



Racial disparities in symptomatology and outcomes of COVID-19 among adults of Arkansas

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ABSTRACT

Few reports have suggested that non-Hispanic (NH) blacks may present with different symptoms for COVID-19 than NH-whites. The objective of this study was to investigate patterns in symptomatology and COVID-19 outcomes by race/ethnicity among adults in Arkansas. Data on COVID-19 symptoms were collected on day of testing, 7th and 14th day among participants at UAMS mobile testing units throughout the state of Arkansas. Diagnosis for SARS-CoV-2 infection was confirmed via nasopharyngeal swab and RT-PCR methods. Data analysis was conducted using Chi-square test and Poisson regression to assess the differences in characteristics by race/ethnicity. A total of 60,648 individuals were RT-PCR tested from March 29, 2020 through October 7, 2020. Among adults testing positive, except shortness of breath, Hispanics were more likely to report all symptoms than NH-whites or NH-blacks. NH-whites were more likely to report fever (19.6% vs. 16.6%), cough (27.5% vs. 26.1%), shortness of breath (13.6% vs. 9.6%), sore throat (16.7% vs. 10.7%), chills (12.5% vs. 11.8%), muscle pain (15.6% vs. 12.4%), and headache (20.3% vs. 17.8%). NH-blacks were more likely to report loss of taste/smell (10.9% vs. 10.6%). To conclude, we found differences in COVID-19 symptoms by race/ethnicity, with NH-blacks and Hispanics more often affected with specific or all symptoms, compared to NH-whites. Due to the cross-sectional study design, these findings do not necessarily reflect biological differences by race/ethnicity; however, they suggest that certain race/ethnicities may have underlying differences in health status that impact COVID-19 outcomes.

1. Background

The Coronavirus disease 2019 (COVID-19) is caused by severe acute respiratory syndrome novel coronavirus (SARS-nCoV or SARS-CoV-2). As of July 2021, the disease has rapidly spread worldwide, in an ongoing pandemic for over a year. Over 184 million cases and more than 3.9 million deaths due to COVID-19 have been reported globally, with numbers continuing to rise. (Hopkins, 2021) In Arkansas, there are currently over 622,000 cases as of July 2, 2021 with over 30,000 hospitalizations and more than 3,000 patients on ventilators (Arkansas Department of Health, 2022).

Several studies from the United States (US) and United Kingdom (UK) demonstrate a strong association between SARS-CoV-2 and race/ethnicity. (Pan et al., 2020; Gross et al., 2020; Sze et al., 2020) Racial/ethnic minorities in both countries have poorer outcomes from SARS-CoV-2 infection than their white counterparts. (Pan et al., 2020; Gross et al., 2020; Sze et al., 2020) In the US, non-Hispanic (NH) blacks have 4.5 and 5.0 times and Hispanics have 4.0 times higher hospitalization and mortality rates, from COVID-19 compared to NH whites. (Laurencin and McClinton, 2020; Price-Haywood et al., 2020; Thebault et al., 2020; Centers for Disease Control and Prevention, 2022; Centers for Disease Control and Prevention, 2020; Gold, 2020; Research Lab, 2020)

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Explanations for these disparities in incidence, severity and mortality are unclear but may reflect socioeconomic, biological, environmental, behavioral, health care or other factors, including higher rates of pre-existing co-morbidities and racism and discrimination (Price-Haywood et al., 2020; Laurencin and McClinton, 2020; Why, 2020; Azar et al., 2020; Chowkwanyun and Reed, 2020; Krishnan et al., 2020; Ferdinand and Nasser, 2020; Fouad et al., 2020; Ford and Commentary, 2020; O'Connor, 2020; Hall et al., 2015). Distrust and misinformation in minority communities can affect differences in outcomes by racial/ethnic group. Furthermore, testing sites for COVID-19 in many US states were disproportionately located in predominantly white neighborhoods, (McMinn, et al., 2020; Hicks, 2020; Coleman, 2020) limiting access for minorities to testing and subsequent contact tracing, which would reduce disease transmission in their communities. Likewise, among patients with COVID-19 from a large Midwestern academic health system, NH-black race was associated with COVID-19 test positivity, and both race and low poverty level was associated with higher risk of hospitalization. (Muñoz-Price et al., 2020) Increased burden of comorbidity among NH-blacks (Clements, 2020) placed them at higher risk for

Table 1

Baseline demographic characteristics and prevalence of symptoms of adults who received COVID-19 lab testing and/or attending UAMS screening location by test results (n = 60,648).

	Overall n (%) n = 45,714	COVID-19 Test Positive n (%) n = 3,746	COVID-19 Test Negative n (%) n = 41,968	Chi- square p-value
Age				
<18 years	1,239 (2.7)	188 (5.0)	1,051 (2.5)	<0.001*
18–64 years	37,669 (82.4)	3,233 (86.3)	34,436 (82.1)	
≥65 years	6,806 (14.9)	325 (8.7)	6,481 (15.4)	
Gender				
Female	26,886 (58.8)	2,010 (53.7)	24,876 (59.3)	<0.001*
Male	18,821 (41.2)	1,736 (46.3)	17,085 (40.7)	
Race				
NH white ^a	2,4319 (53.1)	1,230 (33.5)	2,389 (56.1)	<0.001*
NH black ^a	15,452 (33.8)	1,480 (40.3)	13,972 (33.9)	
Hispanic	3,206 (7.0)	791 (21.5)	2,415 (5.9)	
Other	1,886 (4.1)	172 (4.7)	1,714 (4.2)	
Symptoms				
Fever	4,788 (11.9)	654 (19.7)	4,134 (11.2)	<0.001*
Cough	8,816 (19.3)	1,051 (28.1)	7,765 (18.5)	<0.001*
Shortness of breath	5,093 (11.1)	429 (11.5)	4,664 (11.1)	0.53
Sore throat	5,019 (11.0)	601 (16.0)	4,418 (10.5)	<0.001*
Chills	2654 (5.8)	512 (13.7)	2,142 (5.1)	<0.001*
Muscle pain	3,542 (7.8)	590 (15.8)	2,952 (7.0)	<0.001*
Headache	5,397 (11.8)	776 (20.7)	4,621 (11.0)	<0.001*
Loss of taste or smell	1,553 (3.4)	463 (12.4)	1,090 (2.6)	<0.001*
Testing Site				
Emergency Department Test	1,699 (3.7)	164 (4.4)	1,535 (3.7)	<0.001*
Inpatient Test	5,568 (12.2)	209 (5.6)	5,359 (12.8)	
Mobile Triage	36,899 (80.8)	3,269 (87.4)	33,630 (80.2)	
UAMS Lab	1,321 (2.9)	93 (2.5)	1,228 (2.9)	
Other Clinics/ Departments	167 (0.4)	7 (0.2)	160 (0.4)	

* p-value < 0.05.

^a NH: Non-Hispanic.

adverse COVID-19 outcomes. (Wiley et al., 2022).

Anecdotal reports suggested that NH blacks might present with different symptoms for COVID-19 than NH whites resulting in not being tested or misdiagnosis. (Price-Haywood et al., 2020; Laurencin and McClinton, 2020; Azar et al., 2020) However, very few studies have investigated whether the symptoms specific to COVID-19 differ by race/ethnicity. Only two prior studies have explored the differences in symptomatology of COVID-19 by race/ethnicity, one conducted using social media and another using a cohort of hospitalized patients. (Jones et al., 2020; McCarty, 2020) These studies noted a higher prevalence of some symptoms such as sore throat and fever among Hispanic populations. However, no studies have specifically investigated the Black-White disparity in the symptomatology patterns of COVID-19. There is thus a need for a comprehensive assessment with a larger sample to assess the racial/ethnic differences by natural history and symptomatology effectively. The aim of this study is to investigate patterns in symptomatology and outcomes of COVID-19 among a diverse population of adults in Arkansas, with a focus on healthcare interactions and/or screening and racial/ethnic disparities.

2. Materials and methods

2.1. COVID-19 testing at UAMS

The University of Arkansas for Medical Sciences (UAMS) is the only academic medical center in Arkansas, is the state's largest and most comprehensive facility for medical treatment and biomedical research and has the state's only Level 1 trauma center. Although centrally located in the capital city of Little Rock, it has regional health clinics throughout the state, which is racially/ethnically and geographically diverse. Beginning in March 2020, UAMS offered to the community COVID-19 testing using the nasopharyngeal swab and real-time reverse transcriptase polymerase chain reaction (RT-PCR) methods. (Shen et al., 2020) Drive thru testing was first made available to community members who had COVID-19 symptoms, or had a known exposure to someone who had tested positive for COVID-19 including development of symptoms, exposure to a COVID-19 positive family member or co-worker, or for patients prior to elective procedures. Eligibility was later expanded to include any individual who desired testing. Testing was done statewide at UAMS regional clinics and mobile testing units as well as a dedicated drive through facility, designated clinics, the Emergency Department, and UAMS Medical Center in Little Rock. Individuals were asked a series of screening questions, including symptoms the person was currently experiencing, by UAMS staff at each site. Initially, their symptoms and exposure history were used to determine the need for laboratory testing. Gradually as the cases started to rise rapidly, testing was then performed regardless of symptom or exposure history. Trained UAMS nurses and physicians or National Guard medics following appropriate laboratory, manufacturer, and Centers for Disease Control and Prevention guidelines obtained nasopharyngeal swabs. The samples were processed at the UAMS Clinical lab. Tests were performed either in-house on Genemark, Cepheid, or Biofire multiplex PCR platforms, or on Roche PCR systems, or were sent to regional or national public health and reference laboratories for PCR testing. The period for receiving the test results was variable and dependent on whether the sample was sent out, the volume of tests and the availability of reagents, ranging from several hours up to seven or more days.

2.2. Data collection for follow-up

The Fay W. Boozman College of Public Health at UAMS in collaboration with the College of Medicine established a protocol for following up individuals tested for COVID-19 (regardless of test results) at UAMS. As part of this effort, volunteers (UAMS employees, students and faculty) conducted computer-assisted telephone interviews using REDCap electronic data capture tools (Harris et al., 2009) hosted at UAMS to conduct

Table 2

Follow-up of symptoms at time of COVID-19 testing, 7 days after, and 14 days after testing by race for all individuals, the University of Arkansas for Medical Sciences, March 2020-October 2020 (n = 47,608 at time of testing; n = 27,810 for 7-day and 14-day follow-up after day of testing).

Symptoms	At time of testing				7 days after testing				14 days after testing			
	NH white	NH black	Hispanic	p-value	NH white	NH black	Hispanic	p-value	NH white	NH black	Hispanic	p-value
	n = 30,593	n = 19,381	n = 3,625		n = 14,962	n = 9,624	n = 1,930		n = 14,962	n = 9,624	n = 1,930	
Fever	3542 (15.2)	1340 (9.3)	362 (13.0)	<0.001*	162 (1.1)	70 (0.7)	19 (1.0)	0.03*	25 (0.2)	6 (0.1)	1 (0.1)	0.04
Cough	6058 (23.2)	3104 (19.1)	640 (19.5)	<0.001*	240 (1.6)	103 (1.1)	22 (1.4)	0.00*	44 (0.3)	26 (0.3)	2 (0.1)	0.51
Shortness of breath	3725 (14.3)	1692 (10.4)	296 (9.0)	<0.001*	146 (1.0)	62 (0.6)	17 (0.9)	0.05*	22 (0.2)	12 (0.1)	1 (0.1)	0.74
Sore throat	3515 (13.6)	1454 (9.0)	522 (16.0)	<0.001*	99 (0.7)	61 (0.6)	11 (0.6)	0.91	14 (0.1)	12 (0.1)	0 (0.0)	0.44
Chills	1524 (5.9)	761 (4.7)	274 (8.4)	<0.001*	82 (0.6)	55 (0.6)	7 (0.4)	0.70	11 (0.1)	7 (0.1)	1 (0.1)	0.79
Muscle pain	2078 (8.0)	966 (6.0)	373 (11.5)	<0.001*	113 (0.8)	67 (0.7)	24 (1.2)	0.09	26 (0.2)	11 (0.1)	1 (0.1)	0.20
Headache	3082 (11.9)	1600 (9.9)	536 (16.5)	<0.001*	155 (1.0)	92 (1.0)	24 (1.2)	0.71	21 (0.1)	12 (0.1)	4 (0.2)	0.45
Loss of taste or smell	768 (3.0)	520 (3.2)	222 (6.8)	<0.001*	86 (0.6)	52 (0.5)	17 (0.9)	0.35	11 (0.1)	5 (0.1)	1 (0.1)	0.92

* p-value < 0.05.

two follow-up assessments post-testing (7 and 14 days, respectively). During both follow-up interviews, individuals were asked about their test results, current symptoms, development of new symptoms (if any), medication use, vitamin/supplement use, mental health and crisis difficulties during the pandemic (difficulty getting food, cleaning supplies, lost job or work hours). The current study reports results from the interviews conducted from March 29, 2020 through October 7, 2020.

2.3. Data linkage

Data from the UAMS EPIC© electronic medical records system for each individual tested at UAMS were merged with data from the REDCap interview database. Data in the UAMS EPIC© system included a unique identifier, name, RT-PCR test results, age, gender, race/ethnicity, county of residence and zip code. Datasets were merged using the common MRN records from the EPIC database and REDCap.

2.4. Statistical analysis

After data linkage, the data were checked for errors and consistency. Descriptive analyses were performed using Chi-square tests to assess differences in age (<18, 18 to < 65, ≥65 years), gender (female, male), race/ethnicity (NH white, NH black, Hispanic, Other), symptoms (fever, cough, shortness of breath, sore throat, chills, muscle pain, headache, loss of taste or smell), and testing sites (Emergency department, inpatient test, mobile triage, UAMS laboratory, other clinics/departments) stratified by RT-PCR test results (COVID-19 positive, COVID-19 negative).

Table 3

Prevalence of symptoms at time of COVID-19 testing by race/ethnicity stratified by COVID-19 test results, the University of Arkansas for Medical Sciences, March 2020-October 2020 (n = 47,608).

Symptoms	COVID-19 Positive				COVID-19 Negative			
	NH white	NH black	Hispanic	p-value	NH white	NH black	Hispanic	p-value
	n = 1,230	n = 1,480	n = 791		n = 23,089	n = 13,972	n = 2,415	
Fever	216 (19.6)	218 (16.6)	178 (26.0)	<0.001*	2784 (13.6)	992 (8.1)	167 (8.3)	<0.001*
Cough	338 (27.5)	386 (26.1)	259 (32.7)	0.01*	4675 (20.3)	2376 (17.0)	352 (14.6)	<0.001*
Shortness of breath	167 (13.6)	142 (9.6)	96 (12.1)	0.01*	2908 (12.6)	1363 (9.8)	182 (7.5)	<0.001*
Sore throat	205 (16.7)	159 (10.7)	198 (25.0)	<0.001*	2743 (11.9)	1140 (8.2)	310 (12.8)	<0.001*
Chills	154 (12.5)	174 (11.8)	148 (18.7)	<0.001*	1339 (5.8)	575 (4.1)	125 (5.2)	<0.001*
Muscle pain	192 (15.6)	184 (12.4)	180 (22.8)	<0.001*	1852 (8.0)	768 (5.5)	191 (7.9)	<0.001*
Headache	250 (20.3)	264 (17.8)	217 (27.4)	<0.001*	2783 (12.1)	1311 (9.4)	317 (13.3)	<0.001*
Loss of taste or smell	130 (10.6)	161 (10.9)	147 (18.6)	<0.001*	620 (2.7)	349 (2.5)	75 (3.1)	0.34

* p-value < 0.05.

Chi-square tests were used to assess differences in prevalence of symptoms at time of testing, days 7 and 14 by race/ethnicity separately among adults testing positive and negative for COVID-19. We used Poisson regression with robust variance estimation to estimate prevalence ratios (PRs) and 95% confidence interval (CI) of each symptom by race/ethnicity with NH white as the reference group. All analyses were performed using STATA v15 (Statacorp, College Station, TX).

2.5. Human subjects

The study was reviewed and approved by the Institutional Review Board at UAMS.

3. Results

Table 1 shows the demographic characteristics and prevalence of symptoms at the time of testing by test results. As of October 7, 2020, 60,648 community members and patients received COVID-19 RT-PCR testing at UAMS for various reasons as previously described. Statistically significant differences were observed among adults testing positive or negative by age, gender, race/ethnicity, symptoms, and testing site. Among adults testing positive, 5% were < 18 years of age and 8.7% were 65 years or older. Over a half were females (53.7%) and the majority were NH black (40.3% versus 33.5% NH white and 21.5% Hispanic). The most prevalent symptoms among all adults testing positive were cough (28.1%) followed by headache (20.7%), fever (19.7%), sore throat (16%), muscle pain (15.8%), chills (13.7%), loss of taste or smell (12.4%) and shortness of breath (11.5%).

Table 4

Prevalence Ratios and 95% confidence intervals from Poisson Regression for symptoms for individuals testing positive for COVID-19 on the day of testing, 7- and 14-days post-testing by race/ethnicity, the University of Arkansas for Medical Sciences, March 2020-October 2020 (n = 3,501).

	Time of testing		At Day 7 after testing		At Day 14 after testing	
	Prevalence Ratio (95% CI)	p-value	Prevalence Ratio (95%CI)	p-value	Prevalence Ratio (95%CI)	p-value
Fever						
NH black	0.85 (0.71 – 1.01)	0.06	1.16 (0.65 – 2.08)	0.62	0.85 (0.05 – 13.53)	0.91
Hispanic	1.33 (1.12 – 1.58)*	<0.01	0.77 (0.35 – 1.69)	0.51	N/A*	–
NH white	Referent		Referent		Referent	
Cough						
NH black	0.95 (0.84 – 1.08)	0.41	0.85 (0.51 – 1.41)	0.52	2.12 (0.41 – 10.89)	0.37
Hispanic	1.19 (1.04 – 1.36)*	0.01	0.67 (0.35 – 1.30)	0.24	N/A*	–
NH white	Referent		Referent		Referent	–
Shortness of breath						
NH black	0.71 (0.57 – 0.87)*	<0.01	0.61 (0.30 – 1.24)	0.17	1.27 (0.21 – 7.59)	0.79
Hispanic	0.89 (0.71 – 1.13)	0.35	0.90 (0.42 – 1.94)	0.79	N/A*	–
NH white	Referent		Referent		Referent	–
Sore Throat						
NH black	0.64 (0.53 – 0.78)*	<0.01	0.62 (0.29 – 1.35)	0.23	N/A*	–
Hispanic	1.50 (1.26 – 1.79)*	<0.01	0.65 (0.25 – 1.66)	0.37	N/A*	–
NH white	Referent		Referent		Referent	–
Chills						
NH black	0.94 (0.77 – 1.15)	0.54	1.10 (0.59 – 2.05)	0.77	N/A*	–
Hispanic	1.49 (1.21 – 1.84)*	<0.01	0.48 (0.18 – 1.29)	0.14	N/A*	–
NH white	Referent		Referent		Referent	–
Muscle Pain						
NH black	0.80 (0.66 – 0.96)*	0.02	0.91 (0.54 – 1.54)	0.73	N/A*	–
Hispanic	1.46 (1.21 – 1.75)*	<0.01	0.69 (0.34 – 1.38)	0.29	N/A*	–
NH white	Referent		Referent		Referent	–
Headache						
NH black	0.88 (0.75 – 1.03)	0.10	0.96 (0.59 – 1.56)	0.87	0.42 (0.04 – 4.67)	0.48
Hispanic	1.35 (1.15 – 1.58)	<0.01	0.70 (0.37 – 1.34)	0.28	N/A*	–
NH white	Referent		Referent		Referent	–
Loss of taste or smell						
NH black	1.03 (0.83 – 1.28)	0.80	0.92 (0.58 – 1.47)	0.74	0.56 (0.09 – 3.37)	0.53
Hispanic	1.76 (1.41 – 2.19)*	<0.01	0.49 (0.24 – 0.99)*	0.04	N/A*	–
NH white	Referent		Referent		Referent	–

* Sample size too small for meaningful analysis.

Table 2 shows symptoms by race/ethnicity at the time of testing, 7 days post-testing, and 14 days post-testing among all individuals, regardless of test result. At the time of testing, the differences by race/ethnicity were significant for all symptoms. NH blacks were more likely to report loss of taste or smell (3.2% vs. 3.0%; p < 0.001) compared to NH whites, while the rest of the symptoms were more prevalent among NH whites. Hispanics were more likely to report a sore throat (p < 0.001), chills (p < 0.001), muscle pain (p < 0.001), headache (p < 0.001), and loss of taste or smell (p < 0.001), compared to NH blacks and change whites to NH whites NH whites for all symptoms except shortness of breath. At day 7, symptoms were less prevalent overall and the racial/ethnic differences in prevalence of symptoms were only significant for fever (p = 0.03), cough (p < 0.001), and shortness of breath (p = 0.05). NH whites were more likely to report that they still had those symptoms at day 7. By day 14, almost all symptoms had resolved regardless of racial/ethnic group.

Table 3 shows the prevalence of symptoms at testing by race/ethnicity stratified by COVID-19 test results. Among adults testing positive, except for shortness of breath, Hispanics were more likely to report all symptoms than NH whites or NH blacks. NH whites were more likely to report having: fever (19.6% vs. 16.6%; p < 0.001), cough (27.5% vs. 26.1%; p = 0.01), shortness of breath (13.6% vs. 9.6%; p = 0.01), sore throat (16.7% vs. 10.7%; p < 0.001), chills (12.5% vs. 11.8%; p < 0.001), muscle pain (15.6% vs. 12.4%; p < 0.001), and headache (20.3% vs. 17.8%; p < 0.001). NH blacks were slightly more likely to report loss of taste or smell (10.9% vs. 10.6%; p < 0.001). All differences were thus statistically significant.

Table 4 shows the prevalence ratios for each symptom for NH blacks and Hispanics. At the time of testing, NH blacks were less likely to report shortness of breath (PR 0.71, 95%CI 0.57–0.87) and muscle pain (PR

0.80, 95%CI 0.66–0.96) compared to NH whites. While NH blacks were less likely to report all symptoms overall, the prevalence of loss of taste and smell was higher, although not statistically significant, compared to NH whites. At baseline, Hispanics were more likely to report fever (PR 1.33, 95%CI 1.12–1.58), cough (PR 1.19, 95%CI 1.04–1.36), sore throat (PR 1.50; 95%CI 1.26–1.79), muscle pain (PR 1.46; 1.21–1.75), and loss of taste or smell (PR 1.76; 95%CI 1.41–2.19), compared to NH whites. At day 7, Hispanics were less likely to report loss of taste or smell (PR 0.49; 95%CI 0.24–0.99), compared to NH whites. No significant differences were found among symptoms by race/ethnicity at day 14 of testing. Table 5 shows the prevalence ratios listed in Table 4 adjusted for age and gender. The estimates did not differ noticeably with the adjustment.

4. Discussion

Early in the pandemic, anecdotal reports of racial/ethnic differences in COVID-19 symptoms were reported. Our study found initial evidence to support these reports. At the time of testing, NH blacks were less likely to report having symptoms of fever, cough, shortness of breath, sore throat, chills, muscle pain, headache but were more likely to report loss of taste and smell compared to NH Whites. This difference persisted among individuals testing positive for COVID-19, but not among those testing negative. In contrast, Hispanics were more likely to report all symptoms except shortness of breath, compared to NH blacks and whites.

Some of our results are similar to the two studies that also investigated this topic. A recent cross-sectional study conducted on social media by Jones and colleagues, involving 1,435 participants found sore throat, to be less frequently reported by Asian (5.8%), non-Hispanic Black (5.7%), and other/multiple race (8.9%) participants compared

Table 5

Prevalence Ratios from Poisson Regression for Symptoms for individuals testing positive for COVID-19 on the day of testing, 7- and 14-days post-testing by race/ethnicity adjusted by age and gender, the University of Arkansas for Medical Sciences, March 2020-October 2020 (n = 3,501).

	Time of testing		At Day 7 after testing		At Day 14 after testing	
	Prevalence Ratio (95% CI)	p-value	Prevalence Ratio (95%CI)	p-value	Prevalence Ratio (95%CI)	p-value
Fever						
NH black	0.86 (0.72 – 1.02)	0.06	1.12 (0.63 – 2.00)	0.62	N/A*	–
Hispanic	1.30 (1.09 – 1.55)*	<0.01	0.83 (0.38 – 1.83)	0.51	N/A*	–
NH white	Referent		Referent		Referent	
Cough						
NH black	0.94 (0.83 – 1.07)	0.41	0.82 (0.49 – 1.36)	0.52	N/A*	–
Hispanic	1.19 (1.03 – 1.36)*	0.01	0.70 (0.36 – 1.36)	0.24	N/A*	–
NH white	Referent		Referent		Referent	–
Shortness of breath						
NH black	0.70 (0.57 – 0.87)*	<0.01	0.58 (0.29 – 1.16)	0.17	N/A*	–
Hispanic	0.90 (0.71 – 1.14)	0.35	0.96 (0.44 – 2.10)	0.79	N/A*	–
NH white	Referent		Referent		Referent	–
Sore Throat						
NH black	0.63 (0.52 – 0.77)*	<0.01	0.59 (0.27 – 1.29)	0.23	N/A*	–
Hispanic	1.44 (1.21 – 1.72)*	<0.01	0.67 (0.25 – 1.75)	0.37	N/A*	–
NH white	Referent		Referent		Referent	–
Chills						
NH black	0.94 (0.77 – 1.16)	0.54	1.05 (0.56 – 1.97)	0.77	N/A*	–
Hispanic	1.47 (1.19 – 1.81)*	<0.01	0.50 (0.19 – 1.36)	0.14	N/A*	–
NH white	Referent		Referent		Referent	–
Muscle Pain						
NH black	0.80 (0.66 – 0.96)*	0.02	0.88 (0.52 – 1.49)	0.73	N/A*	–
Hispanic	1.42 (1.18 – 1.71)*	<0.01	0.67 (0.33 – 1.36)	0.29	N/A*	–
NH white	Referent		Referent		Referent	–
Headache						
NH black	0.86 (0.74 – 1.01)	0.10	0.93 (0.58 – 1.51)	0.87	N/A*	–
Hispanic	1.30 (1.10 – 1.52)	<0.01	0.70 (0.37 – 1.34)	0.28	N/A*	–
NH white	Referent		Referent		Referent	–
Loss of taste or smell						
NH black	1.01 (0.81 – 1.25)	0.80	0.88 (0.56 – 1.41)	0.74	N/A*	–
Hispanic	1.69 (1.35 – 2.10)*	<0.01	0.49 (0.24 – 0.99)*	0.04	N/A*	–
NH white	Referent		Referent		Referent	–

* Sample size too small for meaningful analysis.

to those who were Hispanic (18.1%) or NH white (16.2%) (Jones et al., 2020). Another study of 379 hospitalized patients in Massachusetts by McCarty and colleagues showed that LatinX patients more frequently reported fever and myalgia (McCarty, 2020). While findings from these studies were partly similar to our findings of Hispanics reporting greater prevalence of all symptoms except shortness of breath, our study noted greater disparities in symptomatology also among NH blacks. In our study, NH blacks had a greater prevalence of loss of taste or smell compared to NH whites, which no other studies in literature have noted.

The COVID-19 pandemic has consistently shown minority populations to be disproportionately affected by higher incidence, hospitalizations and deaths (Andrulis et al., 2007; Fothergill et al., 1999; Hutchins et al., 2009; Renelus et al., 2021; Centers for Disease Control and Prevention, 2022). Reasons for these disparities are poorly understood. Compared to Whites, Blacks and Hispanics have lower rates of insurance coverage, which reduces direct access to COVID-19 related medical care (e. g., reduced access to testing, postponed treatment), as well as indirect effects related to COVID-19 (e. g., less and less consistent management of pre-existing clinical comorbidities such as diabetes and hypertension), which increase the risk of death from the virus (State Health Access Data Assistance Center, 2020). While the pre-existing social inequalities that occurs due to the structural racism place Black and Hispanic communities at greater risk of the pandemic, the differences in natural history and symptomatology found in our study further demonstrate that racial/ethnic disparities in COVID-19 prevalence and outcomes are also influenced by differences in clinical presentation which subsequently may impact disease progression. In our study, we observed Hispanics to report classic COVID-19 symptoms (fever, cough, sore throat), and potentially having a greater likelihood of receiving care than NH blacks who did not present with classic COVID-19 symptoms.

There is also a possibility of a period effect since during the pandemic these rates have varied.

Our study had a few limitations. Because of the emerging nature of COVID-19, the sensitivity of laboratory confirmed RT-PCR tests has varied from 86% to 98%, indicating a possibility of including false negative subjects. However, the differences in symptomatology by race/ethnicity persisted in both the analyses – all individuals testing positive and negative, and positive-only individuals. Another potential limitation is the changes in eligibility criteria for testing over time. In the initial phases, sick and vulnerable community members were the only eligible group, compared to all members in the later phases. Furthermore, some UAMS PCR testing sites were intentionally placed in areas of the state that were underserved; thus, our study population includes individuals that may not be representative of the general NH white, NH black, and Hispanic population. Finally, we were unable to adjust for income and comorbidities due to unavailability of data. Furthermore, the diagnosis is unlikely to be affected with change in symptoms. However, these differences are likely differences in natural history by racial groups for COVID-19 as seen in other health conditions to aid the clinicians in accurate diagnosis. There are several key strengths to our study. The major advantage of our study was the inclusion of a statewide sample of over 60,000 individuals who were tested for COVID-19, indicating a strong external validity and generalizability. Majority of residents in Arkansas are non-Hispanic white (72%) followed by NH-black (15.4%) and Hispanic (2.4%), similar to the estimates in our study (Bureau, 2021). Also, we used laboratory-confirmed diagnosis of COVID-19 by PCR assay indicating a greater accuracy of reporting outcomes and subsequent comparisons, compared to antigen tests that have lower sensitivity. (Brihn et al., 2021).

In summary, we found differences in presentation of COVID-19

symptoms by race/ethnicity, with NH blacks to be affected more by loss of taste and smell, and Hispanics to be affected by all symptoms compared to NH whites. Our findings indicate that certain race/ethnicities may have underlying differences in health status that affect outcomes of COVID-19. As new variants of SARS-CoV-2 emerge it is crucial to rapidly assess whether disease symptomatology differ among racial/ethnic groups. These differences, along with the pre-existing societal inequities elucidate the important issue of rapidly emerging health disparities during the COVID-19 pandemic. Thus, acknowledging differences in presentation in symptoms at the emergency department or clinic will facilitate faster and more accurate diagnoses of patients that present with COVID-19. This will also help address health disparities related to COVID-19 and reduce distrust of the healthcare system when minority patients feel that healthcare providers take their symptoms seriously.

CRedit authorship contribution statement

Jenil R. Patel: Visualization, Investigation, Methodology, Data curation, Formal analysis, Software, Writing – original draft, Writing – review & editing. **Benjamin C. Amick:** Investigation, Methodology, Writing – review & editing. **Keyur S. Vyas:** Investigation, Methodology, Writing – review & editing. **Emine Bircan:** Methodology, Writing – review & editing. **Danielle Boothe:** Methodology, Writing – review & editing. **Wendy N. Nembhard:** Conceptualization, Visualization, Supervision, Investigation, Methodology, Writing – original draft, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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