



## Research Paper

# Coronavirus disease 2019 pandemic associated with anxiety and depression among Non-Hispanic whites with chronic conditions in the US

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## ABSTRACT

**Objectives:** During the coronavirus 2019 (COVID-19) pandemic, increased anxiety and depression were reported, with mixed findings among individuals of different races/ethnicities. This study examines whether anxiety and depression increased during the COVID-19 pandemic compared to the pre-COVID-19 period among different racial/ethnic groups in the US.

**Methods:** The Health Information National Trend Surveys 5 (HINTS 5) Cycle 4 data was analyzed. We used the time when the survey was administered as the pre-COVID-19 period (before March 11, 2020, weighted  $N = 77,501,549$ ) and during the COVID-19 period (on and after March 11, 2020, weighted  $N = 37,222,019$ ). The Patient Health Questionnaire (PHQ) was used to measure anxiety/depression and further compared before and during COVID-19. Separate multivariable logistic regression analyses were used to determine the association of the COVID-19 pandemic with anxiety/depression after adjusting for age, sex, insurance, income, and education.

**Result:** A higher percentage of Non-Hispanic whites (NHW) with chronic conditions reported anxiety (24.3% vs. 11.5%,  $p = 0.0021$ ) and depression (20.7% vs. 9.3%,  $p = 0.0034$ ) during COVID-19 than pre-COVID-19. The adjusted odds ratio (AOR) of anxiety and depression for NHWs with chronic conditions during the COVID-19 pandemic was 2.02 (95% confidence interval of 1.10–3.73,  $p = 0.025$ ) and 2.33 (1.17–4.65,  $p = 0.018$ ) compared to NHWs who participated in the survey before the COVID-19.

**Limitations:** Limited to the NHW US population. PHQ can only be used as the initial screening tool.

**Conclusion:** The COVID-19 pandemic was associated with an increased prevalence of anxiety and depression among NHW adults with chronic conditions, but not among people of color.

## 1. Introduction

On March 11, 2020, the World Health Organization (WHO) declared coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), a global pandemic as the virus quickly spread throughout the United States (US) and the rest of the world (World Health Organization, 2021). According to the Centers for Disease Control (CDC) statistics, by the end of 2020, there were 20,475,900 COVID-19 cases and 385,236 deaths in the United States alone (Centers for Disease Control and Prevention, 2021; Centers for Disease

## Control and Prevention, 2021b).

Not only has the COVID-19 pandemic taken a toll on people's physical health, but it has affected their mental health as well. Due to the pervasive nature of the virus, COVID-19 has disrupted peoples' daily routines and has contributed to mental health symptoms such as anxiety and depression. Current literature has shown a global psychological impact of COVID-19. In the Republic of Ireland, one study found that participants who suffered from General Anxiety Disorder (GAD) increased from 20% to 27.7%, and depression increased from 22.8% to 27.7%, respectively during the pandemic due to the fear of contracting

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COVID-19 (Hyland et al., 2020). Another study from China found that 28.8% of respondents reported moderate to severe anxiety symptoms, and 16.5% reported moderate to severe depressive symptoms (Wang et al., 2020). In the US, roughly 1 in 4 adults without preexisting mental health conditions, experienced psychological distress symptoms (i.e., anxiety and depression) during the early stages of the pandemic (Holingue et al., 2020). Many factors such as personal and loved one's health, young age, sleep disruptions, food insecurity, economic insecurity, social isolation, and chronic conditions have contributed to the increased rates of anxiety and depression during the COVID-19 pandemic (Zavlis et al., 2021; Smith et al., 2020; Varma et al., 2021). Specifically, It has been reported that individuals with chronic conditions have higher levels of anxiety and depression than those without chronic conditions. A two-fold increased odds of depression have been reported in patients with diabetes compared to those without diabetes (Anderson et al., 2001). A study in Turkey showed that patients with HIV tended to have higher anxiety and depression levels than those without (Kuman et al., 2020). A meta-analysis study found that higher anxiety occurred among cancer patients during the COVID-19 pandemic than the general population (Ayubi et al., 2021).

Six out of every ten individuals have a chronic condition in the US (Centers for Disease Control and Prevention, 2021a). Those with chronic conditions are at higher risk for COVID-19 infections, hospitalizations, and mortality (Kirby et al., 2021). Thus, the COVID-19 related risk and risk perception can make adults with chronic conditions more vulnerable to anxiety and depression (Alessi et al., 2020; Wong et al., 2020). Some studies have reported the association of chronic diseases to anxiety and depression during the COVID-19 pandemic. In a matched case-control study carried out in Bangladesh, it was found that the prevalence of anxiety and depression symptoms was significantly higher among ones with chronic conditions than those without. This is partially due to the increased risk of death from COVID-19 (Sayeed et al., 2020). Moreover, those with asthma, diabetes, cardiovascular disease symptoms, or any combination of these diseases had higher odds of exhibiting stress, anxiety, and depression symptoms than healthy individuals during the COVID-19 pandemic. Individuals with cardiovascular disease were the most vulnerable to anxiety and depression symptoms (Sayeed et al., 2020). One Brazilian study showed increased anxiety and depression rates among individuals with diabetes due to COVID-19 (Alessi et al., 2020). Another study done in Hong Kong showed higher anxiety and depression rates among individuals with multiple comorbidities due to COVID-19 (Wong et al., 2020).

Furthermore, the differential effects of COVID-19 among individuals of different races/ethnicities may also contribute to varying rates of anxiety and depression among these groups (Goldmann et al., 2021; McKnight-Eily et al., 2021; Goldmann et al., 2021; Owens and Saw, 2021). Some studies reported higher anxiety/depression among Non-Hispanic White (NHW) than people of color (Goldmann et al., 2021; Owens and Saw, 2021). Whereas other studies showed higher stress levels among Hispanic populations during the pandemic than their NHW counterparts (McKnight-Eily et al., 2021; Bui et al., 2021). While those with chronic conditions have higher rates of anxiety and depression, it is not known how different race/ethnic groups are affected by anxiety and depression in the presence of chronic conditions. Therefore, the study's primary objective is to determine whether the association of COVID-19 with anxiety and depression varied among different race/ethnic groups.

## 2. Methods

### 2.1. Study setting

This study was a cross-sectional analysis of secondary data from the National Cancer Institute's Health Information National Trends Survey 5 Cycle 4 (2020) (HINTS 5) (National Cancer Institution, 2021). HINTS 5 is a survey of a nationally representative sample of US adults used to

assess the impact of the health information environment (National Cancer Institution, 2021). The HINTS 5 survey was administered to US adults 18 years and older and was conducted from February 2020 through June 2020 using a self-administered questionnaire with results released in March 2021. Complete data were collected from 3865 respondents with a response rate of 37%, did not include a web option, and was entirely conducted by mail. The primary outcomes of this study were to measure anxiety and depression among participants. Participants who had missing and/or erroneous information for these measures were excluded Fig. 1. details the number of adults excluded. Since HINTS 5 is a publicly available, de-identified database and the regional Institutional Review Board (IRB) determined that this project did not meet the definition of human subject research according to federal regulations (IRB No. 1,705,528-1).

As shown in Fig. 1, we restricted the sample to those with any chronic conditions (diabetes, hypertension, heart disease, lung disease, and cancer). In addition, we also excluded individuals with missing sociodemographic characteristics (i.e., age, sex, education level, income level, insurance status, etc.).

### 2.2. Measures

#### 2.2.1. Anxiety and depression

We used the PHQ-4 survey items to measure anxiety and depression. The PHQ-4 included two questionnaires for generalized anxiety disorder (GAD-2) and two questionnaires for depression (PHQ-2). The two questions used to screen anxiety on the GAD-2 were: (1) Over the past two weeks, how often have you been bothered by feeling nervous, anxious, or on edge? (2) Over the past two weeks, how often have you been bothered by not being able to stop or control worrying? The two questions used to screen depression on the PHQ-2 were: (1) Over the past two weeks, how often have you been bothered by little interest or pleasure in doing things? (2) Over the past two weeks, how often have you been bothered by feeling down, depressed, or hopeless? The answers were (1) not at all, (2) several days, (3) more than half the days, and (4) nearly every day. If the participant answered not at all, it is scored as "0", several days scored as "1", more than half the days scored as "2", and nearly every day scored as "3".

We added the scores of two questions of GAD-2 for anxiety and two questions of PHQ-2 for depression to have two final scores. If the final score of GAD-2 or PHQ-2 were equal to or above 3, such individuals were defined as high risk of anxiety or depression. Individuals with a score of 0-2 were defined as low risk of anxiety or depression.

### 2.3. Key independent variables

#### 2.3.1. COVID-19 pandemic

We created an indicator variable (yes/no) to capture whether the survey was completed before or after the pandemic onset. The date of the pandemic onset was determined by the World Health Organization (2021) We used the pandemic flag created by the survey administrators to indicate pre- and during COVID-19 pandemic phases. The pandemic was declared March 11, 2020, with "1" indicating during the COVID-19 period (the survey was received on or after March 11, 2020) and "0" indicating the survey was received prior to the COVID-19 pandemic (i.e., before March 11, 2020).

#### 2.3.2. Race/Ethnicity (NHW vs. people of color)

The survey provides information on Non-Hispanic White (NHW), Non-Hispanic Black (NHB), Hispanic/Latino, and others. However, due to small sample sizes, we grouped NHB, Hispanic/Latino, and others into one category (i.e., people of color).

#### 2.3.3. Other explanatory variables

We included biological (age, sex), socioeconomic status (household income levels, and individual education levels), and access to healthcare

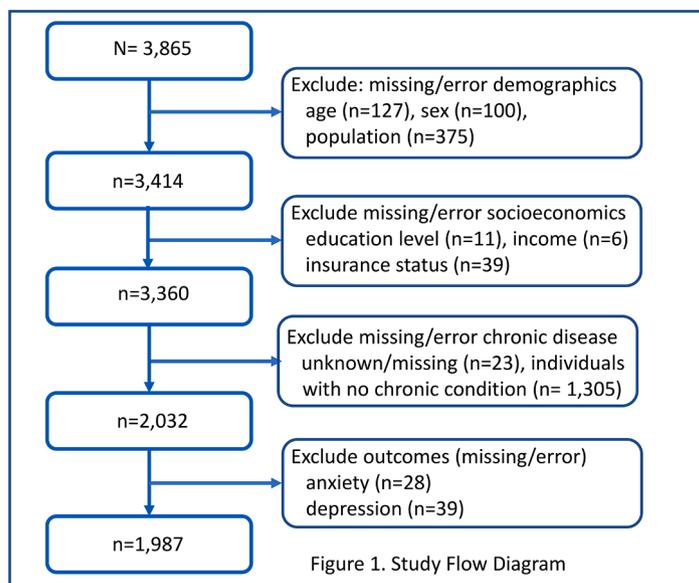


Fig. 1. Study flow diagram.

(health insurance). We used: five age groups (i.e., 18–34, 35–49, 50–64, 65–74, and 75+); two biological sex groups (male and female); two insurance level groups (yes or no); three household income level groups (less than \$50,000 annual household income, \$50,000–100,000 annual household income, and above \$100,000 annual household income); and four education level groups (less than high school graduate level, high school or its similar level, some college level, and college and above level). Individuals with chronic conditions were further combined into two groups (single versus multiple chronic conditions).

2.3.4. Statistical analysis

Weighted percentages were derived using replicate weights. Significant group differences were tested with Rao-Scott chi-square tests. To analyze the presence of anxiety and depression among NHW versus people of color with chronic conditions, we performed separate multivariable logistic regression analyses for anxiety and depression before and during the COVID-19 pandemic. In these analyses, biological, socioeconomic characteristics, and healthcare access were adjusted. With secondary data, small sample sizes can produce unreliable parameter estimates. Relative standard errors (RSE) were used to ensure the reliability of estimates. RSEs greater than 30% indicate poor reliability. The investigators observed that RSEs were less than 30%, suggesting that our findings do not suffer poor reliability due to sample size. All statistical analyses were conducted by STATA version 14.0 (College Station, USA). We followed the HINTS 5 guidelines for data analysis (Finney Rutten et al., 2020) and used survey procedures with replicate weights for all analyses.

2.3.5. Reporting guideline

We used the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) for cross-sectional studies as our reporting guideline (von et al., 2007).

3. Results

The final analysis includes 1987 participants (weighted population of 114,723,568) Table 1. summarizes the biological and socioeconomic characteristics of the study population in terms of whether the survey was responded before or during the COVID-19 pandemic. Nearly two-thirds of the surveys were completed during the COVID-19 pandemic. Individuals who completed the survey during the pandemic tended to be younger, and more were Non-Hispanic Black (NHB) or Hispanic. We did

Table 1 Sociodemographic characteristics of the study sample by individuals responded before and during the COVID-19 pandemic (health information national trends survey –5, cycle 4).

	Individuals who responded before the pandemic		Individuals who responded during the pandemic		p-value
	N	Wt%	N	Wt%	
ALL	787	36.8	1201	63.2	
Sex					0.3744
Male	355	52.2	511	48.8	
Female	432	47.8	690	51.2	
Age in Years					0.0095
18 – 34 years	40	8.9	73	14.0	
35 – 49 years	81	18.2	189	27.4	
50 – 64 years	251	38.7	417	32.0	
65 – 74 years	254	20.2	349	16.0	
75, and older	161	14.0	173	10.6	
Race/Ethnicity					0.0015
Non-Hispanic White	557	76.3	692	62.5	
Non-Hispanic Black	95	9.2	222	16.3	
Hispanic	79	7.0	195	13.5	
Others	56	7.6	82	7.8	
Education					0.2829
LT HS	50	5.8	103	9.1	
HS or similar	209	33.0	330	30.6	
Some College	202	32.2	273	34.1	
College and above	326	29.1	495	26.2	
Health Insurance					0.5336
Yes	768	94.9	1152	93.7	
No	19	5.1	49	6.3	
Income					0.9795
LT 50k	370	44.0	564	43.3	
50k - < 100k	236	30.9	349	30.9	
100k, +	181	25.1	288	25.7	
Chronic diseases					0.9422
One	404	57.7	610	57.4	
Multimorbidity	383	42.3	591	42.6	

Note: Based on pooled data of 1987 adult participants. Significant group differences were tested with Rao Scott chi-square tests for weighted data. Weighted Percentages were derived using replicate weights. HS: High School; LT: Less than; wt: weighted.

not find differences in sex, education levels, insurance status, income levels, or differences in the number of chronic conditions sustained between individuals who responded to the survey before the pandemic from those who responded during the pandemic (Table 1).

The prevalence of anxiety and depression was higher among NHWs during the COVID-19 pandemic as compared to the pre-COVID-19 period ( $p < 0.05$ , Table 2, left panel) across individual items and summary measures. However, such findings were not found among people of color ( $p > 0.05$ , Table 2, right panel).

After adjusting for biological variables (i.e., age, sex), socioeconomic status variables (income and education), and access to care variables (i.e., health insurance), NHW individuals with chronic conditions who responded during the COVID-19 pandemic were more likely to have anxiety and depression compared to ones who responded before the pandemic. The adjusted odds ratio (AOR) for NHW individuals with chronic conditions during the pandemic having high odds of anxiety was 2.02 with a 95% confidence interval (CI) of 1.10–3.73 ( $p = 0.025$ ). The AOR for NHW individuals with chronic conditions during the pandemic having higher odds of depression was 2.33 with a 95% CI of 1.17–4.65 ( $p = 0.018$ , Table 3). In addition, elderly individuals tended to have a lower odd of both anxiety and depression compared to younger individuals (Table 3). However, when focused on people of color who had chronic conditions, the AOR of this cohort during the pandemic had no significant increased odds of anxiety (AOR = 0.59, 95% CI 0.26–1.34,  $p = 0.201$ ) and depression (AOR = 0.77, 95%CI 0.39–1.52,  $p = 0.447$ ) when compared with ones before the pandemic (Table 4).

#### 4. Discussion

In this study, we observed differences between pre-COVID-19 and during COVID-19 responses by using the natural timing of a nationally representative survey. We found that the COVID-19 pandemic was associated with increased odds of anxiety/depression among NHW individuals with chronic conditions. However, we did not observe a statistically significant association of the COVID-19 pandemic with anxiety and depression among people of color. Our findings suggest that among those with chronic conditions, the association of COVID-19 to

depression and anxiety may vary by race/ethnicity.

As stated in the introduction, studies have reported mixed results on the association of race/ethnicity to depression and anxiety (Goldmann et al., 2021;Owens and Saw, 2021) McGuire and Miranda (2008). reported that, in general, people of color had similar or better mental health compared to NHWs. However, this study was conducted before COVID-19. Studies conducted during the pandemic period also support such findings (Goldmann et al., 2021;Owens and Saw, 2021). A US study using the same tool used in our study to measure anxiety and depression reported that during the COVID-19 pandemic, anxiety/depression was lower among NHB compared to NHW individuals (Goldmann et al., 2021). Another US study conducted during the COVID-19 pandemic using data from Understanding American Study also reached similar findings (Owens and Saw, 2021). A similar pattern has been reported that after 9/11, African American persons living in New York City during the disaster were less likely than NHW to suffer from depressions (Adams et al., 2006).

Our study findings regarding race/ethnicity add to the literature that the relationship between race and mental health is very complex and confirms the “mental health paradox”. While our study did not explore the reasons behind our findings, we rely on explanations from the published literature. For example, people of color may have protective factors such as higher levels of coping resources such as self-esteem, social support, religious attendance, and divine control (Louie et al., 2021), resilience levels (Woodward et al., 2013), and strong ethnic identity (Williams et al., 2012). On the other hand, people of color may be less likely to report depression and anxiety compared to NHWs (Huang et al., 2006). Another possible explanation may be the ability for people of color to withstand adversities due to long-standing issues related to stigma, discrimination, lack of opportunities to move upwards in society (Meraya et al., 2018). NHW may experience higher levels of stress and poor mental health than the NHB’s when NHW’s experience external shocks such as COVID-19 or economic declines as they may feel

**Table 2**

Anxiety and depression screening among individuals with chronic conditions prior to and during the COVID-19 pandemic (health information national trends survey –5, cycle 4).

	NHW (n = 1248)				P	People of color (n = 739)				P
	Before		During			Before		During		
	N	Wt%	N	Wt%		N	Wt%	N	Wt%	
<b>Anxiety Screening</b>										
<b>Nervous</b>					0.0142					0.4545
Not at all	358	61.3	391	49.0		147	57.7	330	65.5	
Several days	149	28.8	196	29.8		48	23.3	125	19.1	
More than half the days	27	4.0	46	10.1		20	11.9	27	6.8	
Nearly everyday	23	5.9	58	11.1		15	7.2	27	8.6	
<b>Worrying</b>					0.0221					0.6500
Not at all	406	69.1	449	57.3		147	59.4	341	66.7	
Several days	105	22.4	141	23.4		46	24.1	98	19.4	
More than half the days	27	4.5	56	9.8		15	6.5	36	4.4	
Nearly everyday	19	4.0	45	9.5		22	10.0	34	9.6	
<b>Anxiety GAD-2 score</b>					0.0021					0.2208
Low risk of anxiety	498	88.5	569	75.7		186	77.4	438	83.7	
High risk of anxiety	59	11.5	122	24.3		44	22.6	71	16.3	
<b>Depression Screening</b>										
<b>Little interest</b>					0.0179					0.2980
Not at all	380	68.7	434	54.8		144	53.4	329	64.8	
Several days	119	21.3	163	28.3		42	27.4	96	22.1	
More than half the days	35	6.4	50	7.0		19	8.5	43	4.7	
Nearly everyday	23	3.6	44	9.9		25	10.8	41	8.5	
<b>Hopeless</b>					0.2567					0.1904
Not at all	407	68.9	459	60.5		159	60.1	377	70.5	
Several days	107	22.3	155	25.4		47	30.3	85	20.3	
More than half the days	28	6.4	47	7.9		14	4.3	29	5.3	
Nearly everyday	15	2.4	30	6.2		10	5.3	18	3.9	
<b>Depression PHQ-2 score</b>					0.0034					0.4648
Low risk of depression	500	90.8	587	79.3		190	84.3	426	86.7	
High risk of depression	57	9.3	104	20.7		40	15.7	83	13.3	

Note: Based on pooled data of 1987 adult participants. Significant group differences were tested with Rao Scott chi-square tests for weighted data. Weighted Percentages were derived using replicate weights.

**Table 3**

The association between COVID-19 pandemic and anxiety/depression among NHW individuals with chronic conditions.

	Anxiety Adjusted Odd Ratios (95% CI)	P	Depression Adjusted Odd Ratios (95% CI)	P
COVID-19 Pandemic Chronic condition	2.02 [1.10, 3.73]	0.025	2.33 [1.17, 4.65]	0.018
One condition	Reference		Reference	
Multimorbidity	1.07 [0.51, 2.25]	0.862	0.71 [0.41, 1.21]	0.199
Age in Years				
18–34 years	Reference		Reference	
34–49 years	0.73 [0.20, 2.66]	0.630	0.58 [0.13, 2.51]	0.458
50–64 years	0.24 [0.08, 0.77]	0.017	0.28 [0.08, 0.98]	0.046
65–74 years	0.13 [0.04, 0.42]	0.001	0.23 [0.07, 0.77]	0.019
75 years or older	0.13 [0.03, 0.57]	0.008	0.22 [0.05, 1.02]	0.054
Sex				
Male	Reference		Reference	
Female	1.54 [0.92, 2.59]	0.101	1.20 [0.68, 2.14]	0.520
Education level				
Less than high school	Reference		Reference	
High school or similar	0.67 [0.18, 2.42]	0.529	0.41 [0.11, 1.59]	0.193
Some college	0.53 [0.15, 1.84]	0.312	0.26 [0.07, 0.94]	0.040
College or above	0.32 [0.06, 1.54]	0.151	0.18 [0.05, 0.75]	0.019
Insurance				
No	Reference		Reference	
Yes	0.59 [0.05, 6.36]	0.656	0.55 [0.03, 8.88]	0.666
Household annual income level				
<\$50 K	Reference		Reference	
\$50 K to 100K	1.26 [0.56, 2.87]	0.569	0.79 [0.33, 1.86]	0.577
>\$100K	1.88 [0.73, 4.82]	0.186	0.82 [0.34, 1.97]	0.653

Note: Based on 1248 adult NHW participants without missing data on sex, age, education, insurance, income, and chronic disease conditions, from Health Information National Trends Survey 5 Cycles 4 and separate multivariable logistic regressions of anxiety and depression. The final model adjusted for age, sex, income, education, health insurance, and chronic conditions.

hopeless (Steele, 1978;Ulbrich et al., 1989;Wilks et al., 2018;Nelson et al., 2010). It has also been reported that NHWs with chronic conditions may consume more medications (Briesacher et al., 2003), leading to higher rates of medication-induced anxiety and depression among NHWs (Schnittker and Do, 2020) with chronic conditions. However, findings from our study need to be confirmed with robust study designs using longitudinal data to determine racial differences in the impact of the COVID-19 pandemic on anxiety and depression.

Our study findings suggest that special attention should be paid to NHWs with chronic conditions in terms of initial screening, early prevention, and treatment for those with a high risk of anxiety/depression. Such efforts are essential to overall health outcomes because depression and anxiety in individuals with chronic conditions often lead to negative outcomes, including mortality (Zhu et al., 2020;Oude Voshaar et al., 2021). We believe that using this screening during the COVID-19 pandemic will significantly benefit early anxiety/depression recognition at any healthcare facility (i.e., emergency department, physician clinics). However, such tools can only be used as an initial screening. Further confirmatory testing needs to be rendered.

**5. Limitations**

Our study has several limitations. First, as we relied on previously collected data, we were limited in the choice and definition of variables. For example, chronic conditions were limited to the five available conditions provided in the survey. As such, we were unable to analyze data from patients with other types of chronic conditions. Second, this study only uses PHQ-4 (GAD-2/PHQ-2) for anxiety/depression screening, and individuals with higher odds will need to have further confirmation testing for anxiety/depression diagnoses. Third, this

**Table 4**

The association between COVID-19 pandemic and anxiety/depression among people of color with chronic conditions.

	Anxiety Adjusted Odd Ratios (95% CI)	P	Depression Adjusted Odd Ratios (95% CI)	P
COVID-19 Pandemic Chronic condition	0.59 [0.26, 1.34]	0.201	0.77 [0.39, 1.52]	0.447
One condition	Reference		Reference	
Multimorbidity	1.45 [0.65, 3.19]	0.354	1.71 [0.88, 3.33]	0.112
Age in Years				
18–34 years	Reference		Reference	
34–49 years	0.93 [0.15, 5.60]	0.934	2.33 [0.41, 13.37]	0.336
50–64 years	0.53 [0.10, 2.90]	0.456	1.90 [0.55, 6.54]	0.301
65–74 years	0.18 [0.02, 1.35]	0.094	1.02 [0.21, 4.91]	0.977
75 years or older	0.50 [0.05, 5.63]	0.572	1.73 [0.23, 12.98]	0.589
Sex				
Male	Reference		Reference	
Female	2.43 [1.05, 5.60]	0.038	1.56 [0.67, 3.60]	0.294
Education level				
Less than high school	Reference		Reference	
High school or similar	0.66 [0.15, 2.93]	0.577	0.74 [0.18, 3.16]	0.683
Some college	0.88 [0.22, 3.42]	0.846	0.82 [0.22, 3.10]	0.764
College or above	0.30 [0.06, 1.52]	0.142	0.83 [0.17, 4.02]	0.817
Insurance				
No	Reference		Reference	
Yes	1.68 [0.30, 9.60]	0.550	0.79 [0.21, 2.96]	0.726
Household annual income level				
<\$50 K	Reference		Reference	
\$50 K to 100K	0.68 [0.28, 1.68]	0.569	0.78 [0.37, 1.66]	0.513
>\$100K	0.34 [0.12, 0.95]	0.039	0.51 [0.15, 1.79]	0.288

Note: Based on 739 adult participants (people of color) who had chronic conditions without missing data on sex, age, education, insurance, income, and chronic disease conditions, from Health Information National Trends Survey 5 Cycles 4 and separate multivariable logistic regressions of anxiety and depression. The final model adjusted for age, sex, income, education, health insurance, and chronic conditions.

survey was administered among the US population, and the results may need to be interpreted with caution if applied to other people. Fourth, in this study, we only analyzed the impact of some sociodemographic characteristics. Other potential factors (e.g., substance abuse, unemployment status) that could affect individuals' anxiety and depression levels were not analyzed (Walia et al., 2021). Last, the HINTS 5 Cycle 4 survey was completed in June 2020, which was in an early phase of the COVID-19 pandemic. The causal relationship between the COVID-19 pandemic and anxiety/depression is episodic or constant has not been established and is still largely unknown. Therefore, a large-scale prospective longitudinal study is needed to determine the continuous, long-term impact of the COVID-19 pandemic on anxiety/depression among individuals with chronic conditions.

**6. Conclusions**

COVID-19 pandemic can increase the odds of anxiety and depression among US Non-Hispanic White individuals with chronic conditions but not among people of color. Future studies with cohort design and longitudinal measures of anxiety and depression are warranted to confirm our findings.

**CRedit authorship contribution statement**

**Hao Wang:** Conceptualization, Methodology, Validation, Formal analysis, Resources, Data curation, Writing – original draft, Writing – review & editing. **Jenny Paul:** Writing – review & editing. **Ivana Ye:** Writing – review & editing. **Jake Blalock:** Writing – review & editing. **R.**

**Constance Wiener:** Conceptualization, Writing – review & editing. **Amy F. Ho:** Conceptualization, Writing – review & editing. **Naomi Alanis:** Writing – review & editing. **Usha Sambamoorthi:** Conceptualization, Methodology, Validation, Formal analysis, Resources, Data curation, 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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