ORIGINAL ARTICLE

Heart Failure: the Commonest Reason for Hospital Admission in Germany

Medical and Economic Perspectives

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SUMMARY

Background: Heart failure is now the commonest reason for hospitalization in Germany (German Federal Statistical Office, 2008). Heart failure will continue to be a central public health issue in the future as the population ages. This article focuses on regional differences, the costs of the disease, and the expected rate of increase in cases in the near future.

Methods: This analysis is based on diagnosis statistics, cause-of-death statistics, and cost of illness data, as reported by the German Federal Statistical Office. Age- and sex-specific differences are taken into account.

Results: 2006 was the first year in which heart failure led to more hospital admissions in Germany (317 000) than any other diagnosis. At present, about 141 000 persons in Germany aged 80 and over have heart failure; by the year 2050, it is predicted that more than 350 000 persons in this age group will be affected. The rate of diagnosis of heart failure, its frequency as a cause of death, and the costs associated with it all vary across the individual states of the Federal Republic of Germany. The nationwide cost of heart failure in 2006 was estimated at 2.9 billion euros.

Conclusions: These findings reveal that heart failure has become more common as an admission diagnosis of hospitalized patients in Germany. Because the population is aging, new concepts for prevention and treatment will be needed in the near future so that the affected patients can continue to receive adequate care.

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Key words: heart failure, hospitalization, health services research, regional differences, population trends

Heart failure is currently one of the most common and most cost-intensive of the chronic diseases (1). It is responsible for 1% to 2% of direct health costs in the Western industrialized nations, and for around 1.1% in Germany.

The combination of demographic developments and medical progress—leading to falling mortality rates from ischemic heart events—mean that the prevalence and incidence of heart failure will continue to increase and lead to a further rise in public health costs (2). In addition to this, the course of this disease is characterized by repeated hospital admissions at relatively short intervals and a limited prognosis for survival (3). Thus, heart failure places a heavy medical and economic burden on society. To investigate this disease more closely, and to add value by cross-linking between research and care, the German Heart Failure Competency Network (Kompetenznetz Herzinsuffizienz) was founded in 2003, funded by the Federal Ministry for Education and Research (Bundesministerium für Bildung und Forschung) (4).

The present study analyzes the development of case numbers for heart failure in relation to the period up to 2050. In addition, data from the individual federal states will be used to present information on hospital admissions and deaths and on the use of resources for heart failure in terms of care providers.

Methods

This study is based on the coding I50 "heart failure" in the ICD-10 classification. The analysis is based on data from the Federal Statistical Office (Statistisches Bundesamt) and the Federal Health Monitoring Information System (GBE, Gesundheitsberichterstattung des Bundes). The analyses relate both to the whole of Germany and to the individual federal states. All data regarding diagnoses and causes of death are given as absolute values and as adjusted for age, in order to allow comparison between different years and different regions.

Diagnostic data emanate from the diagnostic statistics of the Federal Statistical Office. These diagnostic statistics were acquired from the hospitals in response to a written survey. Case-related diagnostic statistics are obtained in an annual complete census that records an average of

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TABLE 1

Heart failure diagnoses in Germany, absolute case numbers

	2000	2001	2002	2003	2004	2005	2006
Germany							
Total	239 694	262 560	267 906	271 526	260 803	306 736	317 485
Male	101 217	112 099	115 899	120 879	119 206	141 212	147 498
Female	138 476	150 456	151 941	150 647	141 595	165 523	169 985
Old federal states							
Total	195 152	213 497	218 800	221 133	213 500	247 460	253 709
Male	82 324	91 242	94 521	98 617	98 008	113 912	118 004
Female	112 827	122 250	124 213	122 516	115 490	133 547	135 704
New federal states							
Total	44 542	49 063	49 106	50 393	47 303	59 276	63 776
Male	18 893	20 857	21 378	22 262	21 198	27 300	29 494
Female	25 649	28 206	27 728	28 131	26 105	31 976	34 281

Source: GBE (figures for 2007 for the whole of Germany are given in the text)

17 million hospital admissions (5). Data for the period 2000 to 2007 were included in the study. The coding of diagnoses for inpatient treatment followed the ICD-10-GM system. Records predating the year 2000 were not included, as the ICD-9 classification was still in use up until the end of 1999.

Information about heart failure as cause of death is based on the official statistics on causes of death from the Federal Statistical Office. The data in this annual complete census are acquired from death certificates and statistical bulletins of mortality. Secondary statistics are based on analysis of the data provided by physicians following the ICD system. Since 1998 causes of death have been coded using the German-language WHO edition of ICD-10 (6).

As a basis for representation of costs we used the Health Care Cost Calculation (Krankheitskostenrechnung) from the Federal Statistical Office (7). The Health Care Cost Calculation is a secondary statistical product and is published every 2 years. It takes the national spending figures from the Health Expenditure Calculation according to treatment facility and type of care, and reassigns them under individual disease headings, groups, and categories. International data were taken from a selective literature search covering the period 1980 to 2008.

Results

The results of the analysis relating to diagnoses, mortality, and costs are given below. Results for diagnoses and mortality relate to comparisons between groups matched for sex and age, and to differences between the various federal states.

Heart failure as a primary diagnosis

The rise in heart failure as a primary diagnosis in hospital admissions is shown in *table 1*. In 2002 heart failure (I50) for the first time reached third ranking in absolute

numbers as the primary diagnosis in hospitals, after chronic ischemic heart disease (I25) and mental and behavioral disorders due to use of alcohol (F10). Only 4 years later, in 2006, at 317 000 primary diagnoses, heart failure had become the most common reason for hospital admission in Germany (healthy newborns [Z38] are not included in the ranking). In 2007 hospital admissions for heart failure rose by a further 5.6% to 335 000 cases. This was the first year that heart failure took first place among women, with 178 298 hospitalizations. Among men, heart failure (156 893 cases) is in third place after mental and behavioral disorders due to use of alcohol (F10) and angina pectoris (I20).

Age-adjusted and age-specific data on the number of cases from 2000 to 2006 are given in *figure 1*. These show that from the age of 65 years the age-specific incidence of cases per 100 000 head of population is ten times that in the preceding age group of 45- to 64-year-olds.

From a certain age onward, heart failure as a single diagnosis is more frequently encountered than diagnostic groups (the so-called blocks of the ICD classification). This means, for example, that in persons aged over 50, heart failure case numbers exceed those for the category "cerebrovascular diseases" (I60–I69), and in persons aged over 60 they exceed those for the group "endocrine, nutritional and metabolic diseases" (E00–E90). From the age of 65, heart failure is diagnosed more frequently than diseases of the nervous system (G00–G99). In the over-80 age group, heart failure is a more frequent diagnosis than ischemic heart disease (I20–I25). From the age of 85 years onwards it is more frequent than malignant neoplasms (C00–C97) or the entire group of neoplasms (C00–D48).

Comparison between federal states shows differences in case numbers (*figure 2*). Age-adjusted case numbers are below the federal average in five states: the northern regions Schleswig-Holstein, Hamburg and Bremen, and

FIGURE 1

Age-specific numbers of cases per 100 000 population 2000 to 2006

	2000	2001	2002	2003	2004	2005	2006
< 15 years	2	3	3	2	2	2	2
15 to < 45 years	7	7	8	8	8	9	10
45 to < 65 years	127	137	138	139	133	156	158
65 years and older	1550	1657	1648	1626	1514	1725	1738

Heart failure as primary diagnosis in German hospitals, 2000–2006 (age-adjusted number of cases per 100 000 head of population)

TABLE 2

Medical costs of heart failure (€ millions), Germany, 2006

	Total	Male	Female
All facilities	2879	1169	1710
Health protection	3	1	2
Outpatient facilities	784	301	483
– Physician's practices	162	65	97
– Other medical practices	29	9	20
– Pharmacies	287	120	167
– Medical product suppliers/retailers	59	25	34
– Outpatient departments	239	79	160
– Other outpatient care facilities	7	3	4
Inpatient/day-patient facilities	1721	724	997
– Hospitals	1304	633	670
– Prevention/rehabilitation facilities	11	6	5
– Inpatient/day-patient care	407	84	323
Emergency services	57	27	31
Administration	147	59	88
Other facilities and private households	164	57	108
Abroad	2	1	2

Source: GBE

FIGURE 2

Number of cases per 100 000 population

Heart failure as primary diagnosis in German hospitals, 2006 (age-adjusted number of cases per 100 000 head of population): whole of Germany and individual German states

the more southerly Baden-Württemberg and Lower Saxony. Particularly notable is the number of cases in Bremen, which is 30% below the federal value. In contrast to this, the values for 10 states are higher than the federal average, with Brandenburg in the lead with +29% followed by Mecklenburg-Vorpommern (+28%). In the new (post-1989) states, the age-adjusted figure is 368 cases per 100 000 population; in the old states the figure is 296 per 100 000.

Heart failure as cause of death

From 1998 to 2007, heart failure (I50) was in absolute numbers consistently the third most frequent cause of death in Germany after chronic ischemic heart disease (I25) and acute myocardial infarction (I21). Differences are, however, seen between the sexes: In women heart failure (I50) is in second place behind chronic ischemic heart disease (I25), whereas, in men, since 1999 heart failure (I50) as cause of death has been in fourth place behind chronic ischemic heart disease (I25), acute myocardial infarction (I21), and malignant neoplasm of bronchus and lung (C34).

In 6 states the age-adjusted mortality figure is above the federal average, with Bremen showing a value 22% above the average (figure 3). Ten states have mortality figures below the federal average, with Saarland in the lead with a 49% reduction. Comparison between the old and the new states shows that the mortality in the new states is lower, at 34.5 deaths per 100 000 population, than that in the old states (41.3 per 100 000).

Costs

In 2006, the diagnosis of heart failure led to a cost to the German public health system of 2.9 billion euros. Direct medical costs—that is, costs directly related to medical treatment—are shown in table 2. Inpatient hospital care accounted for a significant part of these costs: inpatient and day-patient facilities were responsible for 1.7 billion euros of the total—that is, 60% of treatment costs for heart failure in Germany. The largest part of this (1.3 billion euros, 45% of total costs) related to hospital stays, followed by care homes (407 million euros). Rehabilitation centers accounted for a small share of the costs (11 million euros).

In the Western industrialized nations, inpatient hospitalization costs account for 50% to 70% of the health costs of patients with heart failure (8–10). Rehospitalization costs vary more widely, but at 17% to 41% are still high (10, 11). Taken all round, it may be said that in this care sector (i.e. in-hospital care) the costs, like the NYHA stage, go up with the severity of the disease (12) (NYHA, New York Heart Association).

In Germany in 2006, 27% (784 million euros) of health care costs for heart failure related to outpatient treatment. Visits to physician's practices accounted for 21% (162 million euros, 6% of total costs).

Outpatient costs also rise with the severity of the disease, but as a percentage of total costs they become smaller as the disease progresses. This means that for patients with advanced-stage disease, other costs (e.g., hospitalization) are more to the fore (11, 12).

FIGURE 3

Mortality from heart failure, 2007 (age-adjusted deaths per 100 000 population)

In the international comparison, the outpatient care sector accounts for 30% to 35% of total costs (8, 10). Visits to physicians make up 6% to 8% of total costs, medication costs 11% to 18%, and the costs of outpatient care 8% to 9% (8–10).

Discussion

This study used data from the German Federal Statistical Office to investigate the current status of and regional differences in heart failure as a diagnosis and as a cause of death, in relation to both sex and age. In addition, the associated economic burden was examined by looking at the costs to the German public health care system.

The analyses for the whole of Germany confirm the age dependency of heart failure. From the age of 60 onwards, heart failure is continually on the rise as the primary diagnosis on admission to German hospitals. The international comparison shows a similar age-dependent increase in this disease (13, 14).

At the level of the individual federal state, however, despite adjustment for age, considerable differences in case numbers are seen. These differences permit various inferences to be made, but none of these can be justified conclusively on the basis of the present data. In particular, differences in medical care, the ways in which diagnoses are made, and documentation at state level could all be contributing to these differences. How far any of these apply must be examined by further studies. In the comparison between the new and the old federal states, too, what underlies the differences is an open question. The

higher case numbers in the new states are notable; this difference has existed to a greater or lesser extent for years, and is also visible in age-adjusted analyses.

Looking at the cause-of-death statistics, the differences between the sexes are particularly worth emphasizing. In the federal states comparison, death figures show more women than men dying of heart failure. In Germany as a whole, heart failure takes second place among women, while among men it is currently in fourth place, although with an upward trend. Since women often live longer than men, it makes sense that in absolute numbers more women than men suffer and die from heart failure at an advanced age (15).

In the international comparison, deaths caused by heart failure make up a higher proportion of all deaths in Germany than the other Western industrialized countries (16). It is therefore incumbent upon us both to seek the cause of this increased mortality and to look for ways of optimizing diagnosis and treatment.

Possible approaches to this are suggested by the results of the SHAPE study (17). This study reported that only a small section of the European population is able to describe the typical symptoms of heart failure. This often goes along with inadequate diagnosis and medical treatment. This is why the authors of the SHAPE study call for better public education together with treatment by physicians that accords with the guidelines.

For example, a whole series of available licensed drugs—including beta blockers and renin-angiotensin-

aldosterone system inhibitors—can reduce symptoms and increase the quality of life of persons with heart failure. This results in a high medical benefit (1). These drugs should therefore be used in accordance with the guidelines. Medical considerations aside, however, health economics ought to play an increasing role in the diagnosis and treatment of all cardiovascular diseases including heart failure. Cost-intensive therapeutic procedures in particular may be expected to come under closer scrutiny from the health economic point of view within the foreseeable future.

As regards the increasing national economic burden due to heart failure in the future, it is important to take account of the age- and sex-specific and regional differences in Germany (15). These data provide a basis not only for calculating future costs, but also for developing the principles on which preventive programs and optimization of care can be planned.

According to information from the Federal Statistical Office, in the future there will be more and more older people, while at the same time the absolute size of the population will become smaller, owing to lower birth rates. The life expectancy of a 65-year-old will go up by about 4.5 years by 2050. In 2050 there will be twice as many 60-year-olds as newborns. As little as 2 years ago, these two age groups were roughly similar in size. At present in Germany, there are about 4 million people aged 80 and over; by 2050 that number will have gone up to 10 million (15). Since heart disease is a disease of age, and is most common in those aged 65 and over, with the population shift described, more and more people are going to be affected by it in future. Today 141 000 80-year-olds and over have heart failure; by 2050 this figure is expected to more than double to an estimated 353 000.

Leaving aside the demographic shift, changes in the frequency of hospitalizations are also due to medical progress. Levy et al. (18) have shown that the use of beta blockers and ACE inhibitors in persons with heart failure results in higher survival rates than symptomatic treatment that does not reduce mortality. This prolongation of the survival of patients with chronic heart failure contributes to the rise in prevalence, and in some cases also to increased hospital admissions.

Limitations of this study relate to the quality of the underlying data. Most of the figures derive from the Federal Statistical Office and are thus based on the official figures from the annual complete census. Limitations in respect of secondary data sources relate mainly to the coding of the diagnoses. Diagnoses are coded in hospitals, and mistakes can occur.

As to cause-of-death statistics, inaccuracies can be introduced during the subjective evaluation of causes of death in the state statistical offices, among other things. How great these inaccuracies might be is impossible to quantify, however.

It should also be pointed out that hospital statistics are based on case-related data, whereas cause-of-death statistics are based on person-related data. Thus, the two sets of data are not directly comparable. Even direct

conclusions about disease prevalence are invalid, since hospital records may include more than one hospital admission for a single person. It is due to the nature of the underlying data that the results of this study are descriptive only, and can offer no explanation for the differences reported here.

Conclusions

Since 2006, heart failure has been the most common primary diagnosis for hospital admission in Germany. The results presented here document the importance of heart failure in the figures for inpatient hospitalization and the costs to the public health system. They also give evidence of regional differences within Germany, and give an indication of the expected continued increase in heart failure in the near future.

The data presented here are important for the planning of research, prevention, and treatment programs, in order to ensure and improve adequate care for patients with heart failure into the future.

Key messages

- Heart failure is presently the most frequent reason for inpatient hospital admission in Germany.
- In the near future, the aging of society as a whole is going to lead to increased numbers of cases, and the diagnosis of heart failure is going to become increasingly significant in terms of the medical care of the population.
- Treatment in accordance with guidelines leads to a reduction in the high mortality rate in this group of patients.
- The direct hospital costs of heart failure (2.9 billion euros in Germany in 2006) mainly relate to the costs of inpatient hospital stays.
- In the face of these rising numbers of cases, strategies for prevention and care are needed in order ensure continuing adequacy of care of patients with heart failure.

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Conflict of interest statement

The authors declare that no conflict of interest exists according to the guidelines of the International Committee of Medical Journal Editors.

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