

Trends in hospitalization for heart failure in Scotland, 1990–1996

An epidemic that has reached its peak?

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Aims Studies in the 1980s and early 1990s showed striking increases in hospitalization rates for heart failure. This report describes contemporary trends in hospitalization for heart failure.

Methods Scotland (population of 5.1 million) has a well described system for recording details of all hospitalizations. All hospital discharges (and deaths) can be linked to each patient. We examined the period 1990–1996 (158 989 hospitalizations with a principal or secondary diagnosis of heart failure).

Results Compared to 1990, the number of hospitalizations with a principal diagnosis of heart failure increased in men (by 16%) and women (by 12%), although the highest numbers were recorded in 1993 in women (21%) and in 1994 in men (24%). Similar trends were seen for the number of patients hospitalized overall and those having a ‘first ever’ hospitalization. Hospitalizations with a secondary diagnosis of heart failure increased much more strikingly (by 110% and 60% in men and women, respectively). Re-hospitalization became more common, increasing by 53% and representing 23% of all hospitalizations in 1996.

Median length of stay fell (from 9 to 8 days in men and 13 to 10 days in women with a principal diagnosis of heart failure), resulting in 100 877 fewer inpatient days. Heart failure (principal diagnosis) still, however, accounted for 4.2% of all inpatient medicine/geriatric bed-days in 1996. Although inpatient case fatality fell slightly, the total number of deaths due to heart failure (principal diagnosis) increased slightly.

Conclusions Heart failure continues to be a common cause of hospitalization. The previously reported ‘epidemic’ of increasing rates of hospitalization for heart failure in Scotland and elsewhere between 1980 and 1990, however, seems to have peaked (in about 1993/4).

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Introduction

Heart failure represents a major and growing public health problem in industrialized countries with ageing populations. It is often associated with persistent and debilitating symptoms requiring chronic pharmaco-

therapy. Periodic episodes of acute clinical deterioration are common and lead to unplanned hospitalization and premature death. Consequently, heart failure imposes a heavy burden on the health care system overall, and in particular, the hospital sector^[1]. Recent reports from the United States^[2–4], Scotland^[5], Sweden^[6,7], the Netherlands^[8], New Zealand^[9] and Spain^[10] have all described an increase in the number of hospitalizations associated with heart failure. For example, in Scotland, the number of hospitalizations with heart failure coded as the principal diagnosis increased from 6796 in 1980 to 10 778 in 1990 (from 1.30 to 2.12 per 1000 of population and from 2.51 to 4.24 per 1000 for heart failure coded in

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any position). However, with the major exception of a more recent report from the United States relating to the period 1985–1995^[4], these reports predominantly describe trends in hospitalization rates that pre-date the widespread use of newer therapies such as angiotensin converting enzyme (ACE) inhibitors.

As reported previously, Scotland, a country of the United Kingdom with a population of 5.1 million, has a well described system for recording details of hospitalizations^[5,11]. This system also permits analyses of hospitalization and survival data on an individual basis. We have utilized these linked data to report in detail trends in hospitalization for heart failure in Scotland for the period 1990–1996. Our findings show that the earlier trends reported in Scotland and elsewhere seem to have changed in recent years.

Methods

Data source

The Information and Statistics Division of the National Health Service in Scotland collects and collates data on all hospital discharges using the Scottish Morbidity Record Scheme^[11]. Between 1990 and 1996, data from patient case records were routinely used to code up to six diagnoses at the time of hospital discharge according to the Ninth Revision of the World Health Organisation International Classification of Diseases (ICD₉). The term 'discharge' includes both live discharges and deaths. These hospital data are also linked to information held by the General Register Office for Scotland, relating to all deaths within the United Kingdom. These data permit analysis of trends in hospitalization on both an 'episode' basis and, using each individual's unique identifier assigned during their first hospital contact, a 'patient' basis.

Hospitalization for heart failure

For the period 1990–1996, we identified all hospitalizations occurring within Scotland where heart failure was coded at discharge as either the principal (first position) or a secondary diagnosis (second to sixth diagnostic positions). This 'episode-based' data set was then analysed to determine the number of individual patients who contributed to these hospitalizations on an annual basis. Using a retrospective review of data we also identified the annual number of men and women who had their 'first ever' hospitalization with a principal diagnosis of heart failure by excluding those with a previous hospitalization for heart failure within 10 years.

The following ICD₉ codes were used to determine the presence of heart failure: 402 (hypertensive heart failure), 425.4 (primary cardiomyopathy), 425.5 (alcoholic cardiomyopathy), 425.9 (secondary cardiomyopathy), 428.0 (congestive heart failure), 428.1 (left heart fail-

ure) and 428.9 (heart failure, unspecified). A recent validation of ICD coding of each hospitalization in Scotland suggests that it is 90% accurate overall^[12].

All data were directly obtained from the Information and Statistics Division of the National Health Service in Scotland. All trends analysis was performed using SPSS version 9.0.

In order to compare the age- and sex-specific rates of hospitalizations associated with both a 'principal' and 'secondary' diagnosis of heart failure, before and after the observed peaks in either 1993 or 1994, we used the z-test for comparing rates with adjustment for the number of individuals at risk per annum.

Results

Total episodes of hospitalization

Between 1990 and 1996, a total of 158 989 hospitalizations in Scotland were coded with a principal or secondary diagnosis of heart failure at discharge. Throughout this period, women accounted for more hospitalizations (52% overall) than men. The proportion of hospitalizations where heart failure was listed in the first three diagnostic positions also remained constant during this period (>95%).

Figure 1 (principal diagnosis) and Fig. 2 (secondary diagnosis) show the sex-specific trends in the number of heart failure hospitalizations ('episodes') recorded per annum, in addition to the number of patients who were hospitalized, during this period. In both men and women, the number of hospitalizations associated with a principal diagnosis of heart failure in 1996 had increased by an additional 744 (16%) and 605 (12%), respectively, compared to 1990. However, in women the highest number of hospitalizations was recorded in 1993 (21% more than 1990) whilst in men this occurred in 1994 (24% more than 1990). During this same period, the number of hospitalizations associated with a secondary diagnosis of heart failure increased substantially in both men (110% more than 1990) and women (60% more than 1990); the rate of increase being most evident between 1990–93/94. In 1996 there were an additional 4965 (62%) male and 3381 (35%) female hospitalizations associated with a diagnosis of heart failure (coded in any position) compared to 1990.

Ratio of patients to hospitalizations

Figure 3 shows the combined, annual total of men and women discharged from hospital with heart failure coded as either the principal or secondary diagnosis and the proportions of whom were hospitalized either once, twice or ≥ three times during that year. Compared to 1990, in 1996 a total of 2201 (414 with a principal diagnosis) more women and 2487 (407 with a principal diagnosis) more men were hospitalized — an increase of

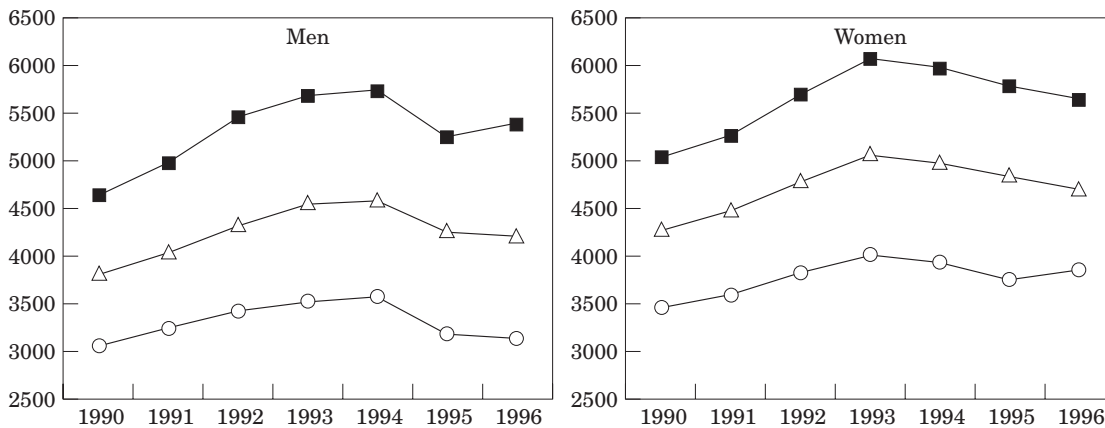


Figure 1 Sex-specific trends in the number of hospitalizations for heart failure as the principal diagnosis and the number of patients who contributed to these (including those with a 'first ever' hospitalization), 1990–1996. ■=total hospitalizations (principal diagnosis), △=number of individual patients hospitalized (principal diagnosis) and ○=number of individual patients with a 'first ever' hospitalization for heart failure (principal diagnosis).

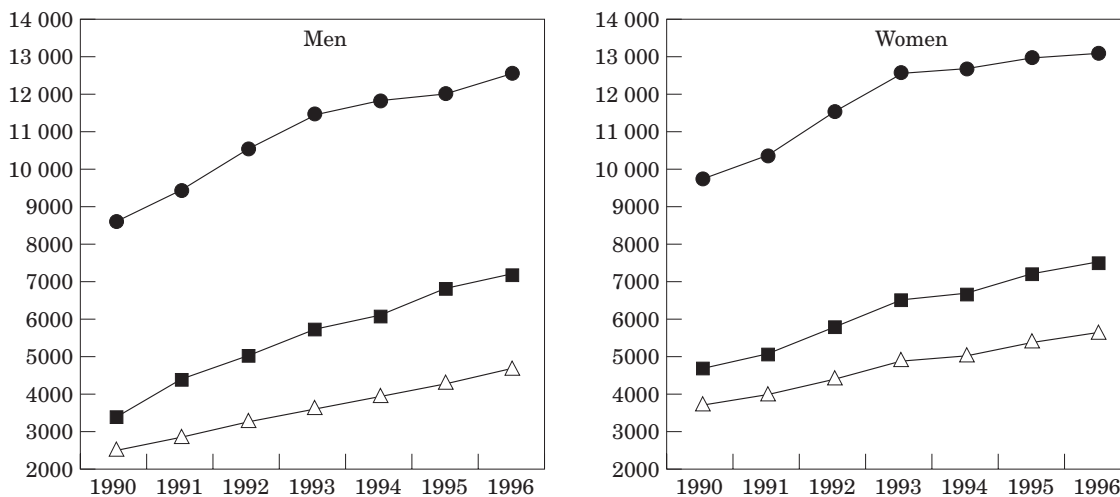


Figure 2 Sex-specific trends in the number of hospitalizations for heart failure as a secondary diagnosis, the associated number of patients who contributed to these and the total number of heart failure hospitalizations (any diagnostic position) 1990–1996. ■=total hospitalizations (secondary diagnosis), △=number of individuals hospitalized (secondary diagnosis) hospitalized and the ●=total number of heart failure hospitalizations (any diagnostic position).

27.2% and 38.5%, respectively (9.6 and 10.6%, respectively, for a principal diagnosis of heart failure). Also during this period, the number of men and women with both a principal and secondary diagnosis hospitalized on more than one occasion during any one year steadily increased (particularly in the latter group) and therefore contributed disproportionately to the total number of hospitalizations. For example, in 1990 14% of women and 17% of men recorded multiple hospitalizations compared to 18% and 21%, respectively, in 1996. As such, the absolute number of re-hospitalizations per annum rose by 53% to 5851 between 1990 and 1996 (representing 23% of all heart failure hospitalizations in 1996) during this period.

'First ever' hospitalization

Table 1 shows the number of individual patients who experienced a first ever hospitalization with a principal diagnosis of heart failure during the period 1990–1996 and their relative contribution to the total number of hospitalizations recorded per annum. Some of these data are also presented in Fig. 1. During this period the absolute number of these 'first ever' hospitalizations rose until 1993 in women and 1994 in men, but thereafter appeared to decline towards 1990 levels. Overall, their contribution to the total number of heart failure hospitalizations per annum gradually declined throughout 1990–1996. The proportion of men and women aged

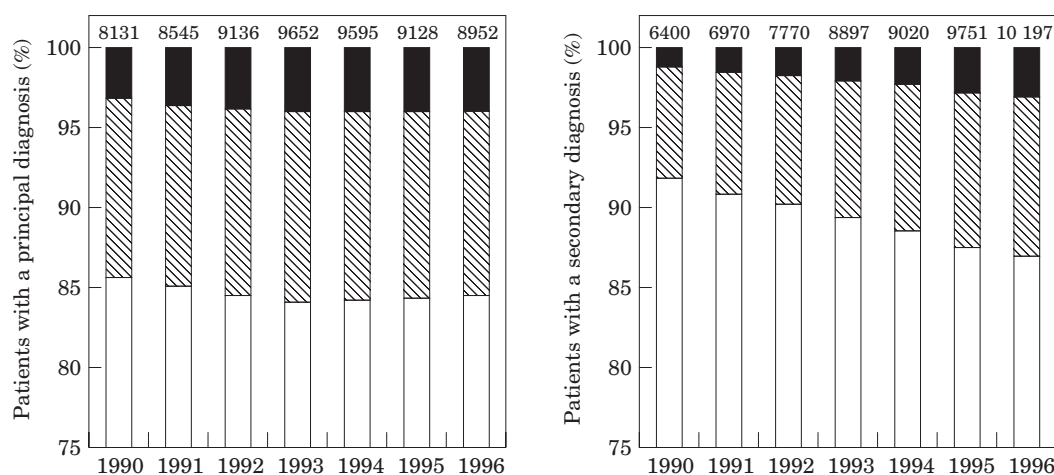


Figure 3 Annual number of hospitalizations per patient (combined male and female data) according to the diagnostic position of heart failure at discharge, 1990–1996. ■ = 3+; ▨ = 2; □ = 1

Table 1 Annual total of 'first-ever' hospitalizations (principal diagnosis) (1990–1996) and their contribution to total hospitalizations

	1990	1991	1992	1993	1994	1995	1996
Men							
First-ever hospitalizations	3071	3241	3435	3526	3587	3189	3301
% all principal diagnosis	66%	65%	63%	62%	62%	61%	61%
% of any diagnostic position	38%	35%	33%	31%	30%	27%	25%
Women							
First-ever hospitalizations	3479	3606	3835	4032	3946	3766	3749
% all principal diagnosis	69%	68%	67%	66%	66%	65%	66%
% of any diagnostic position	36%	35%	33%	32%	31%	29%	25%

Table 2 Annual rate of heart failure hospitalization per 1000 population in Scotland (1990–1996) according to the diagnostic position of heart failure at discharge

	1980*	1990	1991	1992	1993	1994	1995	1996
Men								
Principal diagnosis	1.27	2.1	2.0	2.2	2.3	2.3	2.1	2.2
Secondary diagnosis	1.22	1.4	1.8	2.1	2.3	2.5	2.7	2.9
Any diagnostic position	2.49	3.5	3.8	4.3	4.6	4.8	4.8	5.1
Women								
Principal diagnosis	1.32	1.9	2.0	2.2	2.4	2.3	2.2	1.9
Secondary diagnosis	1.21	1.8	1.9	2.2	2.4	2.5	2.7	2.8
Any diagnostic position	2.53	3.7	3.9	4.4	4.8	4.8	4.9	4.7

*As reported in reference^[5].

≥ 65 years who experienced their first ever heart failure hospitalization remained constant throughout this period — 62% and 76%, respectively.

Population rate of hospitalization for heart failure

Table 2 shows the population rate of hospitalization associated with either a principal or secondary diagnosis of

heart failure at discharge during 1990–1996. While the overall population rate of hospitalization associated with a principal diagnosis of heart failure in both sexes rose slightly in the first 4 years of this period, in the latter 2 years these rates declined to levels equivalent to those of 1990. However, due to a steady increase in the rate of hospitalizations associated with a secondary diagnosis of heart failure, the overall rate of heart failure hospitalization (any diagnostic position) rose appreciably. This increase was most marked in men who in 1990 had a lower,

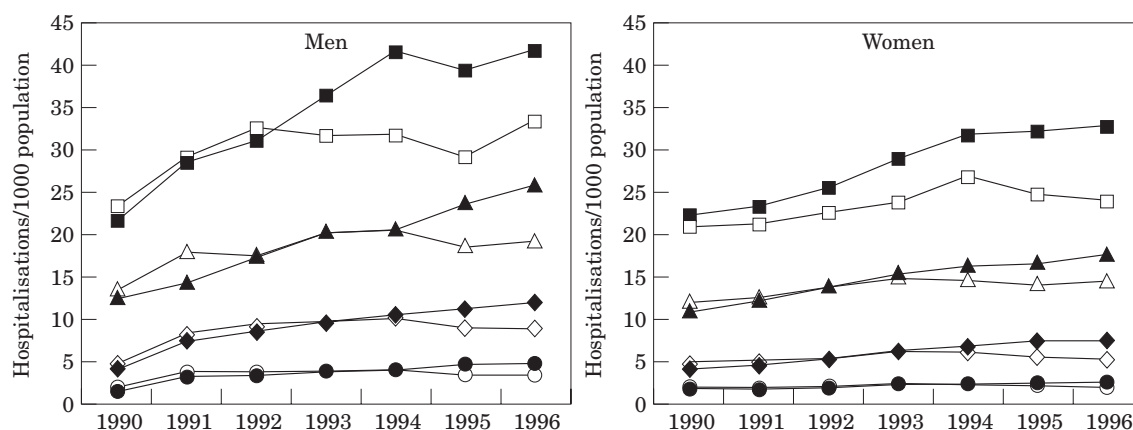


Figure 4 Trends in sex- and age-specific, rates of hospitalization per 1000 population for heart failure both as the principal and secondary diagnosis in those aged >55 years, 1990–1996. Age-groups: ●=55–64 years, ◆=65–74 years, ▲=75–84 years and ■=85 years and over. Open symbols denote a principal diagnosis of heart failure and solid symbols denote a secondary diagnosis of heart failure at hospital discharge.

and by 1996 a higher, overall rate of hospitalization compared to women.

Age and sex-specific rates of hospitalization

Figure 4 shows the age- and sex-specific rates of hospitalization on the basis of either a principal (open symbols) or secondary diagnosis (closed symbols) of heart failure for men and women aged ≥ 55 years during this period. In all age groups the overall rate of hospitalization associated with heart failure (coded in any diagnostic position at discharge) increased appreciably. However, with the exception of men aged ≥ 75 years (who also recorded a modest increase in the number of hospitalizations associated with a principal diagnosis of heart failure) this was almost solely attributable to discharges associated with a secondary diagnosis of heart failure.

The average age of males discharged with a diagnosis of heart failure (coded in any position) was 71.0 (SD 12) years in 1990 and 71.4 (12) years in 1996. The equivalent figures for women were 76.3 (12) years and 76.9 (12) years, respectively. Male patients having a 'first ever' hospitalization for heart failure had an average age in 1990 of 71.2 (12) years and 72.0 (12) years in 1996 (an increase of 0.8 years). In women the equivalent figures for 1990 were 76.2 (11) years and 77.2 (12) years in 1996. While the proportion of men aged over 65 years with a principal diagnosis of heart failure rose from 74% to 78%, the equivalent proportion in women stayed the same between 1990 and 1996 at 88%.

As suggested, the rate of hospitalization during the period 1991–1996 in those individuals aged <75 years, irrespective of their sex and the diagnostic position of heart failure, was not significantly different from that observed in 1990. However, in both men and women aged >75 years and irrespective of the diagnostic position of heart failure, the observed (peak) rate of hospitalization in 1993–1994 was significantly greater

than that observed in 1990 ($P < 0.001$). Alternatively, a comparison between the peak rates observed in 1993–1994 and those of 1996 revealed no significant differences; the major exception being men aged 75–84 years whose peak rate of hospitalization occurred in 1996 and who had significant rate increases during both 1990–1993 and 1993–1996 ($P < 0.001$).

Heart failure hospitalizations as a proportion of all hospital activity in Scotland

As a principal diagnosis, heart failure accounted for 1.1% of all hospital discharges in both 1990 and 1996. As a secondary diagnosis, it was associated with an additional 0.9% of discharges in 1990 increasing to 1.5% in 1996. Overall, therefore, heart failure, as either the principal or secondary diagnosis, contributed to 2.0% of all hospitalizations in 1990 with this figure rising to 2.6% in 1996. In 1996 heart failure (principal diagnosis) accounted for 11.3% of cardiovascular hospitalizations in men (12.2% in 1990) and 15.1% in women (17.3% in 1990). For heart failure (any coding position) in 1996 these proportions were 26.3% in men (22.5% in 1990) and 34.8% in women (33.1% in 1990). Heart failure (principal diagnosis) in 1996 accounted for 18.8% of all men discharged for a cardiovascular reason (16.7% in 1990). The equivalent proportions in women were 21.5% in 1996 (22.6% in 1990). For heart failure (any coding position) these proportions were 41.6% for men in 1996 (30% in 1990) and 46.9% for women (42.4% in 1990).

Heart failure discharges by speciality

In 1996, 66% of male and 60% of female hospital discharges due to a principal diagnosis of heart failure were from general medical units; these proportions

Table 3 Total days of hospitalization associated with a discharge diagnosis of heart failure — 1990 compared to 1996

	1990		1996		1990–1996
	Total days of hospitalization	Days/1000 population	Total days of hospitalization	Days/1000 population	δ in total days per annum
Men					
Principal diagnosis	95 856	36.3	70 413	28.3	– 25 443
Secondary diagnosis	93 790	35.6	96 808	38.9	+ 3018
Any diagnostic position	189 646	71.9	167 221	67.2	– 22 425
Women					
Principal diagnosis	169 067	64.1	93 633	35.4	– 75 434
Secondary diagnosis	234 985	89.1	136 770	51.8	– 98 215
Any diagnostic position	404 052	153.2	230 403	87.2	– 173 649

remained similar to those recorded in 1990. While patients with a secondary diagnosis of heart failure were less likely to be discharged from a general medical unit, increasing numbers of these male patients were more likely to be discharged from a specific cardiology unit. The proportion of all discharges from internal medicine wards related to heart failure (coded in any position) was 5.3% in 1990 and 6.2% in 1996. For geriatric units these figures were 11.6% and 6.3%, respectively.

Length of stay

In 1990 length of stay varied widely according to the age, type of unit and the diagnostic position of heart failure at hospital discharge. Overall median (IQR) length of stay for men and women, regardless of coding position, was 11 (6–21) days in 1990 and 9 (4–18) days in 1996. On average, women, the elderly and those discharged from a geriatric unit had the longest length of stay. However, for both sexes and regardless of the diagnostic position of heart failure, median length of stay progressively decreased between 1990 and 1996. In 1990 the median length of stay for men with a principal diagnosis of heart failure fell from 9 (IQR 5–18) days to 8 (IQR 4–16) days in 1996. For women the equivalent figures were 13 (IQR 7–27) days in 1990 compared to 10 (IQR 5–19) days in 1996. Similarly, the median length of stay for male and female hospitalizations with a secondary diagnosis of heart failure fell from 10 (IQR 5–19) and 13 (IQR 7–27) days to 8 (IQR 3–15) and 10 (IQR 5–21) days, respectively, between 1990 and 1996. In 1996, therefore, for both sexes, regardless of the diagnostic position of heart failure, the median length of stay was broadly the same. Mean length of stay fell from 27 to 14 days over the period of study in patients with a principal diagnosis of heart failure.

Overall days of hospitalization

Despite the overall increase in all heart failure hospitalizations between 1990 and 1996, the reduction in average

length of stay resulted in a 12% and 43% decrease in the total number of days of hospitalization per annum for men and women, respectively. However, the 8914 men who had a total of 13 002 hospitalizations in 1996 still accounted for approximately 170 000 days of inpatient care (about 67 days/1000 population) whilst the 13 061 female hospitalizations recorded in the same year accounted for approximately 230 000 days of inpatient care (about 88 days/1000 population) — refer to Table 3.

Days of hospitalization as a proportion of all hospital activity in Scotland

In 1996, heart failure (as a principal diagnosis) accounted for 1.4% of all inpatient days, 4.7% of internal medicine days and 3.1% of geriatric bed-days. The equivalent figures for a secondary diagnosis of heart failure were 1.9%, 5.7% and 5.0%, respectively. Therefore, heart failure, coded in any diagnostic position, contributed to 10.4% of all internal medicine bed-days. As a principal diagnosis, heart failure accounted for 4.2% of all internal medicine/geriatric bed-days occupied in Scotland in 1996 (9.6% for all diagnostic positions). Remarkably, in 1996, heart failure (as a principal diagnosis) accounted for 25.5% of all bed days used during hospitalizations for cardiovascular reasons by men (compared to 30% in 1990) and 30.1% in women (37.1% in 1990). For heart failure (any coding position) these proportions were 61% (59%) for men and 74% (89%) for women.

Destination following hospital discharge

In 1990, 74% of patients discharged alive from hospital with a principal diagnosis of heart failure went directly to their own home, whereas by 1996 this figure had fallen to 66%. The proportion of 'live' discharges to a non-acute health care institution (e.g. nursing home) rose from 26% in 1990 to 34% in 1996 (an increase of about 4000).

In-hospital case fatality

Annual case fatality rates in both sexes and in all age groups fell during this period. In men, the inpatient case fatality rate associated with a principal diagnosis of heart failure fell slightly from 15.8% in 1990 to 15.2% in 1996 and more substantially from 20.3% to 14.9% in those discharged with a secondary diagnosis of heart failure. In women the equivalent case fatality rates fell from 17.5% to 15.6% for a hospitalization associated with a principal diagnosis of heart failure and from 21% to 15.3% for those with a secondary diagnosis of heart failure. Overall, therefore, the case fatality rate in both sexes in 1996, irrespective of the diagnostic position of heart failure, was between 14.9% and 15.6%. However, compared to 1990, in 1996 the total number of male case fatalities associated with a principal diagnosis of heart failure had risen by 12% (from 733 to 818) and with any heart failure-related hospitalization by 23% (from 1532 to 1878). In women the total number of female case fatalities associated with a principal diagnosis of heart failure were very similar in 1990 and 1996 (884 vs 882) but increased slightly (6%) in terms of all case fatalities associated with any hospitalization for heart failure (1856 vs 1971).

One-year case fatality

In 1990, 1-year sex-adjusted case fatality rates following the first recorded hospitalization for that year were similar for both men and women and for all diagnostic positions. For example, in men, the 1-year case fatality rate in 1990 was 37% for both a principal and secondary diagnosis of heart failure. Similarly, in women, the 1-year case fatality rate associated with a principal diagnosis of heart failure was 40% and 38% for a secondary diagnosis. By 1996, the 1-year case fatality rate following the first recorded hospitalization for that year for a principal diagnosis of heart failure was essentially the same for men (37%) and only slightly lower in women (36%). However, the 1-year case fatality rate associated with a secondary diagnosis of heart failure fell in both men (30%) and women (32%).

Despite the overall fall in 1-year case fatality, the total number of case fatalities associated with a first recorded heart failure hospitalization (any diagnostic position) in 1996 compared to 1990 rose by 361 (10%) in women and 394 (15%) in men.

Discussion

The aim of this study was to describe recent trends in hospital discharges for heart failure in Scotland, following on from an identical study examining the same subject over the earlier period 1980 to 1990. Our original report described a 60% increase in heart failure hospitalizations between 1980 and 1990^[5] and several subsequent reports confirmed similar findings in other countries^[2-4,6-10].

Our present study contrasts considerably with these older reports. Though an increasing incidence and prevalence of heart failure, associated with ageing of the population, has been described, this does not seem to have been reflected in recent trends in heart failure hospitalizations. Instead, there has been a decline in discharges, with heart failure coded as the principal diagnosis since approximately 1993 and a slowing of the rate of increase (or even plateauing) of the number of hospitalizations associated with heart failure coded as a secondary diagnosis. Nevertheless, the number of discharges remains substantially higher than in 1980 (6729 discharges for a principal diagnosis of heart failure in 1980^[5] compared to 11 041 in 1996) and heart failure continues to be a significant cause of hospitalization. Heart failure (as a principal diagnosis) accounted for approximately 1.1% of all hospital discharges in 1996 in Scotland compared to 1.7% in the Netherlands in 1993^[8] and 1.6% in New Zealand in 1991^[9]. Data from Sweden for 1995 suggested that there were 420 hospitalizations for heart failure per 100 000 in that country. In Sweden, heart failure was the fourth most common cause of hospitalization, the most common in those aged >65 years and accounted for 14% of all circulatory causes of hospitalization^[7]. In the same year, there were 380 hospitalizations for heart failure per 100 000 in Scotland and, like Sweden^[7] and the U.S.^[4], heart failure represented the most common cause of non-elective hospitalization in those aged >65 years.

Similar conclusions can be drawn from examination of population rates of discharge which also plateaued during the time scale of this study. The overall rate is, however, considerably higher than 1980 (male and female rates 1.27 and 1.32 per 1000 of the population in 1980 compared to 2.2 and 1.9/1000 in 1996, for a principal diagnosis of heart failure). This compares to a rate of 2.87 hospitalizations per 1000 population, for men and women, in Sweden in 1995, 1.6/1000 in the Netherlands in 1990 and 1.63/1000 in New Zealand 1988–1991. These rates all seem to be substantially lower than recently described in the U.S.A.^[4]. This may reflect a greater degree of coding in the U.S. or lower admission thresholds. Certainly, the case fatality rates reported in heart failure patients in the U.S. are far lower than reported elsewhere, suggesting a different patient population is being described.

Examination of the overall number of individuals hospitalized is also in keeping with the analysis of episodes and rates. The number of men with heart failure as the principal diagnosis coded at discharge also peaked in 1994 and for women the peak was in 1993 (at 20% and 18% above the numbers in 1990, respectively). However, the number of patients with a discharge related to heart failure coded in any position continued to rise between 1990 and 1996 (by 27% in women and 39% in men), though the rate of increase has been much lower since 1993–1994 than it was between 1990 and 1993–1994. For men the rise was 29% between 1990 and 1993 and 7% between 1993 and 1996. For women these increases were 24% and 3%, respectively.

The findings with patients having a 'first ever' hospitalization with heart failure were much the same. The number of men peaked in 1994 and the number of women peaked in 1993. The rise in first discharges from 1990 to these peaks was, however, less marked than for episodes of hospitalization or numbers of patients discharged (the increase in men was 17% and in women 16%).

The striking discrepancy is, therefore, in the much more marked increase in discharges with a secondary coding of heart failure. Why has this occurred? Several suggestions can be made. Firstly, there may simply be pressures to increase secondary coding overall and this has been recognized in other countries. Certainly, there was an overall increase in the number of discharge diagnoses listed during this period. However, heart failure was usually listed in diagnostic positions two or three and this overall increase does not fully account for the observed increase in this type of hospitalization. Secondly, there may now be a greater awareness of heart failure than in the past. A third and intriguing possibility is that we are now seeing heart failure more commonly as a chronic manifestation of coronary heart disease. In 1990, 43.4% of hospitalizations with heart failure as a secondary diagnosis had a principal coding of coronary heart disease (18.3% were for acute myocardial infarction). By 1996, those proportions had changed to 46.4% (10.7% for acute myocardial infarction). This change accounts for approximately 3000 of the 6497 increase in hospitalizations with a secondary diagnosis of heart failure. A fourth possibility is that better investigation of patients with heart failure has led to more primary coding of the underlying diagnosis (e.g. coronary artery disease) with relegation of heart failure, *per se*, to a secondary position. Though also intriguing, this is perhaps unlikely given the advanced age of patients and their general admission to internal medicine wards — both factors mitigating against detailed cardiac investigation.

A further question that arises is whether or not these discharges coded in a secondary position really are cases of heart failure. The data relating to length of stay and case fatality are certainly consistent with discharges being correctly coded with a diagnosis of heart failure. The second new trend we have identified is that of increasing repeat hospitalizations. Whether we look at heart failure as the principal diagnosis at discharge, or heart failure coded in any position, the proportion of patients having multiple hospitalizations is increasing. The absolute number of hospitalizations accounted for by subsequent hospitalization in a given 12-month period increased by 53% over the period of study. By 1996 these second or subsequent hospitalizations made up almost a quarter of all heart failure-related hospitalizations.

Length of stay declined during the period of study, as it did between 1980 and 1990. Indeed, the average length of stay declined by a similar amount in the two time periods in question (by 14 days between 1980 and 1990 and by 13 days between 1990 and 1996, in patients with

a principal diagnosis of heart failure). This decline is quite impressive given that there has been a slight increase in the age of patients and that there is a strong relationship between older age and longer length of stay. Average length of stay is now similar to that in the Netherlands^[8] and New Zealand^[9] but less than that in Sweden (8.1 days in 1995)^[7] and greater than that of the U.S. (3.6–4.6 days in 1995 depending on patient insurance status)^[13]. We do not know whether increased utilization of nursing homes or specialist heart failure clinics may have facilitated earlier discharge. Whatever the explanation, the overall contribution of heart failure to total bed days in Scotland declined from 3.7% in 1990 to 3.3% in 1996. Despite this relative decline, the absolute burden in bed days remains substantial with heart failure contributing to almost 10% of internal medicine/geriatric bed days.

For those discharges coding heart failure as the principal diagnosis, inpatient case fatality rates remained static in men, in contrast to the decline between 1980 and 1990. There was a small fall in case fatality rates in women. This was much less in absolute and relative terms than that noted between 1980 and 1990. The inpatient case fatality rate in men (15.2%) and women (15.6%) with a principal diagnosis of heart failure in 1996 is similar to that reported from the Netherlands in 1993 (15.5% in men and 14.9% in women)^[8] but much higher than recently reported from the U.S.A. in 1995 (8.0% in both sexes)^[4]. Despite the falling case fatality and the slowing of the rate of increase in hospitalization rates, the number of deaths from heart failure (coded as the principal diagnosis) in 1996 (1700) was considerably higher than in 1990 (1617) and 1980 (1543).

Clearly, our most interesting and novel finding is that the much predicted 'epidemic' of heart failure^[4,15] hospitalizations seems to have peaked, at least in Scotland. No matter what measure we looked at, with the exception of hospital discharges associated with a secondary coding of heart failure, there seems to have been a decline in discharges and patients discharged since approximately 1993–1994. This initially seems surprising as improved survival following myocardial infarction and general ageing of the population has been predicted to increase the number of incident cases of heart failure^[15–17]. An increasing incidence, coupled with improving survival in patients with established heart failure, might, in turn, be expected to lead to an increased prevalence. If incidence or prevalence are increasing, they do not seem to be associated with either a rising number of 'new' (first ever) hospitalizations, or overall, hospitalizations primarily for heart failure.

However, recent data from the Framingham study suggest that the premise of increasing incidence of heart failure arising from better post-infarction survival may be false^[18]. This latest Framingham report, in fact, shows a declining incidence of late heart failure in myocardial infarction survivors in recent years^[18].

Of course, in any case, an increased incidence or prevalence need not necessarily translate into more hospitalizations, especially if effective therapies are

available to reduce admissions. Digoxin^[19], ACE inhibitors^[20] and, more recently, beta-blockers^[21] and spironolactone^[22] all do this. In the period of this survey the use of ACE inhibitors increased substantially. Better organized care with specialist nurse intervention has also become more common and may also reduce the need for hospitalization^[23].

Studies of this type necessarily have limitations. Our data are observational and it is difficult to draw firm mechanistic conclusions about the changes observed, especially given the rapid changes that have taken place in awareness, diagnostic and therapeutic strategies, therapeutic practice and, even in the approach of health care systems to the delivery of care to patients with heart failure.

In summary, this is the first and most recent report of its kind to suggest that the previously observed and predicted 'epidemic' of heart failure-related hospitalization, at least in terms of those associated with a principal diagnosis of heart failure, has plateaued since 1993. Pending more contemporary reports from both Scotland and other developed countries, we can only speculate as to the full meaning of these data. It is possible, however, that we have observed the first sign that modern-day strategies for the prevention and treatment of heart failure are beginning to limit its overall burden on the hospital sector and that heart failure hospitalization rates now seem to have started to decline after two decades of steady growth.

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