



Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.



Research paper

An examination of racial and ethnic disparities in mental health during the Covid-19 pandemic in the U.S. South

Emily Goldmann^{a,*}, Daniel Hagen^a, Estelle El Khoury^a, Mark Owens^b, Supriya Misra^c, Johannes Thrul^{d,e,f}

^a Department of Epidemiology, New York University School of Global Public Health, 708 Broadway, 7th Floor, New York, NY 10003, USA

^b Department of Political Science, College of Arts and Sciences, The University of Texas at Tyler, Tyler, TX, USA

^c Department of Public Health, College of Health and Social Sciences, San Francisco State University, San Francisco, CA, USA

^d Department of Mental Health, Johns Hopkins University Bloomberg School of Public Health, Baltimore, MD, USA

^e Sidney Kimmel Comprehensive Cancer Center at Johns Hopkins, Baltimore, MD, USA

^f Centre for Alcohol Policy Research, La Trobe University, Melbourne, Australia



ARTICLE INFO

Keywords:

COVID-19

Mental health, Race

Ethnicity

Stressors

ABSTRACT

Background: The mental health of racial/ethnic minority groups in the United States may be disproportionately impacted by the COVID-19 pandemic due to greater experience of peri-pandemic stressors. Yet, few studies have systematically examined racial/ethnic differences in mental health outcomes in this context.

Methods: Data came from the COVID-19 Southern Cities Study, a probability-based, cross-sectional study conducted in May/June 2020 among adults living in the metropolitan statistical areas of Atlanta, Austin, Dallas, Houston, and New Orleans. Unadjusted and adjusted associations between racial/ethnic identity and past-week depression and/or anxiety symptoms (Patient Health Questionnaire-2 score ≥ 3 or Generalized Anxiety Disorder-2 score ≥ 3), trouble sleeping, physical reactions when thinking about COVID-19, and self-rated worsened mental health due to the pandemic were estimated in separate logistic regression models.

Results: Over 30% of respondents reported depression and/or anxiety symptoms, 21% reported physical reactions, 25% had trouble sleeping, and 33% worsened mental health since the pandemic began. Adjusting for sociodemographic and health-related characteristics and pandemic-related stressors, odds of anxiety symptoms (odds ratio (OR) 0.53, 95% confidence interval (CI) 0.30–0.95) and worsened mental health (OR 0.58, 95% CI 0.36–0.94) were lower among non-Hispanic Black vs. non-Hispanic white respondents.

Limitations: No diagnostic assessments were used, and results may not be generalizable to later phases of the pandemic and the entire U.S. South.

Conclusions: Despite greater pandemic-related stressor experience, poor mental health outcomes were not more common among racial/ethnic minority individuals. However, interventions to reduce disparities in stressor experience and promote mental health are needed.

1. Introduction

The coronavirus disease 2019 (COVID-19) pandemic has had a substantial impact on mental health in the United States. Several studies have reported elevated population burden of psychological distress during the pandemic compared to pre-pandemic periods, estimating prevalence of these symptoms in the early months of the pandemic at levels 3–4 times that found in national surveillance studies from previous years (Ettman et al., 2020; McGinty et al., 2020). The prevalence of past-week symptoms of depressive or anxiety disorder reported by the

weekly U.S. Census Household Pulse Survey has hovered around 30–40% for much of the pandemic period and stands in stark contrast to the 11% reported in the 2019 National Health Interview Survey (NHIS) (Centers for Disease Control and Prevention, 2020). Further, a recent population-representative longitudinal study of U.S. adults 20 years or older found that approximately 1 in 8 participants reported an increase in psychological distress between February 2019 (pre-pandemic) and May 2020 (peri-pandemic) (Breslau et al., 2021). Although mental health has always been an issue of public health concern, these findings suggest that the current situation is particularly dire and warrants

* Corresponding author.

E-mail address: esg236@nyu.edu (E. Goldmann).

<https://doi.org/10.1016/j.jad.2021.08.047>

Received 12 April 2021; Received in revised form 29 July 2021; Accepted 21 August 2021

Available online 27 August 2021

0165-0327/© 2021 Elsevier B.V. All rights reserved.

action.

The mental health of racial and ethnic minority groups in the U.S. may be disproportionately impacted by the pandemic due to greater experience of pre-existing and COVID-related stressors. In addition to disparities in COVID-19-related outcomes (e.g., case positivity rates, disease severity, mortality) (Centers for Disease Control and Prevention, 2021) and race- and class-based discrimination, harassment, and attacks (Devakumar et al., 2020; Ying and Finch, 2020), racial and ethnic minority groups are at greater risk for COVID-related stressors such as economic hardship (The Commonwealth Fund, 2020). Coupled with longstanding health disparities and other stressors (The Commonwealth Fund, 2020), these experiences contribute to an accumulation of stressors across the life course that may increase risk of mental health problems (Pearlin et al., 2005). They could also contribute to greater anxiety and uncertainty about recovery following the pandemic (e.g., loss of primary wage earner) and anticipated discrimination (e.g., during re-entry into the job market).

Despite this evidence, racial and ethnic differences in mental health during the COVID-19 pandemic do not show a clear pattern. Several studies reported the highest prevalence of common mental health conditions among Hispanic compared to non-Hispanic white and Black individuals, but most of these comparisons did not reach statistical significance (Breslau et al., 2021; Centers for Disease Control and Prevention, 2020; Ettman et al., 2020; McGinty et al., 2020; McKnight-Eily et al., 2021). Comparisons between non-Hispanic Black and white adults are less consistent, and the few studies that specifically assess Asian Americans note a lower prevalence of depression or anxiety symptoms in this group compared to others (Centers for Disease Control and Prevention, 2020). For the most part, examining racial and ethnic differences in mental health during the pandemic was not the main focus of these studies; most have taken a descriptive approach, presenting only bivariate comparisons. Accounting for factors that may differ between racial and ethnic groups and impact mental health (e.g., age, education, financial strain, additional COVID-related stressors) is necessary to elucidate mental health disparities and their drivers.

Compared to the North and West regions of the U.S., the South is often characterized by higher levels of racial polarization (Elmendorf and Spencer, 2014), lower public health spending and health insurance coverage (Trust for America's Health, 2018; United States Census Bureau, 2019), and higher prevalence of certain pre-existing health conditions that increase risk of severe COVID-19 (e.g., diabetes, hypertension) (Raghupathi and Raghupathi, 2018). This region has also experienced natural disasters in recent years that have disproportionately affected marginalized racial and ethnic populations (Sastri and Gregory, 2013). All of these factors may contribute to mental health disparities by race/ethnicity. Yet few studies of mental health during COVID-19 have focused on the Southern region of the US. The aim of the current study is to evaluate racial and ethnic differences in COVID-19-related stressors (e.g., financial strain) and mental health among adult residents of 5 large Southern U.S. metropolitan statistical areas (MSA) including Austin, Dallas, Houston, Atlanta, and New Orleans during the early stages of the COVID-19 pandemic. We hypothesized that racial/ethnic minority respondents would report greater COVID-19-related stressor experience and worse mental health compared to non-Hispanic white respondents.

2. Methods

2.1. Participants and data collection

Data came from the COVID-19 Southern Cities Study, a probability-based, cross-sectional survey that collected information on COVID-19 experiences and beliefs, mental health and substance use, political opinions, and sociodemographic factors among adults 18 years or older living in the metropolitan statistical areas (MSA) of Atlanta-Sandy Springs-Alpharetta (GA), Austin-Round Rock-Georgetown (TX), Dallas-

Fort Worth-Arlington (TX), Houston-The Woodlands-Sugar Land (TX), and New Orleans-Metairie (LA) between May 26 and June 6, 2020. Respondents (n=1727) were randomly selected from Dynata's online panel to complete web-based Qualtrics surveys (n=1641) or through random digit-dial (RDD) to complete interviewer-administered landline telephone or cell phone surveys (n=86). The sample of online respondents was randomly recruited with a geographic quota from each MSA. The smaller telephone supplement included a stratified sample of random digit numbers for each city. The supplement of phone interviews aimed to introduce an additional level of randomness to the survey that a well-cultivated opt-in sample may not provide. Mixing modes of participant recruitment into a sample is a common way to compensate for the weaknesses of one mode (De Leeuw 2005) without sacrificing the quality of the survey data when the questionnaire is the same (Kreuter et al., 2008; Ansolabehere and Schaffner, 2014). Surveys were conducted in English (n=1704) and Spanish (n=23). The median duration of web-based surveys was approximately 14 min (interquartile range (IQR): 9–20); for phone surveys, the median duration was approximately 24 min (IQR: 18–33). Specific racial and ethnic group respondents were purposely oversampled to obtain a robust sample for specific racial and ethnic groups in each MSA. Participants provided informed consent before beginning the survey. The study was approved by the University of Texas at Tyler Institutional Review Board. This analysis followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guidelines (von Elm et al., 2007).

2.2. Measures

The outcomes of interest in this study were the following mental health indicators: (1) symptoms of depression and/or anxiety, (2) trouble sleeping, (3) physical reactions when thinking about the COVID-19 pandemic, and (4) self-rated worsened mental health due to the pandemic. Symptoms of depression and anxiety were assessed using the 4-item Patient Health Questionnaire (PHQ-4, Cronbach's alpha=0.85) (Kroenke et al., 2009), which asks about the frequency of experiencing 2 symptoms of depression and 2 symptoms of generalized anxiety disorder (GAD), modified to evaluate symptoms experienced during the past week (not at all or less than 1 day, 1–2 days, 3–4 days, 5–7 days), instead of during the past two weeks, analogously to the Household Pulse Survey (Centers for Disease Control and Prevention, 2020). Total scores for the 2 depression items (PHQ-2, range 0–6, Spearman-Brown split-half reliability=0.80) and the 2 anxiety items (GAD-2, range 0–6, split-half reliability=0.64) were dichotomized separately using a cut point of 2/3 for each domain (Kroenke et al., 2007, 2003), and symptoms of depression and/or anxiety were indicated where either domain score was above this cut point (Centers for Disease Control and Prevention, 2020). Observations with missing data for at least 1 PHQ-4 item were excluded (n=124, 7%) (Löwe et al., 2010). Past-week trouble sleeping was assessed with a single-item question and categorized as rarely or none of the time (less than 1 day) or some or a little of the time (1–2 days) vs. occasionally or a moderate amount of the time (3–4 days) or most or all of the time (5–7 days). Experiencing physical reactions such as sweating, trouble breathing, nausea, or pounding heart when thinking about the COVID-19 pandemic in the past week was operationalized in the same way (Holingue et al., 2020). Respondents were also asked how much their mental/emotional health has been worsened by the pandemic (not at all/slightly vs. moderately/very/extremely).

Self-reported race/ethnicity was categorized as non-Hispanic white; Hispanic, any race; non-Hispanic Black; and non-Hispanic Asian. Those who reported another race were excluded from the analysis due to small sample size (n=39). Other covariates included gender (male vs. female), age group, educational attainment, marital status, country of birth (U.S. vs. non-U.S.), self-reported general health (excellent/very good/good vs. fair/poor), and previous diagnoses of a mental health condition by a healthcare professional. Additionally, we assessed stressors related to

COVID-19, including shortage of money for food for the respondent or their family in the past month (never or once in a while vs. fairly often or very often), essential/frontline worker status (self or someone in household), number of people known personally with COVID-19 (none vs. one or more), and isolating even without having symptoms (as a measure of restricted in-person social interaction). Finally, we examined “personal growth” due to COVID-19 using 5 items from the Complementary and Integrative Research (CAIR) Lab Pandemic Impact Questionnaire (C-PIQ), which assessed the extent to which participants felt the COVID-19 pandemic had led to positive changes in their life (strengthened relationships with others and community, created new possibilities, helped identify personal strengths, created spiritual change, increased appreciation of life). The 5 items of this measure are summed to create a score from 0–20, with higher scores indicating greater personal growth (Lang 2020; Dzierzewski et al., 2021).

2.3. Statistical analysis

The analytic sample comprised respondents who identified as non-Hispanic white, Hispanic, non-Hispanic Black, or non-Hispanic Asian (n=1688). Variables were described using frequencies and weighted percentages or weighted median and IQR in the overall sample and by race/ethnicity. χ^2 tests provided description of bivariate associations between all variables except positive growth score and race/ethnicity, for which a Wald test following survey linear regression with robust standard errors was used. In addition to variables thought to be potential confounders based on previous literature, variables associated with the exposure or any outcome in χ^2 tests at $p < 0.05$ were included as covariates in regression analysis. Six sets of regression analyses evaluated each of the following as the dependent variable in separate models: (1) depression and/or anxiety symptoms, (2) depression symptoms, (3) anxiety symptoms, (4) physical reactions when thinking about COVID-

Table 1
Sociodemographic factors, health-related characteristics, and COVID-related stressors, overall and by race/ethnicity.

	Full sample	Non-Hispanic White	Hispanic, any race	Non-Hispanic Black	Non-Hispanic Asian	p-value ^a
Total	1688 (100.0)	573 (44.3)	381 (26.6)	507 (21.8)	227 (7.4)	N/A
Gender						0.96
Male	811 (50.3)	400 (50.5)	142 (51.2)	168 (49.1)	101 (48.9)	
Female	869 (49.8)	171 (49.5)	237 (48.8)	335 (50.9)	126 (51.1)	
Age category (years)						<0.001
18–24	279 (11.5)	30 (4.7)	108 (20.6)	109 (14.0)	32 (11.9)	
25–34	295 (20.6)	58 (13.1)	96 (29.7)	90 (23.1)	51 (25.2)	
35–44	254 (18.9)	60 (13.3)	60 (20.0)	78 (25.1)	56 (29.8)	
45–64	448 (32.8)	183 (40.2)	69 (26.1)	131 (26.4)	65 (30.3)	
65–89	337 (16.4)	223 (28.8)	29 (3.7)	70 (11.4)	15 (2.8)	
Metropolitan area						<0.001
Atlanta, GA	440 (25.2)	142 (27.6)	82 (11.0)	171 (38.7)	45 (21.6)	
Austin, TX	193 (11.1)	88 (13.2)	59 (14.3)	23 (3.2)	23 (10.7)	
Dallas, TX	412 (24.9)	160 (25.9)	89 (27.1)	112 (19.5)	51 (27.5)	
Houston, TX	508 (30.8)	156 (24.4)	132 (44.9)	121 (24.7)	99 (36.1)	
New Orleans, LA	135 (8.0)	27 (8.9)	19 (2.7)	80 (14.0)	9 (4.1)	
Educational attainment						<0.001
High school diploma (or equivalent) or less	290 (32.1)	50 (21.7)	90 (39.9)	137 (48.4)	13 (17.6)	
Associate degree or some college	474 (29.1)	131 (28.2)	128 (32.4)	178 (30.4)	37 (19.1)	
Bachelor’s degree	541 (24.6)	212 (30.2)	97 (19.0)	129 (15.4)	103 (38.2)	
Post-graduate training or degree	378 (14.2)	180 (19.9)	63 (8.7)	61 (5.8)	74 (25.0)	
Marital status						<0.001
Married or cohabiting	886 (52.7)	367 (60.2)	203 (55.9)	191 (34.7)	125 (49.9)	
Never married	529 (32.9)	110 (22.4)	130 (35.0)	207 (49.0)	82 (41.5)	
Widowed, divorced, or separated	237 (14.3)	86 (17.4)	36 (9.1)	100 (16.3)	15 (8.7)	
Born in the U.S.						<0.001
Yes	1381 (84.2)	539 (93.9)	288 (74.1)	470 (93.8)	84 (33.7)	
No	287 (15.8)	33 (6.1)	82 (25.9)	32 (6.2)	140 (66.3)	
Self-rated general health						0.54
Good, very good, or excellent	1461 (85.4)	499 (84.2)	329 (87.3)	430 (84.3)	203 (89.7)	
Poor or fair	175 (14.6)	59 (15.8)	36 (12.7)	60 (15.7)	20 (10.3)	
Ever diagnosed by health care provider with mental health condition						0.12
No	1302 (80.1)	456 (80.0)	264 (79.4)	386 (77.5)	196 (90.2)	
Yes	321 (19.9)	97 (20.0)	99 (20.6)	98 (22.5)	27 (9.8)	
Past-month shortage of money for food for self and family						<0.001
Once in a while or never	1216 (80.1)	474 (86.5)	247 (78.6)	321 (66.6)	174 (82.2)	
Fairly or very often	280 (19.9)	60 (13.5)	81 (21.4)	109 (33.4)	30 (17.8)	
Essential/frontline worker (either self or in household)						0.001
No	942 (63.6)	389 (70.3)	168 (54.4)	243 (56.4)	142 (74.1)	
Yes	512 (36.4)	132 (29.7)	149 (45.6)	176 (43.6)	55 (25.9)	
Number of people known personally who have or had COVID-19						0.004
None	921 (63.8)	349 (67.4)	193 (63.1)	232 (53.2)	147 (72.9)	
One or more	615 (36.2)	191 (32.6)	146 (36.9)	215 (46.8)	63 (27.1)	
Isolated even without having symptoms						0.27
No	1039 (68.9)	369 (68.1)	229 (70.3)	309 (72.2)	132 (59.7)	
Yes	495 (31.1)	166 (31.9)	111 (29.7)	140 (27.8)	78 (40.3)	
Positive growth score, median (IQR)	6 (3-10)	5 (2-9)	8 (4-10)	8 (5-13)	8 (5-11)	<0.001

Data are shown as n (%).

Raw numbers and weighted column percentages (row percentages for Total) to account for stratification and oversampling of racial/ethnic minorities.

^a Weighted χ^2 tests.

19, (5) trouble sleeping, and (6) self-reported worsened mental health. Binary logistic regression analyses examined the association between race/ethnicity and each mental health indicator in unadjusted models (model 1); models adjusting for gender, age, education, marital status, country of birth, self-reported general health, previous mental health diagnosis, and MSA (model 2); and models further adjusting for shortage of money for food, essential/frontline worker status, knowing someone with COVID-19, and isolating even without having symptoms (model 3). This yielded 18 regression models in total. Odds ratios (OR), 95% confidence intervals (CI), and concordance (c) statistics (as a measure of goodness of fit or predictive accuracy of binary logistic regression models (Hosmer et al. 2013)), were reported. All analyses were conducted using the svy suite of commands in Stata, SE 15.1, and statistical significance was evaluated at $p < 0.05$. Analyses accounted for complex sampling design (i.e., stratification by MSA) and sample weights calculated to ensure that the characteristics of the sample closely reflected the characteristics of the corresponding geographic area. The telephone and web-based samples were balanced using iterative raking estimation to match parameters for sex, age, race/ethnicity, and educational attainment of the corresponding geographic areas using estimates from the 2019 American Community Survey. The weights generated for the probability telephone sample and non-probability online sample were combined into one pseudo weight for the entire sample (Elliott, 2009).

3. Results

3.1. Sociodemographic characteristics and COVID-19-related factors

Table 1 reports sociodemographic characteristics and COVID-related factors overall and by race/ethnicity. The weighted sample was 44.3% non-Hispanic white, 26.6% Hispanic, 21.8% non-Hispanic Black, and 7.4% non-Hispanic Asian. Approximately half of respondents were female (49.8%) and married or cohabiting (52.7%). Adults 45–64 years old made up the largest proportion of the sample (32.8%), and the majority had more than high school education (67.9%) and were born in the US (84.2%). The largest proportion resided in Houston (30.8%) and the smallest proportion in New Orleans (8.0%). Approximately one-fifth had a previous mental health diagnosis (19.9%).

Approximately 20% of respondents reported having experienced a shortage of money for food fairly often or very often in the past month, and about one-third reported being or having a family member who is an

essential or frontline worker (36.4%), knowing someone personally who had or has COVID-19 (36.2%), and self-isolating even without having symptoms (31.1%). All COVID-related stressors were more common among Black and Hispanic respondents compared to white and Asian respondents, with the exception of self-isolating. Over 33% of Black respondents and 20% of Hispanic respondents had past-month shortage of money for food compared to 13.5 and 17.8% among white and Asian respondents, respectively ($p < 0.001$). More than 40% of Black and Hispanic respondents reported being or having an essential worker in their household, compared to less than 30% among white and Asian respondents ($p=0.001$). Almost half of Black respondents knew someone who had COVID-19 (46.8% vs. 36.9% of Hispanic, 32.6% of white, and 27.1% of Asian respondents, $p=0.004$). Median positive growth scores were higher among racial/ethnic minority respondents than among white respondents (Hispanic respondents: median=8, IQR: 4-10; Black respondents: median=8, IQR: 5-13; Asian respondents: median=8, IQR: 5-11; white respondents: median=5, IQR: 2-9; $p < 0.001$).

3.2. Bivariate associations between mental health indicators and race/ethnicity

Over 30% of respondents reported past-week probable depression and/or anxiety symptoms (26.4% with depression symptoms, 22.3% with anxiety symptoms), 21.3% reported experiencing physical reactions when thinking about COVID-19, 25.0% reported trouble sleeping, and almost one-third (33.1%) reported worsened mental health since the pandemic began. Hispanic and Black respondents had the highest prevalence of most mental health outcomes compared to respondents of other race/ethnicity, but the prevalence estimates did not differ significantly by race/ethnicity at $p < 0.05$. The exception was past-week physical reactions when thinking about COVID-19, which were more common among Hispanic (26.3%) and Black (25.0%) respondents compared to white (17.1%) and Asian (18.8%) respondents ($p=0.03$, Table 2).

3.3. Multivariate regression models

In models adjusting for sociodemographic characteristics, self-rated general health, and previous mental health diagnosis (model 2), Hispanic, Black, and Asian respondents had lower odds of probable depression and/or anxiety symptoms compared to non-Hispanic white respondents, although none of these associations reached statistical

Table 2
Mental health indicators, overall and by race/ethnicity.

	Full sample	Non-Hispanic White	Hispanic, any race	Non-Hispanic Black	Non-Hispanic Asian	p-value ^a
Depression and/or anxiety symptoms						
No	1088 (68.7)	409 (68.7)	211 (67.4)	307 (67.2)	161 (77.0)	0.43
Yes	484 (31.3)	137 (31.3)	134 (32.6)	152 (32.8)	61 (23.0)	
Depression symptoms						
No	1176 (73.6)	433 (74.5)	236 (72.4)	338 (71.2)	169 (79.4)	0.51
Yes	412 (26.4)	115 (25.5)	117 (27.6)	127 (28.8)	115 (20.6)	
Anxiety symptoms						
No	1239 (77.7)	449 (76.5)	248 (76.5)	358 (79.1)	184 (85.0)	0.37
Yes	342 (22.3)	100 (23.5)	98 (23.5)	106 (20.9)	38 (15.0)	
Past-week physical reactions when thinking about COVID-19						
2 days or less	1244 (78.7)	469 (82.9)	248 (73.7)	346 (75.0)	181 (81.2)	0.03
3 or more days	343 (21.3)	81 (17.1)	102 (26.3)	120 (25.0)	40 (18.8)	
Past-week trouble sleeping						
2 days or less	1120 (75.0)	410 (75.7)	218 (69.3)	330 (79.8)	162 (78.2)	0.08
3 or more days	378 (25.0)	118 (24.3)	108 (30.7)	102 (20.2)	50 (21.8)	
Self-reported worsened mental/emotional health						
Slightly or not at all	1075 (66.9)	405 (68.8)	204 (62.4)	323 (69.4)	143 (65.0)	0.32
Moderately, very, or extremely	509 (33.1)	143 (31.2)	146 (37.6)	144 (30.6)	76 (35.0)	

Data are shown as n (%).

Raw numbers and weighted column percentages to account for stratification and oversampling of racial/ethnic minorities.

^a Weighted χ^2 tests.

Table 3
Odds ratios of race/ethnicity with mental health outcomes.

	Model 1: OR unadjusted (95% CI)	c- statistic ^a	Model 2: OR adjusted for socio-demographic and health- related variables (95% CI)	c- statistic ^a	Model 3: OR adjusted for variables in Model 2 + stressor variables (95% CI)	c- statistic ^a
Depression and/or anxiety symptoms						
Non-Hispanic white	1.00	0.522	1.00	0.777	1.00	0.788
Hispanic, any race	1.06 (0.71-1.57)		0.73 (0.45-1.19)		0.66 (0.39-1.12)	
Non-Hispanic Black	1.07 (0.73-1.58)		0.77 (0.50-1.20)		0.57 (0.34-0.94)*	
Non-Hispanic Asian	0.66 (0.41-1.05)		0.57 (0.32-1.03)		0.61 (0.31-1.17)	
Depression symptoms						
Non-Hispanic white		0.527	1.00	0.785	1.00	0.799
Hispanic, any race	1.11 (0.74-1.67)		0.75 (0.46-1.24)		0.71 (0.41-1.24)	
Non-Hispanic Black	1.18 (0.79-1.76)		0.83 (0.53-1.31)		0.65 (0.38-1.11)	
Non-Hispanic Asian	0.76 (0.46-1.23)		0.66 (0.36-1.22)		0.75 (0.39-1.47)	
Anxiety symptoms						
Non-Hispanic white	1.00	0.528	1.00	0.751	1.00	0.772
Hispanic, any race	1.00 (0.65-1.54)		0.88 (0.53-1.45)		0.74 (0.42-1.30)	
Non-Hispanic Black	0.86 (0.55-1.33)		0.71 (0.43-1.17)		0.53 (0.30-0.95)*	
Non-Hispanic Asian	0.57 (0.33-0.98)*		0.58 (0.31-1.09)		0.53 (0.27-1.05)	
Past-week physical reactions when thinking about COVID-19						
Non-Hispanic white	1.00	0.566	1.00	0.769	1.00	0.806
Hispanic, any race	1.73 (1.10-2.72)		1.26 (0.71-2.24)		1.06 (0.57-1.96)	
Non-Hispanic Black	1.61 (1.03-2.50)		1.26 (0.76-2.07)		1.11 (0.63-1.94)	
Non-Hispanic Asian	1.12 (0.60-2.08)		1.13 (0.54-2.36)		1.07 (0.47-2.45)	
Past-week trouble sleeping						
Non-Hispanic white	1.00	0.554	1.00	0.706	1.00	0.724
Hispanic, any race	1.38 (0.91-2.10)		0.94 (0.58-1.52)		0.80 (0.47-1.35)	
Non-Hispanic Black	0.79 (0.52-1.18)		0.74 (0.46-1.19)		0.71 (0.43-1.18)	
Non-Hispanic Asian	0.87 (0.49-1.52)		0.68 (0.35-1.33)		0.76 (0.38-1.52)	
Self-reported worsened mental/emotional health						
Non-Hispanic white	1.00	0.533	1.00	0.708	1.00	0.738
Hispanic, any race	1.33 (0.89-1.98)		1.04 (0.65-1.67)		0.91 (0.55-1.52)	
Non-Hispanic Black	0.97 (0.66-1.42)		0.73 (0.47-1.14)		0.58 (0.36-0.94)*	
Non-Hispanic Asian	1.19 (0.74-1.93)		1.26 (0.70-2.24)		1.10 (0.59-2.05)	

Abbreviations: OR, odds ratio; CI, confidence interval.

Model 1: no adjustment

Model 2: adjusted for gender, age group, educational attainment, marital status, country of birth, metropolitan area, self-rated general health, previously diagnosed with mental health condition.

Model 3: adjusted for gender, age group, educational attainment, marital status, country of birth, metropolitan area, self-rated general health, previously diagnosed with mental health condition, past-month shortage of money for food, essential/frontline worker, number of people known with COVID-19, isolated even without symptoms.

^a Area under the Receiver Operating Characteristic (ROC) curve.

* $p < 0.05$.

significance. In models that also adjusted for pandemic-related stressors (model 3), the odds of depression and/or anxiety symptoms were 43% lower among non-Hispanic Black respondents compared to non-Hispanic white respondents (OR 0.57, 95% CI 0.34–0.94). When disaggregating symptoms, only the odds of anxiety symptoms, but not of depression symptoms, were significantly lower for Black compared to white respondents in model 3 (anxiety: OR 0.53, 95% CI 0.30–0.95;

depression: OR 0.65, 95% CI 0.38–1.11). Finally, Black respondents had significantly lower odds of self-rated worsened mental health since the onset of the pandemic as compared to white respondents (OR 0.58, 95% CI 0.36–0.94). At $p < 0.05$, no statistically significant differences were observed between racial/ethnic groups for physical reactions when thinking about COVID-19 and trouble sleeping. Based on the concordance (c) statistic, fully adjusted models for all outcomes (models 3)

demonstrated acceptable to excellent discrimination, with areas under the Receiver Operating Characteristics (ROC) ranging from 0.738 to 0.806 (Hosmer et al., 2013) (Table 3).

4. Discussion

To our knowledge, this is the first study to examine racial/ethnic differences in mental health during the COVID-19 pandemic in Southern U.S. cities that accounts for potential confounding factors and COVID-19-related stressors. Overall, all indicators of poor mental health were common, affecting between one-fifth and one-third of the sample, with prevalence estimates fairly similar to those reported from the late May to early June U.S. Census Household Pulse Survey (Centers for Disease Control and Prevention, 2020) and a March 2020 Pew Research Center survey (Pew Research Center, 2020). A notable exception was physical reactions when thinking about COVID-19, which was reported 3 days or more during the past week by 21% of the current sample, compared to only 7% in the Pew Research Center survey. Besides differences in sample characteristics and the time at which the surveys were conducted, this discrepancy may be due to the fact that the respective item in the Pew Research Center questionnaire asked about physical reactions while thinking specifically about *one's own experiences* with COVID-19, as opposed to the item in this survey that inquired about reactions while thinking about the pandemic *in general*. However, given the high prevalence of physical reactions when thinking about COVID-19, additional research into other short- and long-term manifestations of distress related to the pandemic in this population is warranted.

Compared to non-Hispanic white respondents, the prevalence of most mental health indicators was higher among Black and Hispanic respondents and lower among Asian respondents, similar to some recent COVID-19-related studies (Centers for Disease Control and Prevention, 2020; Ettman et al., 2020; McGinty et al., 2020). However, after adjusting for sociodemographic and health-related factors and COVID-19-related stressors, the odds of anxiety symptoms and self-reported worsened mental health were lower among Black compared to white respondents and did not differ significantly between Hispanic or Asian vs. white respondents, despite significantly greater experience of COVID-19-related stressors. These findings are, for the most part, consistent with a large body of evidence highlighting similar or lower prevalence of mental health conditions among racial/ethnic minority groups compared to non-Hispanic white individuals pre-pandemic (Holzer III and Copeland, 2013), despite greater experience of adversity (Riehm et al., 2021a). The lower odds of distress among Black compared to white respondents in this study are also consistent with results from a recent longitudinal study of mental distress using Understanding America Study data from March to August 2020 (Riehm et al., 2021b).

There are several potential explanations for this somewhat paradoxical finding. Protective factors that buffer the impact of life stressors on mental health – namely, social support and salutary coping resources such as resilience (Kessler et al., 1985) – may be more common among specific racial/ethnic groups. In a recent COVID-19-related study, Black respondents had significantly greater odds of high resilience levels compared to white respondents, which were in turn associated with less mental distress (Riehm et al., 2021a). Social support also significantly buffered the impact of discrimination on depressive symptoms among Asian Americans in another study conducted since the pandemic began (Lee and Waters, 2021). Although we were not able to measure these specific constructs in the current study, personal growth scores were higher among racial/ethnic minority respondents than among non-Hispanic white respondents. Studies have demonstrated that positive emotions, such as finding positive meaning in stressful situations, are associated with greater resilience and better mental health (Tugade and Fredrickson, 2004). The findings of this study may also reflect differences in symptom expression, familiarity with mental health concepts and language, and stigma associated with communicating these

experiences by race/ethnicity that led to less endorsement of the mental health indicators in this study (Holzer III and Copeland, 2013). For example, the PHQ-4 does not include the additional somatic symptoms that comprise Diagnostic and Statistical Manual of Mental Disorders (DSM) depressive and anxiety disorders (American Psychiatric Association 2013) and are more commonly reported among specific racial/ethnic groups (Kim et al., 2015).

4.1. Limitations

The findings of this study should be considered in light of its limitations. First, although survey weights were applied to approximate the target population with respect to key sociodemographic characteristics, the weighted sample may nonetheless deviate from the target population in ways that impact the prevalence estimates and measures of association in this study. Second, similar to the Household Pulse Survey and other surveys, this study used brief, validated psychometric screening instruments and single-item questions to assess mental health outcomes, which cannot be used as diagnostic assessments, nor to indicate clinical need for treatment. Specifically, there is evidence that screening tools such as the PHQ yield substantially higher prevalence estimates than diagnostic interviews based on DSM criteria (Levis et al., 2020); therefore, prevalence estimates from this study for symptoms of depression and/or anxiety should be interpreted primarily between racial/ethnic groups or relative to other population surveys using the same instrument. It is important to note that the reference period for depression and anxiety symptoms assessed by the PHQ-4 was adjusted from 2 weeks to 1 week to facilitate comparison with the Household Pulse Survey. Additionally, the use of the PHQ-2 and GAD-2, instead of the full screening instruments for major depression episode and GAD (PHQ-9 and GAD-7), did not allow for evaluation of other symptoms of these conditions and may be limited in terms of statistical reliability. However, these instruments have previously been validated against gold standard measures of these disorders and capture their sentinel symptoms (Löwe et al., 2010; Kroenke et al., 2003; Kroenke et al., 2007). Further, sensitivity analyses using the sum score of the PHQ-4 (range 0–12), with a score of 6 or more indicating depression and/or anxiety symptoms (Löwe et al., 2010), yielded similar results, such that odds of depression and/or anxiety symptoms were not higher among racial/ethnic minority vs. white respondents despite greater COVID-19-related stressor experience. Third, data collection spanned 2 weeks in late May and early June 2020; given the dynamic nature of the pandemic and social and political events that have occurred since that time, extrapolation of these findings to subsequent time periods should be done with caution. Fourth, study findings may not be generalizable to the entire Southern region of the U.S., particularly to non-urban areas with different sociodemographic makeup, historical contexts, and pandemic experience. Finally, due to the cross-sectional nature of the study, our ability to fully examine causal explanations for our findings (e.g., the role of positive growth) was limited. Additional research that examines various psychological constructs using a longitudinal approach is needed.

Notwithstanding these limitations, this study adds considerable detail and nuance to the existing body of literature on racial/ethnic differences in mental health during the early COVID-19 pandemic. Its unique strengths include the recruitment of a diverse sample interviewed in English and Spanish and the application of survey weights to approximate the underlying target population, which represents a major methodological advantage over convenience samples with potentially limited representativeness. Moreover, this study goes beyond the existing literature by controlling for a large number of sociodemographic, clinical, and COVID-19-related variables that may confound the association between race/ethnicity and mental health outcomes.

5. Conclusions

This study highlights the mental health impact of the COVID-19 pandemic, demonstrating high prevalence of poor mental health indicators among adult residents of Austin, Dallas, Houston, Atlanta, and New Orleans. Contrary to our hypothesis, we did not find evidence of worse mental health among racial and ethnic minority respondents compared to non-Hispanic white respondents, despite greater experience of COVID-19-related stressors among minority respondents. This study's findings related to mental health do not mirror the documented patterns of racial/ethnic disparities in COVID-19-related morbidity and mortality. However, it is important to note that our study's findings suggest that all racial/ethnic groups have experienced an increase in poor mental health since the pandemic began. Additionally, inequities in mental health services utilization by race/ethnicity are well-documented (McGuire and Miranda, 2008), which may aggravate the mental health burden of racial/ethnic minorities in the U.S. The need for substantial investment and strategies to meet the needs of these populations may be ever more urgent as the COVID-19 pandemic continues, as well as in the aftermath of the pandemic, particularly if disproportionate experience of stressors persists. Further research will be needed to identify policies and other interventions that address structural factors driving disparities in stressor experience and that equitably promote public mental health and well-being. Additional research to elucidate the specific individual- and community-level factors that have promoted mental health during the COVID-19 pandemic will also be critical to informing these interventions.

Role of the funding source

The funder had no role in study design, data collection, data analysis, data interpretation, or writing of this report.

CRedit authorship contribution statement

Emily Goldmann: Conceptualization, Methodology, Investigation, Data curation, Formal analysis, Writing – original draft. **Daniel Hagen:** Methodology, Formal analysis, Writing – review & editing. **Estelle El Khoury:** Methodology, Formal analysis, Writing – review & editing. **Mark Owens:** Conceptualization, Methodology, Investigation, Data curation, Writing – review & editing. **Supriya Misra:** Conceptualization, Methodology, Writing – review & editing. **Johannes Thrul:** Methodology, Writing – review & editing.

Declaration of Competing Interest

All authors declare no competing interests.

Acknowledgements

This study was funded by an internal grant from University of Texas at Tyler and discretionary research funding provided by New York University.

References

- American Psychiatric Association, 2013. Diagnostic and Statistical Manual of Mental Disorders, 5th Ed. American Psychiatric Association, Washington, DC. <https://doi.org/10.1176/appi.books.9780890425596.893619>. Diagnostic and Statistical Manual of Mental Disorders 5th Edition.
- Ansolabehere, S., Schaffner, B.F., 2014. Does survey mode still matter? Findings from a 2010 multi-mode comparison. *Polit. Anal.* 22 (3), 285–303.
- Breslau, J., Finucane, M.L., Locker, A.R., Baird, M.D., Roth, E.A., Collins, R.L., 2021. A longitudinal study of psychological distress in the United States before and during the COVID-19 pandemic. *Prev. Med.* 143, 106362 <https://doi.org/10.1016/j.ypmed.2020.106362>.
- Centers for Disease Control and Prevention, 2021. Health equity considerations and racial and ethnic minority groups [WWW Document]. URL <https://www.cdc.gov/coronavirus/2019-ncov/community/health-equity/race-ethnicity.html#fn2> (accessed 3.1.21).
- Centers for Disease Control and Prevention, 2020. Anxiety and depression: household pulse survey [WWW Document]. URL <https://www.cdc.gov/nchs/covid19/pulse/mental-health.htm> (accessed 3.1.21).
- De Leeuw, E.D., 2005. To mix or not to mix data collection modes in surveys. *J. Off. Stat.* 21 (2), 233–255.
- Dzierzewski, J.M., Dautovich, N.D., Ravyts, S.G., Perez, E., Soto, P., Donovan, E.K., 2021. Insomnia symptoms during the COVID-19 pandemic: an examination of biopsychosocial moderators. *Sleep Med.* S1389-9457 (21), 00116–00117. <https://doi.org/10.1016/j.sleep.2021.02.018>.
- Devakumar, D., Shannon, G., Bhopal, S.S., Abubakar, I., 2020. Racism and discrimination in COVID-19 responses. *Lancet* 395, 1194. [https://doi.org/10.1016/S0140-6736\(20\)30792-3](https://doi.org/10.1016/S0140-6736(20)30792-3).
- Elliott, M.R., 2009. Combining data from probability and non-probability samples using pseudo-weights. *Surv. Pract.* 2 <https://doi.org/10.29115/SP-2009-0025>.
- Elmendorf, C.S., Spencer, D.M., 2014. The geography of racial stereotyping: evidence and implications for VRA preclearance after Shelby County. *Calif. Law Rev.* 102, 1123–1180. <https://doi.org/10.2139/ssrn.2262954>.
- Ettman, C.K., Abdalla, S.M., Cohen, G.H., Sampson, L., Vivier, P.M., Galea, S., 2020. Prevalence of depression symptoms in US adults before and during the COVID-19 pandemic. *JAMA Netw. Open* 3, e2019686. <https://doi.org/10.1001/jamanetworkopen.2020.19686>.
- Holingue, C., Badillo-Goicoechea, E., Riehm, K.E., Veldhuis, C.B., Thrul, J., Johnson, R. M., Fallin, M.D., Kreuter, F., Stuart, E.A., Kall, L.G., 2020. Mental distress during the COVID-19 pandemic among US adults without a pre-existing mental health condition: findings from American trend panel survey. *Prev. Med.* 139 <https://doi.org/10.1016/j.ypmed.2020.106231>. Baltimore.
- Holzer, C.E., Copeland, S., 2013. Race, ethnicity, and the epidemiology of mental disorders in adults. In: Paniagua, F., Yamada, A. (Eds.), *Handbook of Multicultural Mental Health*, (2nd Ed.). Academic Press, Cambridge, pp. 89–109.
- Hosmer, D.W., Lemeshow, S., Surdivant, R.X., 2013. Assessing the fit of the model (Chapter 5). In: Hosmer, D.W., Lemeshow, S., Surdivant, R.X. (Eds.), *Applied Logistic Regression*, 3rd Ed. John Wiley & Sons, Hoboken, NJ.
- Kessler, R.C., Price, R.H., Wortman, C.B., 1985. Social factors in psychopathology: stress, social support, and coping processes. *Annu. Rev. Psychol.* 36, 531–572. <https://doi.org/10.1146/annurev.ps.36.020185.002531>.
- Kim, H.J., Park, E.M., Storr, C.L., Tran, K., Juon, H.S., 2015. Depression among Asian-American adults in the community: systematic review and meta-analysis. *PLoS ONE* 10, e0127760. <https://doi.org/10.1371/journal.pone.0127760>.
- Kreuter, F., Presser, S., Tourangeau, R., 2008. Social desirability bias in CATI, IVR, and Web Surveys: the effect of mode and question sensitivity. *Public Opin. Q.* 72 (5), 847–865.
- Kroenke, K., Spitzer, R.L., Williams, J.B.W., 2003. The patient health questionnaire-2: validity of a two-item depression screener. *Med. Care* 41, 1284–1292. <https://doi.org/10.1097/01.MLR.0000093487.78664.3C>.
- Kroenke, K., Spitzer, R.L., Williams, J.B.W., Löwe, B., 2009. An ultra-brief screening scale for anxiety and depression: the PHQ-4. *Psychosomatics* 50, 613–621. <https://doi.org/10.1176/appi.psy.50.6.613>.
- Kroenke, K., Spitzer, R.L., Williams, J.B.W., Monahan, P.O., Löwe, B., 2007. Anxiety disorders in primary care: prevalence, impairment, comorbidity, and detection. *Ann. Intern. Med.* 146, 317–325. <https://doi.org/10.7326/0003-4819-146-5-200703060-00004>.
- Lang, A.J., 2020. Complementary and integrative research (CAIR) lab. CAIR pandemic impact questionnaire (C-piq). COVID-19 NIH office of behavioral and social sciences research (OBSSR) research tools. Available from: https://www.phenxtoolkit.org/toolkit_content/PDF/CAIR_PIQ.pdf.
- Lee, S., Waters, S.F., 2021. Asians and Asian Americans' experiences of racial discrimination during the COVID-19 pandemic: impacts on health outcomes and the buffering role of social support. *Stigma Heal.* Epub ahead. 10.1037/sah0000275.
- Levis, B., Benedetti, A., Ioannidis, J.P.A., Sun, Y., Negeri, Z., He, C., Wu, Y., Krishnan, A., Bhandari, P.M., Neupane, D., Imran, M., Rice, D.B., Riehm, K.E., Saadat, N., Azar, M., Boruff, J., Cuijpers, P., Gilbody, S., Kloda, L.A., McMillan, D., Patten, S.B., Shrier, I., Ziegelstein, R.C., Alamri, S.H., Amtmann, D., Ayalon, L., Baradaran, H.R., Beraldi, A., Bernstein, C.N., Bhana, A., Bombardier, C.H., Carter, G., Chagas, M.H., Chibanda, D., Clover, K., Conwell, Y., Diez-Quevedo, C., Fann, J.R., Fischer, F.H., Gholizadeh, L., Gibson, L.J., Green, E.P., Greeno, C.G., Hall, B.J., Haroz, E.E., Ismail, K., Jetté, N., Khamsheh, M.E., Kwan, Y., Lara, M.A., Liu, S.L., Loureiro, S.R., Löwe, B., Marrie, R.A., Marsh, L., McGuire, A., Muramatsu, K., Navarrete, L., Osório, F.L., Petersen, I., Picardi, A., Pugh, S.L., Quinn, T.J., Rooney, A.G., Shinn, E. H., Sidebottom, A., Spangenberg, L., Tan, P.L.L., Taylor-Rowan, M., Turner, A., van Weert, H.C., Vöhringer, P.A., Wagner, L.I., White, J., Winkley, K., Thoms, B.D., 2020. Patient health questionnaire-9 scores do not accurately estimate depression prevalence: individual participant data meta-analysis. *J. Clin. Epidemiol.* 122, 115–128. <https://doi.org/10.1016/j.jclinepi.2020.02.002>.
- Löwe, B., Wahl, I., Rose, M., Spitzer, C., Glaesmer, H., Wingenfeld, K., Schneider, A., Brähler, E., 2010. A 4-item measure of depression and anxiety: Validation and standardization of the Patient health questionnaire-4 (PHQ-4) in the general population. *J. Affect. Disord.* 122, 86–95. <https://doi.org/10.1016/j.jad.2009.06.019>.
- McGinty, E.E., Presskreischer, R., Han, H., Barry, C.L., 2020. Psychological distress and loneliness reported by US adults in 2018 and April 2020. *JAMA* 324, 93–94. <https://doi.org/10.1001/jama.2020.9740>.
- McGuire, T.G., Miranda, J., 2008. New evidence regarding racial and ethnic disparities in mental health: policy implications. *Health Aff.* 27, 393–403. <https://doi.org/10.1377/hlthaff.27.2.393>.

- McKnight-Eily, L.R., Okoro, C.A., Strine, T.W., Verlenden, J., Hollis, N.D., Njai, R., Mitchell, E.W., Board, A., Puddy, R., Thomas, C., 2021. Racial and ethnic disparities in the prevalence of stress and worry, mental health conditions, and increased substance use among adults during the COVID-19 Pandemic — United States, April and May 2020. *MMWR Morb. Mortal. Wkly. Rep.* 70, 162–166. <https://doi.org/10.15585/mmwr.mm7005a3>.
- Pearlin, L.I., Schieman, S., Fazio, E.M., Meersman, S.C., 2005. Stress, health, and the life course: some conceptual perspectives. *J. Health Soc. Behav.* 46, 205–219. <https://doi.org/10.1177/002214650504600206>.
- Pew Research Center, 2020. People financially affected by COVID-19 outbreak are experiencing more psychological distress than others [WWW Document]. FactTank News Numbers. URL <https://www.pewresearch.org/fact-tank/2020/03/30/people-financially-affected-by-covid-19-outbreak-are-experiencing-more-psychological-distress-than-others/> (accessed 3.1.21).
- Raghupathi, W., Raghupathi, V., 2018. An empirical study of chronic diseases in the United States: A visual analytics approach. *Int. J. Environ. Res. Public Health* 15, 431. <https://doi.org/10.3390/ijerph15030431>.
- Riehm, K.E., Brenneke, S.G., Adams, L.B., Gilan, D., Lieb, K., Kunzler, A.M., Smail, E.J., Hologue, C., Stuart, E.A., Kalb, L.G., Thrul, J., 2021a. Association between psychological resilience and changes in mental distress during the COVID-19 pandemic. *J. Affect. Disord.* 282, 381–385. <https://doi.org/10.1016/j.jad.2020.12.071>.
- Riehm, Kira E, Hologue, C., Smail, E.J., Kapteyn, A., Bennett, D., Thrul, J., Kreuter, F., McGinty, E.E., Kalb, L.G., Veldhuis, C.B., Johnson, R.M., Fallin, M.D., Stuart, E.A., 2021b. Trajectories of mental distress among U.S. adults during the COVID-19 pandemic. *Ann. Behav. Med.* <https://doi.org/10.1093/abm/kaaa126>.
- Sastry, N., Gregory, J., 2013. The effect of Hurricane Katrina on the prevalence of health impairments and disability among adults in New Orleans: differences by age, race, and sex. *Soc. Sci. Med.* 80, 121–129. <https://doi.org/10.1016/j.socscimed.2012.12.009>.
- The Commonwealth Fund, 2020. Beyond the case count: the wide-ranging disparities of COVID-19 in the United States [WWW Document]. URL <https://www.commonwealthfund.org/publications/2020/sep/beyond-case-count-disparities-covid-19-united-states> (accessed 3.2.21).
- Trust for America's Health, 2018. A Funding Crisis for Public Health and Safety: State-by-State and Federal Public Health Funding Facts and Recommendations [WWW Document]. URL <https://www.tfah.org/wp-content/uploads/archive/assets/files/TFAH-2018-InvestInAmericaRpt-FINAL.pdf> (accessed 4.12.20).
- Tugade, M.M., Fredrickson, B.L., 2004. Resilient individuals use positive emotions to bounce back from negative emotional experiences. *J. Personal. Soc. Psychol.* 86 (2), 320–333. <https://doi.org/10.1037/0022-3514.86.2.320>.
- United States Census Bureau, 2019. Uninsured Rate by State: 2008 to 2018 [WWW Document]. URL <https://www.census.gov/library/visualizations/interactive/uninsured-rate-2008-2018.html> (accessed 4.12.20).
- von Elm, E., Altman, D.G., Egger, M., Pocock, S.J., Gøtzsche, P.C., Vandenbroucke, J.P., 2007. The strengthening of reporting of observational studies in epidemiology (STROBE) statement: guidelines for reporting observational studies. *Lancet* 370, 1453–1457. [https://doi.org/10.1016/S0140-6736\(07\)61602-X](https://doi.org/10.1016/S0140-6736(07)61602-X).
- Ying, L., Finch, B.K., 2020. Discrimination against Asian, Black Americans more likely amid coronavirus pandemic [WWW Document]. *Evid. Base, Univ. South. Calif. Schaeffer Cent. Heal. Policy Econ.* URL <https://healthpolicy.usc.edu/evidence-base/discrimination-against-asian-black-americans-more-likely-amid-coronavirus-pandemic> (accessed 4.12.20).