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Authors

Rodriguez, Robert M

Reyes, Karen

Kumar, Vijaya Arun

et al.

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Long COVID Illness: Disparities in Understanding and Receipt of Care in Emergency Department Populations

Robert M. Rodriguez, MD*; Karen Reyes; Vijaya Arun Kumar, MD, MPH; Brian Chinnock, MD; Stephanie A. Eucker, MD, PhD; Kristin L. Rising, MD, MSHP; Zubaid Rafique, MD; Michael Gottlieb, MD; Graham Nichol, MD, MPH; Dana Morse, BSN; Melanie Molina, MD, MAS; Mireya I. Arreguin; Lindsey Shughart; Christopher Conn; Svea Eckstrand; Heba Mesbah, MD; Lauren Chakraborty; Robert D. Welch, MD

*Corresponding Author. E-mail: Robert.rodriguez@ucsf.edu.

Study objective: Most long coronavirus disease (long COVID) studies rely on traditional surveillance methods that miss underserved populations who use emergency departments (EDs) as their primary health care source. In medically underserved ED populations, we sought to determine (1) whether there are gaps in awareness and self-declared understanding about long COVID illness, and (2) the prevalence, impact on school/work attendance, and receipt of care for long COVID symptoms.

Methods: This study was a cross-sectional, convenience sample survey study of adult patients at 11 geographically representative US EDs from December 2022 to October 2023. Awareness and self-declared understanding about long COVID illness were measured. Prevalence, impact on school/work attendance, and receipt of care for long COVID symptoms were also assessed.

Results: Of 1,618 eligible patients, 1455 (89.9%) agreed to participate, including 33.4% African Americans and 30.9% Latino/a. Of the patients, 17.1% lacked primary care. In total, 33.2% had persistent COVID-19 symptoms lasting >1 month, and 20.3% had symptoms >3 months. Moreover, 49.8% with long COVID symptoms missed work/school because of symptoms; 30.3% of all participants and 33.5% of participants who had long COVID symptoms had prior awareness and self-declared understanding of long COVID. Characteristics associated with poor understanding of long COVID were African American race (adjusted odds ratio [aOR] 3.68, 95% confidence interval [CI] 2.66 to 5.09) and Latino/a ethnicity (aOR 3.16, 95% CI 2.15 to 4.64). Participants lacking primary care were less likely to have received long COVID care (24.6% versus 51.2%; difference 26.6%; 95% CI 13.7% to 36.9%).

Conclusions: Despite high prevalence and impact on school/work attendance of long COVID symptoms, most of this ED population had limited awareness and self-declared understanding of long COVID, and many had not received care. EDs should consider the development of protocols for diagnosis, education, and treatment of long COVID illness. [Ann Emerg Med. 2024;■:1-10.]

Please see page XX for the Editor's Capsule Summary of this article.

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INTRODUCTION

Background

Postacute sequelae of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection, or long coronavirus disease (long COVID), is a new disease entity that affects at least 6.9% of American adults and more than 65 million people across the world.^{1,2} Prior investigators have focused on the prevalence and health care impact of long COVID on populations recruited and assessed using traditional online, telephone, electronic health record, and primary care clinic sampling methods, which may miss historically underserved

populations (eg, minority populations and those who lack primary health care access) who may be more vulnerable to poor outcomes from long COVID.³⁻⁵

The emergency department (ED) serves as the primary (and often only) health care access point for a large, medically vulnerable population that includes persons experiencing homelessness, immigrants, and uninsured patients, as well as substantial proportions of African Americans and Latinos/as who have suffered disproportionate morbidity and mortality from acute COVID-19 illness.⁶⁻¹⁰ In a study conducted at 15 safety-net EDs across the United States, we found that many

Editor's Capsule Summary*What is already known on this topic*

Some patients infected with coronavirus disease (COVID-19) will develop prolonged symptoms.

What question this study addressed

This cross-sectional survey of a convenience sample of emergency department (ED) patients questioned their familiarity with long COVID and its impact when suspected.

What this study adds to our knowledge

Many ED patients had limited knowledge of long COVID symptoms despite having such symptoms, and many did not obtain care for the condition.

How this is relevant to clinical practice

Talk to new COVID-19 patients about the risk for long symptoms, and look for this in ED patients after the acute infection.

patients faced major barriers in the prevention, diagnosis, and treatment of acute COVID-19 disease and that a number of participant characteristics, including African American race, Latino/a ethnicity, and lack of primary care, were associated with greater COVID-19 vaccine hesitancy.¹¹ We have further demonstrated that these gaps in COVID-19 diagnosis and care, especially problems with vaccine hesitancy and uptake, can be addressed by ED-centered interventions.^{12,13}

The objective of this study was to determine whether there are similar gaps in medically underserved ED populations' understanding and care for long COVID illness. In a national, convenience sample of adult patients presenting to EDs with chief complaints that could be related to long COVID, we sought to determine (1) patients' awareness and self-declared understanding of the term long COVID, (2) the prevalence and impact on school/work attendance of long COVID symptoms, and (3) patients' prior receipt of care for long COVID symptoms.

METHODS**Study Design and Setting**

We conducted a cross-sectional survey study at 11 geographically representative EDs in 8 cities from December 13, 2022, to October 20, 2023: San Francisco, CA (Zuckerberg San Francisco General Hospital and the

University of California San Francisco Medical Center-Parnassus); Fresno, CA (Community Regional Medical Center); Seattle, WA (University of Washington-Seattle Harborview Medical Center); Detroit, MI (Wayne State-Detroit Receiving Hospital and Henry Ford Hospital); Houston, TX (Baylor University Medical Center); Durham, NC (Duke University Hospital); Chicago, IL (Rush University Medical Center); and Philadelphia, PA (Thomas Jefferson University Hospital and Methodist Hospital). The combined census for the EDs in 2023 was 694,550 patients, and demographic characteristics are presented in [Table E1](#) (available at <http://www.annemergmed.com>). We obtained institutional review board approval at all sites and followed the Strengthening the Reporting of Observational studies in Epidemiology (STROBE) guidelines.

Survey Instrument Development

The investigator team reviewed existing literature regarding the most common symptoms in the diagnosis of long COVID to generate the initial survey template.¹⁴⁻¹⁶ We reviewed this template with the University of California San Francisco COVID-19 Patient Community Advisory Board for input about population relevance, cultural sensitivity, wording comprehension, and length. After revisions, we pilot tested the final survey instrument on 5 ED patients at the Zuckerberg San Francisco General Hospital site and found high survey comprehension and response consistency ([Appendix E1](#) for survey instrument, available at <http://www.annemergmed.com>).

Screening and Participants

Our specific goal in this research was to assess a population of adult patients whose presentations to the ED could be related to long COVID illness, rather than assessing all-comers to the ED, ie, this was not intended to be a true prevalence study. Toward screening for this enriched sample, the investigator team generated a list of "medical" chief complaints by investigator consensus. In this schema, symptoms like fatigue, shortness of breath, chest pain, and abdominal pain were included, whereas trauma, abscess, and vaginal bleeding were excluded ([Appendix E2, Section 2.1](#), for full list of inclusion, available at <http://www.annemergmed.com>).

Due to constraints on research staff work hours during the COVID-19 pandemic, screening occurred in 4- to 8-hour time blocks on weekdays, typically from 8 am to 6 pm. Staff screened ED dashboards for English-speaking (at all sites), Spanish-speaking (at 6 sites), and Cantonese-speaking (at 2 sites) patients ≥ 18 years of age presenting

with one of the listed complaints and enrolled those who had had a positive COVID-19 test at least 1 month prior to their ED visit. We excluded patients with altered mental status, critical illness, incarceration, psychiatric hold, and respiratory isolation (Appendix E2, Section 2.2, for full list of exclusions). Participants did not receive compensation.

Survey Administration

Research staff verbally administered surveys in participants' preferred languages during patient ED wait times and recorded responses directly into a REDCap database hosted by University of California San Francisco.^{17,18} We determined awareness and understanding of long COVID through participant responses to these 2 questions: "Have you ever heard of long COVID?" and "Do you think you understand what it is?" Only participants who responded "yes" or "unsure" to having heard of long COVID and "yes" to understanding what it is were categorized as having prior awareness and understanding of long COVID.

To assess the prevalence of having had long COVID symptoms, participants who answered "yes" to the question "Have you had a positive test for COVID-19?" were asked "Did you have any symptoms or problems that lasted longer than a month after you were sick with COVID-19?" Participants responding "yes" to this question were then asked the open-ended question, "What were these symptoms?"; participants could list as many symptoms as they wanted in response and then were asked to specify the duration of each of these symptoms. To assess the impact on work/school attendance, participants were asked "Did you have to miss work or school because of these prolonged symptoms?"

We assessed participants' demographics and selected social determinants of health characteristics (housing status, access to primary care, insurance status, and primary language spoken) using standard survey questions that we used in prior research.^{11,19} For example, access to primary care was determined by responses to the question, "Do you have a regular clinic or physician for medical care?" (Appendix E1 for full survey instrument).

Outcomes and Analysis

Our key outcomes for this study were (1) prior awareness and self-declared understanding of the term long COVID; (2) prevalence of persistent long COVID symptoms, defined as symptoms from acute COVID-19 illness that lasted more than 1 month and 3 months after their initial test; we designated the more than a 1-month time duration as the primary outcome threshold because at

the time of study initiation (December 2022), this was the long COVID time threshold definition used by the Centers for Disease Control and Prevention; (3) impact on work/school attendance of long COVID symptoms defined as symptoms lasting longer than 1 month that had affected participants' ability to work or attend school; and (4) whether participants with long COVID symptoms had received medical attention for these symptoms (before their current ED visit) with a priori planned comparisons of participants who had primary care versus participants who lacked primary care and participants who had awareness/understanding of long COVID versus participants who lacked awareness/understanding of long COVID.²⁰

Toward determining the association of participant characteristics with the primary outcome of poor awareness and understanding of long COVID, we first used simple logistic regression (1 model for each survey question of interest) to calculate unadjusted odds ratios (ORs). Then, we performed hierarchical logistic regression (with study sites as clusters - PROC GLIMMIX in SAS 9.4) to calculate adjusted odds ratios [aORs] and 95% CIs using collapsed versions of race and ethnicity, sex, primary language spoken, access to primary care, and insurance status. In addition to the above respondent explanatory collapsed variables forced into the model, age was also considered as a potential covariate. For model estimation, we utilized the adaptive Gauss-Hermite quadrature (QUAD) method, and we examined 3 different potential covariance structures for the G-side matrix (variance components, compound symmetry, and unstructured). We also considered interactions of race/ethnicity with language, insurance status, or sex, but none were significant and none improved model fit; therefore, they were removed from the model. Model fit was assessed using both Akaike's information criteria (AIC) and Schwarz's Bayesian criterion (BIC), and the model was examined for collinearity among explanatory variables. Finally, we calculated the intraclass correlation coefficient (ICC) to determine the within-class correlation of study sites with the primary outcome.

For the outcomes of prevalence and impact on work/school attendance of long COVID symptoms, we calculated proportions (percentages). For comparisons of receipt of care for long COVID symptoms between the 2 prespecified groups, we calculated differences in proportions with 95% CIs (Appendix E3 for full description of characteristic consolidation, available at <http://www.annemergmed.com>).

Sample Size and Per-Site Enrollment

Seeking a 3% margin of error around the point estimates of our primary outcomes, we determined that we would

need to enroll 1,068 participants. We sought to enroll at least 50 participants in each of the 8 cities and continued enrollment past 1,068 participants toward that goal.

RESULTS

Of 3,899 patients approached, 1,644 (42.2%) had previously had a positive COVID-19 test; 26 (1.6%) of these had their positive COVID-19 test less than 1 month prior to their ED visit and were excluded. Of 1,618 eligible patients, 1,455 (89.9%) agreed to participate (Figure 1). Among these participants, 823 (56.6%) identified as women, 456 (33.4%) identified as African American, 449 (30.9%) identified as Latino/a/x, 249 (17.1%) lacked primary care, 91 (6.3%) had marginal or unstable housing, and 235 (16.2%) primarily spoke Spanish (Table 1). As compared to our ED population summary characteristics (Table E1), we enrolled higher percentages of Latinos. Participants' most common chief complaints on ED presentation were abdominal pain (28%), chest pain (22%), and shortness of breath (15%).

Two-fifths of participants (582/1446, 9 missing, 40.2%) responded that they had heard the term long COVID, and 29 (2%) said that they were unsure. Of these 611 "yes" and "unsure" respondents, 434/611 (71%) said they knew what long COVID meant, and thus, 30.0% of all respondents had heard the term long COVID and knew what it meant. Data on awareness and understanding of long COVID stratified by cities and sites are presented in Figure 2.

The multivariable model included all postulated predictor variables, but none of the examined interactions improved model characteristics and none were significant.

The ICC for the final model (0.034) was relatively low, but we left the random effect of study site in the model for 2 reasons: (1) its importance in the context of within-site correlations and (2) the model fit was improved (both AIC and BIC) by its inclusion. After adjusting for age, gender, access to primary care, primary language spoken, insurance status, race, and ethnicity, characteristics associated with poor understanding of long COVID were African American race (aOR 3.78, 95% CI 2.72 to 5.24) and Latino/a ethnicity (aOR 3.36, 95% CI 2.25 to 5.01) (Table 2). The unadjusted Spearman coefficient for within-site correlations was 0.07 (0.02 to 0.12).

Approximately one-third of participants (483, 33.2%) met the 1-month definition of having had long COVID symptoms, and 296 (20.3%) met the 3-month definition. Approximately one-third (162, 33.5%) of those with persistent 1-month symptoms had prior knowledge and understanding of the term long COVID. The most common long COVID symptoms were persistent cough (151, 14.4%), fatigue (149, 14.2%), and shortness of breath (134, 12.8%), and 74 (15.3%) participants reported that their ED chief complaint was related to these symptoms. Half (49.8%) of participants who had long COVID symptoms at 1 month stated that they missed work or school because of these persistent symptoms. Nearly half (46.6%) of participants who had long COVID symptoms sought care for these persistent symptoms, most commonly in clinics (57.1%) and EDs (34.0%). As compared to participants who had primary care, participants who lacked primary care were less likely to have received care for their long COVID symptoms (24.6% versus 51.2%; difference 26.6%; 95% CI

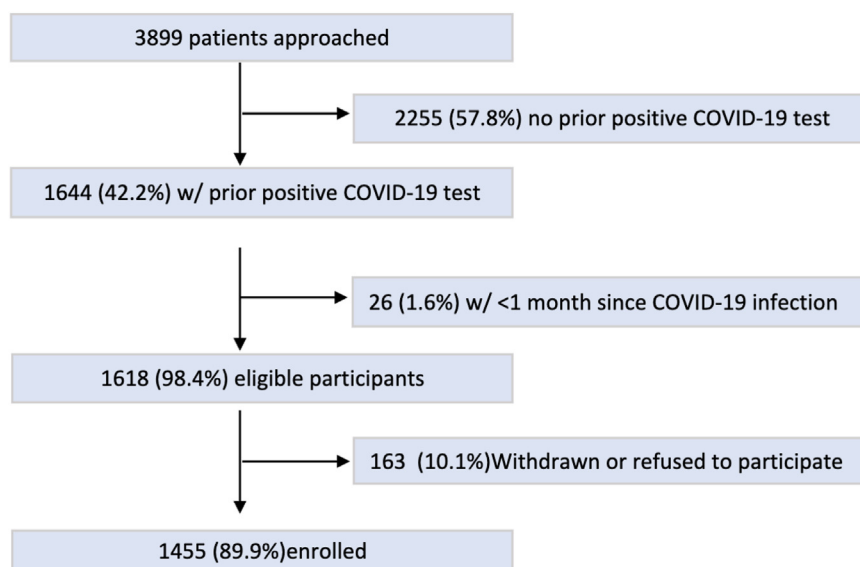


Figure 1. Enrollment flow diagram.

Table 1. Characteristics stratified by having had long COVID symptoms and awareness and self-declared understanding of long COVID.

| Characteristics | All | Had Long COVID Symptoms>1 Month | Did Not Have Long COVID Symptoms>1 Month | Awareness/Understanding of Long COVID [†] | Lack of Awareness/Understanding of Long COVID [†] |
|---|----------------------------|---------------------------------|--|--|--|
| Total | 1,455 | 483 | 972 | 434 | 996 |
| Median age (IQR) | 48 (36-61) | 46 (36-58) | 51 (36-63) | 47 (35-62) | 50 (36-62) |
| Gender (self-identified) | N (% [95% CI]) | N (% [95% CI]) | N (% [95% CI]) | N (% [95% CI]) | N (% [95% CI]) |
| Woman | 823 (56.6% [54.3%-59.1%]) | 310 (37.7% [34.4%-41%]) | 513 (62.3% [58.9%-65.6%]) | 247 (30.6% [27.5%-33.8%]) | 561 (69.4% [66.2%-72.5%]) |
| Man | 615 (42.3% [39.8%-44.8%]) | 163 (26.5% [23.2%-30.1%]) | 452 (73.5% [69.9%-76.8%]) | 180 (29.8% [26.2%-33.5%]) | 425 (70.2% [66.5%-73.8%]) |
| Other/prefer not to answer | 15 (1% [0.6%-1.7%]) | 9 (60% [35.8%-80.2%]) | 6 (40% [19.8%-64.3%]) | 6 (40% [19.8%-64.3%]) | 9 (60% [35.8%-80.2%]) |
| Primary language | | | | | |
| English | 1165 (80.1% [77.9%-82%]) | 383 (32.9% [30.2%-35.6%]) | 782 (67.1% [64.4%-69.8%]) | 388 (33.7% [31% to 36.5%]) | 763 (66.3% [63.5% to 69%]) |
| Spanish | 235 (16.2% [14.3%-18.1%]) | 81 (34.5% [28.7%-40.8%]) | 154 (65.5% [59.3%-71.3%]) | 31 (13.7% [9.8%-18.8%]) | 195 (86.3% [81.2%-90.2%]) |
| Other | 55 (3.8% [2.9%-4.9%]) | 19 (34.5% [23.4%-47.8%]) | 36 (65.5% [52.3%-76.6%]) | 15 (28.3% [18%-41.6%]) | 38 (71.7% [58.4%-82%]) |
| Race and ethnicity* | | | | | |
| American Indian or Alaska Native | 21 (1.5% [1%-2.3%]) | 7 (33.3% [17.2%-54.6%]) | 14 (66.7% [45.4%-82.8%]) | 7 (33.3% [17.2%-54.6%]) | 14 (66.7% [45.4%-82.8%]) |
| Asian | 88 (6.4% [5.2%-7.9%]) | 29 (33% [24%-43.3%]) | 59 (67% [56.7%-76%]) | 22 (25% [17.1%-35%]) | 66 (75% [65%-82.9%]) |
| Black or African American | 456 (33.4% [31%-36%]) | 148 (32.5% [28.3%-36.9%]) | 308 (67.5% [63.2%-71.7%]) | 99 (22% [18.4%-26%]) | 352 (78% [74%-81.6%]) |
| Native Hawaiian or Other Pacific Islander | 16 (1.2% [0.7%-1.9%]) | 5 (31.3% [14.2%-55.6%]) | 11 (68.8% [44.4%-85.8%]) | 2 (13.3% [3.7%-37.9%]) | 13 (86.7% [62.1%-96.3%]) |
| White | 604 (44.2% [41.6%-46.9%]) | 208 (34.4% [30.8%-38.3%]) | 396 (65.6% [61.7%-69.2%]) | 262 (44% [40.1%-48.1%]) | 333 (56% [52%-60%]) |
| Other | 180 (13.2% [11.5%-15.1%]) | 56 (31.1% [24.8%-38.2%]) | 124 (68.9% [61.8%-75.2%]) | 29 (16.6% [11.8%-22.8%]) | 146 (83.4% [77.2%-88.2%]) |
| Latino/a/x | 449 (30.9% [28.5%-33.3%]) | 171 (38.1% [33.7%-42.7%]) | 278 (61.9% [57.3%-66.3%]) | 81 (18.5% [15.2%-22.5%]) | 356 (81.5% [77.6%-84.8%]) |
| Housing status | | | | | |
| Stable | 1364 (93.7% [92.4%-94.9%]) | 455 (33.4% [30.9%-35.9%]) | 909 (66.6% [64.2%-69.1%]) | 422 (31.5% [29%-34%]) | 919 (68.5% [66%-71%]) |
| Unstable | 66 (4.5% [3.6%-5.7%]) | 14 (21.2% [13.1%-32.5%]) | 52 (78.8% [67.5%-86.9%]) | 8 (12.5% [6.5 - 22.8%]) | 56 (87.5% [77.2%-93.5%]) |
| Marginal | 25 (1.7% [1.2%-2.5%]) | 14 (56% [37.2%-73.3%]) | 11 (44% [26.7%-62.9%]) | 4 (16% [6.4%-34.7%]) | 21 (84% [65.4%-93.6%]) |
| Insurance status* | | | | | |
| Private | 520 (31.1% [29%-33.4%]) | 164 (31.5% [27.7%-35.7%]) | 356 (68.5% [64.3%-72.3%]) | 215 (41.8% [37.6%-46.1%]) | 299 (58.2% [53.8%-62.4%]) |
| Medicare | 312 (18.7% [16.9%-20.6%]) | 93 (29.8% [24.3%-34.2%]) | 219 (70.2% [64.9%-75%]) | 97 (31.3% [26.4%-36.7%]) | 213 (68.7% [63.4%-73.6%]) |
| Medicaid | 470 (28.1% [26%-30.4%]) | 158 (33.6% [29.5%-38%]) | 312 (66.4% [62%-70.5%]) | 103 (22.5% [18.9%-26.5%]) | 355 (77.5% [73.5%-81.1%]) |
| Affordable Care Act | 10 (0.6% [0.3%-1.1%]) | 4 (40% [16.8%-68.7%]) | 6 (60% [31.3%-83.1%]) | 1 (10% [1.8%-40.4%]) | 9 (90% [59.6%-98.2%]) |
| Military/VA | 5 (0.3% [0.1%-0.7%]) | 2 (40% [11.8%-76.9%]) | 3 (60% [23.1%-88.2%]) | 1 (20% [3.6%-62.5%]) | 4 (80% [37.6%-96.4%]) |
| Kaiser | 7 (0.4% [0.2%-1%]) | 4 (57.1% [25.1%-84.2%]) | 3 (42.9% [15.8%-75%]) | 6 (85.7% [48.7%-97.4%]) | 1 (14.3% [2.6%-51.3%]) |
| City or county sponsored | 141 (8.4% [7.2%-9.9%]) | 43 (30.5% [23.5%-38.5%]) | 98 (69.5% [61.5%-76.5%]) | 21 (15.4% [10.3%-22.5%]) | 115 (84.6% [77.6%-89.7%]) |

Table 1. Continued.

| Characteristics | All | Had Long COVID Symptoms > 1 Month | Did Not Have Long COVID Symptoms > 1 Month | Awareness/Understanding of Long COVID † | Lack of Awareness/Understanding of Long COVID † |
|--------------------------|----------------------------|-----------------------------------|--|---|---|
| Other | 45 (2.7% [2.2 - 3.6%]) | 21 (46.7% [32.9%-60.9%]) | 24 (53.3% [39.1%-67.1%]) | 13 (28.9% [17.7%-43.4%]) | 32 (71.1% [56.6%-82.3%]) |
| Uninsured | 131 (7.8% [6.7%-9.2%]) | 56 (42.7% [34.6%-51.3%]) | 75 (57.3% [48.7%-65.4%]) | 27 (21.3% [15%-29.2%]) | 100 (78.7% [70.8%-85%]) |
| Unsure | 29 (1.7% [1.2%-2.5%]) | 4 (13.8% [5.5%-30.6%]) | 25 (86.2% [69.4%-94.5%]) | 6 (20.7% [9.8%-38.4%]) | 23 (79.3% [61.6%-90.2%]) |
| Have primary care | | | | | |
| Yes | 1196 (82.4% [80.3%-84.2%]) | 397 (33.2% [30.6%-35.9%]) | 799 (66.8% [64.1%-69.4%]) | 380 (32.2% [29.6%-35%]) | 799 (67.8% [65.1%-70.4%]) |
| No | 249 (17.1% [15.3%-19.2%]) | 83 (33.3% [27.8%-39.4%]) | 166 (66.7% [60.6%-72.2%]) | 53 (22% [17.2%-27.6%]) | 188 (78.0% [72.4%-82.8%]) |
| Unsure | 7 (0.5% [0.2%-1%]) | 1 (14.3% [2.6%-51.3%]) | 6 (85.7% [48.7%-97.4%]) | 1 (14.3% [2.6%-51.3%]) | 6 (85.7% [48.7%-97.4%]) |

CI, Confidence interval; IQR, interquartile range; VA, Veterans Administration.

*More than one answer possible.

†In total, 25 missing responses to this question.

13.7% to 36.9%). As compared to those with knowledge and understanding of long COVID, those who lacked awareness and understanding of long COVID were less likely to have received care for their long COVID symptoms (43.0% versus 54.6%; difference 11.7%; 95% CI 1.2% to 21.8%).

LIMITATIONS

Our methods reflect the fact that this research was not intended to be a true long COVID prevalence study. We enrolled an enriched, convenience sample of patients who were presenting to EDs with acute medical complaints, a population that was intended to be more likely to have long COVID symptoms; our findings likely do not generalize to a representative sample of all patients presenting to EDs. Although self-reports of prolonged symptoms are the standard used in most other long COVID studies, we only surveyed participants at one point in time (not longitudinally), and our results may be subject to greater recall bias than these other studies.^{3,4} Response bias may similarly affect our assessment of missing school and work because of long COVID symptoms. Our 1-month threshold is shorter than the current World Health Organization definition of 3 months; yet, even using a 3-month threshold, our rates of long COVID symptoms are higher than recent standard population surveillance studies.^{1,4,21,22} Although we had a very high participation rate, response and misclassification bias may still be present. Our models included standard covariants, but other untested factors may have influenced outcome findings. In addition, we did not perform a cluster analysis.

In terms of our assessment of awareness and understanding of long COVID, we assumed a pragmatic, patient-centered approach. Long COVID has many different names in the scientific community, but it is our belief that the vast majority of the public uses this term; it is the name utilized on popular websites such as Wikipedia and WebMD, as well as various national news outlets.²³⁻²⁷ Although we did not test patient understanding of long COVID with objective knowledge questions, factual knowledge testing was not our goal. In the ED setting and in the context of assessing health care access behavior, patient awareness and self-perception of understanding of disease entities may be more relevant patient-centered outcomes.

DISCUSSION

The overarching premises underlying this research are that there are disparities in awareness and treatment of disease entities in underserved populations and that

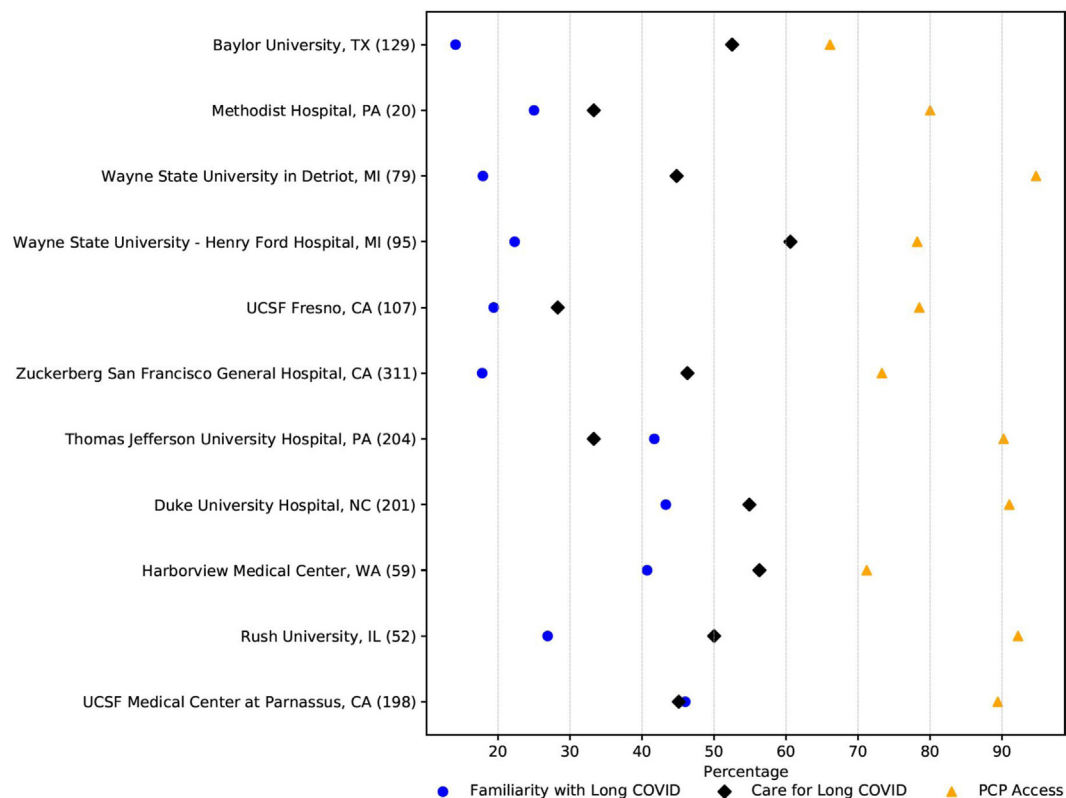


Figure 2. Individual site stratification of familiarity (awareness and understanding) with the term long COVID, care for long COVID, and having primary care. *PCP*, Primary care provider; *UCSF*, University of California, San Francisco.

implementation of ED-centered public health care measures may lead to improved outcomes in these groups. In 2 randomized controlled trials, we demonstrated that ED-based messaging about COVID-19 and influenza vaccines increased vaccine uptake in medically underserved ED populations.^{12,28} In this national study of the new disease entity long COVID, we used the in-person ED setting to examine historically underserved and under-evaluated populations who are otherwise difficult to reach through traditional online, telephone, and clinic-based research methods. We found that, despite the common persistence and high impact on work/school attendance of long COVID symptoms, there were substantial gaps in ED populations' awareness about and receipt of care for long COVID illness. Gaps in awareness and receipt of care for long COVID symptoms were especially prevalent in African Americans, Latinos, and participants who lacked primary care.

We are aware of one other publication assessing knowledge about long COVID illness in the United States, namely, an internet-based survey of a predominantly White, college-educated population, in which investigators found substantially higher (69%) awareness of long COVID than we found in our study.²⁹ When provided the

definition of long COVID in that study, one-third of unvaccinated participants stated that they would be more likely to accept the COVID-19 vaccine (to decrease their chance of getting long COVID in the future).²⁹ The markedly lower rate of awareness and understanding of long COVID in our study highlights the gaps and critical need for education about long COVID for diverse, underserved populations who might similarly increase their intentions to get updated COVID-19 vaccines or implement other measures to decrease their risk of developing long COVID illness.

Over the past 4 years, several promising long COVID prevention and treatment measures have emerged. Investigator teams have shown that COVID-19 vaccination is associated with a lowered risk of the development of long COVID; even after the development of long COVID symptoms, vaccination has been shown to improve symptoms and reduce the levels of long COVID-associated systemic inflammatory cytokines.³⁰⁻³³ In a blinded randomized control, metformin has been shown to decrease the incidence of long COVID, and nirmatrelvir and ritonavir have shown similar promise in long COVID prevention in certain populations.^{34,35} In terms of other treatments for long COVID symptoms, investigators from

Table 2. Unadjusted and aORs for characteristics associated with poor awareness and self-declared understanding of long COVID.

| Characteristics | Awareness and Understanding of Long COVID (N = 1,425)* | |
|-----------------------------------|--|---------------------|
| | OR (95% CI) | aOR (95% CI) |
| Race/ethnicity[†] | | |
| African American (non-Latino/a) | 4.21 (3.11 to 5.70) | 3.78 (2.72 to 5.24) |
| Latino/a | 5.04 (3.69 to 6.89) | 3.36 (2.25 to 5.01) |
| Multiple races | 1.84 (0.85 to 3.99) | 1.54 (0.68 to 3.47) |
| Other | 3.41 (2.19 to 5.31) | 3.13 (1.95 to 5.02) |
| White (non-Latino/a) | Ref | Ref |
| Gender (self-identified) | | |
| Woman | 0.96 (0.76 to 1.21) | 0.85 (0.66 to 1.10) |
| Other | 0.64 (0.22 to 1.82) | 0.57 (0.18 to 1.78) |
| Man | Ref | ref |
| Language | | |
| Non-English vs English | 2.57 (1.83 to 3.61) | 1.37 (0.88 to 2.13) |
| Have primary care | | |
| No vs Yes | 1.71 (1.23 to 2.36) | 1.45 (0.99 to 2.12) |
| Insurance[‡] | | |
| Uninsured vs Insured | 1.72 (1.15 to 2.56) | n/a [§] |

aOR, adjusted odds ratio; OR, odds ratio.

*Of the 1,455 patients in the study, 1,425 (98%) were included in the final model.

[†]Multiple races are participants who selected more than one race. Other are participants who selected race or ethnicity that were not Black or African American, White, or Latino/a.

[‡]Uninsured are participants who answered "None" or "Unsure" to *Do you have health insurance?*

[§]Removed for collinearity.

Hong Kong found that treatment of long COVID with twice daily probiotics led to greater alleviation of various symptoms.³⁶ In the Netherlands, a multicenter, randomized control trial showed that cognitive behavioral therapy was effective in reducing long COVID fatigue.³⁷ Under the Researching COVID-19 to Enhance Recovery (RECOVER) initiative, several long COVID clinical trials are underway: (1) combating viral persistence with nirmatrelvir and ritonavir, (2) treatment of cognitive impairment using an interactive online brain training program (BrainHQ), and (3) treatment for autonomic dysfunction using intravenous immunoglobulin infusions and ivabradine.^{38,39}

Ensuring future equitable access of these preventive and treatment measures is imperative to addressing the COVID-19 pandemic's disproportionate impact on underserved populations. Similar gaps in ED populations' awareness and understanding likely exist for other disease entities. As a primary public health care safety-net with 160 million visits in 2019, EDs are uniquely positioned to provide high volume education and access to treatment for medically underserved groups.⁴⁰ The pivotal role of EDs in reaching these populations is further underscored by the fact that resources aimed at mitigating the COVID-19 pandemic, such as telemedicine, are often not available to

these groups and may inadvertently exacerbate disparities in health care access.^{41,42} Notably, 15.3% of participants' who had had long COVID symptoms stated that these symptoms were reasons they presented to the ED.

Overall, we have demonstrated a stark need for the education, diagnosis and treatment of long COVID symptoms in underserved ED populations that may be otherwise hard to reach. In terms of specific, practical recommendations from our research, we suggest the development of (1) protocols and diagnostic pathways for long COVID diagnosis and treatment in EDs, including specific algorithms to diagnose and distinguish long COVID symptoms from other common presentations in the ED; 2) informational materials and discharge instructions for patients diagnosed with long COVID; and (3) follow-up links to primary care for patients with mild-to-moderate long COVID and specialty care (eg, long COVID clinics) for patients with severe symptoms.

In conclusion, despite the high prevalence and impact on work/school attendance of long COVID symptoms, most of the participants in this national, ED-based research had poor awareness and self-declared understanding about this disease and many had limited access to treatment.

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Author affiliations: From the Department of Emergency Medicine (Rodriguez, Molina, Arreguin) and School of Medicine (Reyes), University of California, San Francisco, CA; Department of Emergency Medicine (Kumar, Conn, Welch), Wayne State University School of Medicine, Detroit, MI; Department of Emergency Medicine (Chinnock), University of California, San Francisco, Fresno, CA; Department of Emergency Medicine (Eucker), Duke University, Durham, NC; Department of Emergency Medicine (Rising, Shughart), Thomas Jefferson University, Philadelphia, PA; Henry JN Taub Department of Emergency Medicine (Rafique, Mesbah), Baylor College of Medicine, Houston, TX; Department of Emergency Medicine (Gottlieb), Rush University Medical Center, Chicago, IL; University of Washington-Harborview Center for Prehospital Emergency Care (Nichol, Morse), Seattle, WA; School of Medicine (Eckstrand), Duke University, Durham, NC; School of Medicine (Chakraborty), Rush University, Chicago, IL.

Author contributions: RR, KR, VK, BC, SE, KR, ZR, MM. and MG designed the study; all authors participated in data acquisition; RR, KR, and RW analyzed and vouch for the analysis; RR, KR, and RW wrote the primary draft with review and revision of other authors; and RR had the primary responsibility for manuscript submission decisions and takes responsibility for the paper as a whole.

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All authors attest to meeting the four [ICMJE.org](http://www.icmje.org) authorship criteria: (1) Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work; AND (2) Drafting the work or revising it critically for important intellectual content; AND (3) Final approval of the version to be published; AND (4) Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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