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The burden of health conditions across race and ethnicity for aging Americans
Disability-adjusted life years

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Abstract

Despite evidence suggesting race and ethnicity are important factors in responses to environmental exposures, drug therapies, and disease risk, few studies focus on the health needs of racially- and ethnically-diverse aging adults.

The objective of this study was to determine the burden of 10 health conditions across race and ethnicity for a nationally-representative sample of aging Americans.

Data from the 1998 to 2014 waves of the Health and Retirement Study, an ongoing longitudinal-panel study, were analyzed.

Those aged over 50 years who identified as Black, Hispanic, or White were included. There were 5510 Blacks, 3423 Hispanics, and 21,168 Whites in the study.

At each wave, participants reported if they had cancer, chronic obstructive pulmonary disease, congestive heart failure, diabetes, back pain, hypertension, a fractured hip, myocardial infarction, rheumatism or arthritis, and a stroke. Disability-adjusted life years (DALYs) were calculated for each health condition by race and ethnicity. Ranked DALYs determined how race and ethnicity was differentially impacted by the burden of each health condition. Sample weights were utilized to make DALY estimates nationally-representative.

Weighted DALY estimates (in thousands) ranged from 1405 to 55,631 for Blacks, 931 to 28,442 for Hispanics, and 15,313 to 295,623 for Whites. Although the health conditions affected each race and ethnicity differently, hypertension had the largest number of DALYs, and hip fractures had the fewest across race and ethnicity. In total, there were an estimated 198,621, 101,462, and 1,187,725 DALYs for older Black, Hispanic, and White aging adults.

Our findings indicate that race and ethnicity may be influential on health and disease for aging adults in the United States. Monitoring DALYs may help guide the flow of health-related expenditures, improve the impact of health interventions, advance inclusive health care for diverse aging adult populations, and prepare healthcare providers for serving the health needs of aging adults.

Abbreviations: COPD = chronic obstructive pulmonary disease, DALY = disability-adjusted life year, HRS = health and retirement study, YLD = years lost due to disease/disability, YLL = years of life lost.

Keywords: aging, DALY, epidemiology, geriatrics, mortality

1. Introduction

Federal mandates of biomedical research in the United States have prioritized the inclusion of racially- and ethnically-diverse populations; yet, approximately 6% of participants in federally funded clinical trials are Black or Hispanic.[1,2] Despite evidence suggesting race and ethnicity are important factors in responses to environmental exposures, drug therapies, and disease risk, few studies focus on minority health needs.[3] This has, in turn,

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contributed to race- and ethnicity-related differences in survival and healthy life expectancy in the United States.[4,5]

As adults are living longer with diseases and disabilities, a large proportion of healthcare expenses come from persons with such health conditions.[6] For example, approximately 86% of older adults in the United States are living with at least one health condition, and certain races and ethnicities are living with more conditions than others.[7] The increased risk for morbidity seen in racially- and ethnically-diverse aging adults, specifically Blacks and Hispanics, is often attributed to differences in socioeconomic status and lack of adequate healthcare accessibility for these populations.[8]

Disability-adjusted life years (DALYs) are used worldwide as a measure of population health to separately evaluate the burden of non-fatal and fatal health outcomes.[9] The burden of various diseases, disabilities, and injuries are monitored over time and compared across populations. For example, ischemic heart disease contributes to the greatest number of DALYs in the United States; whereas, diabetes contributes to the greatest number of DALYs in Mexico.[10] Although this time-based metric quantifies the burden of a health condition in a population and compares it to an ideal population that reaches full healthy life expectancy, the burden of many health conditions has yet to be quantified for a nationally-representative sample of middle-aged and older adults in the United States.

Assessments of DALYs provides insights regarding the burden of health conditions across growing, racially- and ethnically-diverse aging populations.[11] Understanding this information will help to inform the allocation of health-related expenditures, interventions aiming to improve health in aging adults, strategies for a more inclusive healthcare system, and healthcare providers working directly with these populations. Therefore, the purpose of this study was to determine the burden of 10 health conditions across race and ethnicity for a nationally-representative sample of aging Americans.

2. Methods

2.1. Participants

Data from 37,495 participants in the 1998 to 2014 waves of the Health and Retirement Study (HRS) who identified as Black, Hispanic, or White were used for this secondary analysis. Cleaned and standardized RAND HRS data were merged with other individual data files from the HRS. The HRS is a longitudinal-panel study that aims to understand shifts in the health status of aging adults and observe economic circumstances associated with aging at individual- and population-levels.[12] Since 1992, HRS participants have been re-interviewed biennially. Beginning in 1998, the HRS has provided data for a nationally-representative sample of adults aged over 50 years, including surveys from approximately 23,000 households. Participants from the HRS are followed longitudinally until death and new cohorts of participants have been added to the original sample to maintain a national representation of the survey over time. The HRS uses a multi-stage probability design, including geographical stratification and oversampling of certain demographics groups (Blacks and Hispanics). Sample weights are provided by the HRS to account for the multi-stage, area probability design. More details for the HRS are described elsewhere.[13]

Exclusions occurred for missing sex or race (n=134), no participation in the 1998 to 2014 waves (n=3,986), missing,

other, or non-Hispanic ethnicity (n=992), and entry age <50 years (n=2,282). Written informed consent was obtained from all participants in the HRS prior to entering the study. Protocols were approved by the University of Michigan Behavioral Sciences Committee Institutional Review Board (HUM00061128 approved through October 18, 2018).[14] Data from the HRS contain no direct identifiers, thereby ensuring participant anonymity. All data used in this investigation were publicly available.[15]

2.2. Measures

2.2.1. Health conditions. At each wave, interviewers asked participants questions related to their physical health. Participants self-reported physician diagnoses for the following conditions: cancer, chronic obstructive pulmonary disease (COPD), congestive heart failure, diabetes or high blood sugar, back pain, high blood pressure or hypertension, a fractured hip, a heart attack or myocardial infarction, rheumatism or arthritis, and stroke. The wave a health condition was first reported by participants was considered a proxy for the date of diagnosis. These health conditions were selected by the investigators because they were identified as having a corresponding disability weight from the Global Burden of Disease, which is required for calculating DALYs.[16,17]

2.2.2. Mortality. Date of death was observed through linkage to the National Death Index. Exit interviews were performed with a surviving spouse, child, or other informant to collect information about medical expenditures, family interactions, outlook of assets after death, and other circumstances that may have occurred toward the end of life. Mortality validation for the HRS has demonstrated that the National Death Index and post-mortem interviews capture 99% of participant deaths.[18]

2.3. Statistical analysis

Descriptive information was reported as mean±standard deviation for continuous variables and frequency (proportion) for categorical variables. Guidelines from the World Health Organization were used for determining DALYs.[19] Participants were first stratified by race and ethnicity, then within each race and ethnicity, participants were stratified into age categories (50–59 years, 60–69 years, 70–79 years, ≥80 years). The age at which a health condition occurred determined the age categories for participants.

Years lost due to disease/disability (YLD) were calculated by taking the product of the number of incident cases for each health condition, corresponding disability weight, and mean duration of years lived with the condition until death, or truncation. For participants who were still living or lost to follow-up (i.e., truncation), the mean duration of years lived with the condition was determined using their estimated life expectancy at age of truncation.[20] Disability weights for each condition were from the Global Burden of Disease (back pain=0.020, cancer=0.288, COPD=0.019, congestive heart failure=0.201, diabetes=0.015, fractured hip=0.058, hypertension=0.246, myocardial infarction=0.439, rheumatism or arthritis=0.199, stroke=0.266).[16,17] For each race and ethnicity, the YLDs were summed across age categories to determine total YLDs.

Years of life lost (YLL) were calculated by multiplying the number of deaths that occurred by the mean life expectancy at age of death in years. Life expectancy for males and females at

each age was determined from the Period Life Table.[21] The YLLs were summed across age categories to determine total YLLs for each race and ethnicity.

For each race and ethnicity, YLDs and YLLs were summed across age categories to determine DALYs, then the total DALYs for each age category were summed to determine the overall DALYs for each condition. The overall number of DALYs for each health condition were sorted from largest-to-smallest and ranked for each race and ethnicity in order to compare DALY estimates across ethnicities. Sample weights were utilized in the analyses to allow DALY comparisons across race and ethnicity at the population-representative level. The YLLs, YLDs, and DALYs are reported in thousands. All analyses were performed with SAS 9.4 software (SAS Institute; Cary, NC).

3. Results

The non-weighted and weighted descriptive characteristics of the participants are presented in Table 1. There were 5510 Blacks (weighted sample = 13,169,445), 3423 Hispanics (weighted sample = 10,045,723), and 21,168 Whites (weighted sample = 91,395,572) that were included. Black, Hispanic, and White participants entered the study at 61.2 ± 9.9, 60.1 ± 9.0, and 64.4 ± 10.8 years of age, respectively. During the study, there were 1722 (31.2%) Black, 752 (21.9%) Hispanic, and 8030 (37.9%) White participants that died. Table 2 provides person-level DALY estimates and 95% confidence intervals for each health outcome.

Figure 1 presents the burden of each health condition for Blacks. Weighted DALY estimates were 1405 for hip fractures, 7660 for myocardial infarction, 8970 for congestive heart failure, 9307 for COPD, 13,834 for cancer, 15,286 for stroke, 20,391 for diabetes, 24,740 for back pain, 41,397 for arthritis, and 55,631 for hypertension. Collectively, there were an estimated 158,889 YLLs, 39,735 YLDs, and 198,621 DALYs for the 10 health conditions in Blacks.

The burden of each health condition for Hispanics is displayed in Figure 2. Weighted DALY estimates were 931 for hip fractures, 3722 for congestive heart failure, 4121 for COPD, 5235 for myocardial infarction, 6103 for stroke, 7336 for cancer, 11,703 for diabetes, 12,132 for back pain, 21,737 for arthritis, and 28,442 for hypertension. In total, there were an estimated 74,644

YLLs, 23,099 YLDs, and 101,462 DALYs for the 10 health conditions in Hispanics.

Figure 3 depicts the burden of each health condition for Whites. Weighted DALY estimates were 15,313 for hip fractures, 49,852 for congestive heart failure, 51,813 for myocardial infarction, 72,582 for stroke, 76,624 for COPD, 85,023 for diabetes, 120,958 for cancer, 149,149 for back pain, 270,788 for arthritis, and 295,623 for hypertension. There were an estimated 903,201 YLLs, 285,319 YLDs, and 1,187,725 DALYs for the 10 health conditions in Whites. Detailed information for the burden of each health condition stratified by race and ethnicity is in Table 3.

The total weighted DALY estimates for each health condition are presented and ranked by race and ethnicity in Figure 4. Across race and ethnicity, hypertension, rheumatism or arthritis, and back pain had the first, second, and third highest DALY ranks, respectively. The DALY ranks for stroke and congestive heart failure was higher in Blacks, than Hispanics and Whites. Myocardial infarction resulted in a higher DALY rank for Hispanics, than Blacks and Whites. The DALY ranks for cancer and COPD was higher in Whites, than in Blacks and Hispanics. DALY ranks were equal for diabetes in Blacks and Hispanics, but lower in Whites. Across races and ethnicities, hip fractures had the lowest DALY rank. Table 4 shows the percent contribution of each health condition to the collective estimated DALY total for Blacks, Hispanics, and Whites.

4. Discussion

The principal results of this investigation suggest that the estimated burden of certain health conditions impacted aging Blacks, Hispanics, and Whites differently. While hypertension, arthritis, back pain, and hip fractures had the same DALY ranks for each race and ethnicity, the DALY ranks for diabetes, stroke, cancer, COPD, congestive heart failure, and myocardial infarction varied across older Blacks, Hispanics, and Whites. For example, of the 10 health conditions examined, the burden of stroke was fifth highest for Blacks, sixth highest for Hispanics, and seventh highest for Whites. These results can be used to guide the distribution of health-related provisions, screening efforts and targeted interventions designed to improve health, and approaches to making health care more inclusive for racially- and ethnically-diverse aging adults.

Table 1

Non-weighted and weighted descriptive characteristics of the participants.

	Blacks (n = 5,510)	Weighted Blacks (n = 13,169,445)	Hispanics (n = 3,423)	Weighted Hispanics (n = 10,045,723)	Whites (n = 21,168)	Weighted Whites (n = 91,395,572)
Age (yr)	61.2 ± 9.9	59.8 ± 9.1	60.1 ± 9.0	58.9 ± 8.2	64.4 ± 10.8	61.3 ± 10.3
Female (n (%))	3,249 (58.9%)	7,250,754 (55.0%)	1,849 (54.0%)	5,160,995 (51.3%)	11,493 (54.2%)	46,772,021 (51.1%)
Died During Study (n (%))	1,722 (31.2%)	3,543,699 (26.9%)	752 (21.9%)	1,804,347 (17.9%)	8,030 (37.9%)	26,606,177 (29.1%)
Age at Death (years)	76.7 ± 11.5	74.8 ± 11.7	77.7 ± 11.0	76.2 ± 11.3	80.5 ± 10.1	79.1 ± 10.8
Household Income ($)	39,443 ± 55,249	42,195.9 ± 2,951,129	36,997 ± 144,831	44,132 ± 10,972,940	64,485 ± 99,793	75,456 ± 7,405,734
Education Completed (n (%))						
Less Than High School	1,898 (34.5%)	4,173,298 (31.7%)	1,868 (54.6%)	5,253,375 (52.3%)	3,916 (18.5%)	13,259,817 (14.5%)
General Education Development	300 (5.4%)	733,398 (5.6%)	163 (4.8%)	468,761 (4.7%)	940 (4.4%)	3,972,398 (4.4%)
High School Graduate	1,389 (25.2%)	3,173,313 (24.1%)	591 (17.3%)	1,784,579 (17.8%)	6,797 (32.1%)	27,808,867 (30.4%)
Some College	1,244 (22.6%)	3,200,607 (24.3%)	541 (15.8%)	1,663,279 (16.5%)	4,815 (22.8%)	22,572,097 (24.7%)
College Graduate and Above	677 (12.3%)	1,883,994 (14.3%)	259 (7.5%)	874,464 (8.7%)	4,698 (22.2%)	23,773,812 (26.0%)

Missing observations for education completed were: 2 for Black, 1 for Hispanic, and 2 for White. Household income and education completed were listed for descriptive purposes and not part of the disability-adjusted life year calculations.

Table 2

Estimated person-level disability-adjusted life year means and 95% confidence intervals.

	Arthritis		Back Pain		Cancer	
	Mean	95% Confidence Interval	Mean	95% Confidence Interval	Mean	95% Confidence Interval
Black						
50–59 Years	22.5	22.1, 23.0	22.7	22.0, 23.3	24.9	24.0, 25.7
60–69 Years	15.9	15.5, 16.2	15.2	14.7, 15.7	17.0	16.4, 17.6
70–79 Years	9.6	9.4, 9.8	8.9	8.5, 9.3	10.7	10.3, 11.1
≥80 Years	5.6	5.4, 5.7	4.8	4.6, 5.1	5.7	5.4, 6.0
Hispanic						
50–59 Years	21.9	21.0, 22.9	21.7	20.6, 22.8	23.2	21.5, 24.8
60–69 Years	15.4	14.9, 15.9	15.0	14.3, 15.7	16.2	15.3, 17.2
70–79 Years	9.9	9.5, 10.2	8.9	8.5, 9.4	10.9	10.2, 11.7
≥80 Years	5.8	5.5, 6.0	4.6	4.3, 5.0	6.0	5.6, 6.4
White						
50–59 Years	21.5	21.2, 21.9	21.4	21.0, 21.8	23.2	22.7, 23.7
60–69 Years	15.0	14.9, 15.2	14.0	13.8, 14.3	16.5	16.3, 16.7
70–79 Years	9.5	9.4, 9.6	8.8	8.7, 9.0	10.5	10.4, 10.7
≥80 Years	5.7	5.6, 5.7	4.8	4.7, 4.9	6.2	6.1, 6.3

	Chronic Obstructive Pulmonary Disease		Congestive Heart Failure		Diabetes	
	Mean	95% Confidence Interval	Mean	95% Confidence Interval	Mean	95% Confidence Interval
Black						
50–59 Years	22.8	21.7, 23.9	24.0	23.1, 24.9	21.4	20.8, 22.1
60–69 Years	15.5	14.8, 16.1	16.7	16.0, 17.3	14.6	14.2, 15.1
70–79 Years	9.1	8.5, 9.7	10.5	10.1, 11.0	8.8	8.4, 9.2
≥80 Years	4.8	4.4, 5.2	5.3	5.0, 5.7	5.1	4.8, 5.4
Hispanic						
50–59 Years	20.9	18.4, 23.4	22.3	19.8, 24.8	20.8	19.7, 21.8
60–69 Years	15.6	14.5, 16.7	17.7	16.2, 19.2	14.7	14.0, 15.4
70–79 Years	8.9	8.1, 9.7	10.5	9.8, 11.2	8.6	8.1, 9.1
≥80 Years	4.7	4.1, 5.3	5.7	5.2, 6.2	4.9	4.5, 5.3
White						
50–59 Years	20.4	19.9, 21.0	22.5	21.7, 23.4	20.4	19.9, 20.9
60–69 Years	14.3	14.0, 14.6	16.0	15.7, 16.4	14.0	13.7, 14.2
70–79 Years	9.1	8.9, 9.2	10.3	10.2, 10.5	8.6	8.4, 8.8
≥80 Years	5.2	5.1, 5.3	5.6	5.5, 5.7	5.1	4.9, 5.2

	Fractured Hip		Hypertension		Myocardial Infarction	
	Mean	95% Confidence Interval	Mean	95% Confidence Interval	Mean	95% Confidence Interval
Black						
50–59 Years	–	–	23.2	22.8, 23.6	24.7	23.5, 26.0
60–69 Years	15.1	13.7, 16.6	16.2	16.0, 16.5	17.7	17.1, 18.4
70–79 Years	10.1	8.7, 11.4	10.0	9.9, 10.2	11.6	11.1, 12.0
≥80 Years	4.9	4.3, 5.4	5.9	5.8, 6.1	6.9	6.5, 7.4
Hispanic						
50–59 Years	–	–	22.8	22.0, 23.6	22.8	21.7, 23.9
60–69 Years	12.8	3.1, 22.6	16.0	15.5, 16.5	16.9	16.0, 17.9
70–79 Years	10.4	9.2, 11.6	10.0	9.7, 10.3	11.5	11.0, 12.1
≥80 Years	5.1	4.3, 5.9	5.9	5.7, 6.2	6.8	6.2, 7.4
White						
50–59 Years	–	–	22.1	21.8, 22.4	23.1	22.5, 23.8
60–69 Years	15.1	14.3, 16.0	15.5	15.3, 15.6	17.0	16.7, 17.3
70–79 Years	9.6	9.2, 10.0	9.9	9.8, 10.0	11.3	11.2, 11.5
≥80 Years	5.0	4.8, 5.1	6.0	5.9, 6.0	6.7	6.5, 6.8

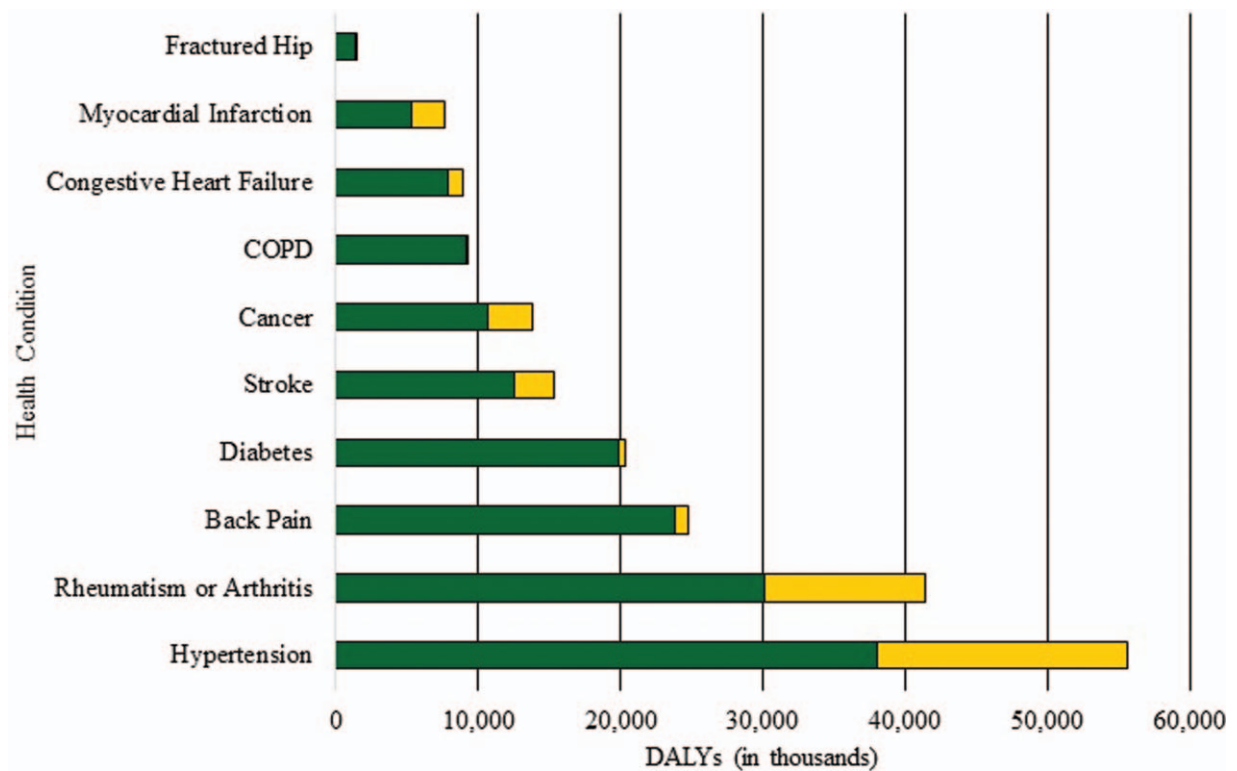|	Stroke	
	Mean	95% Confidence Interval
Black		
50-59 Years	23.6	22.8, 24.4
60-69 Years	16.8	16.2, 17.3
70-79 Years	10.8	10.5, 11.2
≥80 Years	5.8	5.6, 6.1
Hispanic		
50-59 Years	22.4	20.5, 24.4
60-69 Years	16.7	15.8, 17.6
70-79 Years	10.6	10.0, 11.2
≥80 Years	6.2	5.8, 6.7
White		
50-59 Years	22.3	21.6, 23.1
60-69 Years	16.4	16.1, 16.7
70-79 Years	10.2	10.0, 10.3
≥80 Years	5.9	5.8, 6.0

Figure 1. The estimated burden of each health condition for blacks. COPD=chronic obstructive pulmonary disease, Green Bars=years of life lost, Yellow Bars=years lived with disability.
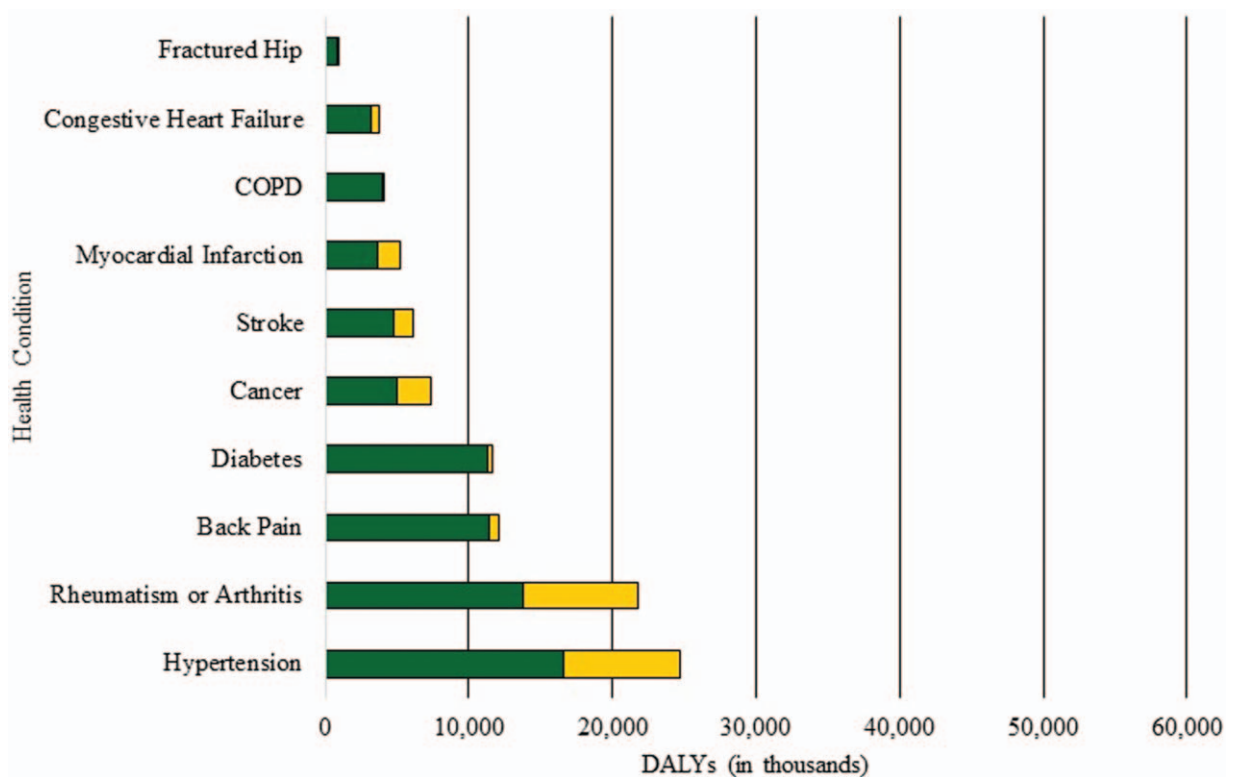

Figure 2. The estimated burden of each health condition for hispanics. COPD=chronic obstructive pulmonary disease, Green Bars=years of life lost, Yellow Bars=years lived with disability.
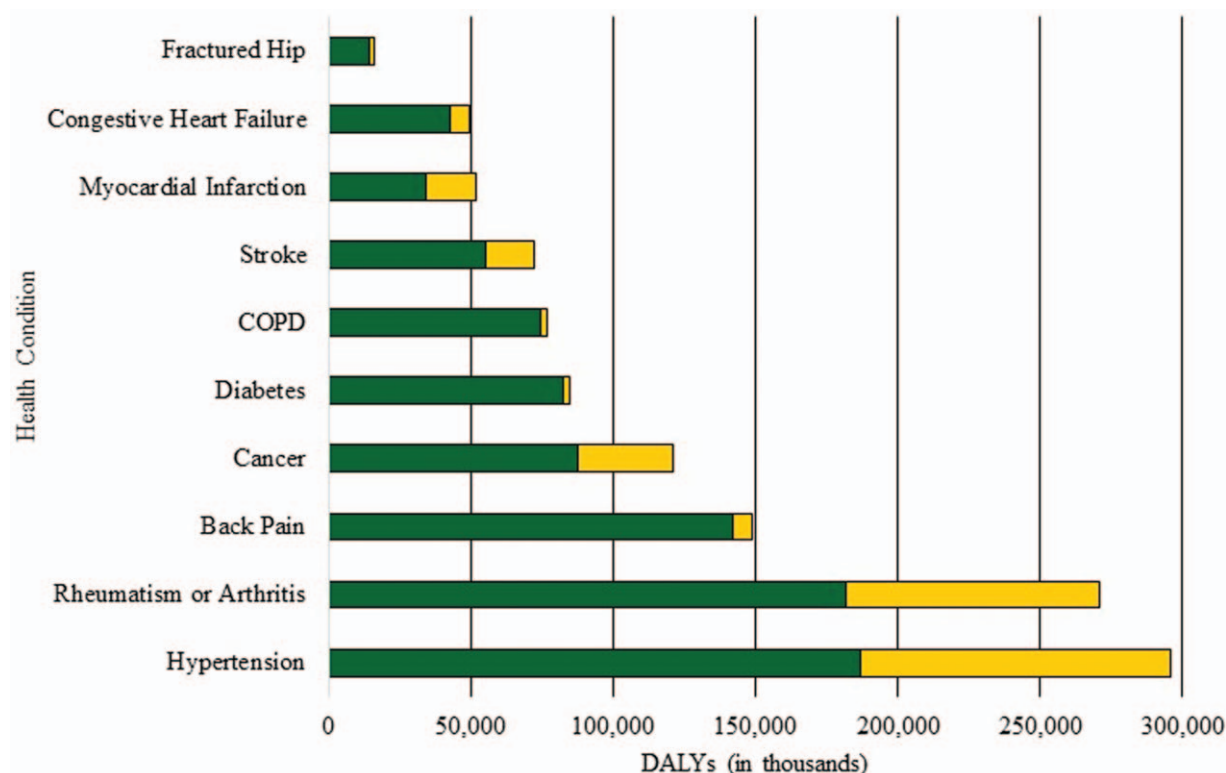
Figure 3. The estimated burden of each health condition for whites. COPD = chronic obstructive pulmonary disease, Green Bars = years of life lost, Yellow Bars = years lived with disability.

Hypertension has been ranked as the single leading risk factor for the Global Burden of Disease.[22] The overall increase in poor lifestyle behaviors such as high sedentary time and calorically dense diets has influenced the elevated worldwide prevalence of hypertension.[23] These results align with our investigation which indicated the estimated burden of hypertension was highest across race and ethnicity. Rheumatism and arthritis are also highly prevalent health conditions in the United States. Approximately 50% of aging adults have been diagnosed with rheumatism or arthritis, and the prevalence of rheumatism and arthritis varies across race and ethnicity.[24] Most people with rheumatism or arthritis also have another chronic disease,[24] thereby contributing to why these individuals are at greater risk for all-cause mortality compared to the general population.[25] These factors may explain why our results were compatible with the results of another investigation suggesting the burden of rheumatoid arthritis manifests with significant health consequences.[26] Similarly, our results indicate that back pain had the third highest DALY rank across race and ethnicity. Another similar investigation revealed the burden of back pain was high in the United States for the year 2010, likely because back pain is prevalent in the growing aging population.[27] Considering the high numbers of middle-aged and older adults with hypertension, rheumatism, arthritis, or back pain, preventing and treating these conditions should be a public health priority.

Diabetes is a chronic disease that represents a profound economic burden on the United States healthcare system, and is more prevalent in minority populations compared to Whites.[28] For example, the risk of diabetes is 77% higher in Blacks and 66% higher in Hispanics compared to Whites; moreover, Blacks and Hispanics are 2.3 and 1.5 times more likely to die from complications of diabetes than Whites, respectively.[28] This may explain why our findings suggest that the burden of diabetes was greater in Blacks and Hispanics than in Whites. Murray et al[27] determined the overall burden of diabetes in 2010 was 2,557 DALYs (in thousands), further demonstrating the negative impact diabetes has on health in the United States.

Likewise, stroke risk is higher for Blacks and Hispanics compared to Whites.[29] Particularly, the burden of disease from stroke and higher stroke-related mortality is greatest in Blacks.[30] These results are supported by the results of the present investigation, wherein stroke had the highest DALY ranking among Blacks. Similar to stroke risk, the risk of developing congestive heart failure is higher in Blacks compared to Whites.[31] This may also explain why our results indicated the burden of congestive heart failure had a higher DALY rank in Blacks than in Hispanics and Whites.

The results of this investigation also showed that the DALY rank for cancer was highest in Whites compared to Blacks and Hispanics. These results are inconsistent with other previous research that revealed Black men and White women may have the highest incidence rates for cancer, and Blacks have the highest mortality rate from cancer.[32] However, it is possible that most White participants who reported having cancer may have had Melanoma, as Whites have substantially higher Melanoma incidence and mortality rates.[33]

The age-adjusted prevalence for COPD in the United States is higher in Whites compared to Blacks and Hispanics, and COPD deaths are greatest in Whites than other races and ethnicities.[34,35] Although progress in COPD prevention has been made

Table 3

Detailed information for the estimated disability-adjusted life years of each health condition by race and ethnicity.

Arthritis

Black

	Cases	Number Dead	YLLs/1000	YLDs/1000	DALYs/1000
50–59 Years	3,900,493	602,612	12,798	5294	18,091
60–69 Years	2,408,099	613,607	8860	3537	12,397
70–79 Years	1,213,041	734,882	6053	1693	7,746
≥80 Years	692,202	532,620	2447	716	3163
Overall	8,213,835	2,483,721	30,158	11,240	41,397

Hispanic

	Cases	Number Dead	YLLs/1000	YLDs/1000	DALYs/1000
50–59 Years	2,586,251	229,489	4710	3804	8514
60–69 Years	1,635,386	323,187	4478	2615	7093
70–79 Years	830,463	36,980	3,152	1163	4315
≥80 Years	385,673	296,053	1405	409	1815
Overall	5,437,773	885,709	13,745	7991	21,737

White

	Cases	Number Dead	YLLs/1000	YLDs/1000	DALYs/1000
50–59 Years	22,748,095	2,518,965	50,310	36,759	87,069
60–69 Years	16,314,426	3,951,026	53,173	26,644	79,817
70–79 Years	12,021,749	6,614,907	53,112	18,334	71,446
≥80 Years	6,814,004	5,440,143	25,441	7015	32,456
Overall	57,898,274	18,525,041	182,036	88,752	270,788

Back Pain

Black

	Cases	Number Dead	YLLs/1000	YLDs/1000	DALYs/1000
50–59 Years	3,935,709	536,232	12,112	473	12,584
60–69 Years	1,833,645	380,708	5759	229	5988
70–79 Years	962,371	483,724	4261	123	4384
≥80 Years	458,440	363,471	1740	44	1784
Overall	7,190,165	1,764,135	23,872	869	24,740

Hispanic

	Cases	Number Dead	YLLs/1000	YLDs/1000	DALYs/1000
50–59 Years	3,044,306	209,966	4545	371	4915
60–69 Years	1,418,128	262,691	3913	184	4097
70–79 Years	620,773	250,016	2215	78	2293
≥80 Years	276,941	174,195	799	27	827
Overall	5,360,148	896,868	11,472	660	12,132

White

	Cases	Number Dead	YLLs/1000	YLDs/1000	DALYs/1000
50–59 Years	24,061,087	2,235,380	47,656	3334	50,989
60–69 Years	12,148,731	2,798,819	38,981	1754	40,735
70–79 Years	9,196,503	4,085,123	35,704	1200	36,904
≥80 Years	5,800,618	4,184,859	19,964	557	20,521
Overall	51,206,939	13,304,181	142,305	6845	149,149

Cancer

Black

	Cases	Number Dead	YLLs/1000	YLDs/1000	DALYs/1000
50–59 Years	610,890	174,380	4102	853	4954
60–69 Years	778,820	221,618	3424	1239	4663
70–79 Years	483,035	256,954	2382	721	3102
≥80 Years	265,216	175,168	816	299	1,115
Overall	2,137,961	828,120	10,724	3112	13,834

Hispanic

	Cases	Number Dead	YLLs/1,000	YLDs/1,000	DALYs/1,000
50–59 Years	458,898	94,352	2022	813	2835

Table 3

(continued).

Hispanic

	Cases	Number Dead	YLLs/1,000	YLDs/1,000	DALYs/1,000
60–69 Years	481,274	122,795	1779	860	2640
70–79 Years	266,060	90,736	836	469	1305
≥80 Years	131,368	84,252	421	135	556
Overall	1,337,600	392,135	5058	2,277	7336

White

	Cases	Number Dead	YLLs/1000	YLDs/1000	DALYs/1000
50–59 Years	5,153,263	958,882	20,599	9081	29,680
60–69 Years	5,923,962	1,896,355	28,076	10,421	38,497
70–79 Years	5,795,758	3,039,329	27,091	9729	36,820
≥80 Years	3,209,620	2,363,213	11,852	4108	15,961
Overall	20,082,603	8,257,779	87,618	33,339	120,958

Chronic Obstructive Pulmonary Disease

Black

	Cases	Number Dead	YLLs/1000	YLDs/1000	DALYs/1000
50–59 Years	711,238	170,632	3878	68	3946
60–69 Years	664,243	208,851	3215	73	3288
70–79 Years	316,334	177,047	1605	32	1636
≥80 Years	112,952	89,611	430	7	437
Overall	1,804,767	646,141	9128	180	9307

Hispanic

	Cases	Number Dead	YLLs/1,000	YLDs/1000	DALYs/1,000
50–59 Years	428,456	69,645	1449	53	1502
60–69 Years	356,952	89,198	1386	37	1423
70–79 Years	227,527	97,210	857	25	882
≥80 Years	100,952	65,876	306	7	314
Overall	1,113,887	321,929	3998	122	4121

White

	Cases	Number Dead	YLLs/1000	YLDs/1000	DALYs/1000
50–59 Years	4,910,970	1,016,178	20,685	693	21,378
60–69 Years	4,417,988	1,595,050	22,673	592	23,265
70–79 Years	4,127,694	2,514,715	22,641	446	23,087
≥80 Years	2,232,582	1,686,139	8729	164	8894
Overall	15,689,234	6,812,082	74,728	1895	76,624

Congestive Heart Failure

Black

	Cases	Number Dead	YLLs/1000	YLDs/1000	DALYs/1000
50–59 Years	363,424	145,629	3368	346	3,714
60–69 Years	359,359	138,172	2177	343	2520
70–79 Years	266,344	194,233	1837	293	2130
≥80 Years	142,414	108,026	502	104	606
Overall	1,131,541	586,060	7884	1086	8970

Hispanic

	Cases	Number Dead	YLLs/1000	YLDs/1000	DALYs/1000
50–59 Years	176,133	45,601	962	222	1184
60–69 Years	145,930	44,036	745	118	864
70–79 Years	146,493	101,761	974	144	1,117
≥80 Years	117,532	94,463	480	77	557
Overall	586,088	285,861	3161	561	3,722

White

	Cases	Number Dead	YLLs/1000	YLDs/1000	DALYs/1000
50–59 Years	1,145,359	336,467	7218	1296	8514
60–69 Years	1,592,384	704,772	10,609	1650	12,259

Table 3

(continued).

White

	Cases	Number Dead	YLLs/1000	YLDs/1000	DALYs/1000
70–79 Years	2,396,118	1,607,466	15,158	2322	17,480
≥80 Years	2,412,382	2,003,586	10,082	1517	11,599
Overall	7,546,243	4,652,291	43,067	6785	49,852

Diabetes

Black

	Cases	Number Dead	YLLs/1000	YLDs/1000	DALYs/1000
50–59 Years	2,307,618	434,077	9288	235	9522
60–69 Years	1,545,949	427,618	6235	163	6399
70–79 Years	763,997	391,021	3434	73	3508
≥80 Years	277,596	186,981	944	18	962
Overall	4,895,160	1,439,697	19,901	489	20,391

Hispanic

	Cases	Number Dead	YLLs/1000	YLDs/1000	DALYs/1000
50–59 Years	1,905,288	226,152	4685	212	4898
60–69 Years	1,264,574	270,918	3966	131	4097
70–79 Years	568,525	242,563	2074	58	2132
≥80 Years	187,620	114,476	564	12	576
Overall	3,926,007	854,109	11,289	413	11,703

White

	Cases	Number Dead	YLLs/1000	YLDs/1000	DALYs/1000
50–59 Years	7,690,748	1,332,860	27,118	862	27,981
60–69 Years	7,145,544	1,814,823	25,231	787	26,019
70–79 Years	5,066,080	2,672,203	22,893	498	23,391
≥80 Years	2,234,172	1,478,172	7486	147	7632
Overall	22,136,544	7,298,058	82,728	2294	85,023

Fractured Hip

Black

	Cases	Number Dead	YLLs/1000	YLDs/1000	DALYs/1000
50–59 Years	0	0	–	–	–
60–69 Years	90,509	33,794	505	20	526
70–79 Years	96,739	46,167	454	27	482
≥80 Years	129,725	79,268	376	21	397
Overall	316,973	159,229	1335	68	1405

Hispanic

	Cases	Number Dead	YLLs/1000	YLDs/1000	DALYs/1000
50–59 Years	0	0	–	–	–
60–69 Years	55,131	9660	119	34	153
70–79 Years	103,305	40,440	413	24	437
≥80 Years	105,321	64,281	319	23	341
Overall	263,757	114,381	851	81	931

White

	Cases	Number Dead	YLLs/1000	YLDs/1000	DALYs/1000
50–59 Years	0	0	–	–	–
60–69 Years	325,485	113,802	1696	884	1780
70–79 Years	1,074,887	641,394	5977	334	6312
≥80 Years	2,020,738	1,416,478	6817	404	7221
Overall	3,421,110	2,171,674	14,490	1622	15,313

Hypertension

Black

	Cases	Number Dead	YLLs/1000	YLDs/1000	DALYs/1000
50–59 Years	5,558,840	819,520	17,739	9046	26,785
60–69 Years	2,905,607	760,983	11,000	5297	16,297

Table 3

(continued).

Hypertension

Black

	Cases	Number Dead	YLLs/1000	YLDs/1000	DALYs/1000
70–79 Years	1,382,715	827,771	6891	2449	9340
≥80 Years	623,741	513,118	2,406	802	3209
Overall	10,780,903	2,921,392	38,036	17,594	55,631

Hispanic

	Cases	Number Dead	YLLs/1000	YLDs/1000	DALYs/1000
50–59 Years	3,460,688	282,735	5981	5905	11,887
60–69 Years	2,071,914	428,224	6105	3712	9818
70–79 Years	955,351	400,200	3300	1686	4986
≥80 Years	376,560	269,434	1241	510	1751
Overall	6,864,513	1,380,593	16,627	8101	28,442

White

	Cases	Number Dead	YLLs/1000	YLDs/1000	DALYs/1000
50–59 Years	23,728,718	2,678,355	54,209	44,972	99,182
60–69 Years	16,010,127	4,034,066	54,549	31,845	86,394
70–79 Years	12,580,126	6,748,071	54,452	23,554	78,007
≥80 Years	6,575,321	4,990,118	23,454	8586	32,040
Overall	58,894,292	18,450,610	186,664	108,957	295,623

Myocardial Infarction

Black

	Cases	Number Dead	YLLs/1000	YLDs/1000	DALYs/1000
50–59 Years	333,331	78,617	1699	1055	2754
60–69 Years	219,178	120,539	1880	477	2357
70–79 Years	212,641	144,854	1322	529	1850
≥80 Years	114,235	94,022	464	235	699
Overall	879,385	438,032	5365	2296	7660

Hispanic

	Cases	Number Dead	YLLs/1000	YLDs/1000	DALYs/1000
50–59 Years	233,204	83,379	1655	703	2358
60–69 Years	174,681	57,762	845	410	1255
70–79 Years	142,285	88,749	821	333	1155
≥80 Years	87,763	62,114	320	147	467
Overall	637,933	292,004	3641	1593	5235

White

	Cases	Number Dead	YLLs/1000	YLDs/1,000	DALYs/1000
50–59 Years	1,559,908	297,315	5916	5125	11,042
60–69 Years	1,929,065	727,109	10,621	4717	15,338
70–79 Years	1,988,291	1,204,918	10,615	5150	15,765
≥80 Years	1,641,456	1,369,168	6889	2780	9668
Overall	7,118,720	3,598,510	34,041	17,772	51,813

Stroke

Black

	Cases	Number Dead	YLLs/1000	YLDs/1000	DALYs/1000
50–59 Years	734,492	208,910	4644	1045	5688
60–69 Years	582,910	247,835	3801	863	4664
70–79 Years	455,076	298,604	2871	572	3,443
≥80 Years	320,604	239,165	1170	321	1491
Overall	2,093,082	994,514	12,486	2,801	15,286

Hispanic

	Cases	Number Dead	YLLs/1000	YLDs/1000	DALYs/1000
50–59 Years	272,827	60,662	1285	346	1631
60–69 Years	327,363	111,676	1703	480	2183

Table 3

(continued).

Hispanic				
	Cases	Number Dead	YLLs/1000	YLDs/1000	DALYs/1000
70–79 Years	253,290	126,808	1179	339	1519
≥80 Years	159,546	116,926	635	135	770
Overall	1,013,026	416,072	4802	1300	6103

White				
	Cases	Number Dead	YLLs/1000	YLDs/1000	DALYs/1000
50–59 Years	1,815,831	432,240	8834	3541	12,375
60–69 Years	2,583,425	958,727	14,305	3890	18,195
70–79 Years	3,714,046	2,190,842	18,960	5902	24,862
≥80 Years	3,766,630	2,728,074	13,425	3725	17,150
Overall	11,879,932	6,309,883	55,524	17,058	72,582

DALY = disability-adjusted life year, YLD = years lived with disease/disability, YLL = years of life lost.

in the United States,[34] COPD remains a leading cause of death.[35] Our results support these findings by suggesting non-fatal health loss and premature mortality from COPD ranked highest in Whites than in Blacks and Hispanics.

The "Hispanic Paradox" posits that persons with a Hispanic ethnicity have lower levels of cardiovascular disease despite having more risk factors compared to Whites.[36] Our results show the DALY rank of myocardial infarction was higher in Hispanics compared to Blacks and Whites. This may suggest that myocardial infarctions are a more impactful health condition for Hispanics as they age. While hip fractures are common in older adults, other investigations have determined hip fracture incidence and mortality rates have

declined in the United States.[37,38] Hip fracture cases and related deaths were lowest in our investigation compared to the other health conditions examined, which explains why the DALY ranking for hip fractures was also lowest across all race and ethnicity. A similar investigation revealed there were 5964 healthy years of life lost from hip fractures in a sample of 223,880 older adults that were followed for approximately 13 years.[39] Although the DALY ranks in this investigation were lowest for hip fractures across race and ethnicity, hip fractures remains a primary etiology of poor function and quality of life.[40]

Indeed, our DALY estimates revealed that the burden of some health conditions impacted each race and ethnicity

Figure 4. Combined weighted DALY estimates for each health condition ranked by race and ethnicity. COPD = chronic obstructive pulmonary disease, DALYs = disability-adjusted life years.

Percentage of collective disability-adjusted life year estimated totals for each health condition by race and ethnicity.

Blacks			Hispanics			Whites		
Health Condition	DALY/1000	% DALY*	Health Condition	DALY/1000	% DALY*	Health Condition	DALY/1000	% DALY*
Hypertension	55,631	28.0%	Hypertension	28,442	28.0%	Hypertension	295,623	24.9%
Rheumatism or Arthritis	41,397	20.8%	Rheumatism or Arthritis	21,737	21.4%	Rheumatism or Arthritis	270,788	22.8%
Back Pain	24,740	12.5%	Back Pain	12,132	12.0%	Back Pain	149,149	12.6%
Diabetes	20,391	10.3%	Diabetes	11,703	11.5%	Cancer	120,958	10.2%
Stroke	15,286	7.7%	Cancer	7336	7.2%	Diabetes	85,023	7.2%
Cancer	13,834	7.0%	Stroke	6103	6.0%	COPD	76,624	6.5%
COPD	9307	4.7%	Myocardial Infarction	5235	5.2%	Stroke	72,582	6.1%
Congestive Heart Failure	8970	4.5%	COPD	4121	4.1%	Myocardial Infarction	51,813	4.4%
Myocardial Infarction	7660	3.9%	Congestive Heart Failure	3722	3.7%	Congestive Heart Failure	49,852	4.2%
Fractured Hip	1405	0.7%	Fractured Hip	931	0.9%	Fractured Hip	15,313	1.3%

* Represents the percentage from the collective estimated daly total for each race or ethnicity.
COPD = chronic obstructive pulmonary disease, DALY = disability-adjusted life years.

differently. These findings suggest that healthcare providers and interventions should consider the role of race and ethnicity for health. For example, continuing to develop programs that reduce racial and ethnic disparities in healthcare access and insurance coverage may help to provide more inclusive and quality healthcare.[41] Our findings suggest that hypertension accounted for the largest amount of DALYs for each race and ethnicity. Interventions aiming to prevent and improve health outcomes such as hypertension in at risk populations should include community engagement and culturally responsive strategies for behavior change initiation and adherence.[42] Continuing to work toward more inclusive healthcare may reduce future DALY estimates.

Some limitations should be noted. The HRS provides a rich amount of health data for aging Americans. Although some have provided evidence for the concordance between self-report measures of morbidity and claim-based administrative data,[43] the extent of the reliability and validity for each self-reported health condition item in this study is unknown.[44,45] While the use of an incidence-based YLD calculation allowed us to evaluate how the burden of each health condition longitudinally, we were unable to control for multimorbidity in our disability weights. The authors did not exclude participants for having a cognitive impairment because the presence of these health conditions would not have changed if reported by a proxy. Being that health conditions were self-reported by participants at each wave, it is possible that our results were underestimated from recall biases. Adults over 50 years of age were included; therefore, some participants may have had health conditions at younger ages prior to entering the study, thereby causing DALYs to be underestimated. Moreover, those who were lost from follow-up or died may have had a health condition that was not reported before the event, thereby generating underestimations for our results. It is possible that participants may have disputed their records for having a diagnosis or were no longer living with a health condition after initial diagnosis. We were also unable to specify certain health conditions (e.g., cancer). Statistical tests of inference were not used for making comparisons between DALY estimates because DALYs are often presented as a stand-alone statistic. As such, other important factors that may have helped to explain the DALY estimates such as socioeconomic status could not be taken into account. Future research should continue monitoring DALYs, including the use of the prevalence-based DALY calculation so that temporal trends can be observed.

5. Conclusions

The burden of 10 health conditions accounted for millions of healthy years of life lost for Black, Hispanic, and White aging Americans. Some health conditions impacted each race and ethnic groups differently, while others remained consistent. Trends in DALYs should continue to be monitored in middle-aged and older adults so that healthcare resources are prioritized to match such trends, and for gauging the efficacy of interventions aiming to prevent and treat health conditions. This will help the efficiency of health-related expenditures, improve the impact of health interventions, advance inclusive health care for the growing aging adult population, and prepare healthcare providers for serving the health needs of aging adults.

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