Heterogeneous Trends in Burden of Heart Disease Mortality by Subtypes in the United States, 1999-2018: Observational Analysis of Vital Statistics

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Heterogeneous Trends in Burden of Heart Disease Mortality by Subtypes in the United States, 1999-2018: Observational Analysis of Vital Statistics

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Abstract (Word Count = 298; Maximum = 300)

Objective: To describe trends in burden of subtypes of heart disease (HD) mortality from 1999-2018, in order to inform targeted prevention strategies and reduce disparities.

Design: Serial cross-sectional analysis of cause-specific HD mortality rates using national death certificate data.

Setting: United States, 1999-2018

Participants: 12.9 million decedents from HD (49% women, 12% black, and 19% <65 years old).

Main Outcome Measures: Age-adjusted mortality rates (AAMR) and years of potential life lost (YPLL) for each HD subtype as underlying cause of death, and mean annual percentage change (APC).

Results: Total HD deaths fell from 752,192 to 596,577 from 1999-2011, then increased to 655,381 in 2018. Proportions of deaths from each of the top 3 subtypes of HD deaths changed during the study period, including decrease in ischemic HD (IHD, 73% to 56%) compared with increases in heart failure (HF, 8% to 13%) and hypertensive HD (HTN-HD, 4% to 9%). AAMR was highest from IHD, but APC from HF and HTN-HD was highest after 2011. The steepest increases in HF were in black men (APC +4.9% [+4.0 to +5.8]) whereas fastest increases in HTN-HD occurred in white men (+6.3% [+4.9 to +9.4]). The most rapid increases in midlife mortality (45-64 years) from HD occurred in black women due to HF (+7.0% [+5.1 to +8.9]), and in white women due to HTN HD (+4.1% [+3.7 to +4.5]). The burden of YPLL was greatest for IHD, but black-white disparities in YPLL were driven by HF and HTN-HD.

Conclusions: AAMR from almost all subtypes of HD have become stagnant or increased since 2011. Increases in HD AAMR are attributed to HF and HTN-HD, which also account for the widest black-white disparities in YPLL. Early and targeted prevention and control of HTN is needed with a focus on high-risk groups to promote health equity.

Summary Box

Section 1 (What is already known):

- Surveillance data from national death certificates show that declines in heart disease mortality have slowed since 2011 in the United States.
- Advances in medical and surgical therapies may have led to heterogeneous patterns in death rates for specific subtypes of heart disease.
- A detailed understanding of how mortality from subtypes of heart disease contributes to overall heart disease mortality patterns will inform implementation of multi-level prevention interventions.

Section 2 (What this study adds):

- In the United States, increases in heart failure and hypertensive heart disease mortality occurred parallel to declines in ischemic heart disease death rates, resulting in 3.5 million years of potential life lost from total heart disease in 2018 and warranting focus on reducing the growing burden of hypertension and other heart failure risk factors.
- Black men had the highest burden of mortality from leading subtypes of heart disease, but the greatest increases midlife mortality due to heart disease subtypes were observed in black women (heart failure) and white women (hypertensive heart disease), indicating the need to enhance prevention in high risk populations to reduce disparities and promote health equity.

Introduction

Age-adjusted mortality rates (AAMR) due to heart diseases (HD) declined by more than 50% in the United States (US) in the second half of the 20th century from a peak of 307 per 100,000 in 1950. This fall was predominantly driven by rapid declines in mortality from ischemic heart disease (IHD), as a result of progress in prevention (e.g. decline in smoking rates) and evidence-based treatments (e.g. statins, anti-platelet agents, and anti-hypertensives).[1-3] While mortality rates continued to decline after 2000,[4] recent data demonstrated that HD AAMR plauteaued in 2011.[2 5 6] Furthermore, some indicators now suggest a trend reversal with increasing HD death rates in certain population subgroups, such as middle-aged Americans,[7 8] thus undoing decades of progress in HD prevention and treatment and contributing to decreases in overall US life expectancy.[9]

However, subtypes of HD are heterogeneous in their pathophysiology and contribution toward preventable deaths. Recent analysis indicates that the stagnation in HD mortality rates in 2011 was driven by a slowing in the decline of IHD deaths, and increases in heart failure (HF) mortality rates.[10 11] Further detailed characterization of patterns for each subtype of HD across race-sex and age subgroups that are responsible for the observed changes in HD mortality rates would inform targeted prevention and treatment efforts. We therefore investigated trends across race-sex and age groups in cause-specific HD deaths (IHD, HF, hypertensive HD [HTN HD], valvular HD, arrhythmia, pulmonary HD, and other HD) using national death certificate data from 1999 to 2018. We calculated complementary metrics to assess burden due to subtypes of HD, including age-adjusted mortality rates (AAMR), years of potential life lost (YPLL), and mean annual percent changes (APC) in AAMR and YPLL from HD subtypes to better evaluate the burden of avoidable HD mortality overall and by race-sex groups.

Methods

Using mortality data from the Centers for Disease Control and Prevention's Wide-Ranging Online Data for Epidemiologic Research (WONDER) database of death certificates, we identified decedents from 1999 to 2018 by International Classification of Diseases (ICD)-10 code with an underlying cause of death of HD (total), which comprised of HD subtypes classified as: IHD (ICD-10 code I20-I25), HF (I50), HTN HD (I11, I13), valvular HD (I34-I38), arrhythmia (I47-I49), pulmonary HD (I26-I28), and other HD (I00-I09, I30-I33, I40-I46, I51, which includes acute and chronic rheumatic heart disease, pericardial diseases, acute myocarditis, and unspecified cardiomyopathy and cardiac arrest not otherwise defined). The percentage of each HD subtype's contribution to total HD was calculated overall and by race-sex and age subgroups.

Trends were examined in the overall population (all race groups), separately by race-sex groups (black women, white women, black men, white men), and stratified by age at death (<45 years, 45-64 years, ≥65 years). The race-sex analysis was limited to black and white individuals because other race/ethnic groups (Asian Americans, Native Americans, Hispanic Americans) were either too small (e.g., Native Americans) or less reliably identified (e.g., Hispanic American, Asian Americans[12 13]) in CDC WONDER.

We calculated AAMR per 100,000 population adjusted using the 2000 US standard population overall and stratified by race-sex and age subgroups.[14] YPLL was calculated using standard methods previously employed.[13 15] An average life expectancy between 1999-2018 for the total US population and individually for race-sex subgroups was obtained from US vital statistics reports, and was used as the reference age for YPLL calculation.[16 17] For each year of analysis, YPLL was calculated by multiplying number of deaths from HD subtypes in each of a series of 5-year age group decrements from the reference age, by the difference between the reference age and the midpoint age at death within each 5-year age group. This result was divided by the total 5-year age group population, then multiplied by 100,000 to obtain YPLL per 100,000 population. After age standardizing YPLL with the 2000 US standard population, the sum of YPLL in each 5-year age group provided cause-specific YPLL per 100,000 in the total population and race-sex subgroups, for each year of analysis. YPLL was calculated for total HD, IHD, HF, and HTN HD. Because of relatively few deaths due to other HD subtypes, YPLL was also calculated for an All Other HD category that comprised the remainder of the underlying cause of death codes.

Temporal trends in AAMR and YPLL were characterized by fitting log-linear regression models using Joinpoint Regression Program (National Cancer Institute).[18] Log-transformed data were used as certain subtypes of HD had relatively few deaths. We used Joinpoint to identify an inflection point in the overall trend where significant temporal variation existed in the trend ($p<0.05$), the temporal intervals from which were applied to all subsequent analyses to calculate mean annual percent change (APC). Within each individual model, the slopes of trend intervals between up to three inflection points were used to calculate the annual percent change for each trend segment, and the weighted average of the annual percent change was reported as the mean annual percent change (APC) of AAMR and YPLL before and after 2011 (which was the inflection point identified for total HD during the study period, consistent with previously published trends identified with Joinpoint Regression[5 6 18]), with weights equal to the length of the inter-inflection point annual percent change for each model. APCs based on the linear trend segments identified are dependent on the model-determined number of inflection points (i.e., if the trend is optimized with 0 inflection points, indicating 1 linear trend across the study period, APC before and after 2011 would be the same).

As a secondary analysis, AAMR and YPLL from HF as a contributing cause of cardiovascular death was evaluated using the CDC WONDER multiple cause of death files, in order to more broadly characterize quantify the burden of HF-related mortality. These metrics were calculated as previously described, for deaths defined as any mention of HF (ICD-10 code I50) on death certificates with any cardiovascular disease (I00-I78) listed as underlying cause of death.

This study was determined exempt from review by the Northwestern University institutional review board. As the results are based on publicly available national vital statistics, neither patients nor the general public were directly involved in the conduct of this analysis and direct dissemination is not applicable.

Results

Study Population

Between 1999 and 2018 there were 12.9 million deaths from HD, of whom 49.1% were women, 11.6% were black, and 86.2% were white. From 1999 to 2018, IHD accounted for a declining proportion of total HD deaths (from 73.0% to 55.8%), alongside increasing proportion of total HD from HF (7.6% to 12.8%), HTN HD (3.6% to 9.2%), valvular HD (2.7% to 3.7%), arrhythmia (2.5% to 5.6%), pulmonary HD (1.8% to 2.8%), and other HD (8.7% to 10.3%); see Figure 1. Overall, 2.6% of decedents were <45 years old, 16.3% were 45-64 years old, and 81.2% were ≥65 years old. The proportion of deaths among middle-aged decedents (45-64 years) increased from 13.7% in 1999 to 17.3% in 2018.

Total HD AAMR declined from 267 per 100,000 in 1999, to 164 per 100,000 in 2018 (Table 1). APC of overall HD AAMR declined, from -3.7% per year (95% confidence interval -3.8 to -3.5) before 2011 to -0.7% per year (-1.1 to -0.3) after 2011 for all decedents. AAMR from IHD declined from 195 per 100,000 in 1999, to 109 per 100,000 in 2011, but further declined only to 91 per 100,000 in 2018. The rate of AAMR declines (i.e., APC) from IHD-mortality slowed from -4.7% per year (-5.1 to -4.2) before 2011 to -2.6% per year (-3.3 to -2.0) after 2011. Trends in HF mortality rates reversed and increased (overall APC -1.7% per year [-2.5 to -0.8] before 2011, versus +3.5% per year [+2.6 to +4.5] after 2011), reflecting a decline in AAMR from 20 per 100,000 in 1999, to 17 per 100,000 in 2011, which rose to 21 per 100,000 again by 2018. Overall, APC of HTN HD mortality rates accelerated from +1.2% per year (+0.7 to +1.7) before 2011 to +4.8% per year (+3.3 to +6.3) after 2011. Absolute number of deaths from and AAMR of valvular HD, arrhythmia, and pulmonary HD were relatively low in comparison to IHD, HF, and HTN HD. While AAMR from valvular HD decreased from 2011 to 2018 (from 7 to 6 per 100,000, APC -1.6% per year [-2.8 to -0.4]), AAMR from arrhythmia and pulmonary HD increased to 9 per 100,000 and 5 per 100,000, respectively.

Trends in HD Mortality Rates by Race-Sex

Black men had the highest AAMR from total HD (260 per 100,000 in 2018), which was reflected primarily in high AAMR from IHD (138 per 100,000 in 201), HF (29 per 100,000), and HTN HD (35 per 100,000). Trends in AAMR from total HD and IHD slowed similarly after 2011 in black and white women and men (Figure 2 and Supplemental Table 1). All race-sex groups experienced a reversal of HF mortality trends after 2011; notably, after 2011 APC of HF mortality rates was highest in black men (+4.9% per year [+4.0 to +5.8]) compared to black women, white men, and white women. Acceleration of HTN HD mortality rates was highest in white women (APC +5.6% per year [+4.3 to +7.0]) and white men (APC +6.3% per year [+4.9 to 9.4]) after 2011. Although APC of HTN HD mortality rates was lower in black women and black men, absolute AAMR was higher in black compared to white decedents.

Trends in HD Mortality Rates by Age

AAMR was lowest for decedents <45 years old at time of death (Table 2). In this youngest age stratification, AAMR from any HD was 9 per 100,000 in 2018, predominantly attributable to IHD (AAMR 3 per 100,000 in 2018) and HTN HD (AAMR 1 per 100,000). APC of HTN HD mortality rates declined from +4.8% per year (+3.7 to +5.9) before 2011 to +2.3% per year (+1.9 to +2.8) after 2011. However, APC of HF mortality rates accelerated after 2011, and APC of valvular HD reversed from decreasing to increasing.

For decedents age 45-64 years at time of death (Table 2), AAMR from all HD declined from 1999 to 2011 (from 164 to 121 per 100,000; APC -2.5% per year [-2.8 to -2.2]), but remained generally unchanged between 2011 to 2018 (to 122 per 100,000; APC +0.2%/year [-0.1 to +0.4]). AAMR was highest for IHD (73 per 100,000 in 2018), HTN HD (15 per 100,000 in 2018), and HF (7 per 100,000 in 2018). APC of IHD mortality rates declined after 2011, but accelerated for HTN HD mortality rates (APC +3.0% per year [+2.6 to +3.5]) and HF mortality rates (+5.7% per year [+4.4 to 7.0]).

Decedents aged ≥65 years had the highest AAMR for all types of HD compared to younger decedents (Table 2). AAMR for overall HD declined from 1767 per 100,000 in 1999, to 1116 per 100,000 in 2011 (APC -3.7% per year [-4.3 to -3.1]), but further declined only to 1035 per 100,000 between 2011 to 2018 (APC -1.1% per year [-1.6 to -0.6]). Similar to mortality patterns at younger ages, HTN HD mortality rate trends increased after 2011, and HF mortality rate trends reversed to increasing.

Trends in Years of Potential Life Lost due to Subtypes of HD

Estimated YPLL per 100,000 population is shown in Table 3 and the Supplemental Figure. Total YPLL in the US population was estimated to be 1068 years per 100,000 population in 2018. Of all the HD subtypes, YPLL in 2018 was highest for IHD (578 years per 100,000), followed by HTN HD (132 years per 100,000) then HF (64 years per 100,000). YPLL due to IHD was similar in white and black men, but 1.3-fold higher in black women compared with white women. For IHD, APC of YPLL declined from -3.8% per year (-3.9 to -3.7) overall before 2011 to -1.6% per year (-1.8 to -1.4) after 2011 with similar trends in all race-sex groups. YPLL from HTN HD was 2.9-fold higher in black women (219 years per 100,000) and 2.3-fold higher in black men (305 per 100,000) compared with white women and men in 2018, respectively. However, greater increases in YPLL over the study period was observed in white women (APC +4.2% per year [0.9 to 7.7] after 2011) and white men (+3.3% per year [3.0 to 3.5] after 2011). For HF, YPLL changed from either decreasing or stagnant prior to 2011, to increasing after 2011. Black women and men had a 2-fold higher YPLL due to HF compared with white women and men, with highest APC of YPLL in black women (+5.8% per year [4.5 to 7.2]) and black men (+6.6% per year [5.0 to 8.3]).

Discussion

Changing mortality patterns in HD subtypes in the US are reflected overall by a plateau in total HD AAMR since 2011, within which slowing in declines in IHD mortality rates are coupled with considerable increases in HF and HTN HD deaths in all sex-race groups. In particular, black men had both the highest AAMR and fastest increase in mortality rates due to HF. While HTN HD mortality rates increased for all race-sex groups, fastest increases in HTN HD AAMR were observed in white women and men between 2011-2018. However, AAMR for HTN HD remained about 2 times higher in black compared with white populations by 2018. Our comprehensive estimates of the burden of HD leveraging YPLL translate into approximately 3.5 million potential years of life lost in 2018 due to total HD, but this burden was borne disproportionately in different race-sex groups and attributed to different HD subtypes.

Substantial burden of premature mortality increased from 2 of the top 3 subtypes of HD deaths: HTN HD and HF, reflected by an 80% and a 31% increase in YPLL from HTN HD and HF, respectively, from 1999-2018. While HF AAMR was higher than for HTN HD, YPLL from HTN HD was higher indicating that HTN HD-related deaths are occurring at younger ages. Patterns of AAMR from less common causes of HD (arrhythmia, pulmonary HD, and other HD) were either stagnant or increased from 2011 to 2018. Valvular HD was the only subtype where mortality rates declines accelerated after 2011, although relative burden of deaths from valvular HD remained low.

These findings align with recent data showing contemporaneous slowing in the decline of cardiometabolic disease mortality rates, and recent surveillance of HD mortality that showed that the growth in the population of older Americans age ≥65 years during this time was associated with an increase in the number of HD deaths, despite a stagnant or slowly declining AAMR.[6 11] Our results build on these reports by providing broader and detailed mortality patterns of the range of HD subtypes as underlying causes of death, particularly highlighting the rapid growth and high burden of death overall from HTN HD, increasing HF and HTN HD mortality rates at younger ages reflected in a high magnitude of YPLL from these causes, and worrisome patterns in mortality from arrhythmia and pulmonary HD.

The observed patterns may be due to the growing burden of cardiometabolic risk factors for HD. Obesity, diabetes, and hypertension likely play a sizeable role in the observed changes in recent HD mortality rates in the US, where the prevalence of obesity now exceeds 42%,[19] the prevalence of both prediabetes and diabetes approaches 50%,[20] and the prevalence of hypertension is approximately 30%.[21] Recent trends in assessment of cardiovascular health in the US project continued worsening in prevalences of poor levels of diet quality, physical inactivity, obesity, and diabetes in the coming decades.[22-25] Such trends will likely result in continued increases in HF and HTN HD mortality given their direct association with these cardiometabolic risk factors if current trends continue without intervention.[26-28]

The observed differences in HD mortality by race may partly reflect underlying and pervasive disparities in cardiovascular health and burden of cardiovascular disease.[22] Specifically, obesity, diabetes, and hypertension in the US remain most prevalent in black Americans, and rates of control remain remain lower in black compared with white Americans.[29] Differences in patterns of guideline-recommended medication use, including medication prescription, optimization, and adherence, especially for HTN, likely contribute to racial disparities in HD morbidity and mortality.[30-33] A growing body of evidence supports that racial differences in cardiovascular health and HD mortality are in large part, representative of disparities in many other factors, including a range of social determinants of health and structural and systemic racism that require individual and policy-level changes to address and reduce persistent health inequities.[34 35]

The principal strength of our analysis is investigation of contemporary nationwide mortality data attributed to leading subtypes of HD and differences among race-sex and age subgroups. These data allow for evaluating changes and disparities in cause-specific cardiovascular mortality patterns, which contribute to the observed increases in total HD deaths in the past decade and disproportionally burden black Americans. Limitations of our analysis include incomplete race/ethnic data as our investigation focus on the most reliable data available to evaluate trends in white and black Americans. However, data for disaggregated Asian American subgroups, Hispanic Americans, and Native Americans were either not available or unreliable. Additionally, death certificate data are subject to potential miscoding and misclassification. As the clinical syndrome of HF represents a mode of death frequently attributable to HTN, IHD, valvular HD, or diabetes as the underlying cause,[36] our primary analysis may underestimate the burden of HF-related mortality. Notably, similar patterns were seen in our secondary analysis evaluating trends in mortality rates from HF as a contributing cause of cardiovascular death. Finally, the 'Other HD' category reflects a heterogenous mix of HD that may have dissimilar pathophysiology.

Future research and public health strategies should focus on dissemination and implementation of interventions that focus on prevention of HD in the highest risk populations in order to promote equity, clinical quality improvement to optimize primary and secondary prevention, and policies to improve diet quality and facilitate physical activity. These strategies may help reduce obesity, diabetes, and hypertension prevalence and improve control of these risk factors, and subsequently reduce deaths due to the HD subtypes that account for the majority of HD mortality (i.e., IHD, HF, HTN HD).[37] Ultimately, a comprehensive multi-level, multi-stakeholder approach focused on prevention of modifiable risk factors is urgently needed to curb worrisome trends in HD deaths in the US.

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The lead author Dr. Nilay Shah and senior author Dr. Sadiya Khan affirm that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as originally planned have been explained.

Figure Titles and Legends

Figure 1. Proportion of total heart disease deaths attributable to each heart disease subtype category in the US, 1999-2018. Proportion of total heart disease deaths due to each individual subtype or cateogry. Proportion of HD deaths due to IHD decreased, while proportion of HD deaths due to all other causes increased, predominantly from HF and HTN HD, which were the second and third leading cause of HD death. HF: heart failure, HTN HD: hypertensive heart disease, IHD: ischemic heart disease, Other HD: other heart disease, Pulmonary HD: pulmonary heart disease, Valvular HD: valvular heart disease.

Figure 2. Trends in age-adjusted mortality rate due to leading heart disease subtypes in black and white women and men in the US, 1999-2018. Age-adjusted mortality rates shown for (A) total heart disease, (B) ischemic heart disease, (C) heart failure, and (D) hypertensive heart disease in black and white women and men. Dashed line represents temporal inflection point identified by Joinpoint regression. Average annual percentage change of AAMR before and after 2011 are listed in Supplemental Table 1. AAMR from total HD and IHD plateaued after 2011. AAMR from HF increased after 2011, particularly in black men. Absolute AAMR from HTN HD was highest in black men and women from 1999-2018, but increases in AAMR during this time was fastest in white men and women.

TABLES

Table 1. Trends in age-adjusted mortality rate attributed to each heart disease subtype in the total US population, 1999-2018

	Age-adjusted mortality rate (per 100,000)			Mean Annual Percent Change (95% CI)	
	1999 (N = 725,192)	**2011** (N = 596,577)	**2018** (N = 655,381)	**1999-2011**	**2011-2018**
Total Heart Disease	266.5	173.7	163.6	-3.7 (-3.8, -3.5)*	-0.7 (-1.1, -0.3)*
Ischemic Heart Disease	194.6	109.2	90.9	-4.7 (-5.1, -4.2)*	-2.6 (-3.3, -2.0)*
Heart Failure	20.3	16.9	20.8	-1.7 (-2.5, -0.8)*	3.5 (2.6, 4.5)*
Hypertensive Heart Disease	9.6	10.8	15.1	1.2 (0.7, 1.7)*	4.8 (3.3, 6.3)*
Valvular Heart Disease	7.2	6.7	6.1	-0.4 (-0.6, -0.1)*	-1.6 (-2.8, -0.4)*
Arrhythmia	6.7	8.2	9.1	1.7 (1.4, 2.0)*	1.7 (1.4, 2.0)*
Pulmonary Heart Disease	4.8	4.2	4.6	-0.9 (-2.1, 0.2)	1.5 (1.0, 1.9)*
Other Heart Disease	23.2	17.8	17.1	-2.0 (-2.3, -1.6)*	-0.7 (-1.0, -0.4)*

CI: Confidence interval.
*Indicates that the mean annual percent change is significantly different from zero, $p<0.05$. Mean annual percentage change shown for AAMR for the specified time range.

Table 2. Trends in age-adjusted mortality rate attributed to each heart disease subtype by age at death in the total US population, 1999-2018

Heart disease subtype	Age at Death	Age-adjusted mortality rates per 100,000			Mean Annual Percent Change (95% CI)	
		1999	2011	2018	1999-2011	2011-2018
Total Heart Disease	<45	10.3	9.0	8.7	-1.0 (-1.5, -0.5)*	-0.3 (-0.7, 0.1)
	45-64	164.1	121.0	122.3	-2.5 (-2.8, -2.2)*	0.2 (-0.1, 0.4)
	≥65	1767.0	1115.6	1034.6	-3.7 (-4.3, -3.1)*	-1.1 (-1.6, -0.6)*
Ischemic Heart Disease	<45	4.9	3.8	3.2	-1.9 (-2.6, -1.3)*	-2.3 (-2.7, -1.9)*
	45-64	121.1	79.3	73.1	-3.4 (-3.6, -3.3)*	-1.4 (-1.6, -1.2)*
	≥65	1301.6	704.7	573.8	-4.9 (-5.4, -4.4)*	-3.0 (-3.4, -2.3)*
Heart Failure	<45	0.2	0.3	0.4	2.8 (0.5, 5.0)*	5.1 (2.7, 7.6)*
	45-64	4.8	4.5	6.8	-0.6 (-1.2, -0.1)*	5.7 (4.4, 7.0)*
	≥65	150.8	124.5	150.4	-1.7 (-2.6, -0.9)*	3.3 (2.4, 4.3)*
Hypertensive Heart Disease	<45	0.7	1.2	1.4	4.8 (3.7, 5.9)*	2.3 (1.9, 2.8)*
	45-64	8.1	12.1	15.2	3.9 (2.1, 5.6)*	3.0 (2.6, 3.5)*
	≥65	57.6	58.0	85.5	0.3 (-0.2, 0.8)	5.4 (3.6, 7.2)*
Valvular Heart Disease	<45	0.3	0.2	0.3	-3.9 (-6.0, -1.8)*	7.1 (1.4, 13.2)*
	45-64	2.5	2.1	2.2	-1.6 (-3.2, 0.1)	1.0 (-2.0, 4.0)
	≥65	51.0	48.1	42.7	-0.3 (-0.5, 0.0)*	-1.9 (-3.2, -0.6)*
Arrhythmia	<45	0.4	0.4	0.4	-0.3 (-1.0, 0.4)	-0.3 (-1.0, 0.4)
	45-64	3.2	3.4	3.9	0.5 (-0.9, 2.0)	2.2 (1.0, 3.4)*
	≥65	45.7	56.6	63.1	1.8 (1.5, 2.1)*	1.8 (1.5, 2.1)*
Pulmonary Heart Disease	<45	0.9	0.7	0.7	-1.8 (-3.0, -0.6)*	0.3 (-0.9, 1.5)
	45-64	4.6	4.0	4.3	-1.8 (-2.5, -1.0)*	1.4 (0.4, 2.4)*
	≥65	25.7	23.0	25.3	-0.7 (-2.1, 0.7)	1.7 (1.1, 2.2)*
Other Heart Disease	<45	2.8	2.4	2.4	-1.3 (-1.7, -1.0)*	-0.1 (-1.0, 0.8)
	45-64	19.8	15.6	16.6	-1.9 (-2.6, -1.2)*	0.9 (0.5, 1.4)*
	≥65	134.5	100.7	93.8	-2.2 (-2.6, -1.7)*	-1.0 (-1.3, -0.6)*

CI: Confidence interval. *Indicates that the mean annual percent change is significantly different from zero, p<0.05. Mean annual percentage change shown for AAMR for the specified time range.

Table 3. Trends in age-standardized years of potential life lost per 100,000 population due to each HD category in the total population and race-sex subgroups in the US, 1999-2018

Heart disease subtype	Race-Sex Group	Years of Potential Life Lost (per 100,000 population)			Mean Annual Percent Change (95% CI)	
		1999	2011	2018	1999-2011	2011-2018
Total Heart Disease	Total	1494	1080	1068	-2.7 (-2.9, -2.6)*	0.1 (-0.2, 0.4)
	Black women	1824	1215	1210	-3.5 (-3.8, -3.3)*	-0.1 (-0.7, 0.6)
	White women	1064	754	744	-2.8 (-3.0, -2.7)*	0.1 (-0.3, 0.4)
	Black men	2183	1549	1602	-2.7 (-3.3, -2.2)*	0.3 (-0.3, 0.9)
	White men	1677	1244	1205	-2.5 (-2.6, -2.3)*	-0.5 (-0.7, -0.2)*
Ischemic Heart Disease	Total	1025	645	578	-3.8 (-3.9, -3.7)*	-1.6 (-1.8, -1.4)*
	Black women	983	543	479	-5.0 (-5.5, -4.4)*	-1.6 (-2.0, -1.1)*
	White women	696	418	373	-4.1 (-4.3, -3.9)*	-1.5 (-1.9, -1.1)*
	Black men	1254	770	716	-3.8 (-4.3, -3.3)*	-1.1 (-1.7, -0.5)*
	White men	1247	816	723	-3.5 (-3.7, -3.4)*	-1.7 (-2.0, -1.5)*
Heart Failure	Total	49	45	64	-1.0 (-1.7, -0.3)*	5.5 (4.8, 6.1)*
	Black women	79	70	103	-1.2 (-2.4, 0.1)	5.8 (4.5, 7.2)*
	White women	50	43	53	-1.4 (-2.9, 0.1)	3.9 (2.6, 5.2)*
	Black men	71	74	116	0.8 (-0.8, 2.5)	6.6 (5.0, 8.3)*
	White men	43	39	57	-0.9 (-1.4, -0.5)*	5.5 (4.5, 6.6)*
Hypertensive Heart Disease	Total	73	107	132	3.4 (2.6, 4.2)*	3.2 (2.4, 4.1)*
	Black women	210	207	219	0.0 (-0.4, 0.3)	0.0 (-0.4, 0.3)
	White women	39	57	76	3.4 (2.5, 4.3)*	4.2 (0.9, 7.7)*
	Black men	237	271	305	1.6 (0.7, 2.5)*	0.6 (0.2, 0.9)*
	White men	57	105	134	5.4 (4.7, 6.0)*	3.3 (3.0, 3.5)*
All Other Heart Disease	Total	346	283	293	-1.6 (-2.0, -1.3)*	0.5 (-0.7, 1.7)
	Black women	551	394	409	-2.7 (-3.1, -2.4)*	0.4 (-0.4, 1.2)
	White women	279	236	241	-1.5 (-1.8, -1.1)*	0.8 (0.2, 1.3)*
	Black men	620	435	465	-2.7 (-3.9, -1.5)*	0.7 (0.1, 1.4)*
	White men	331	284	291	-1.1 (-1.4, -0.8)*	0.3 (0.0, 0.7)

CI: Confidence interval. Mean annual percentage change shown for YPLL for the specified time range.
*Indicates that the mean annual percent change is significantly different from zero, $p<0.05$.

FIGURES

Figure 1. Proportion of total heart disease deaths attributable to each heart disease subtype category in the US, 1999-2018

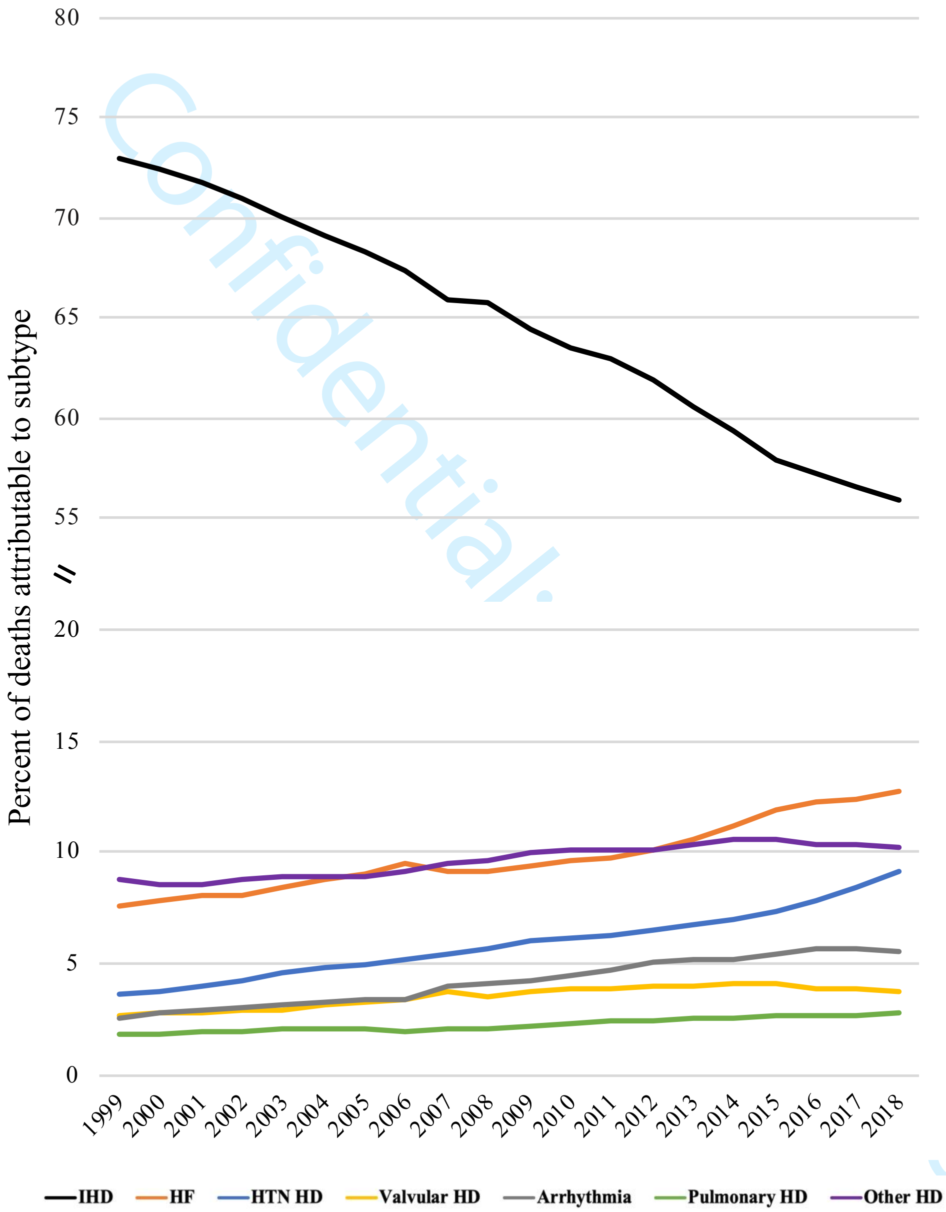
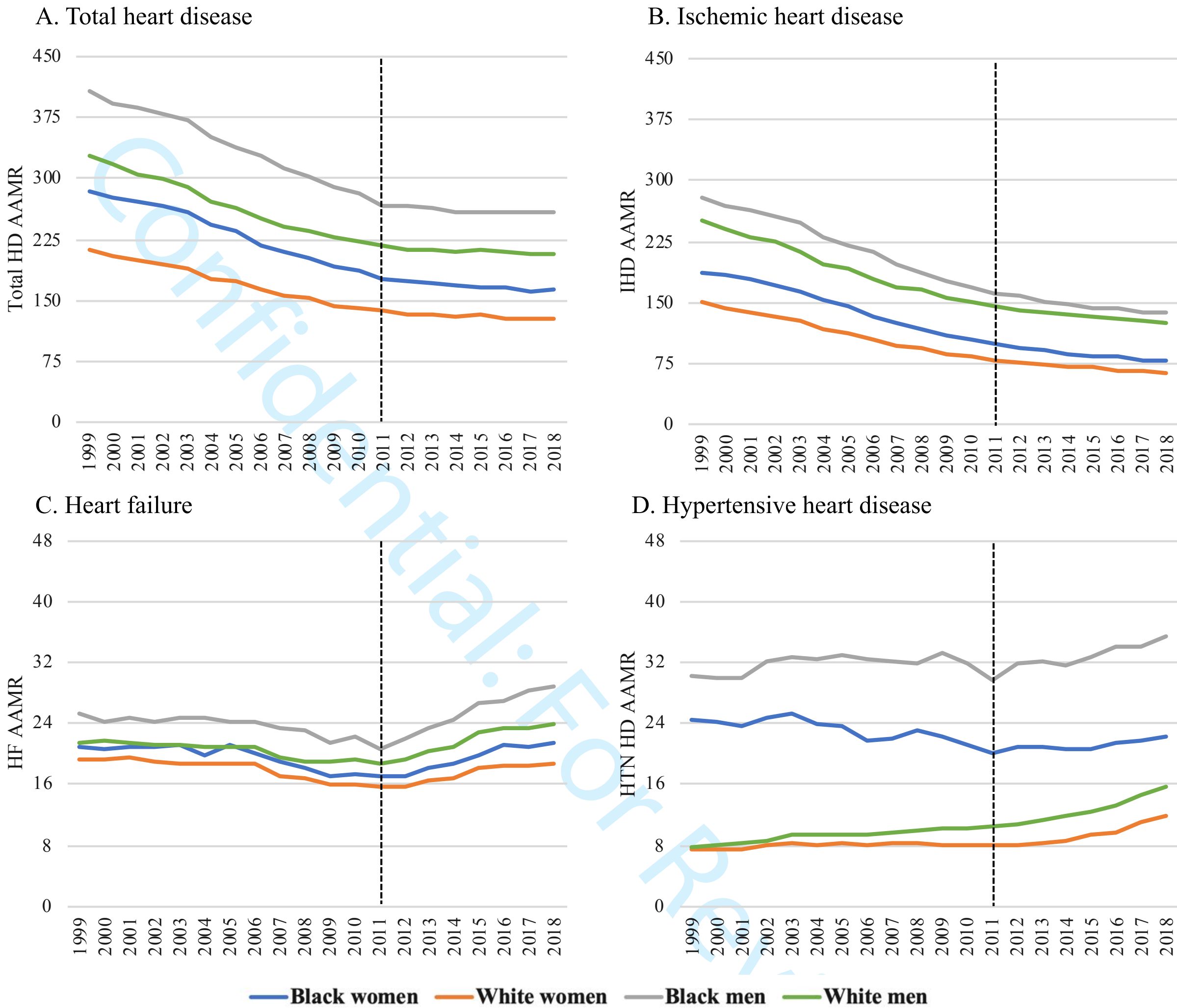


Figure 2. Trends in age-adjusted mortality rate due to leading heart disease subtypes in black and white women and men in the US, 1999-2018.



Heterogeneous Trends in Burden of Heart Disease Mortality by Subtypes in the United States, 1999-2018: Observational Analysis of Vital Statistics

Supplementary Material

Supplemental Table 1. Cause-specific age-adjusted heart disease mortality rate trends in race-sex subgroups of all ages, 1999-2018

Heart disease subtype	Race-Sex Group	AAMR per 100,000			Mean Annual Percent Change (95% CI)	
		1999	2011	2018	1999-2011	2011-2018
Total Heart Disease	Black women	283.7	176.2	162.2	-3.9 (-4.3, -3.5)*	-1.2 (-1.6, -0.8)*
	White women	212.8	136.5	126.6	-3.8 (-4.1, -3.6)*	-0.9 (-1.3, -0.4)*
	Black men	407.2	266.1	259.5	-3.4 (-3.6, -3.2)*	-0.5 (-1.0, 0.0)
	White men	327.1	216.9	206.3	-3.4 (-3.9, -2.9)*	-0.6 (-1.0, -0.3)*
Ischemic Heart Disease	Black women	188.0	99.7	77.9	-5.3 (-5.6, -4.9)*	-3.3 (-3.7, -3.0)*
	White women	150.5	80.1	63.7	-5.1 (-5.6, -4.6)*	-3.3 (-3.7, -2.9)*
	Black men	278.7	161.5	138.1	-4.4 (-4.7, -4.1)*	-2.3 (-2.9, -1.7)*
	White men	251.2	146.5	125.6	-4.4 (-4.8, -3.9)*	-2.2 (-2.6, -1.9)*
Heart Failure	Black women	20.9	17.0	21.5	-1.6 (-2.5, -0.7)*	3.5 (2.8, 4.2)*
	White women	19.3	15.8	18.7	-1.7 (-2.5, -0.9)*	2.6 (2.1, 3.2)*
	Black men	25.3	20.7	28.9	-1.3 (-2.2, -0.4)*	4.9 (4.0, 5.8)*
	White men	21.4	18.8	23.8	-1.3 (-1.7, -0.9)*	3.8 (2.8, 4.8)*
Hypertensive Heart Disease	Black women	24.4	20.2	22.3	-1.4 (-1.8, -1.0)*	0.7 (-1.0, 2.3)
	White women	7.4	8.1	11.8	0.9 (0.5, 1.3)*	5.6 (4.3, 7.0)*
	Black men	30.2	29.7	35.3	0.3 (-0.5, 1.1)	1.8 (0.9, 2.6)*
	White men	7.8	10.4	15.7	2.5 (2.0, 3.0)*	6.3 (4.9, 9.4)*
Valvular Heart Disease	Black women	5.1	4.0	3.8	-1.8 (-2.1, -1.5)*	-1.8 (-2.1, -1.5)*
	White women	7.1	6.7	6.1	-0.4 (-0.6, -0.2)*	-1.5 (-2.5, -0.4)*
	Black men	5.4	4.2	4.2	-1.5 (-2.0, -0.9)*	-1.5 (-2.0, -0.9)*
	White men	7.8	7.6	6.9	0.1 (-0.2, 0.4)	-1.6 (-3.1, 0.0)
Arrhythmia	Black women	6.5	6.5	7.0	0.4 (-1.4, 2.3)	0.9 (-0.1, 1.9)
	White women	6.2	8.1	8.8	2.0 (1.7, 2.3)*	2.0 (1.7, 2.3)*
	Black men	8.9	8.2	9.3	0.1 (-0.3, 0.5)	0.1 (-0.3, 0.5)
	White men	7.4	8.5	10.1	1.0 (0.5, 1.6)*	2.7 (2.3, 3.2)*
Pulmonary Heart Disease	Black women	8.9	7.0	8.3	-1.5 (-2.2, -0.8)*	1.1 (0.4, 1.8)*
	White women	4.6	4.3	4.6	-0.7 (-1.5, -0.2)*	1.4 (1.1, 1.8)*
	Black men	8.4	6.4	7.3	-2.1 (-3.0, -1.2)*	1.3 (0.2, 2.4)*
	White men	4.5	3.7	4.1	-1.8 (-2.5, -1.0)*	2.1 (1.1, 3.0)*
Other Heart Disease	Black women	29.9	21.7	21.3	-2.4 (-2.7, -2.1)*	-0.7 (-1.5, 0.1)
	White women	17.6	13.4	12.8	-2.2 (-2.7, -1.7)*	-0.6 (-2.6, 1.6)
	Black men	50.2	35.4	36.4	-2.5 (-2.9, -2.2)*	0.1 (-0.8, 0.9)
	White men	27.1	21.4	20.2	-1.8 (-2.2, -1.4)*	-0.7 (-1.0, -0.4)*

CI: Confidence interval. AAMR: Age-adjusted mortality rate per 100,000 population. Mean annual percentage change shown for AAMR for the specified time range. *Indicates that the mean annual percent change is significantly different from zero, p<0.05.

Supplemental Table 2. Cause-specific age-adjusted heart disease mortality rate trends in race-sex subgroups, in decedents <45 years of age, 1999-2018

Heart disease subtype		AAMR per 100,000			Mean Annual Percent Change (95% CI)	
		1999	2011	2018	1999-2011	2011-2018
Total Heart Disease	Black women	15.6	12.2	12.1	-2.2 (-2.7, -1.8)*	0.0 (-1.2, 1.3)
	White women	5.2	4.9	4.9	-0.7 (-1.2, -0.3)*	0.5 (-0.3, 1.3)
	Black men	27.4	22.6	23.4	-1.0 (-1.2, -0.7)*	-1.0 (-1.2, -0.7)*
	White men	12.5	11.1	10.2	-1.0 (-1.5, -0.4)*	-0.9 (-1.6, -0.1)*
Ischemic Heart Disease	Black women	4.9	3.2	3.0	-2.8 (-3.3, -2.3)*	-2.8 (-3.3, -2.3)*
	White women	2.0	1.7	1.5	-0.8 (-2.1, 0.4)	-2.2 (-4.6, 0.2)
	Black men	11.3	8.4	7.8	-2.0 (-2.3, -1.7)*	-2.0 (-2.3, -1.7)*
	White men	7.2	5.6	4.4	-2.1 (-2.6, -1.5)*	-3.2 (-3.4, -3.0)*
Heart Failure	Black women	0.5	0.7	0.8	2.1 (-5.0, 9.6)	1.7 (-1.9, 5.5)
	White women	0.1	0.1	0.2	0.2 (-2.8, 3.2)	0.2 (-2.8, 3.2)
	Black men	0.7	1.0	1.7	2.8 (0.0, 5.6)*	8.8 (5.7, 12.0)*
	White men	0.2	0.2	0.4	2.8 (1.4, 4.2)*	2.8 (1.4, 4.2)*
Hypertensive Heart Disease	Black women	2.2	2.6	2.6	0.6 (0.1, 1.1)*	0.6 (0.1, 1.1)*
	White women	0.2	0.4	0.6	4.7 (3.6, 5.8)*	4.7 (3.6, 5.8)*
	Black men	3.6	4.6	5.1	1.8 (1.3, 2.3)*	1.8 (1.3, 2.3)*
	White men	0.7	1.2	1.5	5.2 (3.7, 6.7)*	2.7 (2.0, 3.3)*
Valvular Heart Disease	Black women	0.5	0.4	0.3	-4.5 (-6.1, -2.8)*	-4.5 (-6.1, -2.8)*
	White women	0.3	0.2	0.2	-0.2 (-1.9, 1.5)	-0.2 (-1.9, 1.5)
	Black men	0.6	0.3	0.5	-4.1 (-5.6, -2.5)*	3.6 (-4.9, 12.8)
	White men	0.3	0.3	0.3	-0.1 (-0.1, -0.1)*	0.8 (0.8, 0.8)*
Arrhythmia	Black women	0.6	0.4	0.4	-1.6 (-2.8, -0.4)*	-1.6 (-2.8, -0.4)*
	White women	0.3	0.3	0.3	-0.4 (-1.6, 0.8)	-0.4 (-1.6, 0.8)
	Black men	0.8	0.9	0.8	0.2 (-0.6, 1.1)	0.2 (-0.6, 1.1)
	White men	0.4	0.4	0.4	-0.5 (-4.6, 3.9)	0.1 (-1.1, 1.3)
Pulmonary Heart Disease	Black women	2.2	1.7	1.8	-1.0 (-1.6, -0.3)*	-1.0 (-1.6, -0.3)*
	White women	0.8	0.7	0.7	-2.1 (-3.6, -0.7)*	0.5 (-1.2, 2.3)
	Black men	1.5	1.3	1.4	-0.8 (-1.8, 0.2)	-0.8 (-1.8, 0.2)
	White men	0.7	0.5	0.6	-1.7 (-2.7, -0.8)*	3.2 (1.3, 5.1)*
Other Heart Disease	Black women	4.7	3.3	3.2	-3.1 (-3.7, -2.5)*	-0.7 (-2.2, 0.9)
	White women	1.5	1.4	1.4	0.1 (-0.5, 0.3)	0.1 (-0.5, 0.3)
	Black men	8.8	6.0	6.1	-2.6 (-5.1, 0.0)*	-0.4 (-0.4, 1.2)
	White men	3.0	2.9	2.6	-0.8 (-1.0, -0.5)*	-0.8 (-1.0, -0.5)*

CI: Confidence interval. AAMR: Age-adjusted mortality rate per 100,000 population. Mean annual percentage change shown for AAMR for the specified time range. Total includes all decedents of all race/ethnicity groups. *Indicates that the mean annual percent change is significantly different from zero, p<0.05.

Supplemental Table 3. Cause-specific age-adjusted heart disease mortality rate trends in race-sex subgroups, in decedents age 45-64 years, 1999-2018

Heart disease subtype		AAMR per 100,000			Mean Annual Percent Change (95% CI)	
		1999	2011	2018	1999-2011	2011-2018
Total Heart Disease	Black women	209.1	137.8	140.9	-3.4 (-4.2, -2.6)*	0.3 (-0.4, 1.0)
	White women	83.7	63.1	64.5	-2.2 (-2.5, -2.0)*	0.5 (0.1, 0.9)*
	Black men	414.1	278.8	288.1	-3.3 (-3.6, -3.1)*	0.3 (-0.3, 0.9)
	White men	222.2	166.2	165.3	-2.4 (-2.7, -2.1)*	-0.1 (-0.4, 0.2)
Ischemic Heart Disease	Black women	124.6	70.3	63.9	-4.9 (-5.6, -4.1)*	-1.2 (-1.8, -0.6)*
	White women	57.7	37.9	35.6	-3.3 (-3.5, -3.0)*	-0.8 (-1.2, -0.3)*
	Black men	273.2	160.4	149.7	-4.2 (-4.6, -3.8)*	-1.1 (-1.6, -0.5)*
	White men	176.0	118.3	108.3	-3.2 (-3.4, -3.0)*	-1.4 (-1.7, -1.2)*
Heart Failure	Black women	9.0	7.9	12.3	-1.2 (-3.0, 0.6)	7.0 (5.1, 8.9)*
	White women	3.2	3.0	4.0	-1.5 (-2.2, -0.7)*	4.5 (2.7, 6.4)*
	Black men	14.1	13.4	21.0	0.4 (-1.1, 2.0)	6.5 (4.9, 8.2)*
	White men	5.1	4.8	7.3	-0.6 (-1.3, 0.1)	5.8 (4.2, 7.5)*
Hypertensive Heart Disease	Black women	24.7	23.5	26.1	0.0 (-1.4, 0.5)	0.0 (-1.4, 0.5)
	White women	3.5	5.5	7.2	4.1 (3.7, 4.5)*	4.1 (3.7, 4.5)*
	Black men	41.0	45.8	51.4	1.3 (-0.4, 2.9)	1.0 (0.4, 1.6)*
	White men	7.3	13.6	17.6	5.6 (4.9, 6.3)*	3.6 (3.3, 3.9)*
Valvular Heart Disease	Black women	4.1	2.7	1.7	-2.4 (-3.1, -1.6)*	-2.4 (-3.1, -1.6)*
	White women	1.9	1.5	1.6	-1.6 (-2.2, -1.1)*	0.7 (-0.6, 1.9)
	Black men	5.2	3.7	4.0	-2.4 (-3.2, -1.6)*	-2.4 (-3.2, -1.6)*
	White men	2.7	2.7	2.7	0.1 (-0.3, 0.6)	0.1 (-0.3, 0.6)
Arrhythmia	Black women	4.5	4.1	4.6	-0.1 (-0.7, 0.6)	-0.1 (-0.7, 0.6)
	White women	2.1	2.5	2.5	1.2 (0.7, 1.7)*	1.2 (0.7, 1.7)*
	Black men	7.9	6.7	8.4	-1.8 (-2.9, -0.7)*	3.2 (1.5, 5.0)*
	White men	3.9	4.1	5.1	0.5 (-0.3, 1.3)	3.4 (2.6, 4.1)*
Pulmonary Heart Disease	Black women	11.3	8.4	8.7	-2.0 (-3.0, -0.9)*	0.8 (-0.3, 1.8)
	White women	4.2	3.6	3.7	-2.1 (-2.8, -1.4)*	1.6 (-0.3, 3.6)
	Black men	9.9	8.1	8.3	-2.1 (-3.1, -1.2)*	1.9 (0.7, 3.1)*
	White men	4.4	3.8	4.1	-1.4 (-2.2, -0.6)*	1.9 (1.1, 2.7)*
Other Heart Disease	Black women	31.2	21.1	22.7	-2.7 (-3.2, -2.1)*	0.5 (-0.9, 1.9)
	White women	11.2	9.2	9.6	-1.3 (-1.8, -0.8)*	1.0 (0.5, 1.5)*
	Black men	63.5	41.2	45.2	-3.0 (-3.4, -2.6)*	1.0 (0.0, 2.0)*
	White men	23.1	19.1	20.1	-1.3 (-1.7, -0.9)*	0.4 (0.0, 0.7)*

CI: Confidence interval. AAMR: Age-adjusted mortality rate per 100,000 population. Mean annual percentage change shown for AAMR for the specified time range. *Indicates that the mean annual percent change is significantly different from zero, $p<0.05$.

Supplemental Table 4. Cause-specific age-adjusted heart disease mortality rate trends in race-sex subgroups, in decedents ≥65 years of age, 1999-2018

HD subtype		AAMR per 100,000			Mean Annual Percent Change (95% CI)	
		1999	2011	2018	1999-2011	2011-2018
Total Heart Disease	Black women	1797.1	1089.0	973.7	-4.1 (-4.5, -3.7)*	-1.6 (-2.0, -1.2)*
	White women	1509.8	943.7	863.1	-4.1 (-4.3, -3.8)*	-1.1 (-1.7, -0.6)*
	Black men	2353.2	1499.5	1426.5	-3.6 (-3.9, -3.4)*	-0.9 (-1.2, -0.6)*
	White men	2133.2	1366.5	1289.3	-4.2 (-4.2, -3.1)*	-0.8 (-1.1, -0.4)*
Ischemic Heart Disease	Black women	1243.0	649.2	489.0	-5.2 (-5.6, -4.9)*	-4.0 (-4.5, -3.5)*
	White women	1079.3	558.0	434.1	-5.5 (-5.9, -5.0)*	-3.4 (-3.9, -2.9)*
	Black men	1667.2	952.4	789.1	-4.7 (-5.1, -4.2)*	-2.7 (-3.2, -2.3)*
	White men	1641.3	922.5	780.7	-4.7 (-5.2, -4.2)*	-2.4 (-2.8, -2.0)*
Heart Failure	Black women	146.6	117.3	144.3	-1.8 (-2.7, -0.8)*	3.2 (2.4, 4.0)*
	White women	146.3	118.7	140.0	-1.8 (-2.6, -0.9)*	2.6 (2.0, 3.1)*
	Black men	171.7	135.2	183.1	-1.7 (-2.2, -1.3)*	4.1 (3.1, 5.2)*
	White men	159.0	139.1	173.6	-1.3 (-1.8, -0.9)*	3.6 (2.6, 4.7)*
Hypertensive Heart Disease	Black women	138.5	105.7	117.6	-2.0 (-2.4, -1.6)*	0.6 (-1.0, 2.3)
	White women	51.6	52.2	77.8	0.3 (0.0, 0.6)	5.8 (4.3, 7.3)*
	Black men	148.5	130.4	162.9	-0.6 (-2.4, 1.2)	2.5 (1.4, 3.6)*
	White men	45.3	51.8	85.1	1.2 (0.6, 1.9)*	7.4 (5.7, 9.1)*
Valvular Heart Disease	Black women	30.7	24.8	24.3	-1.5 (-1.9, -1.2)*	-1.5 (-1.9, -1.2)*
	White women	51.5	49.2	44.1	-0.3 (-0.5, 0.1)*	-1.7 (-2.9, -0.5)*
	Black men	30.6	25.0	23.7	-1.1 (-1.7, -0.4)*	-1.1 (-1.7, -0.4)*
	White men	55.3	54.1	47.8	0.1 (-0.2, 0.5)	-1.9 (-3.6, -0.1)*
Arrhythmia	Black women	40.1	42.2	45.5	0.7 (-1.3, 2.6)	1.0 (-0.1, 2.0)
	White women	44.0	58.7	64.1	2.1 (1.8, 2.4)*	2.1 (1.8, 2.4)*
	Black men	52.5	48.5	54.4	0.1 (-0.4, 0.6)	0.1 (-0.4, 0.6)
	White men	49.2	57.8	68.9	1.2 (0.6, 1.8)*	2.8 (2.3, 3.3)*
Pulmonary Heart Disease	Black women	42.4	33.5	40.9	-1.3 (-2.1, -0.5)*	2.2 (0.7, 3.8)*
	White women	25.9	25.3	26.2	0.0 (-1.3, 1.3)	1.5 (1.2, 1.8)*
	Black men	45.1	32.6	35.9	-2.1 (-3.4, -0.9)*	0.9 (-0.6, 2.5)
	White men	26.6	21.7	22.3	-1.8 (-2.7, -0.9)*	2.1 (1.0, 3.2)*
Other Heart Disease	Black women	157.7	117.3	112.1	-2.3 (-2.6, -1.9)*	-1.1 (-1.9, -0.3)*
	White women	112.3	82.6	76.9	-2.5 (-3.0, -1.9)*	-1.0 (-3.2, 1.1)
	Black men	240.5	176.8	177.3	-2.4 (-2.8, -1.9)*	-0.1 (-1.2, 1.0)
	White men	158.5	120.9	111.0	-2.1 (-2.6, -1.6)*	-1.0 (-1.4, -0.6)*

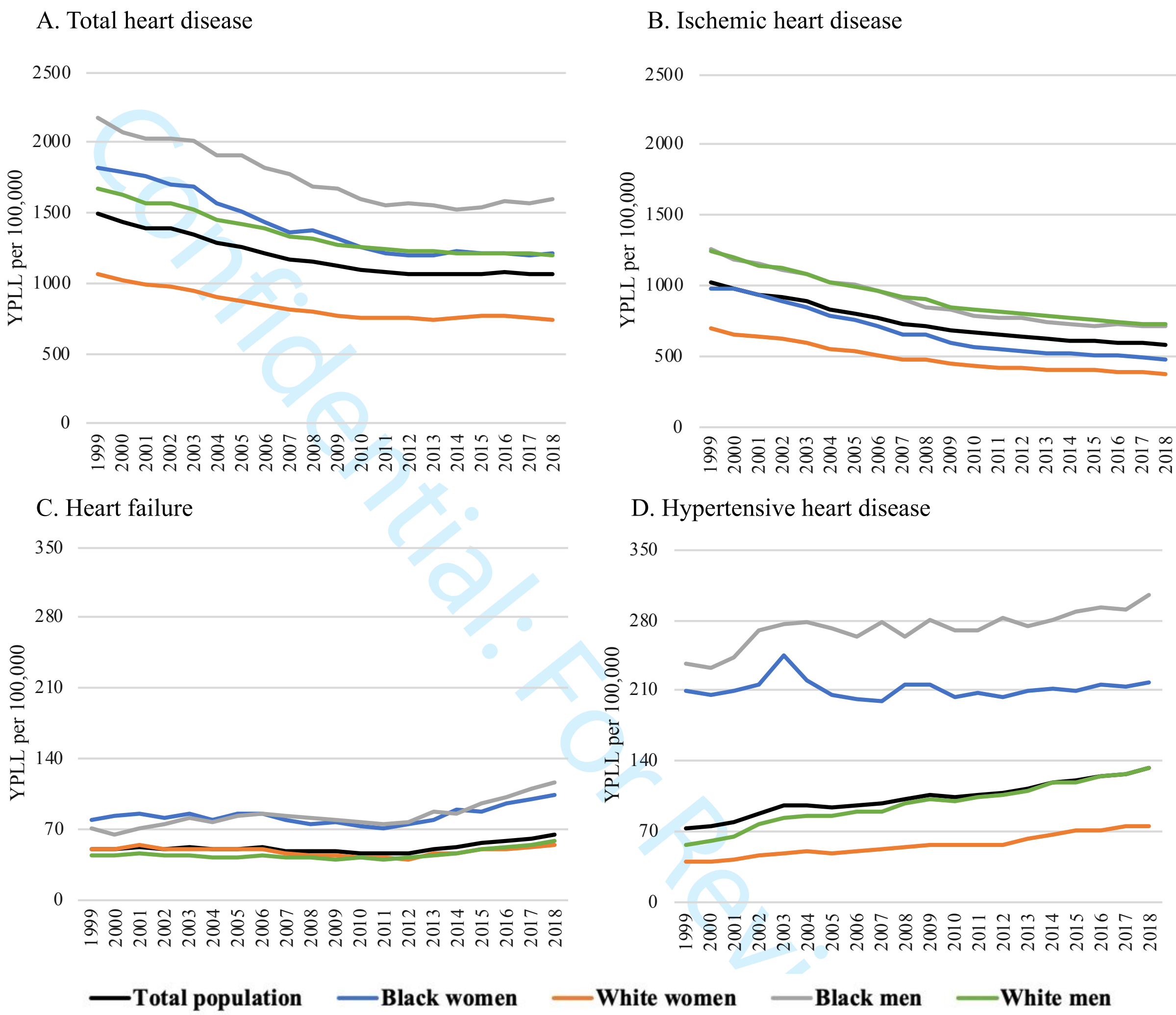
CI: Confidence interval. AAMR: Age-adjusted mortality rate per 100,000 population. Mean annual percentage change shown for AAMR for the specified time range. *Indicates that the mean annual percent change is significantly different from zero, $p<0.05$.

Supplemental Table 5. Heart failure-related cardiovascular mortality trends by race, sex, and age, 1999-2018

	Race-Sex Group	AAMR or YPLL per 100,000			Mean Annual Percent Change (95% CI)	
		1999	2011	2018	1999-2011	2011-2018
AAMR (All Ages)	Total	74.6	53.3	58.1	-2.8 (-3.5, -2.1)*	1.3 (0.6, 1.9)*
	Black women	67.6	48.5	53.3	-2.9 (-3.7, -2.2)*	1.7 (0.8, 2.6)*
	White women	67.5	47.3	50.3	-3.0 (-4.0, -2.1)*	0.9 (0.1, 1.7)*
	Black men	82.1	61.3	73.6	-2.4 (-2.8, -1.9)*	2.7 (2.2, 3.2)*
	White men	86.3	63.2	70.4	-2.5 (-3.2, -1.9)*	1.5 (1.2, 1.9)*
AAMR (<45)	Total	0.8	0.9	1.2	0.0 (-1.4, 1.4)	4.9 (3.1, 6.7)*
	Black women	1.9	1.7	2	-0.6 (-1.2, 0.0)*	2.0 (0.9, 3.2)*
	White women	0.5	0.5	0.6	-1.5 (-2.9, -0.2)*	4.2 (1.5, 6.9)*
	Black men	2.6	3.1	4.3	1.1 (-1.4, 3.7)	4.8 (2.8, 6.9)*
	White men	0.8	0.8	1.1	-0.1 (-1.9, 1.8)	4.5 (2.8, 6.3)*
AAMR (45-64)	Total	20.1	15.1	20.2	-2.5 (-2.8, -2.3)*	4.3 (3.7, 5.0)*
	Black women	32	25.1	32	-2.1 (-3.1, -1.0)*	3.8 (2.7, 4.9)*
	White women	12.3	8.9	11.1	-3.2 (-3.7, -2.8)*	3.7 (2.6, 4.8)*
	Black men	52.8	41.4	58	-1.6 (-2.5, -0.7)*	4.8 (3.8, 5.9)*
	White men	24.1	17.6	23.6	-2.7 (-3.0, -2.5)*	4.5 (3.9, 5.1)*
AAMR (≥65)	Total	550.5	390.6	418.4	-2.9 (-3.6, -2.1)*	1.0 (0.4, 1.6)*
	Black women	468.7	330.8	354.8	-3.1 (-3.9, -2.3)*	1.4 (0.5, 2.3)*
	White women	510	356.2	375.4	-3.0 (-4.0, -2.1)*	0.8 (0.0, 1.6)*
	Black men	543.7	396.4	458.6	-2.6 (-3.1, -2.1)*	2.2 (1.6, 2.8)*
	White men	636	465.3	509.9	-2.6 (-3.3, -1.8)*	1.3 (0.9, 1.7)*
YPLL	Total	203	150	189	-2.8 (-3.1, -2.5)*	3.7 (3.3, 4.1)*
	Black women	284	218	268	-2.3 (-3.1, 1.6)*	3.3 (2.5, 4.1)*
	White women	189	131	152	-3.2 (-4.3, -2.1)*	2.3 (1.4, 3.2)*
	Black men	257	226	312	-1.0 (-1.8, -0.2)*	4.8 (3.9, 5.7)*
	White men	195	140	178	-2.9 (-3.1, -2.7)*	3.9 (3.4, 4.3)*

CI: Confidence interval. AAMR: Age-adjusted mortality rate per 100,000 population. YPLL: Years of potential life lost per 100,000 population. Mean annual percentage change shown for AAMR or YPLL for the specified time range. *Indicates that the mean annual percent change is significantly different from zero, $p<0.05$.

Supplemental Figure. Cause-specific age-standardized years of potential life lost per 100,000 population in the total and race-sex subgroup populations in the US, 1999-2018



Years of potential life lost (YPLL) per 100,000 shown for (A) total heart disease, (B) ischemic heart disease, (C) heart failure, and (D) hypertensive heart disease, in black and white women and men. Average annual percentage change of YPLL before and after 2011 are listed in Table 3.