

Trends in hospital admissions and case fatality due to heart failure in England, 1990/91 to 1999/2000

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This paper examines how the public health burden of heart failure is changing by analysing trends in hospital admissions during the period 1990/91 to 1999/2000 using English Hospital Episode Statistics data. The total number of hospital admissions for heart failure was 5 per cent higher for men and 4 per cent higher for women in the financial year 1999/2000 compared to 1990/91. Heart failure admissions reached a peak in 1993/94 and has fallen since by 13 per cent for men and by 15 per cent for women. Between 1990/91 and 1999/2000 the age-standardised hospital admissions rate fell by 8 per cent for men and 5 per cent for women. The case fatality rate among heart failure patients has also fallen considerably over the ten-year period. These findings suggest that hospital care for heart failure patients has improved and the fall in hospital admissions since 1993/94 suggests a higher proportion of heart failure patients are being managed within a primary care setting.

INTRODUCTION

Heart failure is common and thought to be increasing in prevalence due to an ageing population and greater survival of patients with ischaemic heart disease (see Box 1 for definition). It is estimated that there are over 100,000 admissions each year due to heart failure in the United Kingdom (UK), this accounts for approximately 5 per cent of all adult admissions to a medical ward.¹ During the 1980s hospital admissions because of heart failure were increasing in the United States and the UK whilst the average length of hospital stay was decreasing during the same period.^{2,3} A recent study in Scotland found that heart failure admissions rose to a peak in 1993 and fell.⁴ Patient re-admission rates remain very high and elderly patients are at increased risk of early hospital re-admission.⁵ The high re-admission rates may reflect the complex clinical syndrome of heart failure, which has a natural history of progressively worsening or may also indicate inappropriately shortened lengths of hospital stay.

Episodes of hospital care are expensive. They account for the largest proportion of health care expenditure in managing patients with heart failure and yet are potentially preventable.⁶ Clinical trials have shown that drug treatment with Angiotensin-Converting Enzyme (ACE) inhibitors can reduce the number of hospital admissions among heart failure patients.^{7,8} Studies indicate that the prescribing of such drugs among heart failure patients although rising is still below recommended standards.⁹ Over the past decade, efforts have been made to reduce the public health burden of heart failure and to control costs by reducing the number of admissions to hospital. More recently the National Service Framework (NSF) for Coronary Heart Disease (CHD) for England sets out standards in prevention and treatment across a number of cardiovascular conditions including heart failure.¹⁰ Primary care has an essential role as a gatekeeper to hospital care and in implementing these standards in managing heart failure patients in the community.

Our analysis uses data from the English Hospital Episode Statistics (HES). The objectives of our study were to understand how the public health burden of heart failure is changing by examining the number of hospital admissions, hospital admission and case fatality rates for heart failure, in England during the ten-year period 1990/91 to 1999/2000.

Box one

HEART FAILURE

Heart failure is a clinical syndrome that occurs when the heart is unable to pump enough blood to meet the demands of the body. Some people with mild heart failure may have very few symptoms. Patients with moderate or severe heart failure suffer from a number of problems including shortness of breath (particularly when lying flat), waking up suddenly at night with a feeling of breathlessness, general tiredness, swelling of the feet, ankles and legs, rapid weight gain and chronic cough. Heart failure is a serious condition with a poor prognosis and one that can markedly reduce the quality of life.

Heart failure has many causes. The commonest cause is ischaemic heart disease. Other causes include problems with the heart muscle (cardiomyopathy), high blood pressure (hypertension), problems with any of the heart valves, abnormal heart rhythms (arrhythmias) and excess alcohol. The diagnosis is sometimes unclear from the history and examination and usually has to be confirmed by investigations such as chest x-ray or echocardiography.

METHODS

HES data were obtained from the Department of Health. The HES database contains all records of in-patient care provided by NHS hospitals in England. The data recorded are consultant episodes, defined as ‘the period during which an admitted patient is under the care of a particular medical consultant within a Hospital Provider’.¹¹ One record is generated for each consultant episode. Data extracted for the purpose of this study were Finished Consultant Episodes (FCEs); these are consultant episodes ended by internal transfer within the hospital, discharge or death. A patient can have several FCEs during a stay in hospital and these are numbered accordingly. Diagnoses were coded using the International Classification of Diseases Ninth Revision (ICD9) before April 1995, and ICD10 from this date. We examined total admissions due to heart failure; we were not able to distinguish between re-admission and admissions in the figures.

Number of heart failure admissions

The number of heart failure admissions gives an indication of the workload associated with the condition in secondary care. All first FCEs were selected where the main diagnosis was heart failure (ICD9 code 428 and ICD10 code 150) for the financial years 1990/91 to 1999/2000. By selecting heart failure as the main diagnosis it is assumed that the patient was admitted for treatment of this condition or its consequences. The admissions data are presented for patients aged 45 and over by age group and sex. This article examines only patients aged 45 and over as the prevalence of heart failure below the age of 45 is extremely low.⁹

Heart failure admission rates

Heart failure admission rates allow direct comparisons of the frequency of admissions between the sexes, in different age groups and over time. Hospital admission rates per 1,000 population are presented for the period 1990/91 to 1999/2000 by age and sex. These were calculated by dividing the number of admissions for heart failure by the England mid-year population estimates. As the number of admissions are presented in financial years and the population estimates in calendar years, population estimates for the calendar year overlapping nine months of any given financial year were used in the rate calculations. For example, we calculated heart failure admission rates for 1991/92 by dividing the 1991/92 number of admissions by the 1991 mid-year population estimates. To allow comparisons over time and between the sexes, we calculated age-standardised admission rates by applying the 45 to 64, 65 to 74, 75 to 84 and 85 and over age-specific admission rates to the European standard population.

Case fatality rates

We identified all heart failure admissions ended by death as opposed to discharge. Case fatality rates following admission for heart failure were then calculated by dividing the number of admissions ending in death by the total number of admissions for heart failure. These were calculated for patients aged 45 and over by age and sex for the ten-year period 1990/91 to 1999/2000. We calculated age-standardised case fatality rates by applying the age specific rates (as above) to the European standard population.

Projected number of admissions

The projected number of heart failure admissions was calculated for every five years between 2001/02 and 2026/27 by applying the most recent admission rates (1999/2000) to the mid-year population projections by age and sex.

RESULTS

Time trends in numbers of heart failure admissions

The number of hospital admissions for heart failure (for patients aged 45 and over) between 1990/91 and 1999/2000 rose to a peak in 1993/94 and then fell (Table 1). The number of admissions in 1999/2000 was 5 per cent higher for men and 4 per cent higher for women than in 1990/91. Since 1993/94 the number of hospital admissions has fallen by 13 per cent for men and by 15 per cent for women.

Time trends in heart failure admission rates by age

The age-standardised admission rate rose to a peak in 1993/94 and then fell (Table 2 and Figure 1). Between 1990/91 and 1999/2000 the age-standardised rate fell by 8 per cent for men and by 5 per cent for women. The age-standardised admission rate was higher among men than women throughout the period. Furthermore, the age-specific admission rates were higher among men than women in all age groups. Heart failure admission rates increased with age (Figures 2 and 3). Admission rates in the younger age groups fell between 1990/91 and 1999/2000. However, rates in the 85 and over age group increased by 4 per cent for men and by 7 per cent for women.

Table 1 Number of admissions for heart failure in those aged 45 and over, by age group and sex, England, 1990/91 to 1999/2000

	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/2000	Percentage change 1990/91 to 1999/2000
Men											
45-64	7,382	7,442	7,521	7,617	7,391	6,601	6,344	6,346	6,133	6,091	-17.5
65-74	11,785	12,296	13,490	14,585	14,365	13,117	12,486	12,129	11,866	11,156	-5.3
75-84	13,330	14,039	15,159	15,716	15,545	14,986	15,339	15,107	14,980	14,712	+10.4
85 and over	4,139	4,421	5,089	5,605	5,931	5,815	6,378	6,422	6,281	6,473	+56.4
Total	37,260	38,835	41,851	44,113	43,780	40,989	41,078	40,479	39,790	38,973	+4.6
Women											
45-64	3,287	3,227	3,512	3,617	3,542	3,079	3,096	3,076	3,031	2,730	-16.9
65-74	8,297	8,675	9,345	10,101	10,094	8,790	8,471	8,459	7,996	7,461	-10.1
75-84	16,083	16,929	18,337	19,113	18,216	17,006	16,839	16,541	15,920	15,552	-3.3
85 and over	9,448	10,205	11,401	12,731	12,891	12,341	13,001	13,054	13,088	12,881	+36.3
Total	37,533	39,670	43,086	45,994	45,061	41,564	41,716	41,405	40,317	39,017	+4.0

Source: Hospital Episode Statistics.

Table 2 Heart failure admission rates per 1,000* for heart failure in those aged 45 and over, by sex, England, 1990/91 to 1999/2000

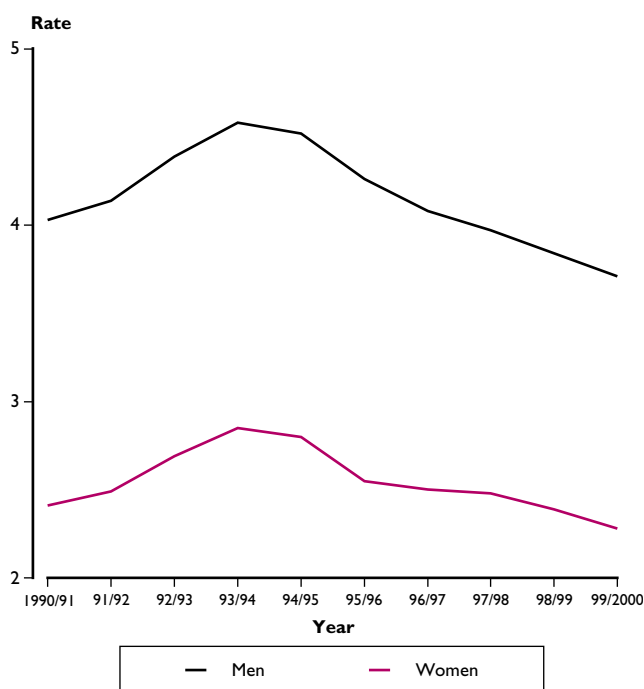
	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/2000	Percentage change 1990/91 to 1999/2000
Men											
45 and over	1.59	1.65	1.77	1.85	1.83	1.72	1.70	1.67	1.63	1.59	0.0
ASR **	4.03	4.14	4.39	4.58	4.52	4.26	4.08	3.97	3.84	3.71	-7.9
Women											
45 and over	1.53	1.61	1.75	1.86	1.82	1.68	1.67	1.65	1.61	1.55	+1.3
ASR **	2.41	2.49	2.69	2.85	2.80	2.55	2.50	2.48	2.39	2.28	-5.4

* Mid-year estimates of England population.

** ASR denotes age-standardised rate.

Source: Office for National Statistics from data supplied by Hospital Episode Statistics.

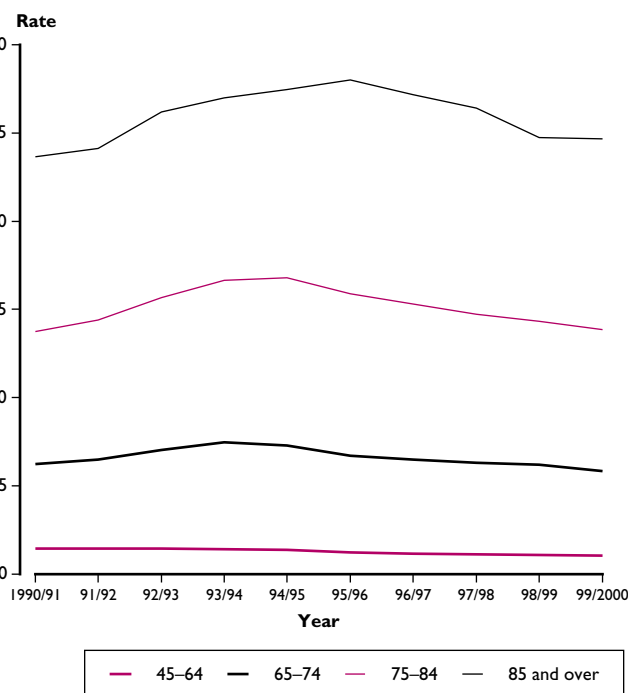
Figure 1 Age-standardised heart failure admission rates* in England, by sex and financial year, 1990/91 to 1999/2000



* Age-standardised for ages 45 and over.

Source: Office for National Statistics from data supplied by Hospital Episode Statistics.

Figure 2 Heart failure admission rates per 1,000* men, in England, by age and financial year, 1990/91 to 1999/2000

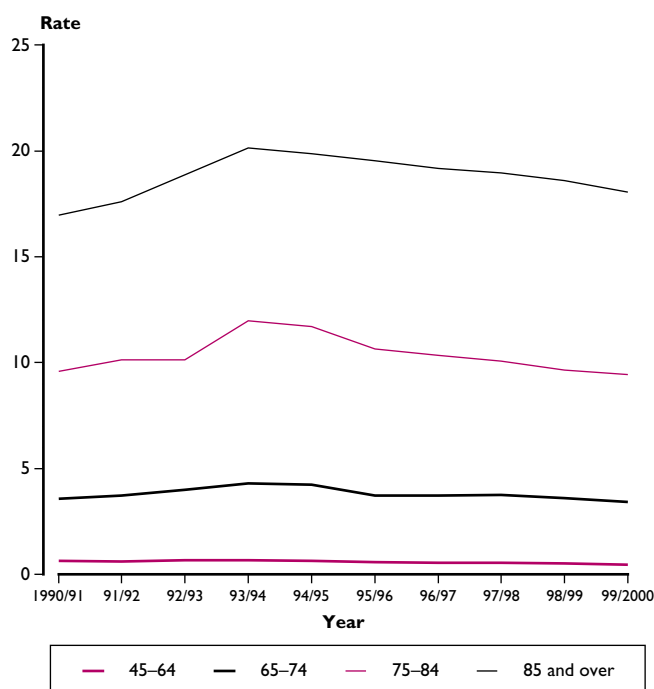


* Mid-year estimates of England population.

Source: Hospital Episode Statistics.

Figure 3

Heart failure admission rates per 1,000* women, in England, by age and financial year, 1990/91 to 1999/2000



* Mid-year estimates of England population.
Source: Hospital Episode Statistics.

Trends in case fatality rates following admission for heart failure

The age-standardised case fatality rates following admission for heart failure have fallen dramatically, by 43 per cent for men and by 61 per cent for women between 1990/91 and 1999/2000 (Table 3). The case fatality rate increased with age and the rate in the 85 and over age group was roughly 3 times higher than the rate in the 45 to 64 age group in 1999/2000.

Trends in the projected number of admissions for heart failure

The number of admissions for heart failure is projected to increase from 39,400 in 2001/02 to 62,600 in 2026/27 for men and over the same period, from 38,800 to 50,500 for women (Table 4). There are a projected 34,900 extra admissions in 2026/27 compared to 2001/02. This projection is based on the assumption that the admissions rate due to heart failure remains unchanged during the period 1999/2000 to 2026/27.

DISCUSSION

Main results

The total number of admissions due to heart failure in the financial year 1999/2000 was 3 per cent higher for men and 4 per cent higher for women than the 1990/91 figure. The number of heart failure admissions reached a peak in 1993/94 of 44,113 for men and 45,994 for women and has since fallen. The age-standardised admissions rate due to heart failure has also fallen since 1993/94. There are several possible explanations for the observed decrease in heart failure admissions. Hospital referral patterns and admission policies may have changed such that patients with milder forms of disease are managed entirely in primary care. During the 1990s, the increased prescribing of ACE inhibitors among heart failure patients may have reduced the number of hospital admissions, reflecting results seen in clinical trials.⁹ The improved management of patients in primary care with established ischaemic heart disease, the major cause of heart failure may also explain the falling rate of admissions. Changes in coding of hospital admissions data in particular the change from ICD9 to ICD10 in April 1995 may have affected comparisons across the years of 1994/95 and 1995/96. Our study is not able to determine which combination of these factors is responsible for the decrease in the hospital admission rate for heart failure.

The crude heart failure admissions rate was similar for men and women during the period 1990/91 to 1999/2000. Over the same time period, the age-standardised admissions rate was higher among men than women and the age-standardised death rate was higher for women compared with men. Men were more likely to be admitted than women but had a lower hospital death rate. This suggests that the severity of heart failure among patients was not the only factor that determined admission to

Table 3

Case fatality rates (percentage) among admissions for heart failure in those aged 45 and over, by age group and sex, England, 1990/91 to 1999/2000

	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/2000	Percentage change 1990/91 to 1999/2000
Men											
45-64	11.1	9.7	8.9	8.9	7.5	8.3	7.5	6.8	6.9	6.2	-44.1
65-74	18.2	16.1	15.0	14.2	13.3	13.5	11.8	10.6	10.5	10.1	-44.5
75-84	25.9	23.4	21.8	20.7	19.6	19.6	18.3	16.3	16.6	15.5	-40.2
85 and over	33.4	29.6	27.8	27.8	26.0	25.9	24.5	21.7	22.0	21.9	-34.4
Total	21.1	19.0	17.8	17.3	16.2	16.6	15.5	13.9	14.0	13.4	-36.5
ASR*	14.3	12.6	11.7	11.5	10.2	10.8	9.7	8.8	8.9	8.1	-43.4
Women											
45-64	18.8	12.1	10.3	10.4	9.7	9.4	10.2	7.1	7.2	6.7	-64.4
65-74	25.0	17.5	15.1	15.4	14.5	13.5	12.8	11.2	11.2	9.9	-60.4
75-84	30.6	22.2	20.1	19.1	18.7	18.7	17.4	15.8	16.3	14.7	-52.0
85 and over	32.7	26.9	25.1	24.4	23.7	24.0	22.7	20.8	21.0	20.0	-38.8
Total	24.0	21.5	19.5	19.1	18.4	18.4	17.5	15.7	16.1	14.9	-37.9
ASR*	21.4	14.4	12.5	12.5	11.8	11.4	11.7	9.0	9.1	8.4	-60.7

* ASR denotes age-standardised rate.

Source: Office for National Statistics from data supplied by Hospital Episode Statistics.

Table 4 Projected number of admissions for heart failure* in those aged 45 and over, by age group and sex, England, 2001/02 to 2026/27

	2001/02	2006/07	2011/12	2016/17	2021/22	2026/27
Men						
45–64	6,200	6,700	7,400	7,700	7,800	7,700
65–74	11,200	11,600	12,900	15,100	15,800	16,400
75–84	15,200	16,200	17,000	18,400	20,900	25,000
85 and over	6,700	7,600	9,100	10,400	11,900	13,500
Total	39,400	42,200	46,400	51,600	56,500	62,600
Women						
45–64	2,800	3,000	3,300	3,300	3,400	3,300
65–74	7,400	7,400	8,100	9,500	9,800	10,000
75–84	15,500	15,400	15,100	15,600	17,500	20,600
85 and over	13,100	13,300	14,000	14,400	15,200	16,500
Total	38,800	39,200	40,500	42,900	45,800	50,500

* Based on current (1999/2000) admission rates rounded to the nearest hundred.

Source: Office for National Statistics from data supplied by Hospital Episode Statistics.

hospital. Differences between the sexes in admission and hospital death rates may be explained by greater co-morbidity among women.

The admission rate due to heart failure increased with age and over the ten-year period increased in the 85 and over age group whilst falling in the younger age groups. These age differences may be explained by the fact that older patients have more severe disease and are therefore more likely to be admitted than younger patients. Heart failure management among younger patients may now be carried out predominantly in primary care with the use of drugs such as ACE inhibitors. Furthermore, the admissions policies may result in admitting older patients with milder disease because of inadequate social support at home.

The case fatality rate among heart failure patients admitted to hospital fell considerably between 1990/91 and 1999/2000. This finding may indicate an improvement in hospital care over this period. Alternatively it may be explained in part by changes in hospital admission policy or the case-mix of patients resulting in a higher proportion of patients with mild heart failure now being admitted than previously. The reductions in lengths of stay in hospital leading to more heart failure patients dying in the community rather than in hospital may also explain the falling case fatality rate. Our finding is similar to a recent Scottish study, which showed a fall in hospital deaths among heart failure patients during 1986 to 1995.¹²

In this study, to calculate the case fatality rate we have identified all deaths that followed admission for heart failure. However, there is no information available on cause of death. Our data therefore include both patients admitted for heart failure whose hospital stay was ended by death from heart failure, and patients admitted for heart failure whose stay was ended by death from a different condition, for example pneumonia. Furthermore, the case fatality data in our study are not comparable with national cause of death statistics calculated from information recorded on death certificates. Heart failure is regarded as a mode of dying rather than an acceptable cause of death and therefore is not expected to be the only cause mentioned on a death certificate. A death certificate must include the underlying cause of death. Cause of death statistics are likely to underestimate the total number of deaths where heart failure was involved. This is because deaths with heart failure as an immediate but not an underlying cause of death will be ascribed to the underlying cause, for example ischaemic heart disease. However, analyses of multiple causes of death data, in which all the medical conditions mentioned on the death certificate are coded, may still underestimate the total number of deaths where heart failure was in anyway involved. This is because the certifier may not necessarily

record all the medical conditions of the patient. The certifier is required to record the exact sequence of causes directly leading to death, in addition to any contributory causes.

The projected numbers of heart failure admissions are expected to increase based on current admission rates. This projected increase in heart failure admissions mirrors the estimated increase in heart failure prevalence associated with an ageing England population. However, these projections will be over estimates if admission rates continue their recent downward trend.

Strengths and weaknesses of study: comparison with other studies

This is the first study to examine trends in hospital admissions and case fatality for heart failure over a ten-year period for England. The diagnostic coding of HES data has improved over recent years and is less of a key limitation than previously stated.¹³ HES data only relate to admissions to NHS hospitals and therefore exclude patients who are admitted to private hospitals. However, this is unlikely to affect our main findings because admissions to private hospitals tend to occur among younger age groups and for less serious conditions than heart failure.

FCEs are an indirect measure of hospital admissions. Typically single-episode spells account for 95 per cent of hospital activity and therefore including all FCEs will over estimate the true number of admissions.¹¹ The combination of the first FCE and the primary diagnosis field for heart failure was chosen as a good approximation for a hospital admission.¹⁴ However, our study will underestimate the overall burden of heart failure on secondary care as heart failure might be coded secondary to other conditions for example, pneumonia or ischaemic heart disease.

Earlier studies reported a steady rise in the number of heart failure admissions, which is in contrast to our finding.^{15,16,17} This increase may be partly explained by a greater proportion of total heart failure admissions accounted for by re-admission. A later study in the USA showed stable admission rates for heart failure, and further showed that re-admission rates were also stable.¹⁸ More recently, a study in Scotland examining heart failure admissions during 1990 to 1996 found that admissions rose to a peak in 1993 to 1994 and then fell.⁴ Interestingly, this observed trend in heart failure admissions is very similar to the findings of our study. We were not able to examine trends in re-admission rates as separate FCEs are not routinely linked. Furthermore, we were not able to determine whether the severity of disease among patients being admitted had changed over time and thus affected heart failure admission rates.

Implications of study and future research

Hospital activity levels are affected by many factors that include the underlying prevalence of heart failure, the severity of disease, referral and admission practices and the provision of services. Hence, interpreting data on admissions is complex. Greater use of the NHS number in HES data will enable future trends in hospital admissions to be examined and links made to patient re-admission and clinical outcomes, such as out of hospital mortality.

Improved heart failure management, including the prescribing of ACE inhibitors, over recent years may have reduced the hospital admissions rate. However, studies show that many heart failure patients are not prescribed ACE inhibitors and other effective drug interventions such as beta-blockers and spironolactone.⁸ This may indicate the need to further improve current heart failure strategies, as there are patients who would potentially benefit from such interventions. As the prevalence of treated heart failure in general practice has remained stable over recent years, the fall in the admissions rate also suggests that there is a greater proportion of heart failure patients who are predominantly managed in primary care. The burden of care will increasingly fall to primary care teams who will have a key role in initiating effective treatments and managing heart failure patients.

CONCLUSIONS

The hospital admissions rate due to heart failure has fallen since 1993/94 and the case fatality rate has fallen considerably over the period 1990/91 to 1999/2000. The fall in case fatality rate due to heart failure may indicate improvements in the hospital care received by these patients. The reduced admissions rate may signal a shift in workload from secondary to primary care for most patients with heart failure. It may also indicate that the use of interventions such as ACE inhibitors has reduced heart failure admissions. Future analysis of trends in hospital admissions, re-admissions and hospital death rates will help to monitor the impact of the standards set in the NSF for CHD.

Key findings

- The total number of hospital admissions for heart failure was 5 per cent higher for men and 4 per cent higher for women in the year 1999/2000 compared to 1990/91.
- The number of heart failure admissions reached a peak in 1993/94 and has fallen since by 13 per cent for men and 15 per cent for women.
- The age-standardised hospital admissions rate fell by 8 per cent for men and 5 per cent for women between 1990/91 and 1999/2000.
- The case fatality rates for heart failure patients fell dramatically by 43 per cent for men and 61 per cent for women between 1990/91 and 1999/2000.
- Assuming current admission rates prevail, the number of heart failure admissions is projected to increase from 39,400 in 2001/02 to 62,600 in 2026/27 for men and over the same period from 38,800 to 50,500 for women.

REFERENCES

1. Dargie H J and McMurray J J V (1994). Diagnosis and management of heart failure. *BMJ* 308, 321–8.
2. Ghjali J K, Cooper R and Ford E (1990). Trends in hospitalization rates for heart failure in the United States, 1973–1986. *Arch Intern Med* 150, 769–73.
3. McMurray J, McDonagh T, Morrison C E and Dargie H J (1993). Trends in hospitalization for heart failure in Scotland 1980–1990. *Eur Heart J* 14, 1158–62.
4. Stewart S, MacIntyre K, MacLeod M C C, Bailey A E M, Capewell S *et al* (2001). Trends in hospitalization for heart failure in Scotland 1990–1996. *Eur Heart J* 22, 209–17.
5. Vinson J M, Rich M W, Sperry J C, Shah A S and McNamara T (1990). Early readmissions of elderly patients with congestive heart failure. *J Am Geriatr Soc* 38, 1290–95.
6. McMurray J and Davie A (1996). The pharmacoeconomics of ACE inhibitors in chronic heart failure. *Pharmacoeconomics* 9(3), 188–97.
7. SOLVD Investigators (1991). Effect of enalapril on survival in patients with reduced left ventricular ejection functions and congestive heart failure. *N Engl J Med* 325, 303–10.
8. Garg R and Yusuf S (1995). Overview of Randomized Trials of Angiotensin–Converting Enzyme Inhibitors on Mortality and Morbidity in patients with Heart Failure. *JAMA* 273 (18), 1450–56.
9. Ellis C, Gnani S, Majeed A (2001). Prevalence and management of Heart Failure in General Practice in England and Wales, 1994–1998. *Health Statistics Quarterly* 11, 17–24.
10. Department of Health. *National Service Framework for Coronary Heart Disease*. March 2000. Department of Health.
11. Department of Health (1999). An introduction to HES, Overview of the Hospital Episode Statistics system. Department of Health.
12. MacIntyre K, Capewell S, Stewart S *et al* (2000). Evidence of improving prognosis in Heart Failure: Trends in case fatality in 66 547 patients hospitalized between 1986 and 1995. *Circulation* 102(10), 1126–31.
13. Majeed A (1997). Hospital admissions data: Why are they collected. *Clinician in management* 7, 160–66.
14. Hansell A, Bottle A, Shurlock L and Aylin P (2001). Accessing and using hospital activity data. *Journal of Public Health Medicine* 23, 51–6.
15. Reitsma J B, Mosterd A, de Craen A J M, Koster R W, van Capelle F J L *et al* (1996). Increase in hospital admission rates for heart failure in the Netherlands, 1980–1993. *Heart* 76, 388–92.
16. Rodriguez–Artalejo F, Guallar–Catillon P, Banegas Banegas J R and del Rey Calero J (1997). Trends in hospitalization and mortality for heart failure in Spain, 1980–1993. *Eur Heart J* 18, 1771–79.
17. Doughty R, Yee T, Sharpe N and MacMahon S (1995). Hospital admissions and deaths due to congestive heart failure in New Zealand, 1988–91. *N Z Med J* 108, 473–5.
18. Ni H, Nauman D J and Hershberger R E (1999). Analysis of trends in hospitalization for heart failure. *J of Cardiac Failure* 5(2), 79–84.