

Association Between State-Level Income Inequality and COVID-19 Cases and Mortality in the USA



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INTRODUCTION

COVID-19, caused by the novel coronavirus SARS-CoV-2, has resulted in the largest pandemic in 100 years. The USA has been particularly impacted, reporting a third of the cases and a quarter of the deaths worldwide. In recent weeks, the unequal impact of COVID-19 across communities has become glaringly apparent. Data from New York and Chicago indicate that African American and Hispanic people experience disproportionately higher rates of COVID-19 infection and mortality.^{1,2} Inequality may compound these disparities further through economic segregation, decreased social mobility, and lower access to medical care.³ Given that low-income individuals are more likely to be in essential occupations with a high exposure risk and have less access to healthcare, income inequality may exacerbate the impact of the COVID-19 outbreak.

METHODS

We examined the association between income inequality and the number of COVID-19 cases and deaths. State income inequality data—as measured by the Gini index—were extracted from the 2018 American Community Survey. The number of cases and deaths was calculated using the COVID-19 Dashboard, a data set hosted by the Center for Systems Science and Engineering at Johns Hopkins University.^{4,5} We limited our analysis to the 50 states from January 22, 2020, through April 13, 2020.

First, we performed simple correlation analyses between the state-level Gini index and the number of cases and deaths per 100,000 population due to COVID-19 using the Spearman rank-order correlation test. To account for the right-skewed distribution, we log-transformed the data on the number of COVID-19 cases and deaths.

Second, using multivariable regressions, we examined the associations between the state-level Gini index and log-transformed number of cases and deaths due to COVID-19 adjusting for potential confounders. The adjustment variables

included the proportion of the population 65+ years, female, African American, Hispanic, and below poverty; median household income; the number of tests performed per capita; doctors per capita (2018–2019 Area Health Resource File); beds per capita (2009–2018 American Hospital Association Annual Survey); and whether a state had a stay-at-home or shelter-in-place policy (no order, order in some parts of the state, statewide order; the New York Times database).⁶

This study was exempted from review by the institutional review board of UCLA.

RESULTS

On April 13, 2020, there were a total of 577,414 cases and 23,424 deaths across 50 states. The number of cases ranged from 28.7 to 1,006.2 cases per 100,000 (median, 73.0; IQR, 47.7–133.6). The mortality rates ranged from 0.17 to 51.7 deaths per 100,000 (median, 2.0; IQR, 1.2–4.5).

We observed positive correlations between the Gini index and the number of cases (correlation coefficient = 0.38; $P = 0.006$) and deaths (correlation coefficient = 0.44; $P = 0.002$) due to COVID-19 (Fig. 1). After adjusting for potential confounders, we found that states with a higher Gini index experienced a larger number of deaths due to COVID-19 (adjusted percent change for one unit increase in Gini index, +27.2%; 95%CI, +3.5% to +56.3%; $P = 0.02$); the Gini index was marginally associated with the number of COVID-19 cases (+13.5%; 95%CI, +0.0% to +30.0%; $P = 0.07$) (Table 1).

DISCUSSION

We found that states with higher income inequality experienced a higher number of deaths due to COVID-19. These findings suggest that social factors such as income inequality may explain why some parts of the USA are hit harder by the COVID-19 pandemic than others.

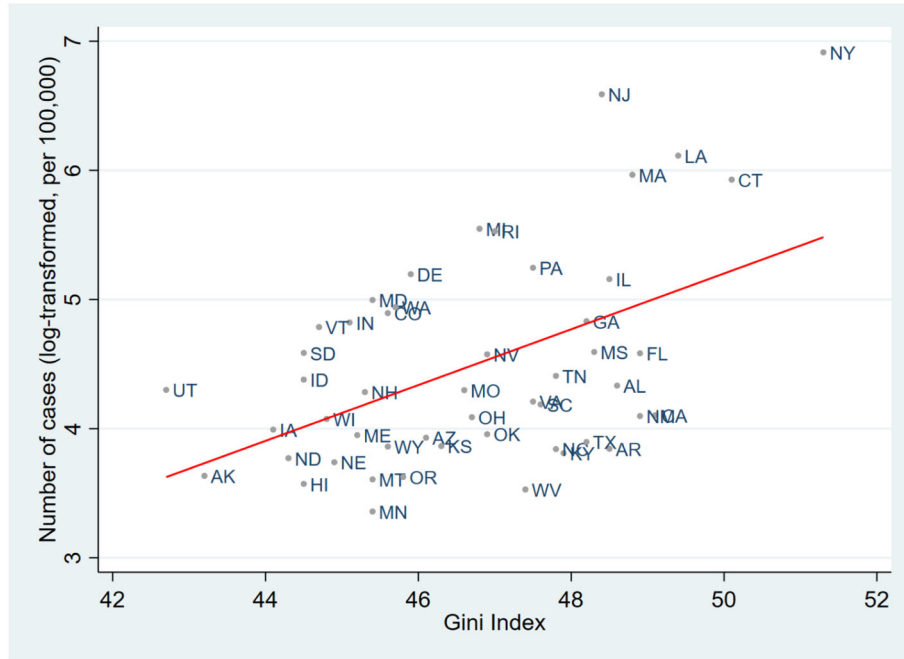
Our study has limitations. First, as is the case with observational studies, there is a possibility of residual confounding, including from comorbidities. However, we included the proportion of the population 65+ years which may be a proxy of underlying health risks of the populations. Second, the use of state-level data precluded us from making any inferences about individual-level associations between inequality and COVID-19 infections.

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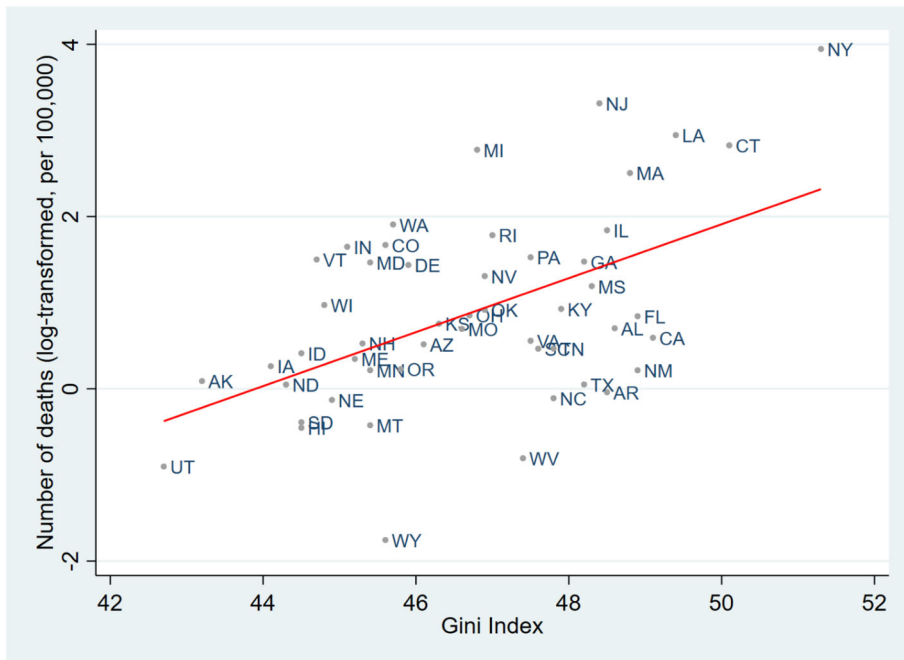
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(a) The number of COVID-19 cases



Correlation coefficient=0.38; P=0.006

(b) The number of COVID-19 deaths



Correlation coefficient=0.44; P=0.002

Figure 1 The unadjusted correlation between the state-level Gini index and the number of COVID-19 cases (a) and deaths (b).

Table 1 The Adjusted Association Between the State-Level Gini Index and the Number of COVID-19 Cases and Deaths

	Change in the number of COVID-19 cases/deaths (95% CI)	P value
Cases per 100,000	+ 13.5% (0.0% to + 30.0%)	0.07
Deaths per 100,000	+ 27.2% (+ 3.5% to + 56.3%)	0.02

*Adjusted for the following state-level variables: proportion of the population over 65 years, female, African American, Hispanic, and below poverty; median household income; the number of tests performed per capita; total doctors per capita; total beds per capita; and whether a state had a stay-at-home or shelter-in-place policy on April 1, 2020

Our findings should be informative for policymakers considering additional policies to mitigate the effects of COVID-19 on the most financially vulnerable.

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Compliance with Ethical Standards:

Conflict of Interest: The authors declare that they do not have a conflict of interest.

Disclaimer: The contents do not represent the views of the U.S. Department of Veterans Affairs or the US Government.

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