Social Disadvantage, Politics, and SARS-CoV-2 Trends: A County-Level Analysis of United States Data

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Summary: In our retrospective analysis of SARS-CoV-2 case counts at the US county level, areas of 250,000 – 1 million population, higher percentage of Black residents, and a Republican victory in 2016 were independently associated with increasing case counts in June 2020.
Abstract

**Background** Understanding the epidemiology of SARS-CoV-2 is essential for public health control efforts. Social, demographic, and political characteristics at the US county level might be associated with changes in SARS-CoV-2 case incidence.

**Methods** We conducted a retrospective analysis of the relationship between the change in reported SARS-CoV-2 case counts at the US county level during June 1, 2020 – June 30, 2020 and social, demographic, and political characteristics of the county.

**Results** 1023/3142 US counties were included in the analysis. 678 (66.3%) had increasing, and 345 (33.7%) had non-increasing SARS-CoV-2 case counts between June 1 – June 30, 2020. In bivariate analysis, counties with increasing case counts had significantly higher Social Deprivation Index (median 48, IQR 24 – 72) than counties with non-increasing case counts (median 40, IQR 19 – 66; p=0.009). Counties with increasing case counts were significantly more likely to be metropolitan areas of 250,000 – 1 million population (p<0.001), to have a higher percentage of Black residents (9% vs. 6%, p=0.013), and to have voted for the Republican presidential candidate in 2016 by a 10-point or greater margin (p=0.044). In the multivariable model, metropolitan areas of 250,000 – 1 million population, higher percentage of Black residents and a 10-point or greater Republican victory were independently associated with increasing case counts.

**Conclusions** Increasing case counts of SARS-CoV-2 in the US during June 2020 were associated with a combination of sociodemographic and political factors. Addressing social disadvantage and differential belief systems that may correspond with political alignment will play a critical role in pandemic control.

**Keywords:** SARS-CoV-2, COVID19, Social Disadvantage, Politics
Background

The SARS-CoV-2 pandemic has been associated with massive societal upheaval worldwide and in the United States (US). In the absence of a vaccine or effective prophylactic medications, the most effective control measures have relied on behavioral change, primarily consisting of social distancing and wearing masks [1-3]. However, the ability of individuals in different communities to effectively adhere to behavioral measures relies on an array of social and community factors such as population density, transportation, and poverty. Furthermore, even when these social and community factors are conducive to behavioral change, the willingness of the population in a given community to adhere to behavioral control measures may differ depending on local political ideology. In the early months of the pandemic in the US, social distancing was variable but fairly widespread across the country, despite marked variability in local SARS-CoV-2 epidemiology and government policies [4]. Reported increasing “COVID-skepticism” as well as reduced adherence to social distancing associated with Republican political affiliation may be associated with changes in incident SARS-CoV-2 cases [5, 6]. During the month of June 2020, there was a resurgence of SARS-CoV-2 cases in the US after it appeared that the “curve” was being flattened in May 2020 [7]. We sought to understand how county sociodemographic and political characteristics might be associated with this increase in SARS-CoV-2 incidence.

Design and Methods

We performed a retrospective analysis of the relationship between the change in reported SARS-CoV-2 case counts at the US county level during the month of June (time period 06/01/2020 – 06/30/2020) and social, demographic, and political characteristics. We chose this particular month because of the apparent nationwide resurgence in cases at the time. We used a month duration because other investigators have observed roughly linear changes in case rates in several US States over a 4-5 week range [7, 8]. County-level case data were obtained from the Johns Hopkins Coronavirus Dashboard (downloaded 07/02/2020) [7]. Counties with >50 cumulative reported SARS-CoV-2 cases as of 05/01/2020 were included in the analysis. We excluded counties with fewer than 50 cumulative cases at that timepoint because sociodemographic factors are unlikely to impact SARS-CoV-2 epidemiology in a meaningful way if there are a very small number of infected persons in a community. The dependent variable was a binary assessment of whether case counts in
that community were increasing during the study period (06/01/2020–06/30/2020), derived by fitting a least-squares linear regression line to the case counts during the study period. Counties with a slope >0 were deemed to have increasing case counts, and counties with a slope ≤0 non-increasing case counts.

The independent sociodemographic variables included metropolitan designation, percentage of residents of Black race, percentage of residents of Hispanic ethnicity, and the Social Deprivation Index (SDI) [9]. SDI is a composite measure of area level deprivation based on seven demographic characteristics collected in the American Community Survey (2015 update): percent living in poverty, percent of adults ≥25 with <12 years of education, percent single parent household, percent living in a rented housing unit, percent living in an overcrowded housing unit, percent of households without a car, and percent non-employed adults <65 years of age [10, 11]. The SDI ranges from 0–100, with higher values indicating more social deprivation. The independent measure of county-level political affiliation was a binary indicator of whether the Republican presidential candidate won the 2016 election in that county by ≥10 percentage points [12].

Bivariate associations were assessed using the Wilcoxon rank-sum test for continuous variables and the chi-squared test for categorical variables. Multivariable associations were assessed using unconditional logistic regression. All independent variables were simultaneously entered into the unconditional regression model. Collinearity was assessed using variance inflation factors, with a cutoff of <3 indicating acceptable collinearity. We examined two-way interactions between SDI and each of the following: the political variable, race/ethnicity, and metropolitan designation, but none of these interactions were statistically significant (p=0.2), and they were removed from the final model. R version 4.0.0 (R Core Team, Vienna, Austria) using the RStudio interface was used for data analysis.

As all data were publicly available and no individual identifiers were used, this study did not require institutional review board review.
Results

Of 3,142 US counties, 1025 had >50 cumulative reported SARS-CoV-2 cases as of 05/01/2020; 1023 of these had available election results and were included in the analysis. Of these 1023 counties, 678 (66.3%) had increasing daily case counts and 345 (33.7%) had non-increasing case counts between 06/01/2020–06/30/2020. In bivariate analysis, counties with increasing case counts had a significantly higher SDI (median 48, IQR 24 – 72) than counties with non-increasing case counts (median 40, IQR 19 – 66; p=0.009). Counties with increasing case counts were more likely to be designated medium-sized metropolitan areas (population ≤1 million) vs. large metropolitan or nonmetropolitan areas (p<0.001), to have a higher percentage of residents of Black race (p=0.013), and to have voted for the Republican presidential candidate in 2016 by a ≥10-point margin (p=0.044) (Table 1).

Table 2 summarizes the bivariate and multivariable associations between county characteristics and increasing/non-increasing case counts. In the multivariable model, higher proportion of Black residents OR 5.73 (95% CI 1.69 – 19.45; p=0.005), residence in a metropolitan area of 250,000 – 1 million population OR 2.04 (95% CI 1.37 – 3.05; p<0.001), and a ≥10-point Republican presidential victory in 2016 OR 1.80 (95% CI 1.33 – 2.42; p<0.001) were independently associated with increasing case counts.

Discussion

Our study found that medium-sized metropolitan status, higher proportion of Black residents, and Republican victory in the 2016 presidential elections were independently associated with rising SARS-CoV-2 county case counts during June 2020. This analysis illustrates the complex interplay between demographic and social factors in propagation of the pandemic. In the US, the bulk of cases during the first two months were in urban areas on the East and West coasts, but with time the pandemic has taken root in smaller metropolitan and rural areas [7, 13, 14]. The racial disparity in cases persists – and has been demonstrated by several other studies [15-18]. However, the finding that voting patterns were independently associated with increased case numbers during June 2020 bears further examination.
During the first few months of the pandemic in the US, voter attitudes toward the pandemic and appropriate behavioral responses were similar across party lines. However, the months of May and June have witnessed increasing partisan divisions in belief and attitudes related to the pandemic and appropriate responses [5, 19]. There have been suggestions that Republican voters are increasingly likely to believe that the severity of the pandemic has been overstated and less likely to believe that public health authorities are providing credible information, in addition to being less likely to adhere to social distancing [6, 19, 20]. Furthermore, these beliefs do not seem to be modulated by local case burden [5]. Conversely, voting patterns may simply be a surrogate for other public health factors such as relative funding for county health departments or preparedness to perform extensive contact tracing [21]. On the other hand, we also noted an independent association between counties with a higher proportion of Black residents (who are statistically less likely to have voted Republican in 2016) and rising SARS-CoV-2 case numbers in June 2020 [22]. While at first glance these findings may seem contradictory, one might hypothesize that multiple, independent factors can concurrently contribute to propagation of SARS-CoV-2. For example, political beliefs might drive transmission because of higher-risk behaviors (i.e. eschewing masks) in some members of a given community, while socioeconomic necessity (i.e. having to ride public transportation to a job or working in close quarters) might drive transmission in other community members.

Our study is limited by the nature of the data as well as the potential for confounding. As our data examines county-level demographics and voting patterns, not individual data, this work is clearly subject to the potential for ecologic fallacy [23]. Even though we observed an association between rising SARS-CoV-2 infection rates in a given county and the political/demographic composition of that county, firm conclusions cannot be drawn regarding causality. The individuals infected with SARS-CoV-2 during June 2020 in a given county may not represent the demographics of the county as a whole. For example, rising case counts in a county with a relatively high percentage of Black residents may be attributable to persons of other races. In addition, there may be other unmeasured confounders such as voter participation, i.e. populations who do not participate in voting such as undocumented immigrants being disproportionately affected [24], and census classification within counties.

Furthermore, prior studies have shown that larger urban areas were more likely to vote Democrat and that rural-urban interface and rural areas were more likely to vote Republican [25]. However, our findings
may well represent the geographic evolution of the epidemic over time from larger cities to smaller metropolitan areas, with voting patterns merely a surrogate for geographic change. We attempted to adjust for these geographic differences in the analysis, but any such adjustment will incompletely account for temporal trends and other unmeasured confounders.

In conclusion, the evolution of the SARS-CoV-2 pandemic within the U.S. may be an apt illustration of the oft-quoted statement “Social issues with medical consequences”. The cause of the increase in cases during June 2020 in the US is multifactorial and likely associated with sociodemographic factors and politics. We are faced with a situation in which politics may be negatively affecting public health. As healthcare workers and leaders, we must pursue a two-pronged approach of mitigating social disadvantage and appealing to a sense of collective purpose across political boundaries.
Declaration of interests: No conflicts of interest exist for any of the authors.

Funding: No funding was provided for this work.
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Table 1. Sociodemographic characteristics and SARS-CoV-2 case count trends during the period June 1-June 30, 2020 among 1,023 US counties with 50 or more cumulative reported cases as of May 1, 2020.

| Sociodemographic characteristic | Increasing case counts (N=678) | Non-increasing case counts (N=345) | p      |
|---------------------------------|---------------------------------|-----------------------------------|--------|
| Metropolitan designation, n (%)| ..                              | ..                                | <0.001 |
| Metropolitan, 1 million or more population | 193 (28.5) | 118 (34.2) | .. |
| Metropolitan, 250,000 – 1 million population | 178 (26.3) | 51 (14.8) | .. |
| Metropolitan, < 250,000 population | 130 (19.2) | 53 (15.4) | .. |
| Nonmetropolitan                  | 177 (26.1) | 123 (35.7) | .. |
| % Black race, median (IQR)      | 9 (3 – 23) | 6 (2 – 17) | 0.013 |
| % Hispanic ethnicity, median (IQR) | 6 (3 – 12) | 5 (3 – 12) | 0.856 |
| Social Deprivation Index, median (IQR) | 48 (24 – 72) | 40 (19 – 66) | 0.009 |
| Social Deprivation Index by quartile, n (%) | .. | .. | .. |
| 1 – 17                          | 120 (17.7) | 82 (23.8) | .. |
| >17 – 39                        | 164 (24.2) | 89 (25.8) | .. |
| >39 – 60                        | 150 (22.1) | 78 (22.6) | .. |
| >60 – 100                       | 244 (36.0) | 96 (27.8) | .. |
| Republican presidential candidate won by ≥10 percentage points in 2016, n (%) | 414 (61.1) | 188 (54.5) | 0.044 |
Table 2. Univariate and multivariable relationships between independent variables and increasing county SARS-CoV-2 case counts June 1–June 30, 2020.

| Sociodemographic characteristic | Univariate odds (95% CI) | Multivariable odds (95% CI) | p     |
|---------------------------------|--------------------------|-----------------------------|-------|
| Metropolitan designation, n (%)| ···                       | ···                         | ···   |
| Metropolitan, 1 million or more population | Reference | Reference | <0.001 |
| Metropolitan, 250,000 – 1 million population | 2.13 (1.45 – 3.14) | 2.04 (1.37 – 3.05) | ···   |
| Metropolitan, < 250,000 population | 1.50 (1.01 – 2.22) | 1.38 (0.91 – 2.10) | ···   |
| Nonmetropolitan                  | 0.88 (0.64 – 1.22)      | 0.70 (0.49 – 1.10)         | ···   |
| % Black race                     | 3.01 (1.29 – 7.01)      | 5.73 (1.69 – 19.45)        | 0.005 |
| % Hispanic ethnicity             | 2.16 (0.72 – 6.49)      | 3.75 (0.93 – 15.11)        | 0.063 |
| Social Deprivation Index by quartile | ···                   | ···                        | ···   |
| 1 – 17                           | Reference                | Reference                   | ···   |
| >17 – 39                         | 1.26 (0.86 – 1.84)      | 1.17 (0.79 – 1.75)         | 0.431 |
| >39 – 60                         | 1.31 (0.89 – 1.94)      | 1.02 (0.66 – 1.57)         | 0.933 |
| >60 – 100                        | 1.74 (1.20 – 2.51)      | 1.22 (0.73 – 2.04)         | 0.456 |
| Republican presidential candidate won by ≥10 percentage points in 2016 | 1.31 (1.01 – 1.70) | 1.80 (1.33 – 2.42) | <0.001 |
**Figure 1.** Map of United States Counties illustrating which counties were included in the analysis. Counties shaded white (N=2,119) had fewer than 50 cumulative SARS-CoV-2 cases as of May 1, 2020 and were not included. Counties shaded gray (N=345) had greater than 50 cumulative SARS-CoV-2 cases as of May 1, 2020 but non-increasing average case counts during the month of June 2020. Counties shaded black (N=678) had greater than 50 cumulative SARS-CoV-2 cases as of May 1, 2020 and increasing average case counts during the month of June 2020. Counties shaded gray and black were included in the primary analysis.
