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

Ahmad Mourad, MD[1], Nicholas A. Turner, MD, MHS[2], Arthur W. Baker, MD, MPH[2], Nwora Lance Okeke, MD, MPH[2], Shanti Narayanasamy, MBBS[2], Robert Rolfe[2], MD, John J. Engemann, MD[3],Gary M. Cox, MD[2], Jason E. Stout, MD, MHS[2]

[1]Department of Medicine, Duke University Medical Center, Durham, NC 27710

[2]Division of Infectious Diseases and International Health, Department of Medicine, Duke University Medical Center, Durham, NC 27710

[3]Raleigh Infectious Diseases Associates, Raleigh, NC 27607

Corresponding author:

Jason E. Stout, MD, MHS

Box 102359-DUMC, Durham, NC 27710

Email: jason.stout@dm.duke.edu

Phone: +1 (919) 668-0826

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.

References

1. Cheng VC, Wong SC, Chuang VW, et al. The role of community-wide wearing of face mask for control of coronavirus disease 2019 (COVID-19) epidemic due to SARS-CoV-2. J Infect **2020**; 81(1): 107-14.
2. Cowling BJ, Ali ST, Ng TWY, et al. Impact assessment of non-pharmaceutical interventions against coronavirus disease 2019 and influenza in Hong Kong: an observational study. Lancet Public Health **2020**; 5(5): e279-e88.
3. Wang Y, Tian H, Zhang L, et al. Reduction of secondary transmission of SARS-CoV-2 in households by face mask use, disinfection and social distancing: a cohort study in Beijing, China. BMJ Glob Health **2020**; 5(5).
4. Badr HS, Du H, Marshall M, Dong E, Squire MM, Gardner LM. Association between mobility patterns and COVID-19 transmission in the USA: a mathematical modelling study. Lancet Infect Dis **2020**.
5. Clinton J, Cohen J, Lapinski J, Trussler M. Partisan Pandemic: How partisanship and public health concerns affect individuals' social distancing during COVID-19. Available at: https://ssrn.com/abstract=3633934. Accessed 7/5/2020.
6. Kavanagh NM, Goel RR, Venkataramani AS. Association of County-Level Socioeconomic and Political Characteristics with Engagement in Social Distancing for COVID-19. medRxiv **2020**: 2020.04.06.20055632.
7. Johns Hopkins Center for Systems Science and Engineering. Coronavirus COVID-19 Global Cases by the Center for Systems Science and Engineering. Available at: https://coronavirus.jhu.edu/map.html. Accessed 06/27/2020.
8. Li Y, Zhang R, Zhao J, Molina MJ. Understanding transmission and intervention for the COVID-19 pandemic in the United States. Sci Total Environ **2020**; 748: 141560.
9. Ingram DD, Franco SJ, National Center for Health Statistics (U.S.). 2013 NCHS urban-rural classification scheme for counties. Hyattsville, Maryland: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics, **2014**.
10. Butler DC, Petterson S, Phillips RL, Bazemore AW. Measures of social deprivation that predict health care access and need within a rational area of primary care service delivery. Health Serv Res **2013**; 48(2 Pt 1): 539-59.
11. Liaw W, Krist AH, Tong ST, et al. Living in "Cold Spot" Communities Is Associated with Poor Health and Health Quality. J Am Board Fam Med **2018**; 31(3): 342-50.
12. McGovern T. US County Level Election Results 08-16. Available at: https://github.com/tonmcg/US_County_Level_Election_Results_08-16. Accessed 07/05/2020.
13. Paul R, Arif AA, Adeyemi O, Ghosh S, Han D. Progression of COVID-19 From Urban to Rural Areas in the United States: A Spatiotemporal Analysis of Prevalence Rates. J Rural Health **2020**.
14. Zhang CH, Schwartz GG. Spatial Disparities in Coronavirus Incidence and Mortality in the United States: An Ecological Analysis as of May 2020. J Rural Health **2020**; 36(3): 433-45.
15. Selden TM, Berdahl TA. COVID-19 And Racial/Ethnic Disparities In Health Risk, Employment, And Household Composition. Health Aff (Millwood) **2020**: 101377hlthaff202000897.
16. Yehia BR, Winegar A, Fogel R, et al. Association of Race With Mortality Among Patients Hospitalized With Coronavirus Disease 2019 (COVID-19) at 92 US Hospitals. JAMA Netw Open **2020**; 3(8): e2018039.
17. Webb Hooper M, Napoles AM, Perez-Stable EJ. COVID-19 and Racial/Ethnic Disparities. JAMA **2020**.
18. Moore JT, Ricaldi JN, Rose CE, et al. Disparities in Incidence of COVID-19 Among Underrepresented Racial/Ethnic Groups in Counties Identified as Hotspots During

June 5–18, 2020 — 22 States, February–June 2020. Morbidity and Mortality Weekly Report **2020**; 69(33): 1122 - 6.
19. Mitchell A, Jurkowitz M, Oliphant J, Shearer E. Three months in, many Americans see exaggeration, conspiracy theories, and partisanship in COVID-19 news. Available at: https://www.journalism.org/2020/06/29/three-months-in-many-americans-see-exaggeration-conspiracy-theories-and-partisanship-in-covid-19-news/. Accessed 7/5/2020.
20. Lack of staff, funds and tools: health officials worry the US isn't ready for Covid vaccines. Available at: https://www.theguardian.com/world/2020/sep/02/us-health-officials-covid-19-coronavirus-vaccine?CMP=Share_iOSApp_Other. Accessed 09/04/2020.
21. Wasfy JH, Stewart C, 3rd, Bhambhani V. County community health associations of net voting shift in the 2016 U.S. presidential election. PLoS One **2017**; 12(10): e0185051.
22. Wallace DS, Abduk-Khaliq A, Czuchry M, Sia TL. African American's Political Attitudes, Party Affiliation, and Voting Behavior. Journal of African American Studies **2009**; 13(2): 139-46.
23. Kramer JS, Yelin EH, Epstein WV. Social and economic impacts of four musculoskeletal conditions. A study using national community-based data. Arthritis Rheum **1983**; 26(7): 901-7.
24. Clark E, Fredricks K, Woc-Colburn L, Bottazzi ME, Weatherhead J. Disproportionate impact of the COVID-19 pandemic on immigrant communities in the United States. PLoS Negl Trop Dis **2020**; 14(7): e0008484.
25. Monnat SM, Brown DL. More than a Rural Revolt: Landscapes of Despair and the 2016 Presidential Election. J Rural Stud **2017**; 55: 227-36.

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.

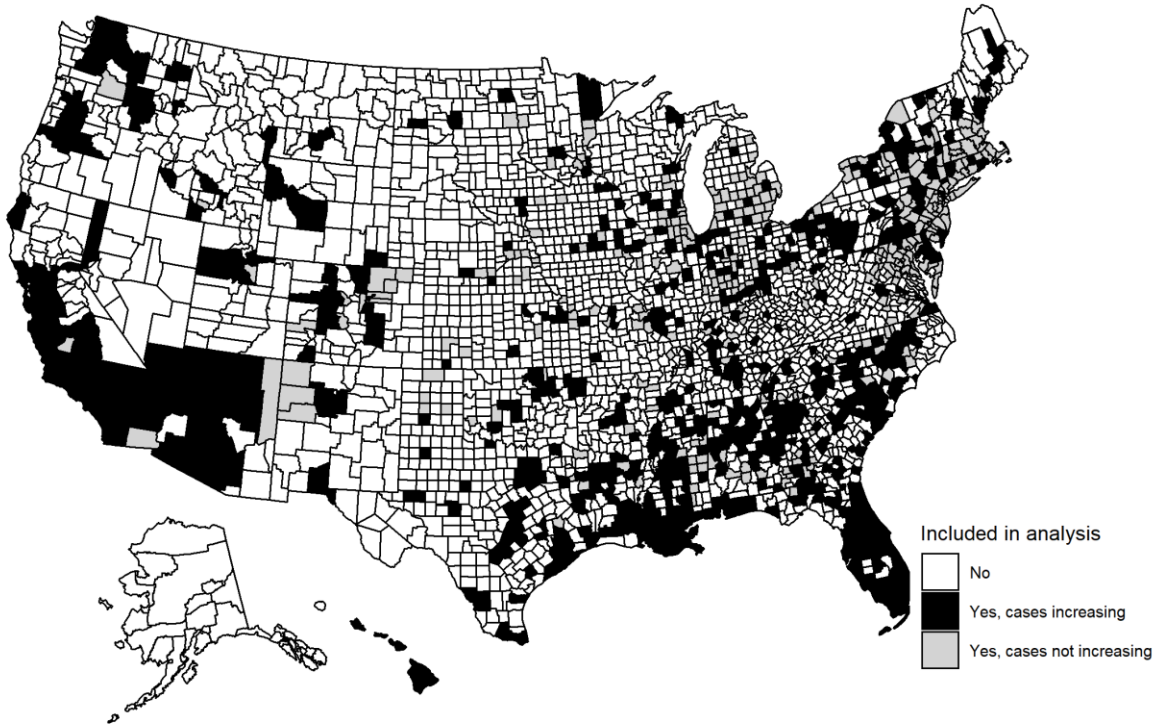
Sociodemographic characteristic		Increasing case counts (N=678)	Non-increasing case counts (N=345)	p
Metropolitan designation, n (%)		..	..	<0.001
	Metropolitan, 1 million or more population	193 (28.5)	118 (34.2)	..
	Metropolitan, 250,000 – 1 million population	178 (26.3)	51 (14.8)	..
	Metropolitan, < 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.

Figure 1


Included in analysis
No
Yes, cases increasing
Yes, cases not increasing