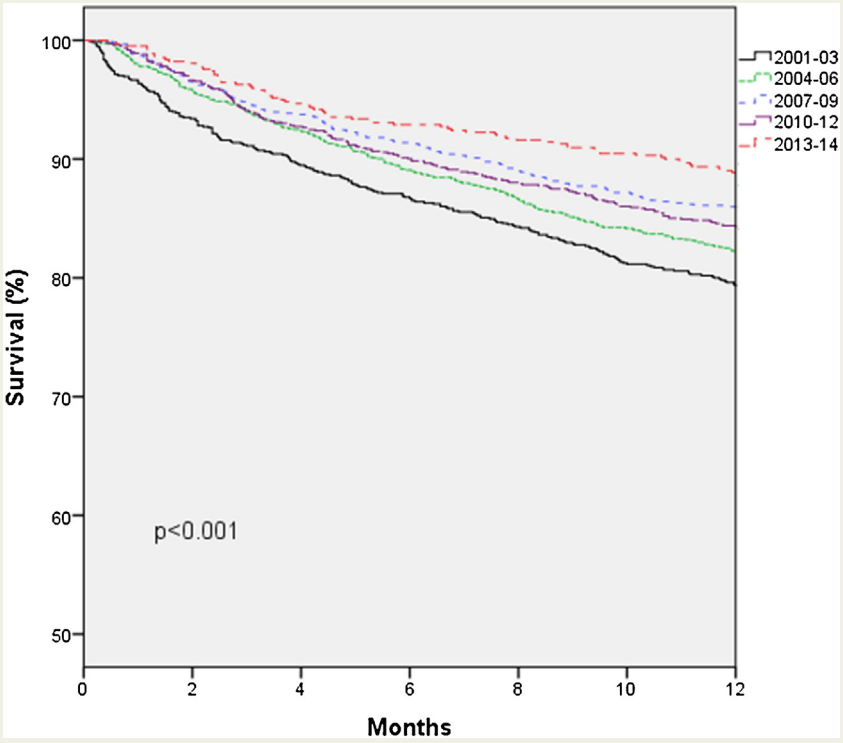

Figure 1 Temporal trends in 1-year survival rates of patients hospitalised with heart failure. The final cohort (2013–2014) excluded patients hospitalised in 2015 to allow for 1-year follow-up.

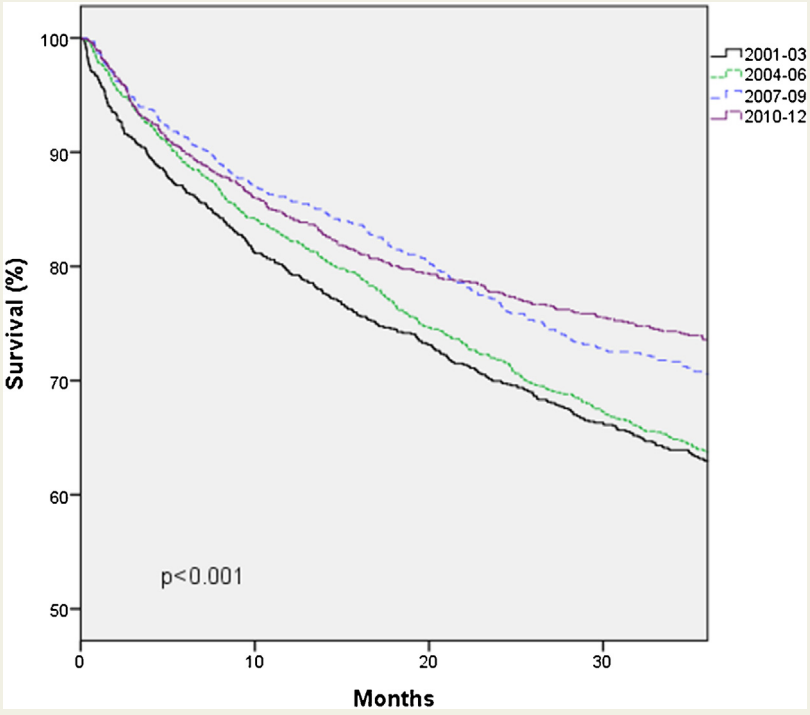

Figure 2 Temporal trends in 3-year survival rates of patients hospitalised with heart failure. The final cohort 2013–15 was excluded to allow for 3 years follow-up.

in use. In addition, there has been a gradual decline in use of ACE inhibitors. While we cannot exclude contraindications to their use, it is important that suitable patients with HFrEF not be denied these therapies, especially since there is no significant evidence that elderly patients will not derive benefit from these therapies, despite being under-represented in randomised trials [36–38].

In our cohort as in others, the proportion of HFpEF patients is increasing [39,40]. The lack of randomised trial data for proven treatment options to lower mortality [41], highlights the need for further trials of novel therapies for these patients. Diuretic use, including spironolactone, has increased between 2001–2015 for both HFrEF and HFpEF, with the reported reduction in hospitalisation shown with spironolactone in HFpEF contributing to its increased use [42]. The presence of impaired renal function in half of our cohort provides a reminder of the need for monitoring of patients on spironolactone [43], especially given the poor rates of guideline indicated follow-up after spironolactone's initiation reported in outpatient settings[44].

Limitations

Our readmission and mortality rates may be less than for patients who do not receive a specialist HF nurse directed program of education, home visits and/or phone calls. However, the analysis is strengthened by being from the same community population of HF patients over 15 years, using a consistent model of care. Some patients may have been rehospitalised outside of our area and not been recorded in our dataset, although the proportion of these readmissions was unlikely to change during the period of study. The HF diagnosis was made using Framingham criteria, and confirmed with the treating physician, however BNP measures were not routinely obtained during the study period. Other important variables not recorded included obesity, sleep apnoea and frailty. While the HFpEF rates increase in the elderly, there has also been a greater awareness in recent years of the HFpEF diagnosis. We cannot exclude some individual variation over the 15 years between our HF nurses in classification of precipitants, presenting symptoms and risk factors. Finally, we do not have information on the characteristics or numbers of patients with HF who were excluded or chose not to participate in the HF program from which the data were obtained. However, the eligibility criteria remained consistent during the study period.

Conclusion

Between 2001–2015, the age of patients hospitalised with HF and enrolled in a HF management program has increased by 10 years to an average of 84 years. Despite the advanced age of the patients, with their increased comorbidities, the mortality rates and length of stay have continued to improve. However, HF remains a significant burden on morbidity and mortality, with 1-year readmission rates remaining over 40%. Strategies to reduce readmission due to both HF and non-HF causes, will need to address the implications of the changing characteristics of these patients.

Conflicts of Interest

None.

Disclosures

None.

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None.

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