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ORIGINAL RESEARCH ARTICLE

Racial and Ethnic Disparities in Heart and Cerebrovascular Disease Deaths During the COVID-19 Pandemic in the United States

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BACKGROUND: Cardiovascular deaths increased during the early phase of the COVID-19 pandemic in the United States. However, it is unclear whether diverse racial/ethnic populations have experienced a disproportionate rise in heart disease and cerebrovascular disease deaths.

METHODS: We used the National Center for Health Statistics to identify heart disease and cerebrovascular disease deaths for non-Hispanic White, non-Hispanic Black, non-Hispanic Asian, and Hispanic individuals from March to August 2020 (pandemic period), as well as for the corresponding months in 2019 (historical control). We determined the age- and sex-standardized deaths per million by race/ethnicity for each year. We then fit a modified Poisson model with robust SEs to compare change in deaths by race/ethnicity for each condition in 2020 versus 2019.

RESULTS: There were a total of 339 076 heart disease and 76 767 cerebrovascular disease deaths from March through August 2020, compared with 321 218 and 72 190 deaths during the same months in 2019. Heart disease deaths increased during the pandemic in 2020, compared with the corresponding period in 2019, for non-Hispanic White (age–sex standardized deaths per million, 1234.2 versus 1208.7; risk ratio for death [RR], 1.02 [95% CI, 1.02–1.03]), non-Hispanic Black (1783.7 versus 1503.8; RR, 1.19 [95% CI, 1.17–1.20]), non-Hispanic Asian (685.7 versus 577.4; RR, 1.19 [95% CI, 1.15–1.22]), and Hispanic (968.5 versus 820.4; RR, 1.18 [95% CI, 1.16–1.20]) populations. Cerebrovascular disease deaths also increased for non-Hispanic White (268.7 versus 258.2; RR, 1.04 [95% CI, 1.03–1.05]), non-Hispanic Black (430.7 versus 379.7; RR, 1.13 [95% CI, 1.10–1.17]), non-Hispanic Asian (236.5 versus 207.4; RR, 1.15 [95% CI, 1.09–1.21]), and Hispanic (264.4 versus 235.9; RR, 1.12 [95% CI, 1.08–1.16]) populations. For both heart disease and cerebrovascular disease deaths, Black, Asian, and Hispanic populations experienced a larger relative increase in deaths than the non-Hispanic White population (interaction term, $P<0.001$).

CONCLUSIONS: During the COVID-19 pandemic in the United States, Black, Hispanic, and Asian populations experienced a disproportionate rise in deaths caused by heart disease and cerebrovascular disease, suggesting that these groups have been most impacted by the indirect effects of the pandemic. Public health and policy strategies are needed to mitigate the short- and long-term adverse effects of the pandemic on the cardiovascular health of diverse populations.

Key Words: cardiovascular disease ■ cerebrovascular disease ■ COVID-19 ■ health disparities ■ pandemic, mortality ■ race/ethnicity

The novel coronavirus disease 2019 (COVID-19) pandemic has disrupted the delivery of health care services to patients with cardiovascular disease in the United States. During the early phase of the pandemic, hospitalizations for acute cardiovascular conditions such as myocardial infarction and stroke declined by 40% to 50% across the country.[1–4] At the same time, population-level deaths caused by cardiac and cerebro-

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Clinical Perspective

What Is New?

- Although cardiovascular deaths increased during the coronavirus disease 2019 (COVID-19) pandemic in the United States, it is unclear whether racial and ethnic diverse populations were disproportionately affected.
- Our findings demonstrate that Black, Hispanic, and Asian populations each experienced a ≈20% relative increase in heart disease deaths, and an ≈13% relative increase in cerebrovascular disease deaths, during the COVID-19 pandemic. In contrast, the non-Hispanic White population experienced a 2% and 4% relative increase in deaths due to these causes, respectively.
- Black, Asian, and Hispanic populations experienced a larger relative increase in heart disease and cerebrovascular disease deaths than the non-Hispanic White population.

What Are the Clinical Implications?

- During the COVID-19 pandemic, Black, Hispanic, and Asian populations experienced a disproportionate rise in deaths caused by heart disease and cerebrovascular disease compared with non-Hispanic White people, suggesting that these racial/ethnic groups have been most impacted by the indirect effects of the pandemic.
- Public health and policy strategies are urgently needed to mitigate the short- and long-term adverse effects of the pandemic on the cardiovascular health of diverse racial/ethnic populations.

Nonstandard Abbreviations and Acronyms

COVID-19	Coronavirus disease 2019
NCHS	National Center for Health Statistics

vascular causes increased in some geographic regions,[5] raising concern that the pandemic has had a substantial, indirect toll on patients with non–COVID-19–related medical conditions.

Despite the concerning national rise in cardiovascular deaths during the pandemic, little is known about whether these increases have been disproportionately concentrated among racially and ethnically diverse populations. A large body of evidence has shown that Black and Hispanic communities have borne a high burden of COVID-19.[6–10] It is possible that these communities have also been disproportionately affected by factors that have contributed to an increase in heart and cerebrovascular disease deaths, including reduced access to health care services, increased health system strain, and hospital avoidance caused by fear of contracting the virus in high-burden areas.[11–14] In addition, inequities in the social determinants of health that are associated with cardiovascular risk, such as poverty and stress, have worsened for these groups.[15–17] Understanding how deaths have changed across different racial and ethnic populations is critically important, and could inform public health strategies to mitigate the short- and long-term adverse effects of the pandemic on cardiovascular health.

Therefore, in this study, we aimed to characterize heart disease and cerebrovascular deaths by race and ethnicity (non-Hispanic White, non-Hispanic Black, Asian, and Hispanic populations) during the US COVID-19 pandemic in 2020 compared with a historical control (2019). In addition, we evaluated whether relative increases in deaths were more pronounced among diverse racial and ethnic groups, compared with non-Hispanic White persons, after the onset of the pandemic in 2020 relative to corresponding months in 2019.

METHODS

The data that support the findings of this study are publicly available from the National Center for Health Statistics (NCHS).

Data

We obtained monthly cause of death data from the NCHS from March through August 2020, as well as for the corresponding months in 2019.[18,19] We focused on deaths beginning in March because this is when many states began to experience a rapid rise in COVID-19 cases and issued stay-at-home orders. *International Classification of Diseases, Tenth Revision* codes were used to identify underlying causes of death caused by heart diseases (I00-I09, I11, I13, I20-I51) and cerebrovascular diseases (I60-I69). Deaths with an underlying cause of COVID-19 were excluded.

Race and Ethnicity

Information about the race/ethnicity for deaths is obtained from death certificates by the NCHS. We included the following racial/ethnic groups in the analysis: non-Hispanic White, non-Hispanic Black, non-Hispanic Asian, and Hispanic. We excluded American Indian/Alaska Natives and racial/ethnic groups designated as "other" because data for these groups were often suppressed because of low counts in accordance with NCHS confidentiality standards. Population data for each race/ethnicity were obtained from the American Community Survey files.

Statistical Analysis

To determine heart disease and cerebrovascular disease deaths by race and ethnicity, we divided the total number of deaths (March through August of each respective year) for

each condition by the total population (per million) of each group. We then calculated age- and sex-standardized deaths per million for each racial and ethnic group (non-Hispanic Black, non-Hispanic Asian, and Hispanic) by applying direct standardization using census counts of the White population (in 2019) as the reference. Using the same reference population, the direct standardization approach was also applied to determine monthly age- and sex-standardized deaths per million for each racial and ethnic group. The relative and absolute monthly difference in deaths per million in 2020 versus 2019 was calculated for each racial and ethnic group.

Next, we fit a modified Poisson regression model with robust SEs to calculate the risk ratio for death in 2020 versus 2019 for each racial/ethnic group after adjustment for age and sex.[20] We used this approach because information on deaths for each condition was available as summarized (grouped tabular) binomial data (eg, the number of deaths for each unique combination of age strata in 5-year intervals, sex, and racial/ethnic group). The modified Poisson model is a numerically stable procedure, and use of the robust variance allows for valid inference (eg, accounting for heteroscedasticity).[20,21] Our model included an interaction term for race/ethnicity and year, which allowed us to compare the relative risk of death for each racial/ethnic group (versus non-Hispanic White) in 2020 versus 2019.

Two-sided $P<0.05$ defined statistical significance. Analyses were performed using R 3.5.2. Institutional Board Review approval from Beth Israel Deaconess Medical Center was not required because of the use of publicly available, deidentified datasets.

RESULTS

In the United States, there were a total of 339 076 heart disease and 76 767 cerebrovascular disease deaths during the pandemic from March through August 2020, compared with 321 218 and 72 190 deaths during the corresponding months in 2019. Observed heart disease and cerebrovascular disease deaths per million for each year are shown by race and ethnicity in Table I in the Data Supplement, and age–sex standardized deaths per million are shown in Table 1. In addition, monthly age–sex standardized deaths per million are shown in Figure 1. The relative and absolute monthly differences are shown by race/ethnicity (2020 versus 2019) in Figures 2 and 3.

Overall, heart disease deaths increased during the pandemic in 2020 compared with the corresponding period in 2019 for non-Hispanic White (age–sex standardized deaths per million, 1234.2 versus 1208.7; risk ratio [RR], 1.02 [95% CI, 1.02–1.03]), non-Hispanic Black (1783.7 versus 1503.8; RR, 1.19 [95% CI, 1.17–1.20]), non-Hispanic Asian (685.7 versus 577.4; RR, 1.19 [95% CI, 1.15–1.22]), and Hispanic (968.5 versus 820.4; RR, 1.18 [95% CI, 1.16–1.20]) populations (Table 2 and Figure I in the Data Supplement). Cerebrovascular disease deaths also increased for non-Hispanic White (age–sex standardized deaths per million, 268.7 versus 258.2; RR, 1.04 [95% CI, 1.03–1.05]), non-Hispanic Black (430.7 versus 379.7; RR, 1.13 [95% CI, 1.10–1.17]), non-Hispanic Asian (236.5 versus 207.4; RR, 1.15 [95% CI, 1.09–1.21]), and Hispanic (264.4 versus 235.9; RR, 1.12 [95% CI, 1.08–1.16]) populations (Table 2). For both heart disease and cerebrovascular disease deaths, the interaction term for each racial/ethnic group (versus non-Hispanic White people) and year was statistically significant ($P<0.001$), indicating that the non-Hispanic Black, non-Hispanic Asian, and Hispanic populations each experienced a larger relative increase in deaths compared with non-Hispanic White people during the pandemic (2020 versus 2019).

DISCUSSION

In the United States, across all racial and ethnic groups, heart disease and cerebrovascular disease deaths were higher after the onset of the COVID-19 pandemic between the months of March and August in 2020 relative to corresponding months in 2019. Black, Hispanic, and Asian populations each experienced a ≈20% relative increase in heart disease deaths, and a ≈13% relative increase in cerebrovascular disease deaths, during the pandemic. The increase in deaths caused by heart disease and cerebrovascular disease was significantly more pronounced among these groups compared with the non-Hispanic White population.

The racial and ethnic disparities in cardiovascular deaths that have emerged amid the COVID-19 pandemic are concerning. Although the direct toll of COVID-19 on Black and Hispanic adults as well as subgroups of the Asian population has been substantial,[6–10,22,23] the marked rise in heart disease and cerebrovascular disease deaths suggests that these groups have also disproportionately been

Table 1. Age–Sex Standardized Heart Disease and Cerebrovascular Disease Deaths per Million by Race and Ethnicity

Population	Heart disease deaths per million, 2019	Heart disease deaths per million, 2020	Cerebrovascular disease deaths per million, 2019	Cerebrovascular disease deaths per million, 2020
NH White	1208.7	1234.2	258.2	268.7
NH Black	1503.8	1783.7	379.7	430.7
NH Asian	577.4	685.7	207.4	236.5
Hispanic	820.4	968.5	235.9	264.4

The White population (in 2019) was used as the reference for age-sex standardization. NH indicates non-Hispanic.

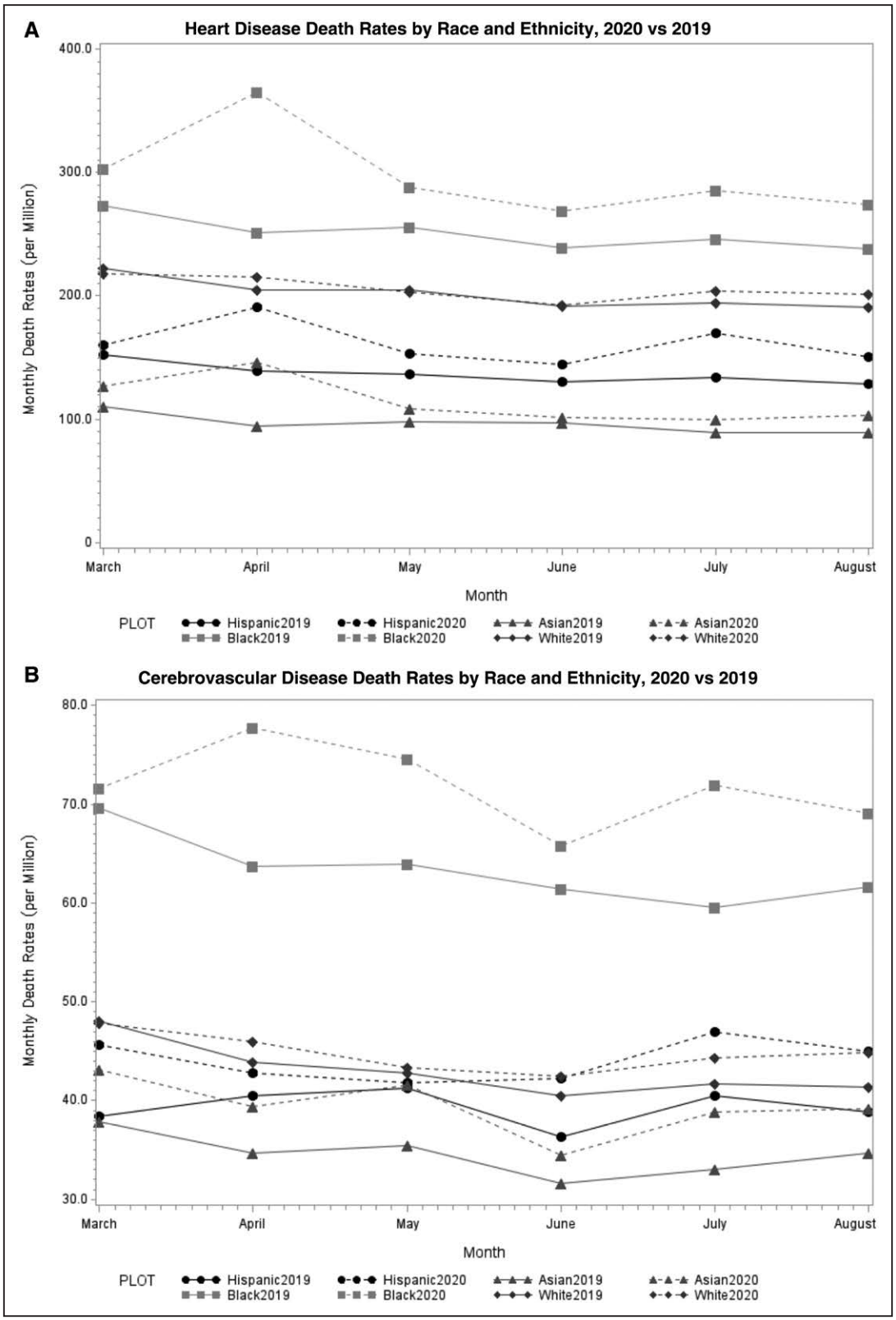

Figure 1. Monthly age–sex standardized heart disease and cerebrovascular disease deaths per million by race and ethnicity, 2020 vs 2019.

Age–sex standardized heart disease (**A**) and cerebrovascular disease (**B**) deaths per million from March through August 2020 (dashed lines) compared with corresponding months in 2019 (solid lines) for non-Hispanic White, non-Hispanic Black, non-Hispanic Asian, and Hispanic populations.

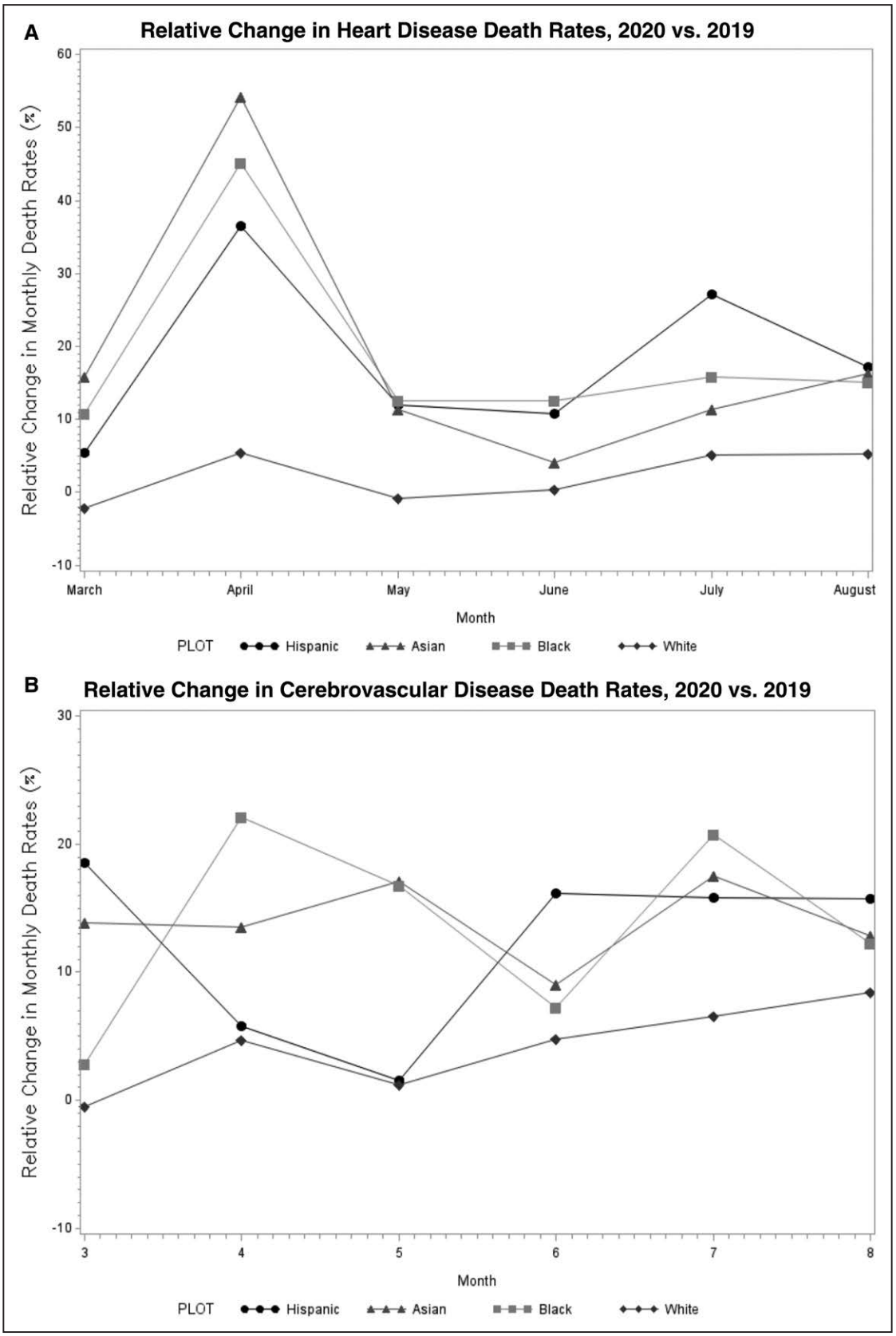

Figure 2. Relative monthly change in age–sex standardized heart disease and cerebrovascular disease deaths per million by race and ethnicity, 2020 vs 2019.

Relative (%) change in age–sex standardized heart disease (**A**) and cerebrovascular disease (**B**) deaths per million from March through August (2020 vs 2019) for non-Hispanic White, non-Hispanic Black, non-Hispanic Asian, and Hispanic populations.

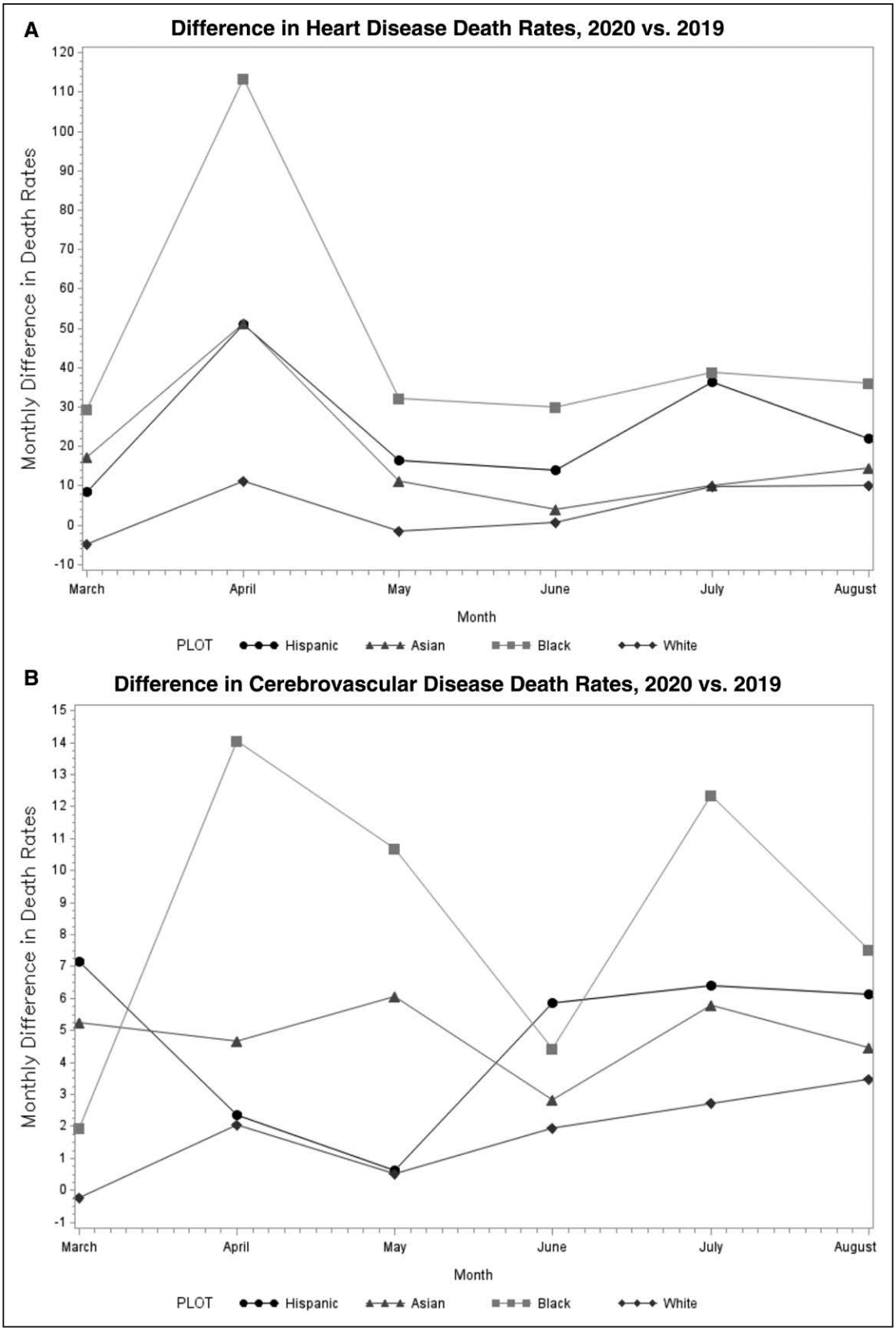

Figure 3. Absolute monthly differences in age–sex standardized heart disease and cerebrovascular disease deaths per million by race and ethnicity, 2020 vs 2019.

Absolute differences in age–sex standardized heart disease (**A**) and cerebrovascular disease (**B**) deaths per million from March through August (2020 vs 2019) for non-Hispanic White, non-Hispanic Black, non-Hispanic Asian, and Hispanic populations.

Table 2. Heart Disease and Cerebrovascular Disease Deaths by Race/Ethnicity (2020 Versus 2019)

Population	Risk ratio (2020 Versus 2019)*	95% CI
Heart disease		
Non-Hispanic White	1.02	1.02–1.03
Non-Hispanic Black	1.19	1.17–1.20
Non-Hispanic Asian	1.19	1.15–1.22
Hispanic	1.18	1.16–1.20
Cerebrovascular disease		
Non-Hispanic White	1.04	1.03–1.05
Non-Hispanic Black	1.13	1.10–1.17
Non-Hispanic Asian	1.15	1.09–1.21
Hispanic	1.12	1.08–1.16

*Data represent deaths that occurred from March through August in each year. The interaction term for race/ethnicity and year (2020 vs 2019) was statistically significant ($P<0.001$), indicating that each racial and ethnic group experienced a more pronounced increase in deaths relative to the non-Hispanic White population.

impacted by the indirect effects of the pandemic. Disruptions in access to health care services during the pandemic may have had a larger impact on the health outcomes of Black and Hispanic individuals, as these populations have a higher burden of cardiovascular risk factors, including hypertension,[24] obesity,[25] and diabetes,[26] as well as cardiovascular disease. At the same time, the strain imposed on already resource-constrained health care systems in these communities may have led to issues in care delivery, such as delays in access to hospital services, the deferral of cardiovascular procedures, and the delivery of suboptimal inpatient care for non–COVID-19 conditions.[27–29]

The avoidance of health care systems has likely also played a role in the disproportionate rise in cardiac and cerebrovascular deaths among diverse populations, particularly during the early phase of the pandemic, when less was known about severe acute respiratory syndrome coronavirus 2 (SARS-CoV2).[14] Because COVID-19 case rates have been highest in Black and Hispanic communities,[6–9] individuals residing in these areas may have been more reluctant to seek hospital care for acute conditions. For example, a recent survey by the American Heart Association found that 41% of Hispanic Americans and 33% of Black Americans would stay at home if they thought they were experiencing a heart attack or stroke because of fear of exposure to COVID-19 at the hospital.[30] Although the use of telemedicine increased during the early phase of the COVID-19 pandemic to bridge gaps in care, Black, Hispanic, and Asian patients have experienced unequal access to video telemedicine, and these services alone may not be adequate for acute conditions.[31] Overall, our data highlight the urgent need to improve public health messaging and provide reassurance that hospitals are safe places to receive care.

The pandemic has also impacted the social determinants of health associated with cardiovascular risk.[15–17] Racial and ethnic minority groups disproportionately experience poverty in the United States,[32] and 60% of Black and 72% of Hispanic households reported serious financial problems during the pandemic, compared with only 36% of White households.[33] As a result of financial strain and job losses, Black and Hispanic households have experienced large increases in housing and food insecurity.[34] Communities of color have also disproportionately been exposed to psychosocial stressors associated with the pandemic.[16,35] These social risk factors, which collectively worsened for Black and Hispanic communities during the pandemic, have likely contributed to the disparate rise in cardiovascular deaths in these groups. The ensuing socioeconomic repercussions of the pandemic, coupled with delays in care, may also explain why heart disease and cerebrovascular disease deaths increased again for some racial/ethnic groups in July and August 2020.

Policy-level factors may have also contributed to worse cardiovascular outcomes during the pandemic. In early 2020, just before the onset of the US pandemic, the Trump administration implemented a revised "public charge" immigration rule. Under this policy, legal immigrants who used public benefits from the government, such as Medicaid insurance or the Supplemental Nutrition Assistance Program, or were in poor health could be at risk of being denied permanent residency status.[36] As a result, Hispanic and Asian immigrant families may have avoided seeking care for non–COVID-19–related illnesses, such as cardiovascular disease, because of concerns related to this policy.[8,37,38] The extent to which the avoidance of health care systems, either because of fear of contracting COVID-19 or immigration concerns, contributed to the increase in heart disease and cerebrovascular deaths observed in our study remains an important area for future study.

Limitations

This study has limitations. First, our analysis was based on provisional death counts from the NCHS, which may be incomplete in recent weeks because of reporting delays. To minimize the impact of reporting delays, we analyzed data only through August 2020. Second, although our analysis only included underlying causes of death as a result of heart or cerebrovascular diseases, and excluded underlying causes as a result of COVID-19, it is possible that undiagnosed cases of COVID-19 partially contributed to the increase in deaths. However, our analysis is consistent with observations from other nations, such as England and Wales, that have also experienced an increase in cardiovascular deaths caused by the indirect effects of the pandemic.[39,40] Third, the identification of race and ethnicity relied on death certification information, which may have been misclassified.

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Conclusions

During the COVID-19 pandemic in the United States, Black, Asian, and Hispanic populations experienced a disproportionate rise in deaths caused by heart disease and cerebrovascular disease compared with the non-Hispanic White population. These findings suggest that Black, Asian, and Hispanic populations have been most impacted by the indirect effects of the pandemic. Public health and policy strategies are urgently needed to mitigate the short- and long-term adverse effects of the pandemic on the cardiovascular health of diverse populations.

ARTICLE INFORMATION

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Supplemental Materials

Data Supplement Table I
Data Supplement Figure I

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