Disparities in rates of COVID-19 infection, hospitalization, and death by race and ethnicity

October 30, 2020

Highlights

This brief analyzes data from state and county health departments on the racial and ethnic demographics of COVID-19 infection, hospitalization, and death.

- As of September 9, 2020, all 50 states and the District of Columbia were reporting data on COVID-19 infections and/or deaths by race and/or ethnicity. Only 7 states reported race and ethnicity for testing, and 17 for hospitalizations.
- Blacks and Hispanics represent a disproportionately greater number of COVID-19 hospitalizations and cases, whereas Blacks are disproportionately represented in COVID-19 deaths across the majority of U.S. states.
- All six states investigated at the county or district level showed significant relationships between higher prevalence of one or more racial and ethnic minority groups and higher COVID-19 case burden.
- Over 5% of the population living in Navajo Nation had contracted COVID-19 by July, which was higher than every U.S. state and New York City.
- COVID-19 racial and ethnic disparities are geographically widespread, and not specific to urban centers.

Introduction

The COVID-19 pandemic has resulted in over 6.5 million infections and more than 194,000 deaths in the U.S. alone,[1] and has exposed long-standing health disparities through the disproportionate impact of COVID-19 on racial and ethnic minority communities. As the pandemic continues, understanding the presence and extent of the disproportionate impact of COVID-19 on racial and ethnic minority populations remains an area of active and ongoing research.[2] Recent reports have highlighted disparities in both COVID-19 cases and deaths at national,[3] state,[4] county,[5] and municipal[6] levels. Fueling this body of research has been a growing quantity of data compiled by the Centers for Disease Control and

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[1] CDC COVID Data Tracker: United States COVID-19 Cases and Deaths by State. Updated September 15, 2020. Accessed at https://covid.cdc.gov/covid-data-tracker/?CDC_AA_refVal=https%3A%2F%2Fwww.cdc.gov%2Fcoronavirus%2F2019-ncov%2Fcases-updates%2Fcases-in-us.html#cases

[2] LitCovid provides a clearinghouse for COVID-19-related research that can be searched using terms such as "racial and ethnic disparity" to uncover the wealth of literature on this subject. Chen Q, Allot A, Lu Z. Keep up with the latest coronavirus research. Nature. 2020;579(7798):193.

[3] CDC COVID Data Tracker: Demographic Trends of COVID-19 cases and deaths in the US reported to CDC. Accessed at https://www.cdc.gov/covid-data-tracker/index.html#demographics

[4] The COVID Racial Data Tracker. Accessed at https://covidtracking.com/race

[5] New York Times. The Fullest Look Yet at the Racial Inequity of Coronavirus. Accessed at https://www.nytimes.com/interactive/2020/07/05/us/coronavirus-latinos-african-americans-cdc-data.html

[6] Benitez J, Courtemanche CJ, and Yelowitz A. Racial and Ethnic Disparities in COVID-19: Evidence from Six Large Cities. NBER Working Paper Series. 2020;10.1111/jrh.12451. DOI: 10.3386/w27592

Prevention (CDC). CDC tracks a wide range of COVID-19 measures including testing,[7] cases,[8] hospitalizations,[9] and deaths.[10] Additionally, CDC reports race and ethnicity for cases and deaths at the national level,[11] as well as race and ethnicity for hospitalizations in the COVID-NET surveillance area.[12] Although significant progress has been made in characterizing disparities in COVID-19 outcomes, incomplete data and limited availability remain considerable challenges.

The disparities identified in a number of COVID-19 metrics are likely due to a complex combination of risk factors, such as the presence of comorbidities (e.g., cardiovascular disease or diabetes), discrimination, healthcare access and utilization, occupation, or other social determinants of health such as education or housing. Although relatively few studies have evaluated the causative factors of COVID-19 disparities, one recent study found that the higher mortality rate for Black or African Americans (Blacks) was partially, but not completely, explained by age, comorbidities, and sociodemographic disparities.[13] Another study evaluating the demographics in COVID-19 outbreaks in meat and poultry processing plants observed that 87% of cases were in minorities.[14] Minority employment in essential industry and larger, multigenerational households may contribute to greater COVID-19 exposure for minority groups.[15] These kinds of analyses are essential in understanding the underlying factors contributing to disproportionate numbers of minorities in COVID-19 cases and deaths, but also emphasize that further research is critical.

The goal of this report is to provide a comprehensive overview of COVID-19 case and mortality demographic data at state and, where available, county levels. We focus on identifying and quantifying the racial disparities in COVID-19 cases and mortality rather than providing any causal explanation of racial disparities in COVID-19 cases and mortality. Given the limitations of state-level data, we also provide more detailed analyses of county/health district COVID-19 case and/or mortality data for selected states. We observe widespread racial and ethnic disparities among several minority groups in U.S. states. Our research shows both urban and rural minorities experience disproportionate numbers of COVID-19 cases and deaths. The results highlight that racial and ethnic health disparities that may have existed prior to the COVID-19 pandemic are becoming increasingly complex in light of the public health emergency and require thoughtful policy to resolve.

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[7] CDC. Testing Data in the U.S. Accessed at https://www.cdc.gov/coronavirus/2019-ncov/cases-updates/testing-in-us.html

[8] CDC. Cases in the U.S. Accessed at https://www.cdc.gov/coronavirus/2019-ncov/cases-updates/cases-in-us.html

[9] CDC. COVID-NET: A Weekly Summary of U.S. COVID-19 Hospitalization Data. Accessed at https://www.cdc.gov/coronavirus/2019-ncov/covid-data/covid-net/purpose-methods.html

[10] CDC, National Center for Health Statistics. COVID-19 Death Data and Resources. Accessed at https://www.cdc.gov/nchs/nvss/covid-19.htm

[11] CDC COVID Data Tracker: Demographic Trends of COVID-19 cases and deaths in the US reported to CDC. Accessed at https://www.cdc.gov/covid-data-tracker/index.html#demographics

[12] COVID-NET is a population-based surveillance system that collects data through a network of over 250 acute-care hospitals in 14 states. Data are available at https://www.cdc.gov/coronavirus/2019-ncov/covid-data/covid-net/purpose-methods.html

[13] Golestaneh L, Neugarten J, Fisher M, et al. The association of race and COVID-19 mortality. The Lancet. [published online ahead of print, 2020 July 14]. DOI: 10.1016/j.eclinm.2020.100455

[14] Waltenburg MA, Victoroff T, Rose CE, et al. Update: COVID-19 Among Workers in Meat and Poultry Processing Facilities — United States, April–May 2020. MMWR Morb Mortal Wkly Rep 2020;69:887-892. DOI: 10.15585/mmwr.mm6927e2.

[15] Seldon, T. and Berdahl, T. COVID-19 and Racial/Ethnic Disparities in Health Risk, Employment, and Household Composition. Health Affairs. DOI: 10.1377/hlthaff.2020.00897

Demographic data on race and ethnicity for COVID-19 cases and deaths were collected from the COVID Racial Data Tracker, which is updated twice per week with numbers from state departments of health.[16] Data used in this report were collected on 9/9/20. As of the time of this data collection, 7 states reported race for COVID-19 testing (both positive and negative test results), and 17 states for COVID-19 hospitalizations. Data for testing and hospitalizations were obtained directly from state department of health websites. A majority of states now report race and/or ethnicity data for COVID-19 cases and deaths (Table 1). However, these data do not consistently follow the OMB guidance[17] on reporting race and ethnicity data. In particular, there is considerable variation in reporting of Hispanic or Latino (Hispanic) origin as well as inconsistent reporting of data for American Indian/Alaska Native (AIAN), Native Hawaiian or Other Pacific Islander (NHPI), and Asian populations. These limitations are discussed in more detail in the "Challenges and Limitations" section of this brief.

Table 1: Number of states reporting race or ethnicity data for COVID-19 cases and deaths as of 9/9/20.

	Total	COVID-19 cases and deaths	COVID-19 cases only	COVID-19 deaths only
Race	50 states and D.C.	47 states and D.C.	2 states	1 state
Ethnicity	47 states and D.C.	44 states and D.C.	1 state	2 states

Note: At the time of data collection, Hawaii, North Dakota, and West Virginia did not report ethnicity for cases or deaths.

County data were retrieved with and without racial/ethnic demographic breakdown. County-level data for COVID-19 cases without demographic breakdown were retrieved from the New York Times COVID-19 database.[18] County-level data with racial/ethnic breakdown were retrieved from state/tribal health department websites. States with county-level analysis presented in this brief were chosen based on data availability and relative population size for the racial/ethnic minority group(s) of interest. Data for Virginia are presented both by health district (where we measure disparity), which include one or more counties, and by county and independent city (where we measure the relationship between COVID-19 cases and minority population). The collection date and source for data used to create each figure is provided in the legend. Indian Health Service (IHS) COVID-19 testing data were retrieved from current and archived versions of the IHS COVID-19 information webpage spanning 3/24/2020 to 7/23/2020.[19]

Testing, hospitalization, case, and mortality rates were recalculated as a percentage of the number of reports with known race, which varied substantially from state to state.[20] For cases in which ethnicity was reported separately from race, Hispanic population was recalculated as a percentage of the number of reports with known ethnicity. However, many states reported race and ethnicity together; in those cases, Hispanic population was calculated as a percentage of the number of reports with known race.

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[16] The COVID Racial Data Tracker. Accessed at https://covidtracking.com/race

[17] Office of Management and Budget. Standards for Maintaining, Collecting, and Presenting Federal Data on Race and Ethnicity. Accessed at https://www.federalregister.gov/documents/1997/10/30/97-28653/revisions-to-the-standards-for-the-classification-of-federal-data-on-race-and-ethnicity

[18] Smith M, Yourish K, Almukhtar S *et al.* Coronavirus (COVID-19) Data in the United States. Accessed at https://github.com/nytimes/covid-19-data

[19] Indian Health Service. Coronavirus (COVID-19). Accessed at https://www.ihs.gov/coronavirus/

[20] This method inherently assumes that the racial/ethnic distribution of reports with known race/ethnicity is identical to that of the reports with unknown race/ethnicity.

The percentage of cases and deaths reporting race and ethnicity for each state is provided in Appendix Table 1.

The population percentage of each racial and ethnic group in each state was taken from the U.S. Census Bureau's 2019 Estimated Population race and ethnicity data.[21] County-level racial and ethnic demographics were obtained from the CDC WONDER Online Database for 2018 Single-Race Population Estimates.[22] The total population of the Navajo Nation was determined using the 2014-2018 American Community Survey 5-year estimate, which is the most recent population estimate.[23]

COVID-19 case burden in a given geographical area (state, health district, or county) was defined as:

$$Burden_i = \frac{Cases_i}{Population_i}$$

where i is the geographical area of interest, $Cases_i$ is the number of cases in that area, and $Population_i$ is the total population in that area. This metric can be used regardless of whether a county reports race and ethnicity but cannot unambiguously determine the burden on specific minorities in an area. For example, if a county has a large minority population and a high case burden it would be incorrect to assume that the minority population is the source of the high case burden. While regressions can potentially link racial/ethnic demographics and COVID-19 case burden, any such relationship is likely mediated by a variety of other factors.

Racial or ethnic disparities in COVID-19 cases or deaths in a given geographical area (state, health district, or county) were estimated according to:

$$Disparity_m = \frac{COVID_m - Population_m}{Population_m} * 100$$

where m is the racial or ethnic minority of interest, $COVID_m$ is the proportion of COVID-19 cases or deaths in that area belonging to minority m, and $Population_m$ is the proportion of minority m in that area. As an example of this measure, imagine a state has a population that is 70% White and 30% Black with 60% of COVID-19 cases occurring in White residents and 40% occurring in Black residents. The disparities for each population would be:

$$Disparity_{Black} = \frac{COVID_{Black} - Population_{Black}}{Population_{Black}} * 100 = \frac{0.40 - 0.30}{0.30} * 100 = 33\%$$

$$Disparity_{White} = \frac{COVID_{White} - Population_{White}}{Population_{White}} * 100 = \frac{0.60 - 0.70}{0.70} * 100 = -14\%$$

Blacks in this state would be experiencing 33% more cases than expected based on their proportion of the population while Whites would be experiencing 14% fewer cases. This definition is used to identify where COVID-19 cases or deaths are higher or lower than the prevalence of a racial group in a

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[21] U.S. Census Bureau, Population Estimates Program. Updated July 1 2019. Accessed at https://www.census.gov/programs-surveys/popest.html

[22] Single-race Population Estimates, United States, 2010-2018. July 1st resident population by state, county, age, sex, single-race, and Hispanic origin, on CDC WONDER Online Database. Vintage 2018 estimates released by U.S. Census Bureau on June 20, 2019. Accessed at http://wonder.cdc.gov/single-race-v2018.html

[23] US Census Bureau. My Tribal Area. Accessed at https://www.census.gov/tribal/?st=04&aianihh=2430

population, highlighting where a particular racial group is more affected by COVID-19 than would be expected considering only demographics.[24] It is important to emphasize that this measure cannot and is not intended to identify the cause of the disparity. We use this metric throughout the report to identify and quantify racial and ethnic disparities in COVID-19 outcomes at various geographical scales.

Results

Change in Data Reporting over Time

Since the initial reports of disproportionate case and death burden of COVID-19 among minority populations, data reporting on the racial/ethnic demographics of COVID-19 cases and deaths has improved significantly. In mid-April, the percentage of COVID-19 cases and deaths with unknown race or ethnicity was approximately 75% and 25%, respectively (Figure 1). As the number of states reporting these data increased, the percentage of cases and deaths with unknown race or ethnicity declined. However, with the majority of U.S. states now reporting race or ethnicity for COVID-19 cases and deaths, the percentage of cases with unknown race or ethnicity has declined slowly since June to 38% and the percentage of deaths with unknown race or ethnicity has remained stable around 5%. While these percentages represent all COVID-19 cases, recent data suggest that reporting of race/ethnicity for new COVID-19 cases has improved: among new cases between July 29 and August 30 in all U.S. states and territories, only 29% had unknown race/ethnicity.
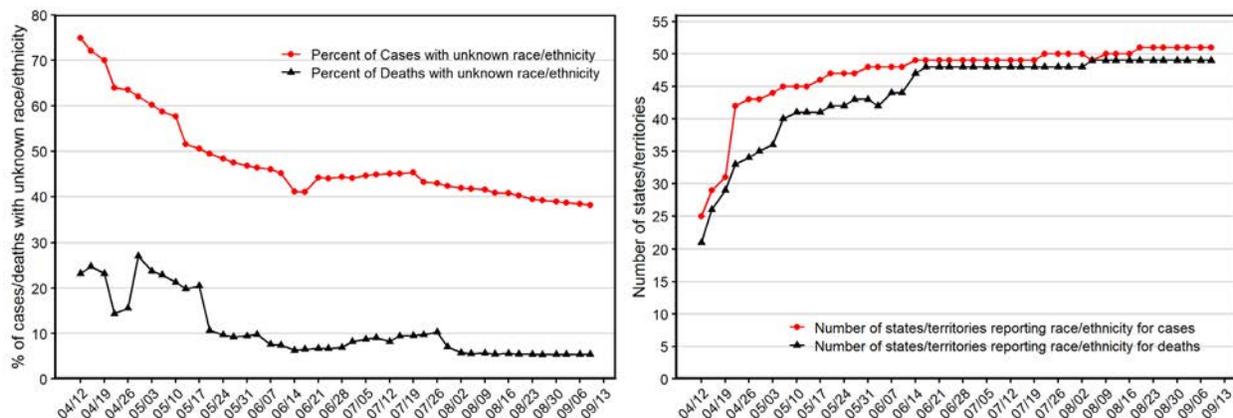

Figure 1: Percentage of cases/deaths with unknown race/ethnicity (left) and number of states including D.C. reporting race/ethnicity data for COVID-19 cases or deaths (right). Data were obtained from the COVID tracking project on 9/9/20. New York was the only state not reporting race/ethnicity for cases; Hawaii and North Dakota did not report race/ethnicity for deaths. Among U.S. territories, the Northern Mariana Islands, Puerto Rico, and Virgin Islands did not report race/ethnicity for cases or deaths. Guam reported race/ethnicity data for COVID-19 cases only. American Samoa had no reported cases of COVID-19.

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[24] To evaluate the sensitivity of this metric to cases/deaths with unknown race or ethnicity, we performed a sensitivity analysis in which the racial and ethnic distribution of unknown cases/deaths was considered identical to that of the population. With a significant disparity defined as >33%, the majority of states with significant disparities remained significant even if the unknown cases/deaths were considered to be distributed according to the population. Results of the sensitivity analysis are detailed in the report for Black, Hispanic, and Asian state-level disparities.

Disparities in COVID-19 Outcomes for Black Populations

State-level Testing

At the time of this report, seven states reported racial demographics for COVID-19 testing. In all cases, Blacks made up a similar share of tests with known race information as their share of the population (Table 2). Notably, race data is missing from many tests in these states, emphasizing the significant gaps that remain in collecting demographic information for COVID-19 testing.

Table 2: Percentage of COVID-19 tests given to Black individuals in 7 reporting states. The percentage of tests where race was Black was calculated based on the number of tests with known race. Data for all states are current as of 9/11/20.

	Total Number of Tests	% of Tests with Known Race	% of Tests with Known Race Administered to Blacks	% Black Population
Delaware	256,698	79.3	22.6	23.0
Illinois	4,575,721	52.9	16.1	14.6
Indiana	1,618,804	84.6	9.6	9.8
Kansas	448,930	67.9	6.8	6.1
Nevada	632,668	46.4	10.0	10.1
Rhode Island	275,782	37.1	8.0	8.4
Utah	698,059	77.8	1.5	1.4

State-level Hospitalizations

Black individuals were overrepresented in COVID-19-related hospitalizations in the majority of states reporting demographics for statewide hospitalization data as of 9/11/20 (Table 3). These results are consistent with a recent CDC Morbidity and Mortality Weekly Report (MMWR), in which non-Hispanic Black individuals made up a greater proportion of hospitalizations in eight Georgia hospitals than would have been expected based on overall (non-COVID-19) hospitalization rates in these hospitals.[25] Similarly, data from hospitalizations in the COVID-NET surveillance system, which comprises over 250 acute-care hospitals in 14 states[26], indicated a higher proportion of Black hospitalizations than expected based on their prevalence in the population.[27,28]

Table 3: Hospitalization rates of Black COVID-19 patients in 17 reporting states. Data for percent of Black hospitalized patients was calculated based on the percentage of cumulative hospitalizations with known race. Data were updated on 9/11/20.

	Total Number of hospitalizations	% Black Hospitalizations	% Black Population
Arizona	21,611	5.5	5.1
Florida	40,807	25.0	16.9
Kansas	2,537	13.4	6.1

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[25] Gold JA, Wong KK, Szablewski CM, et al. Characteristics and Clinical Outcomes of Adult Patients Hospitalized with COVID-19 — Georgia, March 2020. MMWR Morb Mortal Wkly Rep. ePub: 29 April 2020. DOI: http://dx.doi.org/10.15585/mmwr.mm6918e1

[26] CDC. Coronavirus Disease 2019 (COVID-19)-Associated Hospitalization Surveillance Network (COVID-NET). Accessed at https://www.cdc.gov/coronavirus/2019-ncov/covid-data/covid-net/purpose-methods.html

[27] Garg S, Kim L, Whitaker M, et al. Hospitalization Rates and Characteristics of Patients Hospitalized with Laboratory-Confirmed Coronavirus Disease 2019 — COVID-NET, 14 States, March 1–30, 2020. MMWR Morb Mortal Wkly Rep 2020;69:458–464. DOI: 10.15585/mmwr.mm6915e3

[28] COVIDView: A Weekly Surveillance Summary of U.S. COVID-19 Activity. Week ending July 18, 2020. Accessed at https://www.cdc.gov/coronavirus/2019-ncov/covid-data/covidview/index.html

	Total Number of hospitalizations	% Black Hospitalizations	% Black Population
Maine	432	10.6	1.6
Massachusetts	12,401	13.5	8.9
Minnesota	6,830	24.2	6.8
Nebraska	2,119	9.6	5.1
New Hampshire	719	4.8	1.7
Ohio	14,164	30.9	13.0
Oregon	2,222	4.5	2.2
Rhode Island	2,620	13.0	8.4
South Carolina	8,353	49.5	27.1
South Dakota	1,138	5.0	2.4
Utah	3,273	2.5	1.4
Vermont	142	2.0	1.4
Virginia	10,155	30.0	19.9
Washington	6,993	6.0	4.3

State-level Cases and Deaths

Black individuals were disproportionately overrepresented among state-level cases in the majority of states, regardless of Black population in the state (Figure 2A). Black individuals were also disproportionately overrepresented in COVID-19 related deaths in the majority of states reporting race data (Figure 2B).[29] The size of the COVID-19 case and death disparity for Black populations varies widely among the states, with both large and small Black populations experiencing significant disparities (for example, Maine for COVID-19 cases, Kansas and Wisconsin for COVID-19 deaths; Appendix Figure 2). Interestingly, states with the largest disparities in COVID-19 cases did not consistently have disparities in COVID-19 deaths, and vice versa. These data emphasize the importance in monitoring disparities across all COVID-19 outcomes to fully understand the impact on minority communities.

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[29] With a significant disparity defined as >33%, 28 states/territories had significant disparities in cases, and 24 for deaths. If unknown cases were distributed according to the state's racial/ethnic demographics, 23/28 jurisdictions remained significant for case disparities and 23/24 for death disparities.
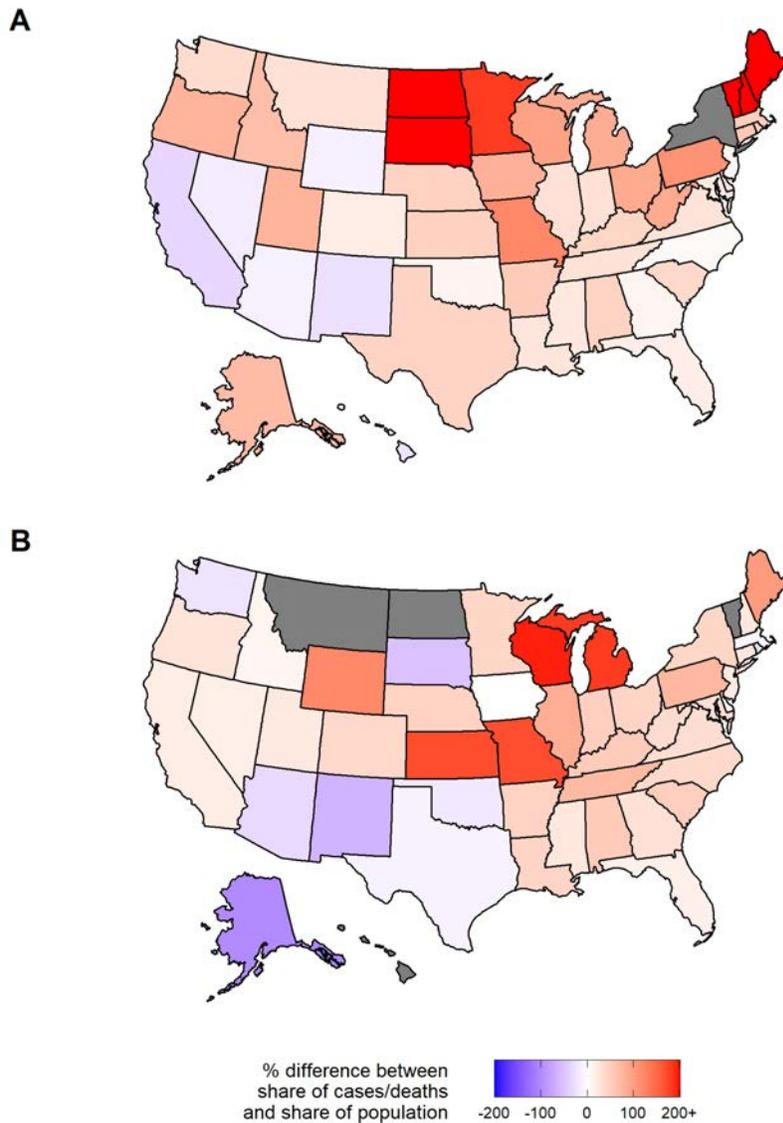
Figure 2: Disparities in COVID-19 cases (A) and deaths (B) among Black populations. *Disparities were calculated as described in the Methods. States without race data are shown in gray. Data were updated on 9/9/20.*

County-level Cases and Deaths

Although state-level data are informative, greater explanatory power is provided by more granular county and regional data. These sources can help identify whether disparities are widespread or focused (e.g., in high-population regions) within a state, allowing for a clearer picture of COVID-19 case disparities. Although county-level data are limited in most states, Mississippi, Louisiana, and Virginia provide a racial breakdown of COVID-19 cases at the county or health district level that can be compared to their state-wide disparities.

The county-level data for each state reveals that the largest disparities are not necessarily found in counties or health districts that contain a major city (defined as having a population over 100,000). In

Louisiana, disparities in both COVID-19 cases and deaths are present in parishes with and without large cities (Figure 3). In Mississippi, the counties experiencing the most significant COVID-19 case disparities among Blacks do not contain a major city (Figure 4). Similarly, health districts in Virginia with the largest disparities in COVID-19 do not always contain a large city (Figure 5). There is also no relationship between a county's population size and its case burden in any of the three states (Appendix Fig. 3-5). One way to identify a relationship between minority populations and COVID-19 impact is to look for relationships between the proportion of a minority in a region and the COVID-19 case burden in that region. Virginia and Mississippi have small but significant relationships between the Black population and the COVID-19 case burden in a county (Appendix Figure 3 and 4). Louisiana shows a similar relationship, though this is driven by two majority Black counties with high COVID-19 case burdens (Appendix Figure 5). These results indicate that, in some states, counties with high Black population experience higher COVID-19 case burden, independent of the total population size of the county. This observation is not causal, but causative factors are the subject of investigation by other researchers.[30]
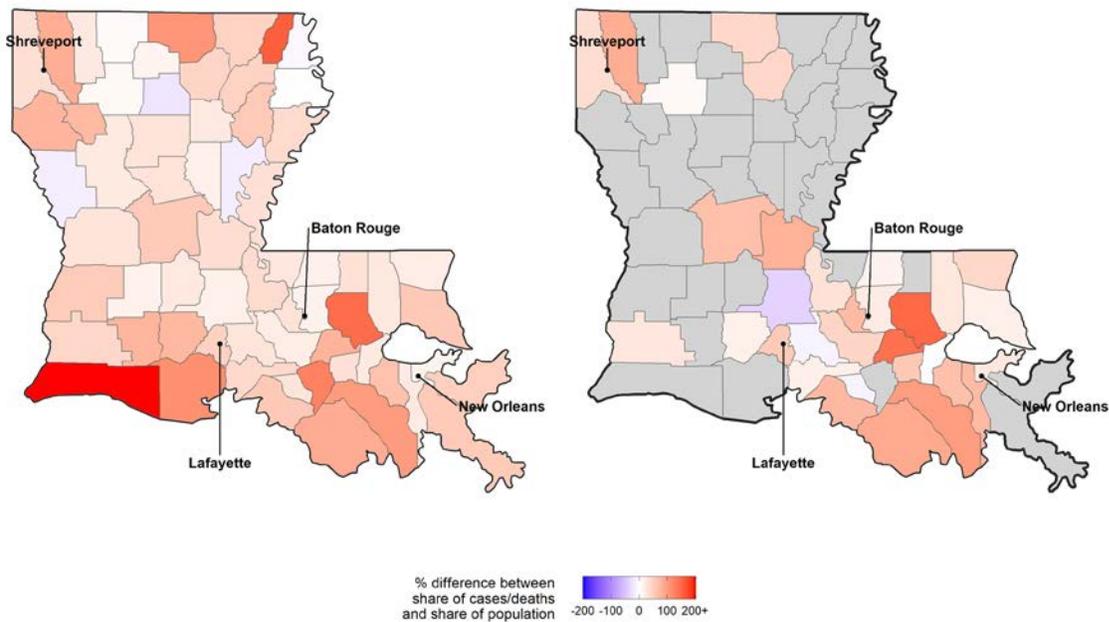

Figure 3: Disparities in COVID-19 cases (left) or deaths (right) among Black populations in Louisiana parishes. Disparities were calculated as described in the Methods. Parishes with fewer than 25 deaths did not report data and are shown in gray. Cities with population greater than 100,000 are labeled with only one such city displayed per county. Data were obtained from the Louisiana Department of Health website on 8/3/20.

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[30] See footnotes 2, 6, 13-15.
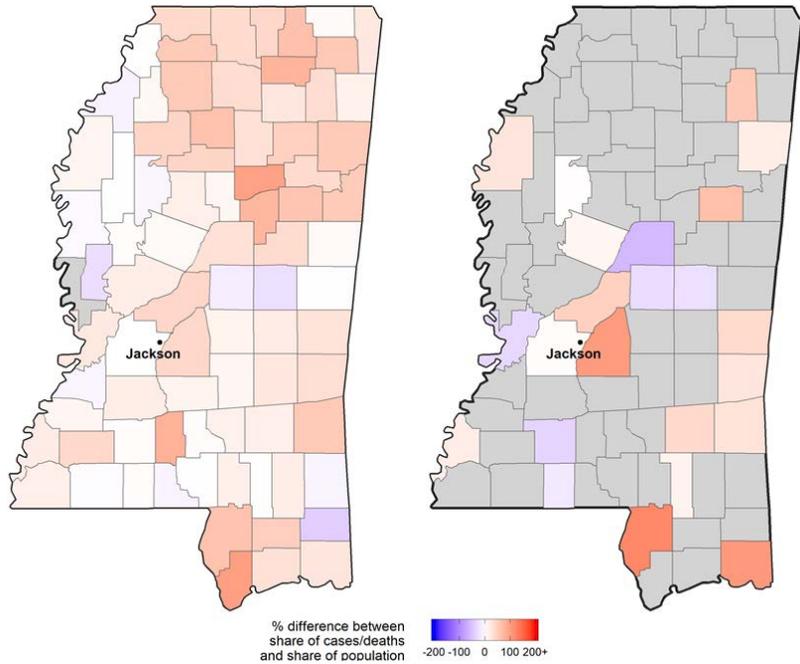
Figure 4: Disparities in COVID-19 cases (left) or deaths (right) among Black populations in Mississippi counties. Disparities were calculated as described in the Methods. Counties that are gray have fewer than 20 cases or deaths and are not reported. Cities with population greater than 100,000 are labeled with only one such city displayed per county. Data used in this figure were obtained from the Mississippi Department of Health website on 7/21/2020.
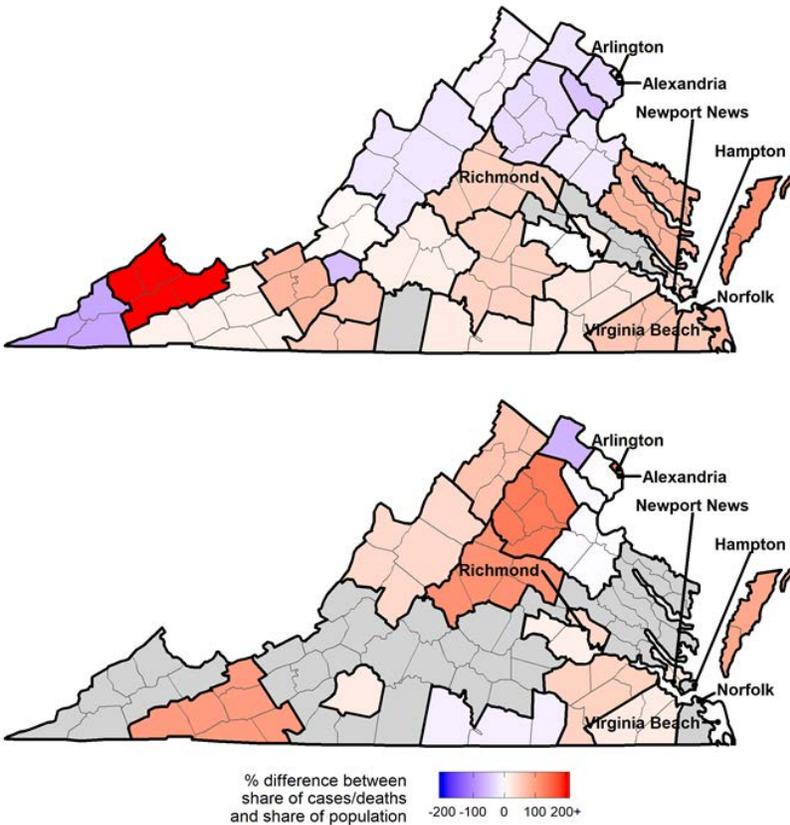

Figure 5: Disparities in COVID-19 cases (top) or deaths (bottom) among Black populations in Virginia health districts. Disparities were calculated as described in the Methods. Data are presented for health districts, with district boundaries bolded and county boundaries in gray. Health districts that are gray have fewer than 20 cases or deaths and are not reported. Cities with population greater than 100,000 are labeled with only one such city displayed per county. Data used in this figure were obtained from the Virginia Department of Health website on 7/21/2020.

Disparities in COVID-19 Outcomes for Hispanic Populations

Testing

At the time of this report, seven states reported ethnicity data for COVID-19 testing. Hispanics made up a similar percentage of tests with known ethnicity compared to their share of the population in four states, but were significantly underrepresented in testing data from Nevada and overrepresented in Rhode Island testing data (Table 4). However, large numbers of tests in each state were missing ethnicity data, including over half of tests in Indiana, Nevada, and Rhode Island.

Table 4: Percentage of COVID-19 tests given to Hispanic individuals in 7 reporting states. The percentage of tests where ethnicity was Hispanic was calculated based on the number of tests with known ethnicity. Data for all states are current as of 9/11/20.

	Total Number of Tests	% of Tests with Known Ethnicity	% of Tests with Known Ethnicity Administered to Hispanics	% Hispanic Population
Delaware	256,698	79.3	9.6	9.5
Illinois	4,575,721	52.9	13.3	17.4
Indiana	1,618,804	45.3	7.7	7.1
Kansas	448,930	59.0	13.5	12.1
Nevada	632,668	46.4	12.0	29.0
Rhode Island	275,782	37.1	23.0	15.9
Utah	698,059	77.8	15.4	14.2

Hospitalizations

Hispanics were overrepresented in hospitalizations in the majority of states reporting ethnicity (Table 5). These results are consistent with recent reports that the hospitalization rate among Hispanic individuals is 4.6 times higher than that for non-Hispanic Whites in the COVID-NET surveillance network.[31]

Table 5: Hospitalization rates of Hispanic COVID-19 patients in 16 reporting states. The percent of Hispanic hospitalized patients was calculated based on cumulative hospitalizations with known ethnicity. Data were updated on 9/11/20.

	Total Number of Hospitalizations	% Hispanic Hospitalizations	% Hispanic Population
Arizona	21,611	40.6	31.6
Florida	40,807	31.8	26.1
Kansas	2,537	28.6	12.1
Maine	432	3.0	1.7
Massachusetts	12,401	16.7	12.3
Minnesota	6,830	15.8	5.5
Nebraska	2,119	37.4	11.2
New Hampshire	719	10.4	3.9
Ohio	14,164	6.5	3.9
Oregon	2,222	30.8	13.3
Rhode Island	2,620	36.0	15.9
South Carolina	8,353	7.4	5.8
South Dakota	1,138	7.0	4.1
Utah	3,273	35.4	14.2
Virginia	10,155	29.5	9.6
Washington	6,993	30.0	12.9

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[31] COVIDView: A Weekly Surveillance Summary of U.S. COVID-19 Activity. Week ending July 18, 2020. Accessed at https://www.cdc.gov/coronavirus/2019-ncov/covid-data/covidview/index.html

Cases and deaths

Hispanics were disproportionately overrepresented in COVID-19 cases in the majority of states reporting ethnicity data for COVID-19 cases (Figure 6A). Disparities were consistently observed in COVID-19 cases among Hispanics regardless of the total Hispanic population of the state (Appendix Figure 6). However, many states reported Hispanics as a mutually exclusive race category, rather than as an ethnicity as defined by OMB (i.e., Hispanics can be of any race).[32] Variation in reporting of ethnicity data complicates the comparison of these reported values to existing demographic data. Therefore, states that combined ethnicity data with race data are marked with an asterisk (*) in Appendix Table 1 to indicate potential complications in comparing these data with the state demographic data.

Although Hispanics were overrepresented in COVID-19 cases in many states, the proportion of Hispanics in COVID-19 deaths is lower than expected in nearly all states (Figure 6B and Appendix Figure 7),[33] which is surprising given Hispanics make up a larger than expected share of COVID-19 hospitalizations (Table 5). Underreporting of ethnicity on death certificates or incomplete ethnicity reporting by states could contribute to underreporting of Hispanic COVID-19 deaths. However, underlying factors in the Hispanic population such as age structure may also contribute to lower overall mortality rates. The median age of Hispanics in 2019 was 29.8 years, compared to 43.7 for non-Hispanic Whites,[34] and the risk for severe illness from COVID-19 increases with age.[35] Data from Illinois suggest that Hispanics make up a large proportion of COVID-19 cases in younger age groups, but a relatively small proportion of cases in the highest-risk age groups (Appendix Figure 8). Importantly, age-adjusted COVID-19 mortality rates for Hispanics at the national level are much higher than non-Hispanic Whites.[36] Additional data on testing rates, hospitalization rates, age distributions of cases, and improved consistency in ethnicity reporting may provide insight into mortality rates for Hispanics.

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[32] Office of Management and Budget. Standards for Maintaining, Collecting, and Presenting Federal Data on Race and Ethnicity. Accessed at https://www.federalregister.gov/documents/1997/10/30/97-28653/revisions-to-the-standards-for-the-classification-of-federal-data-on-race-and-ethnicity

[33] With a significant disparity defined as >33%, 43 states/territories had significant disparities in cases, and 5 for deaths. If unknown cases/deaths were distributed according to the state's racial/ethnic demographics, 39/43 jurisdictions remained significant for case disparities and 5/5 for death disparities.

[34] U.S. Census Bureau. National Population by Characteristics: 2010-2019. Accessed at https://www.census.gov/data/tables/time-series/demo/popest/2010s-national-detail.html

[35] CDC. COVID-19: People at Increased Risk. Accessed at https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/index.html

[36] CDC. Health Disparities: Race and Hispanic Origin. Accessed at https://www.cdc.gov/nchs/nvss/vsrr/covid19/health_disparities.htm
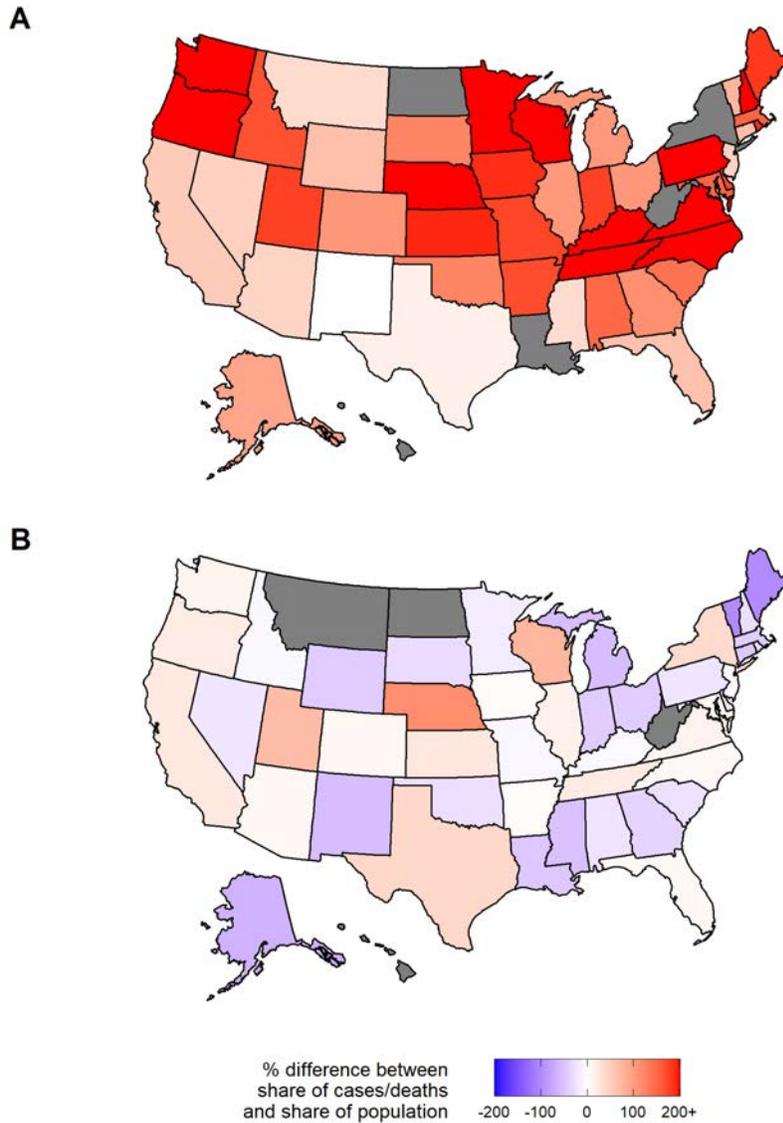
Figure 6: Disparities in COVID-19 cases (A) and deaths (B) among Hispanic populations. *Disparities were calculated as described in the Methods. States without reported ethnicity data are shown in gray. Data were updated on 9/9/20.*

County-level Data

The state of Florida reported ethnicity for COVID-19 cases at both the state- and county-level. As of 7/26/20, Florida reported 423,855 cases, of which approximately 56% had associated ethnicity data. Hispanics made up 43.7% of cases with known ethnicity but make up approximately 26% of the state population. Analysis of county-level ethnicity data indicates that these disparities are not distributed evenly throughout the state (Figure 7). As observed in the county data for Blacks, overrepresentation of Hispanics in cases is not linked to high Hispanic population. For example, Miami-Dade County has the highest Hispanic population in the state (69%), but has a near-proportional Hispanic percentage of cases (71%). These data indicate that disparities among Hispanics and Blacks are not necessarily centered in counties with large cities or areas of high minority populations. Investigating the variation of disparities between counties will require additional analysis with other data sources.

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Furthermore, interesting trends emerge when comparing the demographics of Florida counties to their COVID-19 case burden (Appendix Figure 9). Total population is not significantly predictive of COVID-19 case burden, but this is largely due to the wide variation in COVID-19 case burden among the smallest counties. If counties with populations less than 50,000 are excluded from the analysis, there is a statistically significant relationship between total population and COVID-19 burden in the remaining 41 counties. This pattern appears to be unique among our sample of states we have investigated at the county level (Louisiana, Mississippi, Virginia, Illinois, and Arizona). Florida has sizeable Black and Hispanic populations, with a number of counties that have a large population of one minority but not the other. In order to capture the relationship between racial/ethnic minority populations and COVID-19 case burden, we aggregated the Black and Hispanic population numbers within each county to perform regression analysis. This resulted in a significant relationship between a county's combined Black and Hispanic population size and its COVID-19 case burden. Since total population size may be predictive of case burden in Florida counties with a population greater than 50,000, some component of the relationship between race/ethnicity and case burden could be explained by these groups living in more heavily populated areas. While these observations do not imply causation, they underscore the disproportionate impact that Black and Hispanic communities have experienced in the state of Florida.
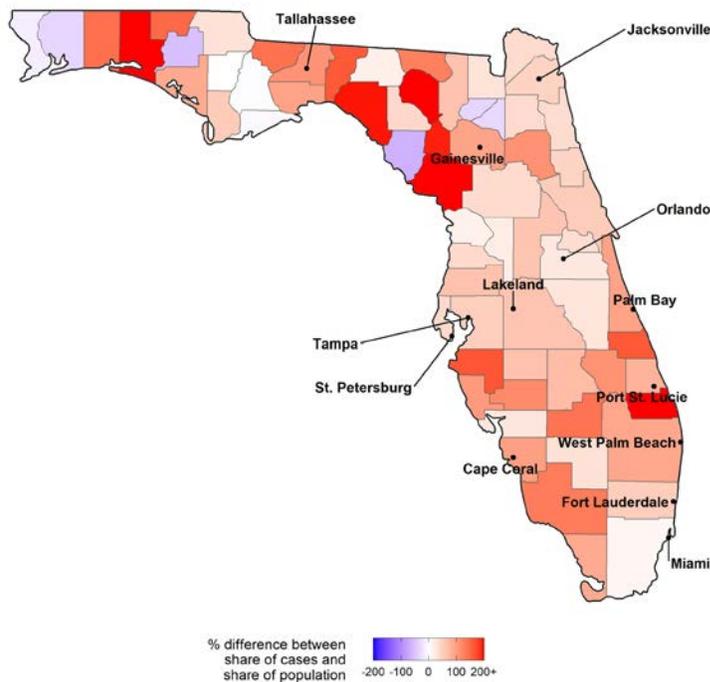

Figure 7: Disparities in COVID-19 cases among Hispanic populations in Florida counties. Disparities were calculated as described in the Methods. The largest city with population greater than 100,000 in each county is labeled with only one such city displayed per county. Data used in this figure were obtained from the Florida Department of Health website on 7/23/20.

Similarly, the state of Illinois reported race and ethnicity for COVID-19 cases at both the state- and county-level. As of 7/26/20, Illinois reported 172,666 cases, of which approximately 76% reported race and ethnicity. Hispanics made up approximately 39.5% of cases with known ethnicity, compared to 17.4% of the population. Many counties in Illinois did not report race/ethnicity or had large numbers of cases without demographic data. However, the available data emphasize the importance of additional

data collection and analysis at local- and county-levels to further understand disparities in minority groups. Some, but not all, counties containing major cities had disproportionately high numbers of cases in Black populations (Figure 8A). Many of the counties with large disparities for Black cases did not have disparities for Hispanic cases, and vice versa (compare Figures 8A and 8B). For example, in Cook County (the home of Chicago and one of the most racially/ethnically diverse counties in the state) the rate of cases among Black populations is near-proportional to the Black population size (26.6% of cases vs. 23.9% of population), whereas the rate of cases among Hispanic populations is much higher than expected (42.2% of cases vs. 25.5% of population). These data emphasize that disparities are not limited to urban areas, or even areas of high minority population. Furthermore, these data highlight the importance of evaluating disparities among each minority group, and the need for more granular data on how minorities are being impacted by COVID-19.
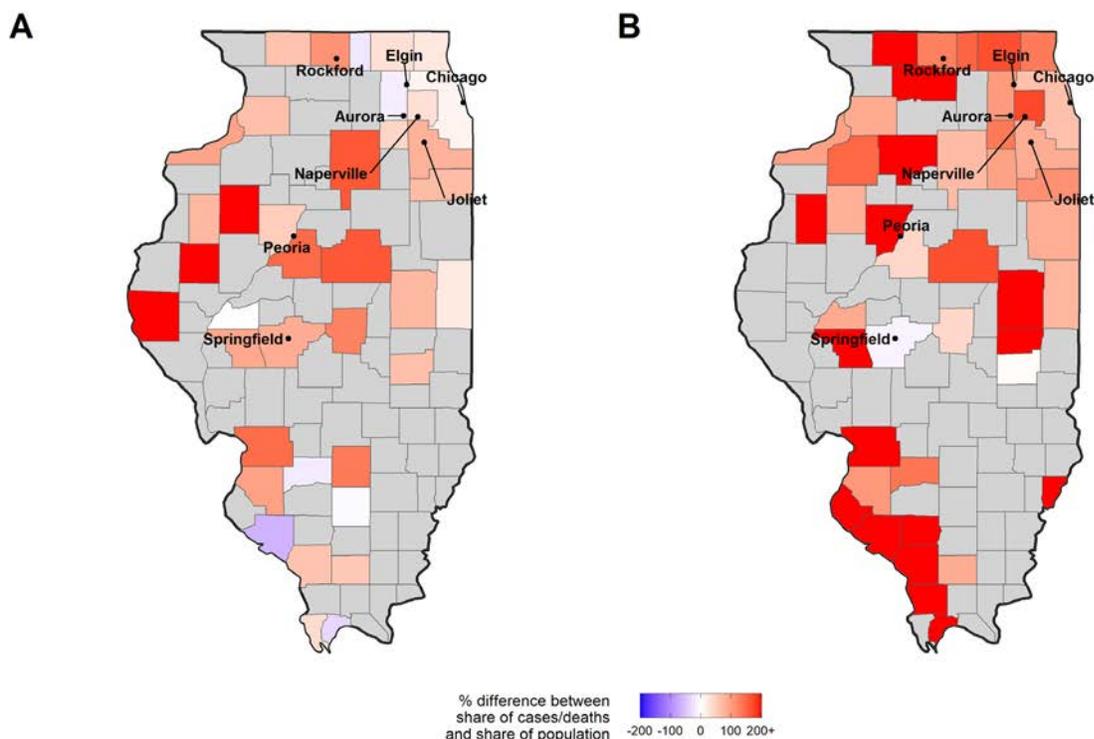
Figure 8: Comparison of COVID-19 case disparities in Black (A) and Hispanic (B) populations in Illinois counties. Disparities were calculated as described in the Methods. Counties with zero cases for the minority group of interest or fewer than 20 total cases are presented in gray. Cities with population greater than 100,000 are labeled. Data used in these figures were obtained from the Illinois Department of Public Health website on 7/24/20.

The lack of race and ethnicity data at the county level can be supplemented by looking for relationships between county demographics and COVID-19 case burden. In Illinois, the proportion of Black residents in a county is a significant predictor of that county's COVID-19 case burden, which suggests that communities with a larger Black population tend to experience larger numbers of COVID-19 cases in Illinois (Appendix Figure 10). The percentage of Hispanic residents in a county is an even stronger predictor of that county's COVID-19 case burden. As previously observed, the relationship between case burden and minority population, but not total population, indicates that this trend is not due to these groups living in more heavily populated areas. The regressions provide some evidence that minority communities throughout Illinois are experiencing greater rates of COVID-19 infection, though the level

of disparity in many Illinois counties remains unclear due to small case numbers and/or limited demographic data.

Disparities in COVID-19 Outcomes for Asian and Native Hawaiian or Other Pacific Islander (NHPI) Populations

Asians were not consistently reported in all states reporting racial classification of COVID-19 cases or deaths, and several states report Asian as a pan-racial category that includes NHPI. As a result, it is considerably more difficult to quantify the impact of COVID-19 in Asian populations. 38 states and D.C. reported Asians as a unique group in their COVID-19 case numbers, and 35 states and D.C. reported Asians as a unique group in numbers of COVID-19 deaths. In most states, Asians made up a near-proportional, or slightly less than expected, number of COVID-19 cases (Figure 9A) and deaths (Figure 9B).[37]

Only 23 states reported NHPI as an independent group for COVID-19 cases. In most of these states, NHPI make up less than 1% of the population and less than 1% of COVID-19 cases. These small numbers make it difficult to robustly calculate disparities for NHPI at the state level. However, in the state of Hawaii, NHPI make up 10% of the population but 43% of COVID-19 cases. These data, and several recent reports including city-level data,[38,39,40] suggest that NHPI have been disproportionately impacted by COVID-19. However, limitations with the data pose a considerable challenge to understanding disparities in NHPI populations.

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[37] With a significant disparity defined as >33%, 8 states/territories had significant disparities in cases, and 5 for deaths. If unknown cases and deaths were distributed according to the state's racial/ethnic demographics, 7/8 jurisdictions remained significant for case disparities and 4/5 for death disparities.

[38] "Count Native Hawaiian And Pacific Islanders In COVID-19 Data—It's An OMB Mandate." Health Affairs Blog, August 27, 2020. DOI: 10.1377/hblog20200825.671245

[39] Kaholokula, J., Samoa, R., Miyamoto, R., Palafox, N., Daniels, Sheri-Ann. COVID-19 Special Column: COVID-19 Hits Native Hawaiian and Pacific Islander Communities the Hardest. Hawaii J Health Soc Welf ; 79(5): 144-146.

[40] Torralba, E. COVID-19 exposes how Native Hawaiians and Pacific Islanders face stark health care disparities. UCLA Newsroom. Accessed at https://newsroom.ucla.edu/stories/covid-19-stark-differences-NHPI

A

B

% difference between
share of cases/deaths
and share of population   -200 -100   0   100 200+
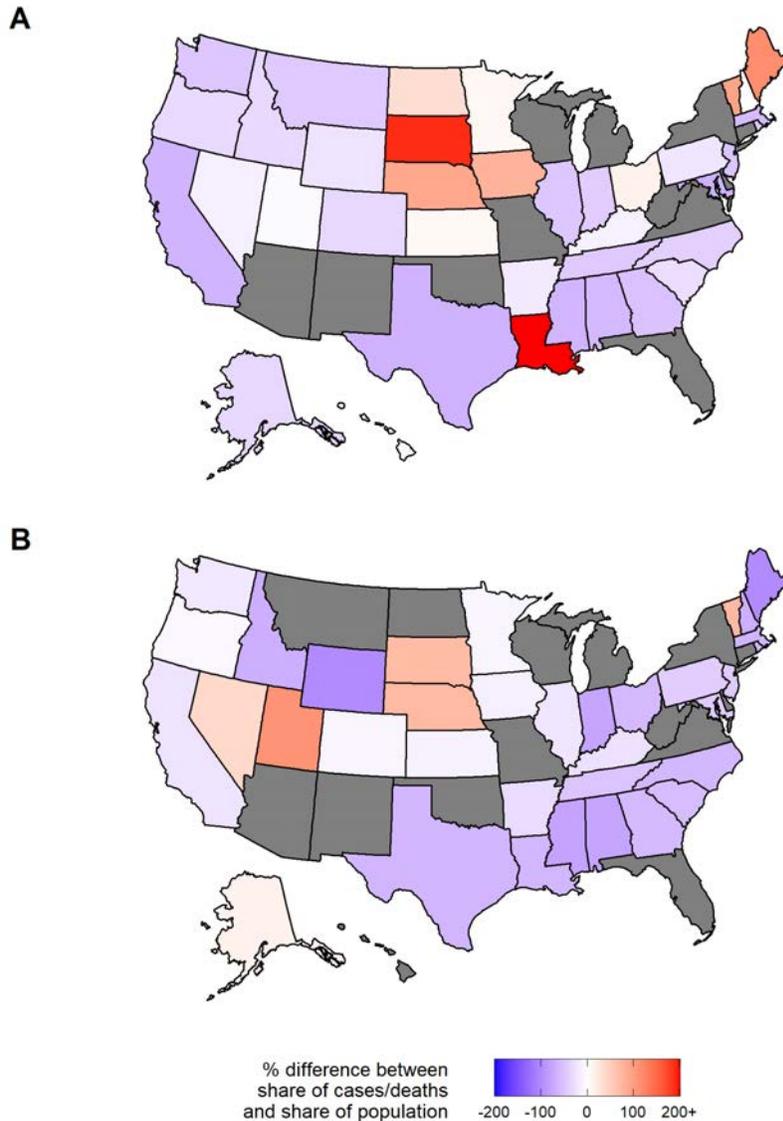
Figure 9: Disparities in COVID-19 cases (A) and deaths (B) among Asian populations. Disparities were calculated as described in the Methods. States without reported data, or those for which Asian was grouped with other racial groups, are shown in gray. Data were updated on 9/9/20.

Disparities in COVID-19 Outcomes for American Indian Populations

American Indians and Alaska Natives (AIAN) represent one of the hardest hit communities during the COVID-19 pandemic, due in part to limited health services and an existing burden of chronic and infectious diseases.[41,42] These factors contribute to the special sensitivity of AIAN communities to the current pandemic. Exploring the impact of COVID-19 on AIANs is complicated by their low prevalence in

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[41] Espey DK, Jim MA, Cobb N, et al. Leading causes of death and all-cause mortality in American Indians and Alaska Natives. *Am J Public Health*. 2014;104 Suppl 3(Suppl 3):S303-S311. DOI: 10.2105/AJPH.2013.301798

[42] Adakai M, Sandoval-Rosario M, Xu F, et al. Health Disparities Among American Indians/Alaska Natives — Arizona, 2017. MMWR Morb Mortal Wkly Rep 2018;67:1314–1318. DOI: 10.15585/mmwr.mm6747a4.

most states and the overlapping jurisdictions of state and tribal authorities. However, Navajo Nation presents a unique case where enough information exists to provide insights into the effects of COVID-19 on a majority-American Indian population. Additionally, IHS data show that Navajo Nation is experiencing significantly higher rates of COVID-19 cases (5% of the population had contracted COVID-19 as of 7/23/20) and a greater need for additional testing (17% of tests had a positive result as of 7/22/20; WHO recommends 10% of tests should return positive for sufficient testing) than most other IHS regions (Appendix Figure 11), making it a particularly salient case study.

Navajo Nation territory spans Arizona, New Mexico and Utah and is home to the majority of the American Indian populations in these three states (Figure 10). Counties with Navajo Nation territory have the largest case burden in New Mexico and Utah, though in Arizona there are several counties with substantial numbers of cases in counties outside Navajo Nation territory (Figure 10). This may reflect the rapid rise in cases across Arizona since mid-June, though the three counties of Arizona that contain Navajo Nation territory are among those with the highest COVID-19 case burden.
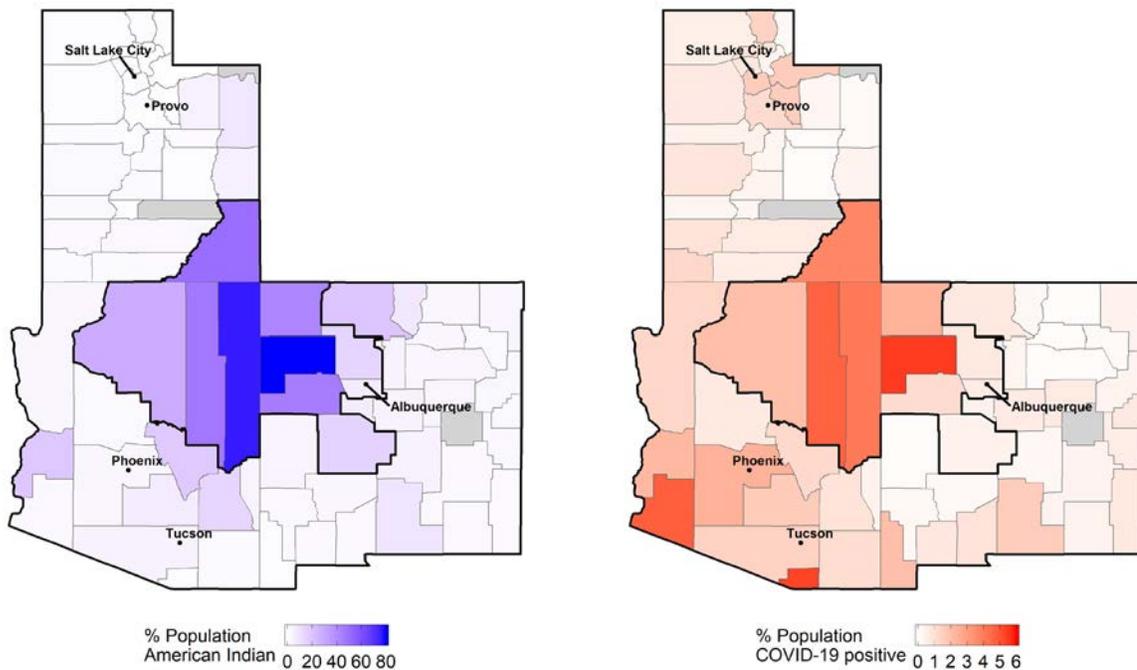
Figure 10: Comparison of American Indian populations to COVID-19 case burden by county. Counties with Navajo Nation territory are outlined in black with the color bar showing the proportion of American Indians in the county population (left, blue) and the percentage of the population testing positive for COVID-19 (right, red; where percentage positive = positive cases / total population in county). Cities with a population greater than 175,000 are displayed. Data for this figure were taken from the NY Times COVID-19 database on 7/23/2020.

The high case burden results from the persistent accumulation of cases since April, resulting in 5% of the Navajo Nation population having contracted COVID-19 (Figure 11). A comparison highlights the significance of the situation in Navajo Nation: Arizona would have to continue to experience the same growth in cases it has during the most recent outbreak for three to four months for a similar proportion of its population to have contracted COVID-19.

AIAN communities may be particularly sensitive to the pandemic given the high prevalence of comorbidities associated with adverse outcomes from COVID-19 and social determinants of health (inadequate access to healthcare, running water, and food) associated with these communities.[43] It is probable that these data underestimate the true case burden in Navajo Nation given the complicated overlapping state/tribal jurisdictions in the area and the accuracy of population data for the tribal region, which is largely rural.
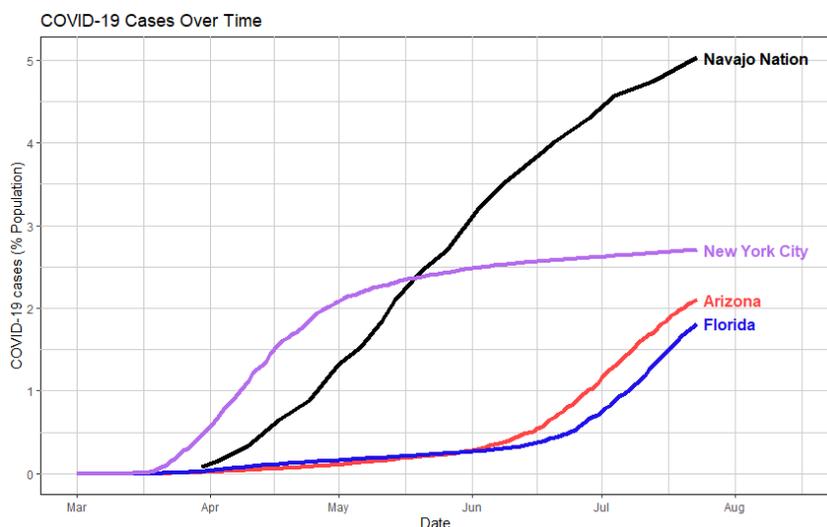
Figure 11: The growth in cumulative COVID-19 case burden for the Navajo Nation and several states and New York City. Data were taken from the NY Times COVID tracking data (daily) on 7/23/2020 and Navajo Nation department of health reports (weekly) from 3/30 to 7/23/2020.

Despite the large number of cases in the Navajo Nation, a county-level analysis of American Indian populations in Arizona shows that Navajo Nation-containing counties tend to have lower disparities than those outside it (Figure 12). This illustrates the importance of evaluating both disparities and total case burden: Navajo Nation tribal members might make up a near-proportional share of cases (i.e., percentage of cases vs. percentage of population) in a county while still having a far greater case burden (i.e., COVID-19 cases per unit population) than other counties with fewer Navajo Nation tribal members. Both metrics describe a disproportionate impact on American Indians. The presence of significant disparities in counties with very low numbers of American Indians is an important result that is often obscured when data from low-population minorities are recorded as 'Other', 'Unknown', or in combination with larger racial groups, such as Asian and NHPI populations. This particular case highlights the importance of data completeness to accurately capturing where minorities are under the most stress from the pandemic.

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[43] Kakol M, Upson D, Sood A. Susceptibility of Southwestern American Indian Tribes to Coronavirus Disease 2019 (COVID-19) [published online ahead of print, 2020 Apr 18]. J Rural Health. 2020;10.1111/jrh.12451. DOI: 10.1111/jrh.12451
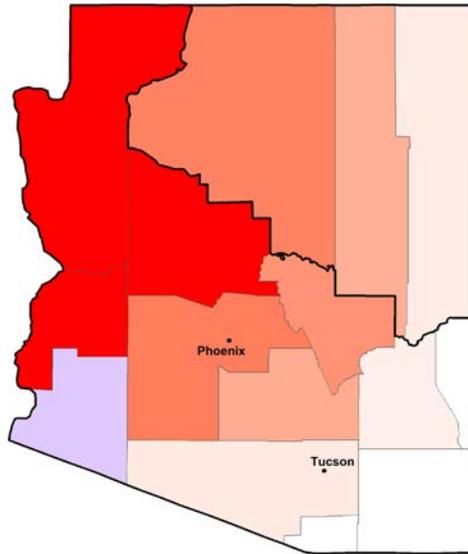
Figure 12: County-level disparities for American Indians in Arizona counties with Navajo Nation territory. *Arizona is separated into counties with Navajo Nation territory (North East counties) with the color bar indicating the size of the difference between the proportion of American Indians in a county and the proportion of American Indian COVID-19 cases. Cities with population greater than 100,000 are labeled with only one such city displayed per county. Data used in this plot were taken from the Arizona state department of health website on 7/23/2020.*

Furthermore, analysis of Arizona counties revealed that counties with larger populations of Hispanics and/or American Indians have higher COVID-19 case burden that cannot be explained by whether these groups live in more or less populated areas (Appendix Figure 12). Out of all the other states analyzed, only Illinois shows a similarly large relationship between county-level COVID-19 case burden and a minority population (Hispanics). The relationship between minorities and COVID-19 case burden observed at varying strengths across states is consistent with findings in other regions and highlights the widespread relationship between race, ethnicity, and COVID-19.[44]

Challenges and Limitations

Incomplete data

Although the number of states reporting race and ethnicity data has increased significantly since the pandemic began, states are inconsistent with the data that are reported. Importantly, many states are missing race or ethnicity data for a large number of cases. Nationwide, approximately 38% of COVID-19 cases and 5% of COVID-19 deaths were missing race or ethnicity data as of 9/9/20. The percentage of cases and deaths in reporting states with associated race and ethnicity data are highly variable, ranging

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[44] Millett GA, Jones AT, Benkeser D, et al. Assessing Differential Impacts of COVID-19 on Black Communities [published online ahead of print, 2020 May 14]. Ann Epidemiol. 2020;47:37-44. DOI: 10.1016/j.annepidem.2020.05.003

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from 6.6% in Texas to near 100% in several states (Appendix Table 1). Our analysis inherently assumes that cases with race/ethnicity data reported are representative of the racial and ethnic diversity of all cases; however, we do not know whether the large number of cases and deaths without race/ethnicity data may cause under- or over-representation of any racial or ethnic group. Furthermore, only seven states currently report race/ethnicity for tests, and among those, many tests are missing data. This represents a considerable challenge in understanding whether minority groups have adequate access to COVID-19 testing.

Variation in reporting methodology for race and ethnicity

Variation in reporting methodology for race and ethnicity between states further complicates the ability to make comparisons to existing demographic data. For example, many states report data from small minority groups such as American Indian, Asian, and NHPI in overlapping groups (i.e., Asian/Pacific Islander) or group all small minority groups into an "Other" category. Similarly, states have differing methodology for multiracial individuals: some states have a separate category for multiracial, while others include multiracial individuals in the "Other" category.

Ethnicity reporting is particularly variable and presents a significant challenge for evaluating disparities in this population. Ethnicity is defined by the U.S. Census Bureau as the Hispanic or non-Hispanic origin of an individual, but Hispanics can be of any race. However, many states report race/ethnicity as a single variable – therefore, each of the races are reported as non-Hispanic. In addition to complicating the comparison to existing demographic data which separate race and ethnicity, this approach leaves many questions unanswered, such as how an individual who identifies as Black Hispanic would be reported in the dataset.

Decentralized data sources

Data are reported by individual state departments of health and are often formatted and presented differently. States use a variety of interactive dashboards, pie charts, text tables, and pdf documents to report their data. This creates technical challenges in collecting and compiling data – in particular, it prohibits the use of an automated data collection technique such as web scraping. An additional complication is whether cases and mortalities are reported in the state or county where the individual resides or where they are tested/treated. The CDC case report form provides fields for both variables,[45] but states may have different methodologies for determining geographic location that may also change over time. This problem is especially complex in areas with overlapping state, county, and tribal jurisdictions, such as in many Arizona counties. The volunteer-based COVID tracking project[46] has created the most comprehensive centralized resource for race and ethnicity data at the state level. However, it is important to emphasize that the underlying issues of reporting heterogeneity and completeness remain a challenge that centralizing the data does not resolve.

Data for county and other regional sources are even more difficult to obtain. Some states report county/region-level race and ethnicity data through their department of health websites. To our knowledge, this report contains the only county/region-level race and ethnicity data that were available in July through state departments of health (Arizona, Florida, Illinois, Louisiana, Mississippi, and

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[45] CDC. Human Infection with 2019 Novel Coronavirus Case Report Form. Accessed at: https://www.cdc.gov/coronavirus/2019-ncov/downloads/pui-form.pdf

[46] The COVID Tracking Project. The COVID Racial Data Tracker. Accessed at: https://covidtracking.com/race

Virginia). However, of these, only two states (Louisiana and Virginia) provide these data in a downloadable spreadsheet format. Arizona and Illinois require the user to select a county of interest and manually record the data for each county. Florida and Mississippi provide county-level data in pdfs that cannot be readily converted to a spreadsheet format. County-level data from other states are available on a limited basis from individual county department of health websites. Therefore, although county-level and even more granular geographic data are critical to understanding these disparities in COVID-19 outcomes, the time commitment required to build a comprehensive resource based on available data at this time is extremely high.

Aggregated data

Many states report a variety of additional demographics for COVID-19 cases and deaths, such as age, sex, residence type (i.e., long-term care facility, homeless, incarcerated), employment in health care industry, etc. Several states also list comorbidities that were present in COVID-19 deaths. However, very few states provide linkages between these datasets, which could provide useful insight into the nature of the disparities in COVID-19 outcomes among minority groups. The majority of states do not provide race/ethnicity breakdowns of COVID-19 cases or deaths by age, sex, residence type, comorbidities, or other factors. Were these data made widely available, it would be possible to determine whether, for example, the average age of COVID-19 deaths varied between Black and White populations. It could provide insight into whether particular minority groups are being disproportionately impacted due to their types of employment or other factors. Many states collect and report these data currently in an aggregated fashion; future disaggregation of these datasets by race have the potential to further characterize the disproportionate impact of COVID-19 on minority communities.


Conclusions and Next Steps

Currently available data indicate significant, widespread disparities in COVID-19 cases and deaths for Black, Hispanic, and American Indian populations, and suggest that disparities may also exist in some locations for Asian and NHPI populations. Evaluation of disparities at the county level highlights potential geographic variation in the severity of the impact on minority communities, but also indicates that disparities persist in rural, suburban, and urban counties. State-level data are insufficient to fully characterize the impact of COVID-19 on minority communities. Collecting more detailed data on COVID-19 impact, such as in individual counties, cities, or zip codes, is critical to further understand the impact of this disease on minority groups. However, data at this level of granularity raise additional concerns regarding privacy that would need to be considered during collection and reporting. Additional insights could be gained from linking COVID-19 demographic data to other data sources, such as social vulnerability, healthcare access, employment, and other health disparities such as chronic health conditions. Such analyses would shed further light on the observed disparities in COVID-19 impact in minority communities.

APPENDIX

Appendix Table 1: Percentage of cases and deaths reporting racial/ethnic demographics as of 9/9/20.
States that reported race/ethnicity together (i.e., Hispanic as a mutually exclusive race category) are indicated with an asterisk (*). "NOT REPORTED" indicates that there was no data available for that state.

State	Percent of Cases Reporting Race	Percent of Cases Reporting Ethnicity	Percent of Deaths Reporting Race	Percent of Deaths Reporting Ethnicity
Alabama	60.1	49.2	91.1	83.1
Alaska	52.6	40.1	95.2	95.2
Arizona*	66.4	66.4	88.6	88.6
Arkansas	92.0	100.0	99.8	99.8
California*	67.8	67.8	98.1	98.1
Colorado*	84.9	84.9	98.2	98.2
Connecticut*	70.5	70.5	99.1	99.1
Delaware*	91.9	91.9	100.0	100.0
District of Columbia	99.5	91.3	100.0	100.0
Florida	73.8	67.1	94.4	88.9
Georgia	70.9	60.9	99.0	98.6
Hawaii	41.9	NOT REPORTED	NOT REPORTED	NOT REPORTED
Idaho	65.5	53.1	99.0	99.3
Illinois*	74.7	74.7	95.8	95.8
Indiana	79.1	46.1	86.8	49.9
Iowa	82.2	83.2	89.4	88.5
Kansas	82.1	76.7	95.6	93.5
Kentucky	68.1	63.7	91.4	87.9
Louisiana	88.4	NOT REPORTED	96.3	94.3
Maine	90.7	84.4	91.8	83.6
Maryland*	85.0	85.0	99.6	99.6
Massachusetts*	71.5	71.5	99.4	99.4
Michigan	83.7	67.9	97.2	82.8
Minnesota*	100.0	100.0	97.3	97.3
Mississippi	85.0	63.8	98.1	86.0
Missouri	46.0	63.4	89.4	86.6
Montana	67.1	65.1	80.3	NOT REPORTED
Nebraska	79.2	75.6	92.4	85.5
Nevada*	71.7	71.7	64.0	64.0
New Hampshire*	88.1	88.1	97.9	97.9
New Jersey*	64.0	64.0	98.0	98.0
New Mexico*	92.7	92.7	91.6	91.6
New York	NOT REPORTED	NOT REPORTED	89.2	89.2
North Carolina	77.3	66.2	95.1	89.2

State	Percent of Cases Reporting Race	Percent of Cases Reporting Ethnicity	Percent of Deaths Reporting Race	Percent of Deaths Reporting Ethnicity
North Dakota	69.9	NOT REPORTED	NOT REPORTED	NOT REPORTED
Ohio	88.2	77.3	99.1	98.3
Oklahoma	79.9	72.1	93.9	86.2
Oregon	87.9	88.1	85.8	81.4
Pennsylvania	53.2	33.2	99.2	99.2
Rhode Island*	75.4	75.4	81.9	81.9
South Carolina	71.2	58.7	86.1	75.6
South Dakota*	100.0	100.0	100.0	100.0
Tennessee	85.0	78.5	99.0	98.6
Texas*	6.6	6.6	99.9	99.9
Utah*	89.7	89.7	95.1	95.1
Vermont	99.5	99.7	100.0	100.0
Virginia*	77.4	77.4	96.6	96.6
Washington*	69.4	69.4	98.7	98.7
West Virginia	100.0	NOT REPORTED	24.2	NOT REPORTED
Wisconsin	90.4	86.3	98.2	97.6
Wyoming*	80.5	80.5	83.3	83.3
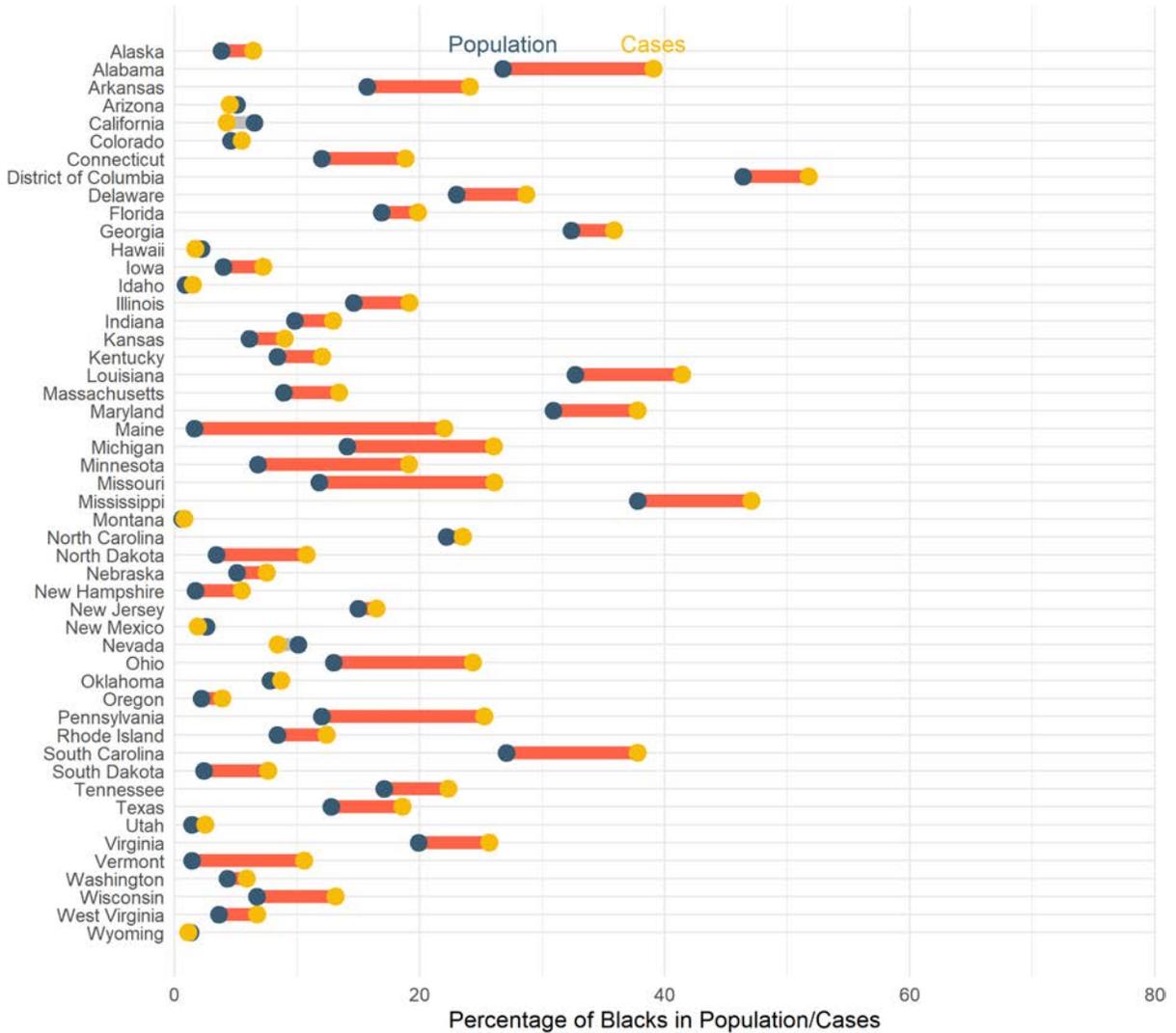
Appendix Figure 1: Disproportionality of COVID-19 cases in Black populations. *Population* is the percentage of a state's population that is Black in the U.S. Census Bureau's 2019 Estimated Population data. *Cases* are the percentage of cases reporting race that are Black. The color of the line joining Cases and Population indicates the direction of the difference between the two (red is cases > population, gray is population > cases). Data were updated on 9/9/20.
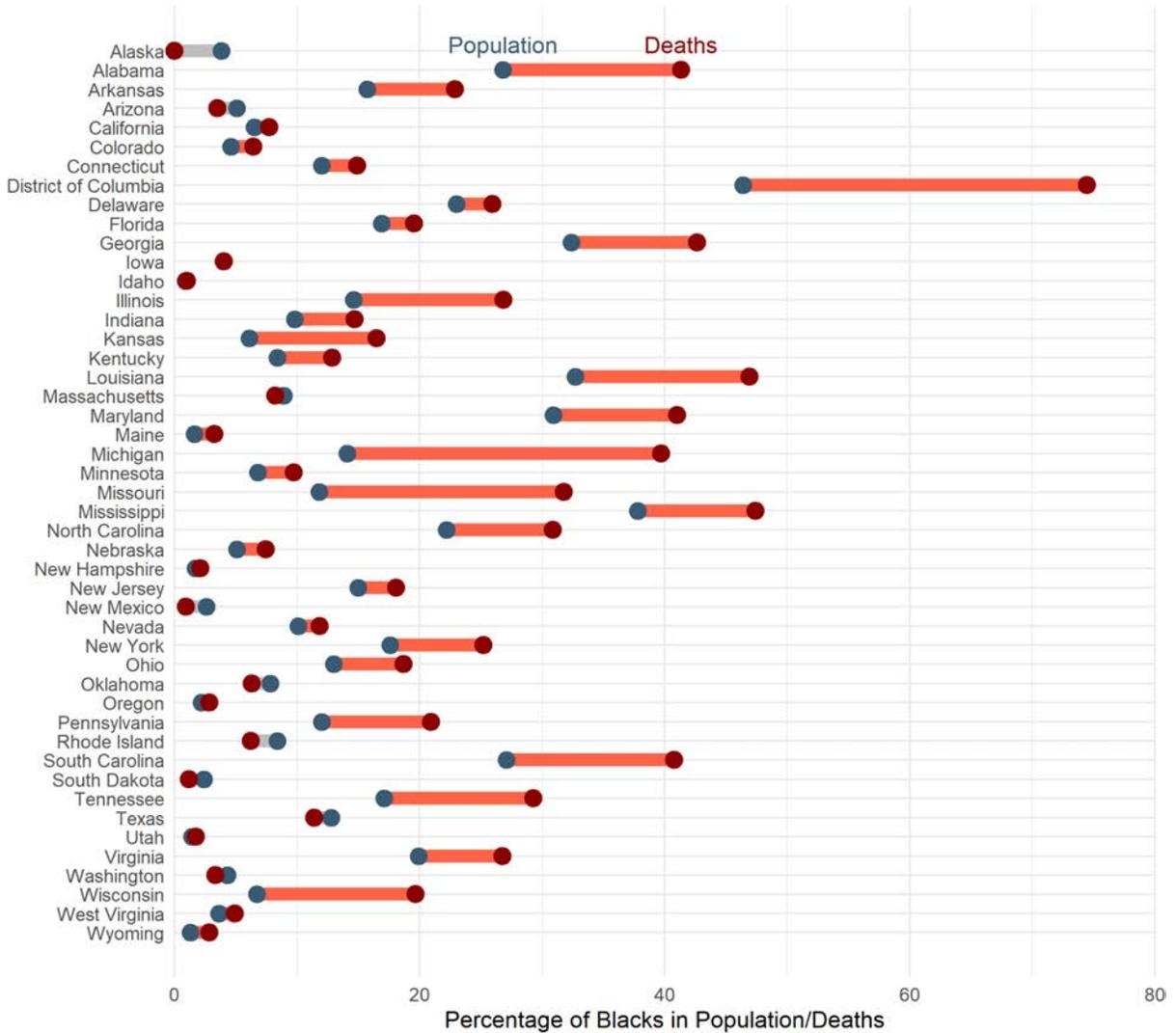
Appendix Figure 2: Disproportionality of COVID-19 deaths in Black populations. *Population* is the percentage of a state's population that is Black in the U.S. Census Bureau's 2019 Estimated Population data. *Deaths* are the percentage of COVID-19-linked deaths reporting race that are Black. The direction of the line joining Deaths and Population indicates the size of the difference between the two (red is deaths > population, gray is population > deaths). Data were updated on 9/9/20.
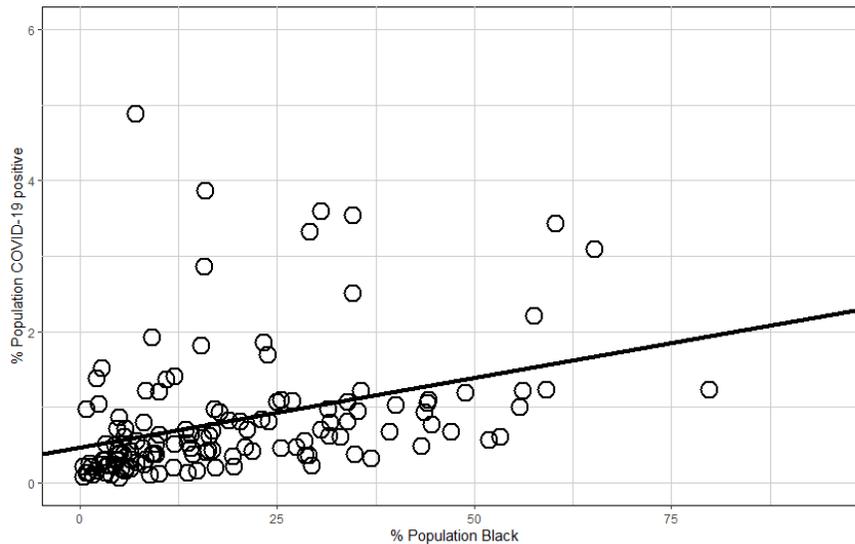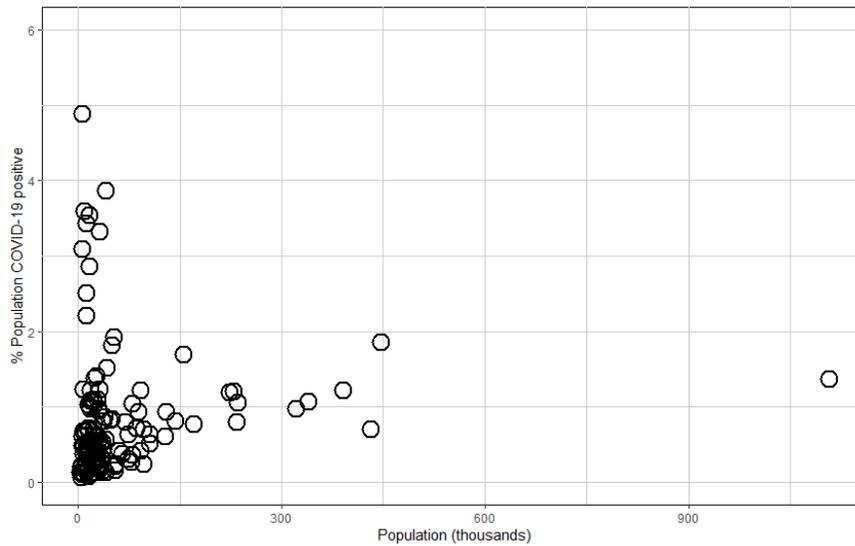
Appendix Figure 3. Relationship between COVID-19 case burden and population characteristics in Virginia counties and independent cities. Plots show the relationship between the county or independent city's case burden and its total population (top) or proportion of the population that is Black (bottom). Points represent Virginia's counties and independent cities. No significant relationship exists between the case burden and total population. There is a significant, positive relationship between the county/independent city case burden and the proportion of that county/independent city that is Black (black line in bottom left plot; parameters are slope = 0.02, R-squared = 0.12, p-value = 2e⁻⁵). Data for the regressions were collected on 7/23/2020.
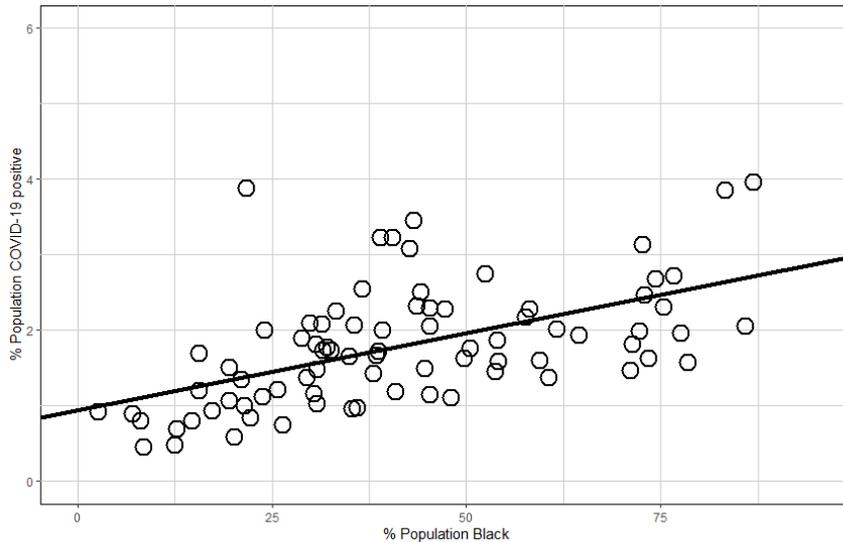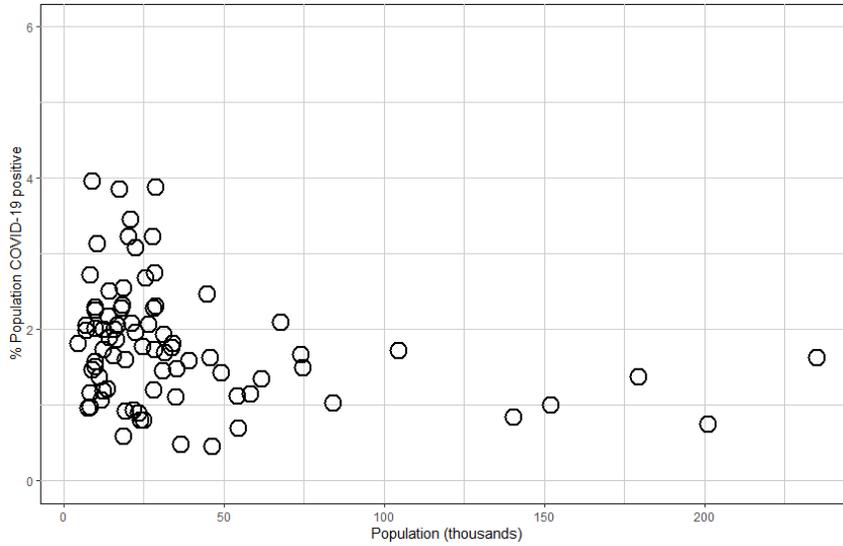
Appendix Figure 4: Relationship between COVID-19 case burden and population characteristics in Mississippi counties. Plots show the relationship between the county case burden and the total county population (top) or proportion of the county's population that is Black (bottom). Points represent Mississippi counties. No significant relationship exists between the case burden and total population. There is a significant, positive relationship between the county case burden and the proportion of that county that is Black (black line, parameters are slope = 0.02, R-squared = 0.29, p-value = $1.5e^{-7}$). Data for the regressions were collected on 7/21/2020.
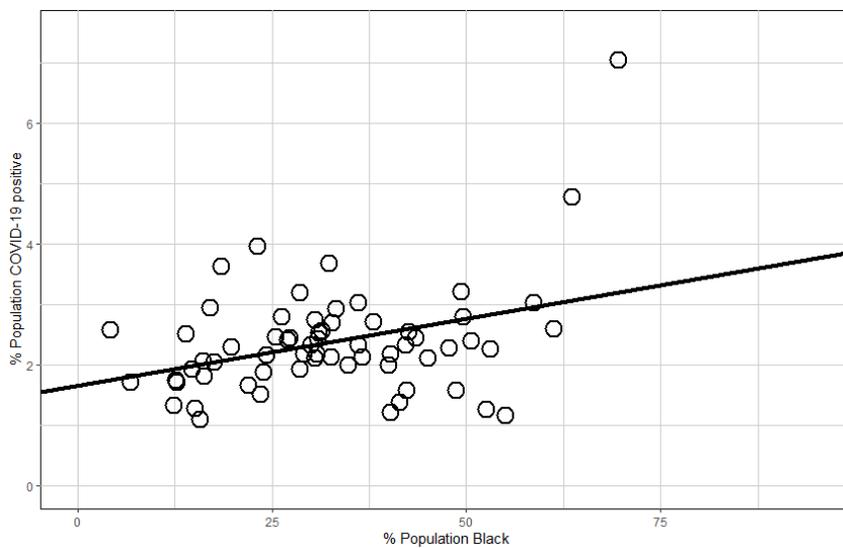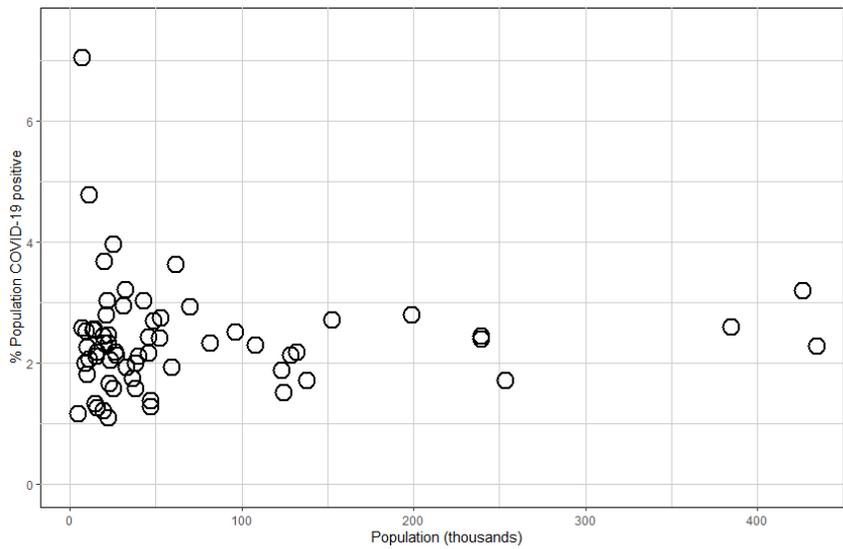
Appendix Figure 5: Relationship between COVID-19 case burden and population characteristics in Louisiana parishes. The case burden in each parish is plotted against the parish's total population (top) and percentage of Blacks in the parish population (bottom). Points represent individual parishes. No significant relationship exists between the case burden and total population. There is a significant, positive relationship between the case burden and the proportion of that parish that is Black (black line, parameters are slope = 0.02, R-squared = 0.11, p-value = $4e^{-3}$). The regression results are driven by the two counties with the highest proportion of COVID-19 cases (East Carroll and Madison); if these points are removed there is no significant trend. Data for the regressions were collected on 8/3/2020.
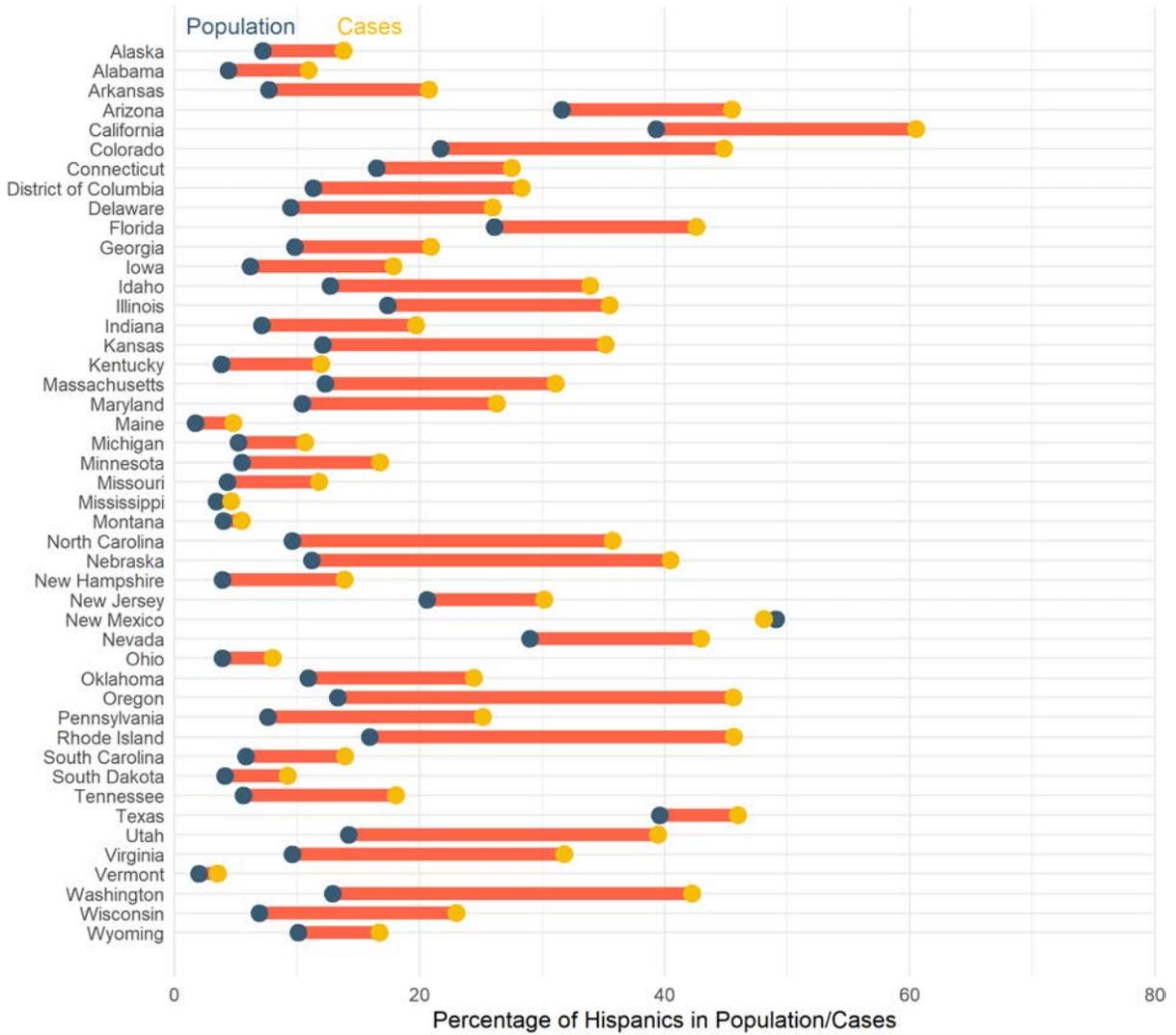
Appendix Figure 6: Disproportionality of COVID-19 cases in Hispanic populations. Plot is formatted as in Appendix Figure 1. Only states reporting ethnicity data are included.
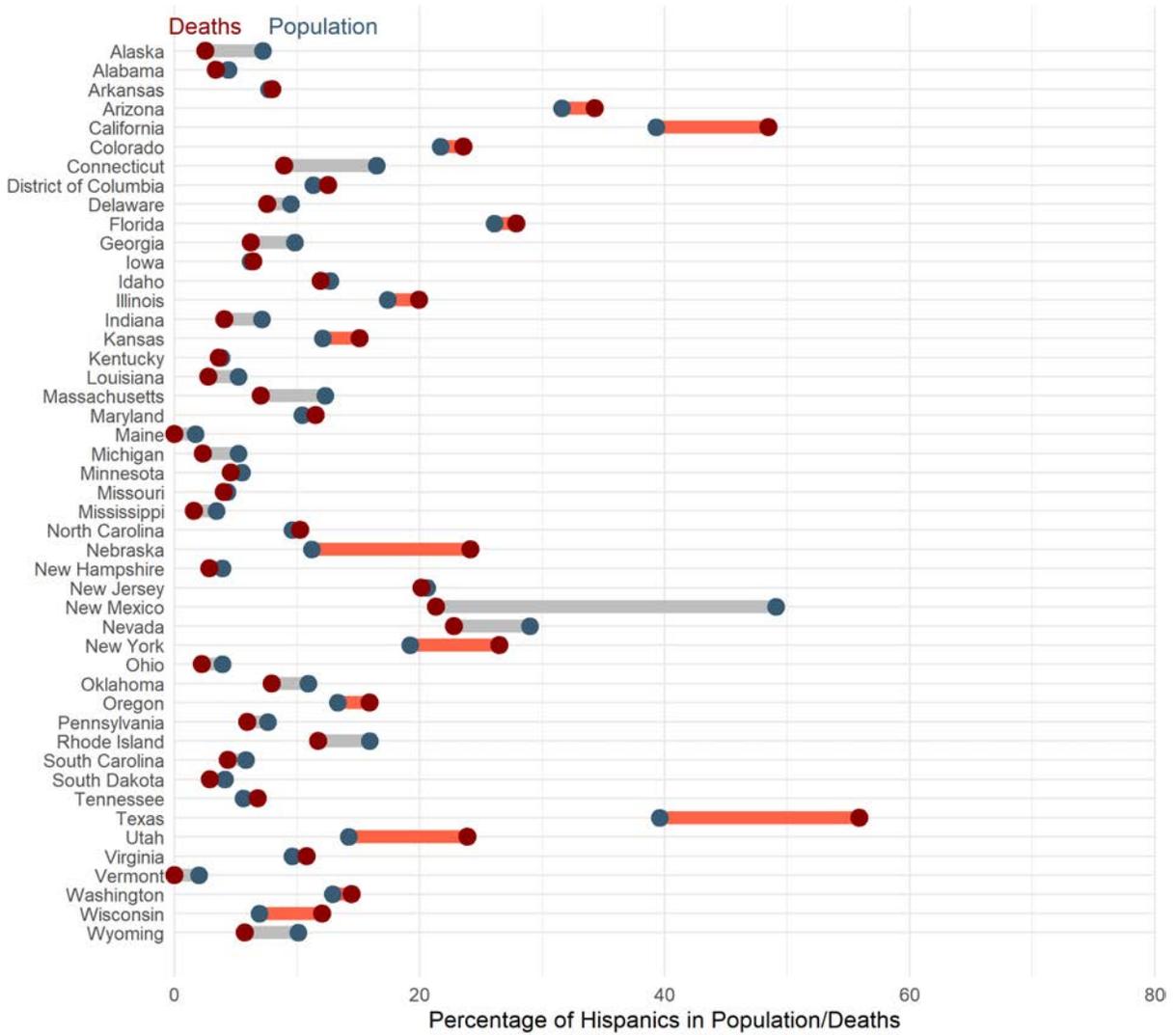
Appendix Figure 7: Disproportionality of COVID-19 deaths in Hispanic populations. Plot is formatted as in Appendix Figure 2. Only states reporting ethnicity data are included.
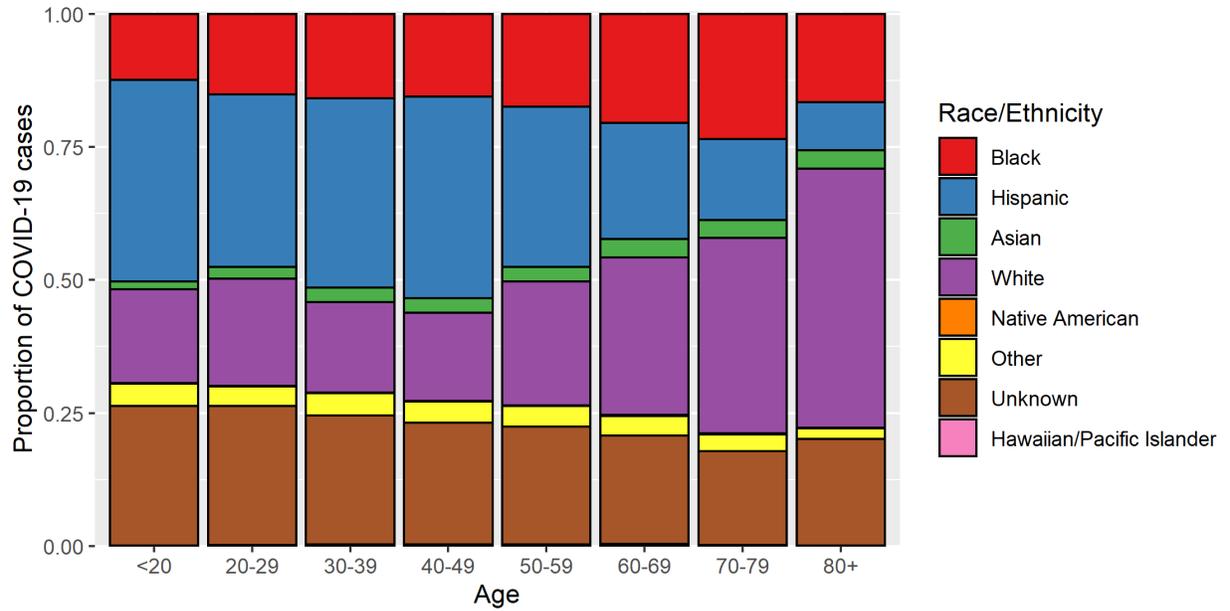
Appendix Figure 8: Proportion of COVID-19 cases by race/ethnicity and age in the state of Illinois. The racial/ethnic distribution of cases varied significantly by age; notably, Hispanic cases made up a smaller proportion of all cases in the high-risk age groups (60+). Data were collected on 7/27/20.
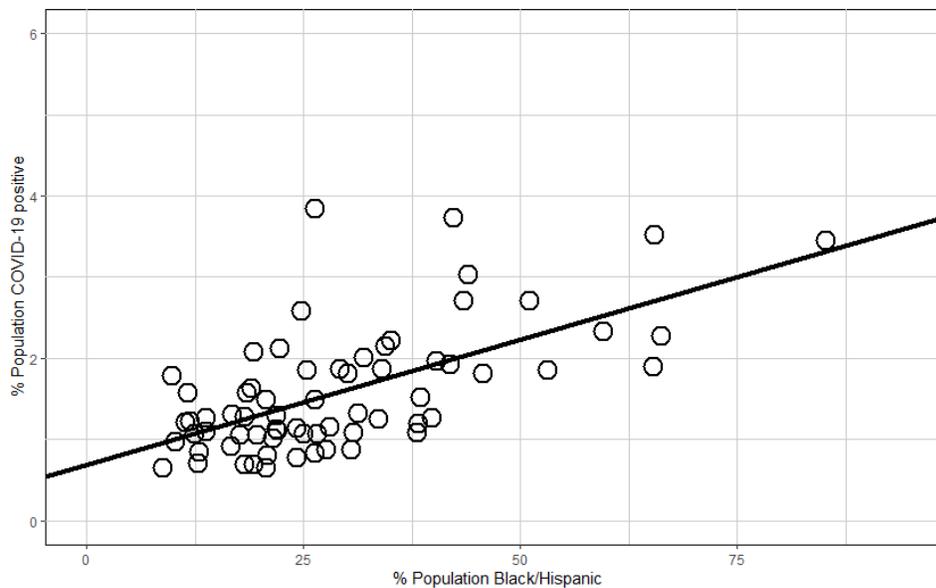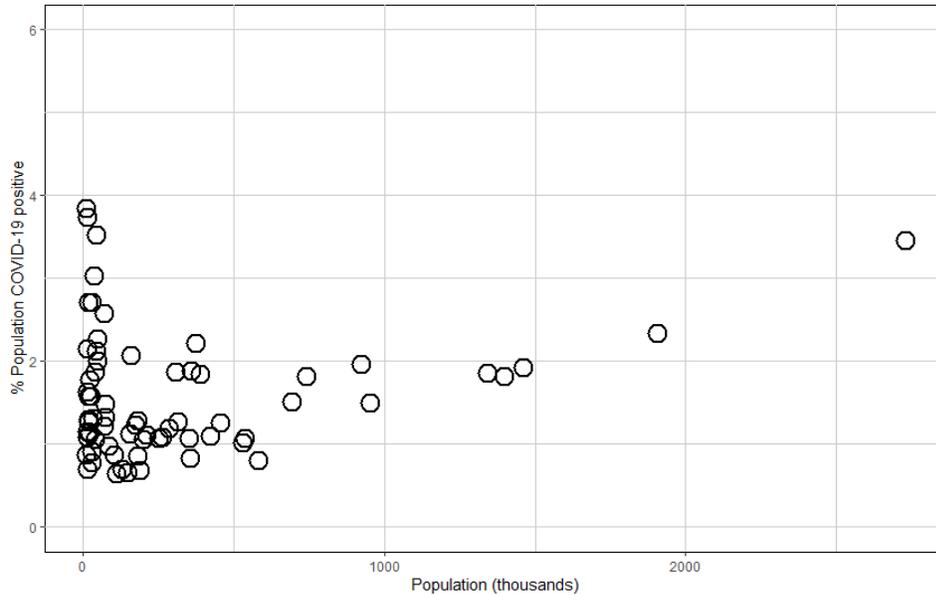
Appendix Figure 9: Relationship between COVID-19 case burden and population characteristics in Florida counties. Plots show the relationship between the county case burden and the total county population (top) or proportion of the county's population that is Hispanic and/or Black (bottom), calculated as the sum of Non-Hispanic Black and Hispanic populations. No significant relationship exists between the case burden and total population; however, if counties with a population less than 50,000 are excluded the relationship becomes significant (parameters are slope = $7e^{-4}$, R-squared = 0.43, p-value = $2e^{-6}$). There is a significant, positive relationship between the case burden and the proportion of that county that is Black and/or Hispanic (black line, parameters are slope = 0.03, R-squared = 0.38, p-value = $1e^{-8}$). Data for the regressions were collected on 7/23/2020.
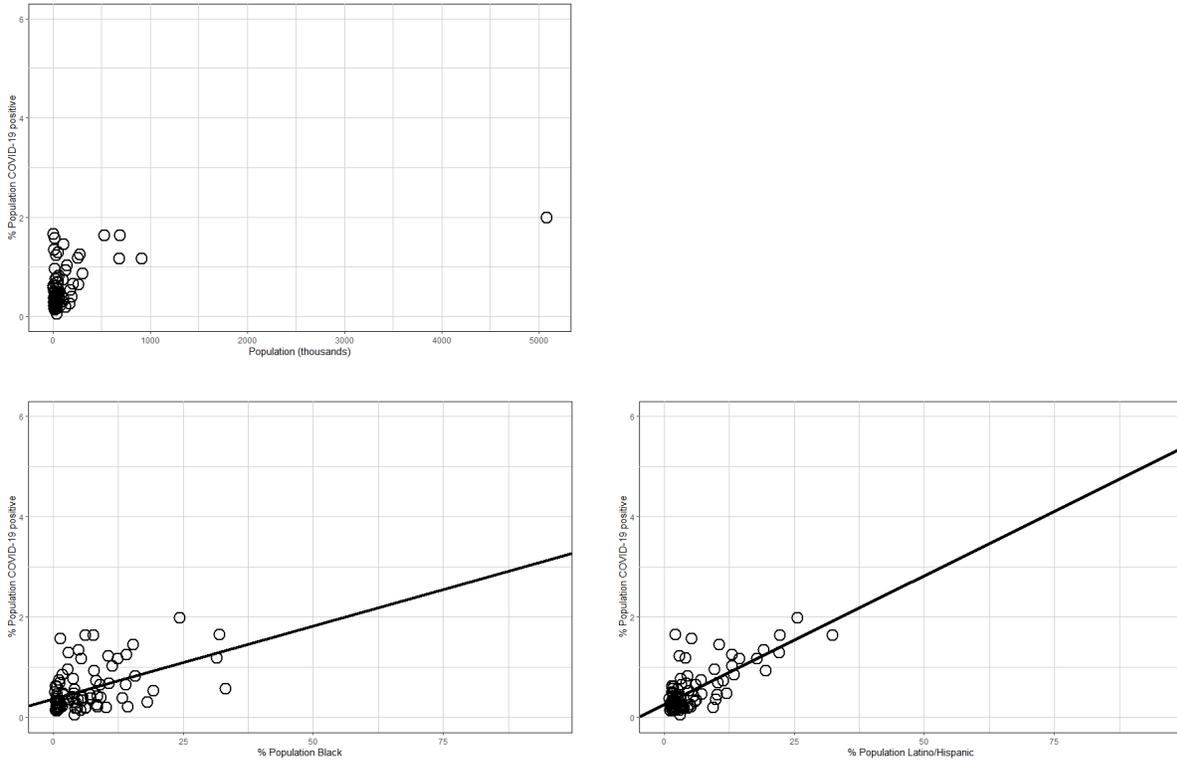
Appendix Figure 10: Relationship between COVID-19 case burden and population characteristics in Illinois counties. Plots show the relationship between the county case burden and the total county population (top) or proportion of the county's population that is Black (bottom left) or Hispanic (bottom right). Points represent Illinois counties. No significant relationship exists between the case burden and total population. There is a significant, positive relationship between the county case burden and the proportion of that county that is Black (black line, parameters are slope = 0.03, R-squared = 0.22, p-value = 4e^{-6}) or Hispanic or Latino (black line, parameters are slope = 0.05, R-squared = 0.52, p-value = 3e^{-15}). Data for the regressions were collected on 7/24/2020.
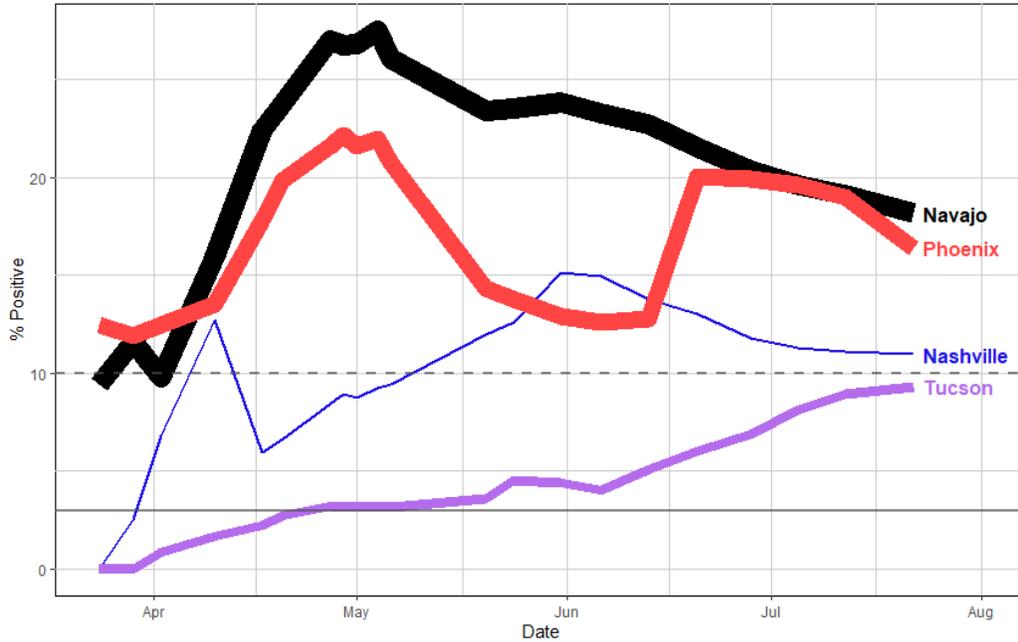
Appendix Figure 11: IHS testing of select areas.[47] The proportion of positive test results is plotted over time for the four IHS areas with the highest proportion of positive test results. Linewidths are proportional to the tests performed per IHS region's service population (larger linewidth means a larger proportion of testing) using the most recent service population estimates[48] and most recent testing numbers. The horizontal lines represent sufficient (10%, dashed) and ideal (3%, solid) percentages of positive results as suggested by the WHO and epidemiologists.[49] Data were collected at one-week intervals from 3/24 to 7/22/2020.

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[47] "The Indian Health Service is divided into twelve physical areas of the United States: Alaska, Albuquerque, Bemidji, Billings, California, Great Plains, Nashville, Navajo, Oklahoma, Phoenix, Portland, and Tucson." Taken from: IHS. Locations. Accessed at https://www.ihs.gov/locations/

[48] Indian Health Services. Trends in Indian Health 2014 Edition. Accessed at https://www.ihs.gov/sites/dps/themes/responsive2017/display_objects/documents/Trends2014Book508.pdf

[49] Begley S. Many states are far short of Covid-19 testing levels needed for safe reopening, new analysis shows. STAT News. 04/27/2020. Accessed at https://www.statnews.com/2020/04/27/coronavirus-many-states-short-of-testing-levels-needed-for-safe-reopening/
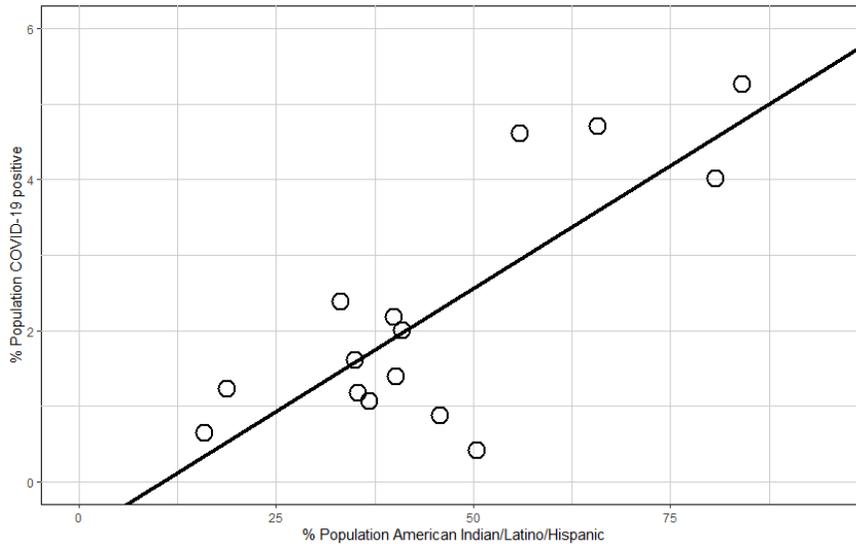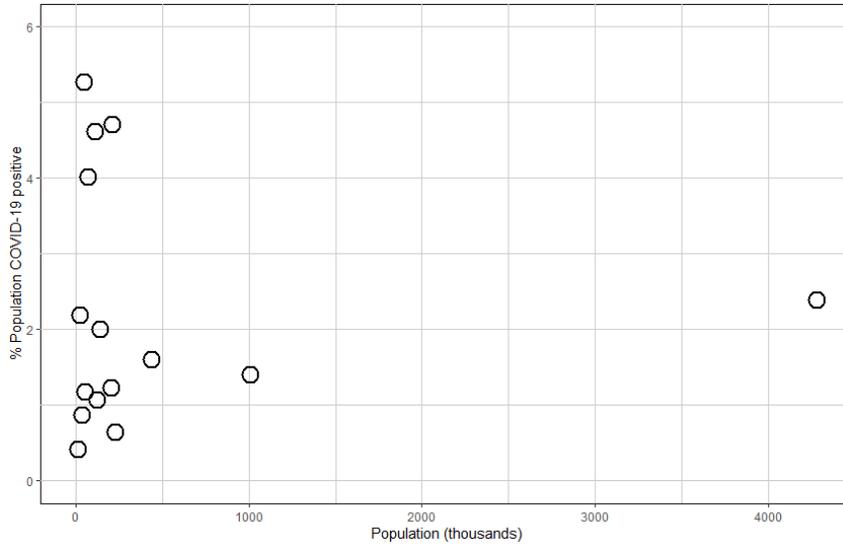
Appendix Figure 12: Relationship between COVID-19 case burden and population characteristics in Arizona counties. Plots show the relationship between the county case burden and the total county population (top) or proportion of the county's population that is Hispanic or American Indian (bottom). Points represent Arizona counties. No significant relationship exists between the case burden and total population. There is a significant positive relationship between the county case burden and the proportion of that county that is Hispanic, Latino, or American Indian (black line, parameters are slope = 0.06, R-squared = 0.62, p-value = 4e^{-4}). Data for the regressions were collected on 7/21/2020.