Contemporary Epidemiology of Heart Failure in Fee-For-Service Medicare Beneficiaries Across Healthcare Settings

BACKGROUND: To assess the current landscape of the heart failure (HF) epidemic and provide targets for future health policy interventions in Medicare, a contemporary appraisal of its epidemiology across inpatient and outpatient care settings is needed.

METHODS AND RESULTS: In a national 5% sample of Medicare beneficiaries from 2002 to 2013, we identified a cohort of 2 331 939 unique fee-for-service Medicare beneficiaries ≥65-years-old followed for all inpatient and outpatient encounters over a 10-year period (2004–2013). Preexisting HF was defined by any HF encounter during the first year, and incident HF with either 1 inpatient or 2 outpatient HF encounters. Mean age of the cohort was 72 years; 57% were women, and 86% and 8% were white and black, respectively. Within this cohort, 518 223 patients had preexisting HF, and 349 826 had a new diagnosis of HF during the study period. During 2004 to 2013, the rates of incident HF declined 32%, from 38.7 per 1000 (2004) to 26.2 per 1000 beneficiaries (2013). In contrast, prevalent (preexisting + incident) HF increased during our study period from 162 per 1000 (2004) to 172 per 1000 beneficiaries (2013) (P_{trend} <0.001 for both). Finally, the overall 1-year mortality among patients with incident HF is high (24.7%) with a 0.4% absolute decline annually during the study period, with a more pronounced decrease among those diagnosed in an inpatient versus outpatient setting ($P_{interaction}$ <0.001)

CONCLUSIONS: In recent years, there have been substantial changes in the epidemiology of HF in Medicare beneficiaries, with a decline in incident HF and a decrease in 1-year HF mortality, whereas the overall burden of HF continues to increase.

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WHAT IS NEW?

- Between 2004 to 2013, the rate of new diagnosis of heart failure (HF) among elderly Medicare beneficiaries declined across both inpatient and outpatient healthcare settings. The 1-year mortality rate after a diagnosis of HF was high but improved during this period.
- The prevalence of HF continued to increase throughout this period. Further, in more recent years, HF is increasingly being diagnosed in the outpatient setting, and patients with an outpatient diagnosis have a lower 1-year mortality after their diagnosis, compared with those for whom a hospitalization represents their first manifestation of HF.

WHAT ARE THE CLINICAL IMPLICATIONS?

- Given the evolving landscape of HF among the elderly and the rising proportion of HF being diagnosed and managed in the outpatient setting, healthcare systems would need to focus on strengthening outpatient care services for HF.
- Further, our observations suggest that although fewer patients are being diagnosed with HF, the mortality rates in the year after the diagnosis and the rising prevalence of HF continue to be major challenges.
- Healthcare interventions would need to be aimed at understanding and improving the care patients receive in the period after their diagnosis of HF.

Heart failure (HF) affects 6.5 million Americans and is associated with nearly $31 billion in healthcare costs annually.[1] Given the high societal burden of HF, a clear understanding of epidemiological trends is critical for determining future workforce needs, focusing drug and device discovery investments, and prioritizing healthcare policy initiatives.

The epidemiology of HF has experienced substantial changes over time. Over a time period from the 1970s to 1990s, when atherosclerotic cardiovascular disease rates were falling steadily, HF incidence increased annually, likely because of aging of the population and better survival with atherosclerotic cardiovascular disease.[2] After stabilizing in the mid 1990s, a trend toward declining HF incidence was reported over the next decade.[3–5] For example, among fee-for-service Medicare beneficiaries, a 10% drop in the rates of new diagnosis of HF was reported from 1994 to 2003,[6] with similar trends reported from other Western countries.[7] A more recent investigation from Olmstead County suggested that the rates of incident HF declined in that community even more rapidly in the most recent decade, with a 37.5% decline from 2003 to 2013.[8] A similar pattern has been observed in a nationwide Danish investigation which documented a 30% to 40% decline in HF incidence in the elderly during 1995 to 2012.[9]

However, it is unknown if the changes in HF epidemiology observed in the United States are driven by regionally limited factors or represent a larger shift in HF epidemiology experienced by the health system. Recent investigations examining this question have focused solely on HF hospitalizations,[10] which do not account for new cases diagnosed in an outpatient setting, something increasingly likely given the trend toward shifting care from inpatient to outpatient settings. In the present study, using an administrative cohort of fee-for-service Medicare beneficiaries, we assessed calendar year trends in HF incidence during the last decade, and elucidated annual rates of new HF cases in both inpatient and outpatient settings, as well as the burden of prevalent disease and 1-year HF mortality rates. Further, we elucidated trends in incident and prevalent HF in major demographic and regional subgroups.

METHODS

Data Sources

The 5% national Medicare limited data set for the years 2002 to 2013 was the data source for the study. The Medicare 5% data set is an unbiased sample designed by the Center for Medicare and Medicaid Services (CMS) and represents a 5% sample of all Medicare beneficiaries in the United States.[6] Briefly, for every 100 new Medicare enrollees, based on a predetermined combination of beneficiary identification numbers, 5 are randomly selected into the sample and are represented in the data sets for all the subsequent years. The data for each year consists of information on Medicare eligibility classification (fee-for-service versus managed care), and claims submitted to Medicare for reimbursement for all healthcare contact across both inpatient (Medicare part A) and outpatient (Medicare part B) settings. Claim records are captured separately in inpatient and outpatient claims files, and claims submitted by individual physicians are captured in carrier files. Each of these Medicare claim files includes information on dates of encounter (as calendar quarters) as well as up to 10 associated diagnosis and procedure codes (reported as *International Classification of Diseases, Ninth Edition* codes). Further, an accompanying annual record provides information on demographic characteristics, including patient age (in years), sex, race, and the date of death for patients who died during that calendar year. The date of death was available as exact dates throughout the study period.

The Medicare data used in the study are proprietary and owned by the CMS. Therefore, although the authors cannot make them available to the public for purposes of reproducing the results, these can be obtained from the CMS directly.

Study Population

We identified all fee-for-service Medicare beneficiaries ≥65 years of age with at least 1 year of continuous enrollment in both Medicare Parts A and B (Figure I in the Data Supplement). Similar to prior studies,[6] we selected

fee-for-service enrollees with data on both Medicare Part A and B coverage because we wanted complete information on all potential inpatient and outpatient care encounters. Further, only elderly Medicare beneficiaries were included because those <65 years are not representative of the larger Medicare population. Of the total 3 915 899 unique Medicare beneficiaries in our sample, patients with missing identification numbers (n=54), age <65 years (n=748 712, 19%), and overall enrollment period of <1 year (n=270 993, 6.8%) were not included. For those with ≥1 year of enrollment, those who did not have even 1 calendar year of continuous fee-for-service follow-up in the cohort were also not included—that is, those with 1 or more months of nonenrollment in parts A and B (n=234 506, 6%) or enrollment in Medicare managed care (n=329 641, 8%) for every calendar year throughout the analysis period were not included. All patients were followed as a longitudinal cohort until their death, end of the study, or at their first transition out of Medicare fee-for-service coverage.

Study Variables and Outcomes

Medicare insurance claims records for beneficiaries selected into the cohort were reviewed for the entire period of follow-up. We identified HF encounters using a combination of *International Classification of Diseases, Ninth Edition* codes 428.x, 402.x1, 404.x1, and 404.x3 as any of the diagnosis codes on the claim record. These codes have been validated for identification of HF and are currently used by the American Heart Association's Get With The Guidelines-Heart Failure Registry as well as CMS to identify HF encounters.[11–13] Further, we queried all healthcare claims files (inpatient and outpatient) for previously validated combinations of *International Classification of Diseases, Ninth Edition* codes to identify both the number and the nature of comorbidities recorded for each patient for every calendar year in the study, using the Charlson comorbidities: myocardial infarction (acute or prior), peripheral vascular disease, cerebrovascular disease, dementia, chronic lung disease, connective tissue disease, peptic ulcer disease, liver disease, diabetes mellitus with and without end-organ complications, hemiplegia, moderate or severe kidney disease, any malignancy, including leukemia and lymphoma, metastatic solid tumors, rheumatologic disease, and AIDS.[14] We also included additional comorbidities that are relevant in the context of HF, specifically, hypertension, atrial fibrillation, obesity, and valvular heart disease.

Statistical Analyses

First, we identified patients with preexisting HF for each calendar year. Patients with preexisting HF were defined by any claim record in the inpatient, outpatient, or carrier claim files with a diagnostic code for HF in any position (ie, primary, secondary, etc) during the first year of their entry into the analysis. Second, among patients without a diagnosis of HF within the first year, we identified patients who subsequently developed new-onset or incident HF, based on healthcare encounters for HF. Incident HF was defined by either 1 inpatient claim with a diagnosis code for HF or ≥2 outpatient or carrier claims with a HF code in 2 separate calendar quarters. The latter criterion to select outpatient HF was intentionally more stringent to ensure that at least 2 encounters separated in time were consistent with a HF diagnosis. Further, resolution of 2 outpatient encounters was set at calendar quarters since claims for the all years through 2008 were reported as calendar quarters, as opposed to exact dates. We reorganized data for 2009 through 2013 when exact dates were reported into calendar quarters to maintain consistency over the study period. All encounters within a calendar quarter were assigned to the first day of the quarter for the respective years (January 1 for the first calendar quarter, April 1 for the second quarter, July 1 for third calendar, and October 1 for the fourth quarter, within respective calendar years). Further, similar to prior studies,[6] outpatient encounters for HF included any of the encounters that are represented in the outpatient/carrier files, including clinic visits, emergency department visits, observation care, and urgent care.

We obtained rates of new HF diagnosis for each year for the 10-year period between 2004 and 2013, allowing for additional years (2002 and 2003) of look back at the start of the analysis to exclude preexisting HF. Next, we calculated age-adjusted rates of new HF diagnoses using Poisson regression, using age at the time of the diagnosis. Third, we examined differences in patient characteristics at the time of the diagnosis across calendar years, including patient demographics (age, sex, and race) and comorbid conditions. Next, we examined trends in incident HF within major demographics groups, including age-groups (65–69, 70–74, 75–79, 80–85, and over 85 years of age), sex (men versus women), and racial groups (white, black, Hispanic, and Asian), as well as across the 4 major US Census regions (Midwest, Northeast, West, and South). Next, prevalent HF for each calendar year was defined by the sum of the number of unique individuals with preexisting and incident HF for the respective years as well as those with incident HF in preceding years. Finally, to assess changes in early mortality after a HF diagnosis, we calculated 1-year risk-adjusted hazard for mortality using Cox-proportional hazards model with calendar year of diagnosis as the exposure, and the study start year (2004) as the reference year. Our risk-adjustment model accounted for age, sex, race, and Charlson comorbidities enumerated above. The year 2004 was the reference year for these analyses, and population characteristics and observed mortality rates for patients with incident HF in this year represented the reference values for calendar year trends in risk-adjusted mortality.

Sensitivity Analyses

We conducted several sensitivity analyses to assess the robustness of our findings pertaining to the identification of incident HF. First, to examine the effect of missed prevalent disease in the 1 year look back period that may have been miscategorized as incident HF, we considered an alternative look back period of 2 years. In this approach, any HF encounter within the first 2 years after the start of the analysis period for patients was considered prevalent disease, and incident HF was diagnosed in patients with at least 2 prior years of records without any HF claims. Second, we used alternative, more stringent definitions to identify a new diagnosis of HF, including using (1) only 1 inpatient encounter, (2) 1 inpatient or 2 outpatient encounters, and (3) 1 inpatient or 3 outpatient encounters for the diagnoses of HF to account

for different methodologies suggested in published research using Medicare data.[6]

Analyses were performed using SAS 9.4 (Cary, NC). All statistical tests were 2-sided, and the level of significance was set at an α of 0.05. The study was reviewed and approved by the institutional review board at the University of Texas Southwestern Medical Center, and because the data were deidentified, the requirement for informed consent was waived.

RESULTS

We identified 2 331 993 unique fee-for-service Medicare beneficiaries ≥65 years of age with at least 1 year of continuous study eligibility. There were a mean 1.3 million eligible patients in the study annually (Figure II in the Data Supplement), with median follow-up of 62 months (interquartile range, 29–120 months). The mean age of study participants at the beginning of the analysis period was 72 years, 57% were women, and 86% and 8% were white and black, respectively.

Within this cohort, 518 223 patients had preexisting HF, defined by a HF encounter during the first year of eligibility for the analysis. Among patients without preexisting HF, 349 826 patients had a new diagnosis of HF over the 10 years of follow-up. Of these, 207 687 (59.4%) were diagnosed in the inpatient setting and 142 139 (40.6%) in the outpatient setting. Trends in incident and prevalent HF across calendar years are presented in Figure 1A. The rates of incident HF, defined by either 1 inpatient or 2 distinct outpatient encounters (in 2 calendar quarters), declined 32% over the study period, from 38.7 per 1000 beneficiaries during 2004 to 26.2 per 1000 beneficiaries during 2013 (*P*-trend <0.001; Figure 1A and 1B). The decline was observed in both the inpatient and outpatient settings, though the decline in hospitalizations was most prominent (*P* for interaction, 0.003; Figure 1B), and the proportion of outpatient diagnoses of HF relative to the total increased from 36% in 2004 to 41% in 2013 (*P* for trend <0.001).

The mean age at diagnosis of HF was 80 years and this did not vary substantially across study years. The table presents calendar year trends in patient characteristics at the time of diagnosis of incident HF. Age-adjusted trends in new HF diagnosis closely follow the unadjusted trends (Figure III in the Data Supplement). Throughout the study period, there was a modest increase in comorbid conditions including myocardial infarction, peripheral artery disease, cerebrovascular disease, and chronic obstructive pulmonary disease. There was also a near doubling in the rates of coexisting chronic kidney disease (18.9% to 37%). Although there was a decline in incident HF, the proportion of prevalent HF increased during our study period from 162 per 1000 in 2004 to 172 per 1000 beneficiaries during 2013 (*P*-trend <0.001; Figure 1A).

The overall unadjusted 1-year mortality rate among patients with incident HF was 24.4%, with rates of 31.9% and 13.5% for HF diagnosed as inpatient and outpatient, respectively. Trends in observed mortality rates in subgroups based on age, sex, race/ethnicity, and US Census regions are presented in Figure IV in the Data Supplement. Risk-adjusted mortality in patients within 1 year from diagnosis of HF improved from 25.7% to 23.0% during the study period (Figure 2A). The risk-adjusted 1-year mortality after incident HF in the inpatient setting declined between the years 2004 and 2010 (32.9% in 2004 to 27.8% in 2010; *P* for trend <0.001), with a small increase between 2010 and 2012 (27.8% in 2010 to 31.1% in 2012). There was a modest, but statistically significant, decline in mortality after incident HF in the outpatient setting for the entire study period (13.0% in 2004 to 12.3% in 2012; *P* for trend =0.02). Although mortality declined for patients with both inpatient and outpatient diagnosis of HF, there was a more prominent decline among those with

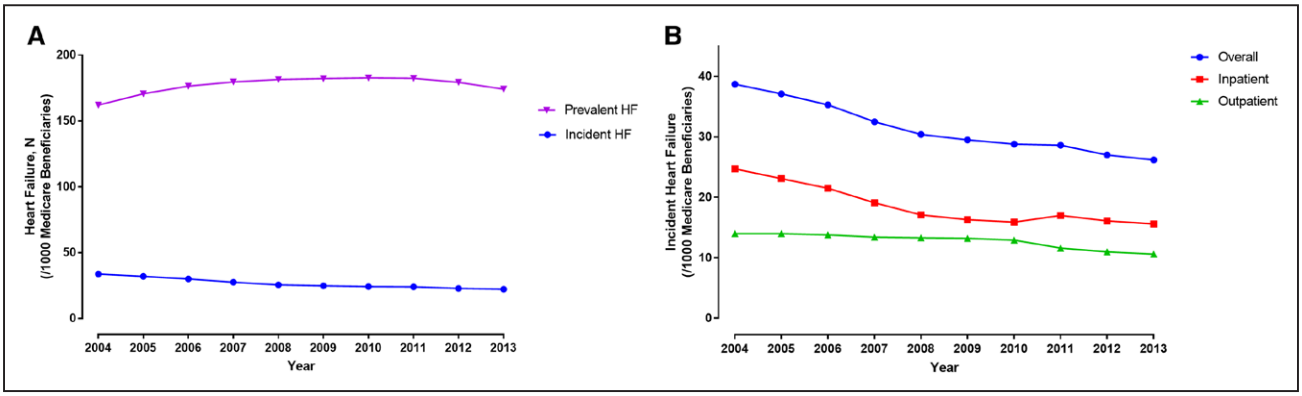

Figure 1. Calendar year trends in heart failure (HF) in fee-for-service Medicare beneficiaries in a claims-based administrative cohort defined in detail in the Methods section.

A, Trends in incidence and prevalence (preexisting+incident) of heart failure (HF). **B**, Trends in incidence of overall, inpatient, and outpatient HF. P<0.001 for all.

Table. Patient Characteristics at the Time of Diagnosis of Incident Heart Failure, by Calendar Year of Diagnosis

Characteristics at Heart Failure Diagnosis	2004–2005	2006–2007	2008–2009	2010–2011	2012–2013	*P*-Trend
n	90617	77141	65055	60987	56026	
Age, y (SD)	79.7 (7.6)	79.7 (7.6)	80.1 (7.7)	79.9 (8.0)	79.9 (8.1)	<0.001
Men, %	42.0	42.3	42.4	43.5	44.2	<0.001
Race						0.69
White, %	87.5	87.8	87.8	87.7	88.2	
Black, %	8.4	8.0	7.7	7.8	7.4	
Others, %	3.9	4.1	4.4	4.4	4.4	
Missing/unknown, %	0.2	0.1	0.1	0.1	0.2	
Region*						<0.001
Midwest, %	26.4	26.0	25.2	24.7	24.6	
Northeast, %	19.7	20.3	20.2	20.0	20.1	
South, %	38.8	38.6	39.3	39.7	39.4	
West, %	14.1	14.6	14.9	15.2	15.5	
Comorbid conditions						
Any myocardial infarction	24.8	23.8	23.3	24.0	26.1	<0.001
Atrial fibrillation	14.3	11.2	9.2	7.9	7.3	<0.001
Hypertension	70.3	70.0	67.8	66.7	65.9	<0.001
Obesity	3.1	3.3	3.6	4.3	5.0	<0.001
Peripheral disease	22.8	23.6	24.6	26.2	26.4	<0.001
Cerebrovascular disease	33.3	34.5	34.6	34.6	34.5	<0.001
Chronic pulmonary disease	46.8	46.1	45.2	46.6	47.4	0.06
Diabetes mellitus without end-organ damage	39.7	41.0	41.2	41.8	42.2	<0.001
Diabetes mellitus with end-organ damage	10.7	11.5	12.0	13.0	13.9	<0.001
Moderate or severe renal disease	18.9	25.5	28.3	33.2	37.0	<0.001
Connective tissue disease	5.4	5.7	6.1	6.3	6.4	<0.001
Leukemia/metastatic malignancy	5.3	5.2	5.0	5.0	5.4	0.82
Valvular heart disease	15.4	13.9	12.8	11.9	11.3	<0.001
Charlson Comorbidity Score	4.3 (2.7)	4.4 (2.8)	4.5 (2.8)	4.7 (2.8)	4.8 (2.9)	<0.001

an inpatient diagnosis (*P* for diagnosis type and calendar year interaction <0.001), with an absolute decline in 1-year mortality by 0.36% per year in the inpatient compared with 0.15% per year in the outpatient setting (Figure 2B). Decline in mortality was observed consistently across demographic subgroups defined by sex and race (*P* for interaction >0.10 for both).

In subgroup analyses, rates of incident HF declined across age-groups with the greatest decline in the oldest age-group (>85 years of age, 92.6/1000 in 2004 to 70.5/1000 in 2013; Figure 3A). There were notable sex differences in rates of new HF diagnosis in Medicare, with higher rates in men compared with women throughout the study period (Figure 3B). There was a consistent decline in rates of incident HF in both men and women (*P* for calendar year and sex interaction >0.10). Among racial/ethnic groups, self-reported blacks had the highest rates of new HF diagnosis, followed by Hispanics, whites, and Asians (Figure 3C). Further, black patients were, on average, 2 years younger than the white patients at diagnosis (*P*<0.001). Notably, racial/ethnic differences in HF incidence persisted across the years of our study with consistently higher HF incidence among blacks across study years (*P* for calendar year and black–white race interaction >0.10). Finally, in our prespecified analysis by US Census regions, Western region had the lowest incidence of HF (*P*<0.001, west versus other regions), with similar rates across the other 3 census regions (*P*=0.12) and a consistent decline in HF incidence over time seen across all 4 regions (Figure 3D; *P* for interaction for region >0.10). Consistent with the overall population, prevalent HF increased across demographic subgroups of sex and race, as well as all 4 US Census regions (Figure 4A through 4C).

In sensitivity analyses, based on longer period of look back to define prevalent HF as well as 4 different definitions to identify incident HF (Figures V through VIII in the Data Supplement) we found that the decline

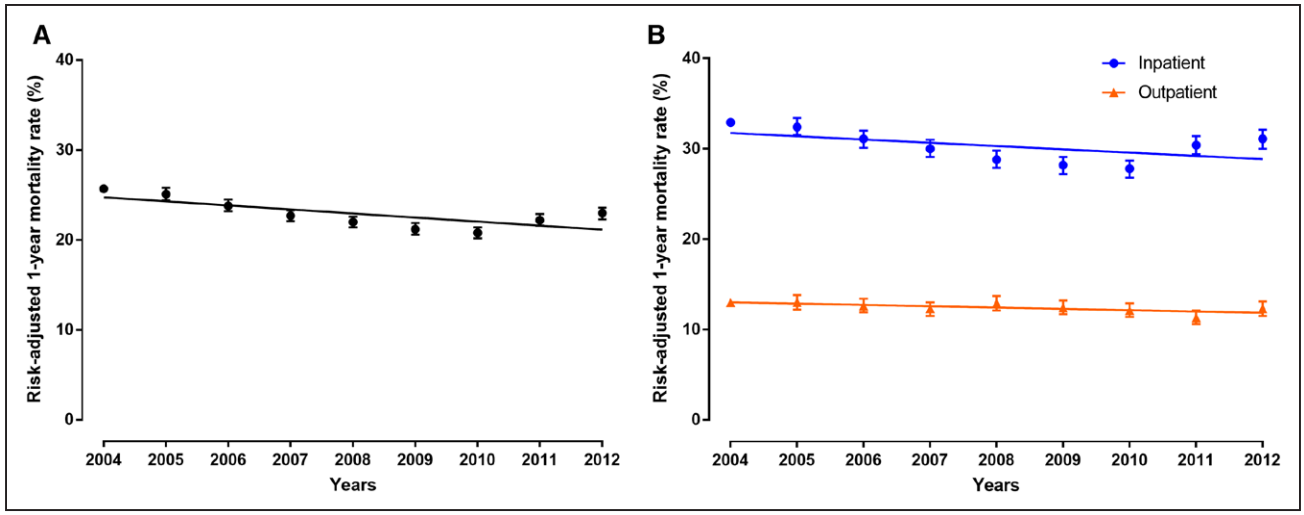

Figure 2. Calendar year trends in risk-adjusted 1-y mortality rate among patients with diagnoses of heart failure (HF). **A**, Trends among patients with incident diagnosis of HF (reference year, 2004). **B**, Trends among patients with inpatient and outpatient diagnoses of HF (reference year, 2004).

in rates of new HF diagnosis was consistent with our primary analysis.

DISCUSSION

In this large, national cohort study of fee-for-service Medicare beneficiaries followed for a decade, we made the following key observations. First, there has been a >30% decline in the rates of new HF diagnoses across inpatient and outpatient care settings over the 10-year study period between 2004 and 2013, though the decline in hospitalizations was most prominent. Second, rates of incident HF varied across demographic groups, with a higher incidence with advancing age and among men compared with women and blacks compared with whites. Third, there has been a decline in 1-year mortality after a new diagnosis of HF across the study period, which was more prominent for diagnoses in the inpatient setting. Finally, in contrast to incident HF which has declined over time, there has been an increase in prevalent HF over the years of the present study, across demographic and geographic subgroups.

This is the first national-level study of United States patients that demonstrates a decline in the number of new HF cases over the last decade. We observe a 30% decline in the rates of incident HF that is consistent with a declining trend in incident HF over the last 2 decades,[2] and is qualitatively similar to the 37.5% decline observed in Olmstead County during the same period.[8] A Danish study has recently also demonstrated a similar nationwide decline in incident HF among the elderly.[9] Further, a prior study in the Medicare fee-for-service population demonstrated a decline in first HF hospitalizations from 28 per 1000 in 1998 to 20 per 1000 in 2008.[10] Our study, which includes both inpatient and outpatient diagnoses of HF, provides evidence that the decline observed in the inpatient setting does not merely reflect transition of diagnosis and care from the inpatient to the outpatient setting, because a decline is observed in both settings. However, with an outpatient diagnosis representing an increasing proportion of all HF diagnoses, studies that rely solely on inpatient HF diagnoses are likely to provide only a partial assessment of the HF epidemic. The trend observed in our study is consistent across groups defined by sex, race, and US Census regions, suggesting that common factors underlie these temporal changes.

In contrast to the decline in incident HF cases, we found an increasing burden of unique Medicare beneficiaries with prevalent HF each year, consistent with prior reports suggesting that the overall burden of the HF epidemic continues to rise.[13] Our study suggests that the impact of HF on the healthcare system is being influenced by the decreasing mortality with HF, thereby resulting in an increasing number of patients surviving with HF. Therefore, from a resource utilization perspective, the declining incident HF is outweighed by declining mortality, with increasing current and future healthcare costs and expenditures for HF. Therefore, in addition to continued emphasis on HF prevention, further resources would need to be directed toward a potentially aging HF population with the associated resource-intensive care and need for advanced therapies. Future studies are needed to evaluate new strategies to mitigate the continued high burden of HF on the healthcare system.

The underlying cause of the observed decline in incident HF is unknown. Several improvements in the management of risk factors for HF may be implicated. These include improved management of both diabetes mellitus and hypertension,[15–19] treatment of acute

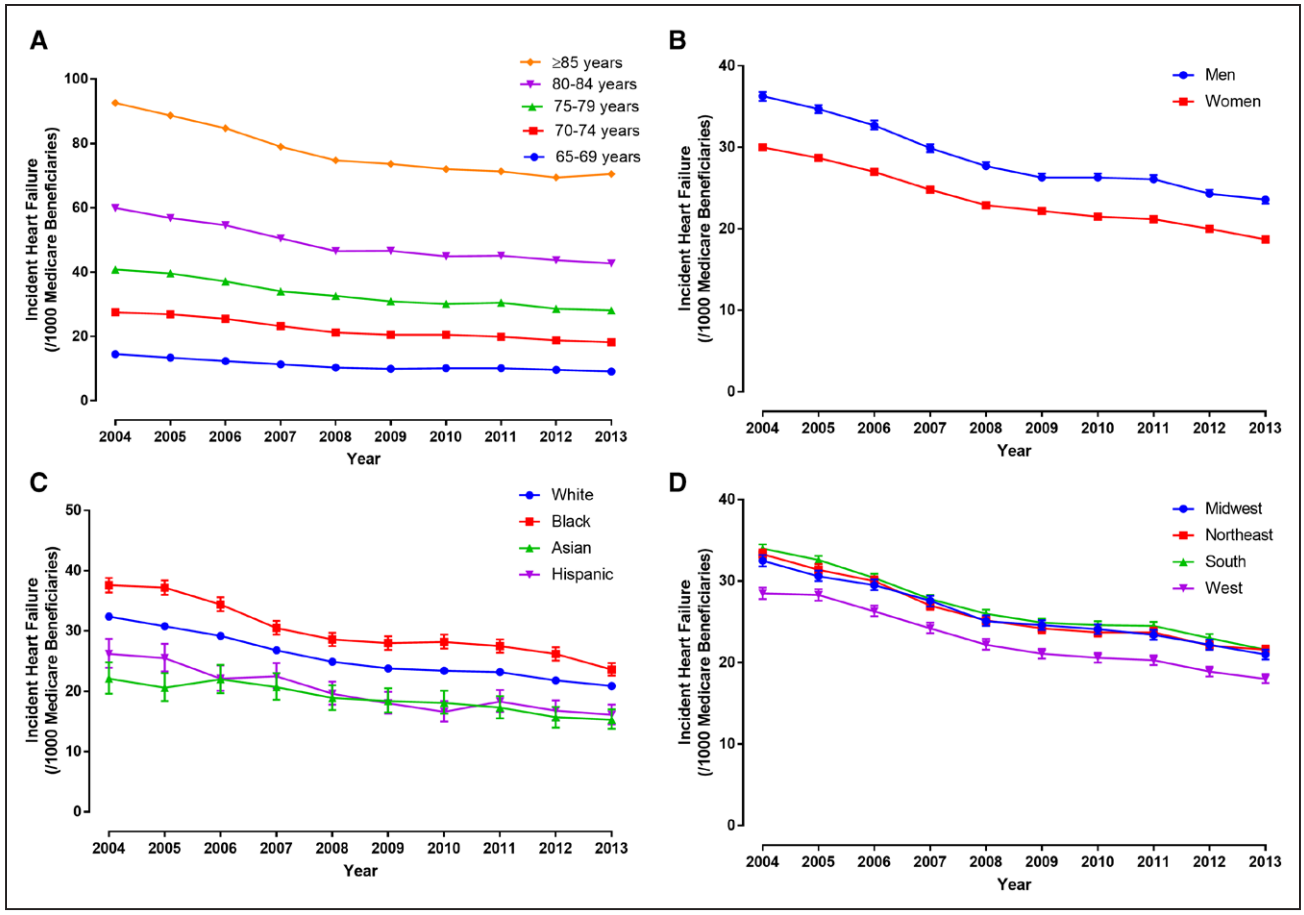

Figure 3. Trends in incidence of heart failure in subgroups of Medicare beneficiaries by (A) age, (B) sex (age adjusted), (C) race (age adjusted), and (D) US Census regions (age adjusted).

and chronic coronary disease with guideline directed therapy including statins and antiplatelet agents,[20–23] and rapid revascularization in acute myocardial infarction and improvements in postmyocardial infarction care.[24,25] Additionally, some of the observed changes in the rates of incident HF across studies may represent better discrimination of HF from its mimics. The introduction of B-type natriuretic peptide testing has likely increased the specificity of HF diagnoses,[26] as well as the more widespread use of echocardiography.[27,28] Thus, epidemiological changes may represent in part more accurate diagnosis of HF, with the reporting of fewer false-positive cases.

Our study findings should be interpreted in the light of the following limitations. First, HF in our study is based on administrative records and has not been independently adjudicated. However, the combination of *International Classification of Diseases, Ninth Edition* codes used in our study is consistent with those used by both CMS and HF registries,[13,29] and have been demonstrated to be both sensitive and specific for the identification of HF in large validation studies.[11]

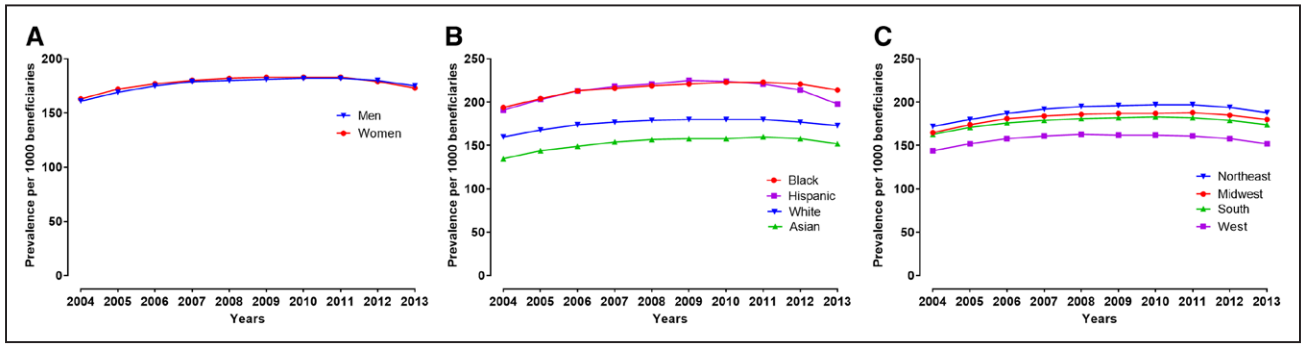

Figure 4. Trends in prevalence of heart failure in subgroups of Medicare beneficiaries by (A) sex, (B) race, and (C) US Census regions.

Also, our findings are in agreement with other prior studies which demonstrate similar trends in regional US cohorts and studies in other industrialized countries.[3,7–9] Further, the ascertainment of HF within an administrative record forms the basis for healthcare resource allocation as well as health policy interventions. Second, we do not have information on HF subtypes because the administrative codes for HF with reduced and preserved ejection fraction, and with acute decompensated HF have not been independently validated. Therefore, it is possible that the trends observed in our study do not apply to individual subtypes. Third, our study cannot make assumptions about the nonfee-for-service Medicare beneficiaries, represented by the Medicare managed care population, because claim-level data are not available for these patients. However, differences in HMO participation are unlikely to explain differences in our study findings because Medicare studies during our study period have revealed that HMO rates have remained stable and represent a modest proportion of total Medicare beneficiaries.[13] Fourth, we did not examine patterns of HF among patients <65 years of age because the younger Medicare beneficiaries mostly reflect those with end-stage renal disease and severe disability and are not representative of the general population. Future studies are needed to assess if trends in rates of new HF diagnosis vary in younger age-groups. Finally, our assessment of HF only represents Medicare beneficiaries who sought medical care, and community-level assessment of prevalence and incidence of HF cannot be inferred. However, the care-seeking practices for HF within a closed insurance system is unlikely to be a function of time, and therefore, unlikely to account for our study findings.

In conclusion, although there has been an increasing burden of prevalent HF in Medicare beneficiaries during 2004 to 2013, the number of unique fee-for-service Medicare beneficiaries with a new HF diagnosis has declined annually during the same period. This has been accompanied by an overall improvement in 1-year mortality after HF diagnosis. Our study suggests that along with emphasis on HF prevention and appropriate identification, health policy interventions should focus on the needs of an aging HF population.

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DISCLOSURES

None.

AFFILIATIONS

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FOOTNOTES

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Contemporary Epidemiology of Heart Failure in Fee-For-Service Medicare Beneficiaries Across Healthcare Settings

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SUPPLEMENTAL MATERIAL

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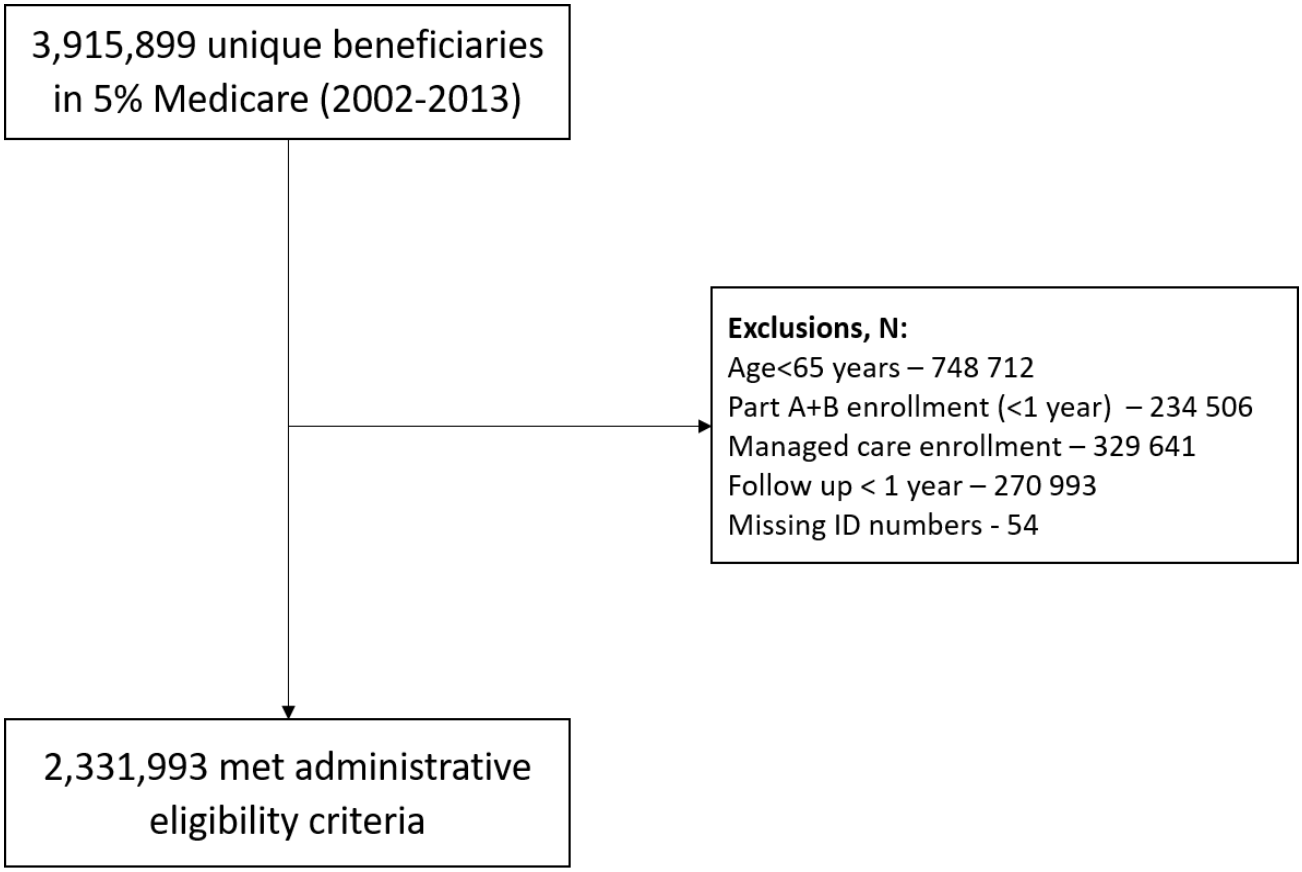
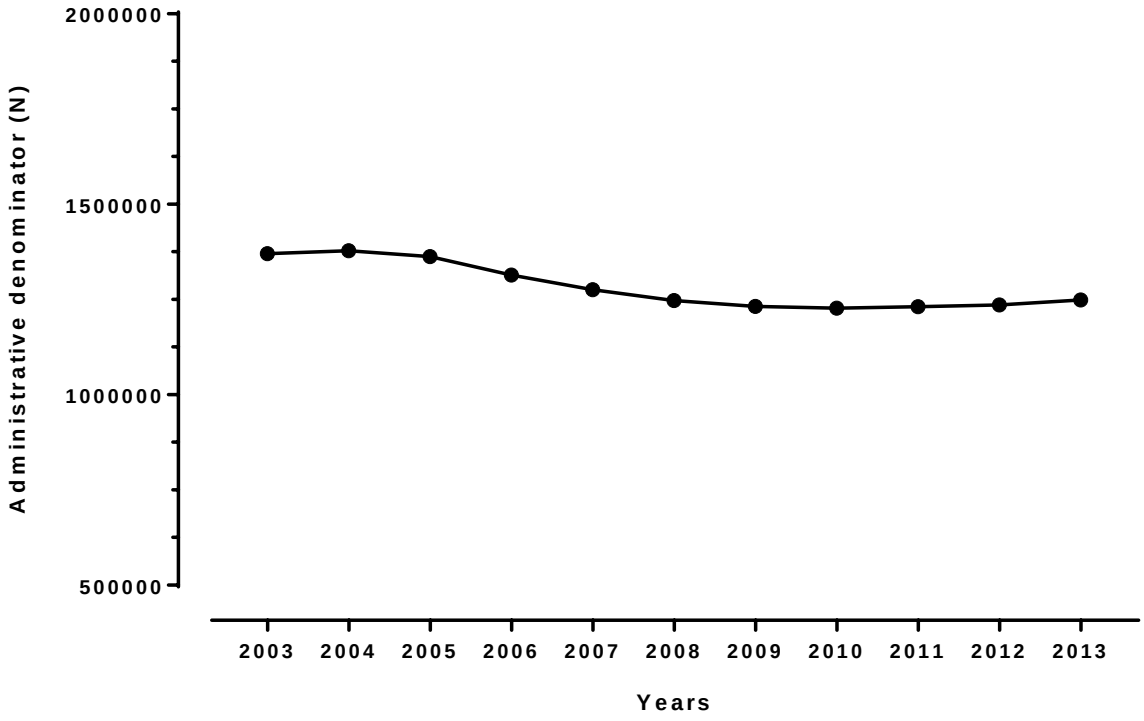
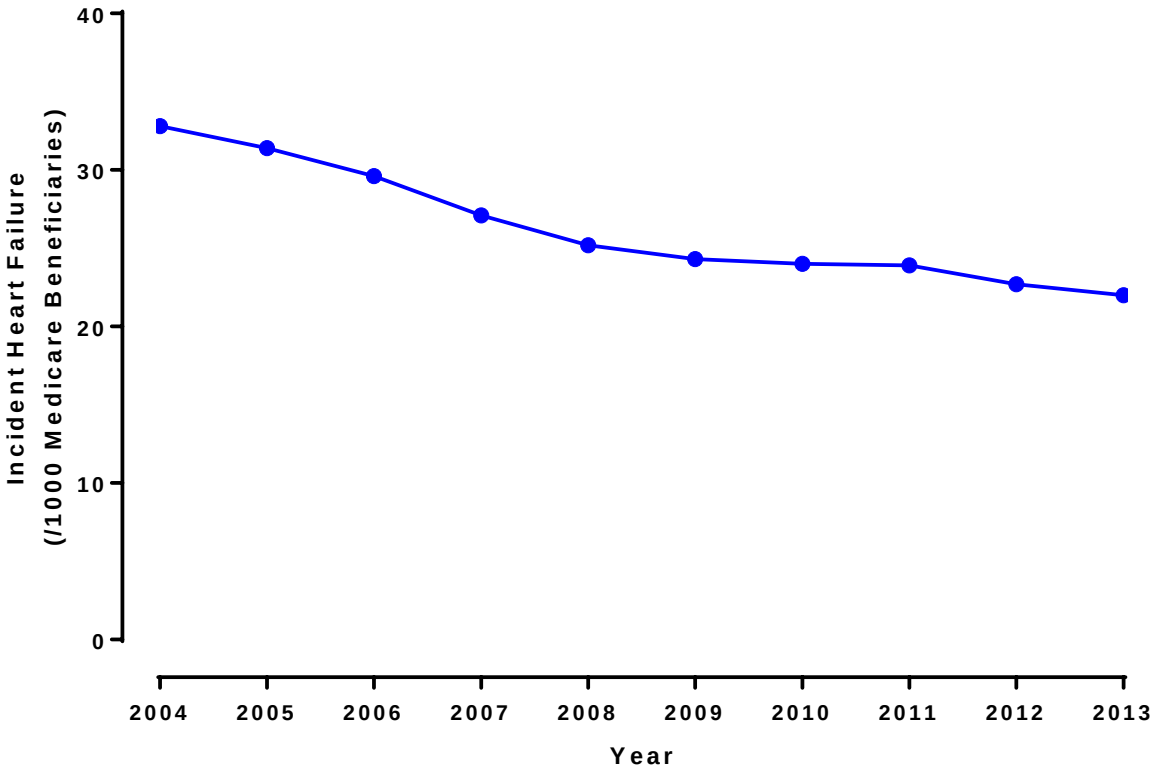
eFigure 1: Study selection flowsheet



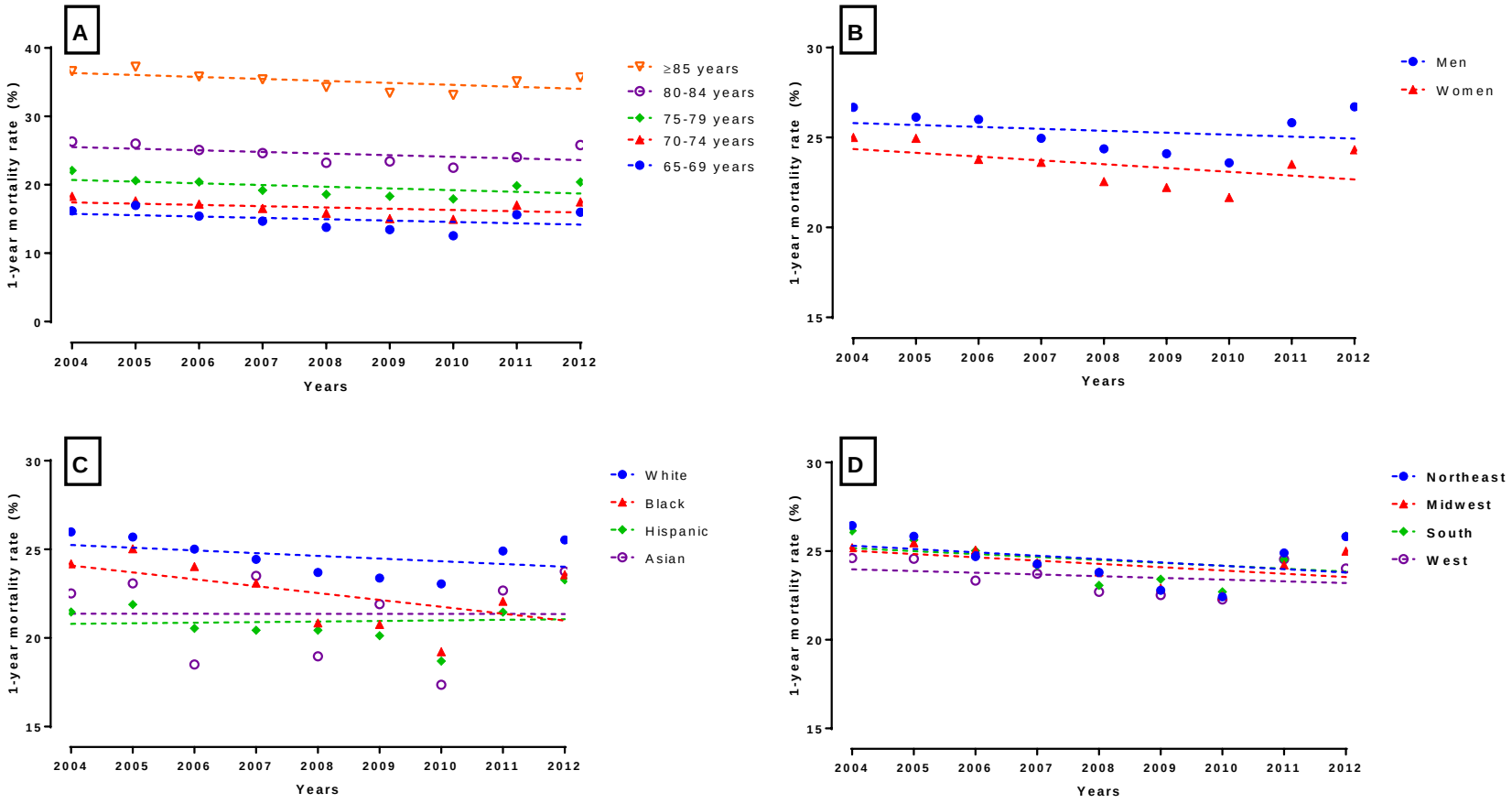
eFigure 2: Number of eligible Medicare beneficiaries in the denominator, by calendar year



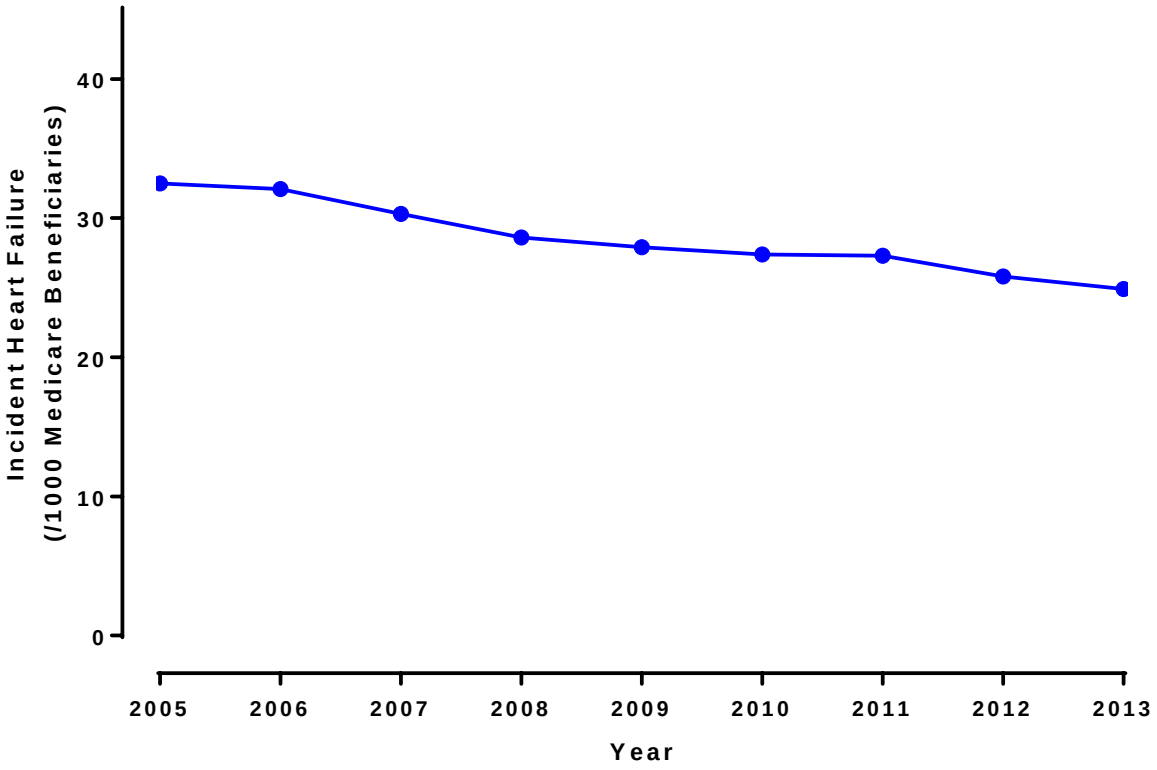
eFigure 3: Age-adjusted trends in heart failure incidence (overall)



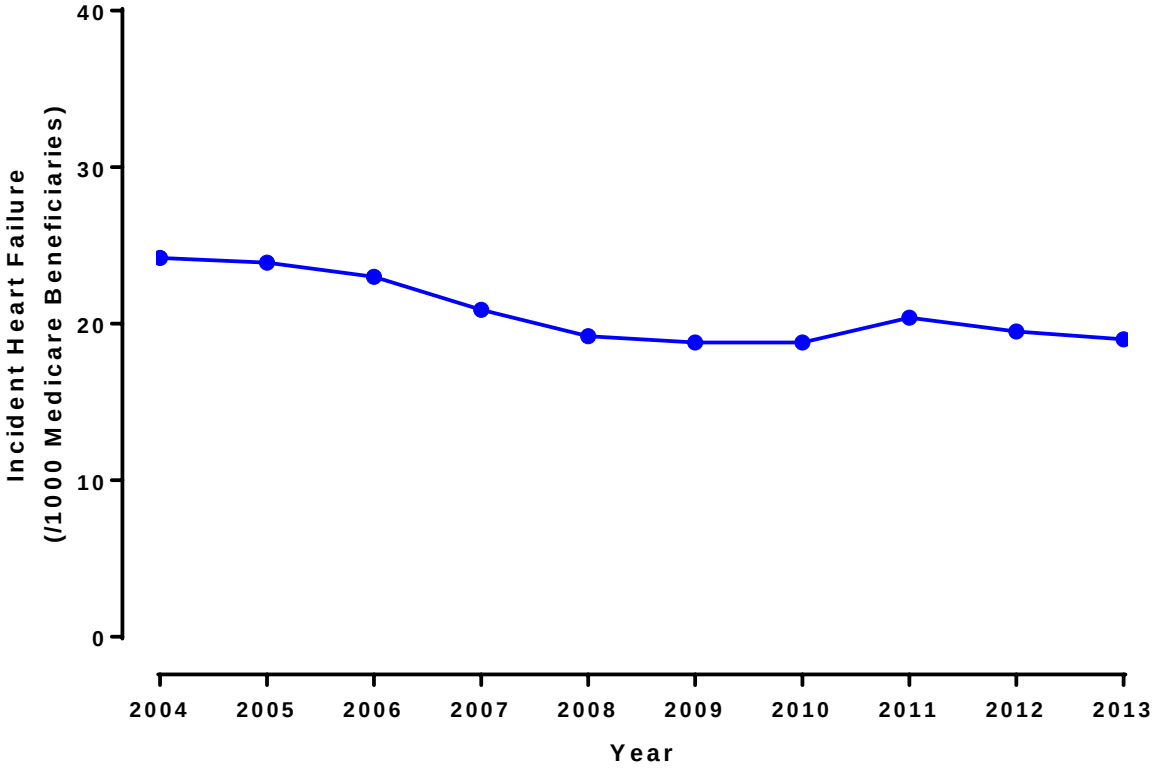
eFigure 4: Observed 1-year mortality rates in subgroups based on (A) age, (B) sex, (C) race/ethnicity, (D) U.S. census regions.



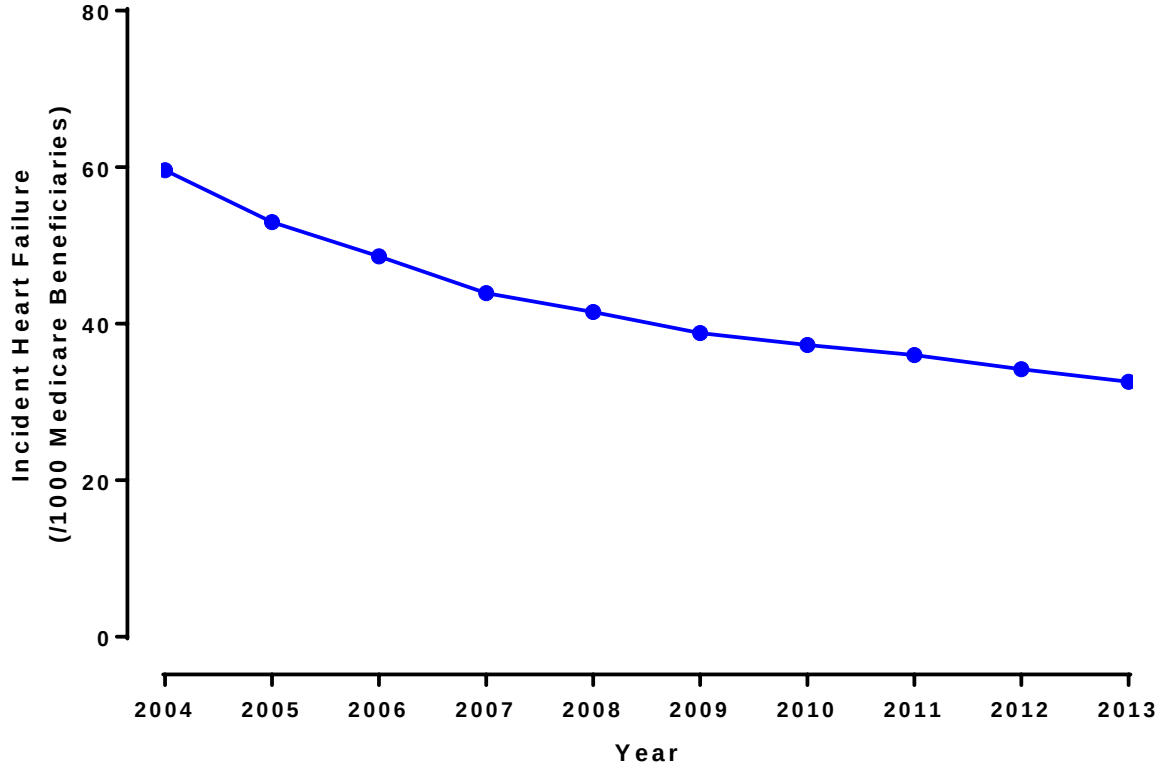
eFigure 5: Sensitivity analysis - trends in heart failure incidence with 2-year lookback period.



eFigure 6: Sensitivity analysis - trends in heart failure incidence with at least 1 hospitalization with heart failure required for heart failure diagnosis.



eFigure 7: Sensitivity analysis - trends in heart failure incidence with 1 inpatient or 1 outpatient encounter for heart failure diagnosis.



eFigure 8: Sensitivity analysis - trends in heart failure incidence with 1 inpatient or 3 outpatient encounters for heart failure diagnosis.