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Racial Disparities in Patients with COVID-19 Infection and Gynecologic Malignancy

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Abstract

Background: Mounting evidence suggests disproportionate COVID-19 hospitalizations and deaths due to racial disparities. The association of race in a cohort of gynecologic oncology patients with SARS-CoV-2 infection is unknown.

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Author Contributions

O.D.L., M.S., and B.P. contributed to the study design, acquired and analyzed data, generated figures, and wrote the manuscript. R.O.C., C.C., S.V.B., E.C.D., V.K., A.K., J.E., L.G., J.J., J.F., Y.L., contributed to data acquisition. Y.W. and M.L. performed statistical analysis. R.O.C., J.W., S.V.B. and S.I. provided intellectual input. All authors contributed to the interpretation of data, vouched for the data analysis, contributed to the editing of the manuscript, and agreed to publication of this study.

Methods: Data were abstracted from gynecologic oncology patients with COVID-19 infection among 8 New York City (NYC) area hospital systems. Multivariable mixed-effects logistic regression model accounting for county clustering was utilized to analyze COVID-19 related hospitalization and mortality.

Results: Of 193 patients with gynecologic cancer and COVID-19, 67 (34.7%) were Black and 126 (65.3%) were non-Black. Black patients were more likely to require hospitalization compared with non-Black patients (71.6% [48/67] vs. 46.0% [58/126], $P=.001$). Of 34 (17.6%) patients who died from COVID-19, 14 (41.2%) were Black. Among those hospitalized, Black patients compared to non-Black patients were more likely to: have 3 comorbidities (81.1% [30/37] vs 59.2% [29/49], $P=.05$); reside in Brooklyn (81.0% [17/21] vs 44.4% [12/27], $P=.02$); live with family (69.4% [25/36] vs 41.6% [37/89], $P=.009$); and have public insurance (79.6% [39/49] vs 53.4% [39/73], $P=.006$). In multivariable analysis, for patients younger than 65 years of age, Black patients were more likely to require hospitalization compared to non-Black patients (OR, 4.87; 95% CI 1.82 to 12.99, $P=.002$).

Conclusions: Although Black patients with gynecologic cancer represented only 1/3 of patients, they accounted for disproportionate rates of hospitalization (>45%) and death (>40%) due to COVID-19 infection; younger Black patients had nearly 5-fold greater risk of hospitalization. Efforts to understand and improve these disparities in COVID-19 outcomes in Black patients are critical.

Lay Summary

In gynecologic cancer patients with COVID-19 infection, 72% of Black patients required hospitalization, compared to 46% of non-Black patients. Black patients younger than 65 years old had nearly 5 times greater risk of hospitalization compared to non-Black patients of the same age. Disparities in COVID-19 severity were driven by higher prevalence of comorbidities rather than cancer disease or treatment status, and Black patients were significantly more likely to have 3 or more comorbidities. Pre-existing racial disparities have been exacerbated during the COVID-19 pandemic and these data necessitate immediate change to enable health equity and outcomes for Black patients.

Precis

In gynecologic cancer patients with COVID-19 infection, Black patients were more likely to require hospitalization for COVID-19 infection compared to non-Black patients. Younger black patients, <65 years of age, had nearly 5-fold greater risk of hospitalization due to COVID-19 infection.

Keywords

Coronavirus disease 2019 (COVID-19); gynecologic cancer; racial disparities; outcomes; severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)

Introduction

Racial disparities in outcomes and survival of patients diagnosed with SARS-CoV-2 (COVID-19) have been observed.¹⁻⁴ The overall US mortality rate is reported to be 3.2%, but preliminary US data suggests mortality among Black patients is 2.5 times higher than Whites.⁵ In New York State (NYS), Black or African American patients represent 14% of the population but 25% of COVID-19 related deaths.⁶ This discrepancy suggests Black patients are disproportionately affected by COVID-19; these data have been replicated in subsequent population-level studies throughout the country in large urban areas as well as rural regions.⁷⁻¹¹

COVID-19 disproportionately affects vulnerable populations including cancer patients and low-income and non-English speaking populations.^{12,13} Currently no comprehensive guidelines inform decision-making and healthcare for these populations to ensure health equity and optimal outcomes. Although epidemiologic studies have demonstrated worse COVID-19 clinical outcomes in Black Americans, limited data explore these racial disparities in disease-specific patient populations. Improved characterization of potential contributing factors is essential to guide policy and practice towards correcting these disparities among gynecologic cancer patients.

The aim of this multicenter study is to examine whether there are racial disparities in gynecologic cancer patients with COVID-19. We compare the baseline and clinical characteristics, explore the differences in hospitalization and fatality rates, and investigate the impact that race and other socio-economic and health-related factors have on COVID-19 related outcomes.

Methods

Study Population

We conducted a multi-institutional, retrospective, observational cohort study at 8 NYC area hospital systems. The study was approved by the institutional review board at each site. Patients 18 years or older with gynecologic malignancy and confirmed SARS-CoV-2 infection from March 1, 2020 and May 20, 2020 (initial surge in NYC) were included. SARS-CoV-2 infection was defined as: a positive result with a real-time reverse transcriptase-polymerase chain reaction assay on a nasopharyngeal swab; serologic confirmation of SARS-CoV-2; or a diagnosis based on radiologic imaging by chest radiograph or chest computed tomography.¹⁴ All included subjects were de-identified prior to data review.

Data Collection

Clinical data were abstracted from the electronic medical record (EMR) for all patients meeting inclusion criteria using Research Electronic Data Capture software (Vanderbilt University).^{15,16} Patient characteristics included age, self-reported race and ethnicity, county of residency, employment status, essential worker status, insurance status, housing status, medical comorbidities, Eastern Cooperative Oncology Group (ECOG) performance status,¹⁷ severity of COVID-19 infection, cancer type, stage of diagnosis, current

cancer disease status, and recent anti-cancer treatment. Clinical COVID-19 characteristics include symptoms of COVID-19, vital signs at admission, inpatient complications due to COVID-19, and need for supplemental oxygen including invasive mechanical ventilation.

Race and Outcome Measures

Race was the primary variable of interest. Race was classified as two groups: Black vs. non-Black (White plus Other). We grouped patients who identified themselves as Asian, American Indian or Alaska Native, and Native Hawaiian or Pacific Islander into Other because of low numbers in each category. Considering the high proportion of White in non-Black and diversity in Other group in this cohort, we also classified race as three groups, Black vs. Other vs. White in supplemental analyses (Supplemental Table 1–3). Outcomes, including hospitalization and mortality rate of Other group were similar to White group, thus were grouped together in final analysis as non-Black group to maximize the sample size in all analyses. Patients of Hispanic ethnicity were included in each racial category and represented in respective tables.

Our primary outcomes were hospitalization due to COVID-19 infection and COVID-19 related mortality. Hospitalization due to COVID-19 was stratified by COVID-19 severity, grouped as mild for cases managed on an outpatient basis and moderate or severe for cases requiring hospitalization. Severe COVID-19 cases were defined as COVID-19 infection requiring ICU admission, invasive mechanical ventilation, or resulting in COVID-19 related mortality. COVID-19 related mortality was defined as patients who died of COVID-19 related complications and not due to their cancer.

Statistical Analysis

Descriptive statistics were calculated for demographic, socioeconomic, health-related, cancer-related, and COVID-19 related characteristics by Black and non-Black patients. Continuous variables were described as median and interquartile range (IQR) and compared between groups using the Wilcoxon rank-sum test. Categorical variables were presented as frequency and proportion and compared between groups using the Chi-squared test. Hospitalization and mortality rates were calculated in Black and non-Black patients in the overall population or the subpopulation stratified by other categorical covariates and compared using the Chi-squared test. To account for potential clustering effects among geographical regions, multivariable mixed-effects logistic models were fitted with county variable as a random effect. County of residency included New York (Manhattan), Brooklyn (Kings County), Queens, and Bronx. Surrounding counties including Richmond, Nassau and Westchester County were grouped into Other because of low numbers in each category. To explicitly model the interaction of race and age on COVID-19 outcomes, we defined the groups as non-Black under age 65 years (based on median age of 65), Black under age 65 years, non-Black aged 65 or older, and Black aged 65 or older. Multivariable models adjusted for insurance status (public vs. private), smoking status (never vs. former/current), performance status (score of 0–1 vs. 2–3), number of comorbidities (0–2 vs. 3 or more), initial cancer stage (I/II vs. III/IV), cancer status (evidence of disease vs. remission), and current cancer treatment (no vs. yes). For missing covariate values, 16 cases with unknown information were put into the ‘other’ county group, 5 cases with unknown smoking status

were put into the ‘never’ group, 18 cases with unknown performance status were put into ‘<2’ group, and 19 cases with unknown cancer stage were put into the ‘I/II’ group. Odds ratios (OR) and 95% confidence intervals (CI) were reported for all logistic models. Statistical analyses were performed using R version 4.0.1 (<https://cran.r-project.org/>). All statistical tests were two-sided, and a P-value of less than .05 was considered statistically significant.

Results

Baseline Characteristics of Patients

A total of 193 patients with gynecologic malignancy and COVID-19 infection were identified, of whom 67 (34.7%) were Black and 126 (65.3%) were non-Black. The baseline demographic and cancer characteristics of the patients are shown in Table 1. Among all patients included in the analysis, the median age was 65 years. Most Black patients were non-Hispanic and Black patients were more likely to speak English as a first language compared to non-Black patients (85.1% [57/67] vs 68.3% [86/126], $P=.02$). Thirty eight of 67 (56.7%) Black patients resided in Brooklyn and Bronx counties; Black patients compared to non-Black patients were more likely to reside in a county with higher poverty percent based on 2018 US Census Bureau Small Area Income and Poverty Estimates¹⁸ (median [IQR]: 18.9 [15.6, 23.1] vs 15.6 [11.7, 18.9], $P=.004$). We observed no differences between living situation, employment status, or essential worker status between Black and non-Black patients. Black patients were less likely to have private insurance compared to non-Black patients (26.9% [18/67] vs 42.1% [53/126], $P=.05$).

No differences were seen in performance status between Black and non-Black patients. Compared with non-Black patients, Black patients were more likely to have three or more comorbidities (55.2% [37/67] vs 38.9% [49/126], $P=.04$), with higher prevalence of hypertension (74.6% [50/67] vs 51.6% [65/126], $P=.003$), obesity (62.7% [42/67] vs 44.4% [56/126], $P=.02$), and diabetes (47.8% [32/67] vs 30.2% [38/126], $P=.02$). Gynecologic cancer type and stage were evenly distributed among Black and non-Black patients (Table 1). Among the cohort, 56.7% (38/67) Black and 49.2% (62/126) non-Black patients presented with stage III or IV disease.

COVID-19 Related Characteristics of Patients

Table 2 presents clinical COVID-19 related characteristics of patients. 106 (54.9%) patients required hospitalization. Black patients were more likely to require hospitalization compared with non-Black patients (71.6% [48/67] vs 46.0% [58/126], $P=.001$). The majority of hospitalized patients in Brooklyn and Bronx were Black, while a higher percentage of non-Black patients were hospitalized in Manhattan (Figure 1). A higher percentage of Black patients compared to non-Black patients presented with shortness of breath (49.3% [33/67] vs 31.7% [40/126], $P=.03$). Black patients were also more likely to require supplemental oxygen (49.3% [33/67] vs 31.0% [39/126], $P=.04$). Black patients experienced higher rates of renal (16.4% [11/67] vs 7.9% [10/126], $P=.12$), cardiovascular (10.4% [7/67] vs 7.1% [9/126], $P=.64$), and pulmonary (44.8% [30/67] vs 28.6% [36/126], $P=.04$) complications during hospitalization compared to non-Black patients. Six of the 13 (46.2%) patients who

required mechanical ventilation were Black. Of the 34 patients who died due to COVID-19 related complications, 14 (41.2%) were Black. The case-fatality rate for Black patients was 20.9% (14/67), compared to 15.9% (20/126) among non-Black patients, with the highest percentage of COVID-19 related deaths in Brooklyn, followed by Bronx. (Figure 1).

Hospitalization and Mortality between Racial Groups

Table 3 presents outcome rates in Black and non-Black patients separately and compares them between racial groups. The higher rates of hospitalization seen in Black patients compared with non-Black patients was most pronounced age <65 years (68.8% [22/32] vs 29.0% [18/62], $P<.001$), obese (80.0% [32/40] vs 50.0% [27/54], $P=.006$), never smokers (67.4% [31/46] vs 43.0% [40/93], $P=.01$), residents of Brooklyn (81.0% [17/21] vs 44.4% [12/27], $P=.02$), primarily English speakers (73.7% [42/57] vs 46.5% [40/86], $P=.002$), currently living with family (69.4% [25/36] vs 41.6% [37/89], $P=.009$), employed (73.3% [11/15] vs 35.6% [16/45], $P=.02$), with public insurance (79.6% [39/49] vs 53.4% [39/73], $P=.006$), and performance status score <2 (70.2% [33/47] vs 37.6% [38/101], $P<.001$). Black patients who were essential workers during the COVID-19 pandemic were more likely to die than non-Black essential workers (50.0% [4/8] vs 7.1% [1/14], $P=.04$).

Factors Associated with Hospitalization and Death

Table 4 presents the estimated odds ratios and p-values for factors associated with hospitalization and mortality. In the unadjusted analysis, Black patients had a 2.7 fold higher risk of hospitalization compared with non-Black patients (OR=2.69; 95% CI= 1.37 to 5.26; $P=.004$), but no statistically significant racial differences in the risk of dying were observed (OR=1.57; 95% CI= 0.71 to 3.46; $P=.26$). The effect of race on hospitalization and mortality varied between patient groups age <65 years and ≥65, indicating an interaction between race and age. In adjusted mixed-effects logistic models, compared with non-Black patients aged <65 years, Black patients aged <65 years had the highest risk of hospitalization (OR=4.87; 95% CI= 1.82 to 12.99; $P=.002$). Hospitalization risk was also increased for Black patients aged ≥65 years (OR=3.44; 95% CI= 1.17 to 10.11; $P=.02$) and non-Black patients aged ≥65 years (OR=2.64; 95% CI= 1.13 to 6.18; $P=.02$). Poorer performance status (score ≥2) (OR=3.58; 95% CI= 1.12 to 11.39; $P=.03$) and ≥3 comorbidities (OR=1.97; 95% CI= 1.01 to 3.85; $P=.05$) were also statistically significant risk factors for hospitalization in the multivariable model.

The risk of death from COVID-19 infection was higher in Black aged <65, non-Black aged ≥65, and Black aged ≥65 compared with non-Black aged <65 years patients but this was not statistically significant. The only risk factor significantly associated with mortality after adjustment was former/current smoking status (OR=2.93; 95% CI= 1.28 to 6.70; $P=.01$).

To further understand the interaction of race and age, clinico-demographic characteristics among patients under age 65 years are detailed in Table 5. Black patients <65 years were more likely than all other patients to live in Brooklyn and Bronx counties (62.5% [20/32], $P=.01$), and to reside in a county with higher poverty percent (median [ICR] 18.9 [18.9,27.3], $P=.02$). Black patients <65 years of age were just as likely as Non-Black patients ≥65 years to have more ≥3 comorbidities (46.9% [15/32] vs 48.4% [31/64]).

Discussion

This study examined clinical characteristics and outcomes of a diverse cohort of gynecologic cancer patients with COVID-19 across 8 hospital systems in New York City. Over 70% of Black patients in this study required hospitalization for COVID-19 infection, compared to only 46% of non-Black patients. In addition to race and age, poor performance status and increasing number of comorbidities were associated with increased odds of hospital admission. Notably, Black patients less than 65 years of age were nearly 5 times more likely to require hospitalization for COVID-19 compared with non-Black patients younger than 65 years. Black race was not associated with increased mortality due to COVID-19 before or after adjustment for clinical and socioeconomic characteristics.

The findings of this study are consistent with prior studies from across the country that have demonstrated increased COVID-19 hospitalization rates in minority groups. We were unable to demonstrate a mortality difference among Black and non-Black patients likely due to our limited cohort size. Studies have found that Black patients are two to three times as likely as White patients to require hospitalization after adjusting for confounders including age, sex, comorbidities, and income and are over five times as likely to die from COVID-19 infection. On a nationwide level, an analysis across 2,886 US counties found a positive correlation between the percentage of African Americans in a county and the number of confirmed cases and deaths in the county.¹¹ Here we report Black patients with COVID-19 were more likely to have public insurance, live in a county below the poverty index, and live with family. Hospitalized Black patients were more likely to be essential workers during the COVID-19 pandemic. These findings are consistent with previous reports that Black Americans and other minorities are more likely to work essential, front-line jobs at risk for exposure.²¹ These structural factors prevent minority populations from practicing social distancing, increasing their risk of COVID-19 infection.

The underlying causes of racial disparities are multifactorial and include limited access to healthcare, structural and social determinants of health, racism, and discrimination. The COVID-19 pandemic has exacerbated these baseline inequalities. Black Americans are more likely to suffer from medical comorbidities known to be risk factors for severe COVID-19 infection, including hypertension, diabetes, kidney disease, and respiratory disease.^{22–25} In this cohort, a higher percentage of Black patients less than 65 years of age had three or more comorbidities, with a higher prevalence of hypertension, obesity, and diabetes compared with non-Black patients in this age group. We also noted that in the younger Black (< 65 years) cohort the majority resided in Brooklyn and Bronx and were from counties with higher poverty index. We hypothesize that the development of chronic conditions in Black patients at younger ages drives the increased risk of hospitalization. Furthermore, while less Black patients were former or current smokers at baseline, those that did smoke were at increased risk of mortality secondary to COVID-19 infection. This represents a modifiable risk factor which stresses the urgent need for community wide policies to eliminate disparities through equitable access to health care resources and improved education specifically in younger patients.

Higher rates of comorbidities seen in Black Americans may be due to weathering, a phenomenon in which chronic economic and social stressors caused by systemic racism result in increased activation of the sympathetic nervous system and the hypothalamic-pituitary-adrenal axis.²⁶ When these physiologic stress responses are chronically activated over a lifetime, Black Americans are put at greater risk for developing health conditions, placing them at increased risk for poor COVID-19 outcomes. Additionally, structural biases embedded in healthcare systems decrease minority access to healthcare and implicit biases by healthcare providers can adversely impact the quality of care.²⁷ Together, these factors create an environment where Black Americans are at increased risk for contracting COVID-19 infection, have a greater chance of developing severe disease, and are then more likely to receive substandard care.

This study has several limitations. In our small cohort, an evaluation of outcomes and risk factors associated with COVID-19 in other minority groups was not feasible. Our sample size is limited by the number of patients with gynecologic cancer who developed COVID-19 infection in NYC, which hampers our ability to detect mortality differences between Black and non-Black patients. Our sample may also be biased because we included patients who sought care for cancer treatment at academic institutions and their affiliates. Our patients therefore have proven to have some degree of access to the health care system that might not be true for all Black or minority patients in the US. Since lack of health care access is one explanation for COVID-19 disparities, our study may have underestimated disparities in outcomes. Interestingly, even with access to care, we still demonstrate disparities among this relatively well-connected patient cohort. It is possible that this cohort of patients did not include those with milder symptoms who did not present for COVID-19 testing as well as patients with more severe symptoms who did not seek care and died at home.

Strengths of this study include our diverse population. The population served by these NYC institutions is racially, ethnically, and socioeconomically diverse. This population has a higher proportion of Black (23% vs 13% US overall), and Hispanic (27% vs 18% US overall) individuals. Significant variability is observed in racial and ethnic compositions within and across neighborhoods in NYC and Long Island. Black individuals make up 43.6% of the Bronx, 34.1% of Brooklyn, 20.7% of Queens, 17.9% of Manhattan, 13.0% of Nassau County, and 11.7% of Staten Island. Additionally, this study presents poverty estimate data based on county of residence. These data show that Black patients had higher percentages of hospitalization and mortality in counties with a higher poverty percent (Bronx 27.3% and Brooklyn 18.9% vs US overall 13.1%).¹⁸

In summary, this study highlighted the racial disparities that exist in patients with gynecologic cancer diagnosed with COVID-19. Racial differences in both the severity and outcomes of COVID-19 infection seem to reflect differences in chronic conditions rather than cancer disease or treatment status. Younger (<65 years) Black patients had the highest risk of hospitalization in our cohort. Pre-existing racial disparities have been exacerbated during the COVID-19 pandemic and these data necessitate immediate change to enable health equity and outcomes in vulnerable populations. COVID-19 infection outcomes experienced by Black women highlight pre-existing disparities and call for multifaceted

attention to address these longstanding differences in health outcomes among gynecologic cancer patients.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Conflict of Interest Disclosures

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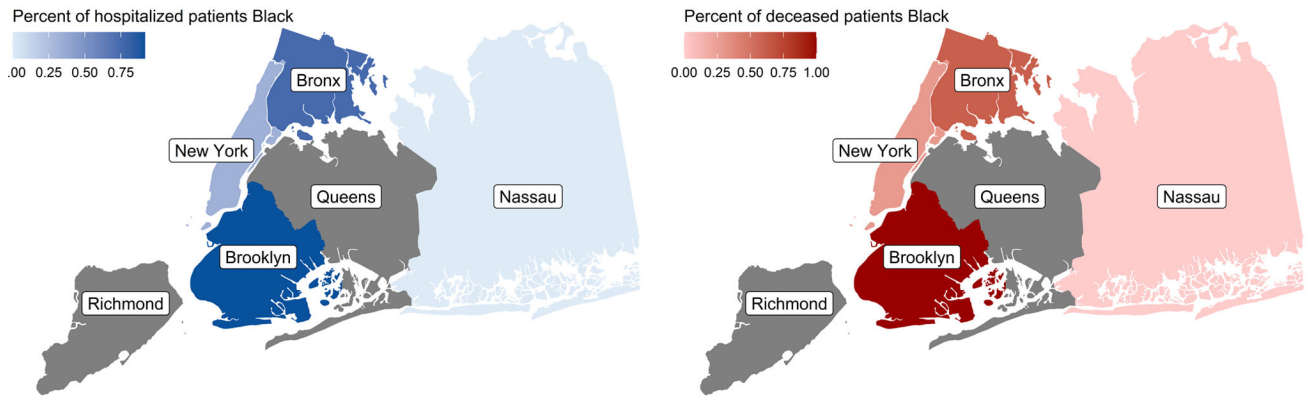


Figure 1. COVID-19 hospitalizations (A) and mortality (B) data in Black patients. Percentages reflect the percentage of Black patients of total patients in our cohort who were hospitalized or died due to COVID-19 infection. Grey areas indicate no COVID-19 hospitalization or mortality cases.

Table 1.

Description of baseline characteristics by race.

Characteristic	Overall (n=193)	Black (n=67)	Non-Black (n=126)	P-value
Age – median (IQR)	65.0 (54.0, 73.0)	65.0 (56.5, 73.0)	65.0 (53.3, 72.0)	.49
Ethnicity – N (%)				.002
Hispanic	39 (20.2)	4 (6.0)	35 (27.8)	
BMI – median (IQR)	30.0 (25.0, 36.8)	32.0 (25.6, 38.0)	28.7 (24.4, 36.3)	.16
Smoking status – N (%)				.44
Former/current smoker	49 (25.4)	18 (26.9)	31 (24.6)	
Never smoker	139 (72.0)	46 (68.7)	93 (73.8)	
Unknown	5 (2.6)	3 (4.5)	2 (1.6)	
County of residence – N (%)				.001
New York	41 (21.2)	14 (20.9)	27 (21.4)	
Brooklyn	48 (24.9)	21 (31.3)	27 (21.4)	
Queens	17 (8.8)	1 (1.5)	16 (12.7)	
Bronx	40 (20.7)	17 (25.4)	23 (18.3)	
Other	31 (16.1)	4 (6.0)	27 (21.4)	
Unknown	16 (8.3)	10 (14.9)	6 (4.8)	
Poverty percent by county – median (IQR)	18.9 (15.6, 18.9)	18.9 (15.6, 23.1)	15.6 (11.7, 18.9)	.004
Primary language English – N (%)	143 (74.1)	57 (85.1)	86 (68.3)	.02
Current living situation – N (%)				.09
Alone	39 (20.2)	19 (28.4)	20 (15.9)	
Family	125 (64.8)	36 (53.7)	89 (70.6)	
Skilled nursing facility	7 (3.6)	2 (3.0)	5 (4.0)	
Unknown	22 (11.4)	10 (14.9)	12 (9.5)	
Employed – N (%)	60 (31.1)	15 (22.4)	45 (35.7)	.14
Worker in essential industry – N (%)	22 (11.4)	8 (11.9)	14 (11.1)	.80
Private insurance – N (%)	71 (36.8)	18 (26.9)	53 (42.1)	.05
Performance status – N (%)				.24
<2	148 (76.7)	47 (70.1)	101 (80.2)	
2	27 (14.0)	13 (19.4)	14 (11.1)	
Unknown	18 (9.3)	7 (10.4)	11 (8.7)	
Number of comorbidities 3 – N (%)	86 (44.6)	37 (55.2)	49 (38.9)	.04
Comorbidity – N (%)				
Asthma	21 (10.9)	11 (16.4)	10 (7.9)	.12
COPD/emphysema	5 (2.6)	3 (4.5)	2 (1.6)	.47
Obstructive sleep apnea	12 (6.2)	4 (6.0)	8 (6.3)	1.0
Pulmonary embolism	11 (5.7)	6 (9.0)	5 (4.0)	.27
Hypertension	115 (59.6)	50 (74.6)	65 (51.6)	.003
Coronary artery disease	13 (6.7)	7 (10.4)	6 (4.8)	.23
CKD/ESRD	21 (10.9)	11 (16.4)	10 (7.9)	.12

Characteristic	Overall (n=193)	Black (n=67)	Non-Black (n=126)	P-value
Diabetes mellitus	70 (36.3)	32 (47.8)	38 (30.2)	.02
Obesity	98 (50.8)	42 (62.7)	56 (44.4)	.02
Autoimmune disease	18 (9.3)	7 (10.4)	11 (8.7)	.90
Cancer type – N (%)				.24
Cervical	24 (12.4)	9 (13.4)	15 (11.9)	
Ovary	67 (34.7)	18 (26.9)	49 (38.9)	
Uterine	87 (45.1)	34 (50.7)	53 (42.1)	
Vaginal	2 (1.0)	2 (3.0)	0 (0.0)	
Vulvar	8 (4.1)	2 (3.0)	6 (4.8)	
Other	5 (2.6)	2 (3.0)	3 (2.4)	
Cancer stage at diagnosis – N (%)				.18
I/II	74 (38.3)	26 (38.8)	48 (38.1)	
III/IV	100 (51.8)	38 (56.7)	62 (49.2)	
Unknown	19 (9.8)	3 (4.5)	16 (12.7)	

Table 2.**Description of COVID-19 characteristics by race.**

Characteristic	Overall (n=193)	Black (n=67)	Non-Black (n=126)	P-value
COVID-19 severity – N (%)				.002
Mild	87 (45.1)	19 (28.4)	68 (54.0)	
Moderate	67 (34.7)	33 (49.3)	34 (27.0)	
Severe	39 (20.2)	15 (22.4)	24 (19.0)	
Admitted from – N (%)				.33
Home	104 (53.9)	42 (62.7)	62 (49.2)	
Hospital transfer	3 (1.6)	1 (1.5)	2 (1.6)	
Skilled nursing facility	11 (5.7)	4 (6.0)	7 (5.6)	
Other	4 (2.1)	2 (3.0)	2 (1.6)	
Unknown	71 (36.8)	18 (26.9)	53 (42.1)	
COVID-19 symptoms – N (%)				
Fatigue	67 (34.7)	24 (35.8)	43 (34.1)	.94
Fever	99 (51.3)	32 (47.8)	67 (53.2)	.57
Cough	94 (48.7)	30 (44.8)	64 (50.8)	.52
Shortness of breath	73 (37.8)	33 (49.3)	40 (31.7)	.03
Myalgia	30 (15.5)	9 (13.4)	21 (16.7)	.73
Sore throat	11 (5.7)	2 (3.0)	9 (7.1)	.39
Headache	12 (6.2)	5 (7.5)	7 (5.6)	.83
Anosmia	9 (4.7)	1 (1.5)	8 (6.3)	.24
Ageusia	7 (3.6)	1 (1.5)	6 (4.8)	.45
Rhinorrhea	13 (6.7)	2 (3.0)	11 (8.7)	.23
Nausea or vomiting	26 (13.5)	5 (7.5)	21 (16.7)	.12
Diarrhea	33 (17.1)	11 (16.4)	22 (17.5)	1.0
Abdominal pain	11 (5.7)	5 (7.5)	6 (4.8)	.66
Asymptomatic	28 (14.5)	9 (13.4)	19 (15.1)	.93
Hospitalization – N (%)	106 (54.9)	48 (71.6)	58 (46.0)	.001
Vital signs on ED admission* –				
Oxygen saturation %	95.0 (91.0, 98.0)	95.0 (91.0, 98.0)	95.0 (92.0, 98.0)	.64
Temperature, °F	98.8 (98.1, 100.2)	98.6 (98.0, 100.2)	98.9 (98.2, 100.2)	.69
Heart rate, beats/min	101.0 (82.5, 114.3)	107.0 (95.25, 117.0)	94.0 (76.3, 109.0)	.002
Respiratory rate, breaths/min	20.0 (18.0, 22.0)	21.0 (19.0, 24.0)	19.0 (18.0, 20.5)	.006
Required supplemental oxygen – N (%)	72 (37.3)	33 (49.3)	39 (31.0)	.04
Required invasive mechanical ventilation – N (%)	13 (6.7)	6 (9.0)	7 (5.6)	.52
COVID-19 complications – N (%)				
Bleeding	3 (1.6)	2 (3.0)	1 (0.8)	.58
Disseminated intravascular coagulation	1 (0.5)	0 (0.0)	1 (0.8)	1.0
Multiorgan failure	9 (4.7)	2 (3.0)	7 (5.6)	.65
Sepsis	12 (6.2)	5 (7.5)	7 (5.6)	.83

Characteristic	Overall (n=193)	Black (n=67)	Non-Black (n=126)	P-value
Pulmonary	66 (34.2)	30 (44.8)	36 (28.6)	.04
Cardiac	16 (8.3)	7 (10.4)	9 (7.1)	.64
Renal	21 (10.9)	11 (16.4)	10 (7.9)	.12
None	105 (54.4)	25 (37.3)	80 (63.5)	.01
Current COVID-19 status – N (%)				.40
Died of COVID-19 related complications	34 (17.6)	14 (20.9)	20 (15.9)	
Ongoing infection	20 (10.4)	6 (9.0)	14 (11.1)	
Recovered with complications	16 (8.3)	8 (11.9)	8 (6.3)	
Fully recovered	123 (63.7)	39 (58.2)	84 (66.7)	

* vital signs of hospitalized patients only

Table 3.

Comparison of hospitalization and mortality between racial groups.

Characteristic	Hospitalization			Mortality		
	Black	Non-Black	P-value	Black	Non-Black	P-value
Overall – N (%)	48/67 (71.6)	58/126 (46.0)	.001	14/67 (20.9)	20/126 (15.9)	.50
Ethnicity – N (%)						
Hispanic	2/4 (50.0)	16/35 (45.7)	1.0	2/4 (50.0)	6/35 (17.1)	.18
Age – N (%)						
<65 years	22/32 (68.8)	18/62 (29.0)	<.001	6/32 (18.8)	5/62 (8.1)	.23
65 years	26/35 (74.3)	40/64 (62.5)	.33	8/35 (22.9)	15/64 (23.4)	1.0
BMI – N (%)						
Normal	11/15 (73.3)	15/34 (44.1)	.07	5/15 (33.3)	8/34 (23.5)	.71
Overweight	5/11 (45.5)	15/35 (42.9)	1.0	1/11 (9.1)	3/35 (8.6)	1.0
Obese	32/40 (80.0)	27/54 (50.0)	.006	8/40 (20.0)	8/54 (14.8)	.70
Smoking status – N (%)						
Former/current smoker	15/18 (83.3)	17/31 (54.8)	.06	6/18 (33.3)	9/31 (29.0)	1.0
Never smoker	31/46 (67.4)	40/93 (43.0)	.01	6/46 (13.0)	11/93 (11.8)	1.0
Unknown	2/3 (66.7)	1/2 (50.0)	1.0	2/3 (66.7)	0/2 (0.0)	.40
County of residence – N (%)						
New York	7/14 (50.0)	16/27 (59.3)	.81	1/14 (7.1)	7/27 (25.9)	.31
Brooklyn	17/21 (81.0)	12/27 (44.4)	.02	5/21 (23.8)	1/27 (3.7)	.10
Queens	0/1 (0.0)	5/16 (31.2)	1.0	0/1 (0.0)	2/16 (12.5)	1.0
Bronx	13/17 (76.5)	11/23 (47.8)	.10	7/17 (41.2)	4/23 (17.4)	.19
Other	3/4 (75.0)	12/27 (44.4)	.33	0/4 (0.0)	5/27 (18.5)	1.0
Unknown	8/10 (80.0)	2/6 (33.3)	.12	1/10 (10.0)	1/6 (16.7)	1.0
Primary language English – N (%)	42/57 (73.7)	40/86 (46.5)	.002	13/57 (22.8)	12/86 (14.0)	.25
Current living situation – N (%)						
Alone	13/19 (68.4)	9/20 (45.0)	.25	4/19 (21.1)	4/20 (20.0)	1.0
Family	25/36 (69.4)	37/89 (41.6)	.009	4/36 (11.1)	8/89 (9.0)	.98
Skilled nursing facility	2/2 (100.0)	4/5 (80.0)	1.0	1/2 (50.0)	3/5 (60.0)	1.0
Unknown	8/10 (80.0)	8/12 (66.7)	.65	5/10 (50.0)	5/12 (41.7)	1.0
Employed – N (%)	11/15 (73.3)	16/45 (35.6)	.02	5/15 (33.3)	6/45 (13.3)	.18
Worker in essential industry – N (%)	6/8 (75.0)	4/14 (28.6)	.07	4/8 (50.0)	1/14 (7.1)	.04
Insurance – N (%)						
Public	39/49 (79.6)	39/73 (53.4)	.006	11/49 (22.4)	14/73 (19.2)	.83
Private	9/18 (50.0)	19/53 (35.8)	.43	3/18 (16.7)	6/53 (11.3)	.86
Performance status – N (%)						
<2	33/47 (70.2)	38/101 (37.6)	<.001	9/47 (19.1)	11/101 (10.9)	.27
2	11/13 (84.6)	12/14 (85.7)	1.0	4/13 (30.8)	6/14 (42.9)	.80
Number of comorbidities 3 – N (%)	30/37 (81.1)	29/49 (59.2)	.05	8/37 (21.6)	12/49 (24.5)	.96
Comorbidity – N (%)						
Asthma	9/11 (81.8)	6/10 (60.0)	.36	1/11 (9.1)	3/10 (30.0)	.51

Characteristic	Hospitalization			Mortality		
	Black	Non-Black	P-value	Black	Non-Black	P-value
COPD/emphysema	2/3 (66.7)	2/2 (100.0)	1.0	0/3 (0.0)	2/2 (100.0)	.10
Obstructive sleep apnea	4/4 (100.0)	6/8 (75.0)	.52	1/4 (25.0)	3/8 (37.5)	1.0
Pulmonary embolism	5/6 (83.3)	3/5 (60.0)	.55	1/6 (16.7)	1/5 (20.0)	1.0
Hypertension	37/50 (74.0)	37/65 (56.9)	.09	12/50 (24.0)	13/65 (20.0)	.77
Coronary artery disease	7/7 (100.0)	3/6 (50.0)	.07	3/7 (42.9)	1/6 (16.7)	.56
CKD/ESRD	9/11 (81.8)	9/10 (90.0)	1.0	2/11 (18.2)	5/10 (50.0)	.28
Diabetes mellitus	24/32 (75.0)	25/38 (65.8)	.56	8/32 (25.0)	8/38 (21.1)	.92
Autoimmune disease	4/7 (57.1)	6/11 (54.5)	1.0	1/7 (14.3)	4/11 (36.4)	.63
Cancer stage – N (%)						
I/II	20/26 (76.9)	19/48 (39.6)	.005	5/26 (19.2)	8/48 (16.7)	1.0
III/IV	25/38 (65.8)	26/62 (41.9)	.03	9/38 (23.7)	10/62 (16.1)	.50
Unknown	3/3 (100.0)	13/16 (81.2)	1.0	0/3 (0.0)	2/16 (12.5)	1.0

Table 4.

Odds ratios from logistic models.

	Hospitalization		Mortality	
	OR (95%CI)	P-value	OR (95%CI)	P-value
Unadjusted model				
Non-Black race	1.00 (Referent)		1.00 (Referent)	
Black race	2.69 (1.37, 5.26)	.004	1.57 (0.71, 3.46)	.26
Adjusted Model				
Interaction as categorical (cut at 65 years)				
Age < 65, Non-Black race	1.00 (Referent)		1.00 (Referent)	
Age < 65, Black race	4.87 (1.82, 12.99)	.002	2.08 (0.54, 8.03)	.29
Age ≥ 65, Non-Black race	2.64 (1.13, 6.18)	.02	2.58 (0.76, 8.74)	.13
Age ≥ 65, Black race	3.44 (1.17, 10.11)	.02	1.95 (0.46, 8.26)	.36
Private insurance	0.60 (0.28, 1.26)	.18	0.97 (0.36, 2.65)	.96
Former/current smoker	1.56 (0.74, 3.31)	.25	2.93 (1.28, 6.70)	.01
Performance status = 2	3.58 (1.12, 11.39)	.03	2.55 (0.97, 6.70)	.06
Number of comorbidities = 3	1.97 (1.01, 3.85)	.05	1.70 (0.74, 3.93)	.21
Cancer stage III/IV	0.79 (0.37, 1.7)	.54	1.32 (0.50, 3.50)	.58
Cancer status in remission	1.15 (0.43, 3.03)	.78	0.55 (0.17, 1.73)	.30
Current cancer treatment	0.83 (0.34, 2.05)	.69	0.58 (0.20, 1.67)	.32

Table 5.

Description of characteristics of patient stratified by age and race.

Characteristic	Overall (n=193)	Non-Black, Age < 65 (n=62)	Black, Age < 65 (n=32)	Non-Black, Age 65 (n=64)	Black, Age 65 (n=35)	P-value
Age – median (IQR)	65.0 [54.0, 73.0]	53.0 [43.0, 59.0]	55.0 [50.0, 61.0]	72.0 [69.0, 75.3]	73.0 [68.0, 78.0]	<.001
Ethnicity – N (%)						.03
Hispanic	39 (20.2)	17 (27.4)	1 (3.1)	18 (28.1)	3 (8.6)	
BMI – median (IQR)	30.0 [25.0, 36.8]	30.2 [25.3, 38.0]	31.9 [26.9, 39.8]	27.0 [23.9, 35.5]	32.9 [24.5, 37.6]	.15
Smoking status – N (%)						.79
Former/current smoker	49 (25.4)	13 (21.0)	8 (25.0)	18 (28.1)	10 (28.6)	
Never smoker	139 (72.0)	48 (77.4)	23 (71.9)	45 (70.3)	23 (65.7)	
Unknown	5 (2.6)	1 (1.6)	1 (3.1)	1 (1.6)	2 (5.7)	
County of residence – N (%)						.01
New York	41 (21.2)	9 (14.5)	5 (15.6)	18 (28.1)	9 (25.7)	
Brooklyn	48 (24.9)	12 (19.4)	11 (34.4)	15 (23.4)	10 (28.6)	
Queens	17 (8.8)	11 (17.7)	0 (0.0)	5 (7.8)	1 (2.9)	
Bronx	40 (20.7)	11 (17.7)	9 (28.1)	12 (18.8)	8 (22.9)	
Other	31 (16.1)	16 (25.8)	3 (9.4)	11 (17.2)	1 (2.9)	
Unknown	16 (8.3)	3 (4.8)	4 (12.5)	3 (4.7)	6 (17.1)	
Poverty percent by county – median (IQR)	18.9 [15.6, 18.9]	15.6 [11.6, 18.9]	18.9 [18.9, 27.3]	15.6 [15.6, 18.9]	18.9 [15.6, 18.9]	.02
Primary language English – N (%)	143 (74.1)	40 (64.5)	29 (90.6)	46 (71.9)	28 (80.0)	.04
Current living situation – N (%)						.07
Alone	39 (20.2)	6 (9.7)	10 (31.2)	14 (21.9)	9 (25.7)	
Family	125 (64.8)	49 (79.0)	19 (59.4)	40 (62.5)	17 (48.6)	
Skilled nursing facility	7 (3.6)	1 (1.6)	0 (0.0)	4 (6.2)	2 (5.7)	
Unknown	22 (11.4)	6 (9.7)	3 (9.4)	6 (9.4)	7 (20.0)	
Employed – N (%)	60 (31.1)	31 (50.0)	14 (43.8)	14 (21.9)	1 (2.9)	<0.001
Worker in essential industry – N (%)	22 (11.4)	9 (14.5)	8 (25.0)	5 (7.8)	0 (0.0)	.03
Private insurance – N (%)	71 (36.8)	40 (64.5)	16 (50.0)	13 (20.3)	2 (5.7)	<0.001
Performance status – N (%)						.01
<2	148 (76.7)	57 (91.9)	26 (81.2)	44 (68.8)	21 (60.0)	
2	27 (14.0)	2 (3.2)	3 (9.4)	12 (18.8)	10 (28.6)	
Unknown	18 (9.3)	3 (4.8)	3 (9.4)	8 (12.5)	4 (11.4)	
Number of comorbidities 3 – N (%)	86 (44.6)	18 (29.0)	15 (46.9)	31 (48.4)	22 (62.9)	.01
Comorbidity – N (%)						
Asthma	21 (10.9)	6 (9.7)	6 (18.8)	4 (6.2)	5 (14.3)	.27
COPD/emphysema	5 (2.6)	0 (0.0)	0 (0.0)	2 (3.1)	3 (8.6)	.06
Obstructive sleep apnea	12 (6.2)	3 (4.8)	2 (6.2)	5 (7.8)	2 (5.7)	.92

Characteristic	Overall (n=193)	Non-Black, Age < 65 (n=62)	Black, Age < 65 (n=32)	Non-Black, Age 65 (n=64)	Black, Age 65 (n=35)	P-value
Pulmonary embolism	11 (5.7)	3 (4.8)	2 (6.2)	2 (3.1)	4 (11.4)	.39
Hypertension	115 (59.6)	20 (32.3)	21 (65.6)	45 (70.3)	29 (82.9)	<0.001
Coronary artery disease	13 (6.7)	0 (0.0)	0 (0.0)	6 (9.4)	7 (20.0)	.001
CKD/ESRD	21 (10.9)	2 (3.2)	3 (9.4)	8 (12.5)	8 (22.9)	.03
Diabetes mellitus	70 (36.3)	17 (27.4)	12 (37.5)	21 (32.8)	20 (57.1)	.03
Obesity	98 (50.8)	33 (53.2)	20 (62.5)	23 (35.9)	22 (62.9)	.02
Autoimmune disease	18 (9.3)	5 (8.1)	5 (15.6)	6 (9.4)	2 (5.7)	.54
Cancer stage – N (%)						.20
I/II	74 (38.3)	27 (43.5)	10 (31.2)	21 (32.8)	16 (45.7)	
III/IV	100 (51.8)	30 (48.4)	20 (62.5)	32 (50.0)	18 (51.4)	
Unknown	19 (9.8)	5 (8.1)	2 (6.2)	11 (17.2)	1 (2.9)	
COVID-19 severity – N (%)						<0.001
Mild	87 (45.1)	44 (71.0)	10 (31.2)	24 (37.5)	9 (25.7)	
Moderate	67 (34.7)	12 (19.4)	16 (50.0)	22 (34.4)	17 (48.6)	
Severe	39 (20.2)	6 (9.7)	6 (18.8)	18 (28.1)	9 (25.7)	
Hospitalization – N (%)	106 (54.9)	18 (29.0)	22 (68.8)	40 (62.5)	26 (74.3)	<0.001
COVID-19 complications – N (%)						
Bleeding	3 (1.6)	0 (0.0)	0 (0.0)	1 (1.6)	2 (5.7)	.14
Disseminated intravascular coagulation	1 (0.5)	0 (0.0)	0 (0.0)	1 (1.6)	0 (0.0)	.57
Multiorgan failure	9 (4.7)	1 (1.6)	1 (3.1)	6 (9.4)	1 (2.9)	.18
Sepsis	12 (6.2)	4 (6.5)	2 (6.2)	3 (4.7)	3 (8.6)	.90
Pulmonary	66 (34.2)	13 (21.0)	14 (43.8)	23 (35.9)	16 (45.7)	.04
Cardiac	16 (8.3)	1 (1.6)	5 (15.6)	8 (12.5)	2 (5.7)	.05
Renal	21 (10.9)	3 (4.8)	2 (6.2)	7 (10.9)	9 (25.7)	.01
None	105 (54.4)	45 (72.6)	12 (37.5)	35 (54.7)	13 (37.1)	.001
Current COVID-19 status – N (%)						.11
Died of COVID-19 related complications	34 (17.6)	5 (8.1)	6 (18.8)	15 (23.4)	8 (22.9)	
Ongoing infection	123 (63.7)	48 (77.4)	18 (56.2)	36 (56.2)	21 (60.0)	
Recovered with complications	20 (10.4)	8 (12.9)	3 (9.4)	6 (9.4)	3 (8.6)	
Fully recovered	16 (8.3)	1 (1.6)	5 (15.6)	7 (10.9)	3 (8.6)	