Increase in hospital admission rates for heart failure in the Netherlands, 1980–1993

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Abstract

Objective—To study the trend in hospital admission rates for heart failure in the Netherlands from 1980 to 1993.

Design—All hospital admissions in the Netherlands with a principal discharge diagnosis of heart failure were analysed. In addition, individual records of heart failure patients from a subset of seven hospitals were analysed to estimate the frequency and timing of readmissions.

Results—The total number of discharges for men increased from 7377 in 1980 to 13,022 in 1993, and for women from 7064 to 12,944. From 1980 through 1993 age adjusted discharge rates rose 48% for men and 40% for women. Age adjusted inhospital mortality for heart failure decreased from 19% in 1980 to 15% in 1993. For all age groups in-hospital mortality for men was higher than for women. The mean length of hospital admissions in 1993 was 14·0 days for men and 16·4 days for women. A review of individual patient records from a 6·3% sample of all hospital admissions in the Netherlands indicated that within a 2 year period 18% of the heart failure patients were admitted more than once and 5·5% more than twice.

Conclusions—For both men and women a pronounced increase in age adjusted discharge rates for heart failure was observed in the Netherlands from 1980 to 1993. Readmissions were a prominent feature among heart failure patients. Higher survival rates after acute myocardial infarction and the longer survival of patients with heart disease, including heart failure may have contributed to the observed increase. The importance of advances in diagnostic tools and of possible changes in admission policy remain uncertain.

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Keywords: heart failure; hospital discharges; time trends; Netherlands

Heart failure is a complex clinical syndrome representing a common and important health problem. In 1988 the direct medical costs of heart failure in the Netherlands were estimated at £182 million, corresponding to 1% of the total health care budget for that year. The prognosis of a patient with heart failure is poor. In the Framingham heart study 75% of men and 60% of women died within five years after the diagnosis of heart failure. Despite its importance, reliable estimates of the incidence and prevalence of heart failure in the general population are surprisingly scarce. This may probably be attributed to the atypical symptoms of the early stages of heart failure, the ongoing debate on the definition of heart failure, and the lack of a gold standard to assess the presence of heart failure. Hospital based registries provide some insight into the occurrence of heart failure in the population. Increases in age adjusted discharge rates for heart failure in the United States, Sweden, and Scotland have been reported in recent years. A recently developed model predicts a further increase in the number of heart failure patients in the Netherlands in the coming decades. We describe the trend in hospital admissions for heart failure in the Netherlands from 1980 to 1993. Furthermore, we assessed the frequency and timing of readmissions for heart failure during a two year period in a subset of seven hospitals.

Patients and methods

Population figures were obtained from the office of Statistics Netherlands, Voorburg, the Netherlands. The number of hospital discharges for heart failure by five year age groups were derived from the National Medical Register of SIG Health Care Information, Utrecht, the Netherlands. From 1986 onwards all hospitals (university and general) in the Netherlands participated in this register. In 1980, the starting year of our analysis, 95% of all hospital admissions in the Netherlands were recorded. Based on this coverage we used appropriate multiplying factors to estimate the yearly number of hospital discharges in the Netherlands before 1986. All records contain a principal diagnosis coded according to International Classification of Diseases Clinical Modification (9th revision), age and gender of the patient, status at discharge (dead or alive), and length of stay. We used the following codes to identify discharges for heart failure: heart failure (428.x), hypertensive heart disease (402.x), and myocardial degeneration (429-1). Only admissions with a first-listed (principal, main) discharge diagnosis of heart failure were included in this analysis. In-hospital mortality (as a percentage) was calculated by dividing the number of hospital admissions with a discharge status of dead by the total number of hospital admissions for heart failure.
**Table 1** Number of hospital discharges for heart failure, mean length of stay, and mean age at admission in the Netherlands from 1980 through 1993

<table>
<thead>
<tr>
<th>Year</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No of discharges</td>
<td>Mean length of stay (days)</td>
</tr>
<tr>
<td>1980</td>
<td>7377</td>
<td>19-1</td>
</tr>
<tr>
<td>1981</td>
<td>7626</td>
<td>18-9</td>
</tr>
<tr>
<td>1982</td>
<td>8504</td>
<td>18-4</td>
</tr>
<tr>
<td>1983</td>
<td>8917</td>
<td>17-8</td>
</tr>
<tr>
<td>1984</td>
<td>9143</td>
<td>17-1</td>
</tr>
<tr>
<td>1985</td>
<td>9927</td>
<td>16-6</td>
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<td>1986</td>
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<td>16-3</td>
</tr>
<tr>
<td>1988</td>
<td>11472</td>
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<tr>
<td>1989</td>
<td>11698</td>
<td>15-4</td>
</tr>
<tr>
<td>1990</td>
<td>12420</td>
<td>15-0</td>
</tr>
<tr>
<td>1991</td>
<td>12522</td>
<td>14-8</td>
</tr>
<tr>
<td>1992</td>
<td>12452</td>
<td>14-4</td>
</tr>
<tr>
<td>1993</td>
<td>13022</td>
<td>14-0</td>
</tr>
</tbody>
</table>

Source: SIG Health Care Information.

**Figure 1** Age adjusted discharge rates for heart failure in men (solid line) and women (broken line) in the Netherlands, 1980–1993. Source: SIG Health Care Information. The "new" European Standard Population was used as a standard.

To calculate the average age at admission we assumed that all persons were admitted at, on average, the midpoint of each five year age category. Age adjusted discharge rates were calculated by direct standardisation using the "new" European Standard Population as a standard. Tests for linear trend were performed with Poisson regression.

Furthermore, because the registry does not provide data on individual patients, we conducted a survey to obtain individual records of patients with heart failure to estimate the contribution and timing of readmissions. Seven hospitals (two university and five general) participated on a voluntary basis. This survey spanned a two year period from 1991 to 1992 and covered 6-3% of all hospital admissions for heart failure in that period. Time to readmission was analysed using Kaplan-Meier curves. Separate curves for readmission were constructed in patients with one, two, or three previous hospital admissions, respectively. End points were the dates of readmission and the starting points were the dates of discharge. Patients who died during their stay in the hospital were excluded from the subsequent readmission analysis.

**Results**

Table 1 lists the total number of discharges for heart failure, the mean length of stay, and the mean age at admission. The total number of hospital discharges for heart failure rose from 7377 in 1980 to 13022 in 1993 for men, and from 7064 to 12944 for women. The contribution of heart failure to the total number of hospital discharges in the Netherlands in 1993 was 1-7%. The International Classification of Disease code 428 (heart failure) was by far the most common (98-8% in 1993) of the codes we combined for this study. The average age at admission increased slightly during the study-period (table 1). On average women were 4-5 years older than men. There was a marked and steady increase in the age adjusted discharge rates for both men and women (fig 1). From 1980 to 1993 the age adjusted discharge rates for heart failure increased by 48% in men and by 40% in women. Analysis of age specific discharge rates showed that the rise in the number of discharges was more pronounced in the older age groups (figs 2 and 3). The test of trend was significant (P < 0.05) in all age groups. In each age group the risk of hospital admission was higher for men than for women.

In 1993 the average length of hospital admission for patients with heart failure was
The length of hospital stay declined steadily from 21·6 days in 1980 to 15·2 days in 1993. Slightly longer hospital admission times were observed with increasing age (table 2). In all age groups women stayed longer in the hospital than men, on average 1·6 days. During the study period the difference in length of stay between men and women decreased.

15·3% of all patients with a principal discharge diagnosis of heart failure in 1993 died in the hospital. In-hospital mortality was strongly age related. After stratification for age, in-hospital mortality for men was higher than for women in all age groups (fig 4). During the study period age adjusted in-hospital mortality decreased from 19·9% in 1980 to 15·5% in 1993 in men, and from 17·8% to 14·9% in women.

The survey conducted in seven hospitals for the years 1991 and 1992 yielded 3090 admissions with a first-listed discharge diagnosis of heart failure in 2440 patients. This corresponds to a 6·3% sample of all hospital admissions for heart failure in the Netherlands in that period. The inclusion of hospital admissions with a discharge diagnosis of heart failure in any position would have increased the number by 86% from 3090 to 5740. Within the two year period 18% of the patients were admitted more than once, and 5% more than twice. The percentage of patients readmitted for heart failure within six months after their first discharge was 14% (95% CI 13% to 16%). Of all patients discharged (alive) after their second hospital admissions 26% (95% CI 21% to 30%) and of all patients discharged after their third hospital admissions 34% (95% CI 25% to 43%) were readmitted within six months (fig 5).

Discussion
This study shows a pronounced increase in age adjusted discharge rates for heart failure for both men and women in the Netherlands during the past 14 years. Similar increases have been reported in the United States of America, Sweden, and Scotland. Compared with Scotland there was a difference in the absolute rate (1990: 212/100 000 in Scotland versus 160/100 000 in the Netherlands), but time trends were very similar. From 1980 to 1990 the crude discharge rate in Scotland increased 63%, compared with 57% in the Netherlands. Explanations for the discrepancy in absolute rate could be differences in the age structure of the two countries, differences in admission policy, differences in the place of heart failure among the list of discharge diagnoses, and a true difference in prevalence of heart failure between the two countries.

We will discuss three possible explanations for the rise in age adjusted discharge rates for heart failure. These are an increase in the incidence of heart failure, the longer survival of heart failure patients, and changes in admission policy and coding practice.

INCREASE IN INCIDENCE OF HEART FAILURE?
Hospital statistics cannot be used as a measure of incidence of heart failure per se, although an increase in incidence of heart failure in the general population should eventually be reflected in higher hospital admissions rates. For an estimate of the prevalence and incidence of heart failure in the general population other types of studies are needed.

The two main causes of heart failure in the western world are coronary heart disease and hypertension. Mortality from coronary heart disease in the Netherlands started to decline in the early seventies and continued to do so, as in many other Western countries. It is believed that this decline is caused by a decrease in incidence as well as by improved survival of patients with coronary heart disease. Data from the Framingham study suggest that one third of the decline in coronary heart mortality was caused by a decline in inci-
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The number of hospital admissions for heart failure in the Netherlands increased by 48% for men and by 40% for women in the period 1980 to 1993. Readmissions within a short period of time are a typical feature of heart failure patients.

In view of the expected rise in the number of persons above the age of 65 years and the progress in medical care a further increase in heart failure prevalence and readmissions for heart failure is likely. More efforts are needed to prevent and delay the development of heart failure in high risk patients, and more research is needed into the factors influencing the decision to (re)admit patients with heart failure to hospital.

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