OBSERVATIONS: BRIEF RESEARCH REPORTS

COVID-19 Inequities Across Multiple Racial and Ethnic Groups: Results From an Integrated Health Care Organization

Background: Coronavirus disease 2019, the illness caused by SARS-CoV-2, has shown stark health inequities, including by race/ethnicity (1). Prior research has often been limited by small, nondiverse samples or lack of reliable clinical data to provide a detailed picture of COVID-19–related inequities across multiple racial/ethnic groups in the same population. Some studies suggest that racial/ethnic disparities in comorbidities and obesity may be major drivers of racial inequities in COVID-19 outcomes (2,3). Comprehensive health equity assessments of COVID-19 testing and outcomes are needed to support an equitable pandemic response and vaccination efforts.

Objective: To compare age- and sex-adjusted relative risk (RR) of COVID-19 testing, cases, hospitalizations, and intensive-level care among Hispanic, Black or African American, Asian, and Pacific Islander populations versus White populations before and after adjusting for comorbidities and body weight status.

Methods: We conducted a retrospective cohort study using electronic health record data from Kaiser Permanente Southern California (KPSC), a large, integrated health care system that serves 10 Southern California counties and has a membership that approximately represents the population in its service region (4). We identified 47 974 COVID-19 cases via diagnoses and positive COVID-19 test results during 1 March to 31 July 2020. The sample was restricted to members who were at least 18 years old, had 12 months of membership, and had a single race/ethnicity category available (93.4% of eligible members). Race/ethnicity was identified using an algorithm that relies on several data sources, including membership data, birth certificates, encounter-based race/ethnicity data, and language preferences. This approach was concordant with self-reported race/ethnicity in 91% of cases for major race/ethnicity categories in previous, unpublished validation studies.

Robust Poisson regression was used to estimate 2 sets of models that adjust for age and sex and for age, sex, body mass index categories, Elixhauser Comorbidity Index, and 5 comorbidity

Table. Sample Characteristics by COVID-19 Status and Outcomes Among KPSC Members, 1 March to 31 July 2020*

Characteristic	Total	Tested at KP	COVID-19 Positive Test Result or Diagnosis†				
			All Cases	Tested Positive	Diagnosis Only	Hospitalized	Intensive-Level Care
KPSC members, *n*	2 928 353	279 615	47 974	39 918	8056	4517	1498
Mean age on 1 March 2020 (SD), *y*	48.5 (18.3)	49.1 (18.1)	44.1 (16.2)	44.1 (16.2)	44.0 (16.4)	57.9 (17.3)	60.5 (15.4)
Female, %	53.6	59.2	54.7	53.9	58.9	45.6	35.7
Race/ethnicity, %							
White	36.3	32.2	17.0	16.8	18.0	16.2	14.4
Hispanic	42.4	48.7	69.0	69.8	65.4	63.3	64.4
Asian	11.8	9.8	6.7	6.3	8.5	10.1	10.8
Black/African American	8.8	8.5	6.5	6.3	7.3	9.3	9.0
Pacific Islander	0.8	0.8	0.8	0.8	0.8	1.1	1.4
Insurance type, %							
Medicaid	7.1	8.3	9.4	9.6	8.0	13.0	12.1
Medicare	6.6	6.9	2.3	2.3	2.4	7.9	8.2
Commercial/self-funded	53.7	55.6	59.3	59.3	59.3	43.5	40.8
Private pay/high deductible	32.4	29.0	28.7	28.4	29.9	35.5	38.9
Other	0.2	0.2	0.3	0.3	0.4	0.2	0.1
Body mass index, %							
Underweight	1.5	1.5	0.8	0.7	0.8	1.8	1.3
Normal weight	26.1	23.5	17.4	17.1	19.0	17.3	16.2
Overweight	32.5	32.0	31.4	31.3	32.1	30.5	29.2
Obese	36.6	42.1	48.4	49.0	45.6	50.3	53.3
Missing	3.4	0.9	2.0	1.9	2.5	0.2	0.1
Comorbidity category, %‡							
Cardiovascular disease	12.4	17.9	8.5	8.5	8.6	26.4	27.8
Hypertension	24.7	29.9	21.3	21.4	21.0	48.0	53.7
Pulmonary disease	10.6	16.6	11.1	11.2	10.4	16.4	17.2
Diabetes	13.8	18.1	16.4	16.7	15.0	38.6	45.9
Other	36.6	48.9	38.4	38.5	38.3	56.7	57.2
Mean Elixhauser Comorbidity Index (SD)	1.4 (2.1)	2.0 (2.7)	1.4 (2.0)	1.4 (2.0)	1.3 (2.1)	3.1 (3.2)	3.3 (3.1)

KPSC = Kaiser Permanente Southern California.

* KPSC members can obtain their insurance through employer-sponsored plans, private plans, Medicare, Medicaid (MediCal) and other low-income programs.

† Diagnoses and COVID-19 molecular tests are listed separately because patients may have received only a diagnosis without a test at KPSC. COVID-19 cases were identified between 1 March and 31 July 2020. The cohort was followed until 11 September 2020 to observe hospitalizations or intensive-level care outcomes. COVID-19 hospitalizations were defined as a KPSC hospitalization occurring within 21 d of a COVID-19 diagnosis or positive test result. Intensive-level care was defined as a high (1:1 or 2:1) patient–nurse ratio or receipt of either high-flow oxygen or mechanical ventilation–as indicated by nursing flow sheets.

‡ The 5 broad comorbidity categories are created by aggregating the following Elixhauser comorbidities: "cardiovascular diseases" includes congestive heart failure, cardiac arrhythmia, valvular disease, pulmonary circulation disorders, and peripheral vascular disorders; "pulmonary disease" includes chronic pulmonary disease; "hypertension" includes uncomplicated and complicated hypertension; "diabetes" includes diabetes with and without chronic complications; and the remaining Elixhauser comorbidities were grouped as "other."

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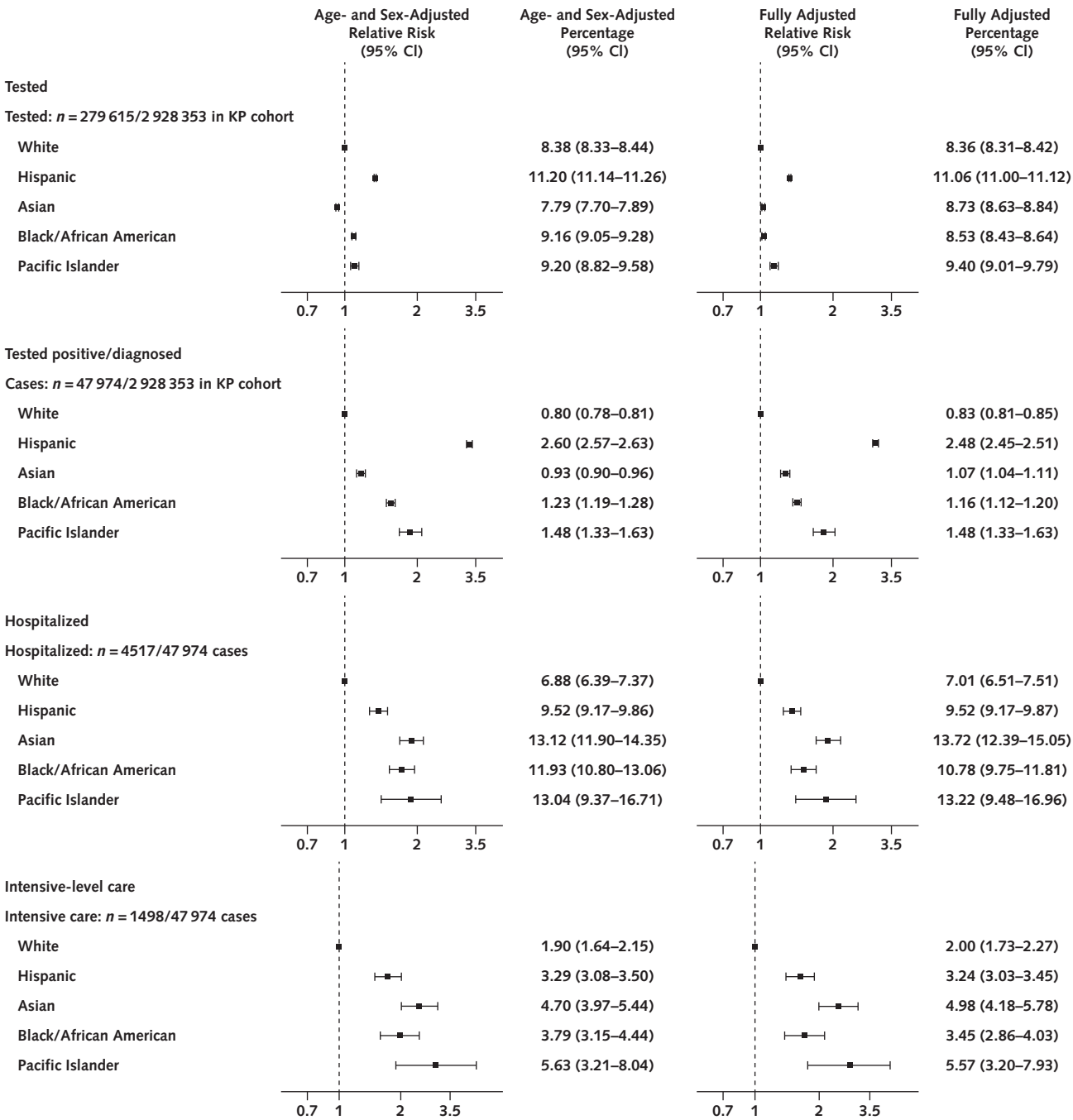
categories (Table) (2). For each race/ethnicity, we estimated the RR of an event occurring, with being White as the reference category. We also provide the adjusted marginal probability of each outcome, expressed as percentages for ease of interpretation. This research was approved by the KPSC Institutional Review Board.

Findings: We identified 47 974 COVID-19 cases; 4517 (9.42%) required hospitalization and 1498 (3.12%) required intensive-level care (Table). Patients who required hospitalization and intensive-level care were on average older, more likely to be obese, and more likely to have a higher Elixhauser Comorbidity Index than

Figure. Relative risks and adjusted marginal percentages of COVID-19 testing, hospitalizations, and receipt of intensive-level care, by race/ethnicity.



All relative risks and adjusted marginal percentages were estimated using robust Poisson regression and included the log of follow-up days as offset to account for differential follow-up (<5% were lost to follow-up). Analyses were done using SAS, version 9.4 (SAS Institute). The fully adjusted model adjusted for age, sex, comorbidity categories, Elixhauser Comorbidity Index (count of comorbidities documented within past 12 mo), and body mass index categories. No collinearity issues were observed when using the Elixhauser Comorbidity Index along with the 5 broad comorbidity categories that adjust for the independent effects of each respective disease category.

those with COVID-19 who did not experience these events (**Table**). The COVID-19 outcomes also varied by race/ethnicity.

We observed disparities across race/ethnicity for all outcomes before and after adjustment for age, sex, comorbidities, and body mass index. Patients of color were slightly more likely to be tested and to test positive or be diagnosed with COVID-19 than White patients but were substantially more likely to be hospitalized and to receive intensive-level care (**Figure**). Hispanic patients had the highest RRs of being tested and testing positive or being diagnosed with COVID-19 compared with White patients; however, Pacific Islander, Black or African American, and Asian patients had higher RRs for severe COVID-19 outcomes than White patients (**Figure**).

Discussion: Our results confirm findings from earlier in the pandemic that suggest that COVID-19 affects Hispanic, Black or African American, and Asian persons disproportionately (2). We further provide evidence of the disproportionate effect of COVID-19 on Pacific Islanders. We show that even after adjustment for known COVID-19 risk factors, such as comorbidities and body mass index, persons of color continue to have a substantially higher risk for hospitalization and requiring intensive-level care than White persons (1–3).

A limitation of this study is that some KPSC members may have been tested outside the KPSC system, particularly early in the pandemic. We have no information on these results. We are, however, able to identify patients seeking COVID-19–related care after an outside test. These patients were given a COVID-19 diagnosis by their provider, often without receiving a second confirmatory test at KPSC. We could not identify COVID-19–related intensive-level care that was delivered outside KPSC. Similar to other research on COVID-19 using KP data, we used only data from encounters within the KP system (2). Inequities in deaths were not analyzed because some racial/ethnic groups had fewer than 10 cases.

Inequities in COVID-19 outcomes are a call to action for a culturally appropriate pandemic response and vaccination strategies that go beyond addressing comorbidities and account for factors like distrust in the medical system, resource constraints, language proficiency, and health literacy.

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