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The unequal toll of COVID-19 mortality by age in the United States:
Quantifying racial/ethnic disparities

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The views expressed in this paper are those of the author(s) and do not necessarily reflect those of the Harvard Center for Population and Development Studies.

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Abstract

Importance: Excess COVID-19 mortality has been described among Non-Hispanic Blacks (NHB), Hispanics and Non-Hispanic American Indians/Alaska Natives (NHAIAN), compared to non-Hispanic Whites (NHW), but not in relation to age at death. Recent release of national COVID-19 deaths by racial/ethnic group now permit analysis of age-specific mortality rates.

Objective: To examine variation in age-specific mortality rates by racial/ethnicity and calculate its impact using Years of Potential Life Lost (YPLL).

Design: This is a descriptive study using the most recently publicly available data on COVID-19 deaths, with population data drawn from the US Census

Setting: United States

Participants: All persons for whom there were reported deaths, COVID-19 deaths and reported racial/ethnicity February 1, 2020-May 20, 2020

Results: Age-standardized rate ratios relative to NHW were 3.6 (95% CI 3.5, 3.7) for NHB, 2.6 (95% CI 2.4, 2.7) for Hispanics, 1.2 (0.8, 1.6) for NHAIAN, and 1.7 (1.6, 1.9) for NHAPI. By contrast, NHB rate ratios relative to NHW were as high as 7.3 (95% CI 5.6, 9.5) for 25-34 year old, 9.0 (95% CI 7.6, 10.8) for 35-44 year old, and 6.9 (95% CI 6.3, 7.6) for 45-54 year old. Even at older ages, NHB rate ratios were between 1.9 and 5.7. Similarly, rate ratios for Hispanics vs. NHW were 5.5 (95% CI 4.2, 7.2), 7.9 (95% CI 6.7, 9.3), and 5.8 (95% CI 5.3, 6.3) for corresponding age strata, with remaining rate ratios ranging from 1.4 to 4.1. Rate ratios for NHAIAN were similarly high, ranging from 1.4 to 8.2 over ages 25-75, and only dipping below 1.0 for age 75-84 and 85+. Among NHAPI, rate ratios ranged from 2.2 to 2.4 for ages 25-75 and were 1.6 and 1.2 for age 75-84 and 85+ respectively. As a consequence, more years of potential life lost were experienced by African Americans and Latinos than whites, although the white population is 3-4 fold larger.

Conclusion/Relevance: This analysis makes clear the importance of examining age-specific mortality rates and underscore how age standardization can obscure extreme variations within age strata. Data that permit age-specific analyses should be routinely publicly available.

Title: The Unequal Toll of COVID-19 Mortality by age in the United States: Quantifying Racial/Ethnic Disparities

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Key Points

Question: How do COVID-19 mortality rates vary by age across US racial/ethnic groups?

Findings: In all age strata, COVID-19 mortality rates were higher for racial/ethnic minorities compared to whites, with extremely high rate ratios (5-9-fold higher) among younger adults (24-54 years) more than 3 times the age-standardized rate ratio. More years of potential life lost were experienced by African Americans and Latinos than whites, although the white population is 3-4 fold larger.

Meaning: Extreme variations in age-specific mortality are obscured by age standardization. Inspection of age-specific mortality rates is crucial to understanding the disparate impact of COVID-19 on racial/ethnic minorities.

Abstract

Importance: Excess COVID-19 mortality has been described among Non-Hispanic Blacks (NHB), Hispanics and Non-Hispanic American Indians/Alaska Natives (NHAIAN), compared to non-Hispanic Whites (NHW), but not in relation to age at death. Recent release of national COVID-19 deaths by racial/ethnic group now permit analysis of age-specific mortality rates.

Objective: To examine variation in age-specific mortality rates by racial/ethnicity and calculate its impact using Years of Potential Life Lost (YPLL).

Design: This is a descriptive study using the most recently publicly available data on COVID-19 deaths, with population data drawn from the US Census

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Results: Age-standardized rate ratios relative to NHW were 3.6 (95% CI 3.5, 3.7) for NHB, 2.6 (95% CI 2.4, 2.7) for Hispanics, 1.2 (0.8, 1.6) for NHAIAN, and 1.7 (1.6, 1.9) for NHAPI. By contrast, NHB rate ratios relative to NHW were as high as 7.3 (95% CI 5.6, 9.5) for 25-34 year old, 9.0 (95% CI 7.6, 10.8) for 35-44 year old, and 6.9 (95% CI 6.3, 7.6) for 45-54 year old. Even at older ages, NHB rate ratios were between 1.9 and 5.7. Similarly, rate ratios for Hispanics vs. NHW were 5.5 (95% CI 4.2, 7.2), 7.9 (95% CI 6.7, 9.3), and 5.8 (95% CI 5.3, 6.3) for corresponding age strata, with remaining rate ratios ranging from 1.4 to 4.1. Rate ratios for NHAIAN were similarly high, ranging from 1.4 to 8.2 over ages 25-75, and only dipping below 1.0 for age 75-84 and 85+. Among NHAPI, rate ratios ranged from 2.2 to 2.4 for ages 25-75 and were 1.6 and 1.2 for age 75-84 and 85+ respectively. As a consequence,

more years of potential life lost were experienced by African Americans and Latinos than whites, although the white population is 3-4 fold larger.

Conclusion/Relevance: This analysis makes clear the importance of examining age-specific mortality rates and underscore how age standardization can obscure extreme variations within age strata. Data that permit age-specific analyses should be routinely publicly available.

Introduction

The first death due to COVID-19 in the United States was reported on February 29, 2020. In late March, media reports brought to national attention of the disproportionate number of COVID-19 cases and deaths occurring among Blacks and Latinos (1). Typically these reports compared the proportion of cases and deaths by reported racial/ethnicity to the racial/ethnic composition of the population. Milwaukee, for example, noted on March 27 that all (100%) of its eight deaths were African Americans, who comprised 38% of their population; in all of Wisconsin, only 15 deaths statewide had occurred (2). Such reports came from state and local jurisdictions. At the time, the Centers for Disease Control and Prevention (CDC) made COVID-19 data publicly available only by age and sex, prompting many calls to release racial/ethnicity data (3). New York City produced both crude and age-adjusted COVID-19 mortality rates, permitting some insight into the impact of population age structure and age at death on racial/ethnic specific mortality rates (4). Suggesting such information could be important, marked racial/ethnic inequities in premature morbidity and mortality, including for conditions that increase risk of COVID-19 mortality (e.g., diabetes and cardiovascular disease), are well-documented (5-7).

Newly released data by the National Center for Health Statistics (NCHS) (8) make it possible for the first time to explore with national data the likelihood that Blacks, Latinos, American Indian/Alaska Natives, and Asian and Pacific Islanders, in addition to experiencing higher COVID-19 mortality rates than white Americans, are also dying at younger ages.

Methods

Mortality rates and rate ratios

We used the publicly available NCHS data on Covid19 deaths race/ethnicity, age, and state (8) instead of the data on cases and race and ethnicity by age posted by the Centers for Disease Control (CDC) (9), because the NCHS data file includes death counts from New York City (NYC), a major hotspot for COVID-19, which is excluded in the CDC webpage and also provides the data jointly (rather than separately) by “race” and “ethnicity” (Hispanic or not). Racial/ethnic groups were limited to non-Hispanic white (NHW), non-Hispanic black (NHB), non-Hispanic American Indian or Alaskan Native (NHAIAN), non-Hispanic Asian or Pacific Islander (NHAPI), and Hispanic by the availability of denominator data in CDC Wonder (10). Only 1.7% of the NCHS COVID-19 deaths had missing data on race/ethnicity.

We calculated rates for 100,000 person years by dividing deaths by the person-time from February 1 (the "Start Week" listed in the CDC data file) and May 20 (the "Data as of" field in the data file). This permits comparison of the age-specific and age-standardized rates to published mortality rates for common causes of death in previous years. We age-standardized to the Year 2000 standard million and computed age-standardized rates, rate ratios, rate differences, and their confidence intervals using standard methods (11,12).

Years of Potential Life Lost (YPLL) and Years of Potential Life Lost (YPLL) rates

To capture the population impact of premature death, we computed Years of Potential Life Lost (YPLL) by multiplying the number of deaths in each age category by the number of years from

the midpoint of the age category to age 65 and summing over age. We used the cut-point of 65 because of the importance of attainment of 65 years to eligibility for a range of social benefits, including Medicare.

Because the YPLL is sensitive to the size of the population and differences in the age distribution for racial/ethnic groups, we also computed the age-standardized YPLL rate per 100,000 by computing age-specific YPLL rates and then taking a weighted sum with the weights coming from the Year 2000 standard million) (13).

Results

As of May 20, the number of COVID-19 deaths equaled 36,545 for NHW, 15,631 for NHB, 322 for NHAIAN, 3,862 for NHAPI, and 11,303 for Hispanics; the corresponding population sizes were 186.4 million, 40.6 million, 2.6 million, 19.5 million, and 57.7 million (Supplemental Table 1).

Table 1 and Figure 1 show the racial/ethnic disparities in COVID-19 mortality, with Table 1 additionally providing the age-standardized comparisons. Discounting trends for ages below 25 because of instability due to small numbers, disparities were observed in every age stratum and were especially stark among young adults into midlife (25-54 years). NHB rate ratios relative to NHW were as high as 7.3 (95% CI 5.6, 9.5) for 25-34 year old, 9.0 (95% CI 7.6, 10.8) for 35-44 year old, and 6.9 (95% CI 6.3, 7.6) for 45-54 year old. Even at older ages, NHB rate ratios were

between 1.9 and 5.7. Similarly, rate ratios for Hispanics vs. NHW were 5.5 (95% CI 4.2, 7.2), 7.9 (95% CI 6.7, 9.3), and 5.8 (95% CI 5.3, 6.3) for corresponding age strata, with remaining rate ratios ranging from 1.4 to 4.1. Rate ratios for NHAIAN were similarly high, ranging from 1.4 to 8.2 over ages 25-75, and only dipping below 1.0 for age 75-84 and 85+. Among NHAPI, rate ratios ranged from 2.2 to 2.4 for ages 25-75 and were 1.6 and 1.2 for age 75-84 and 85+ respectively. By contrast, the age-standardized rate ratios equaled 3.6 (95% CI 3.5, 3.7) for NHB, 2.6 (95% CI 2.4, 2.7) for Hispanic, 1.2 (0.8, 1.6) for NHAIAN, and 1.7 (1.6, 1.9) for NHAPI.

Table 2 shows corresponding Years of Potential Life Lost (YPLL) for COVID-19 (with Supplemental Table 2 also showing YPLL for all-cause mortality, for comparison). For NHB, disparities in COVID-19 mortality translate to 45,777 (95% CI 32,061 to 34,832) years of potential life lost, for Hispanics, 48,204 (95% CI 46,328 to 50,080), 1,745 (95% CI 1,371 to 2,119) for NHAIAN, and 8,905 (95% CI 8,156 to 9,654) for NHAPI, compared with 33,446 (95% CI 32,061 to 34,832) for NHW. Accounting for age distribution and population size differences between racial/ethnic groups, the age-standardized YPLL rate was 6.7 (95% CI 6.7, 6.8) for NHB, 5.4 (95% CI 5.3, 5.4) for Hispanics, 4.0 (95% CI 3.9, 4.0) for NHAIAN, and 2.6 (95% CI 2.6, 2.7) for NHAPI times higher compared with NHW.

Discussion

These data demonstrate excess risk of COVID-19 death at all ages among Non-Hispanic Blacks, Hispanics, Non-Hispanic American Indian or Alaskan Natives, and Non-Hispanic Asian Pacific Islanders (NHAPI) as compared to Non-Hispanic Whites (NHW), with disparities particularly

extreme at younger ages (25-54 years old). The impact of lives prematurely cut short (before attaining 65 years) can be measured in the absolute number of years of potential life lost. For both NHBs and Hispanics this loss is much larger than for NHW, despite the fact that the NHW population is respectively 4.5 and 3 -fold larger. Poor quality of AIAN mortality and population data likely means the estimated excesses are underestimates (14).

Examination of age-specific mortality rates, and not simply counts of deaths or crude comparisons of the racial/ethnic composition of COVID-19 deaths to the total population, is crucial to revealing racial/ethnic disparities. Nor are age-standardized rates sufficient because age standardization, while accounting for the different age distributions across racial/ethnic groups, notably obscured the magnitude of mortality inequities at younger ages (5-7). These COVID-19 mortality rate ratios, 7-9-fold higher for NHB, NHAIAN, and Hispanics, are extreme and reflect the devastating toll COVID-19 has taken among communities of color. Age-specific mortality rates for COVID-19 should be routinely available by race/ethnicity as well as by gender.

References

1. Eligon J, Burch ADS, Searcey D, Opper RA Jr. Black Americans face alarming rates of virus infection in some states. *New York Times*, April 7, 2020, updated April 14, 2020. <https://www.nytimes.com/2020/04/07/us/coronavirus-race.html> ; accessed June 12, 2020.
2. Bauer S. Milwaukee's black community hit hard by coronavirus. AP News, March 27. 2020. <https://apnews.com/b52e4e9a63d64e3a25109f09010508b6> ; accessed June 12, 2020.
3. Krieger N, Gonsalves, G, Bassett MT, Hanage W. Krumholz HM. The Fierce Urgency of Now: Closing Glaring Gaps In US Surveillance Data On COVID-19. *Health Affairs Blog*, April 14, 2020. <https://www.healthaffairs.org/doi/10.1377/hblog20200414.238084/full/> ; accessed June 12, 2020.
4. New York City Department of Health and Mental Hygiene. COVID-19 data. <https://www1.nyc.gov/site/doh/covid/covid-19-data-archive.page> ; accessed June 12, 2020.
5. Cunningham TJ, Croft B, Liu Y, Lu H, Eke PI, Giles WH. Vital Signs: racial disparities in age-specific mortality among Blacks or African-Americans – United States, 1999-2015. *MMWR Morb Mortal Wkly Rep* ePub: 2 May 2017. <https://www.cdc.gov/mmwr/volumes/66/wr/mm6617e1.htm> ; accessed June 12, 2020.
6. Chen Y, Freedman ND, Rodriguez EJ, et al. Trends in Premature Deaths Among Adults in the United States and Latin America. *JAMA Netw Open*. 2020;3(2):e1921085. doi:10.1001/jamanetworkopen.2019.21085
7. Williams DR, The Health of US Racial and Ethnic Populations). *J Gerontol* 2005, 60B (Special Issue II): 53-62.
8. Data.CDC.gov. Deaths involving coronavirus disease (COVID-19) by race and Hispanic origin group and age, by state, NCHS. Updated May 2020. Data provided by the National Center for Health Statistics. <https://data.cdc.gov/NCHS/Deaths-involving-coronavirus-disease-2019-COVID-19/ks3g-spdg> ; accessed June 12, 2020.
9. CDC. Coronavirus Disease 2019 (COVID-19). Cases in the US. <https://www.cdc.gov/coronavirus/2019-ncov/cases-updates/cases-in-us.html> ; accessed June 12, 2020.
10. CDC WONDER. <https://wonder.cdc.gov/> ; accessed June 12, 2020.
11. National Cancer Institute, Surveillance and Epidemiology End Results Program. Standard Populations (Millions) For Age Adjustment. <https://seer.cancer.gov/stdpopulations/> ; accessed June 12, 2020.
12. Rothman KJ, Greenland S. *Modern Epidemiology*, 2nd edition, Chapter 14. Philadelphia, PA: Lippincott-Raven, 1998
13. Centers for Disease Control (CDC). Premature mortality in the United States: public health issues in the use of years of potential life lost. *MMWR Suppl*. 1986;35(2):1S-11S. <https://www.cdc.gov/mmwr/preview/mmwrhtml/00001773.htm> ; accessed June 12, 2020.
14. Arias E, Heron M, National Center for Health Statistics, Hakes J, US Census Bureau. The validity of race and Hispanic-origin reporting on death certificates in the United States: an update. *Vital Health Stat 2*. 2016;(172):1–21.

Table 1: Age-specific and age-standardized rate ratios and rate differences per 100,000 person-years comparing rates of COVID-19 mortality for racial/ethnic groups compared with Non-Hispanic Whites, United States, February 1-May 20, 2020

Age group	Incidence Rate Ratio (95% CI) (reference group: Non-Hispanic White)			
	Non-Hispanic Black	Non-Hispanic American Indian or Alaska Native	Non-Hispanic Asian or Pacific Islander	Hispanic
age-standardized	3.61 (3.41, 3.81)	1.16 (0.84, 1.60)	1.74 (1.58, 1.91)	2.59 (2.43, 2.76)
Under 1 year	-*	-	-	3.96 (0.36, 43.70)
1-4 years	3.37 (0.21, 53.90)	-	-	-
5-14 years	13.82 (1.54, 123.70)	-	8.84 (0.55, 141.40)	-
15-24 years	5.43 (2.89, 10.20)	3.51 (0.47, 26.50)	1.64 (0.48, 5.60)	4.20 (2.27, 7.80)
25-34 years	7.29 (5.60, 9.50)	7.29 (3.79, 14.10)	2.42 (1.58, 3.70)	5.51 (4.24, 7.20)
35-44 years	9.04 (7.58, 10.80)	8.16 (5.20, 12.80)	2.44 (1.83, 3.30)	7.89 (6.67, 9.30)
45-54 years	6.91 (6.29, 7.60)	3.49 (2.46, 4.90)	2.79 (2.40, 3.20)	5.79 (5.28, 6.30)
55-64 years	5.68 (5.39, 6.00)	2.11 (1.65, 2.70)	2.72 (2.49, 3.00)	4.10 (3.87, 4.30)
65-74 years	5.05 (4.86, 5.30)	1.37 (1.09, 1.70)	2.22 (2.07, 2.40)	3.52 (3.36, 3.70)
75-84 years	3.61 (3.48, 3.70)	0.83 (0.64, 1.10)	1.61 (1.51, 1.70)	2.49 (2.38, 2.60)
85 years and over	1.92 (1.84, 2.00)	0.61 (0.47, 0.80)	1.22 (1.15, 1.30)	1.39 (1.33, 1.50)
	Incidence Rate Difference per 100,000 person-years (95% CI) (reference group: Non-Hispanic White)			
	Non-Hispanic Black	Non-Hispanic American Indian or Alaska Native	Non-Hispanic Asian or Pacific Islander	Hispanic
age-standardized	109.9 (145.0, 145.0)	6.9 (33.3, 33.3)	31.0 (66.3, 66.3)	67.0 (103.2, 103.2)
Under 1 year	-0.2 (-0.5, 0.2)	-0.2 (-0.5, 0.2)	-0.2 (-0.5, 0.2)	0.5 (-0.5, 1.5)
1-4 years	0.1 (-0.2, 0.4)	-0.0 (-0.1, 0.0)	-0.0 (-0.1, 0.0)	-0.0 (-0.1, 0.0)
5-14 years	0.2 (-0.0, 0.4)	-0.0 (-0.0, 0.0)	0.1 (-0.1, 0.4)	-0.0 (-0.0, 0.0)
15-24 years	1.0 (0.5, 1.5)	0.6 (-1.0, 2.1)	0.1 (-0.3, 0.6)	0.7 (0.4, 1.1)
25-34 years	6.9 (5.6, 8.2)	6.9 (1.9, 11.9)	1.6 (0.5, 2.6)	4.9 (4.0, 5.9)
35-44 years	20.8 (18.4, 23.2)	18.5 (9.5, 27.6)	3.7 (2.1, 5.4)	17.8 (16.0, 19.6)
45-54 years	57.3 (53.2, 61.4)	24.2 (12.6, 35.8)	17.4 (13.8, 21.0)	46.5 (43.2, 49.8)
55-64 years	281.6 (268.5, 294.7)	66.8 (36.1, 97.5)	103.4 (89.8, 117.0)	186.5 (175.5, 197.5)
65-74 years	372.5 (358.2, 386.8)	33.8 (5.4, 62.1)	111.9 (98.5, 125.3)	231.9 (219.2, 244.6)
75-84 years	755.3 (723.0, 787.6)	-49.4 (-110.0, 11.2)	176.8 (147.1, 206.4)	430.6 (402.6, 458.5)
85 years and over	943.0 (870.5, 1015.4)	-402.9 (-570.4, -235.5)	225.2 (148.4, 302.1)	400.3 (337.5, 463.0)

* "-" indicates rate ratio or rate difference not calculated due to zero cases in this age stratum.

Table 2: Years of potential life lost with age 65 cutoff (YPLL65) and age-standardized YPLL65 rate per 100,000 by race/ethnicity, with age-standardized YPLL65 rate ratios and rate differences per 100,000, COVID-19 related deaths in the United States, February 1-May 20, 2020

Race/ethnicity	YPLL65	Age-standardized YPLL65 rate per 100,000	Age-standardized YPLL65 rate ratio	Age-standardized YPLL65 rate difference per 100,000
Non-Hispanic White	33,446 (32,061 to 34,832)	18.9 (16.6, 21.2)	1.00 (reference)	0.0 (reference)
Non-Hispanic Black	45,777 (44,023 to 47,531)	127.6 (114.4, 140.9)	6.7 (6.7, 6.8)	108.7 (95.3, 122.2)
Non-Hispanic American Indian or Alaska Native	1,745 (1,371 to 2,119)	75.4 (30.6, 120.2)	4.0 (3.9, 4.0)	56.5 (11.6, 101.3)
Non-Hispanic Asian or Pacific Islander	8,905 (8,156 to 9,654)	50.1 (39.2, 61.0)	2.6 (2.6, 2.7)	31.2 (20.0, 42.3)
Hispanic or Latino	48,204 (46,328 to 50,080)	101.3 (91.2, 111.4)	5.4 (5.3, 5.4)	82.4 (72.0, 92.7)

SUPPLEMENTAL TABLES

Title: The Unequal Toll of COVID-19 Mortality by age in the United States: Quantifying Racial/Ethnic Disparities

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Supplemental Table 1: Age-specific and age-standardized deaths, population, and mortality rate per 100,000 person years for total all cause and COVID-19 mortality in the United States, February 1-May 9, 2020, along with corresponding mortality rate ratios and rate differences per 100,000 person-years

Racial/ethnic group	Cause of death	Age group	Deaths	Population	Rate per 100,000 person-years	Incidence Rate Ratio (95% CI)	Incidence Rate Difference per 100,000 person-years (95% CI)
Non-Hispanic White	COVID-19 mortality	age-standardized	36545	186,405,546	42.2 (40.9, 43.5)	referent group	referent group
		Under 1 year	1	1,994,440	0.2 (0.0, 0.6)		
		1-4 years	1	8,244,087	0.0 (0.0, 0.1)		
		5-14 years	1	21,483,759	0.0 (0.0, 0.1)		
		15-24 years	16	23,544,616	0.2 (0.1, 0.3)		
		25-34 years	84	25,657,465	1.1 (0.9, 1.3)		
		35-44 years	183	23,709,326	2.6 (2.2, 3.0)		
		45-54 years	760	26,232,985	9.7 (9.0, 10.4)		
		55-64 years	2,726	15,189,511	60.1 (57.9, 62.4)		
		65-74 years	6,340	23,091,706	92.0 (89.7, 94.3)		
		75-84 years	10,409	12,034,203	289.8 (284.3, 295.4)		
		85 years and over	16,024	5,223,448	1028.0 (1012.0, 1043.9)		
		All Cause mortality	age-standardized	671,316	186,405,546		
	Under 1 year		1,898	1,994,440	318.9 (304.5, 333.2)		
	1-4 years		376	8,244,087	15.3 (13.7, 16.8)		
	5-14 years		651	21,483,759	10.2 (9.4, 10.9)		
	15-24 years		3,960	23,544,616	56.4 (54.6, 58.1)		
	25-34 years		9,834	25,657,465	128.4 (125.9, 131.0)		
	35-44 years		14,456	23,709,326	204.3 (201.0, 207.6)		
	45-54 years		29,137	26,232,985	372.2 (367.9, 376.5)		
	55-64 years		76,781	15,189,511	1693.8 (1681.9, 1705.8)		
	65-74 years		128,841	23,091,706	1869.7 (1859.4, 1879.9)		
75-84 years	172,745		12,034,203	4810.1 (4787.4, 4832.8)			
85 years and over	232,637	5,223,448	14924.0 (14863.4, 14984.6)				
Non-Hispanic Black	COVID-19 mortality	age-standardized	15631	40,613,993	152.1 (145.1, 159.0)	3.61 (3.41, 3.81)	109.9 (145.0, 145.0)
		Under 1 year	0	591,754	-	-	-0.2 (-0.5, 0.2)
		1-4 years	1	2,447,225	0.1 (0.0, 0.5)	3.37 (0.21, 53.90)	0.1 (-0.2, 0.4)
		5-14 years	4	6,217,144	0.2 (0.0, 0.4)	13.82 (1.54, 123.70)	0.2 (-0.0, 0.4)
		15-24 years	24	6,500,474	1.2 (0.7, 1.7)	5.43 (2.89, 10.20)	1.0 (0.5, 1.5)
		25-34 years	159	6,658,091	8.0 (6.8, 9.2)	7.29 (5.60, 9.50)	6.9 (5.6, 8.2)
		35-44 years	378	5,414,553	23.4 (21.0, 25.8)	9.04 (7.58, 10.80)	20.8 (18.4, 23.2)
		45-54 years	1,058	5,287,236	67.1 (63.0, 71.1)	6.91 (6.29, 7.60)	57.3 (53.2, 61.4)
		55-64 years	2,706	2,653,390	341.7 (328.9, 354.6)	5.68 (5.39, 6.00)	281.6 (268.5, 294.7)
		65-74 years	4,168	3,006,666	464.5 (450.4, 478.6)	5.05 (4.86, 5.30)	372.5 (358.2, 386.8)
		75-84 years	4,148	1,329,955	1045.1 (1013.3, 1076.9)	3.61 (3.48, 3.70)	755.3 (723.0, 787.6)
		85 years and over	2,985	507,505	1970.9 (1900.2, 2041.6)	1.92 (1.84, 2.00)	943.0 (870.5, 1015.4)
		All Cause mortality	age-standardized	117,244	40,613,993	1125.1 (1106.3, 1143.9)	1.35 (1.33, 1.37)
	Under 1 year		1,243	591,754	703.9 (664.7, 743.0)	2.21 (2.05, 2.40)	385.0 (343.3, 426.7)
	1-4 years		229	2,447,225	31.4 (27.3, 35.4)	2.05 (1.74, 2.40)	16.1 (11.7, 20.4)
	5-14 years		274	6,217,144	14.8 (13.0, 16.5)	1.45 (1.26, 1.70)	4.6 (2.7, 6.5)
	15-24 years		1,899	6,500,474	97.9 (93.5, 102.3)	1.74 (1.64, 1.80)	41.5 (36.8, 46.3)

		25-34 years	3,721	6,658,091	187.3 (181.3, 193.3)	1.46 (1.40, 1.50)	58.8 (52.3, 65.4)	
		35-44 years	5,038	5,414,553	311.8 (303.2, 320.4)	1.53 (1.48, 1.60)	107.5 (98.2, 116.7)	
		45-54 years	9,634	5,287,236	610.6 (598.4, 622.8)	1.64 (1.60, 1.70)	238.4 (225.5, 251.3)	
		55-64 years	21,297	2,653,390	2689.6 (2653.4, 2725.7)	1.59 (1.56, 1.60)	995.7 (957.7, 1033.8)	
		65-74 years	27,161	3,006,666	3027.1 (2991.1, 3063.1)	1.62 (1.60, 1.60)	1157.4 (1120.0, 1194.8)	
		75-84 years	24,792	1,329,955	6246.5 (6168.8, 6324.3)	1.30 (1.28, 1.30)	1436.4 (1355.4, 1517.4)	
		85 years and over	21,956	507,505	14496.9 (14305.2, 14688.7)	0.97 (0.96, 1.00)	-427.1 (-628.2, -225.9)	
Non-Hispanic American Indian or Alaska Native	COVID-19 mortality	age-standardized	322	2,592,666	49.0 (33.4, 64.7)	1.16 (0.84, 1.60)	6.9 (33.3, 33.3)	
		Under 1 year	0	38,260	-	-	-0.2 (-0.5, 0.2)	
		1-4 years	0	156,473	-	-	-0.0 (-0.1, 0.0)	
		5-14 years	0	409,393	-	-	-0.0 (-0.0, 0.0)	
		15-24 years	1	419,255	0.8 (0.0, 2.9)	3.51 (0.47, 26.50)	0.6 (-1.0, 2.1)	
		25-34 years	10	418,797	8.0 (3.0, 13.0)	7.29 (3.79, 14.10)	6.9 (1.9, 11.9)	
		35-44 years	21	333,378	21.1 (12.1, 30.1)	8.16 (5.20, 12.80)	18.5 (9.5, 27.6)	
		45-54 years	33	326,384	33.9 (22.3, 45.4)	3.49 (2.46, 4.90)	24.2 (12.6, 35.8)	
		55-64 years	66	174,263	126.9 (96.3, 157.5)	2.11 (1.65, 2.70)	66.8 (36.1, 97.5)	
		65-74 years	76	202,493	125.8 (97.5, 154.0)	1.37 (1.09, 1.70)	33.8 (5.4, 62.1)	
		75-84 years	61	85,020	240.4 (180.1, 300.8)	0.83 (0.64, 1.10)	-49.4 (-110.0, 11.2)	
		85 years and over	54	28,950	625.0 (458.3, 791.8)	0.61 (0.47, 0.80)	-402.9 (-570.4, -235.5)	
		age-standardized	5,190	2,592,666	776.3 (714.4, 838.1)	0.93 (0.86, 1.01)	-57.5 (714.1, 714.1)	
		Under 1 year	47	38,260	411.6 (294.0, 529.3)	1.29 (0.97, 1.70)	92.8 (-25.8, 211.3)	
		1-4 years	15	156,473	32.1 (15.9, 48.4)	2.10 (1.25, 3.50)	16.8 (0.5, 33.2)	
	5-14 years	16	409,393	13.1 (6.7, 19.5)	1.29 (0.79, 2.10)	2.9 (-3.5, 9.4)		
	15-24 years	113	419,255	90.3 (73.7, 107.0)	1.60 (1.33, 1.90)	34.0 (17.2, 50.7)		
	25-34 years	316	418,797	252.8 (225.0, 280.7)	1.97 (1.76, 2.20)	124.4 (96.4, 152.4)		
	35-44 years	395	333,378	397.0 (357.9, 436.2)	1.94 (1.76, 2.10)	192.7 (153.4, 232.0)		
	45-54 years	583	326,384	598.6 (550.0, 647.1)	1.61 (1.48, 1.70)	226.4 (177.6, 275.1)		
	55-64 years	972	174,263	1869.1 (1751.6, 1986.6)	1.10 (1.04, 1.20)	175.2 (57.1, 293.3)		
	65-74 years	1,085	202,493	1795.5 (1688.7, 1902.3)	0.96 (0.90, 1.00)	-74.2 (-181.5, 33.2)		
	75-84 years	949	85,020	3740.3 (3502.3, 3978.3)	0.78 (0.73, 0.80)	-1069.8 (-1308.8, -830.7)		
	85 years and over	699	28,950	8090.8 (7491.0, 8690.6)	0.54 (0.50, 0.60)	-6833.2 (-7436.0, -6230.3)		
	Non-Hispanic Asian or Pacific Islander	COVID-19 mortality	age-standardized	3862	19,492,466	73.2 (66.5, 79.9)	1.74 (1.58, 1.91)	31.0 (66.3, 66.3)
			Under 1 year	0	216,177	-	-	-0.2 (-0.5, 0.2)
			1-4 years	0	949,886	-	-	-0.0 (-0.1, 0.0)
5-14 years			1	2,429,718	0.1 (0.0, 0.5)	8.84 (0.55, 141.40)	0.1 (-0.1, 0.4)	
15-24 years			3	2,692,199	0.4 (0.1, 0.9)	1.64 (0.48, 5.60)	0.1 (-0.3, 0.6)	
25-34 years			28	3,534,255	2.7 (1.7, 3.6)	2.42 (1.58, 3.70)	1.6 (0.5, 2.6)	
35-44 years			61	3,233,519	6.3 (4.7, 7.9)	2.44 (1.83, 3.30)	3.7 (2.1, 5.4)	
45-54 years			223	2,759,529	27.1 (23.5, 30.6)	2.79 (2.40, 3.20)	17.4 (13.8, 21.0)	
55-64 years			573	1,174,022	163.5 (150.2, 176.9)	2.72 (2.49, 3.00)	103.4 (89.8, 117.0)	
65-74 years			918	1,508,767	203.9 (190.7, 217.1)	2.22 (2.07, 2.40)	111.9 (98.5, 125.3)	
75-84 years			987	708,822	466.6 (437.5, 495.7)	1.61 (1.51, 1.70)	176.8 (147.1, 206.4)	
85 years and over			1,068	285,572	1253.2 (1178.0, 1328.4)	1.22 (1.15, 1.30)	225.2 (148.4, 302.1)	
age-standardized			28,184	19,492,466	531.1 (513.0, 549.2)	0.64 (0.62, 0.66)	-302.6 (512.1, 512.1)	
Under 1 year			167	216,177	258.9 (219.6, 298.1)	0.81 (0.69, 1.00)	-60.0 (-101.8, -18.2)	
1-4 years			41	949,886	14.5 (10.0, 18.9)	0.95 (0.69, 1.30)	-0.8 (-5.5, 3.9)	
5-14 years		61	2,429,718	8.4 (6.3, 10.5)	0.83 (0.64, 1.10)	-1.7 (-4.0, 0.5)		
15-24 years		227	2,692,199	28.3 (24.6, 31.9)	0.50 (0.44, 0.60)	-28.1 (-32.2, -24.0)		
25-34 years		434	3,534,255	41.1 (37.3, 45.0)	0.32 (0.29, 0.40)	-87.3 (-91.9, -82.7)		
35-44 years		736	3,233,519	76.3 (70.8, 81.8)	0.37 (0.35, 0.40)	-128.0 (-134.5, -121.6)		
45-54 years		1,575	2,759,529	191.3 (181.8, 200.7)	0.51 (0.49, 0.50)	-180.9 (-191.3, -170.6)		
55-64 years		3,257	1,174,022	929.6 (897.7, 961.5)	0.55 (0.53, 0.60)	-764.2 (-798.3, -730.1)		
65-74 years		5,223	1,508,767	1160.0 (1128.5, 1191.5)	0.62 (0.60, 0.60)	-709.6 (-742.7, -676.6)		

		75-84 years	6,848	708,822	3237.4 (3160.7, 3314.0)	0.67 (0.66, 0.70)	-1572.7 (-1652.7, -1492.8)
		85 years and over	9,615	285,572	11282.3 (11056.8, 11507.8)	0.76 (0.74, 0.80)	-3641.7 (-3875.2, -3408.2)
Hispanic or Latino	COVID-19 mortality	age-standardized	11303	57,731,112	109.2 (103.3, 115.1)	2.59 (2.43, 2.76)	67.0 (103.2, 103.2)
		Under 1 year	2	1,007,577	0.7 (0.1, 1.9)	3.96 (0.36, 43.70)	0.5 (-0.5, 1.5)
		1-4 years	0	4,164,396	-	-	-0.0 (-0.1, 0.0)
		5-14 years	0	10,535,155	-	-	-0.0 (-0.0, 0.0)
		15-24 years	28	9,814,256	1.0 (0.6, 1.3)	4.20 (2.27, 7.80)	0.7 (0.4, 1.1)
		25-34 years	170	9,429,166	6.0 (5.1, 6.9)	5.51 (4.24, 7.20)	4.9 (4.0, 5.9)
		35-44 years	523	8,587,112	20.4 (18.7, 22.2)	7.89 (6.67, 9.30)	17.8 (16.0, 19.6)
		45-54 years	1,178	7,025,565	56.2 (53.0, 59.4)	5.79 (5.28, 6.30)	46.5 (43.2, 49.8)
		55-64 years	2,024	2,749,799	246.6 (235.9, 257.4)	4.10 (3.87, 4.30)	186.5 (175.5, 197.5)
		65-74 years	2,593	2,682,684	323.9 (311.4, 336.4)	3.52 (3.36, 3.70)	231.9 (219.2, 244.6)
		75-84 years	2,658	1,236,374	720.4 (693.0, 747.8)	2.49 (2.38, 2.60)	430.6 (402.6, 458.5)
		85 years and over	2,127	499,028	1428.3 (1367.6, 1489.0)	1.39 (1.33, 1.50)	400.3 (337.5, 463.0)
		All Cause mortality	age-standardized	77,373	57,731,112	727.3 (712.2, 742.5)	0.87 (0.85, 0.89)
	Under 1 year		1,063	1,007,577	353.5 (332.3, 374.8)	1.11 (1.03, 1.20)	34.6 (9.0, 60.3)
	1-4 years		206	4,164,396	16.6 (14.3, 18.8)	1.08 (0.92, 1.30)	1.3 (-1.4, 4.0)
	5-14 years		290	10,535,155	9.2 (8.2, 10.3)	0.91 (0.79, 1.00)	-0.9 (-2.2, 0.4)
	15-24 years		1,783	9,814,256	60.9 (58.1, 63.7)	1.08 (1.02, 1.10)	4.5 (1.2, 7.8)
	25-34 years		2,851	9,429,166	101.3 (97.6, 105.0)	0.79 (0.76, 0.80)	-27.1 (-31.6, -22.6)
	35-44 years		4,051	8,587,112	158.1 (153.2, 162.9)	0.77 (0.75, 0.80)	-46.2 (-52.1, -40.3)
	45-54 years		6,752	7,025,565	322.0 (314.4, 329.7)	0.87 (0.84, 0.90)	-50.1 (-58.9, -41.4)
	55-64 years		11,597	2,749,799	1413.2 (1387.5, 1438.9)	0.83 (0.82, 0.90)	-280.6 (-309.0, -252.3)
	65-74 years		14,234	2,682,684	1778.0 (1748.7, 1807.2)	0.95 (0.93, 1.00)	-91.7 (-122.6, -60.8)
	75-84 years		16,347	1,236,374	4430.5 (4362.6, 4498.4)	0.92 (0.91, 0.90)	-379.6 (-451.2, -308.0)
	85 years and over		18,199	499,028	12220.4 (12042.9, 12398.0)	0.82 (0.81, 0.80)	-2703.6 (-2891.2, -2516.0)

Supplemental Table 2: Years of potential life lost with age 65 cutoff (YPLL65) and age-standardized YPLL65 rate per 100,000 by race/ethnicity, with age-standardized YPLL65 rate ratios and rate differences per 100,000, COVID-19 related and total deaths in the United States, February 1-May 20, 2020

Cause	Race/ethnicity	YPLL65	Age-standardized YPLL65 rate per 100,000	Age-standardized YPLL65 rate ratio	Age-standardized YPLL65 rate difference per 100,000
covid	Non-Hispanic White	33,446 (32,061 to 34,832)	18.9 (16.6, 21.2)	1.00 (reference)	0.0 (reference)
covid	Non-Hispanic Black	45,777 (44,023 to 47,531)	127.6 (114.4, 140.9)	6.7 (6.7, 6.8)	108.7 (95.3, 122.2)
covid	Non-Hispanic American Indian or Alaska Native	1,745 (1,371 to 2,119)	75.4 (30.6, 120.2)	4.0 (3.9, 4.0)	56.5 (11.6, 101.3)
covid	Non-Hispanic Asian or Pacific Islander	8,905 (8,156 to 9,654)	50.1 (39.2, 61.0)	2.6 (2.6, 2.7)	31.2 (20.0, 42.3)
covid	Hispanic or Latino	48,204 (46,328 to 50,080)	101.3 (91.2, 111.4)	5.4 (5.3, 5.4)	82.4 (72.0, 92.7)
total	Non-Hispanic White	1,886,288 (1,872,584 to 1,899,992)	1104.5 (1080.6, 1128.5)	1.00 (reference)	0.0 (reference)
total	Non-Hispanic Black	702,076 (693,066 to 711,087)	1799.0 (1736.7, 1861.2)	1.6 (1.6, 1.6)	694.4 (627.7, 761.1)
total	Non-Hispanic American Indian or Alaska Native	44,466 (42,215 to 46,718)	1786.1 (1539.3, 2032.9)	1.6 (1.6, 1.6)	681.6 (433.6, 929.5)
total	Non-Hispanic Asian or Pacific Islander	100,384 (97,032 to 103,735)	543.6 (491.7, 595.6)	0.5 (0.5, 0.5)	-560.9 (-618.2, -503.7)
total	Hispanic or Latino	537,846 (529,638 to 546,053)	960.0 (922.8, 997.1)	0.9 (0.9, 0.9)	-144.6 (-188.8, -100.3)