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**Association Between Race/Ethnicity and COVID-19 Disease Outcomes in the United States:
A Qualitative Systematic Review of the Literature**

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Abstract

Background/Objective: As studies have shown disparities in coronavirus disease-19 prevalence and severity, we sought to evaluate differences in outcomes of acute SARS-CoV-2 infection by race/ethnicity.

Design: Systematic review

Data Source: Studies from PubMed were included.

Review methods: Articles published in English language from January 1, 2019 through March 22, 2020. Studies included were observational studies that examined racial or ethnic disparities in SARS-CoV-2 infection outcomes in the United States. One reviewer performed data extraction.

Results: Out of a possible 1,944 articles, 99 observational studies (82 individual-level and 17 population-level) were included. Differential rates of hospitalization or otherwise severe illness (as indicated by intensive care unit admission, complications, and/or death) from coronavirus disease-19 (COVID-19) by race/ethnicity were reported, with many studies indicating higher rates of hospitalization for minority populations (particularly African American individuals) and results more mixed on differences in severe illness. Ecological studies showed associations between population-level proportion of minority residents and greater mortality from COVID-19. There were few studies examining racial differences in pediatric populations.

Conclusions: There are disparities in hospitalization for COVID-19, with non-Hispanic black and Hispanic individuals experiencing higher rates. This disparity is not consistently seen in case-fatality among individuals receiving care, suggesting that social and economic inequity, rather than individual biological factors, drive individual-level COVID-19 hospitalization, as well as mortality at the population level.

Introduction

As of 25 March 2021, over 124 million confirmed cases of coronavirus disease 2019 (COVID-19) and 2.7 million confirmed deaths have been reported in the world, with 30,014,615 cases and 545,317 deaths in the United States (U.S.).¹ COVID-19, caused by Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2), was declared as a pandemic by the World Health Organization (WHO) on 11 March 2020.² SARS-CoV-2 causes a range of illness, from asymptomatic infection to severe pneumonia and fatality.

Various health professionals and organizations have noticed racial or ethnic disparities in rates of COVID-19 infection or COVID-19 outcomes, calling on health professionals, public health departments, and policy makers to recognize and mitigate the role of structural racism and other social and economic determinants on health in historically marginalized groups.³⁻⁶ While the impact of racial and ethnic minority status on poor health outcomes has long been recognized, COVID-19 has highlighted the disparity, with reports showing disproportionately high hospitalization and mortality rates for COVID-19 among minority populations.^{3, 7-9} However, there has also been suggestion that, among patients receiving medical care, there is no disparity in clinical outcomes from COVID-19.¹⁰

In order to assess racial and ethnic disparities in outcomes of COVID-19, we conducted a qualitative systematic review of studies in one database, with a focus on outcomes such as hospitalization, admission to the intensive care unit (ICU), death, or composite severity. Because of differences in COVID-19 mortality reported in county-level and individual-level analyses, we include both population-level and individual-level studies.

Methods

Eligibility Criteria

Studies were included if they were observational in nature (cohort, cross-sectional, case-control, ecological) and examined children or adults in the United States. They had to include information on SARS-CoV-2 infection confirmed by polymerase chain reaction (PCR) or antibody testing in participants, and examine outcomes (mortality, hospitalization, admission to intensive care unit, severity, acute kidney injury, myocardial infarction, cerebrovascular incidents) of SARS-CoV-2 infection. Additionally, studies had to include data on SARS-CoV-2 infection outcome by >1 race or ethnicity. Case reports and case series were not eligible for inclusion. Studies were excluded if they were not available in English language.

Information Sources

One online database (PubMed) was searched for relevant articles. The database was last searched on March 22, 2021.

Search

A literature search was conducted with the search terms: ‘covid-19,’ ‘coronavirus,’ ‘SARS-CoV-2,’ or ‘severe acute respiratory syndrome’ in combination with ‘racial disparities,’ ‘ethnic disparities,’ ‘hispanic,’ or ‘asian’ and ‘outcomes,’ ‘hospitalization,’ ‘hospital admission,’ ‘intensive care,’ ‘mortality,’ or ‘severity.’ The search was filtered such that only results from 2019 to March 22, 2021 were included.

Study Selection

After initial review, studies were screened by title and abstract by the author to determine potential relevance. The full-text articles determined to be relevant were then reviewed for inclusion in the systematic review, with duplicates being removed.

Data Collection Process

Data were taken directly from articles. No additional contact was made with authors of articles to obtain raw data or confirm results. If no comparison of COVID-19 outcomes was made between racial/ethnic groups, the article was excluded from the review.

Results

Study Selection

Results from study selection are shown in the study flow diagram in Figure 1. On the initial search, 1,944 studies were identified. Initial screening of title and abstract resulted in exclusion of 1,689 articles. Duplicates were removed to result in 243 possible studies. Full-text articles were then assessed for eligibility; after removal of ineligible articles as shown in Figure 1, 99 studies remained. Characteristics of each study, including design, sample, location, outcomes, and results are given in Table 1.

Study Characteristics

Observational Studies

A total of 82 individual-level cohort and cross-sectional studies were eligible for inclusion, with 75 having a sample consisting of mostly adults (Table 1). These studies spanned from nationwide samples to regional and hospital samples, with representation from all states in the U.S.

Thirty-two studies examined differences in hospital admission by race/ethnicity. Of these, 23 showed significantly higher ratios of hospitalization among black/non-Hispanic black individuals as compared to white/non-Hispanic white individuals,¹¹⁻³³ with four showing no difference.³⁴⁻³⁷ One study showed a nominally lower rate of hospitalization in Maya as compared to non-Maya patients.³⁸ Twelve studies showed higher rates of COVID-19 hospitalization among

Hispanic individuals as compared to non-Hispanic white individuals,^{13, 14, 17-21, 23, 25, 30, 31, 39} with six showing no difference^{12, 15, 24, 33, 35, 36} and two showing lower hospitalization among Hispanic individuals.^{16, 40}

In contrast, most individual-level studies found statistically similar rates of COVID-19-related mortality, severe illness and/or ICU admission between at least two race/ethnicities.^{10, 11, 14-22, 24, 27, 29, 30, 32-37, 40-65} Twelve studies showed higher ratios of severe COVID-19 when comparing minority populations to non-Hispanic white populations.^{13, 15, 17, 25, 30, 31, 33, 39, 42, 50, 66-73} Ten showed lower rates of severe COVID-19 among minority populations as compared to non-Hispanic whites.^{10, 35, 53, 56, 71, 74-79} One study showed there was no significant difference in prevalence of COVID-19-related thrombotic events between race/ethnicities,⁸⁰ and one study showed more severe radiographic presentation of lung disease among non-white vs. white patients with COVID-19.⁷⁰

Ecological Studies

A total of 17 population-level studies were eligible for inclusion (Table 1). Out of these studies, 15 showed a significant positive relationship between proportion of black or other minority residents in a geographic area (most often county-level) and COVID-19 mortality.⁸¹⁻⁹⁵ Five studies showed a significant positive relationship between proportion of Hispanic residents and COVID-19 mortality.^{83, 87, 90, 91, 93} Two showed no relationship between proportion of population considered a minority and COVID-19 mortality.^{96, 97}

Studies in Predominantly Pediatric Populations

Of the individual-level studies, seven had samples of all or mostly pediatric individuals. In the only study that included a sample of children with COVID-19 from across the U.S., non-Hispanic black race/ethnicity predicted increased odds of hospitalization and death compared to

non-Hispanic white race/ethnicity; Hispanic youth also had increased odds of hospitalization.⁹⁸ An increased risk of hospitalization and more severe illness was also seen among non-Hispanic black youth in two other studies,^{99, 100} and a high proportion of deaths due to COVID-19 in the U.S. was observed in Hispanic and non-Hispanic black children.¹⁰¹ However, a few studies have shown no differences in hospitalization, severe disease, or time to discharge in minority as compared to non-Hispanic white pediatric populations.^{45, 102, 103}

Discussion

Summary of Evidence

Our systematic review revealed national studies and regional studies from across the U.S. that examined racial and ethnic differences in outcomes of COVID-19. While most individual-level studies revealed disparities in hospitalization rates for COVID-19, those that studied in-hospital mortality or case-fatality due to COVID-19 in individuals otherwise receiving care often showed no significant differences by race/ethnicity.¹⁰ This contrasts with population-level studies, where increases in black/other minority population was often associated with increase in COVID-19 related mortality.⁸¹ The combination of these two findings may suggest that disparities in hospitalization and mortality are not necessarily due to individual-level differences in biology or health behaviors, but may be a result of limited access to care, limited health literacy, and the built environment.

Socioeconomic and health care inequities, in addition to structural racism, have long been known to contribute to adverse health outcomes (including chronic medical conditions), decreased health care access/utilization, and poor living circumstances.⁶ Consider, for example, the study by Hawkins et al., where black and Hispanic individuals were found to work more

often in high-risk essential occupations and have higher age-adjusted mortality rates from COVID-19 than white individuals.¹⁰⁴ This study suggests that black and Hispanic individuals may face a higher risk of exposure to SARS-CoV-2, as they are overrepresented in jobs that cannot be performed from home. Minority groups also have disproportionately high rates of low socioeconomic status;⁸¹ this may result in not only a need to work in occupations that require them to be in person but also more crowded living circumstances that promote spread of viral pathogens.¹⁰⁵ Counties with higher levels of segregation were also shown to have higher rates of COVID-19-related mortality, which again suggests that racial inequity is a risk factor for poor outcomes related to COVID-19.⁹⁴ Factors such as racial discrimination and other forms of racism may also result in diminished ability of communities and individuals to respond to public health emergencies and seek care, resulting in delay from presentation to treatment or no treatment at all.^{4, 106} Structural racism – and its ability to cause toxic levels of stress and resultant inflammation – may also increase risk for greater initial severity of COVID-19 illness.¹⁰⁷

Furthermore, diseases that have been associated with worse outcomes from SARS-CoV-2, especially in the absence of proper treatment, tend to be more common among historically marginalized groups of people.^{6, 108} Many black, Hispanic, and other minority communities have poorer air quality, less access to healthy foods, less access to outdoor recreational areas, and higher rates of crime that lead to such diseases as obesity, hypertension, diabetes and chronic lung disorders that can worsen initial SARS-CoV-2 infection.^{109, 110} Thus, hospitalization rates may be higher among minority groups due to the burden of chronic disease they carry.

Racial disparity in hospitalization also appears to exist among children, and there may be a higher odds of death from COVID-19 in non-Hispanic black children,^{98, 100} however, further studies must be conducted to more fully examine differences in outcomes in pediatric

populations. Unfortunately, while children tend to suffer less severe disease, the future impact of disparities in COVID-19 outcomes among adults may result in increases in household dysfunction and adverse childhood experiences.¹¹¹ Adverse childhood experiences often have intergenerational impacts, which may not bode well for future health in historically marginalized race/ethnicities.

Limitations

In the current study, no quantitative synthesis was undertaken, which limits understanding of the results to a qualitative nature. Only one database was queried for articles, which may have limited the total number articles that could have been included in this review. Moreover, the author included several studies that were pre-printed and not yet peer reviewed. Ecological studies may suffer from ecological fallacy. We do not include studies from outside of the U.S. We recommend that observational studies examining differences in outcomes by race/ethnicity standardize by age, as not all did so in this review, and increasing age is known to be associated with significant increases in severity of illness.

Conclusions

There is a need for more high-quality observational studies that examine differences in outcomes of COVID-19 disease, especially as the pandemic continues and evolves. Because hospitalization rates tend to be higher, but in-hospital or post-care mortality rates about the same, among minority race/ethnicities, our review suggests that social and economic inequity may drive disparities in outcome severity. However, access to care appears to aid in reducing mortality. Interventions that address the root cause of inequity (e.g., poverty, segregation, systemic racism) are needed to reduce disparities in COVID-19 outcomes.

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Tables and Figures

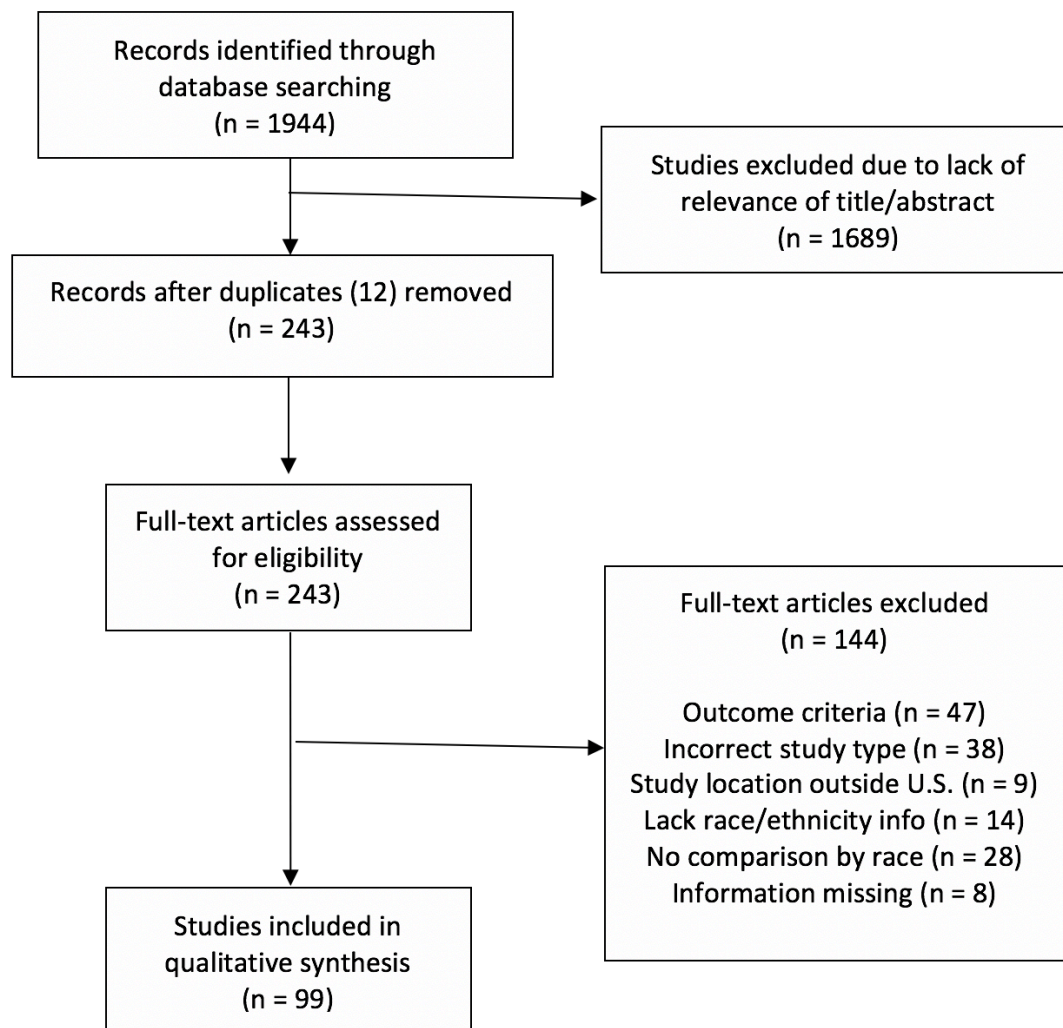


Figure 1. Study PRISMA flow diagram.

Table 1. Characteristics for observational studies of COVID-19 outcome by race/ethnicity.

Study	Design	Sample	Sample size	Location	Outcomes Assessed	Reference Category	Results
Abedi et al., 2020 ^{96*}	Ecological	369 counties	102,178,117	Seven states in U.S.A.	Increase in COVID-19 mortality per percent increase in race/ethnicity, by county (est. (95% CI))	--	Asian: -0.27 (-0.41, -0.12) Black: -0.064 (-0.24, 0.11) Hispanic: -0.21 (-0.38, -0.04) White: 0.12 (-0.05, 0.29)
Abrams et al., 2021 ¹⁰⁰	Cross-sectional	Individuals <21 years hospitalized with MIS-C	1,080	U.S.A.	aOR (95% CI) for ICU admission	NH white	NH black: 1.6 (1.0, 2.4) Hispanic: NS Other: NS
Adegunsoye et al., 2020 ¹¹	Cohort	SARS-CoV-2 + individuals	785	Chicago, U.S.A.	aOR (95% CI) for hospitalization, mortality	NH white	Black, hospitalization: 1.51 (1.03, 1.95) Black, mortality: 1.01 (0.20, 5.0)
Adhikari et al., 2020 ⁸¹	Ecological	10 U.S. Office of Management and Budget–defined combined statistical areas	--	158 counties in U.S.A.	Adjusted rate ratio (95% CI) for COVID-19 mortality at the county level	Substantially white county	Substantially non-white, less poverty: 2.6 (1.1, 6.5) Substantially non-white, more poverty: 9.3 (4.7, 18.4)
Akanbi et al., 2020 ⁹⁷	Ecological	70 zip codes in Oakland County	1,257,584	Oakland County, Michigan, U.S.A.	Incidence rate ratio (95% CI) for COVID-19 mortality for each percentage point increase in black population at zip code level	--	1.00 (0.99, 1.01)
Anaele et al., 2021 ⁸²	Ecological	States in the U.S.A.	U.S.A. population	U.S.A.	Increase in COVID-19 deaths	--	0.021 (0.009, 0.033)

					per 100,00 per percent increase in African American in state (est. (95% CI))		
Antwi-Amoabeng et al., 2021 ⁴¹	Cross-sectional	SARS-CoV-2 + adults	172	Northern Nevada, U.S.A.	aOR (95% CI) for COVID-19 mortality	Non-Hispanic	Hispanic: 0.029 (0.03, 3.14)
Arrazola et al., 2020 ¹¹²	Cross-sectional	SARS-CoV-2 + adults	340,059	U.S.A.	Rate ratio (95% CI) for cumulative incidence of infection	White persons	American Indian/Alaska Native: 3.5 (1.2, 10.1)
Azar et al., 2020 ¹²	Cohort	SARS-CoV-2 + adults	1,052	Northern California, U.S.A.	aOR (P-value) for hospital admission	NH white	Black (0.007) Asian, Hispanic, other/unknown: NS
Bailey et al., 2021 ⁹⁹	Cohort	Individuals younger than 25 years with information in PEDSNet	5,374	11 states in the U.S.A.	aOR (95% CI) for severe illness (hospitalization for diagnosis of pneumonia, sepsis, respiratory failure, or COVID-19)	NH white	Black: 1.44 (1.02, 2.04)
Bassett et al., 2020 ⁷⁴	Cross-sectional	SARS-CoV-2 + individuals at Massachusetts General	866	Massachusetts, U.S.	Test of proportions for percentage in ICU during follow up and death during follow up	--	ICU: NH white: 0.25 NH black: 0.31 Hispanic: 0.33 P=0.044 Death: NH white: 0.18 NH black: 0.11 Hispanic: 0.02 P<0.001
Bassett et al., 2020 ⁶⁶	Cross-sectional	Individuals with data available in National Center for Health Statistics	U.S.A. population	U.S.A.	Rate ratio (95% CI) for age-standardized COVID-19 mortality per	NH white	NH black: 3.6 (3.5, 3.8) Hispanic: 2.8 (2.7, 3.0)

					100,000 person-years		NH AI/AN: 2.2 (1.8, 2.6) NH A/PI: 1.6 (1.4, 1.7)
Bennett et al., 2021 ^{42*}	Cohort	Hospitalized individuals in the National COVID Cohort Collaborative	174,568	U.S.A.	aOR (p-value) for severe outcome of COVID-19 infection (invasive ventilation, ECMO, death, discharge to hospice)	NH white	Hispanic: 1.04 (0.84) Black: 1.21 (0.09) Asian: 2.36 (0.0017) Other: 1.22 (0.43)
Bhargava et al., 2020 ⁴³	Cohort	SARS-CoV-2 + adults at a single hospital	197	Detroit, Michigan, U.S.A.	OR (95% CI) for severe COVID-19 (requiring mechanical ventilation)	Black	White: 0.7 (0.3, 1.5)
Bixler et al., 2020 ¹⁰¹	Cross-sectional	Deaths due to COVID-19 disease in individuals <21 years	121	U.S.A.	% of deaths by race/ethnicity	--	Hispanic: 44.6% NH AI/AN: 4.1% NH A/PI: 4.1% NH black: 28.9% NH white: 14.0% Other: 1.7%
Boserup et al., 2020 ¹³	Cross-sectional	Individuals with data in COVID-19 Tracking Project	--	U.S.A.	Rate ratio for hospitalization per 100,000 people COVID-19 mortality rate, by state	NH white of corresponding age group in next cell	Hispanic ages 0-17: 8.7 AI/AN ages 18-49: 11.2 NH black ages 50-64: 9.9 NH black age >64: 7.0 Death rates: often higher among NH black compared to NH white by state
Cardemil et al., 2021 ¹⁴	Cohort	Hospitalized, SARS-CoV-2 + Veterans at 5	621	Atlanta, Bronx, Houston, Palo	Adjusted hospitalization	NH white	Hospitalization – Hispanic: 4.6 (3.6, 5.9)

		Veterans Affairs medical centers		Alto, Los Angeles (U.S.A.)	incidence rate ratio (95% CI) Adjusted relative risk for case fatality (95% CI)		NH black: 4.2 (3.4, 5.1) Case fatality – Hispanic: 0.9 (0.6, 1.3) NH black: 0.9 (0.6, 1.5)
Cates et al., 2020 ⁶⁷	Cohort	Adult veterans hospitalized with COVID-19	4,305	U.S.A.	Adjusted relative risk (95% CI) for several complications; we focus here on respiratory failure	NH white	NH black: 1.14 (1.06, 1.23) NH other: 1.3 (1.08, 1.58) Hispanic: 1.13 (0.99, 1.28)
Chang et al., 2021 ¹¹³	Cross-sectional	Medicare beneficiaries	710,980 with COVID-19; 207,600 hospitalized	U.S.A.	Hospitalization rate ratio per 100,000 (no significance tests)	NH white	NH black: 3.3 AI/AN: 3.0 Hispanic: 2.6 A/PI: 1.2
Cheng et al., 2020 ⁸³	Ecological	Non-metropolitan counties	1,976 counties	U.S.A.	Daily incidence rate ratio of COVID-19 deaths per 100,000	Counties in bottom quantile of percent black Counties in bottom quantile of percent Hispanic	Top quantile % black: 1.70 (1.48, 1.95) Top quantile % Hispanic: 1.50 (1.33, 1.69)
Chilimuri et al., 2020 ⁴⁴	Cohort	Individuals hospitalized with COVID-19	375	New York City, U.S.A.	Comparison of crude case fatality rate due to COVID-19	--	Black: 0.42 Hispanic: 0.44 Other: 0.33
Chishinga et al., 2020 ^{15*}	Cohort	Community-based SARS-CoV-2 + individuals	4,322	Atlanta, Georgia, U.S.A.	Unadjusted OR (95% CI) for: Hospitalization ICU admission Death	NH white	Hospitalization – NH black: 2.0 (1.6, 2.5) Hispanic: 1.0 (0.7, 1.4) NH Asian: 1.0 (0.6, 1.9) ICU admission –

							<p>NH black: 2.5 (1.6, 3.7) Hispanic: 1.5 (0.8, 2.7) NH Asian: 2.5 (1.0, 6.1)</p> <p>Death – NH black: 1.4 (1.0, 2.0) Hispanic: 0.6 (0.3, 1.2) NH Asian: 0.5 (0.1, 2.3)</p>
Cohen et al., 2021 ⁷⁵	Cohort	Hospitalized adults with COVID-19	9,407	New York metropolitan region	aOR (95% CI) for composite VTE or mortality	White adults	<p>Asian: 1.08 (0.84, 1.38) Black: 0.68 (0.57, 0.81) Other: 0.81 (0.68, 0.96)</p>
Cromer et al., 2020 ^{16*}	Cross-sectional	Adults testing positive for SARS-CoV-2	9,839	Massachusetts, U.S.A.	aOR (95% CI) for COVID-19-related hospitalization and death	NH white	<p>Hospitalization – NH black: 1.39 (1.16, 1.65) Hispanic: 0.77 (0.63, 0.94) NH Asian: 1.53 (1.14, 2.06)</p> <p>Death – NH black: 0.81 (0.57, 1.14) Hispanic: 1.38 (0.80, 2.36) NH Asian: 0.58 (0.30, 1.11)</p>
Dai et al., 2021 ¹⁷	Cohort	SARS-CoV-2 + adults in a large health system	54,645	California, Oregon and	aOR (95% CI) for hospitalization	White	<p>Hospitalization – Black: 1.18 (1.02, 1.36)</p>

				Washington, U.S.A.	and in-hospital mortality		Hispanic: 1.31 (1.22, 1.42) Asian: 1.62 (1.43, 1.84) NH/PI: 2.01 (1.55, 2.61) AI/AN: 1.56 (1.17, 2.06) In-hospital mortality - Black: 1.05 (0.73, 1.52) Hispanic: 1.41 (1.15, 1.71) Asian: 0.93 (0.69, 1.25) NH/PI: 1.17 (0.6, 2.28) AI/AN: 1.92 (0.96, 3.81)
Dalsania et al., 2021 ⁸⁴	Ecological	Counties in the U.S.A.	2,026 counties	U.S.A.	Incidence rate ratio for COVID-19 deaths for each 1% increase in black population among counties with adverse socioeconomic conditions	--	1.009 (1.005, 1.013)
Derspina et al., 2020 ¹⁰²	Cross-sectional	Critically ill pediatric patients <21 admitted to PICU	70	New York City, U.S.A.	Adjusted hazard ratio (95% CI) for time to hospital discharge	White patients	Black/Latino: 2.76 (0.93, 8.24) Other race: 1.00 (0.29, 3.42)
Escobar et al., 2021 ¹⁸	Cross-sectional	SARS-CoV-2 + adults	3,686	Northern California, U.S.A.	aOR (95% CI) for hospitalization and COVID-19-related death	NH white adults	Hospitalization – NH black: 1.47 (1.03, 2.09) Hispanic: 1.42 (1.11, 1.82)

							NH Asian: 1.47 (1.13, 1.92) Death – NH black: 1.07 (0.58, 1.98) Hispanic: 0.96 (0.57, 1.63) NH Asian: 1.15 (0.69, 1.92)
Esenwa et al., 2021 ⁸⁰	Cross-sectional	Adults hospitalized with COVID-19	4,299	Bronx, New York, U.S.A.	aOR (95% CI) for composite thrombotic events (acute ischemic stroke, deep vein thrombosis, pulmonary embolism, myocardial infarction)	White adults	Asian: 1.97 (0.30, 12.9) Black: 1.46 (.47, 4.54) Hispanic: 1.67 (0.54, 5.17) Other: 2.09 (0.49, 8.98)
Fernandes et al., 2021 ⁴⁵	Cohort	Youth ≤ 22 years hospitalized with SARS-CoV-2 or MIS-C	281	New York, New Jersey, Connecticut, U.S.A.	aOR (95% CI) for severe disease (≥ 48 hours in ICU)	NH white youth	NH black: 1.65 (0.31, 8.87) Hispanic: 0.88 (0.26, 2.98)
Figuroa et al., 2021 ⁸⁵	Ecological	Counties in the U.S.A.	Number not reported	U.S.A.	Change in COVID-19 death rate per 100,000 persons for each 10% increase in proportion of race/ethnicity in county	--	NH black: 9.3 (8.0, 10.6) Hispanic: 0.4 (-1.5, 2.4) NH other: -11.9 (-14.0, -9.7)
Foo et al., 2021 ³⁸	Cross-sectional	Adults with COVID-19	265	Alameda County, California, U.S.A.	Difference in proportions of non-Maya vs. Maya patients hospitalized for COVID-19, admitted to ICU,	--	Hospitalization (non-Maya vs. Maya): 0.43 vs. 0.27 (p=0.03) ICU admission: 0.14 vs. 0.02 (p=0.01)

					and 30-day hospital mortality		In-hospital mortality: 0.06 vs. 0.0 (p=0.01)
Garcia et al., 2021 ⁶⁸	Cross-sectional	Individuals in California	10,200 COVID-19-related deaths	California, U.S.A.	Age-specific COVID-19 mortality rate ratio (95% CI)	NH white	NH black: 2.75 (2.54, 2.97) Hispanic: 4.18 (3.99, 4.37) Higher mortality disparity by race/ethnicity observed in younger age groups
Garibaldi et al., 2020 ⁴⁶	Cohort	Individuals hospitalized for COVID-19	832	Maryland and Washington, D.C., U.S.A.	Adjusted hazard ratio (95% CI) for severe COVID-19 disease or death	White	Non-white: 1.08 (0.81, 1.44)
Gershengorn et al., 2021 ¹⁹	Cohort	SARS-CoV-2 + adults	1,256	Miami, Florida, U.S.A.	aOR (95% CI) for hospitalization due to COVID-19 and mortality due to COVID-19	NH white	Hospitalization – NH black: 3.47 (2.44, 5.00) Hispanic black: 2.15 (1.09, 3.99) Hispanic white: 2.43 (1.78, 3.37) Other: 3.6 (2.37, 5.44) Death – NH black: 0.92 (0.11, 7.85) Hispanic black: 0.13 (0.00, 7.13) Hispanic white: 1.35 (0.29, 7.33) Other: 2.08 (0.27, 16.05)
Gianfrancesco et al., 2020 ²⁰	Cross-sectional	Patients with rheumatologic disease	1,324	U.S.A.	aOR (95% CI) for hospitalization and death due to COVID-19	White	Hospitalization – Black: 2.74 (1.9, 3.95)

							<p>Latinx: 1.71 (1.18, 2.49) Asian: 2.69 (1.16, 6.24) Other/mixed: 2.59 (0.97, 6.90)</p> <p>Death – Black: 1.39 (0.69, 2.79) Latinx: 1.67 (0.81, 3.41) Asian: 2.67 (0.58, 12.16) Other/mixed: 2.49 (0.49, 12.65)</p>
Gil et al., 2021 ⁴⁷	Cohort	Hospitalized SARS-CoV-2 + adults	326	Rhode Island, U.S.A.	Age-adjusted OR (95% CI) for death due to COVID-19	NH white	<p>Hispanic: 1.0 (0.46, 2.16) NH black: 0.88 (0.35, 2.19)</p> <p>Hospitalized hispanic patients noted to be younger</p>
Girardin et al., 2021 ⁶⁹	Cohort	SARS-CoV-2 + individuals visiting a large quaternary academic health center	4,446	New York City and Long Island, U.S.A.	Adjusted Cox proportional hazard ratio (95% CI) for COVID-19-associated mortality	Non-ethnic minority individuals	Ethnic minority: 1.26 (1.10, 1.44)
Golestaneh et al., 2020 ²¹	Cohort	SARS-CoV-2 + individuals visiting Montefiore Health System	2,934	Bronx, New York, U.S.A.	<p>aOR (95% CI) for hospitalization due to COVID-19</p> <p>Adjusted relative risk (95% CI) for in-hospital mortality in COVID-19 patients</p>	NH white	<p>Hospitalization – NH black: 1.7 (1.2, 2.4) Hispanic: 1.5 (1.1, 2.2)</p> <p>Mortality – NH black: 1.2 (0.7, 2.0)</p>

							Hispanic: 1.0 (0.6, 1.7)
Gottlieb et al., 2020 ³⁴	Cohort	Patients at Rush University Medical Center	8,673	Chicago, Illinois, U.S.A.	aOR (95% CI) for hospitalization and critical illness due to COVID-19	Black individuals	Hospitalization – White: 1.04 (0.81, 1.32) Asian: 0.99 (0.51, 1.93) Other: 1.05 (0.78, 1.40) Critical illness – White: 0.86 (0.61, 1.19) Other: 1.21 (0.9, 1.63)
Graff et al., 2021 ¹⁰³	Cohort	SARS-CoV-2 + patients <21 years at Children’s Hospital Colorado	454	Colorado, U.S.A.	OR (95% CI) for hospitalization due to COVID-19	NH white	Black: 1.12 (0.3, 4.3) Hispanic: 1.37 (0.7, 2.7) Other: 0.98 (0.4, 2.4)
Gu et al., 2020 ²²	Cohort	Individuals positive for SARS-CoV-2 when tested at University of Michigan	1,139	Michigan, U.S.A.	aOR (95% CI) for hospitalization and ICU admission due to COVID-19	White	Hospitalization – Black: 1.72 (1.15, 2.58) Other: 1.42 (0.79, 2.54) ICU Admission – Black: 1.15 (0.73, 1.82) Other: 0.86 (0.42, 1.78)
Gupta et al., 2021 ⁴⁸	Cohort	Hospitalized SARS-CoV-2 + individuals at academic medical center	529	New York City, New York, U.S.A.	aOR (95% CI) for COVID-19-related death	Black individuals	Other: 1.38 (0.75, 2.56)

Hawkins et al., 2021 ¹⁰⁴	Cross-sectional	Workers ages 16-64 in Massachusetts	555 COVID-19 deaths	Massachusetts, U.S.A.	Age-adjusted COVID-19 mortality rate per 100,000 persons (95% CI), by race/ethnicity	--	NH white: 10.7 (9.5, 12.0) Hispanic: 53.4 (43.4, 63.4) NH black: 50.4 (40.5, 60.2) NH Asian: 10.2 (5.5, 14.9) Other: 34.1 (18.2, 50.0)
Hawkins et al., 2020 ⁸⁶	Ecological	Counties	3,127 counties	U.S.A.	Adjusted rate ratio (95% CI) for COVID-19 fatalities per 100,000 person for each 1% increase in proportion of black people in county	--	1.03 (1.02, 1.05)
Hsu et al., 2021 ⁴⁹	Cohort	Maintenance dialysis patients positive for SARS-CoV-2 in national dialysis provider	438	29 states in U.S.A.	aOR (95% CI) for all-cause mortality in COVID-19 patients	White	Black: 0.69 (0.40, 1.20) Other: 0.68 (0.32, 1.43)
Ingraham et al., 2020 ^{23*}	Cohort	SARS-CoV-2 + individuals	5,577	12 Midwest hospitals and 60 primary care clinics, U.S.A.	Standardized hazard ratio (95% CI) for hospitalization due to COVID-19	NH white	Black: 1.31 (1.04, 1.65) Asian: 1.78 (1.33, 2.38) Hispanic: 3.02 (2.31, 3.95) Other: 1.89 (1.18, 3.03)
Ioannou et al., 2020 ²⁴	Cohort	SARS-CoV-2 + veterans in Veterans Affairs national health care system	10,131	U.S.A.	Adjusted hazard ratio (95% CI) for COVID-19-related hospitalization and death	White	Hospitalization – Black: 1.13 (1.04, 1.23) Asian: 1.20 (0.79, 1.81)

							AI/AN/NH/PI: 0.74 (0.52, 1.06) Death – Black: 1.04 (0.88, 1.21) Asian: 1.99 (0.85, 4.65) AI/AN/NH/PI: 1.67 (0.99, 2.82) No differences by ethnicity
Iyanda et al., 2021 ⁸⁷	Ecological	Counties	All U.S. counties	U.S.A.	Case fatality ratio (95% CI) for every one percent increase in ethnic/racial minority	--	Black: 8.33 (4.9, 14.2) Hispanic, non-white: 5.93 (3.6, 9.7) AI: 2.70 (2.0, 3.6) A/PI: 1.66 (1.4, 1.9)
Izurieta et al., 2020 ²⁵	Cohort	Medicare beneficiaries	30,284,193	U.S.A.	aOR (95% CI) for COVID-19-related hospitalization and death	NH white	Hospitalization – NH black: 2.47 (2.17, 2.81) Hispanic: 3.11 (2.37, 4.18) AI/AN: 5.82 (3.25, 10.43) Asian: 1.32 (0.93, 1.87) Death – NH black: 2.81 (2.62, 3.02) Hispanic: 3.31 (2.83, 3.87) AI/AN: 4.22 (2.90, 6.16) Asian: 1.50 (1.23, 1.82)
Joseph et al., 2020 ⁷⁰	Cohort	Adults hospitalized with	326	Massachusetts, U.S.A.	Adjusted average difference (95%		Non-white vs. NH white:

		COVID-19 at a single institution			CI) in modified Radiographic Assessment of Lung Edema score		6.1 vs. 4.2 Adjusted average difference = 1.6 (0.5, 2.7)
Karmakar et al., 2021 ⁸⁸	Ecological	Counties	All counties in U.S.A.	U.S.A.	Incidence rate ratio (95% CI) for COVID-19-related mortality per every 1% increase in population of ethnic/racial minority	--	Any racial/ethnic minority: 1.03 (1.02, 1.03)
Khanijahani, 2020 ⁸⁹	Ecological	Counties	3,142	U.S.A.	Increase in confirmed COVID-19 deaths per 100,000 people (estimate, 95% CI)	One percent increase	% Hispanic: 0.37 (-0.12, 0.86) % Black: 0.66 (0.26, 1.07)
Killerby et al., 2020 ²⁶	Cross-sectional	SARS-CoV-2 + adults	531	Atlanta, Georgia, U.S.A.	aOR (95% CI) for COVID-19-related hospitalization	White	Black: 3.2 (1.8, 5.8)
Kim et al., 2020 ⁵⁰	Cohort	Adult patients with chronic liver disease positive for SARS-CoV-2 across 21 institutions	867	21 centers in the U.S.A.	aOR (95% CI) for severe COVID-19 (death, hospitalization, oxygen requirement, ICU admission, requirement of vasopressors, or mechanical ventilation)	NH white	NH black: 0.83 (0.54, 1.28) Hispanic: 2.33 (1.47, 3.70) NH Asian: 1.90 (0.85, 4.27) Other: 3.40 (1.31, 8.81)
Ko et al., 2020 ²⁸	Cross-sectional	Community-dwelling, SARS-CoV-2 + adults	5,416	12 states in U.S.A.	Adjusted rate ratio (95% CI) for COVID-19-	NH white	NH black: 4.0 (3.4-4.8) Other: 3.3 (2.8-4.0)

					related hospitalization		
Krause et al., 2020 ⁵¹	Cohort	Adult patients with confirmed COVID-19 at one hospital	85	Colorado, U.S.A.	aOR (95% CI) for COVID-19 30-day mortality	Non-Hispanic	Hispanic: 0.28 (0.04, 1.80)
Krishnamoorthy et al., 2021 ¹⁰	Cohort	Patients >15 years with COVID-19 admitted to seven hospitals	799	Michigan, U.S.A.	aOR (95% CI) for COVID-19-related death	White	Black: 0.61 (0.37, 0.99) Other: 1.42 (0.58, 3.49)
Lara et al., 2020 ²⁹	Cross-sectional	Patients with gynecologic malignancy and COVID-19 disease	193	New York City, New York, U.S.A.	OR (95% CI) for COVID-19-related hospitalization and death	Non-black	Hospitalizations, black: 2.69 (1.37, 5.26) Death, black: 1.57 (0.71, 3.46)
Lazar et al., 2021 ⁷⁶	Cohort	Adults with COVID-19 in a single ICU	365	Detroit, Michigan, U.S.A.	aOR (95% CI) for COVID-19 28-day mortality	White	Persons of color: 0.60 (0.37, 0.96)
Li et al., 2020 ^{90*}	Ecological	Counties	2,990 counties	U.S.A.	Adjusted relative risk (95% CI) for COVID-19 cumulative death rate per 100,00 persons by increase in proportion of specified race/ethnicities	--	NH black: 1.13 (1.07, 1.19) Hispanic: 1.08 (1.02, 1.14) AI/AN: 1.1 (1.05, 1.15) Asian: 1.01 (0.97, 1.06) NH/PI: 1.02 (0.98, 1.05)
Liao and Maio, 2021 ⁹¹	Ecological	Counties	3,141 counties	U.S.A.	Adjusted mortality rate ratio (95% CI) for COVID-19 mortality per 100,000 persons by each one percent increase in specified	--	Black: 1.076 (1.029, 1.125) Hispanic: 1.105 (1.062, 1.149)

					race/ethnicity in a county		
Lucar et al., 2021 ⁵²	Cohort	Adult patients with COVID-19 admitted to a single medical center	100	Mississippi, U.S.A.	OR (95% CI) for COVID-19-related death	All else besides non-Hispanic black	NH black: 1.70 (0.33, 8.81)
Lundon et al., 2020 ³⁰	Cross-sectional	SARS-CoV-2 + patients at a single health system	8,928	New York, U.S.A.	aOR (95% CI) for COVID-19-related hospitalization and death	White	Hospitalization – African ancestry: 1.47 (1.31, 1.64) Hispanic: 1.29 (1.14, 1.46) Asian: 0.99 (0.89, 1.20) Death – African ancestry: 1.28 (1.10, 1.50) Hispanic: 1.09 (0.92, 1.30) Asian: 0.84 (0.63, 1.12)
Luo et al., 2021 ⁵³	Cross-sectional	Veterans receiving care in Veteran Health Administration with COVID-19	14,259	U.S.A.	Case fatality rate ratio (95% CI)	White	Black: 0.75 (0.68, 0.92) Asian: 0.55 (0.29, 1.03) NH/PI: 0.62 (0.33, 1.15) AI/AN: 1.05 (0.66, 1.65) Other: 0.73 (0.61, 0.90)
Mahajan and Larkins-Pettigrew, 2020 ⁹²	Ecological	Counties	2,886	U.S.A.	Correlation (r, p-value) between COVID-19 case fatality rate and percentage of specific race/ethnicity in county	--	Black: 0.0553 (p=0.0031) White: -0.0479 (p=0.0104) Asian: 0.0258 (p=0.168)

Marmarchi et al., 2021 ⁵⁴	Cohort	COVID-19 adult patients admitted to the ICU in a single health care system	288	Atlanta, Georgia, U.S.A.	OR (95% CI) for COVID-19-related death	Non-black	Black: 1.36 (0.75, 2.47)
McCarty et al., 2020 ⁵⁵	Cross-sectional	Patients with COVID-19 hospitalized at nine hospitals	379	Massachusetts, U.S.A.	aOR (95% CI) for COVID-19-related ICU admission or in-hospital mortality	White	ICU admission – Black: 0.77 (0.39, 1.53) Latinx: 1.50 (0.89, 2.52) In-hospital mortality – Black: 0.39 (0.13, 1.12) Latinx: 0.55 (0.23, 1.29)
Mikami et al., 2020 ⁵⁶	Cohort	Patients with COVID-19 in a single health system	6,493	New York, U.S.A.	Adjusted hazard ratio (95% CI) for COVID-19-related in-hospital death	White	Black: 0.78 (0.65, 0.95) Asian: 0.94 (0.83, 1.08) Other: 1.0 (0.83, 1.19)
Miller et al., 2020 ⁷⁷	Cohort	SARS-CoV-2 + individuals presenting to an ED in a health system	3,633	Detroit, Michigan, U.S.A.	aOR (95% CI) for COVID-19-related 30-day mortality	White	Black: 0.56 (0.40, 0.77)
Misa et al., 2020 ¹¹⁴	Cross-sectional	Patients testing positive for SARS-CoV-2 in emergency department	95	Alameda Health System, Northern California, U.S.A.	Crude in-hospital mortality	--	Non-black vs. black: 0.013 vs. 0.187
Moreira et al., 2021 ⁹⁸	Cross-sectional	Children ages 0-19 with COVID-19	27,045	U.S.A.	aOR (95% CI) for COVID-19-related hospitalization and in-hospital death	NH white	Hospitalization – NH black: 2.28 (1.93, 2.70) Hispanic: 1.38 (1.19, 1.61) NH Asian: 1.11 (0.78, 1.61)

							<p>NH other: 2.95 (2.28, 3.82) NH/PI: 0.25 (0.12, 0.54) AI/AN: 0.20 (0.03, 1.42)</p> <p>In-hospital death – NH black: 2.96 (1.30, 6.73) Hispanic: 0.88 (0.36, 2.13) NH other: 3.33 (0.90, 12.37)</p>
Muhammad et al., 2021 ⁵⁷	Cohort	Adult patients hospitalized for COVID-19 at a single hospital	200	Washington, D.C., U.S.A.	OR (95% CI) for COVID-19 mortality	Non-black	Black: 1.52 (0.69, 3.32)
Muñoz-Price et al., 2020 ²⁷	Cross-sectional	Adults with COVID-19 at an academic medical system	369	Milwaukee, Wisconsin, U.S.A.	aOR (95% CI) for hospitalization, ICU admission, and in-hospital death	All other race/ethnicities	<p>Hospitalization – Black: 1.85 (1.0, 3.67)</p> <p>ICU admission – Black: 1.52 (0.75, 3.07)</p> <p>In-hospital death – Black: 1.43 (0.14, 14.1)</p>
O'Malley et al., 2021 ¹¹⁵	Cross-sectional	Adults with type 1 diabetes mellitus who tested positive for SARS-CoV-2	113	22 states in the U.S.A.	aOR (95% CI) for COVID-19-related hospitalization	NH white	Minority race/ethnicity: 3.63 (1.42, 9.70)
Ogedegbe et al., 2020 ³⁵	Cohort	Patients with COVID-19 in a health system	4,843	New York University Langone Health System, U.S.A.	aOR (95% CI) for COVID-19 hospitalization, critical illness	NH white	<p>Hospitalization – NH black: 0.9 (0.7, 1.1) Hispanic: 1.0 (0.8, 1.2)</p>

					Adjusted hazard ratio (95% CI) for COVID-19 mortality		<p>NH Asian: 1.6 (1.1, 2.3) NH other: 1.4 (1.0, 1.9)</p> <p>Critical illness – NH black: 0.6 (0.4, 0.8) Hispanic: 0.9 (0.7, 1.2) NH Asian: 1.3 (0.9, 1.8) NH other: 1.2 (0.8, 1.8)</p> <p>Mortality – NH black: 0.7 (0.6, 0.9) Hispanic: 1.0 (0.8, 1.2) NH Asian: 1.3 (0.9, 1.7) NH other: 0.9 (0.7, 1.2)</p>
Ojinnaka et al., 2020 ⁹³	Ecological	Counties	254	Texas, U.S.A.	Regression (coef., 95% CI) for prediction of COVID-19 fatality per 100,00 persons for percent increase in each specified race/ethnicity in a county	--	<p>NH black: 5.08 (0.11, 10.04) NH white: 4.78 (-0.28, 9.83) Asian: 5.17 (-0.11, 10.45) Hispanic: 5.41 (0.52, 10.31)</p>
Panagiotou et al., 2021 ⁷⁸	Cohort	Nursing home residents with COVID-19	5,256	U.S.A.	aOR (95% CI) for 30-day all-cause mortality	White	<p>Black: 0.77 (0.62, 0.96) Other: 0.60 (0.45, 0.81)</p>

Paul et al., 2021 ⁹⁴	Ecological	Counties	All U.S. counties	U.S.A.	Adjusted mortality risk ratio (95% CI) (5-unit change in independent variable)	-	For every 5% increase in black population – Rural: 1.051 (1.029, 1.074) Urban: 1.041 (1.014, 1.068)
Pennington et al., 2021 ⁷¹	Cohort	Hospitalized adults diagnosed with COVID-19	181,813 patients	U.S.A. hospitals	Adjusted risk ratio (95% CI) for ICU admission, mortality	NH white	ICU Admission – NH black: 1.02 (1.00-1.03) NH Asian: 1.11 (1.08-1.15) Hispanic: 1.08 (1.05-1.10) Other: 1.07 (1.05-1.09) Death – NH black: 0.96 (0.92 – 0.99) NH Asian: 1.16 (1.09 – 1.23) Hispanic: 1.15 (1.09-1.20), Other: 1.13 (1.06-1.21)
Poulson et al., 2020 ⁷²	Cohort	White and non-Hispanic black patients diagnosed with COVID-19	76,442 white and 48,338 non-Hispanic black	U.S.A.	Adjusted risk ratio (95% CI) for ICU admission, mortality	White	ICU admission – Non-Hispanic black 1.68 (p<0.0001) Mortality – Non-Hispanic black: 1.36 (p<0.001)
Poulson et al., 2021 ³¹	Cohort	Patients diagnosed with COVID-19	78,323	U.S.A.	Adjusted risk ratio (95% CI) for hospitalization, ICU admission, and mortality	NH white	Hospital Admission – Hispanic white: 1.35 (1.32, 1.38) Hispanic black: 1.58 (1.53, 1.64)

							<p>Hispanic multiple / other: 1.50 (1.46, 1.54)</p> <p>ICU Admission – Hispanic white: 1.30 (1.18, 1.42) Hispanic black: 2.27 (1.96, 2.63) Hispanic multiple / other: 2.06 (1.93, 2.21)</p> <p>Mortality – Hispanic white: 1.36 (1.31, 1.43) Hispanic black: 1.72 (1.59, 1.86) Hispanic multiple / other: 1.68 (1.61, 1.75)</p>
Price-Haywood et al., 2020 ³²	Cohort	Patients with COVID-19 seen at an Ochsner health facility	3,481	Louisiana, U.S.A.	aOR (95% CI) for hospitalization adjusted hazard ratio (95% CI) for in-hospital death	White	<p>Hospitalization – Black: 1.96 (1.62, 2.37)</p> <p>In-hospital death – Black: 0.89 (0.68, 1.17)</p>
Quan et al., 2021 ⁵⁸	Cohort	Hospitalized adults with COVID-19	2,038	Michigan, U.S.A.	aOR (95% CI) for ICU admission and death	White	<p>ICU admission – Black: 1.13 (0.88, 1.44)</p> <p>Death – Black: 0.86 (0.64, 1.14)</p>
Razjouyan et al., 2021 ⁵⁹	Cohort	Veterans hospitalized with COVID-19	4,790	U.S.A.	aOR (95% CI) for ICU admission, death	White	<p>ICU Admission – Black: 1.08 (0.95, 1.23) Hispanic: 1.07 (0.86, 1.33)</p>

							Death – Black: 1.16 (0.97, 1.38) Hispanic: 1.22 (0.90, 1.66)
Renelus et al., 2020 ³³	Cohort	Adults hospitalized with COVID-19	734	Single hospital in New York, U.S.A.	OR (95% CI) for hospitalization Hazard ratio (95% CI) for death	White	Hospitalization – Black: 1.89 (1.59, 2.24) Hispanic: 0.84 (0.66, 1.07) Death – Black: 1.30 (0.95, 1.78) Hispanic: 1.84 (1.21, 2.80) Asian: 2.06 (1.08, 3.93) Other: 2.12 (1.11, 4.06)
Rentsch et al., 2020 ⁶⁰	Cohort	Veterans tested for SARS-CoV-2	254,595	U.S.A.	aOR (95% CI) for 30-day COVID-19 mortality	White	Black: 0.97 (0.80, 1.17) Hispanic: 0.99 (0.73, 1.34)
Rodriguez et al., 2020 ⁶¹	Cross-sectional	Patients hospitalized with COVID-19	7,868	88 hospitals in the U.S.A.	aOR (95% CI) for in-hospital mortality	NH white	NH black: 0.93 (0.76, 1.14) Hispanic: 0.90 (0.73, 1.11) Asian: 1.31 (0.96, 1.80)
Rosenthal et al., 2020 ⁷⁹	Cohort	Patients with COVID-19 treated in U.S. hospitals	64,781 patients	592 U.S.A. Hospitals	aOR (95% CI) for in-hospital mortality	White	Black: 0.75 (0.69-0.92) Other/Unknown: 0.95 (0.88-1.03)
Saffary et al., 2020 ⁹⁵	Ecological	Counties	3,108 U.S. Counties	U.S.A.	Global Spatial Correlation of COVID-19 Cases and Deaths	--	Cases Black American: 0.174 Hispanic: 0.008 NH white: -0.203

					(Bivariate Moran's I)		Deaths Black American: 0.264 Hispanic: -0.002 NH white: -0.137
Salter et al., 2021 ³⁶	Cross-sectional	Patients with MS and SARS-CoV-2 in COViMS Registry	1,626 patients	North America	OR (95% CI) for hospitalization, ICU admission, death	NH white	Hospitalization Black: 1.47 (0.98 – 2.22) Hispanic/Latinx: 0.77 (0.41 – 1.44) Other: 0.82 (0.33 – 2.08) ICU admission: Black: 2.28 (1.22-4.23) Hispanic/Latinx: 1.76 (0.76-4.09) Other: 0.94 (0.20-4.36) Death: Black: 1.60 (0.65 – 3.93) Hispanic/Latinx: 0.57 (0.10-3.18) Other: 2.95 (0.45-19.5)
Shah et al., 2020 ⁶²	Cross-sectional	Hospitalized COVID-19 patients in rural Southwest Georgia	522 patients	Phoebe Putney Health System, Southwest Georgia, U.S.A.	OR (95% CI) In-Hospital Mortality	White	Black: 0.82 (0.37-1.78)
Silver et al., 2020 ⁶³	Cross-sectional	SARS-CoV-2 + Patients admitted to an urban safety net hospital in New	249 patients	Safety Net Hospital in New Orleans, Louisiana, U.S.A.	Day 14 outcome (adjusted proportional odds of better	All other racial/ethnic groups	Black: 0.91 (0.70-1.20)

		Orleans, Louisiana			outcomes, 95% CI)		
Twigg et al., 2020 ⁶⁴	Cohort	SARS-CoV-2+ patients ≥18 years admitted to the ICU	242 patients	Two urban, academic referral hospitals in Indianapolis, Indiana, U.S.A.	Hazard Ratio (95% CI) for in-hospital mortality	Caucasian	African American 0.6 (0.3-1.3) Hispanic/Latino: 0.2 (0.03-1.7) Other: 0.5 (0.1-2.7)
Valenzuela et al., 2020 ⁴⁰	Cohort	Hispanic and Non-Hispanic SARS-CoV-2+ patients at large suburban academic tertiary care hospital ER	2,039 patients	Long Island, New York, U.S.A.	OR (95% CI) for hospital admission, ICU admission, mortality	NH white	Hospital Admission – Hispanic: 0.69 (0.52-0.92) ICU Admission - Hispanic: 1.04 (0.70-1.53) Mortality - Hispanic: 0.82 (0.46-1.47)
Vaughan et al., 2021 ³⁹	Cross-sectional	SARS-CoV-2+ cases from Stanford Health Care Laboratory in March, 2020	257 cases	Stanford Health Care, U.S.A.	OR (95% CI) of Hospital admission and/or death	Caucasian	Asian 4.8 (1.6-14.2) Hispanic: 3.6 (1.1-11.9) Other/Unknown: 2.3 (0.7-7.1)
Wang et al., 2020 ⁶⁵	Cohort	Patients at Mount Sinai tested for COVID-19	28,336 patients	Mount Sinai Health System, NYC, New York, U.S.A.	In-Hospital Mortality (Log Odds Ratio, p-value)	Caucasian	Black: 1.04 (0.815) Asian: 1.04 (0.914) Hispanic: 0.93 (0.723) Other: 0.99 (0.975) Unknown: 0.86 (0.750)
Wiley et al., 2021 ³⁷	Cohort	SARS-CoV-2+ Patients presenting to academic emergency rooms	831 patients	Atlanta, Georgia, U.S.A.	Hospital Admission aOR (95% CI), In-Hospital Mortality aOR (95% CI)	Non-black	Hospital Admission – Black: 1.22 (0.76-1.94) In-Hospital Mortality – Black: 1.24 (0.70-2.25)

Zelner et al., 2020 ⁷³	Cross-sectional	Confirmed and probable COVID-19 infections from the Michigan Disease Surveillance System	49,701 cases	Michigan, U.S.A.	Age and sex-standardized mortality rate ratios (95% CI)	White	Black: 6.9 (6.5, 7.3) Latino: 2.2 (1.8, 2.6) A/PI: 2.2 (1.7, 2.7) Native American: 0.7 (0.3, 1.3) Other: 4.2 (3.4, 5.1)
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*Denotes pre-print study; non-peer-reviewed
 NH = non-Hispanic
 AI/AN = American Indian or Alaska Native
 A/PI = Asian or Pacific Islander
 NH/PI = Native Hawaiian/Pacific Islander
 aOR = adjusted odds ratio; CI = confidence interval; ICU = intensive care unit

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