WHITE PAPER

County-Level Proportion of Non-Hispanic Black Population is Associated with Increased County Confirmed COVID-19 Case Rates After Accounting for Poverty, Insurance Status, and Population Density

Authors:

Anne Gaglioti, MD, MS, FAAFP[1,2] Megan Douglas, JD[1,3], Chaohua Li, MPH[1], Peter Baltrus, PhD[1,3], Mitchell Blount, MPH[1], Dominic Mack, MD, MBA[1,2]

Affiliations:

1. National Center for Primary Care, Morehouse School of Medicine,
2. Department of Family Medicine, Morehouse School of Medicine,
3. Department of Community Health and Preventive Medicine, Morehouse School of Medicine

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Background:

Although there is sparsely available race- and ethnicity-specific epidemiologic data for COVID-19, the available data shows non-Hispanic black populations bear a disproportionate burden of COVID-19 cases and fatalities.[i,ii] There have been several potential causal pathways discussed in the media and the public health literature for these differences, including disproportionate employment in high-exposure fields, disproportionate burden of underlying health conditions, disproportionate burdens of poverty, and higher rates of uninsured status.[iii,iv,v] COVID-19 racial health disparities are striking in Georgia; 80% of all those hospitalized for COVID-19 during March 2020 in Georgia were non-Hispanic black.[vi] The Georgia Department of Public Health *(GDPH)* first reported COVID-19 positive cases by race and ethnicity in early April.[vii] At that time, more than 50% of the positive cases initially reported were of unknown race and ethnicity, leaving the true racial and ethnic breakdown unclear. As of April 27, 2020, 35% of positive cases in Georgia were among African Americans and the cases with unknown race had dropped to around 10%. However, Georgia's public data sources are not consistently reporting COVID-19-related deaths by race and ethnicity, so potential disparities in mortality remain unknown. In order to characterize areas with high COVID-19 burden, we examined

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county-level sociodemographic factors as predictors of county-level COVID-19 confirmed case rates using linear regression models. Given the context of the known racial disparities of COVID-19 at the individual level, we conducted this ecologic analysis to examine the association between the proportion non-Hispanic black population in the county and the confirmed COVID-19 case rate in the county.

Methods:

We used publicly available data from the GDPH[vii] to calculate county-level COVID-19 confirmed case rates at number of cases per 100,000 population; counties were included in the analysis if they had a minimum of 10 cases for stable rates. County population and population density were drawn from the United States Census Bureau estimates for 2019. County-level variables including proportion of the county living below the Federal Poverty Level, proportion non-Hispanic black (black) population, and proportion uninsured were drawn from the 2018 American Community Survey estimates. We described the sample by calculating descriptive statistics on all variables of interest. We conducted unadjusted and adjusted linear regression models; the main predictor variable was proportion black population in the county and the main outcome variable was the log-transformed COVID-19 confirmed case rate in the county. Models were adjusted for county-level poverty, uninsured rate, and population density as a proxy for rural status. All analyses were completed using SAS 9.4 *(SAS Institute Inc., Carey, NC)*. We created county-level choropleth maps of the variables of interest to compare the spatial patterns of the measures of interest across the state using ArcGIS Pro (ESRI, Redland, CA).

Results:

There were 135 of 159 counties in Georgia that had at least 10 COVID-19 cases reported as of April 23, 2020. The overall state COVID-19 confirmed case rate was 188.3 per 100,000 with county level rates ranging from (33.4-2198.3 per 100,000). **Table 1** shows the description of the counties in the analysis with respect to confirmed COVID-19 case rate and sociodemographic characteristics.

In bivariate analysis, an increase of 1% of black population in the county was associated with a 2.5% increase in the county COVID-19 confirmed case rate. In fully adjusted models that accounted for county-level poverty, uninsured rates, and population density, proportion black population in the county remained significant (exponentiated Beta Coefficient 1.023, exponentiated CI (1.013-1.033), p<0.001). Every 1% increase in the proportion of African Americans in the county resulted in a 2.3% increase in the county COVID-19 confirmed case rate. Full results of the adjusted and unadjusted linear regression models are presented in **Table 2.** None of the other ecologic variables were significant in the fully adjusted models.

Table 1: Confirmed COVID-19 case rate and sociodemographic features of Georgia counties on April 23, 2020

Number of Counties 135	Mean	Std
Confirmed COVID19 Case Rate, n/100k	275.4	367.7
Log (Confirmed COVID19 Case Rate)	5.2	0.9
Black, %	28.7	18.3
Uninsured, %	14.4	3.2
Poverty, %	20.1	7
Population density, n per square mile	243.5	456.7

In fully adjusted models, every 1% increase in the proportion black population in the county resulted in a 2.3% increase in the county COVID-19 confirmed case rate. None of the other ecologic variables (county-level poverty, uninsured rate, population density) were significant.

Table 2. Results for unadjusted and adjusted linear regression models with log-transformed COVID-19 case rate as the dependent variable

	Unadjusted			Adjusted		
	Exp (Beta)	Exp (95% CI)	P-value	Exp (Beta)	Exp (95% CI)	P-value
Black, %	1.025	1.018-1.032	<.001	1.023	1.013-1.033	<.001
Uninsured, %	1.077	1.029-1.127	0.002	1.037	0.986-1.091	0.159
Poverty, %	1.059	1.038-1.079	<.001	1.007	0.975-1.040	0.683
Population density, n per square mile (Unit=10)	0.998	0.995-1.002	0.344	0.998	0.995-1.001	0.216

Beta coefficients and 95% CIs for each independent variable were exponentiated for convenience of interpretation.

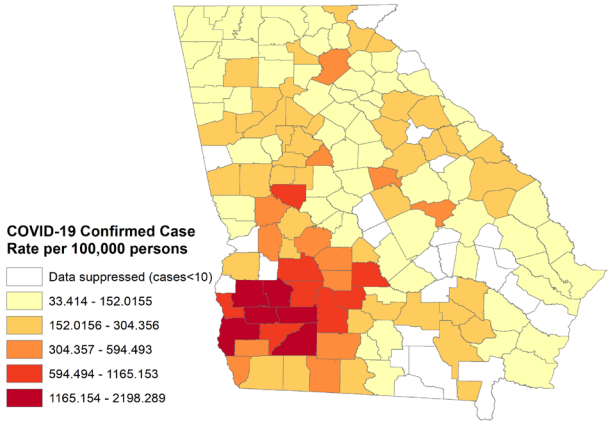

Figure 1: COVID-19 Confirmed Case Rate per 100,000 persons in Georgia Counties as of April 23, 2020

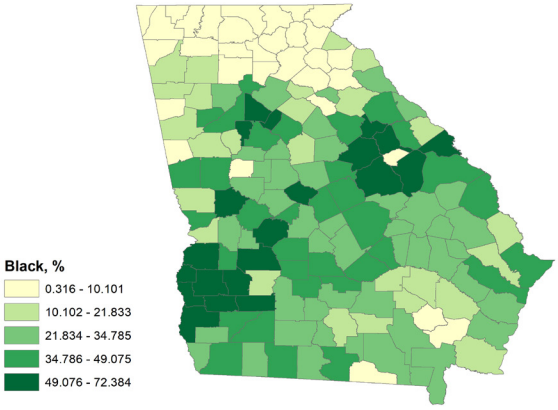

Figure 2: Proportion of the County Population that is Black for Georgia Counties from the American Community Survey Estimates, 2018

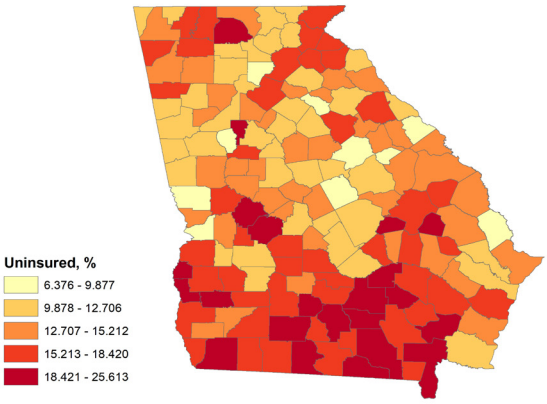

Figure 3: Proportion of County Population that is Uninsured in Georgia, American Community Survey Estimates 2018

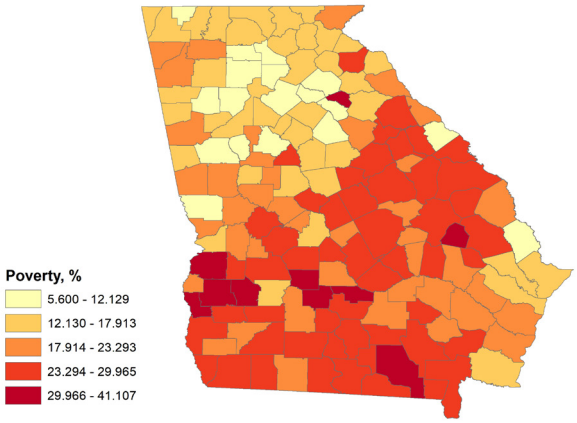

Figure 4: Proportion of County Population Living Below Federal Poverty Level in Georgia, American Community Survey Estimates 2018

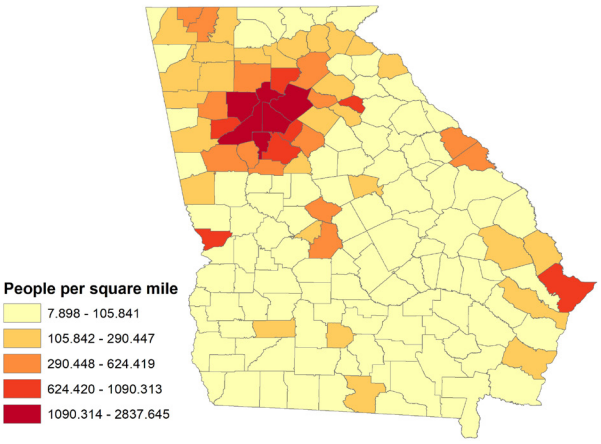

Figure 5: Population Density (Persons per Square Mile) in Georgia Counties, United States Census Bureau Estimates, 2019

County-level choropleth maps of COVID-19 confirmed case showed high rates of COVID-19 infection in the southwest portion of the state. Spatial patterns of county COVID-19 confirmed case rates (**Figure 1**) were visually similar to the pattern of proportion black population in the county (**Figure 2**). **Figures 3-5** show the county level spatial patterns of proportion of the county population uninsured, proportion of the county population living in poverty, and population density respectively. The spatial patterns of these variables were visually dissimilar to the spatial pattern of county COVID-19 confirmed case rates.

Discussion:

We found that the proportion of black population in a county was significantly and positively associated with the county confirmed case rate of COVID-19 in Georgia. This relationship persisted even after controlling for other socio-ecologic factors like population density, poverty, and uninsured rates. Notably none of these socio-ecologic variables had a statistically significant association with county COVID-19 confirmed case rates in the fully adjusted model. These results should not be interpreted as causal, but these results do highlight the potential importance of multi-layered vulnerability to COVID-19 among African American populations. Some factors that may account for these findings include racial biases at the individual, health system, and structural level as well as cultural or biologic factors independent of other socio-ecologic vulnerabilities.

These results are concordant with findings from the Commonwealth Fund that divided counties in the US into high and low concentration black counties and noted high concentration counties had higher rates of COVID-19 infection over time compared to low concentration counties.[viii] Our work adds to these findings by showing there is a linear, independent, and statistically significant association between the proportion black population in a county on COVID-19 confirmed case rates in Georgia. The fact that these models also account for potentially influential socio-ecologic covariates like poverty, insurance, and population density is also novel.

Our results demonstrate the importance of presenting the population rates of confirmed cases rather than raw counts. Raw counts highlight the large number of cases in population dense counties, like the Atlanta



metropolitan counties, while masking the severity of the crisis in less populated counties. This rate-based approach demonstrates the disproportionate burden of the pandemic on southwestern parts of the state, as compared with the Atlanta metropolitan region. Notably, in this analysis county population density, a proxy for rural/urban status, had no association with county-level confirmed COVID-19 case rates. The racial and geographic disparities in COVID-19-related deaths may be even more stark than those observed using confirmed case rates. Data from the GDPH identified that Dougherty County, which is 70% African American, had the most COVID-19 related deaths in the state with 114 for an estimated population of 87,956. On the other hand, Fulton County, the largest county in the state, has a population of over a million and has only had 103 COVID-19 related deaths.

While lack of health insurance and poverty rates were not independent predictors of county-level confirmed COVID-19 case rates, the maps demonstrate that the counties in Georgia with the highest rates of case confirmed COVID-19 also have high concentrations of people without insurance and living in poverty. The southern part of the state has large proportions of the population who lack insurance coverage. And poverty rates are high in the southern counties and in a band running from the mid-eastern to southwestern part of the state. These factors will pose a challenge to the ongoing clinical and public health efforts to combat spread of the virus, coordinate widespread testing efforts, and appropriately treat those who are ill. Further exacerbating the problem, this region of Georgia has limited access

to health care services, with few primary care practices and hospitals (data not shown). Public health practitioners and policy makers could account for the spatial patterns of these socio-ecologic population health indicators to direct intervention efforts. It is notable that population density, a proxy for rural-urban status, has no visual spatial correlation with the spatial patterns of confirmed COVID-19 case rates in Georgia, nor was it significantly associated with case rates in unadjusted and adjusted models.

A major limitation of this analysis is that the number of cases detected is partly a function of the number of tests that have been administered. This may mean that the cases and the corresponding case rate may be underestimated in areas and populations with limited access to healthcare. Additionally, we do not present death data, which may be an important aspect of these health disparities. This analysis was conducted for the state of Georgia, but further work is needed to understand if the state level findings observed here are observed at the national level.

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Policy and Public Health Implications:

These results may inform the untangling of the disproportionate burden of COVID-19 in the African American community in Georgia. First, this study reinforces the need for collecting and reporting high quality racial and ethnic data. Although the rate of confirmed COVID-19 positive cases with unknown race has decreased significantly since early April *(~65% to ~10%)*, efforts to improve racial and ethnic data collection and reporting are needed to resolve the remaining 10% of cases with unknown race. The GDPH has rapidly improved the quality, granularity and format of data being reported. But, in order to fully understand the mortality trends, the state should consistently report COVID-19-related deaths by race and ethnicity, as many other states are doing.[ii]

Second, the results may help guide resource allocation. Racial and ethnic health disparities in Georgia did not begin with the COVID-19 pandemic but are being exacerbated by it. As the state continues to increase COVID-19 screening and testing efforts, African American communities should be prioritized. It is imperative that primary care clinics and hospitals in these communities are supported with the resources needed to prevent spread and treat those afflicted with the virus. Telemedicine and electronic visits may be a mechanism to reach high risk communities, but utilization and reimbursement of telemedicine visits may be limited

by health insurance status and availability of health care in the region. Additionally, the primary care infrastructure in rural and medically underserved areas in the country is under enormous strain, and many practices are in danger of closing due to financial strain, workforce strain, and lack of personal protective equipment.[ix] Financial resources, capacity building, and infrastructure are critically needed to support the primary care practices and health systems serving these communities. In addition to financially supporting the primary care and hospital infrastructure in rural and underserved communities, work is needed to build trust with communities living in places with high burdens of COVID-19 or those at risk for becoming high burden communities. Culturally-tailored, community-centered outreach and messaging approaches should be integrated into the public health communication strategy to effectively reach diverse communities.

Finally, public health practitioners and policy makers may use these findings to address the impact of social determinants of health on minority communities. Unemployment, living below the poverty level, lack of health insurance, lack of healthy food options, and lack of health care, are being amplified in this pandemic.

Conclusion:

This analysis found an independent, positive association between the proportion black population in the county and the confirmed COVID-19 case rate in the county that persisted even after accounting for other ecologic factors that have been thought to influence the disproportionate disease burden among African Americans, including poverty, insurance status, and population density. These results identify place-based racial disparities at the population level that can inform tailored public health efforts to high-risk communities and policy efforts to bolster the vulnerable primary care and health care delivery infrastructure in these communities.

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