Characteristics and Factors Associated with COVID-19 Infection, Hospitalization, and Mortality Across Race and Ethnicity

Chengzhen L. Dai[1], Sergey A. Kornilov[1], Ryan T. Roper[1], Hannah Cohen-Cline[2], Kathleen Jade[1], Brett Smith[1], James R. Heath[1,3], George Diaz[4], Jason D. Goldman[5,6], Jennifer J. Hadlock[1,*], Andrew T. Magis[1,*]

[1] Institute for Systems Biology, Seattle, WA, USA
[2] Providence Center for Outcomes Research and Education, Providence Health System, Renton, WA, USA
[3] Department of Bioengineering, University of Washington, Seattle, WA, USA
[4] Providence Regional Medical Center, Everett, WA, USA
[5] Swedish Center for Research and Innovation, Swedish Medical Center, Seattle, WA, USA
[6] Division of Allergy & Infectious Diseases, University of Washington, Seattle, WA, USA
[*] These authors contributed equally to this study

Background

Data on the characteristics of COVID-19 patients disaggregated by race/ethnicity remain limited. We evaluated the sociodemographic and clinical characteristics of patients across the major racial/ethnic groups and assessed their associations with COVID-19 outcomes.

Methods

This retrospective cohort study analyzed patients who were tested for SARS-CoV-2 in a large, integrated health system spanning California, Oregon, and Washington between March 1 and August 30, 2020. Sociodemographic and clinical characteristics were obtained from electronic health records. Odds of SARS-CoV-2 infection, COVID-19 hospitalization, and in-hospital death were assessed with multivariate logistic regression.

Findings

289,294 patients with known race/ethnicity were tested for SARS-CoV-2 by PCR, of whom 27.5% were non-White minorities. 15,605 persons tested positive, with minorities representing 58.0%. Disparities were widest among Hispanics, who represented 40.5% of infections but 12.8% of those tested. Hispanics were generally younger and had fewer comorbidities except diabetes than White patients. Of the 3,197 patients hospitalized, 58.9% were non-White. 459 patients died, of whom 49.8% were minorities. Racial/ethnic distributions of outcomes across the health system tracked with state-level statistics. Increase odds of testing positive and hospitalization were associated with all minority races/ethnicities except American Indian/Alaska Native. Highest odds of testing SARS-CoV-2 positive was for Hispanic patients (OR [95% CI]: 3.68 [3.52-3.84]) and highest odds of COVID-19 hospitalization was for Native Hawaiian/Pacific Islander patients (2.13 [1.48 - 3.06]). Hispanic patients also exhibited increased morbidity including need for mechanical ventilation. In multivariate modeling, Hispanic race/ethnicity was associated with increased odds of hospital mortality (1.75 [1.15-2.67]) among patients over age 70, but hospital mortality was not increased for any race/ethnicity sub-population in the multivariate model.

Interpretation

Major healthcare disparities were evident, especially among Hispanics who tested positive at a higher rate, and despite younger in age, required excess hospitalization and need for mechanical ventilation compared to their expected demographic proportions. As characteristics of patients varying between race/ethnicity, targeted, culturally-responsive interventions are needed to address the increased risk of poor outcomes among minority populations with COVID-19.

Funding

Biomedical Advanced Research and Development Authority; National Center for Advancing Translational Sciences

Introduction

Since the coronavirus disease 2019 (COVID-19) was first reported in Washington state, the United States has documented the highest number of confirmed cases and deaths in the world. Increasing evidence have indicated that COVID-19 disproportionately affects patients of minority race and ethnicity(1–3). While reports have identified different rates of infection, hospitalization, and mortality among minority populations, there is limited information on the characteristics of COVID-19 patients disaggregated by race/ethnicity.(4,5)

The prevalence of comorbidities and social environments vary between racial/ethnic groups(6,7). Some of these characteristics, such as obesity and crowded housing, are potential risk factors for COVID-19 and disease severity(8,9). Understanding how the characteristics of patients differ between races/ethnicities and which factors are associated with disease outcomes are therefore critical for public health and designing community-based interventions. Unfortunately, such detailed characteristics remain sparse and certain racial/ethnic groups, specifically Asian Americans, Native Hawaiians and Pacific Islanders (NH/PI), and American Indians and Alaska Natives (AI/AN) remain yet to be characterized in detail(10,11). Furthermore, while sociodemographic and health characteristics vary across geography, multi-state comparisons are limited. The objective of this study therefore is to examine the characteristics of and factors associated with SARS-CoV-2 infection, hospitalization with COVID-19, and in-hospital mortality in a large diverse population of patients in a large health system operating in California, Oregon, and Washington.

Method

Study Design, Setting, and Population

This retrospective cohort study included patients from California, Oregon, and Washington who were tested for SARS-CoV-2 with a polymerase chain reaction (PCR) assay of a nasopharyngeal sample and were seen at a Providence St. Joseph Heath (PSJH) facility between March 1, 2020 and August 30, 2020. In-hospital outcomes were monitored through October 4, 2020. PSJH is one of the largest health care system in the US. In 2019, approximately 3.5 million patients in California, Oregon, and Washington received care at the facilities included in this study, of whom 70.2% identified as non-Hispanic White; 12.4% as Hispanic; 7.7% as non-Hispanic Asian American; 4.0% as non-Hispanic Black; 0.7% non-Hispanic American Indian/Alaska Native; 0.6% non-Hispanic Native Hawaiian/Pacific Islander; and 4.4% non-Hispanic Other. The protocol for this study was reviewed and approved by the PSJH Institutional Review Board (IRB #: STUDY2020000203).

Data Collection

Patient demographic and clinical data were extracted from PSJH's Epic electronic health record system and stored in PSJH's cloud relational database management system. Patients with a positive PCR test for SARS-CoV-2 were considered to have a confirmed SARS-CoV-2 infection. For patients who had multiple tests, only the initial positive test result was considered. Extracted demographic data included age, sex, reported race and ethnicity, and insurance plan. 64 patients with missing values for sex were excluded from the study. Missing race and ethnicity were grouped as Unknown. ZIP codes were used to identify the neighborhood-level rates of

poverty, percentage of crowded housing (>1 person per room), percentage of minority population (race/ethnicity except non-Hispanic white), and percentage of limited English proficient population from the US Census Bureau's 2018 American Community Survey, 5-year estimates. Clinical data include underlying medical conditions identified using International Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10-CM) codes or direct clinical measurements linked to past encounters between January 1, 2019 and the date of COVID-19 testing. We included underlying medical conditions that have previously been associated with COVID-19(12,13). Specifically, Charlson Comorbidity Index (CCI) was used to capture the risk from multiple comorbidities while obesity and hypertension, which are not components of CCI, were included as independent variables. For components of the Charlson Comorbidity Index, we used diagnosis codes as previously defined(14). Hypertension was defined as I10. Obesity was defined based on Center for Disease Control definitions using BMI measurements. Inpatient encounter data included presenting vital signs, baseline laboratories or procedures, supplemental oxygen use, acute diagnoses (COVID-19: U07.1; lower respiratory infection: J22; acute respiratory distress syndrome: J80; respiratory failure: J96; pneumonia: J12.89), length of stay, transfer to intensive care unit, and discharge disposition.

For comparison with state-level data, COVID-19 case and death for California, Oregon, and Washington was obtained from the COVID Racial Data Tracker, which aggregates historical COVID-19 case and death data from state public health agencies(15). Data on COVID-19-related hospitalization for California and Oregon was obtained from the Center for Disease Control's Coronavirus Disease 2019 (COVID-19)-Associated Hospitalization Surveillance Network (COVID-NET) while Washington data was obtained from the University of Minnesota COVID-19 Hospitalization Tracking Project(16,17).

Statistical Analysis

We first compared the sociodemographic and clinical characteristics of patients across COVID-19 outcomes and across race/ethnicity categories, defined as Hispanic; non-Hispanic Black (Black); non-Hispanic Asian American (Asian); non-Hispanic Native Hawaiian and Pacific Islander (NH/PI); non-Hispanic American Indian and Alaska Native (AI/AN); non-Hispanic white (White); and non-Hispanic other (Other), which includes multi-race/ethnicity. For patients hospitalized with COVID-19, presenting clinical characteristics were available and were defined as clinical status according to the World Health Organization's 9-point Ordinal Scale(18) and presenting vitals within the first 6 hours of admissions and baseline laboratory test results within 24 hours of admissions.

Associations with SARS-CoV-2 infection, hospitalization, and hospital mortality was assessed with mixed-effect logistic regression models. For each outcome, we first calculated an unadjusted univariate model and an adjusted multivariate model. State and county were included as nested random effects to account for geographical variations in each unadjusted and adjusted model. All multivariate models included race/ethnicity as an independent variable, with demographic factors (age; age-squared; sex), socioeconomic factors (insurance; neighborhood rates of poverty, crowded housing, limited English proficiency, and minority), and comorbidities (Charlson Comorbidity Index score; hypertension; and obesity) as covariates. In

addition to age, an age-squared term was included in the model to capture the previously observed non-linear relationship between COVID-19 outcomes and age(19). For analyses of hospital mortality, additional covariates included WHO Ordinal Scale score and baseline lab results, both at admissions. Covariates were selected based on previously identified risk factors, as well as patterns of missingness and collinearity. Certain characteristics, specifically BMI, insurance coverage, and baseline lab results, were not available for all patients. For clinical labs, B-type natriuretic peptide, C-reactive protein, ferritin, neutrophil count, procalcitonin and venous lactate, while previously associated with COVID-19 outcomes, were not consistently measured or reported at baseline (≥20% missingness). We therefore excluded them from regression analyses. Alanine transaminase was excluded due to high correlation with aspartate transaminase and had more missing values. For variables with less than 20% missingness, missing values were imputed with multiple imputation by fully conditional specification (15 imputations).

To account for changes in public health guidance and the effect of reopening, we also compared the time period earlier in the pandemic ("Initial" period) between March 1, 2020 and June 15, 2020 with the period after June 15, 2020 ("Resurgence" period) when California, Oregon, and Washington began reopening.(20–22)

Results

Characteristics of Patients Tested for SARS-CoV-2

A total of 323,419 patients tested for SARS-CoV-2 were included. 289,288 patients (89.4%) reported race/ethnicity, of which 72.5% were White, 12.8% were Hispanic, 5.3% were Asian, 4.0% Black, 0.9% were AI/AN, 0.7% were NH/PI, and 3.8% were Other (**Table 1**). The mean age (SD) among all tested patients was 52.1 (19.4) and 57.4% were female. The majority of patients (52.9%) had public insurance (Medicaid: 29.1%; Medicare: 23.8%), with higher percentages of Hispanic, Black, NH/PI, and AI/AN patients on Medicaid than White and Asian patients (**Table S1**). The most common comorbidities were obesity (37.0%), hypertension (24.4%), diabetes (10.1%) and asthma (7.0 %). The median score on the Charlson Comorbidity Index was 1.0 (95% CI: 0.0-3.0), corresponding to a 95.9% estimated 10-year survival.

Characteristics of Patients Positive for SARS-CoV-2 Infection

17,831 patients (5.5%) of the 323,419 patients tested for SARS-CoV-2 were positive. Among the 15,609 patients with known race/ethnicity, the rate of positive test results was higher in patients of minority race/ethnicity compared to White patients (3.1%; **Table S1**), with Hispanic and NH/PI patients having the highest rate (17.0% and 11.4%, respectively). Consequently, White and Hispanic patients make up similar percentages of SARS-CoV-2 infected patients (42.0% and 40.5%, respectively), followed by Other (5.3%), Asian (5.1%), Black (5.0%), NH/PI (1.4%), and AI/AN (0.6%) patients (**Table 1**).

Among all SARS-CoV-2 infected patients, the mean age (SD) was 48.1 (19.6) and 52.1% were female (**Table 1**). Compared to White patients, mean ages were lower among patients of minority race/ethnicity, except for Asians, which had a similar mean age (**Table 2**). Scores on the Charlson Cormorbidity Index was also lower among minority patients. The prevalence of

diabetes, however, was higher among minority patients, particularly among Asian, Black, NH/PI and AI/AN patients. Additionally, relative to White patients, Hispanic patients had higher prevalence of obesity; Asian patients had higher prevalence of hypertension and diabetes; Black patients had higher prevalence of both asthma and hypertension; and NH/PI and AI/NH patients had greater proportions of obesity and kidney disease.

Hispanic, Black, NH/PI, and AI/NH patients were more likely to have Medicaid insurance than White and Asian patients (**Table 2**). All minority patients were more likely than White patients to reside in neighborhoods with higher percentages of poverty, crowded housing, and minorities. Hispanic, Asian, and Black patients in particular were also more likely to live in neighborhoods with a higher percentage of limited English proficient population. All minority patients were more likely to have received their tests in the emergency department than White patients.

Characteristics of Patients Hospitalized with COVID-19

18.6% (n=3,321) of the patients who tested positive for COVID-19 were hospitalized. 3,200 patients (96.4%) had known race/ethnicity, of which 41.2% were White, 39.8% were Hispanic, 6.1% were Asian, 5.1% were Black, 1.6% were NH/PI, 0.8% were AI/AN, and 5.4% were Other (**Table 1**). The mean (SD) age of all patients was 63.7 (18.1) and 55.6% were male. The median Charlson Comorbidity Index score was 3.0 (1.0-6.0) and the most common comorbidities were obesity (40.7%), hypertension (37.9%), and diabetes (27.3%). At admission, 26.2% of patients were febrile (≥38ºC), 30.9% had a respiration rate >24 breaths/min, and 33.0% received supplemental oxygen.

White patients had the highest mean age (71.0±16.8; **Table 3**) and median Charlson Comorbidity Index score (5.0 [3.0-7.0]). NI/PI patients had the lowest mean age (52.9±17.2) and NH/PI and Hispanic patients had the lowest mean Charlson Comorbidity Index score (2.0 [1.0-4.0]).) at presentation. The prevalence of obesity was highest among AI/AN, NH/PI, and Hispanic patients and lowest among Asian patients. However, Hispanics had the lowest prevalence of hypertension while Asian patients had the highest. The majority of Hispanic, Black, and AI/AN patients were on Medicaid; and Hispanic, Black and Asian patients resided in neighborhoods with higher percentages of crowded housing, minorities, and limited English speakers than other racial/ethnic subgroups. On admission, a higher percentage of Hispanic patients (10.5%) than White patients (6.1%) had a score of five or above on the WHO Ordinal Scale, and a higher percentage of Hispanic patients than White patients were febrile, had low oxygen saturation, and had high respiration rates. Over the course of hospitalization, a higher percentage of Hispanic patients (21.0%) than White patients (12.6%) needed mechanical ventilation.

Overall, the unadjusted hospital mortality rate was 14.2% (472/3,321 hospitalized patients). 252 of the 472 deceased patients (53.4%) needed mechanical ventilation.

Characteristics of SARS-CoV-2 Infected Patients Over Time

Between the initial and resurgence phase (Methods), the percentage of positive tests increased (5.3% vs. 5.7%), but both the rate of hospitalization among SARS-CoV-2 infected patients

(24.3% vs. 15.3%) and the in-hospital mortality rate (17.2% vs. 11.3%) decreased. Over the course of the pandemic, the proportion of Hispanic patients receiving a test for SARS-CoV-2, testing positive, or were hospitalized with COVID-19 increased while the proportions of patients of another race/ethnicity decreased or remained similar (**Figure S1**). Rates of positive test and hospitalization per 100,000 patients were on average higher among minorities than White patients, with Hispanics and NH/PI patients having the highest rates. In particular, Hispanic consistently had higher rates than White patients throughout the pandemic with rates peaking during the resurgence phase. Between these two periods, the mean age of patients decreased ($P < 0.001$ for all outcomes).

Comparison with State-level SARS-CoV-2 Cases, COVID-19 Hospitalization, and Death

The distribution of race/ethnicity among patients in this study generally reflected state-level distributions for COVID-19 outcomes (**Figure S2-4**). In particular, high proportions of Hispanics were consistently observed both in the state-wide data as well as data within the PSJH system. While the proportions of White patients testing positive and hospitalized was slightly higher in this PSJH population, the differences in racial/ethnic distributions between the PSJH population and the overall census population were consistent or smaller than the differences observed at the state-level (**Figure S5-6**).

Factors Associated with SARS-CoV-2 Infection

Minority populations including Hispanic, Black, Asian, NH/PI and AI/AN had increased odds of SARS-CoV-2 infection compared to Whites in unadjusted and adjusted analysis (**Table 4**). In adjusted multivariate analysis, increased odds of positive SARS-CoV-2 results were independently associated with Hispanic (OR [95% CI]: 3.68 [3.52-3.84]), NH/PI (3.42 [2.95-3.96]), Black (1.78 [1.64-1.93]), Asian (1.58 [1.47 - 1.71]), and Other (2.01 [1.86 - 2.17]) race/ethnicity with White patients as the reference category. Increasing age and age-squared, male sex, overweight, obesity (all categories), Medicaid insurance, lack of insurance, and residence in a neighborhood with higher percentage of minorities and limited English proficient individuals were also independently associated with increased odds of infection. Higher Charlson Comorbidity Index score and Medicare insurance, however, were associated with lower odds of positive SARS-CoV-2 infection. Odds of infection were higher (1.05 [1.01-1.08]) in the resurgence period after June 15, 2020 than the initial period.

Factors Associated with Hospitalization for COVID-19

Minority races/ethnicities were not consistently associated with increased odds for COVID-19 hospitalization, until adjusting for demographics, comorbidities, insurance status and neighborhood characteristics. (**Table 4**). In multivariate analysis, the odds ratio for COVID-19 hospitalization was highest among NH/PI (2.13 [1.48 - 3.06]), followed by Asian (1.50 [1.22 - 1.85]), Hispanic (1.49 [1.32 - 1.69]), AI/AN (1.42 [0.84 - 2.40]), Black (1.29 [1.04 - 1.60]), and Other (1.29 [1.05-1.58]) patients. Increasing age, male sex, public insurance, higher Charlson Comorbidity Index score, being underweight, having class 2 or 3 obesity, having hypertension, and residence in a neighborhood with higher rates of poverty were also independently associated with increased odds of hospitalization. Odds of hospitalization were significantly lower during the resurgence period (0.81 [0.74-0.88]).

Factors Associated with Hospital Mortality in Admissions for COVID-19

Race/ethnicity was not significantly associated with hospital mortality in adjusted analyses of all 3,321 hospitalized patients (**Table 5**). However, Hispanic patients were generally younger than White patients. Hospital mortality rates were higher for Hispanic patients over age 70 than White patients (**Figure S7**). Correspondingly, Hispanic race/ethnicity was significantly associated with higher odds of mortality (1.75 [1.15-2.67]) in adjusted multivariate analysis of patients over age 70 (**Table 5**). Associations with race/ethnicity were not clearly observed among patients under age 70 in multivariate analysis that also controlled for age and age-squared. In an adjusted interaction analysis of race/ethnicity and age, increased odds of mortality were identified among Hispanic patients as age increased (1.55 [1.06 - 2.27]; $P_{interaction}$=0.022; **Table S2**, **Figure S6B**).

Hospital mortality was also independently associated with the sociodemographic factors of age and male sex; the clinical feature of higher score on the WHO Ordinal Scale on admission and Charlson Comorbidity Index score; and the baseline clinical lab results of high white blood cell count, low lymphocyte, low platelet count, high AST, and high blood urea nitrogen. Odds of mortality was lower during the resurgence period.

Discussion

This study examined the characteristics and clinical outcomes of 323,419 patients tested for SARS-CoV-2 across California, Oregon, and Washington. Overall, we highlight how characteristics of SARS-CoV-2 infected patients vary by race/ethnicity and show differential associations of COVID-19 hospitalizations, morbidity, and mortality within race/ethnic populations. While patients of minority race/ethnicity represented 27.5% of patients tested for SARS-CoV-2, they constituted 58.0% of SARS-CoV-2 infected patients and 58.8% of hospitalized COVID-19 patients. Hispanic patients in particular represented 40.5% and 39.8% of SARS-CoV-2 infected and hospitalized COVID-19 patients, respectively, despite making up only 12.8% of tested patients, a pattern consistent with state-level data. Time-series data document a shift over the course of the pandemic to younger and more Hispanic populations. Race/ethnicity was associated with SARS-CoV-2 infection and COVID-19 hospitalization, with adjusted odds of both outcomes highest among Hispanics and NH/PI patients. Older Hispanic patients had significantly increased odds of hospital mortality. These findings highlight the disproportionate burden of COVID-19 born by Hispanics in these western US states, despite younger age and in general fewer comorbidities when compared to White with SARS-CoV-2 infection or COVID-19 hospitalization.

Understanding racial and ethnic disparities in COVID-19 cases and outcomes is important for understanding the nature of the disease and guiding public health prevention efforts and medical interventions. This study comprehensively detailed and compared the clinical and epidemiological characteristics of COVID-19 across all major races/ethnicities, highlighting in particular Asian, NH/PI, and AI/AN patients who have been underrepresented in COVID-19 literature to date. In doing so, we show that these populations, particularly NH/PI patients, have similar or higher odds of SARS-CoV-2 infection and hospitalization as Black and Hispanic patients, demonstrating the need to focus resources on all minority racial/ethnic populations

including public health messaging, recruitment to proportional representation in clinical trials(23) and possibly in efforts by health systems to actively intervene earlier in the disease course.

The significant associations of minority races/ethnicities with SARS-CoV-2 infection and COVID-19-related hospitalization builds on previous analyses of Black and Hispanic patients(24–27). However, unlike previous studies, we found a significant association between Hispanic race/ethnicity and hospital mortality among older patients. Since minority patients were generally younger than White patients in this study and previous studies, our findings suggest that the relationship between race/ethnicity and hospital mortality is moderated by age. The clinical characteristics of Hispanic patients at hospital admission also suggest that they are presenting with more severe illness than White patients. In particular, a higher percentage of Hispanic patients presented with WHO Ordinal Scale scores of five or higher, reflecting a need for high-flow supplemental oxygen or mechanical ventilation. Hispanic patients are also more likely to be febrile, have low oxygen saturation, and high respiration rates. These clinical findings suggest a delay in seeking care among Hispanic patients. While this study cannot identify the causes behind the observed associations, certain social, structural or biologic determinants of health have been suggested(3). Social and structural determinates could include occupation risk and limited access to healthcare and testing(3). These characteristics may thus be the result of delay of care or lack of early diagnosis. Further studies are needed to identify the causal factors driving the disparities in COVID-19.

This study also confirms and expands on sociodemographic and clinical factors associated with COVID-19 severity, including increased age; male sex; multimorbidity; obesity; dyspnea; and biomarkers of cardiovascular, immune, and renal function(28–30). In particular, we demonstrate how these associated characteristics vary across race/ethnicity. For example, Asian patients, when compared to other minority patients, have a higher mean age, lower percentage of obesity, and were less likely to be on Medicaid. These differences suggest varying levels of risk across race/ethnicity and demonstrates the need for further disaggregation of data on racial and ethnic differences in COVID-19 and targeted community intervention at the local level.

While the large size of this study's diverse cohort and its wide geographical distribution are strengths of this study, there are limitations. This study was limited to a subset of catchment areas within California, Oregon, and Washington with patients under care in a single large, integrated health system. Thus, the results may therefore be less generalizable to other regions of the US or other areas within these states. At the same time, structured electronic health record data is subject to the quality, consistency, and completeness of data entry by the care team. In particular, our use of ICD-10-CM code for identifying comorbidities may not capture diagnoses that are not billable or represented by a given code. Some patients may have also received care at other institutions and therefore certain outcomes or characteristics may be underreported. Furthermore, public health guidance and regulations have rapidly changed within and across states over the course of the pandemic. While we controlled for geographical variations and time-periods, we may still not have fully accounted for the effect of policy changes or increasing availability of SARS-CoV-2 testing capacity. Despite these limitations,

however, our results highlight how the impact of COVID-19 vary across race/ethnicity in a large geographical area.

Author Contributions

Chengzhen L. Dai designed the study, performed literature search, collected the data, analyzed and interpreted the data, and wrote the manuscript. Sergey Kornilov assisted in designing the study, analyzing the data, and interpreting the results. Ryan T. Roper assisted in collecting and analyzing the data. Hannah Cohen-Cline, Kathleen Jade, Brett Smith, and James R. Heath assisted in interpreting the results. Jason Goldman and George Diaz assisted in study design and interpreting the data. Jennifer J. Hadlock and Andrew T. Magis jointly supervised the study and assisted in the study design and interpreting the data. All authors assisted in the writing and revising of the manuscript and approved it for submission and publication. Ryan Roper and Sergey Kornilov have accessed and verified the underlying data.

Acknowledgement

We thank the caregivers in the PSJH system for their tireless efforts in caring for patients with COVID-19. We also thank Mark Premo, Lindsay Mico, Jennifer Jones, Andrey Dubovoy, Vivek Tomer, and the PSJH Health Intelligence team for their support and management of the electronic health record data. This study was supported by Biomedical Advanced Research and Development Authority under Contract HHSO10201600031C administered by Merck and Co. (JDG, JRH). J.H. and R.R. were funded by National Center for Advancing Translational Sciences of the National Institutes of Health under Award Number OT2 TR003443.

Declaration of interests

We declare no competing interests.

Data availability

Data used in this study is archived within PSJH in a HIPAA-secure location to facilitate verification of study conclusions.

References

1. CDC. COVID-19 Hospitalization and Death by Race/Ethnicity [Internet]. Centers for Disease Control and Prevention. 2020 [cited 2020 Aug 17]. Available from: https://www.cdc.gov/coronavirus/2019-ncov/covid-data/investigations-discovery/hospitalization-death-by-race-ethnicity.html

2. Moore JT. Disparities in Incidence of COVID-19 Among Underrepresented Racial/Ethnic Groups in Counties Identified as Hotspots During June 5–18, 2020 — 22 States, February–June 2020. MMWR Morb Mortal Wkly Rep [Internet]. 2020 [cited 2020 Oct 12];69. Available from: https://www.cdc.gov/mmwr/volumes/69/wr/mm6933e1.htm

3. Webb Hooper M, Nápoles AM, Pérez-Stable EJ. COVID-19 and Racial/Ethnic Disparities. JAMA. 2020 Jun 23;323(24):2466–7.

4. Yaya S, Yeboah H, Charles CH, Otu A, Labonte R. Ethnic and racial disparities in COVID-19-related deaths: counting the trees, hiding the forest. BMJ Global Health. 2020 Jun 1;5(6):e002913.

5. Artiga S, Corallo B, Pham O. Racial Disparities in COVID-19: Key Findings from Available Data and Analysis - Issue Brief [Internet]. KFF. 2020 [cited 2020 Aug 17]. Available from: https://www.kff.org/report-section/racial-disparities-in-covid-19-key-findings-from-available-data-and-analysis-issue-brief/

6. Quiñones AR, Botoseneanu A, Markwardt S, Nagel CL, Newsom JT, Dorr DA, et al. Racial/ethnic differences in multimorbidity development and chronic disease accumulation for middle-aged adults. PLOS ONE. 2019 Jun 17;14(6):e0218462.

7. Artiga S, Garfield R, Orgera K. Communities of Color at Higher Risk for Health and Economic Challenges due to COVID-19 [Internet]. KFF. 2020 [cited 2020 Sep 28]. Available from: https://www.kff.org/coronavirus-covid-19/issue-brief/communities-of-color-at-higher-risk-for-health-and-economic-challenges-due-to-covid-19/

8. Emeruwa UN, Ona S, Shaman JL, Turitz A, Wright JD, Gyamfi-Bannerman C, et al. Associations Between Built Environment, Neighborhood Socioeconomic Status, and SARS-CoV-2 Infection Among Pregnant Women in New York City. JAMA. 2020 Jul 28;324(4):390–2.

9. Popkin BM, Du S, Green WD, Beck MA, Algaith T, Herbst CH, et al. Individuals with obesity and COVID-19: A global perspective on the epidemiology and biological relationships. Obesity Reviews [Internet]. [cited 2020 Sep 28];n/a(n/a). Available from: https://onlinelibrary.wiley.com/doi/abs/10.1111/obr.13128

10. Chang R, Penaia C, Thomas K. Count Native Hawaiian And Pacific Islanders In COVID-19 Data—It's An OMB Mandate [Internet]. [cited 2020 Oct 1]. Available from: https://www.healthaffairs.org/do/10.1377/hblog20200825.671245/full/

11. Yan B, Ng F, Chu J, Tsoh J, Nguyen T. Asian Americans Facing High COVID-19 Case Fatality [Internet]. Health Affairs. 2020 [cited 2020 Oct 1]. Available from: https://www.healthaffairs.org/do/10.1377/hblog20200708.894552/full/

12. Guan W, Liang W, Zhao Y, Liang H, Chen Z, Li Y, et al. Comorbidity and its impact on 1590 patients with COVID-19 in China: a nationwide analysis. Eur Respir J [Internet]. 2020 May 14 [cited 2020 Aug 7];55(5). Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7098485/

13. Christensen DM, Strange JE, Gislason G, Torp-Pedersen C, Gerds T, Fosbøl E, et al. Charlson Comorbidity Index Score and Risk of Severe Outcome and Death in Danish COVID-19 Patients. J Gen Intern Med. 2020 Jun 24;

14. Quan H, Sundararajan V, Halfon P, Fong A, Burnand B, Luthi J-C, et al. Coding algorithms for defining comorbidities in ICD-9-CM and ICD-10 administrative data. Med Care. 2005 Nov;43(11):1130–9.

15. The COVID Racial Data Tracker [Internet]. The COVID Tracking Project. [cited 2020 Sep 28]. Available from: https://covidtracking.com/race

16. Garg S. Hospitalization Rates and Characteristics of Patients Hospitalized with Laboratory-Confirmed Coronavirus Disease 2019 — COVID-NET, 14 States, March 1–30, 2020. MMWR Morb Mortal Wkly Rep [Internet]. 2020 [cited 2020 Aug 10];69. Available from: https://www.cdc.gov/mmwr/volumes/69/wr/mm6915e3.htm

17. Karaca-Mandic P, Georgiou A, Sen S. Assessment of COVID-19 Hospitalizations by Race/Ethnicity in 12 States. JAMA Intern Med [Internet]. 2020 Aug 17 [cited 2020 Sep 28]; Available from: http://jamanetwork-com/journals/jamainternalmedicine/fullarticle/2769369

18. COVID-19 Therapeutic Trial Synopsis [Internet]. [cited 2020 Sep 27]. Available from: https://www.who.int/publications-detail-redirect/covid-19-therapeutic-trial-synopsis

19. Wu Z, McGoogan JM. Characteristics of and Important Lessons From the Coronavirus Disease 2019 (COVID-19) Outbreak in China: Summary of a Report of 72 □314 Cases From the Chinese Center for Disease Control and Prevention. JAMA. 2020 Apr 7;323(13):1239–42.

20. Inslee announces Safe Start — Washington's Phased Reopening by county | Governor Jay Inslee [Internet]. Governor Jay Inslee. [cited 2020 Sep 14]. Available from: https://www.governor.wa.gov/news-media/inslee-announces-safe-start-%E2%80%94-washington%E2%80%99s-phased-reopening-county

21. Governor Kate Brown Issues Finalized Phase I Guidance for Building a Safe and Strong Oregon [Internet]. State of Oregon. [cited 2020 Sep 14]. Available from: https://www.oregon.gov/newsroom/Pages/NewsDetail.aspx?newsid=36632

22. California Department of Public Health News Releases 2020 [Internet]. California Department of Public Health. [cited 2020 Sep 14]. Available from: https://www.cdph.ca.gov/Programs/OPA/Pages/New-Release-2020.aspx

23. Borno HT, Zhang S, Gomez S. COVID-19 disparities: An urgent call for race reporting and representation in clinical research. Contemporary Clinical Trials Communications. 2020 Sep 1;19:100630.

24. Price-Haywood EG, Burton J, Fort D, Seoane L. Hospitalization and Mortality among Black Patients and White Patients with Covid-19. New England Journal of Medicine. 2020 Jun 25;382(26):2534–43.

25. Yehia BR, Winegar A, Fogel R, Fakih M, Ottenbacher A, Jesser C, et al. Association of Race With Mortality Among Patients Hospitalized With Coronavirus Disease 2019 (COVID-19) at 92 US Hospitals. JAMA Netw Open. 2020 Aug 3;3(8):e2018039–e2018039.

26. Golestaneh L, Neugarten J, Fisher M, Billett HH, Gil MR, Johns T, et al. The association of race and COVID-19 mortality. EClinicalMedicine [Internet]. 2020 Jul 14 [cited 2020 Aug 1];0(0). Available from: https://www.thelancet.com/journals/eclinm/article/PIIS2589-5370(20)30199-1/abstract

27. Kim L, Garg S, O'Halloran A, Whitaker M, Pham H, Anderson EJ, et al. Risk Factors for Intensive Care Unit Admission and In-hospital Mortality among Hospitalized Adults Identified through the U.S. Coronavirus Disease 2019 (COVID-19)-Associated Hospitalization Surveillance Network (COVID-NET). Clin Infect Dis [Internet]. [cited 2020 Aug 10]; Available from: https://academic.oup.com/cid/advance-article/doi/10.1093/cid/ciaa1012/5872581

28. Zheng Z, Peng F, Xu B, Zhao J, Liu H, Peng J, et al. Risk factors of critical & mortal COVID-19 cases: A systematic literature review and meta-analysis. J Infect. 2020;81(2):e16–25.

29. Henry BM, Oliveira MHS de, Benoit S, Plebani M, Lippi G. Hematologic, biochemical and immune biomarker abnormalities associated with severe illness and mortality in coronavirus disease 2019 (COVID-19): a meta-analysis. Clinical Chemistry and Laboratory Medicine (CCLM). 2020 Jun 25;58(7):1021–8.

30. Aggarwal S, Garcia-Telles N, Aggarwal G, Lavie C, Lippi G, Henry BM. Clinical features, laboratory characteristics, and outcomes of patients hospitalized with coronavirus disease 2019 (COVID-19): Early report from the United States. Diagnosis. 2020 May 26;7(2):91–6.

Table 1. Characteristics of patients tested and positive for SARS-CoV-2 and hospitalized for COVID-19

	Tested patients No. (%)	Positive patients No. (%)	Hospitalized patients No. (%)
SOCIO-DEMOGRAPHICS			
Total no. of patients	323,419	17,831	3,321
Age	52.1 ± 19.4	48.1 ± 19.6	63.7 ± 18.1
Sex			
Female	185,595 (57.4%)	9,287 (52.1%)	1,473 (44.4%)
Male	137,824 (42.6%)	8,544 (47.9%)	1,848 (55.6%)
Known race/ethnicity	289,288 (89.4%)	15,609 (87.5%)	3,200 (96.4%)
Hispanic	37,155 (12.8%)	6,324 (40.5%)	1,275 (39.8%)
Black	11,653 (4.0%)	787 (5.0%)	163 (5.1%)
Asian	15,284 (5.3%)	802 (5.1%)	195 (6.1%)
NH/PI	1,911 (0.7%)	218 (1.4%)	51 (1.6%)
AI/AN	2,642 (0.9%)	98 (0.6%)	25 (0.8%)
White	209,700 (72.5%)	6,559 (42.0%)	1,318 (41.2%)
Other	10,943 (3.8%)	821 (5.3%)	173 (5.4%)
Unknown race/ethnicity	34,131 (10.6%)	2,222 (12.5%)	121 (3.6%)
Insurance			
Commercial	139,931/322,904 (43.3%)	7,069/17,780 (39.8%)	627/3,318 (18.9%)
Medicaid	93,934/322,904 (29.1%)	7,031/17,780 (39.5%)	1,742/3,318 (52.5%)
Medicare	76,915/322,904 (23.8%)	2,072/17,780 (11.7%)	858/3,318 (25.9%)
Uninsured/Self-pay	12,039/322,904 (3.7%)	1,596/17,780 (9.0%)	87/3,318 (2.6%)
Other insurance	85/322,904 (0.0%)	12/17,780 (0.1%)	4/3,318 (0.1%)
Neighborhood demographics			
% Poverty	11.9 ± 6.0	13.5 ± 6.4	13.7 ± 6.3
% Crowded housing	4.4 ± 4.7	7.2 ± 6.8	7.9 ± 7.0
% Minority	34.6 ± 21.4	46.8 ± 26.5	50.5 ± 26.4
% Limited English	9.4 ± 8.6	14.4 ± 10.8	16.1 ± 11.0
COMORBIDITIES			
Hypertension	78,890 (24.4%)	3,309 (18.6%)	1,258 (37.9%)
Diabetes	32,540 (10.1%)	2,014 (11.3%)	908 (27.3%)
Weight			
Underweight	6,122/281,114 (2.2%)	266/15,119 (1.8%)	107/3,307 (3.2%)
Normal	82,715/281,114 (29.4%)	3,668/15,119 (24.3%)	811/3,307 (24.5%)
Overweight	88,380/281,114 (31.4%)	4,974/15,119 (32.9%)	1,042/3,307 (31.5%)
Class 1 Obesity	55,315/281,114 (19.7%)	3,310/15,119 (21.9%)	689/3,307 (20.8%)
Class 2 Obesity	26,954/281,114 (9.6%)	1,652/15,119 (10.9%)	348/3,307 (10.5%)
Class 3 Obesity	21,628/281,114 (7.7%)	1,249/15,119 (8.3%)	310/3,307 (9.4%)
Chronic respiratory disease			
Asthma	22,788 (7.0%)	863 (4.8%)	206 (6.2%)
COPD	14,977 (4.6%)	434 (2.4%)	238 (7.2%)
Cardiovascular disease			
Coronary artery disease	19,153 (5.9%)	615 (3.4%)	284 (8.6%)
Myocardial Infarction	7,691 (2.4%)	268 (1.5%)	159 (4.8%)
Congestive heart failure	19,422 (6.0%)	687 (3.9%)	397 (12.0%)
Kidney disease	19,996 (6.2%)	1,005 (5.6%)	550 (16.6%)
Liver disease	10,728 (3.3%)	388 (2.2%)	125 (3.8%)
Immunosuppression			
Cancer	21,169 (6.5%)	503 (2.8%)	201 (6.1%)
HIV/AIDS	759 (0.2%)	35 (0.2%)	10 (0.3%)
Solid organ transplant	1,135 (0.4%)	57 (0.3%)	29 (0.9%)
Charlson Comorbidity Index	1.0 (0.0 - 3.0)	1.0 (0.0 - 2.0)	3.0 (1.0 - 6.0)
GEOGRAPHIC DISTRIBUTION			
California	77,556 (24.0%)	6,948 (39.0%)	1,616 (48.7%)
Oregon	83,553 (25.8%)	3,091 (17.3%)	350 (10.5%)
Washington	162,310 (50.2%)	7,792 (43.7%)	1,355 (40.8%)

Table 2. Characteristics of SARS-CoV-2 infected patients by race/ethnicity

	Hispanic No. (%)	Black No. (%)	Asian No. (%)	NH/PI No. (%)	AI/AN No. (%)	White No. (%)	Other No. (%)	Unknown No. (%)
Demographic characteristics								
Total no. of patients	6,324	787	802	218	98	6,559	821	2,222
Hospitalized	1,275 (20.2%)	163 (20.7%)	195 (24.3%)	51 (23.4%)	25 (25.5%)	1,318 (20.1%)	173 (21.1%)	121 (5.4%)
Age	45.1 ± 17.2	46.4 ± 18.6	52.6 ± 19.4	46.7 ± 16.4	48.1 ± 18.7	53.0 ± 21.2	49.6 ± 19.3	40.7 ± 17.4
Sex								
Female	3,340 (52.8%)	397 (50.4%)	441 (55.0%)	125 (57.3%)	55 (56.1%)	3,400 (51.8%)	411 (50.1%)	1,118 (50.3%)
Male	2,984 (47.2%)	390 (49.6%)	361 (45.0%)	93 (42.7%)	43 (43.9%)	3,159 (48.2%)	410 (49.9%)	1,104 (49.7%)
Insurance								
Commercial	2,021/6,299 (32.1%)	262/785 (33.4%)	404 (50.4%)	84 (38.5%)	22 (22.4%)	2,902/6,542 (44.4%)	332/820 (40.5%)	1,042/2,216 (47.0%)
Medicaid	3,354/6,299 (53.2%)	416/785 (53.0%)	269 (33.5%)	101 (46.3%)	60 (61.2%)	2,077/6,542 (31.7%)	360/820 (43.9%)	394/2,216 (17.8%)
Medicare	294/6,299 (4.7%)	60/785 (7.6%)	97 (12.1%)	16 (7.3%)	13 (13.3%)	1,399/6,542 (21.4%)	70/820 (8.5%)	123/2,216 (5.6%)
Uninsured/Self-pay	623/6,299 (9.9%)	46/785 (5.9%)	31 (3.9%)	17 (7.8%)	3 (3.1%)	162/6,542 (2.5%)	58/820 (7.1%)	656/2,216 (29.6%)
Other insurance	7/6,299 (0.1%)	1/785 (0.1%)	1 (0.1%)	0 (0.0%)	0 (0.0%)	2/6,542 (0.0%)	0 (0.0%)	1/2,216 (0.0%)
Neighborhood demographics								
% Poverty	15.4 ± 6.1	14.8 ± 6.8	12.2 ± 6.0	15.9 ± 7.3	12.9 ± 7.3	11.8 ± 5.9	13.4 ± 6.5	13.0 ± 6.8
% Crowded housing	10.7 ± 7.7	7.0 ± 5.9	5.9 ± 5.1	4.6 ± 4.3	4.2 ± 3.6	4.0 ± 4.0	5.8 ± 5.3	7.8 ± 7.6
% Minority	60.5 ± 26.2	54.4 ± 25.5	48.5 ± 21.3	35.5 ± 19.8	36.3 ± 21.9	32.1 ± 19.2	43.9 ± 22.3	50.6 ± 26.7
% Limited English	20.1 ± 10.7	15.3 ± 9.0	14.5 ± 8.7	10.1 ± 7.4	8.6 ± 7.7	8.9 ± 8.2	13.8 ± 9.5	15.0 ± 11.2
Comorbidities								
Hypertension	960 (15.2%)	208 (26.4%)	212 (26.4%)	52 (23.9%)	16 (16.3%)	1,541 (23.5%)	155 (18.9%)	165 (7.4%)
Diabetes	778 (12.3%)	117 (14.9%)	126 (15.7%)	50 (22.9%)	14 (14.3%)	728 (11.1%)	102 (12.4%)	99 (4.5%)
BMI								
Underweight	53/5,575 (1.0%)	13/697 (1.9%)	28/705 (4.0%)	4/195 (2.1%)	1/87 (1.1%)	130/5,757 (2.3%)	16/724 (2.2%)	21/1,379 (1.5%)
Normal	893/5,575 (16.0%)	169/697 (24.2%)	309/705 (43.8%)	36/195 (18.5%)	19/87 (21.8%)	1,678/5,757 (29.1%)	183/724 (25.3%)	381/1,379 (27.6%)
Overweight	1,915/5,575 (34.3%)	223/697 (32.0%)	233/705 (33.0%)	57/195 (29.2%)	24/87 (27.6%)	1,787/5,757 (31.0%)	240/724 (33.1%)	495/1,379 (35.9%)
Class 1 Obesity	1,471/5,575 (26.4%)	146/697 (20.9%)	91/705 (12.9%)	43/195 (22.1%)	20/87 (23.0%)	1,120/5,757 (19.5%)	155/724 (21.4%)	264/1,379 (19.1%)
Class 2 Obesity	716/5,575 (12.8%)	76/697 (10.9%)	33/705 (4.7%)	26/195 (13.3%)	12/87 (13.8%)	565/5,757 (9.8%)	89/724 (12.3%)	135/1,379 (9.8%)
Class 3 Obesity	527/5,575 (9.5%)	70/697 (10.0%)	11/705 (1.6%)	29/195 (14.9%)	11/87 (12.6%)	477/5,757 (8.3%)	41/724 (5.7%)	83/1,379 (6.0%)
Chronic respiratory disease								
Asthma	251 (4.0%)	59 (7.5%)	45 (5.6%)	11 (5.0%)	10 (10.2%)	397 (6.1%)	30 (3.7%)	60 (2.7%)
COPD	46 (0.7%)	28 (3.6%)	14 (1.7%)	2 (0.9%)	7 (7.1%)	308 (4.7%)	16 (1.9%)	13 (0.6%)
Cardiovascular disease								
Coronary artery disease	100 (1.6%)	18 (2.3%)	34 (4.2%)	10 (4.6%)	5 (5.1%)	409 (6.2%)	26 (3.2%)	13 (0.6%)
Myocardial Infarction	61 (1.0%)	13 (1.7%)	19 (2.4%)	7 (3.2%)	1 (1.0%)	135 (2.1%)	22 (2.7%)	10 (0.5%)
Congestive heart failure	128 (2.0%)	39 (5.0%)	34 (4.2%)	7 (3.2%)	9 (9.2%)	405 (6.2%)	40 (4.9%)	25 (1.1%)
Kidney disease	279 (4.4%)	60 (7.6%)	52 (6.5%)	22 (10.1%)	7 (7.1%)	507 (7.7%)	42 (5.1%)	36 (1.6%)
Liver disease	146 (2.3%)	15 (1.9%)	38 (4.7%)	5 (2.3%)	8 (8.2%)	145 (2.2%)	13 (1.6%)	18 (0.8%)
Immunosuppression								
Cancer	121 (1.9%)	23 (2.9%)	26 (3.2%)	4 (1.8%)	4 (4.1%)	295 (4.5%)	13 (1.6%)	17 (0.8%)
HIV/AIDS	8 (0.1%)	3 (0.4%)	2 (0.2%)	1 (0.5%)	0 (0.0%)	18 (0.3%)	0 (0.0%)	3 (0.1%)
Solid organ transplant	24 (0.4%)	2 (0.3%)	5 (0.6%)	0 (0.0%)	0 (0.0%)	20 (0.3%)	1 (0.1%)	5 (0.2%)
Charlson Comorbidity Index	0.0 (0.0 - 2.0)	1.0 (0.0 - 3.0)	1.0 (0.0 - 3.0)	1.0 (0.0 - 2.0)	1.0 (0.0 - 3.0)	1.0 (0.0 - 4.0)	1.0 (0.0 - 3.0)	0.0 (0.0 - 1.0)
Location of Testing								
Emergency	2,230 (35.3%)	272 (34.6%)	164 (20.4%)	64 (29.4%)	24 (24.5%)	1,168 (17.8%)	244 (29.7%)	131 (5.9%)
Inpatient	1,277 (20.2%)	177 (22.5%)	210 (26.2%)	54 (24.8%)	27 (27.6%)	1,500 (22.9%)	198 (24.1%)	142 (6.4%)
Urgent care	565 (8.9%)	76 (9.7%)	97 (12.1%)	38 (17.4%)	9 (9.2%)	1,112 (17.0%)	123 (15.0%)	216 (9.7%)
Other outpatient	2,029 (32.1%)	232 (29.5%)	311 (38.8%)	47 (21.6%)	33 (33.7%)	2,393 (36.5%)	227 (27.6%)	1,602 (72.1%)

Table 3. Characteristics of patients hospitalized with COVID-19 by race/ethnicity

	Hispanic No. (%)	Black No. (%)	Asian No. (%)	NH/PI No. (%)	AI/AN No. (%)	White No. (%)	Other No. (%)	Unknown No. (%)
Demographic characteristics								
Total no. of patients	1,275	163	195	51	25	1,318	173	121
Age	57.0 ± 16.8	60.7 ± 17.8	66.0 ± 17.6	52.9 ± 17.2	59.7 ± 17.9	71.0 ± 16.8	63.4 ± 16.8	60.2 ± 18.4
Sex								
Female	523 (41.0%)	70 (42.9%)	97 (49.7%)	24 (47.1%)	13 (52.0%)	618 (46.9%)	78 (45.1%)	50 (41.3%)
Male	752 (59.0%)	93 (57.1%)	98 (50.3%)	27 (52.9%)	12 (48.0%)	700 (53.1%)	95 (54.9%)	71 (58.7%)
Insurance								
Commercial	257 (20.2%)	30 (18.4%)	55 (28.2%)	19 (37.3%)	1 (4.0%)	195 (14.8%)	41 (23.7%)	29 (24.0%)
Medicaid	818 (64.2%)	109 (66.9%)	90 (46.2%)	24 (47.1%)	19 (76.0%)	530 (40.2%)	90 (52.0%)	62 (51.2%)
Medicare	138 (10.8%)	20 (12.3%)	45 (23.1%)	6 (11.8%)	5 (20.0%)	580 (44.0%)	38 (22.0%)	26 (21.5%)
Uninsured/Self-pay	58 (4.5%)	4 (2.5%)	4 (2.1%)	2 (3.9%)	0 (0.0%)	11 (0.8%)	4 (2.3%)	4 (3.3%)
Other insurance	3 (0.2%)	0 (0.0%)	1 (0.5%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Neighborhood demographics								
% Poverty	15.9 ± 6.2	14.4 ± 6.8	11.8 ± 5.7	15.0 ± 6.8	15.2 ± 8.3	11.7 ± 5.6	13.1 ± 6.7	13.3 ± 6.0
% Crowded housing	12.0 ± 7.7	8.2 ± 6.8	6.4 ± 5.6	4.3 ± 4.0	4.6 ± 3.6	4.7 ± 4.4	6.5 ± 6.0	5.6 ± 4.9
% Minority	66.0 ± 24.6	60.6 ± 26.7	51.8 ± 20.2	33.4 ± 21.9	40.1 ± 22.7	36.3 ± 20.6	47.1 ± 23.0	41.3 ± 21.3
% Limited English	22.4 ± 10.5	16.6 ± 9.2	16.2 ± 9.2	9.0 ± 7.6	9.5 ± 7.4	10.8 ± 8.9	15.2 ± 10.0	12.1 ± 9.0
Comorbidities								
Hypertension	341 (26.7%)	79 (48.5%)	95 (48.7%)	21 (41.2%)	9 (36.0%)	600 (45.5%)	68 (39.3%)	45 (37.2%)
Diabetes	362/1,272 (28.5%)	61 (37.4%)	63 (32.3%)	21 (41.2%)	5 (20.0%)	317/1,317 (24.1%)	43 (24.9%)	36 (29.8%)
BMI								
Underweight	26/1,271 (2.0%)	7/162 (4.3%)	14/194 (7.2%)	2 (3.9%)	1 (4.0%)	51/1,313 (3.9%)	3/170 (1.8%)	3 (2.5%)
Normal	222/1,271 (17.5%)	39/162 (24.1%)	82/194 (42.3%)	9 (17.6%)	5 (20.0%)	381/1,313 (29.0%)	43/170 (25.3%)	30 (24.8%)
Overweight	425/1,271 (33.4%)	52/162 (32.1%)	61/194 (31.4%)	16 (31.4%)	8 (32.0%)	378/1,313 (28.8%)	59/170 (34.7%)	43 (35.5%)
Class 1 Obesity	322/1,271 (25.3%)	34/162 (21.0%)	24/194 (12.4%)	8 (15.7%)	3 (12.0%)	248/1,313 (18.9%)	35/170 (20.6%)	15 (12.4%)
Class 2 Obesity	148/1,271 (11.6%)	13/162 (8.0%)	8/194 (4.1%)	10 (19.6%)	4 (16.0%)	123/1,313 (9.4%)	21/170 (12.4%)	21 (17.4%)
Class 3 Obesity	128/1,271 (10.1%)	17/162 (10.5%)	5/194 (2.6%)	6 (11.8%)	4 (16.0%)	132/1,313 (10.1%)	9/170 (5.3%)	9 (7.4%)
Chronic respiratory disease								
Asthma	55 (4.3%)	15 (9.2%)	14 (7.2%)	6 (11.8%)	4 (16.0%)	99 (7.5%)	7 (4.0%)	6 (5.0%)
COPD	20 (1.6%)	18 (11.0%)	9 (4.6%)	2 (3.9%)	4 (16.0%)	169 (12.8%)	10 (5.8%)	6 (5.0%)
Cardiovascular disease								
Coronary artery disease	46 (3.6%)	13 (8.0%)	19 (9.7%)	4 (7.8%)	4 (16.0%)	180 (13.7%)	14 (8.1%)	4 (3.3%)
Myocardial Infarction	33 (2.6%)	12 (7.4%)	13 (6.7%)	3 (5.9%)	1 (4.0%)	74 (5.6%)	16 (9.2%)	7 (5.8%)
Congestive heart failure	74 (5.8%)	24 (14.7%)	23 (11.8%)	4 (7.8%)	6 (24.0%)	232 (17.6%)	21 (12.1%)	13 (10.7%)
Kidney disease	159 (12.5%)	32 (19.6%)	36 (18.5%)	10 (19.6%)	3 (12.0%)	273 (20.7%)	21 (12.1%)	16 (13.2%)
Liver disease	36/1,272 (2.8%)	3 (1.8%)	12 (6.2%)	2 (3.9%)	3 (12.0%)	57/1,317 (4.3%)	3 (1.7%)	9 (7.4%)
Immunosuppression								
Cancer	45/1,272 (3.5%)	14 (8.6%)	11 (5.6%)	1 (2.0%)	3 (12.0%)	113/1,317 (8.6%)	7 (4.0%)	7 (5.8%)
HIV/AIDS	4 (0.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	5 (0.4%)	0 (0.0%)	1 (0.8%)
Solid organ transplant	15 (1.2%)	0 (0.0%)	2 (1.0%)	0 (0.0%)	0 (0.0%)	9 (0.7%)	1 (0.6%)	2 (1.7%)
Charlson Comorbidity Index	2.0 (1.0 - 4.0)	3.0 (1.0 - 6.0)	4.0 (2.0 - 6.0)	2.0 (1.0 - 4.0)	4.0 (1.0 - 6.0)	5.0 (3.0 - 7.0)	3.0 (1.0 - 5.0)	3.0 (1.0 - 5.0)
Presenting Vital Signs								
Temperature ≥ 38ºC	355/1,199 (29.6%)	39/152 (25.7%)	51/187 (27.3%)	8/50 (16.0%)	7/24 (29.2%)	303/1,238 (24.5%)	29/157 (18.5%)	24/111 (21.6%)
Oxygen saturation < 94%	573 (44.9%)	48 (29.4%)	75 (38.5%)	18 (35.3%)	9 (36.0%)	494 (37.5%)	64 (37.0%)	50 (41.3%)

Respiration rate > 24 breaths/min	459/1,263 (36.3%)	39/161 (24.2%)	71/193 (36.8%)	17/50 (34.0%)	8 (32.0%)	333/1,302 (25.6%)	47/170 (27.6%)	42/119 (35.3%)
Systolic blood pressure, mmHg	132.0 (118.0 - 146.0)	130.0 (116.0 - 146.8)	132.0 (118.0 - 146.0)	123.0 (110.0 - 144.0)	138.0 (122.0 - 144.0)	131.0 (116.0 - 148.0)	132.0 (119.0 - 146.0)	128.5 (116.8 - 143.0)
Diastolic blood pressure, mmHg	73.0 (64.0 - 83.0)	76.0 (64.2 - 82.8)	75.0 (66.0 - 85.0)	70.0 (64.5 - 82.0)	80.0 (73.0 - 94.0)	72.0 (63.0 - 83.0)	74.0 (65.0 - 83.0)	75.0 (64.0 - 84.2)
Baseline Clinical Labs								
White blood cell > 12 x10^9/L	190/1,252 (15.2%)	21/158 (13.3%)	20/193 (10.4%)	10/50 (20.0%)	6 (24.0%)	152/1,288 (11.8%)	15/168 (8.9%)	14/116 (12.1%)
Lymphocyte < 1 x10^9/L	664/1,192 (55.7%)	67/144 (46.5%)	108/187 (57.8%)	22/46 (47.8%)	14/22 (63.6%)	663/1,212 (54.7%)	80/157 (51.0%)	60/107 (56.1%)
Platelet, < 150,000 x10^9/L	216/1,251 (17.3%)	28/158 (17.7%)	44/193 (22.8%)	10/50 (20.0%)	4 (16.0%)	311/1,287 (24.2%)	38/168 (22.6%)	23/116 (19.8%)
Aspartate transaminase > 40 U/L	628/1,172 (53.6%)	60/144 (41.7%)	119/183 (65.0%)	26/47 (55.3%)	12 (48.0%)	507/1,201 (42.2%)	75/159 (47.2%)	52/108 (48.1%)
Alanine transaminase > 40 U/L	461/1,169 (39.4%)	33/139 (23.7%)	80/182 (44.0%)	20/46 (43.5%)	3 (12.0%)	314/1,198 (26.2%)	60/159 (37.7%)	45/105 (42.9%)
Procalcitonin > 0.5 ng/ML	195/974 (20.0%)	29/108 (26.9%)	34/162 (21.0%)	10/34 (29.4%)	5/16 (31.2%)	150/930 (16.1%)	21/116 (18.1%)	23/88 (26.1%)
Blood urea nitrogen > 20 mg/dL	359/1,247 (28.8%)	61/154 (39.6%)	76/193 (39.4%)	20/49 (40.8%)	6 (24.0%)	581/1,286 (45.2%)	54/164 (32.9%)	47/117 (40.2%)
Creatinine > 1.5 mg/dL	165/1,247 (13.2%)	37/155 (23.9%)	33/193 (17.1%)	12/50 (24.0%)	5 (20.0%)	225/1,287 (17.5%)	29/164 (17.7%)	19/117 (16.2%)
Total bilirubin > 1.2 mg/dL	44/980 (4.5%)	11/140 (7.9%)	12/181 (6.6%)	6/45 (13.3%)	5/23 (21.7%)	55/1,071 (5.1%)	5/145 (3.4%)	6/99 (6.1%)
Sodium < 130 mmol/L	97/1,247 (7.8%)	4/154 (2.6%)	18/193 (9.3%)	7/49 (14.3%)	4 (16.0%)	49/1,286 (3.8%)	8/164 (4.9%)	9/117 (7.7%)
B-type natriuretic peptide > 100 pg/mL	266/571 (46.6%)	17/67 (25.4%)	36/70 (51.4%)	2/13 (15.4%)	4/7 (57.1%)	273/483 (56.5%)	44/77 (57.1%)	23/35 (65.7%)
C-reactive protein > 10 ng/mL	530/854 (62.1%)	60/98 (61.2%)	83/134 (61.9%)	15/27 (55.6%)	6/9 (66.7%)	361/677 (53.3%)	59/108 (54.6%)	44/65 (67.7%)
Ferritin > 300 ng/ml	638/832 (76.7%)	54/82 (65.9%)	82/110 (74.5%)	18/22 (81.8%)	3/8 (37.5%)	374/562 (66.5%)	74/100 (74.0%)	37/58 (63.8%)
Venous lactate > 2 mmol/L	136/830 (16.4%)	13/76 (17.1%)	19/102 (18.6%)	10/34 (29.4%)	4/16 (25.0%)	131/771 (17.0%)	20/98 (20.4%)	8/54 (14.8%)
Acute Diagnosis								
Pneumonia	169 (13.3%)	24 (14.7%)	24 (12.3%)	6 (11.8%)	6 (24.0%)	198 (15.0%)	19 (11.0%)	19 (15.7%)
ARDS	67 (5.3%)	3 (1.8%)	12 (6.2%)	2 (3.9%)	2 (8.0%)	42 (3.2%)	10 (5.8%)	12 (9.9%)
Lower respiratory infection	135 (10.6%)	31 (19.0%)	27 (13.8%)	6 (11.8%)	4 (16.0%)	203 (15.4%)	33 (19.1%)	14 (11.6%)
Respiratory failure	274 (21.5%)	24 (14.7%)	32 (16.4%)	9 (17.6%)	5 (20.0%)	190 (14.4%)	25 (14.5%)	19 (15.7%)
Baseline WHO Ordinal Scale								
WHO Score 3	632/1,273 (49.6%)	97/161 (60.2%)	103 (52.8%)	27 (52.9%)	15 (60.0%)	702 (53.3%)	91/172 (52.9%)	67 (55.4%)
WHO Score 4	508/1,273 (39.9%)	52/161 (32.3%)	79 (40.5%)	20 (39.2%)	5 (20.0%)	535 (40.6%)	70/172 (40.7%)	42 (34.7%)
WHO Score 5	76/1,273 (6.0%)	5/161 (3.1%)	7 (3.6%)	2 (3.9%)	3 (12.0%)	50 (3.8%)	6/172 (3.5%)	5 (4.1%)
WHO Score 6	28/1,273 (2.2%)	5/161 (3.1%)	2 (1.0%)	2 (3.9%)	0 (0.0%)	16 (1.2%)	2/172 (1.2%)	5 (4.1%)
WHO Score 7	29/1,273 (2.3%)	2/161 (1.2%)	4 (2.1%)	0 (0.0%)	2 (8.0%)	15 (1.1%)	3/172 (1.7%)	2 (1.7%)
Clinical Course								
ICU admissions	478 (37.5%)	57 (35.0%)	83 (42.6%)	15 (29.4%)	9 (36.0%)	453 (34.4%)	83 (48.0%)	50 (41.3%)
Mechanical ventilation	268 (21.0%)	27 (16.6%)	34 (17.4%)	8 (15.7%)	5 (20.0%)	166 (12.6%)	30 (17.3%)	25 (20.7%)
Hospital mortality	149 (11.7%)	22 (13.5%)	23 (11.8%)	7 (13.7%)	7 (28.0%)	230 (17.5%)	21 (12.1%)	13 (10.7%)
Time to hospital mortality	14.0 (7.0 - 21.0)	8.0 (4.2 - 9.8)	11.0 (5.5 - 14.5)	11.0 (6.0 - 21.5)	11.0 (5.5 - 20.5)	8.0 (4.0 - 12.0)	8.0 (6.0 - 13.0)	13.0 (2.0 - 16.0)
Discharged alive	1,120 (87.8%)	141 (86.5%)	172 (88.2%)	44 (86.3%)	16 (64.0%)	1,086 (82.4%)	152 (87.9%)	108 (89.3%)
Length of hospitalization	6.0 (3.0 - 11.0)	6.0 (3.0 - 12.0)	8.0 (4.0 - 12.2)	5.0 (2.0 - 12.0)	8.5 (4.5 - 14.5)	6.0 (3.0 - 11.0)	6.0 (3.0 - 10.0)	6.5 (4.0 - 14.0)
Continued hospitalization	6 (0.5%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	2 (8.0%)	2 (0.2%)	0 (0.0%)	0 (0.0%)

Table 4. Factors associated with SARS-CoV-2 infection and COVID-19 hospitalization

	Odds Ratio for Testing Positive		Odds ratio for Hospitalization	
Variable	Unadjusted	Multivariate	Unadjusted	Multivariate
White	(ref)	(ref)	(ref)	(ref)
Hispanic	4.98 (4.79 - 5.19)	3.68 (3.52 - 3.84)	0.74 (0.68 - 0.82)	1.49 (1.32 - 1.69)
Black	2.18 (2.02 - 2.36)	1.78 (1.64 - 1.93)	0.87 (0.73 - 1.05)	1.29 (1.04 - 1.6)
Asian	1.74 (1.61 - 1.88)	1.58 (1.47 - 1.71)	1.1 (0.92 - 1.31)	1.5 (1.22 - 1.85)
NH/PI	4.02 (3.48 - 4.65)	3.42 (2.95 - 3.96)	1.47 (1.07 - 2.02)	2.13 (1.48 - 3.06)
AI/AN	1.29 (1.05 - 1.58)	1.14 (0.93 - 1.4)	1.15 (0.73 - 1.82)	1.42 (0.84 - 2.4)
Other	2.32 (2.15 - 2.5)	2.01 (1.86 - 2.17)	0.9 (0.76 - 1.08)	1.29 (1.05 - 1.58)
Unknown	1.98 (1.88 - 2.08)	1.54 (1.45 - 1.63)	0.19 (0.15 - 0.23)	0.54 (0.44 - 0.66)
Age	0.8 (0.79 - 0.81)	1.2 (1.17 - 1.23)	3.13 (2.99 - 3.28)	2.53 (2.33 - 2.75)
Age-squared	1.05 (1.03 - 1.06)	1.18 (1.16 - 1.2)	1.52 (1.47 - 1.57)	0.78 (0.74 - 0.83)
Female	(ref)	(ref)	(ref)	(ref)
Male	1.25 (1.21 - 1.29)	1.32 (1.28 - 1.36)	1.46 (1.36 - 1.58)	1.66 (1.52 - 1.81)
Charlson Comorbidity Index	0.92 (0.91 - 0.93)	0.94 (0.93 - 0.95)	1.46 (1.43 - 1.48)	1.15 (1.13 - 1.18)
Hypertension	0.94 (0.81 - 1.08)	0.89 (0.85 - 0.94)	0.97 (0.78 - 1.21)	1.27 (1.15 - 1.42)
Underweight	1.24 (1.18 - 1.29)	0.99 (0.85 - 1.16)	1 (0.9 - 1.1)	1.46 (1.1 - 1.95)
Normal	(ref)	(ref)	(ref)	(ref)
Overweight	1.32 (1.26 - 1.38)	1.14 (1.09 - 1.19)	0.99 (0.88 - 1.1)	0.96 (0.85 - 1.09)
Class 1 Obesity	1.38 (1.3 - 1.46)	1.17 (1.12 - 1.23)	1.03 (0.89 - 1.18)	1.05 (0.91 - 1.2)
Class 2 Obesity	1.33 (1.24 - 1.42)	1.22 (1.14 - 1.29)	1.29 (1.11 - 1.5)	1.37 (1.16 - 1.62)
Class 3 Obesity	0.72 (0.69 - 0.75)	1.21 (1.13 - 1.29)	3.97 (3.64 - 4.32)	1.77 (1.48 - 2.11)
Commercial Insurance	(ref)	(ref)	(ref)	(ref)
Medicaid	1.52 (1.47 - 1.58)	1.2 (1.16 - 1.25)	3.17 (2.87 - 3.49)	2.57 (2.3 - 2.87)
Medicare	0.55 (0.52 - 0.58)	0.56 (0.53 - 0.6)	7.77 (6.88 - 8.77)	1.86 (1.6 - 2.16)
Uninsured/Self-pay	2.59 (2.44 - 2.76)	1.86 (1.74 - 1.98)	0.56 (0.44 - 0.7)	0.72 (0.57 - 0.92)
% Poverty	1.27 (1.25 - 1.29)	1.01 (0.99 - 1.03)	1.01 (0.97 - 1.06)	1.09 (1.02 - 1.16)
% Crowded housing	1.35 (1.33 - 1.37)	1.03 (1 - 1.06)	0.93 (0.89 - 0.98)	0.96 (0.86 - 1.07)
% Minority	1.6 (1.57 - 1.64)	1.11 (1.07 - 1.15)	0.86 (0.82 - 0.92)	0.89 (0.79 - 1)
% Limited English	1.46 (1.44 - 1.49)	1.1 (1.06 - 1.14)	0.97 (0.92 - 1.02)	1.08 (0.96 - 1.22)
Resurgence Period	1.07 (1.04 - 1.11)	1.05 (1.01 - 1.08)	0.56 (0.51 - 0.6)	0.81 (0.74 - 0.88)

Table 5. Factors associated with COVID-19 hospital mortality

	Odds ratio for Hospital Mortality			
Variable	Unadjusted	Multivariate	Under 70	Over 70
White	(ref)	(ref)	(ref)	(ref)
Hispanic	0.63 (0.5 - 0.79)	1.34 (0.97 - 1.86)	1.05 (0.62 - 1.8)	1.8 (1.17 - 2.76)
Black	0.7 (0.43 - 1.13)	1.19 (0.67 - 2.1)	0.78 (0.31 - 2)	1.56 (0.73 - 3.34)
Asian	0.64 (0.4 - 1.01)	0.76 (0.44 - 1.3)	1.43 (0.61 - 3.4)	0.55 (0.27 - 1.11)
NH/PI	0.74 (0.32 - 1.67)	1.41 (0.54 - 3.7)	1.43 (0.41 - 4.99)	1.61 (0.32 - 8.24)
AI/AN	1.73 (0.71 - 4.23)	2.7 (0.89 - 8.26)	1.69 (0.25 - 11.39)	4.38 (0.95 - 20.12)
Other	0.64 (0.39 - 1.03)	1.15 (0.66 - 2.01)	1.06 (0.39 - 2.85)	1.23 (0.62 - 2.45)
Unknown	0.57 (0.31 - 1.03)	0.88 (0.46 - 1.71)	1.36 (0.52 - 3.53)	0.57 (0.22 - 1.51)
Age	2.37 (2.1 - 2.68)	2.36 (1.86 - 2.98)	1.93 (1.44 - 2.61)	1.34 (1.13 - 1.6)
Age-squared	0.89 (0.8 - 0.99)	0.82 (0.69 - 0.98)	1.12 (0.83 - 1.52)	0.93 (0.8 - 1.08)
Female	(ref)	(ref)	(ref)	(ref)
Male	1.44 (1.18 - 1.76)	1.39 (1.1 - 1.77)	1.14 (0.75 - 1.72)	1.58 (1.16 - 2.14)
Charlson Comorbidity Index	1.23 (1.19 - 1.26)	1.11 (1.05 - 1.16)	1.15 (1.06 - 1.25)	1.07 (1 - 1.14)
Hypertension	1.28 (1.05 - 1.56)	0.74 (0.58 - 0.95)	0.61 (0.39 - 0.96)	0.81 (0.59 - 1.11)
Underweight	1.51 (0.92 - 2.47)	1.31 (0.75 - 2.27)	1.8 (0.52 - 6.19)	1.36 (0.71 - 2.58)
Normal	(ref)	(ref)	(ref)	(ref)
Overweight	0.84 (0.65 - 1.09)	1.11 (0.83 - 1.49)	1.13 (0.61 - 2.11)	1.16 (0.82 - 1.64)
Class 1 Obesity	0.76 (0.57 - 1.02)	1.32 (0.93 - 1.86)	2.1 (1.12 - 3.96)	1.04 (0.66 - 1.64)
Class 2 Obesity	0.57 (0.39 - 0.85)	1.3 (0.82 - 2.06)	1.63 (0.76 - 3.5)	1.29 (0.68 - 2.46)
Class 3 Obesity	0.7 (0.47 - 1.03)	1.89 (1.17 - 3.05)	3.12 (1.5 - 6.5)	1.16 (0.53 - 2.53)
Commercial Insurance	(ref)	(ref)	(ref)	(ref)
Medicaid	2.92 (1.99 - 4.28)	1.55 (1 - 2.4)	1.57 (0.94 - 2.63)	0.98 (0.34 - 2.8)
Medicare	5.34 (3.61 - 7.9)	1.54 (0.96 - 2.45)	1.44 (0.72 - 2.89)	0.94 (0.33 - 2.7)
Uninsured/Self-pay	2.69 (1.29 - 5.59)	2.32 (1 - 5.4)	2.63 (0.93 - 7.39)	1.19 (0.21 - 6.66)
% Poverty	0.87 (0.78 - 0.97)	0.92 (0.79 - 1.07)	0.92 (0.73 - 1.15)	0.91 (0.76 - 1.1)
% Crowded housing	0.93 (0.83 - 1.05)	1.19 (0.89 - 1.58)	0.86 (0.53 - 1.39)	1.41 (1 - 1.98)
% Minority	0.89 (0.78 - 1.01)	0.82 (0.62 - 1.08)	0.74 (0.47 - 1.16)	0.82 (0.58 - 1.15)
% Limited English	0.91 (0.8 - 1.02)	1.01 (0.74 - 1.37)	1.4 (0.84 - 2.33)	0.88 (0.6 - 1.29)
Resurgence Period	0.63 (0.51 - 0.77)	0.63 (0.5 - 0.8)	0.67 (0.45 - 0.99)	0.57 (0.42 - 0.77)
WHO Score 3	(ref)	(ref)	(ref)	(ref)
WHO Score 4	1.99 (1.59 - 2.49)	1.86 (1.46 - 2.38)	1.44 (0.93 - 2.24)	2.25 (1.66 - 3.05)
WHO Score 5	6.54 (4.53 - 9.45)	5.52 (3.6 - 8.47)	5.77 (3.03 - 11)	6.35 (3.43 - 11.74)
WHO Score 6	6.34 (3.64 - 11.04)	5.39 (2.82 - 10.31)	5.73 (2.3 - 14.3)	6.88 (2.54 - 18.63)
WHO Score 7	9.48 (5.47 - 16.42)	7.2 (3.79 - 13.68)	7.14 (2.78 - 18.3)	8.95 (3.4 - 23.51)
WBC > 12 x10^9/L	2.58 (2.06 - 3.23)	2.1 (1.58 - 2.78)	1.8 (1.11 - 2.94)	2.29 (1.6 - 3.27)
Lymphocyte < 1 x10^9/L	1.62 (1.31 - 2)	1.36 (1.07 - 1.74)	1.21 (0.79 - 1.86)	1.44 (1.06 - 1.97)
Platelet, < 150,000 x10^9/L	1.85 (1.48 - 2.3)	1.56 (1.21 - 2.03)	2.6 (1.68 - 4.02)	1.25 (0.9 - 1.73)
AST > 40 U/L	1.66 (1.36 - 2.04)	1.84 (1.41 - 2.4)	1.12 (0.74 - 1.69)	2.29 (1.69 - 3.1)
BUN > 20 mg/dL	4.34 (3.52 - 5.36)	0.94 (0.7 - 1.25)	2.39 (1.49 - 3.82)	1.54 (1.09 - 2.18)
Creatinine > 1.5 mg/dL	3.1 (2.48 - 3.88)	1.83 (1.39 - 2.4)	0.94 (0.54 - 1.62)	1.46 (1.02 - 2.09)
Total bilirubin > 1.2 mg/dL	1.77 (1.21 - 2.6)	1.3 (0.97 - 1.74)	1.44 (0.7 - 2.98)	1.22 (0.68 - 2.2)
Sodium < 130 mmol/L	1.14 (0.76 - 1.69)	1.33 (0.85 - 2.08)	1.34 (0.67 - 2.67)	0.72 (0.37 - 1.38)