Population Impact of Heart Failure and the Most Common Forms of Cancer
A Study of 1,162,309 Hospital Cases in Sweden (1988 to 2004)

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Background—The contemporary impact of heart failure (HF) versus the most common forms of cancer as reflected by related first-ever hospitalizations and subsequent case-fatality rates is unknown.

Methods and Results—Using a national registry in Sweden, we compared the rate of first-ever hospitalization and associated short- and long-term survival for HF, acute myocardial infarction (AMI), and the most common forms of cancer on an age and sex-specific basis during 1988 to 2004 in 949,733 Swedish patients (1,162,309 hospital admissions in total). Annual incidence of first-ever hospitalization for HF, AMI, and cancer in Sweden were 484, 424, and 373 (lung, colorectal, prostate, and bladder cancer combined) per 100,000 men and 470, 280, and 350 (lung, colorectal, bladder, breast, and ovarian cancer combined) per 100,000 women age >20 years. The ratio of individual cases of HF to cancer was 1.37:1 (465,998 versus 340,738). Despite improvements in 30-day and 5-year survival (adjusted 7% and 6% increase per calendar year for men and women, respectively), HF was associated with an unadjusted case-fatality rate of 59% within 5 years and 196,400 deaths versus 58% and 131,000 deaths in patients with cancer. During 10-year follow-up, HF was associated with 66,318 versus 55,364 premature life-years lost than all common forms of cancer in men. In women, the equivalent figures were 59,535 versus 64,533 premature life-years lost.

Conclusions—These data confirm that, like most common forms of cancer combined, HF exerts a major health burden in respect to age-adjusted rates of first hospitalization, poor overall survival, and premature life-years lost. (Circ Cardiovasc Qual Outcomes. 2010;3:573-580.)

Key Words: heart failure ■ malignancy ■ prognosis ■ population-based

Cardiovascular disease (CVD) states and its major component, heart disease, continue to be the leading cause of death globally accounting for around one third of all deaths in 2004.1 In comparison, malignancies affecting the respiratory and gastrointestinal systems plus breast cancer in women accounted for just over 1 in 10 deaths combined.1 Although the overall global burden of CVD may not change substantially, the contribution of acute coronary events (with age-adjusted declines in case-fatality rates)2 versus chronic forms of heart disease will undoubtedly change. A key marker of that evolving burden has been the rate of hospitalization and subsequent survival associated with the syndrome of heart failure (HF); despite encouraging trends,3-5 this deadly and disabling syndrome will continue to have a profound impact within the ageing populations of high-income countries.6 This is particularly true when considering improved survival rates associated with its major precursor acute myocardial infarction (AMI).5,6 Any direct comparison of malignant versus nonmalignant conditions (given the variance in natural history) is difficult to justify except, perhaps, when attempting to provide some perspective as to their relative impact, particularly when considering the prominence of cancer as a major health issue. Whether the impact of HF is truly appreciated (in respect to public awareness and health care funding) when compared with the common malignancies is debatable.

One of the major determinants of public perception pertaining to any disease state is the age of those affected. For example, in 1997, far more women in the United States died of heart disease than any form of cancer (370,357 versus 258,467 deaths) overall.7 However, in those age <55 years (where death is relatively uncommon), deaths attributable to breast cancer were far more common, and this undoubtedly influences popular perceptions of the same.7 A study of HF versus cancer-related survival in Scotland during the early 1990s8 provided strong evidence that HF, in many ways, is as
“malignant” as common forms of cancer on an age-adjusted basis. Given contemporary changes in HF and cancer-related survival, it is unknown whether this is still the case. We aimed to provide a more contemporary and comprehensive comparison of the rate and consequences of a first-ever hospitalization for HF and the most common forms of cancer (acknowledging that these represent only half of all such cases) in Sweden over a prolonged period.

### WHAT IS KNOWN
- Heart failure is a common cause of hospitalization; particularly in those age $>$65 years.
- The prognosis associated with heart failure is comparable to common forms of cancer.

### WHAT THE STUDY ADDS
- A whole population comparison of the burden of heart failure versus common forms of cancer.
- “Like-for-like comparisons” of trends in first-ever hospital admissions and subsequent mortality associated with heart failure, acute myocardial infarction, and common forms of cancer.
- The decade-long impact of heart failure versus common forms of cancer in respect to premature life-years lost and quality-adjusted life-years lost.

### Methods

#### Study Setting
Sweden has a universal health care system that provides low-cost health care to the Swedish population (range, 8.6 to 9.1 million people during 1988 to 2005). By law, every Swedish resident is entitled to high-quality health services and medical care, with priority given to emergency cases. Some health care facilities are privately run but remain government-subsidized and fully integrated into the health care system.

#### Study Data
A Swedish hospital discharge register has been in operation since the 1960s and has provided national data since 1987.\(^1\)\(^2\)\(^3\) Registration of principal and contributory discharge diagnoses for all patients in the register is mandatory. Diagnosis at discharge is coded with the International Classification of Diseases (ICD) system (ICD 9th revision until December 1996, ICD 10th revision thereafter). Each patient is given a principal diagnosis and up to 5 secondary diagnoses.

In the period 1987 to 1996, a primary discharge diagnosis was lacking in $<$1% of all admissions to Swedish departments of internal medicine, including cardiology. HF and AMI diagnoses in Sweden, according to the hospital discharge register, have been validated. HF, as the principal diagnosis (the coding used in this study), was shown to have a diagnostic accuracy of 95%, whereas HF in any position had a validity of 82%.\(^1\)\(^1\) Similarly, validation of coronary heart disease discharge diagnoses in Sweden demonstrated high sensitivity (94%) and a high positive predictive value (86%) regarding definite AMI.\(^1\)\(^2\)

Data from the national hospital discharge and cause-specific death registers were linked through the personal identity number, which is unique for all Swedish citizens (for confidentiality, personal identity numbers were replaced by codes). Hospital discharge data, for the entire study period, were available from 19 of 24 Swedish counties (including the 3 major cities of Stockholm, Göteborg, and Malmö and approximately 80 hospitals) and comprising just over 86% (7.29 to 7.85 million people) of the Swedish population during the period 1988 to 2005, respectively. Swedish nonresidents were therefore not included in any analyses; events occurring outside of Sweden in Swedish residents were not captured.

#### Study Cohort
We included all male and female patients age $>$20 years discharged from hospitals within the target population area with a first-time discharge diagnosis of HF, AMI, and the most common forms of cancer specific to men and women during the period 1988 to 2004. The latter were defined as any form of cancer involving $>$10,000 cases in this period, with a total of 6 forms of cancer identified (see list below). If a patient was admitted (as opposed to being treated solely within an emergency department) to a hospital during the period 1980 to 1987 with 1 of the target diagnoses, the patient was not allowed to contribute with the same diagnosis in the study. In practice, this means that in this report, the number of individual patients affected by HF is the same as the number of hospital admissions, but there is a degree of overlap in relation to HF and AMI (eg, 39.1% of patients with HF had a preceding admission of AMI) and specific forms of cancer (data available on request).

All admissions associated with a primary diagnosis (recorded in the first position for coding purposes) of the following were identified: heart failure (ICD9 428A; chronic congestive heart failure, right heart failure 428B, left heart failure, and 428X, nonspecific heart failure; ICD10 I50); acute myocardial infarction (ICD9 410; ICD 10 I21); and cancer, in which the primary tumor was situated in the lung (ICD9 162; ICD10 C34), colon or rectum (ICD9 153 to 154; ICD10 C18–20), breast (ICD9 174; ICD10 C50), prostate (ICD9 185; ICD10 C51), bladder (ICD9 188; ICD10 C67), or ovary (ICD9 183; ICD10 C56).

#### Ethics
The study complies with the Declaration of Helsinki, and the protocol was approved by the Ethics board of the University of Gothenburg, in addition to the regional ethics board.

#### Statistical Analyses
All totals and rates are person-based and calculated for men and women separately and performed by Dr Odén (more extensive details are available on request). The relative burden imposed by HF, AMI, and common forms of cancers was examined from a number of perspectives: total number of incident hospitalizations (examined in all I 162 309 cases admitted during 1988 to 2004); age-adjusted rate of “incident” hospitalization per 100 000 (population) at risk for each calendar year (1988 to 2004 cohort); short-term (30-day) survival (1988 to 2004 cohorts); total number and proportion of case-fatalities within 5 years (examined in the 770 485 patients hospitalized during 1988 to 1999); and premature life-years lost and quality-adjusted life-years lost over 10 years in those hospitalized during the calendar year 1995.

Study follow-up data were censored on December 31, 2004 (recognizing a slight short-fall for the final month of 2004). Data from specific age cohorts (ie, those age 60, 70, and 80 years at the time of hospitalization) are presented to highlight age-specific differences in presentation and survival. The risk of disease and the risk of dying were estimated by use of Poisson regression models for men and women separately. Time since admittance to hospital, current age (updated age), and updated calendar time were included in the models for death. Spline functions of time since hospitalization were used in the models, which meant that the estimated hazard functions were continuous and smooth functions of the time with a great freedom. For each of the variables, calendar time and age-piecewise linear functions with 1 break point were used. The break point for calendar time was 1995 and for age, 75 years. Spline functions of calendar time were used to estimate the risk of disease. Logistic regression models were used to estimate 30-day and 5-year survival relative to the first year of available survival data (1988 and 1993, respectively) for each diagnosis.
A complete decade of follow-up data were available for the 1995 cohort to calculate the overall number of related deaths, premature life-years lost, and quality-adjusted life-years lost (QALY).

Age- and sex-dependent QALY values are available in 5-year intervals: QALY values equal 1 per year for ages up to 50 years and then successively decline with age to 0.76 and 0.67 QALY per year for 85-year-old men and women, respectively. The economical value of a QALY in Sweden is often calculated as 450,000 Swedish Krona (SEK) in Sweden and was applied accordingly (with an interest rate of 3.5% per annum) to derive a monetary value of premature loss of life.

A total of 212,756 patients recorded hospitalizations with 2 of the target diagnoses (and therefore contribute to the hazard functions), more than half of which related to patients who were admitted with an AMI first and HF second (39.1%) and those with HF first and an AMI second (28.7%) (full data available on request). Data relating to AMI, therefore, are presented as a reference to HF and the most common forms of cancer only.

Results

Study Cohort

A total of 1,162,309 hospital admissions (involving 949,733 individual male and female patients) with a first diagnosis of HF, AMI, or common forms of cancer were identified during 1988 to 2004. The distribution of cases according to the primary diagnosis and broad demographic profile of patients is presented in Figure 1. During this period, more men were admitted for an AMI, lung cancer, and bladder cancer. In women, the ratio of cases associated with HF relative to breast cancer was approximately 3:1, the latter cases being, on average, 17 years younger (well below average life expectancy). Overall, the ratio of male and female patients admitted for HF (465,998 individual cases) compared with patients with common forms of cancer (colorectal, lung, prostate, breast, bladder, and ovarian) was 1.37: 1 (465,998 versus 353,566 individual patients, respectively) during the period 1998 to 2004.

Rate of Incident Hospital Admissions (1988 to 2004)

During 1988 to 2004, the annual incidence of first-ever admissions for HF, AMI, and the most common forms of cancer in Sweden were 484, 424, and 373 (lung, colorectal, prostate, and bladder cancer combined) per 100,000 men and 470, 280, and 350 (lung, colorectal, bladder, breast, and ovarian cancer combined) per 100,000 women age >20 years.

Figure 2 compares the rates of these incident admissions in 70-year-old Swedish men and women (ie, in those whom any death within 5 years would be premature). The rate of HF admissions in both sexes at this age initially rose between 1988 to 1994 (peak rate of around 1100 and 650 admissions per 100,000 per annum) before declining below 1988 levels by 2004 (lowest rate of approximately 700 and 450 admissions per 100,000 per annum). In men, the most striking of other observed trends were an overall decline in AMI admissions (peak of 1200 and low of approximately 900 admissions per 100,000 per annum), punctuated by a small rise in cases between 2000 to 2002 (after new criteria for the definition of AMI were adopted) and a rise in admissions for cancer of the prostate between 1998 and 2004 (peak of just under 650 admissions per 100,000 per annum). In women, rates of AMI varied less and showed a slight increase after 2000 to 2002. Although there was a small decline in the rate of ovarian cancer, rates of hospitalizations related to lung and breast cancer increased slightly.

Trends in Short-Term (30-Day) and Long-Term (5-Year) Survival

Table 1 shows the probability of death within 30 days and 5 years for men and women age 60 years and 80 years, respectively, and changes in the age-adjusted odds of surviving these 5 years per calendar year of admission over the period 1988 to 2004 and 1988 to 1999, respectively, for men and women of all ages.

In men, there were short-term survival gains across all age groups for those with HF and AMI. For example, in men, survival in HF at 30 days improved by 3% per calendar year...
(see Table 1). More modest gains were observed in relation to the different forms of cancer. On an adjusted basis (all age groups), each calendar year was associated with a significant increase in survival in most diagnostic categories, the exception being prostate cancer, where short-term survival declined. A similar pattern was seen in women with gains of 3% and 6% in 30-day survival associated with HF and AMI, respectively, and 6% for both in 1-year survival but more modest gains for the different forms of cancer.

During the period 1988 to 1999, lung cancer was associated with the worst unadjusted 5-year mortality (83% case-fatality rate associated with approximately 30 000 deaths). At the other end of the spectrum, breast cancer was associated with a 23% case-fatality rate (14 800 related deaths) within 5 years. Overall, HF was associated with an unadjusted case-fatality rate of 59% within 5 years (196 400 related deaths) versus all cases of cancer that were associated with an unadjusted case-fatality rate of 58% (130 500 deaths). On an adjusted basis, there were incremental improvements in the odds of 5-year survival (all ages) associated with a diagnosis of HF (7% per annum), AMI (6% per year), and colorectal cancer (3% per year). In women, there were survival gains associated with HF (6% per year), AMI (6% per year), colorectal cancer (3% per year), and breast cancer (4% per year) (see Table 1).

Figure 3 shows the proportion of survivors (up to 5 years) calculated from continuous hazard functions depending on current age, time since admission, and calendar time (1988 and 1999) on an age-specific basis. In 70-year-old men admitted with HF, the greatest gains in survival occurred early (ie, within 6 months), with slight improvements in the survival profile thereafter. This contrasts to that of colorectal cancer, in which there was a smaller but more constant widening in the survival curves over time. In 70-year-old women, there was a similar pattern in improvements in the survival curves for those admitted with HF (early rather than late). In contrast, observed improvements in survival for those with breast cancer occurred steadily from 6 to 12 months onward, with a gradual widening of the 2 survival curves for 1988 and 1999.

Table 2 shows the estimated change (%) per calendar year of the hazard function of death at the mid points of short (15 days) and longer-term (2.5 years) survival in men and women in the corresponding years of 1992 and 2000. They show there were greater reductions in the death hazard in HF cases

### Table 1. Age-Specific Probability of 30-Day and 5-Year Case-Fatality Rates in 1999 Plus Adjusted Change (per Calendar Year in All Ages) in Survival During 1988 to 2004 (30 Days) and 1988 to 1999 (5 Years)

<table>
<thead>
<tr>
<th>Diagnosis (Index Admission)</th>
<th>Probability of Case Fatality, %</th>
<th>Adjusted OR (95% CI) in Survival per Calendar Year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>60 Years Old</td>
<td>80 Years Old</td>
</tr>
<tr>
<td>Men</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heart failure, 30 d</td>
<td>6.2</td>
<td>12.6</td>
</tr>
<tr>
<td>Heart failure, 5 y</td>
<td>30.2</td>
<td>60.5</td>
</tr>
<tr>
<td>AMI, 30 d</td>
<td>6.8</td>
<td>18.5</td>
</tr>
<tr>
<td>AMI, 5 y</td>
<td>15.7</td>
<td>58.5</td>
</tr>
<tr>
<td>Lung cancer, 30 d</td>
<td>14.9</td>
<td>29.2</td>
</tr>
<tr>
<td>Lung cancer, 5 y</td>
<td>82.2</td>
<td>90.7</td>
</tr>
<tr>
<td>Colorectal cancer, 30 d</td>
<td>3.2</td>
<td>8.7</td>
</tr>
<tr>
<td>Colorectal cancer, 5 y</td>
<td>43.3</td>
<td>62.1</td>
</tr>
<tr>
<td>Prostate cancer, 30 d</td>
<td>1.1</td>
<td>6.7</td>
</tr>
<tr>
<td>Prostate cancer, 5 y</td>
<td>29.3</td>
<td>64.2</td>
</tr>
<tr>
<td>Bladder cancer, 30 d</td>
<td>0.7</td>
<td>3.6</td>
</tr>
<tr>
<td>Bladder cancer, 5 y</td>
<td>21.3</td>
<td>56.5</td>
</tr>
<tr>
<td>Women</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heart failure, 30 d</td>
<td>5.7</td>
<td>10.4</td>
</tr>
<tr>
<td>Heart failure, 5 y</td>
<td>24.5</td>
<td>52.4</td>
</tr>
<tr>
<td>AMI, 30 d</td>
<td>8.1</td>
<td>17.6</td>
</tr>
<tr>
<td>AMI, 5 y</td>
<td>15.7</td>
<td>55.6</td>
</tr>
<tr>
<td>Lung cancer, 30 d</td>
<td>12.9</td>
<td>22.6</td>
</tr>
<tr>
<td>Lung cancer, 5 y</td>
<td>79.7</td>
<td>86.3</td>
</tr>
<tr>
<td>Colorectal cancer, 30 d</td>
<td>2.0</td>
<td>6.8</td>
</tr>
<tr>
<td>Colorectal cancer, 5 y</td>
<td>38.9</td>
<td>56.9</td>
</tr>
<tr>
<td>Breast cancer, 30 d</td>
<td>0.6</td>
<td>2.6</td>
</tr>
<tr>
<td>Breast cancer, 5 y</td>
<td>17.4</td>
<td>36.1</td>
</tr>
<tr>
<td>Bladder cancer, 30 d</td>
<td>1.0</td>
<td>4.7</td>
</tr>
<tr>
<td>Bladder cancer, 5 y</td>
<td>21.7</td>
<td>55.2</td>
</tr>
</tbody>
</table>
in the 1992 versus 2000 cohort and that after 2.5 years of follow-up, any hazard reduction was greater than that seen after 15 days. These data suggest that observed trends (ie, progressively more favorable survival) were probably not attributable to inherently lower-risk patients being hospitalized in more recent years (ie, due to lower admission thresholds and early detection). A similar phenomenon was seen in cases of breast cancer.

Life Expectancy and QALYs (1995 Cohort)
Table 3 shows the survival profile of the 1995 cohort of 61 451 individual patients (total of 66 403 admissions) according to their primary diagnosis on the basis of the actual versus expected (age-adjusted relative to the whole population up to the age of 105 years) life expectancy and its impact on QALY. In men, HF was associated with the greatest number of life-years and QALY lost (66 318 and 36 592 years, respectively). This loss was greater than that seen in patients initially admitted with cancer of the prostate, colon and rectum, lung, and bladder combined (corresponding figure, 55 364 life-years). In women, fewer life-years and QALY associated with HF were lost as compared with men (59 535 and 30 644 years, respectively) and, less than that observed for the common cancers combined (64 533 life-years). In economic terms, the premature death seen in patients of both sexes admitted for HF in 1995 was estimated to be SEK 30.2 billion, more than that associated with the different forms of cancer combined (SEK, 29.6 billion). Overall, total premature mortality (as assessed in life-years lost) seen in both sexes was 125 853 versus 119 897 years for HF and the most common cancers combined, respectively.

Discussion
These long-term data quantify an important component of the individual and societal impact of HF (and its common precursor, AMI) relative to the most common forms of cancer in Sweden. Although confirming previously observed declines in the age-adjusted incidence of HF-related hospitalizations in Sweden and other northern-European populations and improved survival rates, these data reconfirm the potential burden imposed by HF at the whole population level. Compared with the most common forms of cancer (representing 50% of all cancers), HF was associated with approximately 1.4 times the number of first-ever hospitalizations in mainly older individuals during 1988 to 2004. In those subject to 5-year follow-up (1988 to 1999 cohort), HF was associated with approximately 70 000 more deaths (approximately 200 000 versus 131 000 deaths). In contrast to the impression given by clinical trials predominantly focusing on men with left ventricular systolic dysfunction linked to coronary artery disease, as opposed to the equally common form of HF associated with preserved systolic function typically found in hypertensive men and women, there were more female HF cases overall (51%). Although HF affects

Figure 3. Adjusted 5-year survival curves associated with a first-time diagnosis of HF and common forms of cancer in Sweden (1988 versus 1999 cohorts). Ca indicates cancer.
Table 2. Estimated Changes for Men and Women per 1 Calendar Year of the Hazard Function of Death (95% Confidence Intervals)

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>15-Day Case-Fatality Rate</th>
<th>2.5-Year Case-Fatality Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Men</td>
<td>Women</td>
</tr>
<tr>
<td>HF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1992</td>
<td>-5.57 (-5.85 to -5.29)</td>
<td>-5.89 (-6.17 to -5.60)</td>
</tr>
<tr>
<td>2000</td>
<td>-1.63 (-1.91 to -1.34)</td>
<td>-0.44 (-0.72 to -0.16)</td>
</tr>
<tr>
<td>AMI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1992</td>
<td>-4.79 (-5.13 to -4.44)</td>
<td>-4.57 (-4.94 to -4.19)</td>
</tr>
<tr>
<td>2000</td>
<td>-3.57 (-3.89 to -3.23)</td>
<td>-3.81 (-4.15 to -3.46)</td>
</tr>
<tr>
<td>Lung cancer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1992</td>
<td>-0.61 (-1.24 to 0.01)</td>
<td>-1.78 (-2.62 to -0.92)</td>
</tr>
<tr>
<td>2000</td>
<td>0.69 (0.12 to 1.25)</td>
<td>0.61 (-0.08 to 1.30)</td>
</tr>
<tr>
<td>Colorectal cancer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1992</td>
<td>-3.00 (-3.75 to -2.24)</td>
<td>-2.71 (-3.48 to -1.93)</td>
</tr>
<tr>
<td>2000</td>
<td>-1.32 (-2.01 to -0.63)</td>
<td>-0.84 (-1.55 to -0.13)</td>
</tr>
<tr>
<td>Prostate cancer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1992</td>
<td>2.24 (1.61 to 2.88)</td>
<td>. . .</td>
</tr>
<tr>
<td>2000</td>
<td>0.68 (0.17 to 1.20)</td>
<td>. . .</td>
</tr>
<tr>
<td>Bladder cancer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1992</td>
<td>-0.84 (-2.03 to 0.35)</td>
<td>-0.46 (-2.38 to 1.51)</td>
</tr>
<tr>
<td>2000</td>
<td>-0.01 (-1.04 to 1.03)</td>
<td>1.52 (-0.13 to 3.20)</td>
</tr>
<tr>
<td>Breast cancer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1992</td>
<td>. . .</td>
<td>-3.83 (-4.65 to -3.00)</td>
</tr>
<tr>
<td>2000</td>
<td>. . .</td>
<td>-3.15 (-3.92 to -2.37)</td>
</tr>
<tr>
<td>Ovarian cancer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1992</td>
<td>. . .</td>
<td>-4.51 (-5.63 to -3.38)</td>
</tr>
<tr>
<td>2000</td>
<td>. . .</td>
<td>-0.25 (-1.36 to 0.87)</td>
</tr>
</tbody>
</table>

more elderly people compared with most common cancers overall, our unique analysis of QALY (originally developed for cost-utility analyses to calculate the ratio of cost to potential savings for health care interventions\textsuperscript{13,14}) lost over a decade revealed that HF has a greater adverse impact in this respect in men but not in women. Fortunately, there are signs that age-standardized rates of HF hospitalizations have continued to decline since first documented in the mid-1990s\textsuperscript{18} As recently described, these improvements have occurred in parallel with increased population-based prescription of disease modifying therapies for HF\textsuperscript{3} including angiotensin-converting enzyme inhibi-

Table 3. Impact on Life Expectancy and QALY According to Diagnosis (1995 Cohort)

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>1995 Cohort</th>
<th>Average Life Expectancy, Years</th>
<th>Actual Life Expectancy, Years</th>
<th>Average Loss of Life-Years</th>
<th>Total Loss of Life-Years</th>
<th>Total QALY Lost</th>
<th>Value of QALY, SEK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heart failure</td>
<td>14 407</td>
<td>11.10</td>
<td>6.50</td>
<td>-4.60</td>
<td>-66 318</td>
<td>-36 592</td>
<td>16.4 billion</td>
</tr>
<tr>
<td>AMI</td>
<td>11 187</td>
<td>15.00</td>
<td>10.84</td>
<td>-4.16</td>
<td>-46 582</td>
<td>-25 228</td>
<td>11.4 billion</td>
</tr>
<tr>
<td>Prostate cancer</td>
<td>3898</td>
<td>11.08</td>
<td>6.88</td>
<td>-4.20</td>
<td>-16 389</td>
<td>-90 19</td>
<td>4.06 billion</td>
</tr>
<tr>
<td>Colorectal cancer</td>
<td>2197</td>
<td>13.56</td>
<td>7.74</td>
<td>-5.82</td>
<td>-12 780</td>
<td>-66 64</td>
<td>3.00 billion</td>
</tr>
<tr>
<td>Lung cancer</td>
<td>1825</td>
<td>15.17</td>
<td>3.12</td>
<td>-12.05</td>
<td>-21 986</td>
<td>-11 760</td>
<td>5.29 billion</td>
</tr>
<tr>
<td>Bladder cancer</td>
<td>1354</td>
<td>13.77</td>
<td>10.67</td>
<td>-3.11</td>
<td>-4209</td>
<td>-2232</td>
<td>1.00 billion</td>
</tr>
<tr>
<td>Women</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heart failure</td>
<td>14 764</td>
<td>10.32</td>
<td>6.28</td>
<td>-4.03</td>
<td>-59 535</td>
<td>-30 644</td>
<td>13.8 billion</td>
</tr>
<tr>
<td>AMI</td>
<td>7409</td>
<td>12.64</td>
<td>7.55</td>
<td>-5.09</td>
<td>-37 691</td>
<td>-19 711</td>
<td>8.87 billion</td>
</tr>
<tr>
<td>Breast cancer</td>
<td>4853</td>
<td>23.52</td>
<td>18.96</td>
<td>-4.55</td>
<td>-22 098</td>
<td>-93 78</td>
<td>4.22 billion</td>
</tr>
<tr>
<td>Colorectal cancer</td>
<td>2231</td>
<td>15.46</td>
<td>9.13</td>
<td>-6.33</td>
<td>-14 126</td>
<td>-67 69</td>
<td>3.05 billion</td>
</tr>
<tr>
<td>Lung cancer</td>
<td>1213</td>
<td>19.02</td>
<td>4.46</td>
<td>-14.57</td>
<td>-17 670</td>
<td>-86 19</td>
<td>3.88 billion</td>
</tr>
<tr>
<td>Ovarian cancer</td>
<td>1065</td>
<td>23.23</td>
<td>13.24</td>
<td>-9.99</td>
<td>-10 639</td>
<td>-4837</td>
<td>2.18 billion</td>
</tr>
</tbody>
</table>
tors,16 β-blockers,19 and multidisciplinary programs of care,20,21 with the potential to improve long-term survival.22 However, these data also suggest that the continued decline in age-standardized HF hospitalization rates will be countered by a greater pool of older individuals within the population (postwar baby boomers), which, added to improved survival rates, will result in a sustained epidemic of HF in high-income countries.6

Although our data do not permit any interpretation on the relative contribution of the prevention and management of hypertension and preserved systolic HF to observed changes in the rate of HF hospitalizations and subsequent survival, we do have data on the most common precursor of HF in high-income countries—AMI. Consistent with previous reports23 in men, there was marked reduction in the rate of hospitalization for AMI over the study period, punctuated only by a small rise around the year 2000 that reflects changing criteria in defining AMI.24 Also consistent with the overall success of modern therapeutics (including thrombolytic therapy and primary coronary angioplasty25), the severity of myocardial ischemia has decreased and resulted in dramatic improvements in short- and long-term survival (6% per calendar year). Recent US data show that the application of the new AMI definition identifies patients with better systolic function and a lower 1-year risk of subsequent HF,26 although it should not be assumed that contemporary patients will necessarily have a better prognosis than those identified via old criteria.28 Without effective secondary prevention strategies, there probably will be a greater pool of survivors at markedly long-term increased risk of developing symptomatic left ventricular systolic dysfunction.6

With inherent limitations, we used the first admission to hospital as the inclusion criterion. For example, a first admission for cancer is frequently related to elective surgery in newly diagnosed patients. In HF, the first admission will reflect a whole spectrum, from first severe acute symptoms to the final stages of advanced disease. In an attempt to investigate this limitation, we calculated the corresponding incidence figure for breast cancer and HF during the time period of 1988 to 1999, with the incidence of breast cancer calculated (using the 1994 figure as an average estimate) to 56,966 new cases during a 12-year period. The corresponding number of hospital admissions in the present study was 56,848, which supports the assumption that a first hospitalization for breast cancer, in general, is linked to a procedure. Regarding HF, a current estimate of the annual incidence has been estimated to be 289 per 100,000,29 corresponding to an accumulated incidence of 159,528, which was similar to the 162,721 first-ever admissions over 12 years for HF in the present analysis.

It is worth considering cancer-specific data and their overall impact on sex-specific outcomes. For example, survival in lung cancer remains dismal, with no sign of change over time compared with a 4% per calendar-year improvement in short- and long-term survival in women diagnosed with breast cancer. Overall, the number of premature life years lost in the 1995 female cohort (22,098 versus 17,670 years for those diagnosed with breast and lung cancer, respectively) was surprisingly similar. These data indicate the need to apply the same focus on early detection and effective treatments (such as adjuvant therapy, introduced early in breast cancer but only recently in lung cancer) that have favorably altered the natural history of breast cancer7 to achieve the same magnitude of impact on those affected by lung cancer, particularly population strategies to reduce the prevalence of tobacco smoking in both sexes.26 In men, the most striking comparison of hospitalization rates for Swedish men age 70 years was the increase in cases of prostate cancer since the late 1990s. Because of the link to improved awareness and detection rates (with greater awareness and use of prostate-specific antigen screening30), the lack of progress in survival is worth noting. Alternatively, in both sexes, colorectal cancer (a focus of improved population detection via fecal occult testing31 as well as development in surgery and adjuvant therapy) was associated with a 2% to 3% per calendar-year improvement in short- and long-term survival: Its associated prognosis being now very similar to that of HF.

There were a number of study limitations. There was a lack of data relating to clinical presentation (ie, preserved versus impaired systolic dysfunction, although the prognosis for each form of HF is reportedly similar32), comorbidity, and pharmacological therapy. Also, we focused on new hospital rather than community cases. We therefore captured the more serious forms of our target conditions, the major exceptions in this case being sudden out-of-hospital cardiac death caused by AMI and ventricular arrhythmias in community-dwelling adults with or without underlying HF.32 Furthermore, a first admission for cancer often involves elective surgery with curative intention. Alternatively, approximately one quarter of patients with colorectal cancer are diagnosed with a disseminated disease in which ambulatory chemotherapy is recommended, and first admission occurs much later in a palliative situation. The appropriateness of estimating the economic impact associated with QALY in this context (ie, a descriptive study) is also open to debate. Because of the nature of the data registry, we do not have data for the last 4 years. Last, although the broad results of these data are largely consistent with reports from other countries, these data have not been validated beyond Sweden. We acknowledge that, in addition to a close relationship to AMI, older patients with HF are at risk of developing cancer. For example, 19.1% of male HF cases also recorded an admission for prostate cancer and 10% of female patients had breast cancer.

In summary, we found that the contemporary impact of HF is similar to that of the common forms of cancer in respect to total first-ever hospitalizations, 5-year case-fatality rates, and loss of life in both sexes, with more QALY lost in men compared with women. Overall, HF most probably challenges the health care system of countries such as Sweden far more than the general public and health care authorities would believe. A response that is commensurate to its population impact relative to the most common forms of cancer is therefore indicated in the form of increased public awareness and health care funding for research and care.
Sources of Funding
Dr Stewart is supported by the National Health and Medical Research Council of Australia. This study was supported by the Swedish Research Council, the Swedish Heart and Lung Foundation, and the Swedish Council for Working Life and Social Research.

Disclosures
None.

References
Simon Stewart, Inger Ekman, Tor Ekman, Anders Odén and Annika Rosengren

Circ Cardiovasc Qual Outcomes. 2010;3:573-580; originally published online October 5, 2010;
doi: 10.1161/CIRCOUTCOMES.110.957571
Circulation: Cardiovascular Quality and Outcomes is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
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Print ISSN: 1941-7705. Online ISSN: 1941-7713

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