

How Do Presenting Symptoms and Outcomes Differ by Race/Ethnicity Among Hospitalized Patients with COVID-19 Infection? Experience in Massachusetts

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Summary: While early observations suggest SARS-CoV-2 infection disproportionately affects racial/ethnic minorities, patient-level examination of hospitalization outcomes remained limited. Among hospitalized COVID-19 patients, we found no association between race/ethnicity and clinical outcomes (ICU admission, mechanical ventilation, in-hospital mortality), after controlling for comorbidities.

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ABSTRACT

Background: Population-based literature suggest SARS-CoV-2 infection may disproportionately affect racial/ethnic minorities; however, patient-level observations of hospitalization outcomes by race/ethnicity are limited. The aim of this study was to characterize COVID-19-associated morbidity and in-hospital mortality by race/ethnicity.

Methods: This was a retrospective analysis of nine Massachusetts hospitals including all consecutive adult patients hospitalized with laboratory-confirmed COVID-19. Measured outcomes were assessed and compared by patient-reported race/ethnicity, classified as White, Black, Latinx, Asian, or other. Students t-test, Fischer exact test, and multivariable regression analyses were performed.

Results: 379 patients (62.9±16.5 years; 55.7% men) with confirmed COVID-19 were included (49.9% White, 13.7% Black, 29.8% Latinx, 3.7% Asian), of which 376 (99.2%) were insured (34.3% private, 41.2% public, 23.8% public with supplement). Latinx patients were younger, had fewer cardiopulmonary disorders, were more likely to have obesity, more frequently reported fever and myalgia, and had lower D-dimer levels compared to White patients ($p<0.05$). On multivariable analysis controlling for age, gender, obesity, cardiopulmonary comorbidities, hypertension, and diabetes, no significant differences in in-hospital mortality, ICU admission, or mechanical ventilation by race/ethnicity were found. Diabetes was a significant predictor for mechanical ventilation (OR 1.89; 95% CI 1.11-3.23) while older age was a predictor of in-hospital mortality (OR 4.18; 95% CI 1.94-9.04).

Conclusions: In this multi-center cohort of hospitalized COVID-19 patients in the largest health system in Massachusetts, there was no association between race/ethnicity and clinically relevant hospitalization outcomes, including in-hospital mortality, after controlling for key demographic/clinical characteristics. These findings serve to refute suggestions that certain races/ethnicities may be biologically predisposed to poorer COVID-19 outcomes.

Keywords: Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2); Coronavirus disease 2019 (COVID-19); Healthcare Disparities; Race/Ethnicity

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INTRODUCTION

Since severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection was first detected in Wuhan, China in 2019, the single-stranded RNA virus has led to life-threatening disease that has reached pandemic proportions (1, 2). This novel virus, which causes coronavirus disease 2019 (COVID-19), has impacted over 200 countries; however, the United States (U.S.) has surpassed all other countries in number of laboratory-confirmed cases of COVID-19 and associated deaths. As the U.S. has become the epicenter of the SARS-CoV-2 crisis, large-scale studies to examine manifestations of the disease and health-related outcomes are beginning to shed light on the impact of this pandemic nationwide (1, 3).

Alongside this sharp rise in U.S. COVID-19 cases, population-level concerns have emerged regarding the virus disproportionately impacting racial/ethnic minorities. Recently released data by the U.S. Centers for Disease Control and Prevention (CDC) found that Black individuals have a higher rate of hospitalization than their White counterparts – suggesting this group may be disproportionately affected by COVID-19 with higher infection rates, higher disease severity, or both (4). Despite these early observations, patient-level studies with granular clinical data examining how presenting symptoms, co-morbid conditions, baseline patient characteristics, and clinical outcomes differ by race/ethnicity among hospitalized adults with COVID-19 are lacking. The primary aim of this study was to assess presenting symptoms and clinically relevant hospitalization outcomes of COVID-19, and how they differ by race/ethnicity in a large hospital system in Massachusetts.

METHODS

This was a multi-center, retrospective analysis including all consecutive adult patients age ≥ 18 years hospitalized between March 22, 2020 through April 2, 2020 with a laboratory-confirmed diagnosis of COVID-19. SARS-CoV-2 infection was confirmed in all cases via polymerase-chain reaction (PCR) nasopharyngeal swab testing. All patients who had completed hospitalization (i.e., discharge or death) were included. Data was collected from the two tertiary medical centers and the seven community hospitals which comprise Mass General Brigham (formerly Partners Healthcare); all of which are located in Massachusetts. Study approval was obtained from the Partners Healthcare Institutional Review Board (2020P0000983).

Patient characteristics, including gender, race/ethnicity, age, health insurance status, body mass index (BMI, kg/m^2), pre-existing comorbid medical conditions, COVID-19 associated symptoms at time of initial presentation, initial laboratory data, clinical course, and clinical outcomes, including use of mechanical ventilation and in-hospital mortality, were abstracted manually from electronic medical records using a structured abstraction tool. Race/ethnicity information was self-reported and classified as White, Black, Latinx, Asian, or other by patients at the time of initial telephone hospital registration, first emergency department presentation, or hospital admission. All patients in our hospital system are asked standard questions with validated explanations and examples to guide them in accurately reporting their race and ethnicity.

Continuous variables were expressed as means and standard deviations, with categorical data reported using numbers and frequencies. Each of these patient level characteristics were then compared by race/ethnicity. Univariate analyses were performed using Students t-test or Fisher-exact test. Multivariable analyses were performed using logistic regression. All data were analyzed using Statistical Analysis Software 9.4 (SAS Institute Inc., Cary, NC, USA).

RESULTS

Of 386 patients hospitalized for COVID-19 infection during the study period, a total of 379 (98.2%) had completed hospitalization (discharge or death) and met inclusion criteria at the time of analysis. The mean age of the included cohort was 62.9 ± 16.5 years and a majority (55.7%) were men. Within this cohort, 189 (49.9%) patients identified as White, 52 (13.7%) as Black, 113 (29.8%) as Latinx, 14 (3.7%) as Asian, and 11 (2.9%) as other. Nearly all patients (99.2%) in the cohort had health insurance, with 34.3% private, 41.2% public, and 23.8% public supplemented with private coverage. White patients were significantly less likely to only have public insurance coverage compared to Latinx (18.0% versus 62.8%, $p < 0.001$) and Black (18.0% versus 40.4%, $p < 0.001$) patients.

Compared to White patients, Latinx patients were significantly younger (53.7 ± 14.5 versus 68.2 ± 15.2 years, $p < 0.001$) and less likely to have a history of pulmonary disorders (10.6% versus 24.3%, $p = 0.003$), cardiac arrhythmias (7.1% versus 21.2%, $p = 0.02$), or hypertension (38.9% versus 62.4%, $p = 0.01$). However, Latinx patients were more likely to be obese ($\text{BMI} \geq 30 \text{ kg/m}^2$; 56.6% versus 40.7% $p = 0.03$) with higher mean BMI compared to White patients (31.8 ± 6.7 versus 29.8 ± 6.5 , $p = 0.03$) (**Table 1**). Black patients were more likely to have a history of diabetes mellitus than Whites (47.1% versus 26.5%, $p = 0.005$). No other significant differences were noted between hospitalized Black patients and White patients with regards to age or comorbid conditions. Of note, Asian patients were the most likely racial/ethnic group to report a diagnosis of diabetes mellitus (57%), although the size of this group was small.

Overall, these COVID-19 patients presented to the hospital with a wide array of symptoms, including systemic, pulmonary, cardiac, and gastrointestinal symptoms, as detailed in **Table 2**. On presentation, Latinx patients more frequently reported fevers (91.2% versus 64.6%, $p = 0.009$) and myalgias (62.0% versus 33.3%, $p = 0.002$). Examination of initial laboratory values revealed higher ALT levels for Latinx patients compared to Whites (48.3 ± 42.9 versus 34.0 ± 31.5 , $p = 0.002$). Black, Latinx,

and Asian patients all had lower white blood cell (WBC) counts on average than did White patients. Otherwise, there were no significant differences in presenting symptoms or laboratory results by race/ethnicity (**Table 2**).

Next, we examined the clinical outcomes of ICU admission, need for mechanical ventilation, and all-cause, in-hospital mortality. Overall, there were 150 (39.6%) ICU admissions (69/189 [36.5%] Whites, 16/52 [30.8%] Blacks, and 54/113 [47.8%] Latinx); most notably with a significantly higher rate of ICU admission among Latinx patients. A total of 135 (35.6%) patients required mechanical ventilatory support, with 96 (71.9%) successfully extubated and 38 (28.1%) deaths (i.e., in-hospital mortality). The need for mechanical ventilator support did not differ significantly by race/ethnicity (62/189 [32.8%] Whites, 16/52 [30.8%] Blacks, and 47/113 [41.6%] Latinx) (**Figure 1a**). When these outcomes were further examined by both gender and race/ethnicity, the difference in rate of ICU admission between Latinx and White patients were mainly driven by the lower ICU admission rate among White women compared to White men and Latinx women. The other relationships between race/ethnicity and the outcomes of ICU admission, need for mechanical ventilator support and in-hospital mortality observed on univariate analyses were similar across genders. On multivariable analysis, using logistic regression controlling for age, obesity, gender, and cardiopulmonary comorbidities, race/ethnicity was not significantly associated with ICU admission or with a need for mechanical ventilation (**Table 3**). There were no significant predictors of ICU admission found in this multivariable analysis; however, male gender and history of diabetes were strong predictors of ICU admission. A history of diabetes mellitus was the only significant predictor of needing mechanical ventilation, while male gender and a history of hypertension or cardiac disease were strong, but non-significant, predictors of needing mechanical ventilation.

Overall, 57 (15.0%) patients in this cohort died during their hospitalization with COVID-19. All-cause, in-hospital mortality was higher among White patients than Black patients (21.1% vs 9.6%, $p=0.058$) and Latinx patients (21.2% vs 8.0%, $p=0.003$), as can be seen in **Figure 1b**. When mortality

was examined by both gender and race/ethnicity, we found that these relationships were similar between male and female patients. On multivariable analysis using logistic regression controlling for age, gender, obesity, and cardiopulmonary comorbidities, no significant association was found between race/ethnicity and in-hospital mortality (**Table 3**). Older age was the only significant predictor of in-hospital mortality (OR 4.18; 95% CI 1.94-9.04) in this multivariable analysis, while a history of diabetes mellitus or hypertension were both strong but non-significant predictors of in-hospital mortality.

DISCUSSION

In the midst and aftermath of pandemics or natural disasters, racial/ethnic minority populations have been shown to have decreased access to healthcare and higher rates of adverse health outcomes (5-7). Additionally, pre-existing societal inequities, many of which are a result of long-standing structural racism, place Black and Latinx communities and individuals at greater risk of being adversely affected by such disasters. Densely populated communities and homes, along with commutes dependent upon public transportation to “essential jobs”, and high co-morbid rates of cardiopulmonary diseases and diabetes mellitus, generally lead to increased rates of transmission and mortality from communicable diseases. Unfortunately, this further exacerbates existing healthcare disparities (8, 9). Consistent with this dire historic trend, a disproportionate impact of the COVID-19 epidemic on Black and Latinx communities has already been well-documented, including substantially higher infection rates, need for hospitalization, and COVID-19-related death (4, 10, 11).

Our study aimed to examine whether hospitalized patients with COVID-19 have similar presenting symptoms and comorbid conditions by race/ethnicity, and whether these patients ultimately have similar outcomes. The state of Massachusetts has developed an excellent dashboard for tracking COVID-19 cases, hospitalizations, and deaths, yet few conclusions can be drawn

regarding how COVID-19 varies in terms of incidence or outcomes by race/ethnicity throughout the state (12), due to the sizable proportion of patients with missing race and ethnicity identity data. It is quite apparent from data available from the city of Boston (13), however, that there is a substantially higher COVID-19 infection rate among Black residents, especially among those from lower income sections of the city. Furthermore, in the neighboring city of Chelsea, which has the highest COVID-19 incidence in Massachusetts, an alarmingly disproportionate infection rate exists among Latinx patients (13-15). Our findings reported here do not refute those data, but rather demonstrate that despite this disproportionate infection rate among Black and Latinx individuals, when their disease is severe enough to require hospitalization, these patients do just as well in terms of important outcomes, including mortality.

Thus, this study provides one of the first insights into the outcomes of patients hospitalized with COVID-19 by race/ethnicity within Boston and in Massachusetts more broadly. These findings are similar to another recent retrospective, patient-level study using coded data from electronic medical records of ambulatory and hospitalized patients in Louisiana (16). In this study of over 3000 patients, Black race was not associated with higher in-hospital mortality when compared to White race, after adjustment for potential confounders. Another study from California demonstrated several sociodemographic and clinical characteristics, including race/ethnicity, were likely to increase the risk of hospitalization – with Black patients having a rate of hospitalization more than double that of White patients even after controlling for confounders (17). While Black patients in Massachusetts may also have a higher likelihood of hospitalization for COVID-19, we did not have the ability to assess this question. Our study specifically performed extensive chart review to examine outcomes and clinically relevant measures that occurred during the hospital stay – finding no significant association between race/ethnicity and key outcomes of hospitalization, including ICU admission, need for mechanical ventilation, and in-hospital mortality.

We found few differences in presenting symptoms or laboratory studies by race/ethnicity. We did, however, find that Black, Latinx, and Asian patients all had lower white blood cell (WBC)

counts on presentation when compared to White patients. This finding of heterogeneity of hematologic parameters among racial/ethnic groups has been described previously, particularly among Black individuals (18, 19). Importantly, however, these lower initial white blood counts were not associated with poorer health outcomes among these non-White patients. In our cohort, hospitalized Latinx patients were younger, with fewer underlying cardiopulmonary comorbidities compared to White patients, and they were significantly more likely to present with fever and myalgias. This may suggest that Latinx patients presented later or with a more severe disease phenotype among younger, healthier patients; although, interestingly, markers of disease severity and risk of deterioration on admission, such as mean D-dimer and ferritin levels, were not statistically different between the groups. Of note, however, Latinx patients had a higher mean BMI, with a majority of them (56.6%) classified as obese. Obesity may be an early marker of impaired metabolic health and has emerged as an important risk factor for severe illness among those with COVID-19 (20). Despite the disproportionate hospitalization rate of Black patients noted by others and the different clinical characteristics of our Latinx cohort, we found no statistically significant difference in hospitalization outcomes based upon race/ethnicity, even after adjusting for age, gender, BMI, and cardiopulmonary comorbidities (4,17).

Our findings may be explained in part by the characteristics of our included population. While multi-center in design, this was a retrospective analysis limited to the largest health system in Massachusetts, a state where the vast majority of residents have health insurance due to healthcare reform in 2006 (21). In fact, nearly every patient (99.2%) in our cohort had some form of health insurance coverage. As demonstrated by prior studies, disparities, while still present, are less prevalent in Massachusetts post healthcare reform, with improved coverage likely mitigating delays in presentation due to lack of insurance or under-insurance and its subsequent financial burden (22, 23). However, our cohort contained a relatively small percentage of Black patients, and the care experience of this group of Black patients may differ from that of Black patients admitted to hospitals serving mostly Black and other patients of color. Therefore, given this healthcare system's

location, as well as the substantial resources available and utilized to treat all patients, our findings may not be generalizable to patients treated at safety net hospitals or in settings where more patients are uninsured or underinsured. It is possible that safety net hospitals and other hospitals primarily serving Black and/or Latinx patients may not be able to achieve similar outcomes as our system – these hospitals are often under-resourced and understaffed, especially in times of crisis such as the current pandemic (16,17, 24). Furthermore, in addition to the delays in evaluation which result from safety-net hospitals being overwhelmed amidst the crisis, patient awareness of resource limitations and hospital constraints may cause patients to delay seeking care, ultimately worsening their outcome (24). While we endeavored to evaluate whether outcomes differed by race or ethnicity within the largest healthcare system within the state of Massachusetts, for the reasons detailed above, our results may not be generalizable to the general U.S. population. Nonetheless, these results provide insight into outcomes by race/ethnicity when there is equal access to care in terms of health insurance coverage and geography, and when the quality of inpatient care is similar, with few resource limitations, including equal access to clinical trials.

There are several important strengths to this study, including the strict enrollment criteria of laboratory-confirmed SARS-CoV-2 infection, patient-level examination of hospitalized cases, inclusion of both tertiary and community hospitals, and the detailed manual review of data, including patient self-identified race/ethnicities. Importantly, our hospital system has a system-wide consistent and validated methodology for collecting patients' self-reported race/ethnicity. These highly accurate data on racial/ethnic self-identity are found in nearly all patients' medical records, with few missing data, which enhances the validity of our analysis and findings. Furthermore, despite this study's modest size, to our knowledge, this is the largest cohort to-date of hospitalized U.S. adults to specifically examine the impact of race/ethnicity on COVID-19 symptoms and health-related outcomes. As of April 2, 2020, there were 8,966 confirmed cases of COVID-19 within the state of Massachusetts – of which 813 were hospitalized (25). Thus 46.6% of all COVID-19 hospitalizations to date in Massachusetts were included in this study. While there is evidence of

Black and Latinx populations being affected and potentially infected at higher rates compared to White individuals (at least in Boston and nearby cities), their outcomes, once hospitalized, did not appear to differ by their race/ethnicity in our cohort.

Our study also has several important limitations. One limitation, mentioned previously, is the high rate of health insurance among residents of the state of Massachusetts, which differs from many other states, thus limiting this study's generalizability to locations in which a higher proportion of the population, especially Black and Latinx individuals, are uninsured or underinsured. A second and related limitation, as detailed above, is that our hospitals may not be representative of the type of setting where most Black and Latinx patients receive care in the U.S. A third limitation is that our study only included patients hospitalized in the early weeks of the COVID-19 pandemic in Massachusetts. While we believe that these weeks are representative of the entire pandemic in the state, it is unknown whether this may have in some way biased our findings. Finally, we only examined outcomes among hospitalized patients. It may be that pre-hospital or post-hospitalization deaths due to COVID-19 may differ by race/ethnicity, and thus remain unaccounted for in this study. This is important as there is evidence of population level disproportionate death rates among Black and Latinx individuals in Massachusetts at the time of the COVID-19 pandemic, which are not explained by our study's findings (26).

In summary, we found no association between race/ethnicity and clinically relevant outcomes of hospitalization, including mortality, among patients hospitalized with COVID-19 in the largest hospital system in Massachusetts, after controlling for key demographic and clinical characteristics. These findings serve to refute potential hypotheses that certain races or ethnicities may be biologically predisposed to poorer outcomes of COVID-19. Furthermore, while societal inequities, including structural racism, have led to higher COVID-19 infection rates and higher hospitalization rates among Black and Latinx individuals in the U.S., our data along with those from Louisiana, demonstrate that these disparities do not necessarily lead to higher in-hospital mortality

rates (10, 16, 27). Further large-scale, population-based studies are needed, particularly in areas with less equitable health insurance coverage and geographic access to care, to further assess both the immediate and long-term differential impact of COVID-19 outcomes by race/ethnicity.

NOTES

Specific author contributions:

Study concept and design – McCarty TR, Hathorn KE, Redd WD, Shen L, Chan WW

Data Acquisition – Redd WD, Zhou JC, Hathorn KE, McCarty TR, Rodriguez NJ, Bazarbashi A, Njie C, Wong, D, Shen L

Paper preparation and statistical analysis – McCarty TR, Hathorn KE, Redd WD, Trinh QD, Zhou JC, Bazarbashi A, Stone VE, Chan WW

Critical revisions – Redd WD, Zhou JC, Hathorn KE, McCarty TR, Bazarbashi A, Njie C, Wong D, Trinh QD, Shen L, Stone VE, Chan WW

Administrative support and overall study supervision – Chan WW

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Potential Conflicts of Interest:

Thomas R. McCarty has no conflicts to disclose.

Kelly E. Hathorn has no conflicts to disclose.

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Cheikh Njie has no conflicts to disclose.

Danny Wong has no conflicts to disclose.

Quoc-Dien Trinh reports personal fees from Astellas, Bayer, Janssen, Insightec and Intuitive Surgical.

Lin Shen has no conflicts to disclose.

Valerie E. Stone has no conflicts to disclose

Walter W. Chan has no conflicts to disclose.

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TABLE LEGENDS

Table 1: Baseline clinical characteristics of hospitalized COVID-19 patient cohort

Table 2: Clinical symptoms and laboratory values of hospitalized of COVID-19 patients on presentation

Table 3: Multivariable models for predictors of need for mechanical ventilation and in-hospital mortality on presentation among hospitalized COVID-19 patients. * History of cardiac disease include a history of coronary artery disease, congestive heart failure, or arrhythmia. # History of pulmonary disorders include a history of asthma, COPD, interstitial lung disease, pulmonary hypertension, pulmonary embolism.

FIGURE LEGENDS

Figure 1: Hospitalization outcomes of patients with COVID-19 infection by race/ethnicity. (A) ICU admission rate and need for mechanical ventilation. (B) All-cause, in-hospital mortality rate.

Table 1: Baseline clinical characteristics of hospitalized COVID-19 patient cohort

	All COVID-19 (N=379)	White (n=189)	Black (n=52)	Latinx (n=113)	Asian (n=14)	Others (n=11)
Age (years, $\pm$ SD)	62.9 $\pm$ 16.5	68.2 $\pm$ 15.2	62.9 $\pm$ 15.4	53.7$\pm$14.5*	69.5 $\pm$ 12.9	58.5 $\pm$ 23.9
Male (n, %)	211 (55.7)	105 (55.6)	25 (48.1)	67 (59.3)	7 (50.0)	7 (63.6)
BMI (kg/m ² , $\pm$ SD)	(55.7)	(55.6)	30.1 $\pm$ 6.9	31.8$\pm$6.7*	26.1 $\pm$ 4.4	28.4 $\pm$ 3.9
Obesity (BMI>30 kg/m ²)	30.3 $\pm$ 6.6	29.8 $\pm$ 6.5	19 (36.5)	64 (56.6)*	3 (21.4)	4 (36.4)
Comorbidities (n, %)	167 (44.1)	77 (40.7)				
Hypertension			35 (67.3)	44 (38.9)*	10 (71.4)	7 (63.6)
Hyperlipidemia		118 (62.4)	20 (38.5)	40 (35.4)	9 (64.3)	4 (36.4)
Diabetes	214 (56.5)		24 (47.1)*	39 (34.5)	8 (57.1)	2 (18.2)
Pulmonary disorders		99 (52.4)	(47.1)*	12 (10.6)*	2 (14.3)	4 (36.4)
Cardiac arrhythmia	172 (45.4)	50 (26.5)	12 (23.1)	8 (7.1)*	2 (14.3)	1 (9.1)
Coronary artery disease		46 (24.3)	6 (11.5)	11 (9.7)	3 (21.4)	3 (27.3)
Thyroid disorders	123 (32.5)	40 (21.2)	6 (11.5)	12 (10.6)*	1 (7.1)	2 (18.2)
Chronic renal insufficiency		31 (16.4)	4 (7.7)	8 (8.0)	1 (7.7)	1 (9.1)
Tobacco use	76 (20.1)	33 (17.5)	7 (14.3)	8 (7.1)	0 (0)	2 (18.2)
Congestive heart failure	57 (15.0)	27 (15.3)	6 (11.5)	10 (8.9)	1 (7.1)	0 (0)
Cerebrovascular accidents	54 (14.3)	26 (13.8)	6 (11.5)	4 (3.5)	0 (0)	0 (0)
Insurance	52 (13.7)	21 (11.2)	2 (3.9)			
Public	44 (12.6)	6 (3.2)				
Private	42 (11.1)			71 (62.8)*	2 (14.3)	2 (18.2)
Combination	38 (10.1)		21 (40.4)*	37 (32.7)	8 (57.1)	6 (54.6)
Private/Public	12 (3.2)	34 (18.0)		3 (2.7)	4 (28.6)	3 (27.3)
No Insurance		82 (43.4)	23 (44.2)	2 (1.8)	0 (0)	0 (0)
		73 (38.6)	7 (13.5)			
	156 (41.2)	0 (0)	1 (1.9)			
	130 (34.3)					
	90 (23.8)					
	3 (0.79)					

* p<0.05 vs White

Table 2: Clinical symptoms and laboratory values of hospitalized of COVID-19 patients at time of presentation

	All COVID-19 (N=379)	White (n=189)	Black (n=52)	Latinx (n=113)	Asian (n=14)	Others (n=11)
General symptoms (n, %)	313 (82.6)	149 (78.8)	42 (80.8)	103 (91.2)*	10 (71.4)	9 (81.8)
Fever	223 (58.8)	122 (64.6)	23 (44.2)*	60 (53.1)	10 (71.4)	8 (72.7)
Fatigue	157 (41.4)	63 (33.3)	12 (23.1)	70 (62.0)*	6 (42.9)	6 (54.6)
Myalgia	94 (24.8)	43 (22.8)	11 (21.2)	35 (31.0)	2 (14.3)	3 (27.3)
Chills	23 (6.1)	16 (8.5)	1 (1.9)	5 (4.4)	0 (0)	1 (9.1)
Diaphoresis	14 (3.7)	8 (4.2)	1 (1.9)	4 (3.5)	0 (0)	1 (9.1)
Arthralgia	302 (79.7)	153 (81.0)	38 (73.1)	93 (82.3)	9 (64.3)	9 (81.8)
Airway symptoms (n, %)	242 (63.9)	116 (61.4)	30 (57.7)	80 (70.8)	6 (42.9)	10 (90.1))
Cough	71 (18.8)	37 (19.6)	3 (5.9)	29 (25.7)	1 (7.1)	1 (9.1)
Dyspnea	60 (15.8)	32 (16.9)	13 (25.0)	13 (11.5)	1 (7.1)	1 (9.1)
Sore throat	56 (14.8)	28 (14.8)	4 (7.8)	22 (19.5)	1 (7.1)	1 (9.1)
Sputum production	36 (9.5)	18 (9.5)	5 (9.6)	10 (8.9)	0 (0)	3 (27.3)
Rhinorrhea	27 (7.2)	11 (5.9)	5 (9.8)	9 (8.0)	1 (7.1)	1 (9.1)
Loss of smell or taste (n, %)	136 (36.0)	70 (37.0)	21 (41.2)	36 (31.9)	4 (28.6)	5 (45.5)
Anosmia	124 (32.7)	69 (36.5)	13 (25.0)	36 (31.9)	3 (21.4)	3 (27.3)
Ageusia	98 (25.9)	49 (25.9)	12 (23.1)	27 (23.9)	7 (50.0)	3 (27.3)
Gastrointestinal symptoms (n, %)	58 (15.3)	31 (16.4)	6 (11.5)	16 (14.2)	4 (28.6)	1 (9.1)
Anorexia	54 (14.3)	24 (12.8)	7 (13.5)	21 (38.9)	1 (7.1)	1 (9.1)
Diarrhea	41 (10.9)	28 (14.9)	5 (9.6)	6 (5.3)	2 (14.3)	0 (0)
Nausea	7.7±9.5	8.6±13.2	6.6±2.7	6.8±2.9	6.7±2.7	8.2±2.9
Vomiting	1.7±8.2	2.3±11.6	1.2±0.9	1.2±1.0	0.78±0.35	1.0±0.6
Abdominal pain	18.2±12.8	18.3±11.5	17.0±12.0	17.2±9.8	26.4±36.1	17.3±9.8
Weight loss	196.5±83.2	190.5±82.7	209.8±101.1	198.7±79.0	180.8±53.3	218.5±67.3
Laboratory results	1.22±0.47	1.29±0.56	2	1.12±0.20	1.11±0.14	1.18±0.15
White blood cell count (x10 ⁹ /L)	2.16±13.3	2.31±15.7	1.22±0.53	2.59±13.6	1.38±1.34	1.10±0.30
Lymphocytes (x10 ⁹ /L)	53.9±67.5	48.7±54.9	1.14±0.45	56.5±43.8	50.9±49.7	48.6±45.3
Hemoglobin (g/L)	38.1±35.3	34.0±31.5	69.6±130.9	48.3±42.9*	39.9±49.0	34.9±28.6
Platelets (x10 ⁹ /L)	81.7±43.4	84.0±47.2	31.5±22.3	84.4±41.7	73.1±39.9	54.3±12.8
INR	0.62±1.01	0.60±0.59	74.5±34.2	0.58±0.69	0.48±0.25	0.60±0.35
Creatinine (U/L)	97.4±83.7	95.7±90.5	0.84±2.29	97.4±74.8	76.6±59.4	118.4±78.7
AST (U/L)	1501.7±203	1557.4±226	99.5±81.2	1265.1±179	1399.9±101	2224.1±254
	1	5	1750.5±178	6	0	5
	835.2±922.4	807.4±871.3	0	865.9±813.6	811.8±585.4	819.6±829.9
	4	3	882.0±1429	6	4	9
	1.64±1.02	1.60±0.68	1.54±0.85	1.70±0.48	2.48±0.82	1.46±0.94

ALT (U/L)						
Alkaline phosphate (mmol/L)						
Total bilirubin (mmol/L)						
CRP						
D-Dimer (nmol)						
Ferritin						
Lactate						

* p<0.05 vs White

Table 3: Multivariable models for predictors of need for mechanical ventilation and in-hospital mortality on presentation among hospitalized COVID-19 patients.

Multivariable Regression Model for Need for Mechanical Ventilation			
Covariates	Odds Ratio	95% Confidence interval	<i>p</i> -value
Race			
Black vs White	0.89	0.45-1.79	0.45
Latinx vs White	1.34	0.79-2.28	0.21
Age	1.51	0.89-2.54	0.13
Sex (Male)	1.53	0.95-2.45	0.08
Obesity	1.07	0.67-1.71	0.78
History of Cardiac Disease	0.54	0.28-1.04	0.06
History of Pulmonary Disorders	1.10	0.61-1.99	0.76
Hypertension	0.59	0.35-1.01	0.05
Diabetes	1.89	1.11-3.23	0.02
Multivariable Regression Model for ICU			
Covariates	Odds Ratio	95 % Confidence Interval	<i>p</i> -value
Race			
Black vs White	0.77	0.39-1.53	0.17
Latinx vs White	1.50	0.89-2.52	0.15
Age	1.35	0.81-2.25	0.25
Sex (Male)	1.50	0.95-2.37	0.08
Obesity	1.04	0.66-1.65	0.86
History of Cardiac Disease	0.70	0.38-1.30	0.26
History of Pulmonary Disorders	0.90	0.50-1.62	0.73
Hypertension	0.73	0.44-1.22	0.23
Diabetes	1.55	0.93-2.61	0.10
Multivariable Regression Model for In-Hospital Mortality			
Covariates	Odds Ratio	95 % Confidence Interval	<i>p</i> -value
Race			
Black vs White	0.39	0.13-1.12	0.23
Latinx vs White	0.55	0.23-1.29	0.79
Age	4.18	1.94-9.04	0.0003
Sex (Male)	1.07	0.55-2.08	0.85
Obesity	0.69	0.35-1.37	0.29
History of Cardiac Disease	1.22	0.58-2.53	0.60
History of Pulmonary Disorders	1.52	0.72-3.20	0.27
Hypertension	2.15	0.94-4.91	0.07
Diabetes	1.97	0.97-4.02	0.06

* History of cardiac disease include a history of coronary artery disease, congestive heart failure, or arrhythmia.

History of pulmonary disorders include a history of asthma, COPD, interstitial lung disease, pulmonary hypertension, pulmonary embolism.

Figure 1

