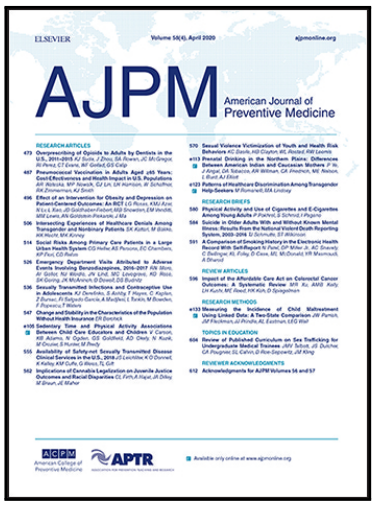

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Racial and Ethnic Disparities in SARS-CoV-2 Testing and COVID-19 Outcomes in a Medicaid Managed Care Cohort

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Introduction: Socioeconomic differences may confound racial and ethnic differences in testing severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) testing and coronavirus disease 2019 (COVID-19) outcomes.

Methods: A retrospective cohort study was conducted of racial/ethnic differences in SARS-CoV-2 testing and positive tests and COVID-19 hospitalizations, and deaths among adults impaneled at a Northern California regional medical center and enrolled in the county Medicaid

managed care plan (N=84,346) as of March 1, 2020. Logistic regressions adjusted for demographics, comorbidities, and neighborhood characteristics.

Results: Nearly 30% of enrollees were ever tested for SARS-CoV-2, and 4% tested positive. A total of 19.7 per 10,000 were hospitalized for and 9.4 per 10,000 died from COVID-19. Those identified as Asian, Black, or of other/unknown race had lower testing rates whereas those identified as Latino had higher testing rates than Whites. Enrollees of Asian or other/unknown race had slightly higher and Latinos much higher odds of a positive test (OR=3.77, 95% CI=3.41, 4.17) than Whites. Odds of hospitalization (OR=2.85, 95% CI=1.85, 4.40) and death (OR=4.75, 95% CI=2.23, 10.12) were higher for Latino relative to White patients, even after adjusting for demographics, comorbidities, and neighborhood characteristics.

Conclusions: In a Medicaid managed care population, where socioeconomic differences may be reduced, the odds of a positive SARS-CoV-2 test, COVID-19 hospitalization, and death were higher for Latino but not Black patients relative to White patients. Racial/ethnic disparities depend on local context. The substantially higher risk facing Latinos should be a key consideration in California's strategies to mitigate disease transmission and harm.

INTRODUCTION

Nationwide, coronavirus disease 2019 (COVID-19) has disproportionately affected racial and ethnic minorities in terms of infection, hospitalization, and mortality.[1–12] The role of sociodemographic, clinical, and neighborhood factors in accounting for racial/ethnic differences in COVID-19 outcomes remains unclear. Higher rates of testing positive for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) among individuals identified as Black or Latino (hereafter Blacks or Latinos) relative to those identified as White (hereafter Whites) persist after adjustment.[13–18] Patterns for COVID-19 outcomes are more variable. Among

confirmed COVID-19 cases, adjusted odds of hospitalization were higher for Black and Latino patients relative to Whites in an integrated Wisconsin health system[16] and for Black but not Latino patients in an integrated California health system.[17] By contrast, adjusted odds of hospitalization were similar for Black and Latino patients relative to White patients in a New York City health system.[15] Adjusted odds of in-hospital COVID-19 mortality did not differ for Blacks relative to Whites in Louisiana[18] whereas Latino but not Black patients had higher adjusted odds of death in Wisconsin.[16] Potential causes of these conflicting findings may be unobserved differences in socioeconomic characteristics, comorbidities, trust of the medical system, and living and working conditions.[19] Little evidence exists for Asian populations.

Nationally, 30-day mortality among SARS-CoV-2-positive veterans did not differ for Blacks or Latinos relative to Whites.[13] Because veterans differ from the overall population (e.g., mostly male), that study may not generalize. In England, Blacks and South Asians had higher odds of COVID-19 death relative to Whites, even after adjusting for socioeconomic and clinical factors.[20] These findings may not apply to the U.S.

This study analyzed data from the county-run Medicaid managed care plan in Contra Costa County, California, an ethnically and economically diverse suburban Bay Area county with a population of about 1.2 million,[21] to study racial/ethnic disparities in SARS-CoV-2 testing and positive test results and COVID-19 hospitalizations and death. The county Medicaid managed care plan and public health testing data systems are integrated, enabling this study to capture the vast majority of the tests conducted throughout the county. The analysis adjusted for demographic and clinical characteristics through November 19, 2020 and 2018 ZIP code

characteristics that may affect virus transmission.[22,23] Because all patients had Medicaid, they are similar along some unmeasured economic dimensions. The hypotheses were that racial/ethnic disparities in testing and outcomes would narrow when controlling for demographics, comorbidities, and ZIP code–level characteristics and would be reduced relative to prior studies given similar insurance coverage, household income, and access to healthcare providers.

METHODS

A retrospective, observational, cohort study of all Medi-Cal patients impaneled on March 1, 2020 at Contra Costa Regional Medical Center (CCRMC), the county public hospital, and affiliated health centers was conducted. CCRMC is a 166-bed full-service health facility that along with its 10 health centers is the primary point of care for patients enrolled in the county's public Medicaid managed care plan, Contra Costa Health Plan (CCHP). CCHP enrollees are auto-assigned to CCRMC as their primary healthcare access point, subject to capacity. Most impaneled patients are Medi-Cal managed care enrollees, although fee-for-service Medi-Cal enrollees who were assigned a CCRMC primary care provider and have been seen at CCRMC in the past 12 months are also included. Data were extracted from the county's electronic medical record (EMR) system. Because both CCRMC and CCHP are county-run, the EMR system is synced with the county's public health SARS-CoV-2 testing data. Patients who were members of the CCHP but not impaneled at CCRMC were excluded from the study. Neighborhood factors were merged to the EMR data by ZIP code, the smallest geographic unit of observation available, from the American Community Survey 5-year (2009–2019) estimates. This study was approved by the University of Southern California IRB, which granted a waiver of informed

consent (as a minimal-risk medical record review), as well as the IRC at Contra Costa Health Services. The study follows the STROBE guidelines for reporting observational studies.

Study Sample

All 84,346 patients aged ≥18 years impaneled at CCRMC as of March 1, 2020 were included in the analysis. All SARS-CoV-2 tests performed by the county between February 28, 2020 to March 4, 2021 were included. Tests were performed at public health testing laboratories, at CCRMC, and in commercial laboratories. Nearly all tests were reverse transcriptase polymerase chain reaction (RT-PCR) tests, although some other test types (4.64% antibody, 0.49% antigen-based) were included. Four outcomes were analyzed, including whether an individual: (1) received ≥1 SARS-CoV-2 test, (2) had ≥1 positive test, (3) had a COVID-19 hospitalization, and (4) died from COVID-19. Sensitivity checks: (1) restricted to RT-PCR tests and (2) analyzed the number of SARS-CoV-2 tests received. COVID-19 hospitalizations were captured in the admission diagnosis and required a positive test. No individuals had >1 COVID-19 hospitalization. COVID-19 deaths were from the California Reportable Disease Information Exchange system and were manually verified by the county.

Measures

Race and ethnicity data were from the EMR and grouped into 5 categories: Asian, Black, Latino, White, and other/unknown. Patients who self-identified as Latino were classified as such regardless of race. Owing to small sample sizes, patients who identified as “Native American/Alaska Native” (*n*=280), multi-racial (*n*=1,452), or another race category (*n*=3,573) were grouped with the <7% of the sample (*n*=5,663) who declined to provide or were otherwise missing race information as “other/unknown” race.

Adjustments were made for demographic and clinical characteristics that, based on prior reports,[2–8] were likely to affect COVID-19 outcomes: age (indicators for ages 18–29, 30–39, 40–49, 50–64, 65–74, 75–84 and ≥85 years), sex, obesity (defined as BMI >30), and indicators for the following medical comorbidities: asthma, cancer, chronic pain, diabetes, chronic obstructive pulmonary disease, and hypertension. Comorbidities were captured as entries in health system registries for each disease as well as medical note lists documented between March 1 and November 19, 2020. Obesity was calculated from the last height and weight measurement in the EMR as of November 19, 2020.

Some models adjusted for ZIP code–level measures of work and economic status, safety net program participation, living arrangements, and access to care from the 5-year (2009–2019) American Community Survey matched to patients based on ZIP code of residence; 1,031 patients (1.22%) were missing ZIP code or did not match to the American Community Survey. Matched patients were from 467 unique ZIP codes, although 98% (*n*=81,482) were from 45 unique ZIP codes with ≥50 patients each (Appendix Table 1). The measures, hypothesized to affect SARS-CoV-2 exposure and COVID-19 outcomes, were median income; average household size; share of the population aged ≥16 years employed; share of the non-institutionalized civilian population without health insurance; share of households receiving (separately) cash public assistance income, Social Security income, and Food Stamp/Supplemental Nutrition Assistance Program benefits; and share of housing units that were single family, detached homes.

Statistical Analysis

The demographics and clinical characteristics of patients overall and within each race/ethnicity

group were compared as were the percentage of patients that had ≥1 SARS-CoV-2 test, the number of tests received, the percentage of patients that ever tested positive, the number of COVID-19 hospitalizations per 10,000 patients, and COVID-19 deaths per 10,000 patients overall and by race/ethnicity group. Three logistic regression models—(1) unadjusted, (2) adjusted for the aforementioned demographics and clinical diagnoses, and (3) Model 2 with adjustment for the aforementioned neighborhood characteristics discussed—were estimated for each outcome. Computed ORs and 95% CIs were reported for each outcome. In models with neighborhood characteristics, SEs and 95% CIs were adjusted for ZIP code–level clustering. Sensitivity analyses tested robustness to: (1) restricting to RT-PCR tests; (2) analyzing the number of COVID-19 tests received; (3) restricting to tested patients; and (4) recoding patients of "other/unknown" race as Latino, Asian, Black, or White. To address repeat testing, a negative binomial regression model was used to analyze the number of tests received. All analyses were performed using Stata/MP, version 15.1. The analysis was not meant to identify a causal model. Race/ethnicity is neither a mutable characteristic nor a risk factor per se for SARS-CoV-2 or COVID-19 outcomes. Rather, the goal was to determine if differences in testing and outcomes differed by race/ethnicity in a relatively socioeconomically homogenous group and after controlling for demographic, clinical, and ZIP code characteristics.

RESULTS

As of March 1, 2020, CCRMC had 84,346 impaneled adult patients. The patient population was racially/ethnically diverse: 15% (*n*=12,751) Asian, 16% (*n*=13,897) Black, 29% (*n*=24,153) Latino, 26% (*n*=21,827) White, and 15% (*n*=11,728) individuals of other/unknown race (Table 1). Blacks, Latinos, and those of other/unknown race were younger than Whites or Asians: A

third of Latino and patients of other/unknown race and a quarter of Black patients were aged 18–29 years compared with 16% for Whites and Asians. Less than 14% of Black, Latino, and patients of other/unknown race were aged ≥65 years compared with 17% of Whites about 30% of Asians. The patient population skewed more female (56%), with the skew larger for Latinos (61%).

Nearly 15% of patients had diagnoses of diabetes and about 35% were obese, 2 key risk factors for severe illness from COVID-19.[24] Asians had higher rates of diabetes (21%) and Whites lower rates (12%) compared with other race/ethnicity groups. Patients of other/unknown race were disproportionately obese (59%). About a quarter of patients had hypertension.[25] Asians and Black patients had the highest rates of hypertension at 37% and 34%, respectively. Compared with Whites, Latinos had lower rates of all diagnosed disease except diabetes.

Twenty-nine percent (*n*=24,508) of individuals were tested at least once for SARS-CoV-2, with 4% (*n*=3,351) ever testing positive; 19.7 per 10,000 (*n*=166) had a COVID-19-related hospitalization and 9.37 per 10,000 (*n*=79) died from COVID-19. Testing rates varied modestly across race/ethnicity groups (Appendix Figure 1A): Latinos had slightly higher rates of testing (34.8%) than Whites (29.1%), Blacks (27.7%), Asians (26.4%), or individuals of other/unknown race (21.6%). The percentage of patients who ever had a positive test was considerably higher for Latinos at 8% (*n*=1,934) compared with Asians at 2.8% (*n*=360), individuals of other/unknown race at 2.4% (*n*=282), Whites at 2.26% (*n*=493), and Blacks at 2.03% (*n*=282). Among tested patients, the mean number of tests received was similar across groups at about 2 tests (Table 1).

Hospitalization rates varied markedly and were highest for Latinos. Hospitalizations per 10,000 were 35.2 (*n*=85) for Latinos compared with 20.4 (*n*=26) for Asians, 15.8 (*n*=22) for Blacks, 12.4 (*n*=27) for Whites, and 5.12 (*n*=5) for individuals of other/unknown race. COVID-19 deaths per 10,000 followed a similar pattern: 17.4 (*n*=42) for Latinos, 11.0 (*n*=14) for Asians, 8.63 (*n*=12) for Blacks, 3.67 (*n*=8) for Whites, and 2.56 (*n*=3) for patients of other/unknown race.

Relative to Whites, Latinos had higher unadjusted odds of testing at least once (OR=1.30, 95% CI=1.25, 1.35); all other groups had lower unadjusted odds (Asians: OR=0.87, 95% CI=0.83, 0.92; Blacks: OR=0.93, 95% CI=0.89, 0.98; other/unknown race: OR=0.67, 95% CI=0.63, 0.71) (Table 2, Panel A). Adjusting for age and comorbidities and including neighborhood characteristics did little to alter these patterns (Figure 1A and Appendix Table 2). The results were qualitatively similar for RT-PCR tests only (Appendix Table 3) and for negative binomial regression models of SARS-CoV-2 test counts (Appendix Table 4).

Unadjusted odds of a positive SARS-CoV-2 test (Table 2, Panel B) were not significantly higher for Blacks or those of other/unknown race relative to Whites but were significantly higher relative to Whites for Asians (OR=1.26, 95% CI=1.10, 1.44) and, most notably, Latinos (OR=3.77, 95% CI=3.41, 4.17). Adjusting for age and comorbidities and including ZIP code characteristics only modestly reduced these disparities (Figure 1B). ORs for Latinos relative to Whites remained very high (Appendix Table 2): OR=3.58 (95% CI=3.23, 3.96) with demographic and clinical adjustment and OR=3.15 (95% CI=2.63, 3.77) with the further addition

of neighborhood characteristics Results were similar for RT-PCR tests (Appendix Table 5) and positive cases relative to SARS-CoV-2 tests (Appendix Table 6).

Unadjusted associations between COVID-19-related hospitalizations and race (Table 2, Panel C) were not statistically distinguishable for any group relative to Whites except for Latinos. For Latinos, the unadjusted OR of hospitalizations relative to Whites was 2.85 (95% CI=1.85, 4.40). Adjusting for demographic and clinical factors and further with neighborhood characteristics did little to alter these patterns (Figure 1C).

Relative to Whites, the unadjusted ORs of COVID-19 deaths (Table 2, Panel D) were statistically distinguishable from 0 and higher for Asians (OR=3.0, 95% CI=1.26, 7.15) and Latinos (OR=4.75, 95% CI=2.23, 10.1) relative to Whites. ORs were also higher for Blacks, although they were not statistically distinguishable from 0 (OR=2.36, 95% CI=0.96, 5.77). Adjusting for demographic and clinical factors and further with neighborhood characteristics did little to alter the pattern or significance of the results for Latinos (Figure 1C, Appendix Table 2). In the fully adjusted models, the ORs remained sizeable but were statistically indistinguishable from Whites for Asians and Blacks. The pattern of results for deaths, and all other outcomes, was unaffected by recoding those categorized as “other/unknown” race as either Asian, Black, or Latino (Appendix Table 7).

DISCUSSION

By analyzing data from a diverse Medicaid Managed Care population, disparities in SARS-CoV-2 testing and COVID-19 outcomes could be compared for not only Blacks but also Latinos and Asians.

Latinos were more likely to be tested for SARS-CoV-2 and receive a positive result compared with Whites. By contrast, Blacks and Asians were less likely to be tested, with Asians more likely to test positive, relative to Whites. Higher testing rates among Latinos may be partly attributable to concerted county efforts to target this group in response to their observed higher disease burden.

Latinos were the only group that had higher ORs of COVID-19 hospitalization and death relative to Whites after adjustment for demographic, clinical, and neighborhood characteristics. The disparities for Latinos were particularly noteworthy given magnitudes and the fact that Latinos were disproportionately younger. Moreover, the magnitudes were scarcely affected by adjustment for individual- or ZIP code–level characteristics.

As controlling for underlying comorbidities and neighborhood characteristics does little to narrow the disparities measured here, the results suggest that other unobserved structural factors, such as inequitable distribution of scarce hospital resources and ability to work from home or take paid leave and ongoing discrimination, are key drivers of the differential impacts of COVID-19.[26] One key limitation, however, is the inherent measurement error in comorbidities due to both a lack of data on disease severity as well as potential differences in registry inclusion caused by disparities in undiagnosed disease.[27,28]

Also of note is the finding of lower odds of positive COVID-19 tests for Blacks relative to Whites. This contrasts with findings for veterans,[13] patients from a Greater Houston area health system,[14] patients from a New York City health system,[15] and patients from a Wisconsin health system.[16] The lack of a Black–White disparity in hospitalizations and mortality, however, is consistent with prior work.[13,15] Caution should be used in interpreting these findings, given that the point estimates were consistent with higher odds of hospitalization and death among Blacks relative to Whites. Estimates were indicative of higher odds of death for Asian relative to White patients but also became imprecise with adjustment. As the pandemic continues, the patterns may become more precise.

The findings for Latinos, who are projected to make up about half of Californians by 2060,[29] are particularly troubling. Consistent with work from a single census tract in San Francisco, Latinos had starkly higher odds of a positive test than Whites.[30] This disparity suggests that Latinos have considerably higher rates of undiagnosed SARS-CoV-2 infection than the general population. Assuming that all severe cases of COVID-19 lead to hospitalization and that severity is equal across groups after controlling for clinical, demographic, and neighborhood characteristics, the odds of SARS-CoV-2 infection among the CCHP Latino population is >2.5 times that of Whites.

Limitations

Data were from 1 county in California and may not generalize. The data did not capture individuals without contact with the healthcare system and may be confounded by selection into health care or Medicaid, an issue sometimes referred to as collider bias. Such selection is problematic if it is differential across race/ethnicity. SARS-CoV-2 testing differs by

race/ethnicity, complicating the interpretation of differences in positive tests; hospitalizations and death are less prone to selection bias. Hospitalizations outside of the county medical center and privately paid SARS-CoV-2 tests were also not captured. Privately paid tests were likely rare as the county provides free testing at multiple sites and the study population is low income. The data capture the presence of specific diseases not disease severity, an important contributor to hospitalization and death. As the limited data set only contained ZIP code of residence, the analysis could not capture neighborhood deprivation or other Census tract measures of disadvantage that may contribute to disparities. The data did not separately identify patients who were both Latino and from another racial group. Owing to limited sample size, Native American/Alaska Natives (0.33%) and individuals indicating >1 race (1.7%) or another race category (4.24%) were grouped with individuals with unknown race/ethnicity (6.7%). Sensitivity analysis of this coding was performed.

CONCLUSIONS

California is home to diverse racial and ethnic populations, with more Latinos than any other state.[31] In a Northern California Medicaid population, Latinos had consistently worse outcomes than Whites whereas Blacks did not. These data highlight that racial/ethnic disparities may not be uniform across geography and that SES may account for some of the observed differences in outcomes.

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Figure 1. Unadjusted ORs and AORs of testing, positivity, and hospitalizations.

Notes: Estimates labeled "Adjusted 1" control for patient demographics and comorbidities. Estimates labeled "Adjusted 2" further control for neighborhood characteristics. Specific controls detailed in the text. Bars correspond to 95% CIs.

Table 1. Characteristics of the Patient Population Overall and by Race/Ethnicity

	Patients, *n* (%)					
Characteristics	**Total**	**Asian**	**Black/African American**	**Latino**	**Other/ Unknown[a]**	**White/ Caucasian**
Impaneled	84,346	12,741 (15)	13,897 (16)	24,153 (29)	11,728 (14)	21,827 (26)
Age groups, years						
18–29	20,023 (23.4)	2,082 (16.3)	3,277(23.6)	7,583 (31.4)	3,642 (31.1)	3,439 (15.8)
30–39	16,733 (19.8)	1,906 (15.0)	2,886 (20.8)	4,695 (19.4)	2,754 (23.5)	4,492 (20.6)
40–49	12,001 (14.2)	1,531 (12.0)	2,114 (15.2)	3,797 (15.7)	1,559 (13.2)	3,000 (13.7)
50–64	21,647 (25.7)	3,349 (26.3)	3,861 (27.8)	4,731 (19.6)	2,444 (20.8)	7,262 (33.3)
65–74	9,523 (11.3)	2,480 (19.5)	1,334 (9.6)	2,070 (8.57)	899 (7.67)	2,740 (12.6)
75–84	3,368 (3.99)	1,052 (8.26)	354 (2.55)	933 (3.86)	390 (2.72)	710 (3.25)
≥85	1,051 (1.25)	341 (2.68)	71 (0.51)	359 (1.42)	111 (0.95)	184 (0.84)
Sex						
Female	47,205 (56.0)	7,330 (57.5)	7,678 (55.3)	14,794 (61.3)	5,991 (51.1)	11,412 (52.3)
Male	37,123 (44.0)	5,410 (42.5)	6,213 (44.7)	9,359 (38.8)	5,730 (48.9)	10,411 (47.7)
Nonbinary or unknown	18 (0.02)	1 (0.01)	6 (0.05)	0	7 (0.06)	4 (0.02)
Diagnoses						
Asthma	8,849 (10.5)	963 (7.56)	2,207 (15.9)	2,456 (10.2)	755 (6.44)	2,468 (11.3)

Cancer	3,220 (3.82)	498 (3.91)	428 (3.1)	753 (3.12)	236 (2.01)	1,305 (5.98)
Pain[b]	11,449 (13.6)	1,407 (11.0)	2,477 (17.8)	2,791 (11.6)	878 (7.49)	3,896 (17.9)
Diabetes	12,216 (14.5)	2,693 (21.1)	2,053 (14.8)	3,908 (16.2)	1,000 (8.53)	2,562 (11.7)
COPD	2,611 (3.10)	305 (2.39)	567 (4.08)	273 (1.13)	192 (1.64)	1,274 (5.84)
Hypertension	22,479 (26.7)	4,645 (36.5)	4,675 (33.6)	5,304 (22.0)	1,738 (14.8)	6,117 (28.0)
BMI ≥30	30,179 (35.3)	2,364 (18.6)	5,210 (37.5)	7,764 (32.2)	9,925 (59.1)	6,764 (31.0)
Tested[c]	24,508 (29.1)	3,368 (26.4)	3,852 (27.7)	8,397 (34.8)	2,531 (21.6)	6,360 (29.1)
Number of tests|test>0[d]	1.91	1.94	1.87	1.79	1.98	2.04
Tested positive[e]	3,351 (3.97)	360 (2.83)	282 (2.03)	1,934 (8.01)	282 (2.4)	493 (2.26)
Hospitalized[f]	166 (19.7)	26 (20.4)	22 (15.8)	85 (35.2)	6 (5.12)	27 (12.4)
Died[f]	79 (9.37)	14 (11.0)	12 (8.63)	42 (17.4)	3 (2.56)	8 (3.67)

[a]Due to small numbers (N=280), American Indian/Native Alaskan is included with Other/Unknown.
[b]Patients with a chronic pain diagnosis in the electronic health record.
[c]Tested positive means tested positive at least once.
[d]Number of tests conditional on at least 1 test for SARS-CoV-2.
[e]Patients who had at least 1 test for SARS-CoV-2.
[f]Hospitalization and Death rate in parentheses are per 10,000.

COPD, chronic obstructive pulmonary disease.

Table 2. Unadjusted ORs

	Panel A: Ever tested for SARS-CoV-2	**Panel B: Ever tested positive for SARS-CoV-2**	**Panel C: COVID-19 hospitalization**	**Panel D: COVID-19 death**
Variable	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**
White (ref)				
Asian	0.87 (0.83, 0.92)	1.26 (1.10, 1.44)	1.65 (0.96, 2.83)	3.00 (1.26, 7.15)
Black	0.93 (0.89, 0.98)	0.90 (0.77, 1.04)	1.28 (0.73, 2.25)	2.36 (0.96, 5.77)
Latino	1.30 (1.25, 1.35)	3.77 (3.41, 4.17)	2.85 (1.85, 4.40)	4.75 (2.23, 10.12)
Other[a]	0.67 (0.63, 0.71)	1.07 (0.92, 1.24)	0.41 (0.17, 1.00)	0.70 (0.19, 2.63)
Observations	84,346	84,346	84,346	84,346
Mean rate	29.1[b]	3.97[c]	19.7[d]	9.37[d]

[a]Due to small numbers (N=280), American Indian/Native Alaskan is included with Other/Unknown.
[b]The percent of patients who had at least 1 test for SARS-CoV-2.
[c]Ever tested positive is denominated by all impaneled patients, irrespective of whether they were ever tested for SARS-CoV-2.
[d]Hospitalizations and deaths are per 10,000.