Journal of Racial and Ethnic Health Disparities
https://doi.org/10.1007/s40615-023-01636-z

The Impact of Language on Hospital Outcomes for COVID-19 Patients: A Study of Non-English Speaking Hispanic Patients

Susan Lopez[1] · Joshua Longcoy[2] · Elizabeth Avery[3] · Zeynep Isgor[4] · Athavi Jeevananthan[5] · Jayline Perez[6] · Brenda Perez[7] · Hernan Daniel Sacoto[8] · Kristina Stefanini[9] · Sumihiro Suzuki[10] · David Ansell[3] · Elizabeth Lynch[11] · Tricia Johnson[4]

Received: 7 December 2022 / Revised: 4 May 2023 / Accepted: 5 May 2023

Abstract

Background The COVID-19 pandemic has highlighted and exacerbated health inequities, as demonstrated by the disproportionate rates of infection, hospitalization, and death in marginalized racial and ethnic communities. Although non-English speaking (NES) patients have substantially higher rates of COVID-19 positivity than other groups, research has not yet examined primary language, as determined by the use of interpreter services, and hospital outcomes for patients with COVID-19.

Methods Data were collected from 1,770 patients with COVID-19 admitted to an urban academic health medical center in the Chicago, Illinois area from March 2020 to April 2021. Patients were categorized as non-Hispanic White, non-Hispanic Black, NES Hispanic, and English-speaking (ES) Hispanic using NES as a proxy for English language proficiency. Multivariable logistic regression was used to compare the predicted probability for each outcome (i.e., ICU admission, intubation, and in-hospital death) by race/ethnicity.

Results After adjusting for possible confounders, NES Hispanic patients had the highest predicted probability of ICU admission (p-value < 0.05). Regarding intubation and in-hospital death, NES Hispanic patients had the highest probability, although statistical significance was inconclusive, compared to White, Black, and ES Hispanic patients.

Conclusions Race and ethnicity, socioeconomic status, and language have demonstrated disparities in health outcomes. This study provides evidence for heterogeneity within the Hispanic population based on language proficiency that may potentially further contribute to disparities in COVID-19-related health outcomes within marginalized communities.

Keywords Hispanic health · Racial/ethnic disparities · COVID-19 outcomes · Patient's preferred language

✉ Joshua Longcoy
Joshua_Longcoy@rush.edu

Susan Lopez
susan_lopez@rush.edu

[1] Department of Internal Medicine, Rush University Medical Center, 1717 W Congress Pkwy, FL 10, Chicago, IL 60612, USA

[2] RUSH BMO Institute for Health Equity and Department of Health Systems Management, Rush University Medical Center, 1700 W. Van Buren St. Suite 470, Chicago, IL 60612, USA

[3] Center for Community Health Equity, Rush University Medical Center and Department of Preventive Medicine, Rush Medical College, 1700 W Van Buren St. Suite 470, Chicago, IL 60612, USA

[4] Department of Health Systems Management, Rush University Medical Center, 1700 W. Van Buren St. Suite 126B TOB, Chicago, IL 60612, USA

[5] Department of Endocrinology, Duke University Medical Center, 200 Trent Drive, Bake House Room 310A, Durham, NC DUMC 3021, USA

[6] Roosevelt University, 430 S Michigan Ave., Chicago, IL 60605, USA

[7] Universidad Autónoma de Guadalajara School of Medicine, Guadalajara, Mexico

[8] Department of Internal Medicine, New York Metropolitan Hospital, 1901 1St Ave., New York, NY 10029, USA

[9] Rush Medical College, 1700 W Van Buren St. Suite 470, Chicago, IL 60612, USA

[10] Department of Family and Preventive Medicine, Rush Medical College, 1700 W Van Buren St. Suite 470, Chicago, IL 60612, USA

[11] RUSH BMO Institute for Health Equity, Rush University Medical Center and Department of Family and Preventive Medicine, Rush Medical College, 1700 W Van Buren St. Suite 470, Chicago, IL 60612, USA

Published online: 16 May 2023

Introduction

Health disparities by race and ethnicity and socioeconomic status (SES) have been documented for centuries in the United States (US) [1]. The COVID-19 pandemic has highlighted and exacerbated health inequities, as demonstrated by the disproportionate rates of hospitalization and death among marginalized communities such as Black and Hispanic populations [2, 3]. The impact of social determinants of health (SDOH) on different racial and ethnic groups during the COVID-19 pandemic has been well documented [2, 4, 5]. Experiences that have increased the risk of COVID-19 include living in multigenerational households, jobs not conducive to remote working, and poor access to healthcare [6].

Health literacy and primary language are two SDOH that may explain health disparities and inequities in racial and ethnic groups impacted by COVID-19 [7]. Language barriers for individuals in the US who are non-English speaking (NES) lead to miscommunication and lower healthcare quality [8]. Language barriers may also be a proxy for other social risk factors, such as lack of health insurance coverage, lack of transportation, and fear of deportation, leading to delays in accessing care [9, 10]. Disparities due to minority race/ethnicity, low SES, and non-English language during the COVID-19 pandemic have been associated with higher incidence and worse outcomes [11–13]. NES individuals are at higher risk of testing positive for COVID-19 than English speaking individuals [14–16]. However, there is a significant overlap between individuals who identify as Hispanic and those who are NES. Thus, these associations may be due to the language barrier in NES Hispanic patients and their need for an interpreter rather than other underlying determinants related to Hispanic ethnicity [17]. Bilingual patients may prefer to speak a language other than English but speak English well enough not to affect their care. Although hospitals collect information about preferred language, language preference does not consider whether patients need an interpreter during their care. Inequities within a racial and ethnic group by use of interpreter has yet to be studied.

Therefore, this study examined the differences in hospital outcomes (intensive care unit [ICU] admission, intubation, and in-hospital death) by race and ethnicity and the use of interpreter services as a proxy for NES among a cohort of COVID-19 patients admitted to an urban academic medical center.

Methods

Data Source

This retrospective cross-sectional study used electronic medical record (EMR) data from patients who visited Rush University Medical Center, an academic medical center in the Chicago, Illinois (IL) metropolitan area that is part of the Rush University System for Health (RUSH). Data were collected from patients diagnosed with COVID-19 admitted between March 14, 2020 and April 30, 2021 and discharged by May 31, 2021.

The sample was limited to the first hospitalization diagnosed with COVID-19 for patients aged 18 and older. Patients were excluded if they were admitted to labor and delivery, inpatient rehabilitation, or the psychiatric unit since these patients were admitted for a primary reason other than COVID-19. Patients were also excluded if they were transferred from another hospital since these patients most likely received treatment before coming to the hospital [18]. These patients did have complete hospital information and were more likely to be transferred directly into the ICU intubated and thus not have the opportunity to use an interpreter. This study focused on non-Hispanic Black (Black), Hispanic, and non-Hispanic White (White) patients due to low counts in Asian (n = 77), American Indian or Alaska Native (n = 4), and Native Hawaiian or other Pacific Islander (n = 5) patients. This study was approved by the Rush University Medical Center Institutional Review Board.

Outcome Variables

Outcomes included ICU admission, intubation, and in-hospital death (all treated as a dichotomous variable) [19]. Patients were classified as having an ICU admission if they were admitted to the ICU at any point during the hospital stay. Patients were classified as being intubated if they received invasive ventilation during the hospital stay in an ICU unit. In-hospital death was defined as a patient who died during the hospital stay or was discharged to an inpatient or home hospice. Although there is a correlation among these three variables, the outcomes were kept separate to be compared with other papers using the same outcomes [2, 4, 5].

Explanatory Variables

Race/Ethnicity and Interpreter Services

The patient's race and ethnicity were based on self-report recorded in the EMR and classified into three groups: Black, Hispanic, and White. Patients were classified as Hispanic if they self-identified as having Hispanic ethnicity, regardless of race.

Since a patient's selection of a primary language may not directly correlate with using interpreter services, we selected patients who used Spanish interpreter services during their hospitalization as a proxy for their preferred/primary

language. Therefore, throughout the remainder of this paper, patients are referred to as NES Hispanic if they used interpreter services two or more times during the hospitalization, and patients who self-identified as Hispanic and did not use an interpreter or only used an interpreter once during their stay are referred to as English-speaking (ES) Hispanic patients. Since the occurrence of needing interpreter services by White patients (n = 24) and Black patients (n = 3) was low, these patients were excluded. Additionally, patients using interpretation services due to loss of hearing were excluded (n = 4). Thus, four categories were included in the analysis: 1) White, 2) Black, 3) ES Hispanic, and 4) NES Hispanic.

Possible Confounding Variables

Demographic characteristics included sex, age, and primary payer (Medicaid, Medicare, private insurance, uninsured). Comorbidities were determined based on the secondary *International Classification of Diseases, 10th Revision* (ICD-10) diagnosis codes from the patient's encounter and grouped into comorbidities using the Agency for Healthcare Research and Quality's Clinical Classification Software Refined algorithm [20]. The comorbidities included in this study came from the Centers for Disease Control's list of medical conditions that place a patient at higher risk for severe COVID-19 illness, including asthma, chronic obstructive pulmonary disease (COPD), diabetes, heart disease, hypertension, kidney disease, liver disease, and obesity [21]. The presence or absence of each comorbidity and a total count of comorbidities (range: 0 – 8) were used for the analysis. In addition, three measures of history of medical care at RUSH were included: having at least one RUSH primary care provider visit within 12 months prior to the hospital admission date in this study, at least one hospitalization at a RUSH hospital within 12 months prior to hospital admission date in this study, or a at least one ED visit within 24 months prior to hospital admission date in this study. The time frame of each visit above was chosen so that the chronic disease history would be up to date for patients with a history of an encounter. Therefore, if the patient had at least one of the visits mentioned above, we classified the patient as having a history of an encounter.

Statistical Analysis

Variables were described using frequency distributions for categorical variables and median and interquartile range (IQR) for continuous variables. The association between each variable and race/ethnicity was examined using a Chi-squared test or a Wilcoxon rank sum test (Table 1). Three separate models were constructed, one for each outcome (i.e., ICU admission, intubation, death), with race/ethnicity (i.e., Black, White, ES Hispanic, and NES Hispanic) and controlling for age, sex, insurance, history of encounter, and count of comorbidities. The inclusion criteria for ICU admission and death/hospice were all patients admitted to the hospital. The analysis of intubation was limited to patients admitted to the ICU at any point in their hospital stay since most of the intubation happens in the ICU. A mixed logistic regression was created for each outcome with admission month and year as clustering effects. The predicted probability was then calculated from the regression coefficients by taking the average predictive probability for each race/ethnic category (i.e., Black, NES Hispanic, ES Hispanic, and White). The 95% confidence intervals were calculated using the delta method. The predictive accuracy of each model was assessed using the area under the receiver operating characteristic curve along with a 95% confidence interval, and goodness-of-fit was evaluated with the Hosmer–Lemeshow test. As a secondary analysis, we reran the three models with ES Hispanic and NES Hispanic, determined by using the preferred language rather than the use of interpreter services, to assess whether the results changed with the less precise but more readily available proxy for the presence of a language barrier. All statistical analyses were performed using SAS version 9.4.

Results

Overall Sample Characteristics

A total of 1,770 patients were included in the sample (Table 1). Most patients had Medicare or private insurance (41% and 29%, respectively). The median count of comorbidities per patient was 3 (IQR: 2, 4), with more than half of the patients having heart disease (75%) and obesity (60%). Thirty-six percent of the patients had an ICU, 37% of the patients admitted to the ICU were intubated, and nearly 9% of patients died in the hospital or were discharged to hospice.

Differences by Race/Ethnicity

ES Hispanic patients were younger (median [IQR]: 54 [42, 63]) than patients from the other three racial/ethnic groups (White patients: 66 [52, 75], Black patients: 61 [49, 71], and NES Hispanic patients: 63 [53, 73]). In addition, NES Hispanic patients had the highest percentage without insurance (27%) among the four racial/ethnic groups (White patients: 3%, Black patients: 3%, and ES Hispanic patients: 13%). Larger proportions of NES Hispanic patients admitted to the ICU were intubated and died in the hospital compared to other racial/ethnic groups. Additionally, NES Hispanic patients had the longest ICU stays (i.e., ICU LOS) and longest hospital stays (i.e., hospital LOS).

Table 1 Patient Characteristics of COVID-19 Confirmed Positive Patients Admitted to an Urban Academic Medical Center in the Chicago, IL Area from March 2020 to May 2021

Patient Characteristic	Total	White	Black	ES Hispanic	NES Hispanic	
	1,770 (100.0)	274 (15.5)	715 (40.4)	456 (25.8)	325 (18.4)	
Male Sex	942 (53.2)	152 (55.5)	321 (44.9)	255 (55.9)	214 (65.9)	*
Age[+]	60 (48, 71)	66 (52, 75)	61 (49, 71)	54 (42, 63)	63 (53, 73)	*
Insurance						
Private	511 (28.9)	90 (32.9)	176 (24.7)	182 (39.9)	63 (19.4)	*
Medicaid	355 (20.1)	33 (12.0)	180 (25.2)	98 (21.5)	44 (13.5)	
Medicare	726 (41.0)	142 (51.8)	339 (47.5)	116 (25.4)	129 (39.7)	
Uninsured	177 (10.0)	9 (3.3)	19 (2.7)	60 (13.2)	89 (27.4)	
Comorbidities						
Obesity	1,067 (60.3)	128 (46.7)	475 (66.4)	341 (74.8)	123 (37.9)	*
Type II Diabetes	761 (43.0)	84 (30.7)	293 (41.0)	202 (44.3)	182 (56.0)	*
Hypertension	1,185 (67.0)	181 (66.1)	566 (79.2)	243 (53.3)	195 (60.0)	
Heart Disease	1,319 (74.5)	207 (75.6)	609 (85.2)	274 (60.1)	229 (70.5)	*
Kidney Disease	489 (27.6)	66 (24.1)	287 (40.1)	70 (15.4)	66 (20.3)	
Liver Disease	152 (8.6)	22 (8.0)	52 (7.3)	45 (9.9)	33 (10.2)	
Asthma	242 (13.7)	31 (11.3)	133 (18.6)	56 (12.3)	22 (6.8)	*
COPD	182 (10.3)	33 (12.0)	110 (15.4)	16 (3.5)	23 (7.1)	*
Count of Comorbidities[+]	3 (2, 4)	3 (2, 4)	4 (3, 5)	3 (1, 4)	3 (1, 4)	
History of Encounter	1,061 (59.9)	158 (57.7)	513 (71.8)	268 (58.8)	122 (37.5)	*
Outcomes						
Death	119 (6.7)	15 (5.5)	39 (5.5)	18 (4.0)	47 (14.5)	*
Hospice	32 (1.8)	8 (2.9)	10 (1.4)	2 (0.4)	12 (3.7)	*
Death/Hospice	151 (8.5)	23 (8.4)	49 (6.9)	20 (4.4)	59 (18.2)	*
Hospital LOS[+]	5.4 (3.1, 10.1)	5.1 (3.0, 9.0)	5.2 (3.0, 9.2)	4.4 (2.9, 8.1)	9.1 (4.8, 17.7)	*
Admitted to ICU	633 (35.8)	84 (30.7)	226 (31.6)	122 (26.8)	201 (61.9)	*
ICU Intubated[a]	234 (37.0)	24 (28.6)	77 (34.1)	39 (32.0)	94 (46.8)	*
ICU Death/Hospice[a]	143 (22.6)	21 (25.0)	44 (19.5)	20 (16.4)	58 (28.9)	*
ICU LOS[+,a]	5.4 (3.1, 10.1)	4.5 (2.2, 10.9)	4.0 (1.8, 9.8)	5.3 (2.5, 12.6)	8.1 (3.2, 19.6)	*

The percentages among all four categories were significantly different except for liver disease; *p-values between Hispanic no interpreter and Hispanic needed interpreter < 0.05; [+]For continuous variables, the median and interquartile range is shown. Percentages for the total column are column percentages. The percentages for the White; Black; ES Hispanic; and NES Hispanic columns are row percentages; [a]The calculation for intubated, ICU Death/Hospice, and ICU LOS was calculated by the number of patients intubated out of patients who were admitted to the ICU. Abbreviations: ES (English speaking), NES (non-English speaking), COPD (chronic obstructive pulmonary disease), ICU (intensive care unit), LOS (length of stay)

Results from Logistic Regression Analysis

Table 2 reports the predicted probabilities for the three hospital outcomes by race/ethnicity. After adjusting for covariates, NES Hispanic patients had the highest probability of being admitted to the ICU (predicted probability: 0.62; 95% confidence interval: [0.52, 0.71]) compared to White patients (0.31 [0.22, 0.40]), Black patients (0.32 [0.24, 0.40]), and ES Hispanic patients (0.27 [0.20, 0.35]). NES Hispanic patients also had the highest probability of being intubated if admitted to the ICU (0.47 [0.31, 0.63]) compared to White patients (0.28 [0.15, 0.47]), Black patients (0.34 [0.21, 0.51]), and ES Hispanic patients (0.32 [0.18, 0.49]). NES Hispanic patients had the highest probability of dying in the hospital or being transferred to hospice (0.18 [0.12, 0.27]) compared to White patients (0.08 [0.05, 0.14]), Black patients (0.07 [0.04, 0.11]), and ES Hispanic patients (0.04 [0.02, 0.08]). Supplemental Table 1 shows the odds ratios for all the covariates in the model.

Discussion

We assessed the outcomes of patients hospitalized with COVID-19 by race and ethnicity and whether Hispanic patients using interpreter services (NES) had poorer hospital outcomes than other patients. Compared to White patients, the predicted probability of ICU admission and intubation

Table 2 Predicted Probabilities from a Multivariable Logistic Regression Examining Association Between Patient Characteristics and ICU Admission, Intubation, and Death/Hospice Among Race and Ethnicity Categories

	ICU Admission Pred Prob (95% CI)	Intubation* Pred Prob (95% CI)	Death/hospice Pred Prob (95% CI)
All Race/Ethnicities			
Black	0.32 (0.24, 0.40)	0.34 (0.21, 0.51)	0.07 (0.04, 0.11)
ES Hispanic	0.27 (0.20, 0.35)	0.32 (0.18, 0.49)	0.04 (0.02, 0.08)
NES Hispanic	0.62 (0.52, 0.71)	0.47 (0.31, 0.63)	0.18 (0.12, 0.27)
White	0.31 (0.22, 0.40)	0.28 (0.15, 0.47)	0.08 (0.05, 0.14)
AUC^{+}	0.70 (0.67, 0.72)	0.73 (0.69, 0.77)	0.76 (0.72, 0.80)

All models used admit month and year as random effects and adjusted for race/ethnicity, age, sex, insurance, history of encounter, and count of comorbidities; $^{+}$Numbers shown are the area under the curve and corresponding 95% confidence limits; *denominator for intubation is out of only patients in the ICU; Abbreviations: ICU (intensive care unit), Pred Prob (predicted probability), ES (English speaking), NES (non-English speaking), AUC (area under the curve)

were similar for Hispanic patients who did not use an interpreter (ES). However, NES Hispanic patients had a significantly higher predicted probability of ICU admission and higher predicted probability of intubation and in-hospital death, although statistical significance was inconclusive, compared to White and ES Hispanic patients.

Previous studies have shown that Hispanic and Black patients with COVID-19 have experienced higher positivity and mortality rates than White patients. [22, 23], Additionally, in a sample of patients testing positive for COVID-19 in Minnesota, Ingraham et al. [24] found that NES patients were 1.91 times more likely (95% CI: 1.51, 2.43) to be hospitalized for COVID-19 than ES patients. While we examined outcomes for patients already hospitalized for COVID-19, we found that NES Hispanic patients were 3.73 times more likely to be admitted to the ICU, 2.25 times more likely to be intubated, and 2.43 times more likely to die in the hospital than White patients (Supplemental Table 2). Some Hispanic patients may have avoided seeking care due to immigration enforcement policies, and hospitals may not have published non-English language editions of their policies [25], especially early in the pandemic. One study found that Hispanic patients presented to the ED at lower rates than White patients [26], suggesting Hispanic patients may have faced greater barriers to care.

In a study of preferred language and COVID-19 hospitalizations in Texas, Velasco et al. found that the odds of ICU admission for NES Hispanic patients was 1.75 times higher than for White patients [27]. In comparison, we found much higher odds of ICU admission (OR = 3.75). However, Velasco et al. used preferred language rather than use of interpreter services to classify patients as ES or NES, and therefore, they may have included people who were fluent in English. We found moderate discordance between NES/ES and preferred language in our sample, with 32% of the Hispanic patients reporting that they did not prefer English but did not use an interpreter. When comparing the use of primary language versus the use of interpreter services to explain being admitted to the ICU, the model with only use of interpreter services as an independent variable had a significantly higher predictive accuracy compared to the model with only primary language ($AUC_{interpreter} = 0.64$ (95% CI: 0.62, 0.67) versus $AUC_{language} = 0.59$ (95% CI: 0.55, 0.62)). These results suggest that use of an interpreter may be a more accurate measure of NES compared to preferred language; however, more research is needed to compare these specifications with actual English language proficiency.

This finding is important, particularly in light of the large number of Hispanic patients whose primary language is not English, compared to other racial and ethnic groups (e.g., German, Russian, Chinese, Arabic) [15]. During the COVID-19 pandemic, the majority of US hospitals did not allow visitors to visit hospitalized patients. These policies may have disproportionately dissuaded NES patients from seeking care in the hospital without a family member due to the lack of familiarity with the language and potentially the hospital. In fact, we found that Hispanic patients who did not have a history of an encounter at RUSH had a higher probability of ICU admission compared to Hispanic patients with a history of an encounter at RUSH.

At this particular institution, if a patient did not have a healthcare provider whom the hospital qualified to discuss care in Spanish, patients were offered interpreter services through various modalities, including telephone or telemedicine with a hospital-provided device as required by the Title VI of the Civil Rights act of 1964 [28]. Although some patients may have declined hospital provided services and opted to use a family member or friend to help interpret care needs during the stay, we believe this was infrequent during the COVID-19 pandemic, due to visitation restrictions that essentially prevented family members from visiting in most circumstances. As a result, family members may change and not be neutral or adequately understand medical terminology, leading to miscommunication, errors, and delayed care

[8, 29, 30]. Future work should examine whether the need for interpreter services changes how healthcare is delivered, such as creating delays in care.

We explored whether lack of insurance drove the outcomes but found no significant associations. However, we found that NES Hispanic patients were older, more likely to be uninsured, and had more comorbidities. Despite the fact that 3.6% of Hispanic adults aged 65 and older in the US were uninsured in 2021 [31], 11% of NES Hispanic patients aged 65 and older in our study were uninsured. Although citizenship status was not collected, this statistic suggests that many of the NES Hispanic patients with poorer outcomes may have been undocumented or had not resided in the United States long enough to accumulate sufficient work experience to qualify for Medicare and, therefore, may have had low acculturation with the healthcare system in Chicago or hesitant to seek care [32].

There were several limitations to this study. First, this study only used data from one academic medical center, and therefore, results may not be generalizable to other settings. However, relatively large numbers of ES Hispanic patients and NES Hispanic patients were included in our study, with these groups representing 26% and 18% of the overall sample, respectively. Second, while the use of interpreter services may be a more accurate proxy for NES than preferred language, we may not have included all NES patients using this approach, particularly patients who had a family member interpret for them, as there is no standard documentation in the EMR for this situation. However, by classifying a patient as NES if they used interpreter services two or more times during the hospitalization, we avoided categorizing a patient as needing interpreter services if it was the patient's family or spouse/partner that needed the interpretation upon discharge which showed up during our validation checks of the data. We also performed a sensitivity analysis to see if the results changed with different definitions of the usage of interpreter services, ranging from once per stay to seven times per stay. We found that doing this did not substantively alter the results. Third, language and NES are only one component of health literacy, and there may be additional aspects related to health literacy that could not be evaluated in this study.

More work is needed to understand the consequences of language barriers in Hispanic patients. Approximately 36% of residents in Chicago report a primary language other than English [33]. Furthermore, of individuals 65 and older who selected speaking Spanish at home, about 74% spoke English less than "very well" [34], suggesting that language may be a significant barrier in seeking necessary medical care. These language barriers are essential for healthcare providers to address since our study suggests that these patients are older and, thus, may need to access healthcare more frequently. Further work should also be done to reinforce the use of interpreters and increase the number of healthcare providers trained and qualified to interpret, as this may provide additional options for communication for NES patients. This study shows the need for future studies to account for the differences between Hispanic patients in terms of NES and English-speaking Hispanic patients whenever possible. Future efforts to assess disparities should examine preferred language and health literacy levels.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s40615-023-01636-z.

Authors' Contributions
- Conceptualization: Susan Lopez and Joshua Longcoy
- Methodology: Susan Lopez, Joshua Longcoy, and Tricia Johnson
- Formal analysis and investigation: Joshua Longcoy, Elizabeth Avery, Zeynep Isgor, and Tricia Johnson
- Writing - original draft preparation: Susan Lopez, Joshua Longcoy, Athavi Jeevananthan, Brenda Perez, Jayline Perez, Hernan Sacoto, and Kristina Stefanini
- Writing - review and editing: Susan Lopez, Joshua Longcoy, David Ansell, Elizabeth Lynch, Sumihiro Suzuki, and Tricia Johnson
- Funding acquisition: Tricia Johnson
- Supervision: Elizabeth Lynch, Sumihiro Suzuki, and Tricia Johnson

Funding Data acquisition for this study was supported by the RUSH Coronavirus Research Fund (PI: T. Johnson).

Data Availability The anonymized data analyzed in this study are available upon reasonable request from the corresponding author.

Code Availability The programming codes can be available upon reasonable request.

Declarations

Ethics Approval This study was approved by the Rush University Medical Center Institutional Review Board.

Consent to Participate Not applicable.

Consent for Publication Not applicable.

Conflicts of Interest The authors have no relevant financial or non-financial interests to disclose.

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