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Research paper

Anxiety during the Pandemic: Racial and ethnic differences in the trajectory of fear

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ABSTRACT

Background: In addition to the threat of serious illness, COVID-19 brought abrupt changes in lifestyle resulting in widespread fear among many Americans. This study examines the evolution of anxiety over the first months of the COVID-19 pandemic, testing for differential experiences among vulnerable populations.

Methods: Phase 1 of the Census Bureau's Household Pulse Survey details the frequency of anxiety among a nationally representative sample of adults from April 23, 2020 through July 21, 2020. Negative binomial regression assessed differences in the frequency of anxiety among demographic, income, health and employment status cohorts. Propensity score matching to the 2019 National Health Interview Survey allowed previous anxiety and health status to be included in the model.

Results: Anxiety frequency for 944,719 individuals was observed over three months. Whites, blacks and Hispanics showed increasing frequency of anxiety over the time period, particularly blacks. Prior to COVID-19, 13% of respondents reported regular or semiregular anxiety, compared to 25–35% during the pandemic. Regression analysis suggests that frequent anxiety was highly and positively correlated with COVID-19 case fatality rate and higher levels of frequency were observed among those with poor health, incomes below \$25,000, and without paid employment.

Limitations: Causal inference was not able to be investigated due to the cross-sectional study design.

Conclusions: While blacks showed lower levels of anxiety initially, the proportion of the population experiencing regular anxiety increased nearly 20% over the first months of the COVID-19 pandemic. This rapid increase in anxiety could be due to inequity in health and economic outcomes among blacks.

1. Introduction

In March 2020 the World Health Organization declared a global pandemic as the novel coronavirus (COVID-19) spread rapidly from its origination point in Wuhun, China throughout the globe. Early in the pandemic little was known about COVID-19 transmission, infection, treatment or mortality. Initial documentation of infections and fatalities were inconsistent and irregular. While the coronavirus was infecting and killing Americans of all races, there was little public data on whether the virus disproportionately impacted any racial or ethnic groups. Initially, only a handful of states released data about the racial composition of those tested for COVID-19, tested positive for COVID-19, hospitalized with COVID-19, become critically ill from the virus, recovered or died from COVID-19 [Kendi \(2020\)](#).

As states slowly began to report COVID-19 data with more uniformity, regularity and detail, it became clear that blacks were being

disproportionately impacted. For example, in North Carolina, blacks made up 36% of COVID-19 cases and 25% of deaths, but only 22% of the population ([North Carolina Department of Health 2020](#)). In Illinois, the first state to start publishing racial statistics, blacks made up 14.6% of the state population, but 31% of the confirmed COVID-19 cases ([Illinois Department of Health 2020](#)). Comparatively, whites accounted for 76.9% of the population but only 29% of confirmed cases. Similarly, Latinos in Illinois comprised 17.4% of the state population and nine percent of confirmed cases ([Illinois Department of Health 2020](#)). An understanding of racial differences in the mental health sequelae of the COVID-19 pandemic has lagged even further behind the reports of physical health outcomes, yet the psychological impact of the pandemic is likely to harm more people than the virus itself.

Evidence suggests that the COVID-19 pandemic and the resulting economic recession had a negative impact on mental health outcomes ([Huang and Zhao, 2020](#)). Fear of getting sick or dying, feeling helpless

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and being stereotyped were reported by individuals of all racial and ethnic cohorts (Hall, et al. 2008). Psychologists have noted that people who are kept in isolation and/or quarantine are more likely to experience significant levels of anxiety, anger, confusion and stress (Brooks, et al. 2020). Frequent exposure to news and social media heightens this mental and emotional distress Neria and Sullivan (2011). Despite these considerations, the full psychological and emotional consequences of COVID-19 in the US will not be known for many years. Early studies from China show that fear and anxiety were the most common mental health symptoms reported even among those who showed no prior indication of mental illness (Shigemura, et al. 2020).

Among mental illnesses, anxiety disorders are among the most prevalent in the US with whites reporting higher levels of anxiety compared to other racial groups (Blanco et al. 2014; Himle et al. 2009; Twenge and Joiner, 2020). In epidemiological studies, the lower prevalence of anxiety among blacks is somewhat surprising given the higher rates of poverty, chronic illness, unemployment and racism they experience (Alvarez et al. 2019; Breslau et al. 2006; Erving et al. 2019). When blacks do meet the criteria for anxiety, they often experience more severe anxiety disorders with large degrees of functional impairment compared to whites (Himle et al. 2009). The lower prevalence of anxiety disorders among blacks is often attributed to strong social ties including religious and family networks in their communities which could partially mitigate the development of anxiety (Hunter and Schmidt, 2010; Levine et al. 2015; Liao et al. 2016). However, the ability of these social ties to alleviate anxiety during the COVID-19 pandemic, when blacks faced many health and social challenges is not yet known. However, evidence from past disasters and public health emergencies suggests that socially disadvantaged groups (e.g., racial/ethnic minorities, low income households) experience a higher incidence of psychiatric morbidity than socially advantaged groups Purtle (2012).

As COVID-19 continued to spread through the nation, subsequent social distancing and isolation mandates began to erode the once protective social assemblage that provided a psychological buffer for many individuals DeLanda (2019). Emergence of data detailing higher rates of hospitalization and mortality in the black community heightened coverage by news and social outlets of the disproportionate impact of COVID-19 on minority groups. Furthermore, blacks were twice as likely to know someone who has been hospitalized or has died due to COVID-19 than whites, thus personalizing the threat of illness and mortality Pew Research Center (2020).

Notwithstanding the indisputable evidence that the black community was being devastated by the spread of COVID-19, little is known about the psychological ramifications that this disease spread had on blacks and other vulnerable populations. While under usual circumstances strong social ties could have averted feelings of fear and disquietude, the heightened awareness of the devastation of COVID-19 in combination with stay-at-home orders could have been a catalyst for increased anxiety. Using a large cross-sectional data set designed to capture the response of Americans to the pandemic, this study explores the psychological consequence of the pandemic. Data from three different sources is matched to incorporate historical, contextual, and current information. Results provide insight into the racial/ethnic differences in COVID-19 related anxiety that occurred over the first three months of the COVID-19 pandemic.

2. Methods

To analyze anxiety during the COVID-19 pandemic, data was drawn from three different data sources—the Household Pulse Survey, the National Health Interview Survey, and the Centers for Disease Control and Prevention COVID-19 Case Reports. Data from the 2020 HPS was matched to data from the 2019 NHIS to provide a baseline anxiety level for all HPS respondents. Since the 2020 HPS did not contain any baseline information, PSM was used to match 2020 HPS respondents to 2019 NHIS respondents. While these were not the same individual

respondents, these surveys are both nationally representative, collected by the same federal agencies, and sampled using similar procedures for national weighting. After respondents were matched, observations were matched with the average state-level COVID-19 case-fatality rate reported during the week using HPS respondent residential location. Data sources used and regression procedures are discussed below.

2.1. *Data: Household Pulse Survey*

Data from this study was drawn from the Phase 1 of the 2020 Household Pulse Survey (HPS)—a quick deployment data collection instrument designed to collect data on a range of ways in which people's lives have been impacted by the pandemic. HPS asked individuals about their experiences in terms of employment status, spending patterns, food security, housing, physical and mental health, access to health care, and educational disruption. Phase 1 began on April 23, 2020 and ended in July 21, 2020 and utilized an overlapping weekly panel of respondents, each of whom was surveyed once per week for three consecutive weeks before being replaced by a new panel.

The survey sampled approximately 13.8 million housing units collecting roughly 108,000 responses per week, for an approximate 5.0% response rate. Households were surveyed on basic demographic information including size, birth year of the responding adult, sex, race, and ethnicity. While race, ethnicity, sex, and age were collected to ensure a representative sample, educational attainment was collected align the final weighted HPS distribution with the 2018 American Community Survey estimates of the adult population's educational attainment. United States. Bureau of the Census, and United States. Bureau of Labor Statistics. Current Population Survey: Annual Social and Economic Supplement (ASEC), United States 2019

While three phases of the HPS have been collected, content varies between phases. This study utilized only Phase 1 which included the question, "Over the last seven days, how often have you been bothered by the following problems ... Feeling nervous, anxious, or on edge? Would you say not at all, several days, more than half the days, or nearly every day?" Responses were coded such that 0 = not at all, 1 = several days, 2 = more than half the days and 3 = nearly every day. The HPS did not include additional indicators of anxiety; therefore, individual responses to this Phase 1 question served as the primary indicator in this analysis.

Additionally, HPS Phase 1 also asked respondents to rate their physical health as excellent, very good, good, fair, or poor and provide their insurance status and type health insurance. Binary indicators were created for having health insurance and being in fair/poor health. To capture labor market effects related to the pandemic, HPS respondents indicated whether they have performed any work in the past seven days for pay or profit. They also categorized their 2019 pre-tax income, which was transformed into a binary indicator of earnings less than \$25,000 and education level was included as a dummy variable indicating less than a high school education.

2.2. *National Health Interview Survey 2019*

As mentioned previously, the HPS contains very few questions about retrospective events or states. To accurately assess the frequency of COVID-19 related anxiety, baseline mental and physical health status must be included to determine if observed level of anxiety is statistically different from the levels experienced during the previous period.

Data from the 2019 National Health Interview Survey (NHIS)—a survey monitoring the health of the US population through the collection and analysis of data on a broad range of health topics—was matched to the HPS to provide baseline anxiety level from the previous year. Since NHIS and HPS were both developed in part by the Department of Health and Human Services (HHS), they contain identical questions regarding health and anxiety collected in different years. This study exploits the parallel data elements by using the 2019 NHIS health

status and anxiety variables as match controls for HPS data.

2.3. COVID-19 Cases

To capture the severity of the COVID-19 pandemic in the respondents' local areas, COVID-19 Case Surveillance Public Use Data was obtained from the Centers for Disease Control and Prevention (CDC). The CDC recorded and archived daily numbers of confirmed cases and confirmed deaths for each state throughout the COVID-19 pandemic. Since each week of the HPS survey was conducted over a range of days, daily values for COVID-19 cases corresponding to the dates of the survey week are averaged to calculate the state-level weekly average confirmed cases and deaths. To indicate both the frequency and severity of the pandemic in each state, the ratio of confirmed cases to deaths is calculated for inclusion in the regression model.

2.4. Propensity score matching

HPS respondents were matched with similar individuals in the 2019 NHIS using propensity score matching (PSM). PSM was performed in SAS 9.4 (Cary, NC) using *Proc Psmatch*. Respondents were matched on race, ethnicity, gender, age, marital status, having private health insurance, current employment status, number of people in the household and region of geographical residence. In order to produce high quality matches, but ensure that final estimates were not biased, two to one greedy matching with replacement was used. This method minimizes the propensity score distance between the matched pairs such that each HPS respondent is matched to the two closest NHIS respondents even if the NHIS respondent has been selected before. To avoid bad matches, NHIS and HPS respondents are only matched if the propensity scores lies within ± 0.5 . Match quality was assessed by comparing the characteristics of the original HPS cohort and the matched HPS cohort to ensure that the standardized variable differences were within an acceptable differential so not to alter the covariate distribution.

2.5. Regression

Negative binomial (NB) regression evaluated the trajectory of anxiety over the first three months of the COVID-19 pandemic. Anxiety was expressed as a discrete, numeric value representing the frequency of anxiety (coded such that 0 = not at all, 1 = several days, 2 = more than half the days and 3 = nearly every day). Dichotomous variables for black race, Hispanic ethnicity, female sex, being married, having health insurance, being employed, having income below \$25,000 and classifying one's current health status as either fair or poor were added. A sequential indicator for the week of the HPS was included to capture the trend in anxiety over time. Anxiety and health status from the match 2019 NHIS respondents were added to account for intertemporal variation. Finally, time-subgroup interaction terms were added—black*week and Hispanic*week—to test for differential anxiety trajectories among minority groups. All estimates were weighted using person-level sampling weights to conform to a nationally representative sample.

Given that the outcome variable is described by a finite set of discrete values, the NB model must account for overdispersion—disproportionately more zeros than any other numerical category. This is particularly important since, during the early weeks of the pandemic, a high proportion of respondents reported never experiencing anxiety—represented by a value of zero.

2.6. Robustness test

Since NB coefficients are often difficult to interpret, ordinary least squares (OLS) regression is also presented as a test for robustness. These estimates provide a more intuitive contextualization of the regression results. While OLS is not the best, unbiased estimator when the

dependent variable is not continuous, OLS estimates are straight forward and widely understood, but the standard errors that accompany these estimates are not considered reliable.

2.7. Sensitivity analysis

Since the validity of estimates depends largely on deriving a high-quality matched sample, it is important to ensure that the matching technique did not bias analyses. In order to test the validity of results, matching was performed using various greedy, nearest neighbor, replacement and match count conditions. The characteristics on which respondents were matched was also adjusted to include the appropriate number and type of characteristics. Each approach was used to generate results, including and excluding different groups of participants. Conclusions were assessed under each additional match specification to ensure that results were not due to group differences or the statistical technique.

3. Results

3.1. Quality of matches

A total of 1,307,384 respondents from the HPS reported their frequency of anxiety during the first three months of the pandemic. The majority of these respondents were female (59.4, SD = 0.49), had health insurance (69.1, SD = 0.46), were married (57.4, SD = 0.49), were currently working (58.0, SD = 0.49) and had at least a high school education (86.0, SD = 0.35). Two to one propensity score matching created 994,604 pairs. As expected, not all HPS respondents had a suitable NHIS match. To ensure the matched cohort provided an accurate representation of the original population, Table 1 summarizes the baseline characteristics of the HPS unmatched and matched samples. Demographic proportions between the two samples were very similar with equal proportions in both groups for the majority of demographic characteristics.

Samples were matched by propensity scores calculated from race, ethnicity, gender, age, marital status, having private health insurance, employment status, number of people in the household and region of geographical residence. Fig. 1 shows the difference between the sample from HPS and those matched case from NHIS. As shown, the sample proportions differ by less than ± 0.2 . These similarities suggest high quality matches and equivalent pairing of demographic characteristics.

3.2. Demographic characteristics

The sample was 59% female with a mean age of 52 (SD = 16.4). Households ranged from one to 10 residents with an average of 2.9 (SD = 1.6) (Table 1). The sample was less than 15% black and 10% Hispanic and roughly 60% of respondents were employed at the time of the survey. Most respondents were married (59.4%, SD = 0.34), had at least a high school education (87.0 percent, SD = 0.49) and had private health insurance (69.1 percent, SD = 0.46). Only 11% (SD = 0.31) reported income below \$25,000 annually—below the prevailing poverty level in 2020. Less than one-fifth reported being in fair/poor health in either 2020 or 2019 (17 and 18% respectively). The impact of the COVID-19 pandemic, reflected as the ratio of average confirmed cases to average confirmed deaths in each state for each week, ranged from, 0.13 to 7.83 with a mean of 1.64 (SD = 1.58). An average daily ratio of 1.64 could correspond to an average of 100 confirmed cases and 61 confirmed deaths in a given state during a given week of the pandemic.

Anxiety level at the time of the survey and anxiety level in the previous year corresponded to values of zero to three indicating relative frequency. On average, HPS respondents experienced anxiety on several days (indicated by a value of one) during the last week (mean = 1.1, SD = 1.1). Chi-square tests indicate a statistically significant difference in the anxiety level of blacks ($\chi^2 = 213.11, p < 0.001$) and Hispanics ($\chi^2 =$

Table 1
HPS Unmatched and Matched Sample Descriptive Statistics.

Variable	Unmatched N	Min	Max	Mean	Std Dev	Matched N	Min	Max	Mean	Std Dev
Poor Health _{t-1}						944604	0	1	0.15	0.36
Poor Health _t	1307384	0	1	0.11	0.31	944604	0	1	0.14	0.35
Currently Employed	1300002	0	1	0.58	0.49	944604	0	1	0.59	0.49
Female	1307384	0	1	0.59	0.49	944604	0	1	0.6	0.49
Insured	945674	0	1	0.69	0.46	944604	0	1	0.69	0.46
Anxiety _t	991412	0	3	1.09	1.05	942983	0	3	1.1	1.05
Anxiety _{t-1}						939965	0	3	1.23	1.02
COVID Cases/Deaths	351330	0.13	7.83	1.64	1.58	304242	0.13	7.83	1.64	1.58
Black*Week	1307384	0	14	0.63	2.42	944604	0	12	0.52	2.02
Hispanic*Week	1307384	0	14	0.7	2.55	944604	0	12	0.58	2.13
Married	1307384	0	1	0.57	0.49	944604	0	1	0.58	0.49
Education > HS	1307384	0	1	0.86	0.35	944604	0	1	0.87	0.34
Age	1307384	18	88	51.43	15.78	944604	18	88	51.14	15.38
Income < \$25,000	943789	0	1	0.11	0.31	905930	0	1	0.11	0.31
Week	1307384	1	14	7.78	3.98	944604	1	12	6.66	3.33
Hispanic	1307384	0	1	0.09	0.28	944604	0	1	0.09	0.28
Black	1307384	0	1	0.08	0.27	944604	0	1	0.08	0.27
Household Size	1307384	1	10	2.84	1.61	944604	1	10	2.86	1.61

Unmatched sample refers to the original HPS data file.

Matched sample refers to the pairs of matched HPS/NHIS data.

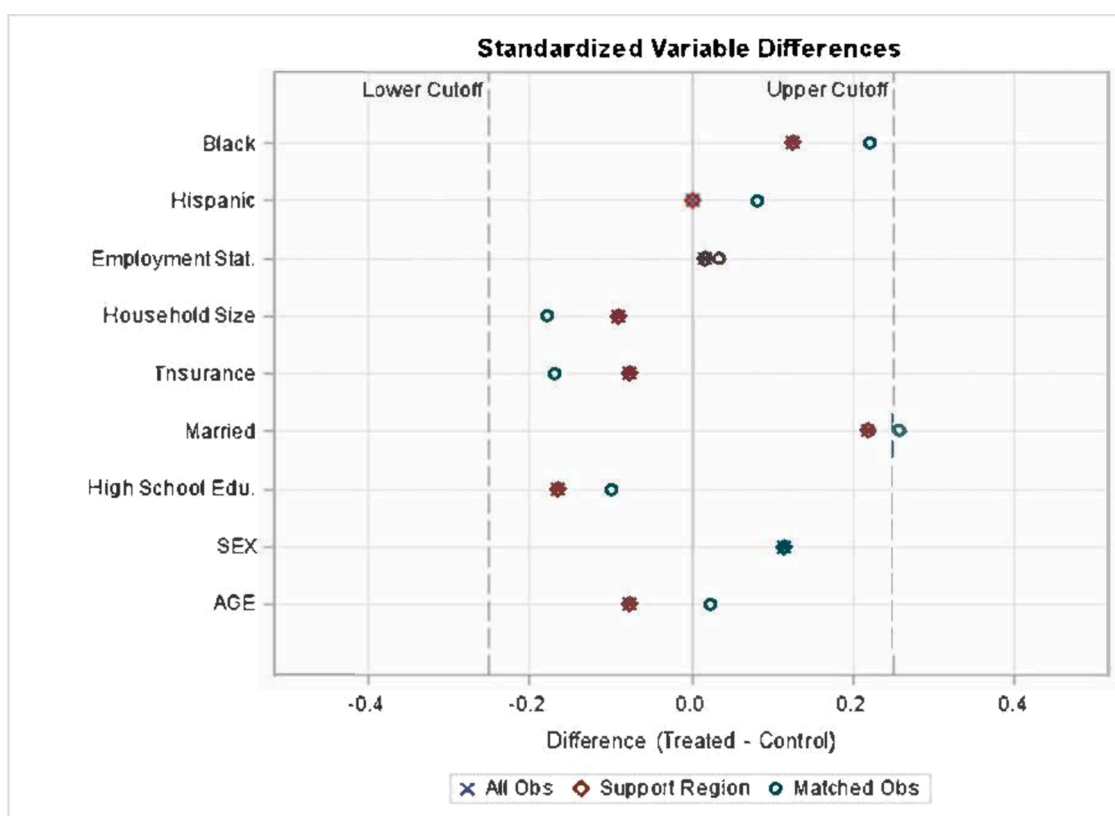


Fig. 1. Difference between Matched and Unmatched Data Sets by Characteristic.

2432.70, $p < 0.001$) compared to other groups. Fig. 2 shows the average proportion of blacks, Hispanics and whites experiencing anxiety during each of the 12 weeks of the survey. White and Hispanics present fairly similar anxiety distributions with only small changes over the duration of the sample. Blacks, however, show a more sizable shift from infrequent to frequent anxiety suggesting a different trajectory of fear among this subgroup. However, this could be attributed to lower average income or higher prevalence of poor health among this cohort.

3.3. Regression analysis

Regression results as well likelihood ratio tests and corresponding significance levels are listed in Table 2. NB coefficients represent the difference in the log of anxiety levels corresponding to a one-unit change in the predictor variable. Estimates indicate higher frequency of anxiety among females (LR = 3500.41, $p < 0.001$), individuals in poor health (LR = 11228.0, $p < 0.001$), those with higher levels of education (LR = 233.19, $p < 0.001$) and those with income below \$25,000 (LR = 123.08, $p < 0.001$) compared to the reference group. Anxiety frequency was

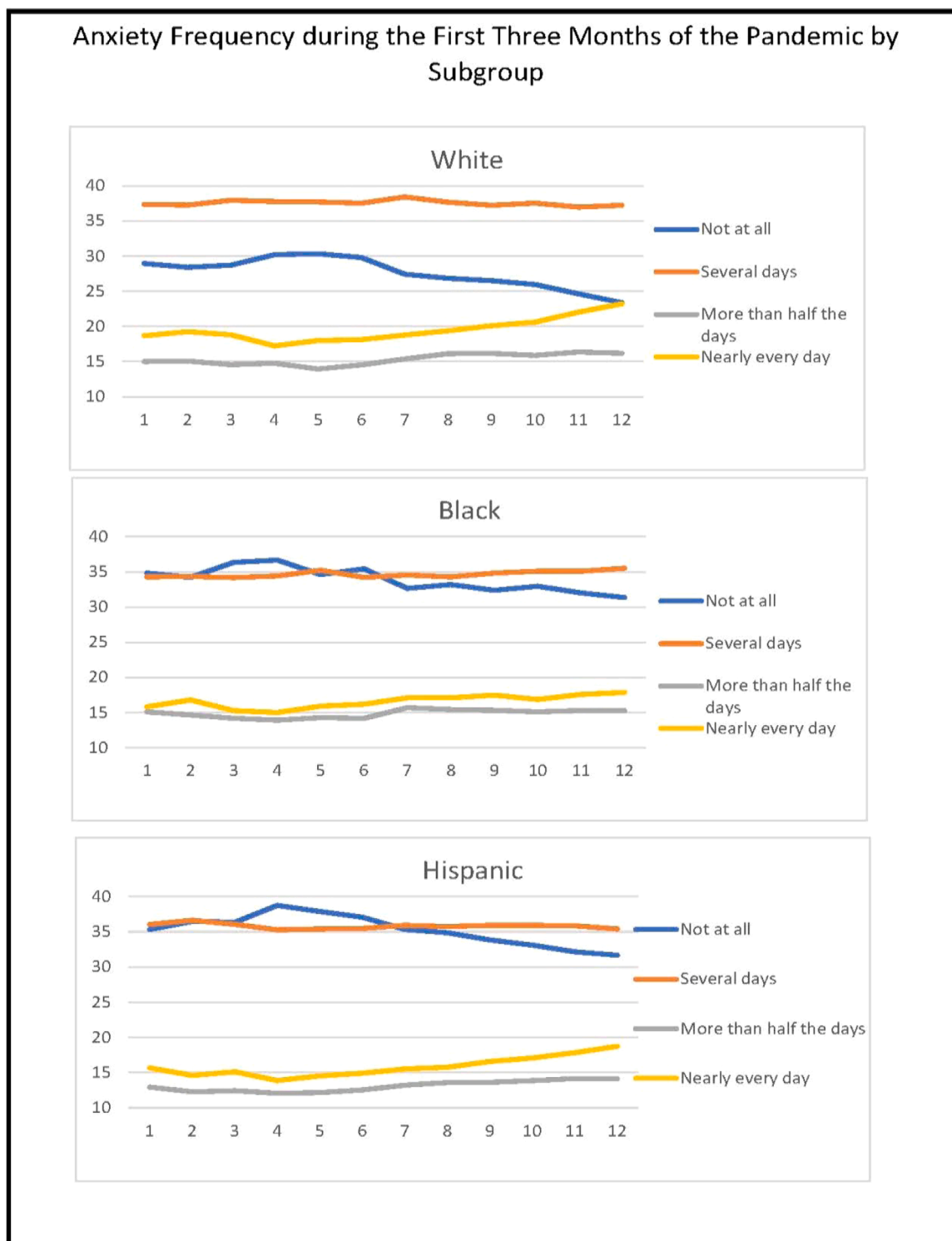


Fig. 2. Anxiety Frequency by Demographic Subgroup.

comparatively lower in older (LR = 13068.9, $p < 0.001$), married (LR = 578.73, $p < 0.001$) and insured (LR = 39.00, $p < 0.001$) respondents. As expected, higher levels of anxiety were correlated with higher cases/deaths ratios (LR = 36.73, $p < 0.001$) in the respondent's state of residence—a possible reaction to the morbidity and mortality of the virus or increased restrictions imposed by local municipalities. Frequency of anxiety in the previous year was positively and associated with anxiety in the current period (LR = 10.3, $p = 0.0013$). Reporting poor health status in the current (LR = 11228.2, $p < 0.001$) or in the previous period

(LR = 4.1, $p = 0.0428$) was associated with more frequent anxiety. Those who were employed had, on average, lower levels of anxiety (LR = 191.73, $p < 0.001$) than those who were not. Hispanics (LR = 0.16, $p = 0.63$) did not have statistically different anxiety levels than the reference group, but blacks (LR = 139.74, $p < 0.001$) had significantly higher frequencies than other subgroups.

As the pandemic progressed, anxiety became more frequent as indicated by the positive and highly significant coefficient for survey week (LR = 36.76, $p < 0.001$). In general, this suggests an upward

Table 2
Negative Binomial Regression Estimates.

Model Significance								
Log Likelihood	-271748							
Full Log Likelihood	-377498							
AIC (smaller is better)	755034.6							
AICC (smaller is better)	755034.6							
BIC (smaller is better)	755235.6							
	Estimate	Std Err	95% Confidence Interval		Chi-Square	Pr > ChiSq	Likelihood Ratio Statistics	
							Chi-Square	Pr > ChiSq
Intercept	0.48	0.01	0.46	0.51	1275.37	<.0001		
Week	0	0	0	0.01	36.76	<.0001	36.76	<.0001
Black	0.09	0.01	0.07	0.11	136.16	<.0001	139.74	<.0001
Black*Week	0.01	0	0	0.01	9.71	0	9.72	0
Hispanic	0.01	0.02	-0.03	0.04	0.16	0.69	0.16	0.69
Hispanic*Week	0	0	-0.01	0.01	0	0.97	0	0.97
Female	0.23	0	0.22	0.23	3424.21	<.0001	3500.41	<.0001
Anxiety _{t-1}	0.01	0	0	0.01	10.31	0	10.3	0
Poor Health _{t-1}	0.01	0.01	0	0.02	4.11	0.04	4.1	0.04
Poor Health _t	0.52	0	0.51	0.53	12215.8	<.0001	11228.2	<.0001
Married	-0.1	0	-0.11	-0.09	580.79	<.0001	578.73	<.0001
Education >HS	0.08	0.01	0.07	0.09	229.17	<.0001	233.19	<.0001
Income<\$25,000	0.07	0.01	0.05	0.08	124.1	<.0001	123.08	<.0001
Currently Employed	-0.06	0	-0.07	-0.05	192.3	<.0001	191.73	<.0001
Age	-0.02	0	-0.02	-0.01	13044.4	<.0001	13068.9	<.0001
Household Size	0	0	0	0.01	4.57	0.03	4.56	0.03
Insured	-0.03	0	-0.04	-0.02	39.09	<.0001	39	<.0001
COVID Cases/Deaths	0.01	0	0	0.01	36.89	<.0001	36.73	<.0001
Dispersion	0	0	0	0.00				

Dependent Variable: Anxiety Frequency- 0=Not at all, 1=Several days, 2=More than half the days, 3=Nearly everyday
Source: Household Pulse Survey Phase 1, National Health Interview Survey 2019

sloping anxiety trajectory. To determine if racial and ethnic subgroups experienced different trajectories of anxiety, time interaction terms were added to the model. Hispanics (LR = 0.00, $p = 0.97$) did not appear to have a significantly different anxiety trajectory from that of the reference group. Blacks, however, had a highly significant interaction term (LR = 9.72, $p = 0.0018$) suggesting they not only experienced anxiety more often than other subgroups but that the proportion of blacks experiencing frequent anxiety was increasing over the sample period more than the reference group.

3.4. Robustness test

OLS regression assessed the trajectory of anxiety using the same covariates outlined above (Table 3). While standard errors are unreliable when OLS is used to estimate a discrete dependent variable model, estimates do approximate the linear association between anxiety and the respective regressors. These estimates reinforce the results found in the NB model. Using these estimates, fitted value of subgroup anxiety levels were approximated (Fig. 3). Curves show the relative trajectories for anxiety among blacks, white and Hispanics. As seen in the NB model, whites experience less/little anxiety and Hispanics experience slightly more, but blacks experience higher levels of anxiety during every week of the pandemic and anxiety levels among blacks increase at a faster rate than that of Hispanics or whites, indicated by the steeper slope in the curve.

3.5. Sensitivity analysis

Results remained largely consistent with those presented when the number of matches, matching characteristics and matching method was changed. The sample was also divided by sex and age to test of structural differences within the sample. Both genders and all age cohorts showed similar results.

Table 3
Ordinary Least Squares Regression Estimates.

N	944604			
R-Square	0.13			
Adj R-Sq	0.13			
F Value (p-value)	2440.96 (p<0.001)			
Variable	Parameter	Std. Err	t Value	Pr > t
Intercept	1.69	0.01	133.51	<.0001
Week	0.01	0	6.33	<.0001
Black	0.2	0.02	-12.98	<.0001
Black*Week	0.01	0	3.43	0.0006
Hispanic	0.01	0.02	0.3	0.76
Hispanic*Week	0	0	0.43	0.67
Female	0.23	0	59.94	<.0001
Anxiety _{t-1}	0	0	2.57	0.0101
Poor Health _{t-1}	0.01	0.01	1.41	0.16
Poor Health _t	0.66	0.01	118.66	<.0001
Married	-0.11	0	-25.66	<.0001
Education >HS	0.09	0.01	16.5	<.0001
Income<\$25,000	0.1	0.01	14.79	<.0001
Currently Employed	-0.08	0	-18.15	<.0001
Age	-0.02	0	-120.42	<.0001
Household Size	0	0	1.39	0.16
Insured	-0.04	0	-8.65	<.0001
COVID Cases/Deaths	0.01	0	6.38	<.0001

Dependent Variable: Anxiety Frequency- 0=Not at all, 1=Several days, 2=More than half the days, 3=Nearly everyday
Source: Household Pulse Survey Phase 1, National Health Interview Survey 2019

4. Discussion

The purpose of this study was to investigate the longitudinal trend in anxiety during the COVID-19 pandemic and to assess racial and ethnic differences in the trajectory of anxiety. Results indicate that although blacks showed lower levels of anxiety at the beginning of the pandemic, the proportion of the population experiencing regular anxiety increased nearly 20 percent in the first three months. This rapid increase in the

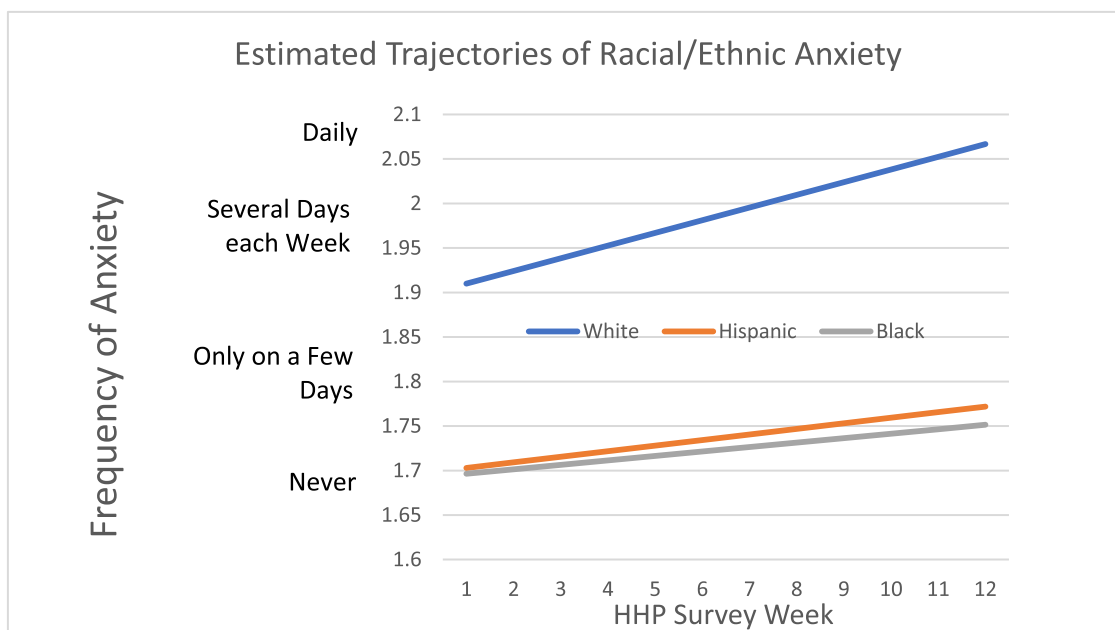


Fig. 3. Estimated Trajectory of Anxiety during the COVID-19 Pandemic.

prevalence of anxiety is likely attributable to the disproportionately high contagion and mortality associated with COVID-19 and the loss of economic resources among members of the black community as well as the loss of protective factors including engagement with social networks.

Pandemics do not impact all racial/ethnic groups equally; furthermore, significant racial and ethnic differences in the prevalence of infectious disease in the US population have been well documented (Dowd, et al. 2009; Aral, 2002; Schillinger, et al. 2004; Jones et al., 2001). Historically, epidemics tend to have the greatest impact on socially and economically disadvantaged populations. During the influenza pandemic in 1918 blacks had lower morbidity and mortality compared to whites; however, higher case fatality rates among blacks suggests that when they did contract influenza, they had a higher risk of dying (Økland and Mamelund 2019). In 2009, blacks experienced a greater number of hospitalizations and deaths as a result of H1N1 (Placzek and Madoff 2014). The inequity in disease burden has continued in 2021 with COVID-19—blacks are 3.7 times more likely to be hospitalized and 2.8 times more likely to die from COVID-19 compared to whites (CDC 2020).

The model includes various individual characteristics that could be related to increased anxiety particularly in the prevailing COVID-19 social climate. In addition to race, frequency of anxiety reported during the control period (pre-pandemic 2019 NHIS data), poor physical health, unemployment, lack of insurance and income at or below the poverty threshold, were all associated with a higher frequency of anxiety over the first few months of the COVID-19 pandemic. Findings are consistent with previous research showing heightened anxiety in the wake of COVID-19 (Alonzi, et al. 2020; Fitzpatrick, et al. 2020; Malhotra, et al. 2020; Xiong, et al. 2020). In a study examining anxiety among young adults in the weeks following the pandemic declaration, Alonzi et al. (2020) found that females, those with mental and physical health conditions and individuals adhering to nonbinary sex identification experienced the highest levels of both depression and anxiety. However, race and ethnicity were not examined. Both Malhotra et al. (2020) and Fitzpatrick et al. (2020) noted a high correlation between anxiety levels and the number of reported COVID-19 cases and deaths, particularly among socially vulnerable populations. Similarly, results were found in studies examining anxiety in Europe, Asian and South America (Xiong et al. 2020).

Studies have suggested that the inequity of COVID-19 infection and

death coupled with subsequent structural, individual and cultural racism experienced by the black community had the potential to heighten anxiety (Husain and Reyes, 2020; Morales et al. 2020; Rapezzi, et al. 2020). Times of social distress, especially when discrimination is perceived, can heighten internalized anxiety (Thompson 2002). Furthermore, blacks who report having been discriminated against are more likely to suffer from anxiety disorders (Smith et al. 2008). These perceptions and issues of social discord coupled with the higher prevalence of the leading comorbid contributors to severe COVID-19—diabetes, chronic kidney disease, cardiovascular disease, sickle cell disease and obesity—comprise two stimuli for increased fear and mental distress among blacks (Menke et al. 2015; Tarver-Carr et al. 2002; Carnethon et al. 2017; Hales et al. 2017; Quiñones et al. 2019). The lineage of racial inequity in the health outcomes of epidemics along with the disparate prevalence of chronic conditions likely contributed to elevated fear among disadvantaged racial/ethnic groups during the COVID-19 pandemic.

As many businesses shuttered to comply with local ordinances, unemployment in the US began to surge. Data from the Urban Institute's Coronavirus Tracking survey showed that more than two in five adults reported a job or income loss due to COVID-19 (Acs and Karpman 2020). While no racial groups were immune to the surge in joblessness, the burden of unemployment fell disproportionately on blacks who experienced an average unemployment of 16.6% compared to 12.8% for whites (Couch et al. 2020). While the white jobless rate began to decrease by May and June (2020), the unemployment rates for blacks remained at a stagnant low (Couch et al. 2020). Since most Americans are covered by employer-provided health insurance, job loss is often accompanied by loss of health coverage. Blacks historically have lower insured rates than whites (11.5% versus 7.5%) (Artiga et al. 2020) and, as many experts expect unemployment rates to continue to rise in those employment sectors disproportionately occupied by blacks, the mental, physical and economic devastation will likely continue with potentially dire consequences (Sloan et al. 2020).

An increase in poverty is often a consequence of unemployment. Poverty rates have been increasing for the past two decades with drastic increases in the representation of blacks and Hispanics (odds ratios of 1.64 and 2.84, respectively) living in severe poverty—defined as surviving on less than \$2.00 per day (Chaudry et al. 2016; Woolf et al. 2006). In 2019, blacks comprised 13.2% of the population but 23.8% of

those living below the poverty threshold (Creamer, 2020). Impoverished households are more likely to suffer from chronic disease, be uninsured and experience food insecurity (Jih et al. 2018). High employment, loss of health insurance and increased poverty are likely to amplify the racial inequity cause by the COVID-19 pandemic (Nagata et al. 2020).

5. Limitations

While the results presented here are both plausible and logical, this study faced several major limitations. First, the HPS is only a temporary, short term data collection instrument. Therefore, no historical data exists. Additionally, the HPS was changed every three months and survey items concerning anxiety were removed after Phase 1. Second, the cross-sectional nature of the data made it impossible to determine causality. Each week of the HPS included a different group of respondents making the evolution of individual anxiety impossible to track. While the average number of respondents who reported frequent anxiety increased, this study cannot definitively attribute these increases to the COVID-19 pandemic or the economic manifestations thereof. Third, propensity score matching cannot account for all sources of potential cofounders available for analysis. While many characteristics were used and the matching procedure was carefully evaluated, these procedures do not guarantee reliable and accurate estimates. As a result, unlike randomized control trials, propensity score analyses have the limitation that remaining unmeasured confounding variables may still be present, thus leading to biased results. Finally, since the HPS only utilizes anxiety in one question, the response to a single survey question was used to assess anxiety. Ideally, a more accurate indicator of anxiety such as the Hamilton Anxiety Rating Scale (HARS), Leibowitz Social Anxiety Scale (LSAS), or the Leibowitz Social Anxiety Scale (LSAS), Patient Health Questionnaire (PHQ), or the Generalized Anxiety Disorder 7 (GAD-7) would have been used to measure the nature, extent, and duration of respondent anxiety.

6. Conclusion

At the beginning of the COVID-19 pandemic blacks reported lower levels of anxiety compared to other racial groups. As the pandemic continued it became evident that the health and economic impact was disproportionately affecting the black community. Anxiety spurred from rising rates of unemployment and loss of insurance was potentially compounded by the grief of losing family members and friends. Over the initial months of the COVID-19 pandemic the proportion of the black community experiencing regular anxiety increased nearly 20%. As the nation moves forward from the pandemic, steps should be taken to mitigate the inequity of mental health consequences for socially disadvantaged groups, specifically the black community. Resources already available in the communities, such as community health workers, should be mobilized to provide education on the importance being vaccinated against COVID-19 and to assist community members in engagement with mental health services as needed. As soon as it is safe, restoration of group-focused activities including religious and extended family gatherings should also be encouraged as these social networks may help dissipate residual anxiety resulting from the health and economic disadvantages experienced by the black community over the course of the COVID-19 pandemic.

Author statement

M.J. and A.B. developed the concept for this study. M.J. performed all data work and statistical analyses. M.J. completed a draft of the manuscript. A.B. contributed to writing, editing, and advising of the project.

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Declarations of Competing Interest

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