COVID-19

Outcomes in Hispanics With COVID-19 Are Similar to Those of Caucasian Patients in Suburban New York

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ABSTRACT

Background: Despite reported higher rates and worse outcomes due to COVID-19 in certain racial and ethnic groups, much remains unknown. We explored the association between Hispanic ethnicity and outcomes in COVID-19 patients in Long Island, New York.

Methods: We conducted a retrospective cohort study of 2,039 Hispanic and non-Hispanic Caucasian patients testing positive for SARS-CoV-2 between March 7 and May 23, 2020, at a large suburban academic tertiary care hospital near New York City. We explored the association of ethnicity with need for intensive care unit (ICU), invasive mechanical ventilation (IMV), and mortality.

Results: Of all patients, 1,079 (53%) were non-Hispanic Caucasians and 960 (47%) were Hispanic. Hispanic patients presented in higher numbers than expected for our catchment area. Compared with Caucasians, Hispanics were younger (45 years vs. 59 years), had fewer comorbidities (66% with no comorbidities vs. 40%), were less likely to have commercial insurance (35% vs. 59%), or were less likely to come from a nursing home (2% vs. 10%). In univariate comparisons, Hispanics were less likely to be admitted (37% vs. 59%) or to die (3% vs. 10%). Age, shortness of breath, congestive heart failure (CHF), coronary artery disease (CAD), hypoxemia, and presentation from nursing homes were associated with admission. Male sex and hypoxemia were associated with ICU admission. Male sex, chronic obstructive pulmonary disease, and hypoxemia were associated with IMV. Male sex, CHF, CAD, and hypoxemia were associated with mortality. After other factors were adjusted for, Hispanics were less likely to be admitted (odds ratio = 0.62, 95% confidence interval = 0.52 to 0.92) but Hispanic ethnicity was not associated with ICU admission, IMV, or mortality.

Conclusions: Hispanics presented at higher rates than average for our population but outcomes among Hispanic patients with COVID-19 were similar to those of Caucasian patients.

There is a large body of evidence documenting considerable racial and ethnic disparities in health care delivery and outcomes in the United States.[1–8] These disparities have been especially apparent during the

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COVID-19 pandemic, receiving widespread attention in the lay media. No area has been harder hit than the New York metropolitan area with over 30,000 deaths in New York City and its surrounding counties.[9,10] Several highly cited reports suggest that the incidence of COVID-19 disproportionately affects minorities and people of color.[7,8,11–15] Additionally, outcomes appear worse in minority groups such as Blacks and Hispanics. These disparities have often been attributed to poverty, high population density, and poor health care access, especially in urban settings. We hypothesized that we would see a similar trend of increased morbidity and mortality among our Hispanic patients afflicted with COVID-19.

Our hospital is located in Suffolk County in eastern Long Island, New York, which has a considerable population of Hispanic patients. With a mixture of suburban, exurban, and rural areas, our area differs from more urban settings described in press reports. Compared to the rest of New York State, median annual household income is the third highest of New York's 62 counties ($96,675 in 2019) and the income gap between the county's upper and lower socioeconomic classes is smaller.[16] Although the population is less diverse than in other parts of New York, Suffolk County is home to many people who identity as Hispanic. In 2019, 67.2% of residents in Suffolk County identified as "non-Hispanic White," compared to 56.0% in all of New York State. The percentage of residents who claim Hispanic ethnicity was 19.8% and comparable with that of New York State.[16] The percentage of residents of Suffolk County who identify as Black (8.8%), on the other hand, is much lower than that in the New York City (24.3%).[16]

Within days of the onset of the first wave of the pandemic we noted that the proportion of Hispanic patients being seen at our center was considerably higher than traditionally seen. Since our patient population is predominantly Caucasian or Hispanic and there are multiple reports focusing on results in Black patients, we limited our study to Caucasian and Hispanic patients with COVID-19. We undertook a detailed analysis to compare the clinical characteristics and outcomes of Caucasian and Hispanic COVID-19 patients presenting to our hospital. We hypothesized that when compared to Caucasian patients, outcomes among Hispanics would be worse after adjusting for confounding variables and similar to reported increased morbidity and mortality among Black patients.

METHODS

Study Design

We performed a structured, retrospective electronic medical record review (Cerner, Kansas City, MO) examining all patients presenting to our emergency department (ED) with confirmed COVID-19 based on a positive SARS-CoV-2 reverse transcription polymerase chain reaction (RT-PCR) test performed on a sample obtained via nasopharyngeal swab. Samples for testing at the start of the pandemic were initially sent to several private labs in the area until our hospital obtained the capacity to perform these tests in house. This study followed the Strengthening of Reporting of Observational Studies in Epidemiology (STROBE) reporting guidelines for cross-sectional studies[17] including the RECORD checklist for observational data. We also followed the recommended methodology of Kaji et al.[18] for retrospective chart reviews. Due to the retrospective nature of this study, we received institutional review board approval with waiver of informed consent.

Patients and Setting

Our hospital is a 650-bed, suburban academic tertiary care hospital located approximately 60 miles from Manhattan. Patient volume is approximately 130,000 adult and pediatric patients per year. We included all patients seen either in our ED or in a separate ED tent for patients with influenza-like illnesses (ILI) who tested positive for SARS-CoV-2. Patients with ILI were initially triaged and then sent either to a large ED tent (if stable) or to the ED (if unstable) and were classified as persons under investigation (PUIs). Patients initially seen in the ED tent were forwarded to the ED if they required admission. Eligible patients presented from March 7, 2020, to May 23, 2020, and were initially classified as PUIs for COVID-19 due to their clinical presentation. When testing confirmed COVID-19–positive status, they were included in our database. Patients were included if their race was Caucasian and/or their ethnicity was explicitly specified as Hispanic or non-Hispanic.

Data Source and Collection

We performed a computerized search and retrospective chart review of our electronic medical records to identify patients meeting all inclusion criteria. For eligible patients, we extracted patient demographic information including race (Caucasian, African American, Asian, American Indian/Alaska Native, Native Hawaiian or other Pacific Islander, more than one race, or

Unknown), ethnicity (Hispanic/Latino vs. not Hispanic/Latino), sex (male vs. nonmale), and comorbidities (presence of diabetes, hypertension, chronic obstructive pulmonary disease, asthma, cancer, congestive heart failure [CHF], coronary artery disease, immunosuppressed status, chronic kidney disease, or body mass index > 30).

We also examined COVID-19 exposure history, prior COVID-19 status, vital signs (temperature, respiratory rate, pulse oxygen saturation), symptoms on arrival, laboratory results (white blood cells, lymphocytes, platelets, creatinine, D-dimer, aspartate aminotransferase, C-reactive protein, procalcitonin, cardiac troponin T, chest X-ray, and computed tomography findings), insurance status (commercial, Medicare, Medicaid, self-pay, other), zip code, disposition, (discharge to home, admission to a non–intensive care floor, admission to an intensive care unit [ICU], death), and need for invasive mechanical ventilation (IMV).

Registration workers seeing patients on presentation were responsible for completing patient's self-reported race and/or ethnicity as well as collecting mailing address. The Cerner EMR includes Hispanic as "ethnicity." Patients with at least one positive COVID-19 test were eligible for inclusion, although patients with more than one visit and more than one positive test across visits were not tracked. Patients with missing data were excluded on an analysis-by-analysis basis. We defined all study data and variables prior to initiating the study and trained our data abstractors using a library of definitions.

Manual data abstraction by research staff included patient demographics, symptoms at presentation, prior medical history, previous laboratory results, radiology reports, need for oxygen or ventilatory support, and disposition. All other variables were collected via computerized abstraction. Staff were trained using EMR access via remote group meetings to ensure that all data were collected via the same collection methods. Interobserver agreement for key predictor variables and outcomes was determined on a random sample of 20 patients after the first 200 patients were enrolled. Ongoing monitoring of data abstraction was conducted during daily meetings to discuss any potential discrepancies that might have risen. At the end of the study another random sample of 200 patients (10% of study cohort) was used to validate interobserver agreement. Interobserver agreement (kappa statistic) for IMV, death, and COVID-19–positive test result (based on prior or current positive PCR result) was excellent (kappa = 1.0). Agreement for ethnicity was 0.94 (95% confidence interval [CI] = 0.88 to 0.99), for race, agreement was 0.99 (95% CI = 0.96 to 0.99), and for ICU admission, agreement was 0.96 (95% CI = 0.90 to 0.99).

Study Outcomes

The primary outcomes were need for ICU level of care and mortality. Secondary outcomes were hospital admission and length of stay, ICU length of stay, and need for noninvasive and/or invasive methods of ventilation.

Data Analysis

Data are summarized as numbers and frequencies for nominal data and means with standard deviations (SDs) for continuous data. For all variables and models, we only used the initial findings at ED presentation. Comparisons between groups were performed using logistic regression. Exploratory multivariable analysis of primary and secondary outcomes was performed using potential predictor variables chosen based on biologic plausibility and previous reports. Level of significance was defined as a p-value of 0.05 or less.

RESULTS

General Characteristics and Results of Univariate Analyses

In the past 2 years (2018–2019) Hispanic patients accounted for 21% of our patient volume in the ED, which is similar to their representation in Suffolk County (19.8% Hispanic). However, between March 7, 2020, and May 23, 2020, Hispanic patients accounted for 41% of the patient volume, whereas Caucasians (46.4%) were represented in lower proportions relative to their representation in Suffolk county (84.4%) These data indicated that Hispanic patients with COVID-19 were disproportionally presenting to our institution in Suffolk County both in regard to their regional representation and in their representation in our traditional ED volume.

During the study period 2,795 patients were diagnosed with COVID-19 by SARS-CoV-2 RT-PCR test. The analysis included 2,336 patients, of those 1,079 (46%) identified as non-Hispanic Caucasians and 960 (41%) as Hispanic. We excluded 459 patients in whom racial and/or ethnic criteria were not determined. An additional 297 patients, who identified as African American, Native American/Alaskan, Asian, Hawaiian/Pacific Islander, or multiracial patients were also not included because of their relatively smaller

representation in our cohort (Data Supplement S1, Figure S1, available as supporting information in the online version of this paper, which is available at http://onlinelibrary.wiley.com/doi/10.1111/acem.14146/full). Patient's median (IQR) age was 52 (38–65) years ranging from perinatal (15 days after birth) to 101 years old; 1,224 (53%) were male.

A summary of the two patient cohorts is presented in Tables 1 and 2. Age distribution differed substantially between Hispanics and non-Hispanic Caucasians seen in the ED (Data Supplement S1, Figure S2). Caucasians were more likely to be older when compared to Hispanic patients, with a mean age of 59 years versus 45 years (mean difference = 14 years,

Table 1
Comparison of Baseline Patient Characteristics

	Non-Hispanic Caucasians*	Hispanics*	Difference, % Unless Otherwise Specified (95% CI)
Total cases	1,079	960	—
Male sex	572 (53)	509 (53)	0 (−4 to 4)
Age (years)			
<19	9 (1)	28 (3)	
20–29	89 (8)	137 (14)	
30–39	91 (8)	187 (19)	
40–49	108 (10)	250 (26)	
50–59	247 (23)	187 (19)	
60–69	175 (16)	118 (12)	
70–79	179 (17)	31 (3)	
80–89	135 (13)	17 (2)	
>90	46 (4)	5 (0.5)	
Mean (±SD)	59 (±19)	45 (±16)	14 (13 to 16)
Insurance			
Commercial	635 (59)	340 (35)	23 (19 to 28)
Medicare	189 (18)	44 (5)	13 (10 to 16)
Medicaid	197 (18)	356 (37)	−19 (−23 to − 15)
Self-pay	28 (3)	211 (22)	−19 (−22 to − 17)
Other	30 (3)	9 (1)	2 (1 to 3)
Comorbidities			
0	434 (40)	634 (66)	−26 (−30 to − 22)
1	280 (26)	177 (18)	8 (4 to 11)
>1	365 (34)	149 (16)	18 (15 to 22)
Type			
Diabetes	198 (18)	138 (14)	4 (1 to 7)
HTN	449 (42)	194 (20)	21 (17 to 25)
COPD	104 (10)	6 (1)	9 (7 to 11)
Asthma	91 (8)	46 (5)	4 (1 to 6)
Cancer	109 (10)	31 (3)	7 (5 to 9)
CHF	83 (8)	17 (2)	6 (4 to 8)
CAD	154 (14)	40 (4)	10 (8 to 13)
Immunosuppressed	70 (6)	38 (4)	3 (1 to 5)
CKD	73 (7)	33 (3)	3 (1 to 5)
BMI > 30 (only admitted)	215 (37)	116 (35)	2 (−5 to 8)
Place of origin			
Home	859 (80)	940 (98)	−18 (−21 to 16)
Nursing home	220 (20)	20 (2)	18 (16 to 21)
Contact with sick person (COVID-19 or flu-like symptoms)	408 (38)	403 (42)	−4 (−8 to 1)

BMI = body mass index; CAD = coronary artery disease; CHF = congestive heart failure; CKD = chronic kidney disease; COPD = chronic obstructive pulmonary disease; HTN = hypertension.
*Data are reported as *n* (%), unless otherwise reported.

Table 2
Signs, Imaging, and Laboratory Characteristics on Presentation

	Non-Hispanic Caucasians	Hispanics	Difference, % unless otherwise specified (95% CI)
Fever > 38°C	137 (13) [1,056]	180 (19) [937]	−6 (−10 to − 3)
Tachypnea RR > 24/min	140 (13) [1,069]	98 (10) [945]	3 (−1 to 6)
Oxygen saturation			
>94%	843 (79)	774 (82)	−3 (−1 to 7)
89%–93%	155 (14)	112 (12)	3 (−1 to − 6)
>88%	71 (7) [1,069]	58 (6) [944]	1 (−2 to 3)
Bilateral opacities on imaging	475 (44) [1,079]	379 (39) [960]	5 (1 to 9)
Leukopenia < 4×10^6	91 (12) [750]	30 (6) [464]	6 (2 to 9)
Lymphocytopenia < 1×10^6	265 (35) [747]	137 (30) [462]	6 (1 to 11)
Platelets < 150×10^9	153 (23) [669]	43 (10) [424]	13 (8 to 17)
Creatinine > 1.5 mg/dL	139 (19) [750]	42 (9) [465]	10 (5 to 13)
D-dimer > 750 mg/L	165 (25) [651]	71 (19) [381]	7 (1 to 12)
CRP > 8.2 mg/dL	267 (41) [657]	194 (49) [392]	−9 (−15 to − 2)
Procalcitonin > 0.5 pg/mL	117 (18) [643]	59 (15) [383]	−3 (−2 to 7)
AST > 40 units/L	285 (40) [709]	229 (53) [430]	−13 (−19 to − 7)
Troponin > 0.06 ng/mL	73 (12) [633]	18 (5) [366]	7 (3 to 10)
Mean (±SD) length of symptoms prior to ED visit, days	5.8 (6.4) [894]	6.6 (6.0) [892]	−0.8 (−1.3 to −0.3)

Normal laboratory values: leukocyte count (normal low, 4.8×10^9/L), lymphocyte count (leukopenia < 4×10^6), platelets (normal low 150×10^9/L), creatinine (normal high 1.20 mg/dL), D-dimer (normal low < 230 D-DU ng/mL), CRP (normal low 0.0 mg/dL), procalcitonin (normal low < 0.10 ng/mL), AST (normal high 40 IU/L), troponin (normal low < 0.01 ng/mL).
AST = aspartate aminotransferase; CRP = C-reactive protein.

95% CI = 13 to 16 years). Specifically, 39% of non-Hispanic patients were 70 years and older, while only 10% of the Hispanic patients belonged to that age group. Consistent with the skewed age distribution, a higher percentage of Caucasian patients had Medicare insurance (18% vs. 5%) or resided in a nursing home (20% vs. 2%) compared with Hispanic patients. Hispanic patients in this cohort were less likely to have commercial insurance and instead were more likely to be covered by Medicaid (37% vs. 18%) or registered as self-payers (22% vs. 3%) when compared with Caucasian patients.

Notably, 66% of Hispanic patients reported no comorbidities (vs. 40% among Caucasians) while more Caucasian patients had one or more comorbidities (34% vs. 16%). Caucasians were more likely to suffer from hypertension (42% vs. 20%), chronic obstructive pulmonary disease (10% vs. 1%), asthma (8% vs. 5%), CHF (8% vs. 2%), cancer (10% vs. 3%), and chronic kidney disease (7% vs. 3%). Obesity was only assessed for admitted patients and did not differ between the cohorts. Both groups reported symptoms for similar lengths of time prior to presentation (5.6 days vs. 6.6 days).

With respect to their admission laboratory values and examinations, Caucasians were also more likely to present with thrombocytopenia (<150×10^9/L; 23% vs. 6%), abnormal kidney function (creatinine > 1.5 mg/dL; 19% vs. 9%), elevated D-dimer (>750 mg/L; 25% vs. 19%), or elevated troponin(>0.06 ng/mL; 12% vs. 5%). The proportion of febrile and hypoxemic patients was comparable between the two groups.

Patient outcomes are summarized in Table 3. Of all the patients seen during the study period 1,043 patients were discharged from the ED and six patients died in the ED. Hispanic patients were more likely to be discharged than Caucasian patients (63% vs. 41%). A total of 996 patients were admitted to the hospital. Caucasians were more likely to be admitted to a regular medicine floor as compared to Hispanic patients (55% vs. 34%) and were more likely to be admitted directly to an ICU when compared to Hispanics (4% vs. 2%). It is noteworthy that more Hispanic patients required intubation and mechanical ventilation (21% of admitted) compared to Caucasian patients (15% of admitted, difference = 6%, 95% CI = 1% to 12%). More importantly, despite lower intubation rates, mortality was higher for admitted Caucasian patients (10% vs. 3%; mean difference = 7%, 95% CI = 5% to 10%). It should be noted that, as an arbitrary endpoint was chosen for data collection to begin our

Table 3
Patient outcomes

	Non-Hispanic Caucasians	Hispanics	Difference, % unless otherwise specified (95% CI)
Discharges from ED, No. (% of all ED visits)	437 (41)	606 (63)	−23 (−27 to − 18)
Admissions to regular floor, No. (% all ED visits)	589 (55)	331 (34)	20 (16 to 24)
Direct admissions to ICU, No. (% of all ED visits)	48 (4)	22 (2)	2 (1 to 4)
Died in ED, No. (% of all ED visits)	5 (0.5)	1 (0.1)	0.4 (−0.3 to 0.1)
LOS for admitted patients (days), mean (±SD)	8.0 (±6.6)	8.1 (±7.1)	−0.1 (−1.0 to 0.8)
Requiring mechanical ventilation, No. (% of all ED visits)	95 (9)	74 (8)	1 (−1 to 4)
No (% of admissions)*	93 (15)	73 (21)	−6(−12 to − 1)
Days of mechanical ventilation, mean (±SD)	11.6 (±9.6)	12.2 (±10.4)	−0/6 (−3.7 to 2.6)
Patients never requiring ICU, No. (% of all ED visits)	954 (88)	874 (91)	−3 (−5 to 1)
Overall mortality, No. (% of all ED visits)	113 (10)	30 (3)	7 (5 to 10)
Age-based case fatality (years)	Percentage of those cases that died		
<19	0/9 (0)	0/28 (0)	0 (−15 to 37)
20–29	1/89 (1)	1/135 (1)	0 (−4 to 3)
30–39	0/91 (0)	2/185 (1)	−1 (−4 to 4)
40–49	2/106 (2)	3/246 (1)	1 (−2 to 6)
50–59	10/237 (4)	4/180 (2)	2 (−2 to 6)
60-69	12/173 (7)	9/110 (8)	−1 (−9 to 5)
70–79	33/169 (20)	8/28 (29)	−9 (−30 to 7)
80–89	45/127 (35)	2/15 (13)	22 (−7 to 36)
>90	10/44 (23)	1/5 (20)	3 (−49 to 27)
Discharged (from ED or hospital), No. (% of all ED patients)	921 (85)	891 (93)	−7 (−10 to − 5)
Died, No. (% of all ED patients)	113 (11)	30 (3)	7 (5 to 10)
Disposition pending, No. (% of all ED patients)	45 (4)	39 (4)	0 (−2 to 2)

*Excludes three patients who were ventilated and died in the ED

analysis, disposition was still pending on 39 Hispanic and 45 Caucasian patients at the time of preparation of the data. Sadly, the ongoing nature of the pandemic precludes a neat endpoint where outcomes for all patients would be available to final disposition. A breakdown of age-specific mortality rates is presented in Data Supplement S1, Figure S3.

Multivariable Group Comparisons

Variables included into our models were male sex, age, ethnicity, fever on presentation (>38°C), tachypnea (heart rate greater than 100 beats/min), hypoxemia (pulse oxygen saturation less than 94%), tachypnea (respiratory rate greater than 24 breaths/min), known exposure to COVID-19–infected individual(s), and insurance status. These were examined with respect to hospital admission, need for IMV, ICU requirement, and mortality (see Tables 4 and 5).

After potential confounders were adjusted for, the odds of hospital admission were lower in Hispanic patients (OR = 0.69, 95% CI = 0.52 to 0.92) but higher in patients with Medicare (OR = 1.88, 95% CI = 1.14 to 3.10) or Medicaid (OR = 1.87, 95% CI = 1.36 to 2.57). Age (OR = 1.05/year, 95% CI = 1.04 to 1.06/year), fever (OR = 2.84, 95% CI = 1.98 to 4.08), tachypnea (OR = 7.05, 95% CI = 3.66 to 13.58), hypoxemia (OR = 16.18, 95% CI = 9.69 to 27.04), and number of comorbidities (OR = 1.79, 95% CI = 1.55 to 2.05) were also associated with increased admission while contact with a symptomatic or COVID-positive person was negatively associated with admission (Table 4).

Variables associated with ICU admission (Table 5) included male sex (OR = 1.56, 95% CI = 1.10 to 2.22), tachypnea (OR = 1.61, 95% CI = 1.08 to 2.39), and hypoxemia (OR = 1.94, 95% CI = 1.54 to 2.45, per 1% decrease in oxygen saturation). Variables associated with IMV (Table 4) included male sex (OR = 1.75, 95% CI = 1.18 to 2.60) and hypoxemia (OR = 2.01, 95% CI = 1.56 to 2.59, per 1% decrease

Table 4
Multivariable Analysis, Outcomes

	OR	95% CI
Admission		
Male sex	1.21	0.93–1.58
Age per year	1.05	1.04–1.06
Non-Hispanic White	Reference	—
Hispanic	0.69	0.52–0.92
Temp > 38°C	2.84	1.98–4.08
Tachypnea	7.05	3.66–13.58
O_2	16.18	9.69–27.04
Any exposure	0.48	0.36–0.62
No. of comorbidities	1.79	1.55–2.05
Insurance		
Private	Reference	—
Medicare	1.88	1.14–3.10
Medicaid	1.87	1.36–2.57
Self	0.28	0.16–0.49
Other	0.58	0.24–1.42
Invasive ventilation (admits only)		
Male sex	1.75	1.18–2.60
Age per year	1.00	0.99–1.01
Non-Hispanic White	Reference	—
Hispanic	1.43	0.93–2.19
Temp> 38	1.17	0.76–1.80
Tachypnea	1.44	0.93–2.22
O_2	2.01	1.56–2.59
Any exposure	1.28	0.87–1.90
No. of comorbidities	0.97	0.83–1.13
Insurance		
Private	Reference	—
Medicare	0.95	0.56–1.62
Medicaid	0.66	0.42–1.04
Self	0.31	0.09–1.15
Other	0.82	0.17–3.93

Table 5
Multivariable Analysis (Continued)

	OR	95% CI
ICU (admits only)		
Male sex	1.56	1.10–2.22
Age per year	0.99	0.98–1.00
Non-Hispanic White	Reference	—
Hispanic	1.04	0.70–1.53
Temp > 38°C	1.12	0.75–1.67
Tachypnea	1.61	1.08–2.39
O_2	1.94	1.54–2.45
Any exposure	1.21	0.84–1.74
No. of comorbidities	1.04	0.90–1.19
Insurance		
Private	Reference	—
Medicare	0.99	0.61–1.60
Medicaid	0.76	0.51–1.15
Self	0.40	0.13–1.28
Other	0.56	0.12–2.66
Mortality		
Male sex	1.77	1.14–2.76
Age per year	1.06	1.05–1.08
Non-Hispanic White	Reference	—
Hispanic	0.82	0.46–1.47
Temp > 38°C	0.69	0.37–1.28
Tachypnea	2.67	1.61–4.44
O_2	2.33	1.72–3.15
Any exposure	0.70	0.43–1.16
No. of comorbidities	1.31	1.13–1.52
Insurance		
Private	Reference	—
Medicare	0.93	0.55–1.57
Medicaid	0.61	0.34–1.09
Self	0.68	0.18–2.49

in oxygen saturation). Variables associated with mortality (Table 5) were male sex (OR = 1.77, 95% CI = 1.14 to 2.76), age (OR = 1.06/year, 95% CI = 1.05 to 1.08/year), tachypnea (OR = 2.67, 95% CI = 1.61 to 4.44), hypoxemia (OR = 2.33, 95% CI = 1.72 TO 3.15, per 1% decrease in oxygen saturation), and comorbidities (OR = 1.31, 95% CI = 1.13 to 1.52). Ethnicity and insurance were not associated with ICU admission, IMV, and mortality after adjusting for confounding variables. The models showed adequate fit based on the Hosmer-Lemeshow test ($\chi^2 = 8.2$, $p = 0.41$ for admission; $\chi^2 = 15.8$, $p = 0.05$ for IMV; $\chi^2 = 3.9$, $p = 0.0.86$ for ICU; $\chi^2 = 5.3$, $p = 0.73$ for mortality).

To determine whether the predictive factors for all outcomes were similar among Hispanic and non-Hispanic Caucasian patients, separate multivariable analyses were performed for each subgroup. There were no obvious differences in the variables associated with admission, ICU admission, IMV, and death between the two groups of patients (data not shown).

DISCUSSION

The relationship between race, ethnicity, sex, and health is a complex one and has previously been described for chronic medical conditions as well as during prior pandemics.[19,20] During the H1N1 pandemic Quinn et al.[20] examined differences in exposure, susceptibility, and access to health care by analyzing surveys of 1,479 adults that included substantial numbers of Black and Hispanic patients. They

reported significant race and ethnicity-related disparities as a potential risk for H1N1 as well as worse morbidity and mortality in those populations. Similarly, media reports described increased COVID-19 infection rates as well as related morbidity and mortality in Black and Hispanic patients. Our experience was different, because we do not report worse outcomes when compared with our Caucasian patients.

We noted an increase in the number of visits to the ED from Hispanic patients both when compared to prior years and in proportion to their representation in our catchment area. A total of 52% of Hispanics and 29% of non-Hispanics were first seen in our ED tent; this could be partially explained by the presence of a New York state testing facility in the same parking lot. The ED tent may have attracted more people from out of the hospital catchment area, or it is possible that less severe cases (which included a higher percentage of Hispanics) were diverted to the tent. At the start of the outbreak, the NY state testing facility was one of the few places COVID-19 testing was readily available, which, along with advertising, may have extended distances well or mildly symptomatic patients were willing to travel.

Hispanic patients tended to present from a handful of zip codes in our catchment areas. One specific zip code from which 25% of the admitted patients stemmed has a high percentage of Hispanic patients. Our Hispanic patients tended to be younger and tended to present from home and not from nursing homes. They exhibited less preexisting medical comorbidities; while more likely to be intubated, they were less likely to die if intubated. These factors all likely contributed to lower mortality when compared to Caucasian patients. Our multivariable analyses showed that being Hispanic was not associated with mortality even after adjusting for age, comorbidities, insurance, and domicile (nursing home vs. home).

Our results appear to differ from those reported in other studies that have highlighted worse outcome in minorities who are diagnosed with COVID-19. These studies have reported worse outcomes in Black patients although increased morbidity, mortality, and health disparities have also been reported in Hispanic patients.[21–24] Our analysis highlights the fact that while rates of COVID-19 infection were higher among our population of Hispanic patients, we did not see worse outcomes in our patients in suburban New York. This is because outcomes in COVID-19 infection are not tied directly to race or ethnicity but, rather, differences in COVID-19 morbidity and mortality are likely the result of a complex interplay of socioeconomic, cultural, social factors, and health care accessibility factors among different groups of patients.

A major difference between our study and previous studies is that we examined the outcome in a predominantly suburban Hispanic population. New York City Department of Health statistics identifies Airport/East Elmhurst (zip code 11369) as one of the areas with high rates of COVID-19 infection. We compared the Airport/East Elmhurst area with the Brentwood area on Long Island (zip code 11717), which represented 25% of our patients. We found that although both areas have comparable percentages of Hispanic residents (67% and 64%), socioeconomic parameters differ significantly. Data from Brentwood indicate per-capita income of $23,579, and a median household income of $74,420 with 7.6% living below the poverty line. Data also indicate that 77% of residents commute by car, that the average persons per household is 4.2, and that 82% of the population lives in a single-unit residence.[25] In contrast, residents in Airport/East Elmhurst report per-capita income of $22,638, a median household income of $54,121, and 15.6% of persons in that district live below the poverty line. It is noteworthy that 55% commute by public transportation, the average persons per household is 3.2, and 70% reside in a multi-unit residence.[26,27]

All these factors emphasize that the Hispanic population in Suffolk County is markedly different from the inner-city Hispanic population in some key ways. Rather than intrinsic genetic differences, socioeconomic characteristics, access to health care, and housing characteristics may be more likely to affect outcome. Whether patients were able to practice sufficient social distancing and whether affected Hispanic patients were living in single-unit housing and commuting alone cannot be concluded from these data.

There are other potential reasons why we did not see worse outcomes in Hispanic patients in our hospital, such as our high availability of ambulatory testing. This may have skewed results toward healthier or wealthier Hispanic populations who were able to travel, even while being under or uninsured or having limited access to routine health care. We did not collect information on patient occupation. Hispanic patient's lack of comorbidities on presentation might have been due to their younger age but could also be explained by differing access to regular medical care. It could also be that Hispanics in urban settings are

more likely to be employed in services or placed in situations daily (e.g., relying on subways or other public transportation) that result in greater exposure to potential infection (and thus higher viral loads) and situations where ability to apply social distancing is limited.

LIMITATIONS

Our study has several limitations. Our data represent a single institution's experience, which may not be generalizable to other settings. Criteria for and availability of testing of ambulatory patients were done according to CDC and department of health (DOH) standards and guidelines as recommended by the CDC and New York DOH, as applied at the time. Changing conditions during the pandemic meant that testing criteria and guidelines changed frequently as new information came to light during the response. Additionally, changes in off-site testing labs and fluctuations in test and reagent availability could not be controlled and surely played a part in affecting the amount and type of patients tested. The reliability of the test appears to be dependent on many factors and may lead to a significant number of false-negative results.[22,25]

The data we collected were retrospective and subject to all the typical limitations of this study design including selection bias, unmeasured confounders, errors in data entry, and residual confounding. While we examined indirect markers of income by examining patient's zip codes, we did not compare income directly. We also did not take into account patients' housing density or other potential environmental factors like use of private or public transportation, ability to work from home, or requirement for work as an "essential worker" who may have variable access to personal protective equipment outside of the health care industry. Finally, this study did not examine potential bias against Hispanic patients by health care workers as a potential factor in differences in discharge rates versus admissions.

CONCLUSION

While our results differ from those of media reporting of increased morbidity and mortality in minority patients, it highlights that socioeconomic, cultural, and environmental factors may be much more significant in explaining the deleterious effects seen in minorities living in more densely populated areas in the epicenters of COVID-19. Our work represents an important step in identifying at-risk populations. Future research should examine the relationship between race and ethnicity with respect to the socioeconomic, cultural, health care accessibility, and other factors that may have protected our population. Only once we understand the complex interplay of these factors will we be able to bring preventative and treatment efforts to bear in a way that can reduce the disproportionate morbidity and mortality within these racial and ethnic groups in other environments.

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Supporting Information

The following supporting information is available in the online version of this paper available at http://onlinelibrary.wiley.com/doi/10.1111/acem.14146/full

Data Supplement S1. Supplemental material.