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Trends in Mortality Rates by Subtypes of Heart Disease in the United States, 2000-2010

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Despite considerable information on overall heart disease (HD) and coronary HD (CHD) mortality trends,[1] less is known about trends for other HD subtypes. This study examines the contributions of HD subtypes to overall HD mortality trends during 2000–2010.

Methods

Mortality data were obtained from the US Centers for Disease Control and Prevention WONDER database, which contains death certificate information collected, via the National Vital Statistics System, from every US state and the District of Columbia.[2] Deaths were included that occurred during 2000–2010 among US residents aged 35 years or older with an underlying cause of death *International Classification of Diseases, Tenth Revision* code for CHD, heart failure, hypertensive HD (HHD), valvular HD, arrhythmia, pulmonary HD, or other HD (Table). This study was determined to be exempt from review by an institutional review board.

Each HD subtype's percentage contribution to total HD deaths was calculated by age group. Mortality rates were direct age standardized to the 2000 US standard population[2] and stratified by subtype, sex, non-Hispanic white and non-Hispanic black, and age group; temporal trends were characterized by fitting log-linear regression models using Joinpoint software version 4.0.1 (National Cancer Institute).[3] Joinpoint identifies trend breaks if significant variation in trends exist ($P < .05$).[3]

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Author Contributions: Dr Ritchey had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Study concept and design: All authors.

Acquisition, analysis, or interpretation of data: Ritchey, Bowman, Hong.

Drafting of the manuscript: Ritchey, Hong.

Critical revision of the manuscript for important intellectual content: All authors.

Statistical analysis: Ritchey.

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Study supervision: Loustalot, Hong.

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The slopes of the models were used to calculate annual percent change (APC) for each trend segment and the average APC (AAPC), which is the weighted average of the APCs. Statistical significance of AAPCs compared with the null hypothesis (slope = 0) and differences among groups were assessed ($P < .05$).[3] All statistical tests were 2-sided.

Results

During 2000–2010, there were 7 102 778 HD deaths (mean: 645 707/year). The mortality rates declined annually for total HD(−3.8%[95%CI,−4.0% to −3.5%];$P < .001$) and CHD (−5.1% [95% CI, −5.3% to −4.8%]; $P < .001$) (Table).Even though mortality from most other subtypes also declined, mortality increased annually for HHD (1.3% [95% CI, 0.8% to 1.8%]; $P < .001$) and arrhythmia (1.0% [95% CI, 0.3%to 1.7%]; $P = .01$). Although the HHD rate increased among non-Hispanic whites and was unchanged among non-Hispanic blacks, it remained much higher among non-Hispanic blacks in 2010 (50.9 per 100 000 vs 17.9 per 100 000 among non-Hispanic whites).

In 2010, excluding CHD and other HD, the leading cause of HD-related death was HHD among adults aged 35 to 54 years (12.1%) and those aged 55 to 74 years (6.7%); among those aged 75 years or older, it was heart failure (12.2%) (Figure).

Discussion

Heart disease remains the leading cause of death in the United States,[1] accounting for nearly 600 000 deaths in 2010. Nevertheless, its mortality rate has continued to decline, driven mostly by a decrease in CHD mortality.

Although the proportions of HD deaths attributable to HHD and arrhythmia are relatively small, their mortality rate increases are notable. Uncontrolled blood pressure and obesity among younger adults, especially non-Hispanic blacks, may be putting them at risk for developing HHD at an early age.[1,4] The increase in arrhythmia mortality was most prominent among non-Hispanic whites, women, and adults aged 75 years or older. These increases might be linked to an aging population, the sequelae of persons living longer with heart failure, increases in chronic kidney disease and HHD prevalence, and possible changes in how arrhythmias are diagnosed and reported on death certificates.[1]

One potential limitation of this study is that the estimates were determined using nonvalidated death certificate data, which possibly overestimate HD-related mortality.[5] However, these data are frequently used in scientific publications[1] and their analysis to assess HD-related mortality trends across combined communities appears valid.[5] Additionally, reporting guidelines state that heart failure should not be designated as the underlying cause of death if another plausible cause is identified[6]; therefore, its effect on HD mortality is likely better characterized using a multiple cause of death definition.

Despite a continued decrease in overall HD mortality, considerable burden still exists. Public health and clinical communities should continue to develop and rigorously apply evidence-based interventions to prevent and treat CHD as well as other HD subtypes such as HHD and arrhythmia.

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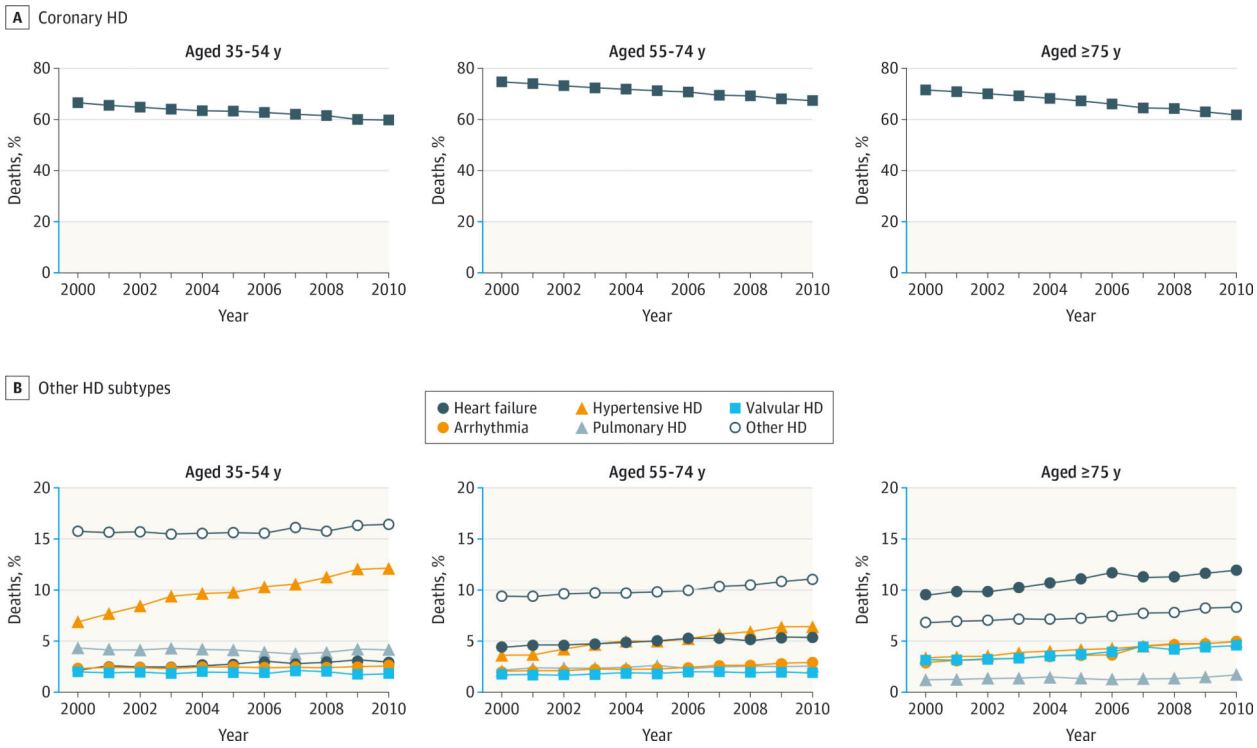

Figure 1.

Percentage of US Heart Disease (HD) Deaths by Age Group and HD Subtype, 2000–2010

The HD subtypes were classified using *International Classification of Diseases, Tenth Revision*, codes: total (I00–I09, I11, I13, I20–I51); CHD (I20–I25); heart failure (I50); hypertensive HD (I11, I13); valvular HD (I34–I38); arrhythmia (I47-I49); pulmonary HD (I26–I28); and other (I00–I09, I30–I33, I40–I46, I51). Y-axis scale shown in blue indicates range of deaths from 0% to 20%.

Table.

Trends in Mortality Rates Among US Adults by Heart Disease (HD) Subtype, 2000–2010

HD Subtype[a]	Trend	Year	Total	Sex		Non-Hispanic		Age Group, y		
				Men	Women	White	Black	35–54	55–74	≥75
Total HD	Deaths, No. (rate/100 000)[b]	2000	705 767 (500.8)	341 676 (622.0)	364 091 (410.1)	591 756 (497.1)	75 194 (635.2)	48 661 (58.7)	185 804 (435.4)	471 302 (2845.7)
		2010	592 738 (347.3)	304 051 (436.1)	288 687 (278.2)	481 328 (349.0)	66 776 (442.4)	47 323 (51.1)	156 928 (282.5)	388 487 (1972.0)
	AAPC (95% CI), %[c]		−3.8 (−4.0 to −3.5)[d]	−3.7 (−3.9 to −3.4)[d]	−4.0 (−4.3 to −3.8)[d,e]	−3.7 (−3.9 to −3.4)[d]	−3.6 (−4.1 to −3.2)[d]	−1.4 (−1.8 to −1.0)[d]	−4.3 (−4.7 to −3.8)[d,e]	−3.8 (−4.1 to −3.5)[d,e]
Coronary HD	Deaths, No. (rate/100 000)[b]	2000	514 042 (364.7)	259 722 (471.2)	254 320 (286.2)	433 758 (364.4)	50 391 (429.9)	32 409 (39.1)	140 622 (329.6)	341 011 (2058.7)
		2010	378 373 (221.6)	206 679 (294.9)	171 694 (165.7)	308 762 (224.2)	38 770 (259.8)	28 338 (30.3)	107 225 (193.1)	242 810 (1237.0)
	AAPC (95% CI), %[c]		−5.1 (−5.3 to −4.8)[d]	−4.8 (−5.1 to −4.5)[d]	−5.6 (−5.9 to −5.2)[d,e]	−4.9 (−5.2 to −4.7)[d]	−4.9 (−5.4 to −4.5)[d]	−2.5 (−3.0 to −2.0)[d]	−5.3 (−5.7 to −4.8)[d,e]	−5.2 (−5.5 to −4.8)[d,e]
Heart failure	Deaths, No. (rate/100 000)[b]	2000	55 542 (39.5)	21 079 (42.0)	34 463 (37.6)	48 696 (40.4)	4880 (43.5)	1073 (1.3)	8614 (20.2)	45 855 (277.1)
		2010	57 558 (33.7)	24 252 (37.4)	33 306 (31.0)	49 159 (34.8)	5421 (38.4)	1414 (1.5)	8776 (16.2)	47 368 (236.9)
	AAPC (95% CI), %[c]		−1.9 (−2.4 to −1.5)[d]	−1.5 (−1.9 to −1.0)[d]	−2.3 (−2.7 to −1.8)[d,e]	−1.7 (−2.3 to −1.1)[d]	−1.5 (−2.4 to −0.7)[d]	1.1 (−0.2 to 2.4)	−2.4 (−2.7 to −2.0)[d,e]	−1.8 (−2.8 to −0.8)[d,e]
Hypertensive HD	Deaths, No. (rate/100 000)[b]	2000	26 260 (18.6)	10 851 (18.9)	15 409 (17.5)	18 046 (15.2)	6466 (52.7)	3315 (4.0)	6902 (16.2)	16 043 (96.9)
		2010	36 037 (20.9)	17 201 (23.3)	18 836 (18.3)	24 528 (17.9)	8163 (50.9)	5732 (6.2)	10 577 (18.6)	19 728 (99.4)
	AAPC (95% CI), %[c]		1.3 (0.8 to 1.8)[d]	2.2 (1.5 to 2.8)[d]	0.5 (0 to 1.0)[e]	1.8 (1.3 to 2.2)[d]	−0.4 (−1.0 to 0.2)[e]	4.6 (3.5 to 5.6)[d]	1.1 (0.3 to 1.8)[d,e]	0.4 (−0.2 to 1.0)[e]
Valvular HD	Deaths, No. (rate/100 000)[b]	2000	19 542 (13.9)	7445 (14.5)	12 097 (13.4)	17 507 (14.6)	1213 (10.2)	954 (1.2)	3395 (8.0)	15 193 (91.8)
		2010	22 627 (13.3)	9092 (14.0)	13 535 (12.7)	20 180 (14.3)	1222 (8.2)	860 (1.0)	3285 (6.0)	18 482 (92.4)
	AAPC (95% CI), %[c]		−0.3 (−0.8 to 0.3)	−0.2 (−0.8 to 0.5)	−0.5 (−1.0 to 0.1)	0 (−0.6 to 0.6)	−1.7 (−2.7 to −0.7)[d,e]	−1.5 (−3.0 to 0)	−2.4 (−3.0 to −1.8)[d]	0.2 (−0.4 to 0.9)[e]
Arrhythmia	Deaths, No. (rate/100 000)[b]	2000	19 398 (13.8)	7834 (14.7)	11 564 (12.9)	17 026 (14.2)	1724 (14.7)	1130 (1.4)	4033 (9.5)	14 235 (86.0)
		2010	26 192 (15.4)	10 595 (15.8)	15 597 (14.8)	22 781 (16.3)	2142 (14.7)	1245 (1.3)	4901 (8.9)	20 046 (100.8)
	AAPC (95% CI), %[c]		1.0 (0.3 to 1.7)[d]	0.5 (−0.1 to 1.1)	1.3 (0.5 to 2.1)[d]	1.3 (0.5 to 2.1)[d]	−0.9 (−1.7 to 0)[e]	−1.0 (−1.8 to −0.2)[d]	−0.7 (−1.5 to 0.1)	1.5 (0.7 to 2.4)[d,e]

HD Subtype[a]	Trend	Year	Total	Sex		Non-Hispanic		Age Group, y		
				Men	Women	White	Black	35–54	55–74	≥75
Pulmonary HD	Deaths, No. (rate/100 000)[b]	2000	12 326 (8.7)	4885 (8.4)	7441 (9.0)	9940 (8.5)	1865 (14.8)	2102 (2.5)	4287 (10.1)	5937 (35.8)
		2010	13 319 (7.9)	5231 (7.3)	8088 (8.4)	10 470 (7.9)	2125 (13.4)	1957 (2.2)	4431 (8.0)	6931 (35.9)
	AAPC (95% CI), %[c]		−1.8 (−2.7 to −0.9)[d]	−2.4 (−3.5 to −1.3)[d]	−1.4 (−2.3 to −0.7)[d]	−1.6 (−2.4 to −0.7)[d]	−1.8 (−2.8 to −0.8)[d]	−1.7 (−4.7 to 1.4)	−3.3 (−4.5 to −2.1)[d]	−0.8 (−1.7 to 0.1)
Other HD	Deaths, No. (rate/100 000)[b]	2000	58 657 (41.6)	29 860 (52.3)	28 797 (33.5)	46 783 (39.7)	8655 (69.5)	7678 (9.3)	17 951 (42.1)	33 028 (199.3)
		2010[f]	58 632 (34.6)	31 001 (43.5)	27 631 (27.5)	45 448 (33.6)	8933 (56.9)	7777 (8.6)	17 733 (31.7)	33 122 (169.7)
	AAPC (95% CI), %[c]		−2.0 (−2.6 to −1.3)[d]	−1.9 (−2.6 to −1.1)[d]	−2.1 (−2.9 to −1.4)[d]	−1.8 (−2.5 to −1.0)[d]	−2.1 (−2.5 to −1.6)[d]	−0.9 (−1.2 to −0.6)[d]	−2.8 (−3.5 to −2.2)[d,e]	−1.8 (−2.3 to −1.4)[d]

[a] TheFigure legend provides the *International Classification of Diseases, Tenth Revision*, codes for each HD subtype.

[b] Standardized by age to the 2000 US standard population.

[c] The average annual percentage change (AAPC) both in the age-standardized or age-specific mortality rate during 2000–2010 reflects the values obtained without pairwise comparison testing being performed.

[d] Values are statistically different than 0 ($P < .05$).

[e] Values are statistically different ($P < .05$) compared with the reference group (women vs men; black vs white; and age groups of 55–74 and ≥75 years vs 35–54 years).

[f] The most frequently occurring causes of death were unspecified cardiomyopathy (17 160 deaths) and unspecified cardiac arrest (13 617 deaths).