

# The Relationship between Social Determinants of Health and Racial Disparities in COVID-19 Mortality

Matthew J. Fastiggi, M.D.1; Ankur K. Dalsania, M.D.1; Aaron Kahlam, M.D.1; Rajvi Shah, M.D.2; Krishan Patel, M.D.1,5; Stephanie Shiao, Ph.D.3; Slawa Rokicki, Ph.D.4; Michelle Dalla Piazza, M.D.6

1Rutgers New Jersey Medical School, Newark, New Jersey 2Rutgers Robert Wood Johnson Medical School, New Brunswick, New Jersey, USA. 3Department of Biostatistics and Epidemiology, Rutgers School of Public Health, Piscataway, New Jersey, USA. 4Department of Health Behavior, Society, and Policy, Rutgers School of Public Health, Piscataway, New Jersey, USA. 5Department of Internal Medicine, University of Texas Southwestern Medical Center, Dallas, Texas, USA. 6Department of Medicine, Division of Infectious Diseases, Rutgers New Jersey Medical School, Newark, New Jersey, USA.

## Background

- The COVID-19 pandemic has magnified existing health disparities for marginalized populations in the United States (U.S.), including among Black Americans. [1,2]
- Social determinants of health (SDH) are powerful drivers of health outcomes. SDH are shaped by structural factors affecting Black Americans disproportionately, and could influence COVID-19 racial disparities seen among Black Americans.
- The objective of this study was to quantitatively analyze relationship between SDH and racial disparities in COVID-19 mortality to further elucidate the role of SDH in shaping COVID disparities.

## Methods

- We used t-tests and negative binomial regression (dependent variable total COVID-19 deaths)
- Time period: 1/22/20 – 10/28/20
- COVID mortality data: National publicly-available county-level data from Johns Hopkins SDH data: County Health Rankings and Vera Institute of Justice
- SDH Indicators: ICE Income, %Uninsured, %Low Birthweight, %No HS Diploma, Incarceration Rate, %No Internet Access
- Covariates: Population density, days since first death, %Over Age 65, %Obesity, %Diabetes, %COPD, %Smokers, %Hypertension

**Table 1:** Subgroup Analysis Method

Model	Counties Included	Independent Variables Included
Subgroup low adverse SDH)	1013 counties with ≥ 5 deaths and lowest half of adverse SDH	Population density Days since first death Covariates %Black residents
Subgroup high adverse SDH)	1013 counties with ≥ 5 deaths and highest half of adverse SDH	Population density Days since first death Co-variables %Black residents
Interaction	2026 counties with ≥ 5 deaths	Population density Days since first death Co-variables %Black residents one high SDH binomial %Black residents * high SDH binomial

## Results

**Table 2:** Regression Results, Individual & Full SDH Models

SDH Indicator	Incidence rate ratio (95% CI)		P*	Incidence rate ratio (95% CI)		P*
	Individual SDH Model (includes either %Black residents or 1 SDH Indicator)			Full SDH Model (includes both %Black residents and all SDH Indicators)		
% Black residents	1.009 (1.005 - 1.013)		<0.001	1.005 (0.999 - 1.011)		0.100
ICE income quintile 1 (low income)	1.675 (1.359 - 2.066)		<0.001	0.850 (0.647 - 1.16)		0.241
ICE income quintile 2	1.360 (1.130 - 1.636)		<0.001	0.895 (0.722 - 1.110)		0.312
ICE income quintile 3	1.125 (0.952 - 1.328)		0.167	0.866 (0.722 - 1.037)		0.118
ICE income quintile 4	1.029 (0.882 - 1.200)		0.720	0.864 (0.736 - 1.015)		0.076
ICE income quintile 5 (high income)	Ref		Ref	Ref		Ref
% Uninsured	1.019 (1.011 - 1.027)		<0.001	1.002 (0.993 - 1.012)		0.640
% Low birthweight	1.076 (1.044 - 1.110)		<0.001	1.014 (0.971 - 1.059)		0.535
% Adults without HS diploma	1.035 (1.025 - 1.045)		<0.001	1.017 (1.004 - 1.031)		0.011
Incarceration rate	1.054 (1.013 - 1.097)		0.009	1.011 (0.973 - 1.051)		0.570
% Households without internet	1.034 (1.025 - 1.042)		<0.001	1.024 (1.013 - 1.034)		<0.001

**Table 3:** Subgroup Regression Results

SDH used for subgroup	Low adverse SDH		High adverse SDH	
	% Black residents incidence rate ratio (95% CI)	p*	% Black residents incidence rate ratio (95% CI)	p*
ICE income	1.005 (0.997 - 1.013)	0.248	1.010 (1.005 - 1.015)	<0.001
% Uninsured	1.016 (1.008 - 1.024)	<0.001	1.007 (1.001 - 1.012)	0.014
% Low birthweight	1.000 (0.985 - 1.016)	0.967	1.011 (1.005 - 1.016)	<0.001
% Adults without HS diploma	1.004 (0.995 - 1.012)	0.372	1.009 (1.003 - 1.014)	0.001
Incarceration rate	1.004 (.998 - 1.011)	0.216	1.013 (1.007 - 1.018)	<0.001
% Households without internet	1.005 (0.997 - 1.014)	0.214	1.010 (1.005 - 1.015)	<0.001

## Key Takeaways

- Independent, two-tailed T tests:** counties in the highest quartile of COVID-19 death rates had a greater percentage of Black residents and higher levels of adverse SDH
- Table 2:** The percentage of Black residents and adverse levels of all 6 SDH indicators are associated with increased COVID-19 mortality at the county level, independent of covariates
- When controlling for SDH, percentage of Black residents is no longer associated with increased COVID-19 mortality at the county level. Education and Internet access appear to be especially important determinants of COVID-19 mortality
- Table 3:** The relationship between Black residents and COVID-19 mortality is different between subgroups (associated with increased mortality in high adverse SDH group), suggesting SDH contribute to racial disparities

## Implications

- This study presents quantitative evidence that %Black residents and 6 diverse indicators of SDH are determinants of COVID-19 mortality at the county level
- Full SDH and Subgroup regressions indicate that SDH contribute to racial disparities in COVID-19 mortality for Black Americans
- Two SDH indicators (education & internet) emerged as key drivers of COVID-19 mortality
- Public policy must address SDH to reduce racial disparities for COVID-19 and many other health outcomes

## References

- [1].Yancy CW. COVID-19 and African Americans. JAMA. 2020;323:1891–2.  
 [2] Braveman P, Gottlieb L. The social determinants of health: it's time to consider the causes of the causes. Public Health Rep. 2014;129(Suppl 2):19–31.