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LETTER TO THE EDITOR

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Differences in race and other state-level characteristics and associations with mortality from COVID-19 infection

As of 1st May 2020, New York state has experienced the greatest mortality from coronavirus disease-2019 (COVID-19) in the United States. Mortality in New York, weighted for racial distribution is higher in the African American population.[1] We investigated the relationship between race and mortality across the United States.

Daily new COVID-19 cases and deaths from 22 January 2020 to 18 April 2020 were obtained from the COVID-19 Global Cases dashboard hosted by the Center for Systems Science and Engineering at Johns Hopkins University (https://github.com/CSSEGISandData/COVID-19). State population was collected from the 2019-US Census Bureau estimates. Race, age, and gender were collected from 2018-American Community Survey, US Census Bureau. Obesity rates were obtained from the Centers for Disease Control and Prevention's Behavioral Risk Factor Surveillance System.[1-6]

Primary exposure was the proportion of people in each state that self-categorized as African American. Daily deaths were modeled using Poisson regression incorporating generalized estimating equations (robust estimators, exchangeable correlation matrices). In primary analyses, we modeled the rate of daily deaths 14-days from the date after cases reached more than 1/million in each state. Cubic splines characterized time in two discreet periods, before and after the institution of stay-at-home orders in each state. State characteristics assessed included population density, people older than 65 years and less than 18 years, obesity rates, insurance data, state gross domestic product (GDP), hospital beds/ventilators per capita, median family income, and high-school graduation rates. The null hypothesis was that there was no association between this state-level exposure and mortality from COVID-19.

Sensitivity analyses included varying the time between new cases and deaths (10 and 18 days) and using single outcome of the number of deaths at 29 days from the first day that the case rate reached more than 1/million for each state.

States where a higher proportion of people who reported African American race or other races had higher death rates, despite accounting for state level differences in cases rates, age, obesity, population density, implementation of stay-at-home orders, uninsured rates, state GDP, and other health care resources (Table 1). Based on these models, the rates of death were substantially greater over time among a hypothetical state with 30% African American residents, compared with a hypothetical state with 10% African American residents (Figure 1). A greater proportion of children and a higher population density were each associated with lower death rates,

TABLE 1 Multivariable Poisson regression models evaluating associations between state-level factors and case rates 14 days from current day

	Mortality rate from COVID-19[a]		Mortality rate from COVID-19[b]	
	IRR (95% CI)	*P*	IRR (95% CI)	*P*
% African American (per 1% of population)	1.07 (1.02-1.12)	.003	1.07 (1.02-1.12)	.006
% Other race (per 1% of population)	1.12 (1.03-1.23)	.008	1.27 (1.13-1.42)	<.001
Case rate (per 100 000)	1.03 (1.01-1.04)	.001	1.02 (1.01-1.04)	.007
Date (per d) (before distancing)	1.09 (1.08-1.11)	<.001	1.09 (1.07-1.11)	<.001
Date (per d) (after distancing)	1.00 (1.00-1.01)	.002	1.00 (1.00-1.00)	.002
Population density (per 1000/mile^2)	0.73 (0.61-0.87)	<.001	0.79 (0.65-0.97)	.02
% >65 y (per 1% of population)	0.97 (0.75-1.25)	.82	1.08 (0.84-1.39)	.57
% <18 y (per 1% of population)	0.66 (0.51-0.86)	.002	0.67 (0.54-0.84)	<.001
% Obese (per 1% of population)	0.91 (0.79-1.03)	.15	1.00 (0.87-1.16)	.96
% Private insurance (per 1%)			1.12 (1.04-1.21)	.003

Note: Other factors evaluated and not included in final models: high-school graduation rates, % Asian, % Pacific Islander, % American Indian, state GDP, median family income, ventilators per capita, hospital beds per capita, % uninsured, and % with Medicare.
Abbreviations: CI, confidence interval; COVID-19, coronavirus disease-2019; GDP, gross domestic product; IRR, incident rate ratio.
[a]Model 1.
[b]Model 2.

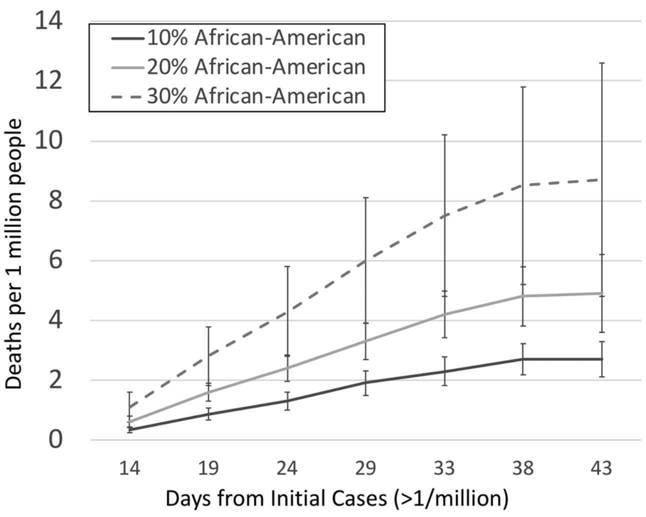

FIGURE 1 Predicted Mortality (per million population) in Hypothetical US States

while the number of current cases (per million) was associated higher death rates 14-days later. States with a higher proportion of private-insurance and Medicare-insured residents also showed higher mortality-rates (incident rate ratio for Medicare [per 1%]: 1.61 [1.06-2.46] $P = .03$). Mortality-rates were not higher in states with greater rates of obesity or in states with a higher proportion of older residents. Sensitivity analyses were highly similar to the primary analysis (not shown).

The primary observation of our study supports prior observations of higher death rates among African American patients.[7,8] While higher death rates among African American patients speaks to an important public health concern, these data are not able to fully consider potential confounding factors on a granular level. Whether the underlying factors that might account for the difference in death rates may be due to genetic, socioeconomic, or related to health care access, remains unclear.

Lower death rates were observed in states with more children and states with a higher population density. Availability of health care resources, urban distribution of residents, and other demographic differences that are difficult to clarify in these data, may explain the lower mortality in high population density areas.

Rates of obesity and older age were not associated with mortality, conflicting with other evidence to support these populations being at greater risk.[9,10] It is likely that these exposures do not sufficiently vary by state or may not adequately capture the risk related to these exposures. Study at a more granular level is needed to further characterize these exposures.

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CONFLICT OF INTERESTS

All the authors declare that there are no conflict of interests.

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