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COVID-related social determinants of substance use disorder among diverse U.S. racial ethnic groups

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ABSTRACT

Objective: Black, Asian, and Hispanic/Latino people are disproportionately impacted by the COVID-19 pandemic and were more likely to experience coronavirus-related racial discrimination. This study examined the association between pandemic-related stressors, including employment and housing disruptions, coronavirus-related victimization distress, and perceptions of pandemic-associated increase in societal racial biases, and substance use disorder (SUD) risk among Asian, Black, Hispanic/Latino, and non-Hispanic White adults in the U.S.

Methods: Data were collected as part of a larger national survey on substance use during the pandemic. Eligible participants for the current study were 1336 adults self-identified as Asian (8.53%), Black (10.55%), Hispanic/Latino (10.93%), and non-Hispanic White (69.99%). Measures included demographic and COVID-19-related employment, housing, and health items, the coronavirus victimization distress scale (CVD), the coronavirus racial bias scale (CRB), and measures of substance use risk.

Results: Across racial/ethnic groups, employment disruption distress and housing disruption due to the pandemic were associated with SUD risk. Binary logistic regression analyses controlling for demographic variables indicated CVD was associated with higher odds of tobacco use risk (AOR = 1.36, 95% CI [1.01, 1.81]) and poly-substance use risk (AOR = 1.87, 95% CI [1.14, 3.06]), yet CRB was unrelated to any SUDs. Logistic regressions for each racial/ethnic group found different patterns of relationships between stressors and risk for SUDs.

Conclusions: Results highlight the significance of examining how the current pandemic has exacerbated racial/ethnic systemic inequalities through COVID-19 related victimization. The data also suggest that across all racial/ethnic groups employment and housing disruptions and perceptions of pandemic instigated increases in societal racial bias are risk factors for SUD. The study calls for further empirical research on substance use prevention and intervention practice sensitive to specific needs of diverse populations during the current and future health crises.

1. Introduction

Prior to the COVID-19 pandemic, Asian, Black, and Hispanic/Latino adults reported similar or lower rates of alcohol and other drug use than their non-Hispanic White counterparts, with one exception: Black adults reported higher rates of cannabis use than other groups (SAMSHA, 2020; SAMSHA, 2020). The pandemic appears to have begun to reverse these trends with Black, Indigenous, and people of color (BIPOC) reporting greater increases in substance use during the pandemic than non-Hispanic White adults (Czeisler et al., 2020; Acuff et al., 2021). This is worrisome, since despite lower levels of intake, Asian, Black, and Hispanic/Latino adults have suffered from inadequate substance use disorder (SUD) treatment and negative SUD outcomes (Camplain et al., 2020; SAMSHA, 2020). From 2015 to 2019, substance use service utilization rates of those who need such treatment were significantly lower among Asians (5.9%) and Hispanic/Latino (12.6%), compared to Black (15.8%) and non-Hispanic White adults (14.9%; SAMSHA, 2020). Despite equivalent rates of use, Black and Hispanic/Latino individuals were more likely than non-Hispanic White individuals to be incarcerated for nonviolent substance-related offenses and imprisoned for drug

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charges (Camplain et al., 2020).

The association between substance use and stress is well-established (Koob and Kreek, 2007; Sinha, 2001). Substance use has been considered a coping strategy for stress in many major theories, including the stress-coping model (Shiffman and Sinha, 1982) and the self-medication model (Khantzian, 1997). These models are supported by recent research including national representative samples across U.S. and Canada indicating that individuals have used alcohol and other substances to cope with coronavirus infection-related worry and fear (Emery et al., 2021; McKnight-Eily et al., 2021; Nyman et al., 2021; Rodriguez et al., 2020; Taylor et al., 2021). However few studies have examined the association between other sources of stress during the pandemic. For example, during the pandemic across racial/ethnic groups, increases in psychological distress have been associated with pre-existing socioeconomic disadvantages, financial and housing disruptions, and in addition to disease stigma against groups associated with the infection (American Psychological Association, 2020; Emery et al., 2021, Di Gessa et al., 2021; ; Posel et al., 2021). Compared to non-Hispanic Whites, BIPOC individuals are at higher risk of distress during the pandemic due to their disproportional higher risk of COVID-19 infections and financial disruptions rooted in long-term health disparities and systemic economic inequalities (American Psychiatric Association, 2017; American Psychological Association, 2017; Webb Hooper et al., 2020). Asian Americans in particular as well as other BIPOC groups have experienced increases in racism, xenophobia, and victimization related to COVID-19 (Croucher et al., 2020; Wu et al., 2021).

Discrimination and social prejudices are other sources of stress during the pandemic. Research on prior infectious disease epidemics (e.g., Emery et al., 2021) suggests that COVID-19-related discrimination, including both individual victimization and exposure to societal bias, may increase substance use among populations assumed to carry infection. Asian Americans, Black, and Hispanic/Latino persons have experienced increases in racism, xenophobia, and victimization related to COVID-19 (Croucher et al., 2020; Pew Research Center, 2020; Wu et al., 2021). Studies have also found that COVID-19-specific individual victimization and related distress were associated with anxiety, depression and substance use risk among Black young adults more than non-Hispanic White peers (; Fisher et al., 2022; Tao et al., 2022).

1.1. The current study

The primary aim of this study was to examine the relationship between a range of substance use disorders and pre-existing health and socio-economic disparities, employment and housing disruptions, coronavirus victimization distress, and perceived societal racial bias among Asian, Black, Hispanic/Latino, and non-Hispanic White adults during the COVID-19 pandemic. Substances of interest included alcohol, tobacco, cannabis, and other substances (i.e., cocaine, hallucinogens, inhalants, meth). We tested the following hypotheses: (1) Asian, Black and Hispanic/Latino compared to non-Hispanic White participants would report higher levels of pre-existing socio-economic disadvantages, employment, and housing disruptions, and coronavirus victimization distress and racial bias than non-Hispanic Whites; and (2) pandemic-related stressors would be associated with increased substance use risk among each racial/ethnic group, with the exception that coronavirus racial bias would not be a stressor associated with substance use among non-Hispanic White adults.

2. Methods

2.1. Participants

Participants were part of a larger longitudinal survey study on mental health and substance use during COVID-19. They were recruited through Qualtrics Panel with monetary compensation for participation in baseline demographic information collection ($30), in a 30-day ecological momentary assessment (EMA) session after baseline ($1 for each day, $30 in total), and in a 2nd wave data collection at 60 days after baseline ($40; see timeline in Fig. 1). Eligible participants for the larger study are individuals who are over 18-years-old, U.S. residents, and active Facebook users. Participants who finished baseline demographic information and completed at least 21 days of EMA data collection were invited to the 2nd wave of data collection at 60 days. In total, 2270 participants were invited for the 2nd wave data collection from December 5, 2020 to June 3, 2021, and 2111 participated in the survey (response rate = 92.9%). Of those, 1727 completed the survey (81.8%). We removed 33 records that had duplicate IDs or no research IDs. We then removed 156 participants who failed to pass all four attention check questions. Among the remaining 1538 participants, individuals who self-identified as Hispanic/Latino regardless of the racial category were categorized as Hispanic/Latino, and those who identified as non-Hispanic Asian, Black, or White were separated as Asian, Black, and White groups. Individuals who had missing values in race/ethnicity ($N = 2$), or endorsed other or more than one racial category ($N = 67$) were not included in the current study. For this study we wanted to examine whether COVID-19 societal stereotypes involving racial/ethnic groups were associated with acts of COVID-19 victimization and subsequent distress. Consequently, we excluded 135 participants who actually had been infected since their experiences might include, but were not solely based on societal stereotypes. The final sample for this study consisted of 1336 adults (*M* age = 39.34, *SD* age = 12.99, *range* = 18–78) self-identified as Asian (8.53%), Black (10.55%), Hispanic/Latino (10.93%), and non-Hispanic White (69.99%) (See in Table 1). The missing values in EMA responses were treated as missings at random and were computed as 0 for analysis. A smaller sample of Asian, Black, and Hispanic/Latino participants were also included in a prior study examining the impact of employment and housing, coronavirus-specific forms of victimization and racial bias on depression and anxiety (for details see Fisher et al., 2021). The current study is distinct in its examination of daily EMA questions on different forms of substance use disorders (e.g., alcohol, tobacco, and cannabis) and its inclusion of non-Hispanic White participants.

2.2. Measures

2.2.1. Demographic variables and pre-existing health and socioeconomic disadvantages

Demographic information included self-reported race/ethnicity and gender. Participants' self-reported household income and education level were assessed to identify socioeconomic backgrounds. Self-reported COVID-19 health risks included seven medical conditions identified by the CDC (2021a) as associated with risks of severe illness from COVID-19, including obesity, high blood pressure, lung disease, diabetes, heart or artery diseases, cancer, and HIV.

2.3. Pandemic-related stressors

2.3.1. COVID-19 related employment and housing disruptions

Changes in employment due to the pandemic were assessed via a single check-all-that-apply question ("Which of the following employment changes have you experienced due to the COVID-19 (coronavirus) pandemic? Please check all that apply".) with 11 options reflecting possible changes (e.g., "None," "Furloughed," "Switched to remote work"). Answers to this question were further dichotomized into 0 if they only selected "None" and 1 if they selected one or more other options reflecting changes. And if they selected one of the changes in the above employment change question, they would be directed to the question assessing the distress associated with employment changes. This distress was assessed using a single 5-point Likert-type scale question ("How troubled or bothered have you been as a result of these employment changes?") with response options ranging from 1 = "not at

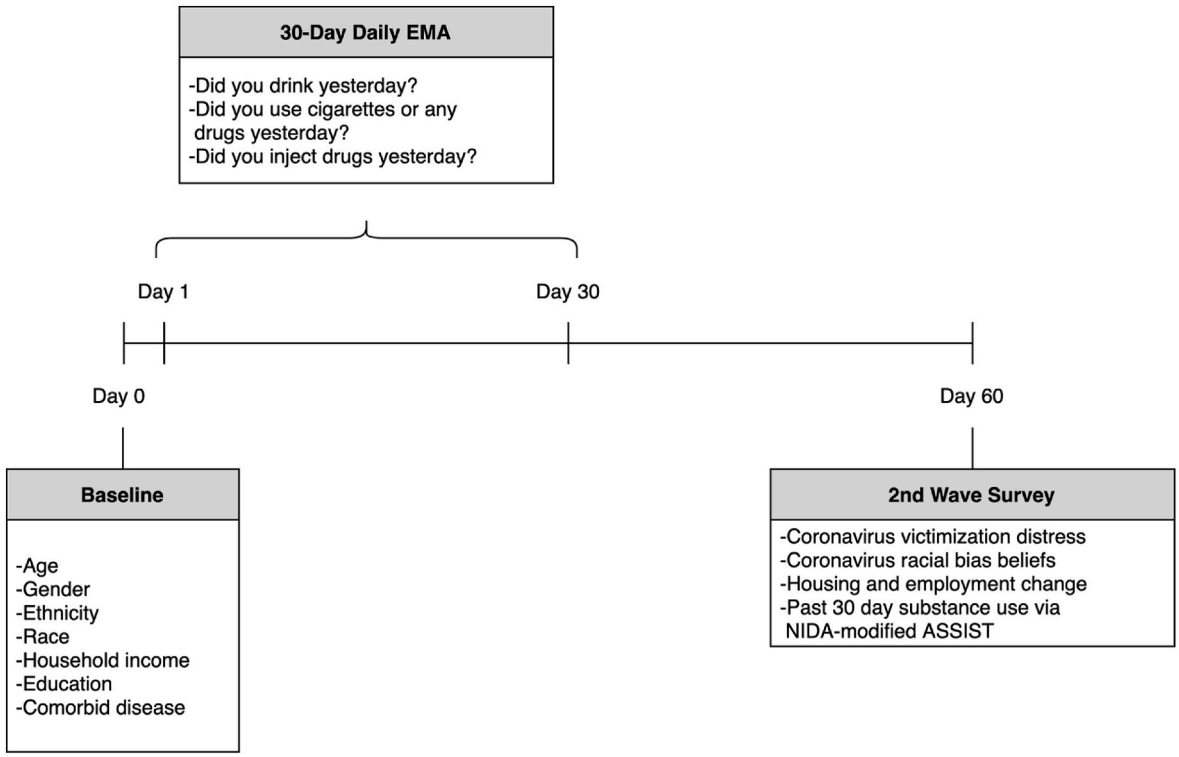

Fig. 1. Timeline of questionnaires.

all troubled" to 5 = "extremely troubled." The housing disruptions due to the pandemic were measured by one check-all-that-apply question ("Did you experience any of the following as a result of the COVID-19 pandemic? Please check all that apply"), which provided 11 options reflecting different changes in housing including no changes (e.g., "None," "Didn't pay the full amount of rent or mortgage," "Had to move," etc). Answers to this housing change question were also dichotomized into 0 if they only selected "None" and 1 if they selected one or more other options reflecting changes in housing.

2.3.2. Coronavirus victimization distress (CVD)

The Coronavirus Victimization Distress Scale (CVDS; Fisher and Yip, 2020a) assessed five coronavirus victimization experiences and associated distress. Items include being teased or bullied, physically threatened, mistreated, verbally taunted or called bad names, or cyberbullied because someone thought the respondent had the coronavirus. Responses were scored on a 5-point Likert-type scale (1 = "It never happened" to 5 = "It happened and upset me quite a bit"). Prior research involving Asian, Black, Indigenous, and Hispanic/Latino young adults (Fisher et al., 2022) reported high inter-item reliability (Cronbach's α = 0.91), and the scale had good reliability for the current study (α = 0.89).

2.3.3. Coronavirus racial bias (CRB)

The 9-item Coronavirus Racial Bias Scale (CRBS; Fisher and Yip, 2020b) assessed participants' beliefs about how the coronavirus is negatively affecting societal attitudes toward one's race/ethnicity (e.g., "I believe the country has become more dangerous for people in my racial/ethnic group because of fear of the coronavirus"). Response options ranged from 1 (Strongly disagree) to 4 (Strongly agree). A prior study (Fisher et al., 2022) with factor analyses identified CVDS and CRBS scale items loaded on distinct dimensions with one exception: there was a significant correlation error between item 7 in the CRBS (i.e., "Due to the coronavirus I have been cyberbullied because of my race/-ethnicity") and item 5 in the CVDS (i.e., "I have been cyberbullied because someone thought I was infected with the coronavirus"); the revised 8-item scale had good reliability among BIPOC young adults (α = 0.87). Accordingly, item 7 was removed from the CRBS for the current study. The scale had excellent reliability for the current study (α = 0.91).

2.4. Risk for substance use disorders (SUDs)

We calculated the substance use risk based on the NIDA-modified ASSIST (National Institute on Drug Abuse modified alcohol, smoking, and substance involvement screening test; NIDA, 2012) but for the past 30 days. The NIDA-modified ASSIST includes eight questions about the patient's use of, desire for, and problems related to the use of a wide range of substances. We replaced the original self-report frequency question in the NIDA-modified ASSIST (Q2) with the manually calculated frequency score from a 30-day EMA assessment. These EMA questions were sent daily at 6 p.m. local time for the 30 days after the baseline (see in Fig. 1), including a binary question on drinking ("Did you drink yesterday?" Yes = 1, No = 0), and a check-list question on other substance use ("Did you use cigarettes or any drugs yesterday? 1 = cigarettes/nicotine/tobacco/vape juice; 2 = cannabis; 3 = cocaine; 4 = prescription stimulants; 5 = methamphetamine; 6 = inhalants; 7 = sedatives or sleeping pills; 8 = hallucinogens; 8 = street opioids; 9 = prescription opioids; 10 = other; 11 = none"). We then added up the 30-day frequency score for each type of substance and divided this total score by 4 to calculate the relative frequency score (0 times per week = 0 - never; less than one time per week = 2 - once or twice per 3 months; one to five times per week = 4 - weekly; more than 5 times per week = 6 - daily or almost daily) to match the NIDA-modified ASSIST scoring format. We kept the original Q3-Q7 from NIDA-modified ASSIST but changed the time frame to the past 30 days (e.g., Q3: "In the past 30 days, how often have you had a strong desire or urge to use?"), and for Q3-Q5, we removed the original response option "Monthly" as it repeats the "Once or Twice" in a 30-day time frame. For each substance type, we added up the substance involvement (SI) score we calculated from EMA questions and received from NIDA-modified ASSIST Q3-Q7. We then use this SI score to identify respondents' risk level (0–3: lower risk, 4–26: moderate risk, 27+: high risk).

Table 1
Demographics, employment and housing disruptions during the COVID-19 pandemic, substance use disorders, and chi-square tests results by race/ethnicity.

	Non-Hispanic Asian	Non-Hispanic Black	Hispanic/Latino	Non-Hispanic White	Total	χ^2 (df)	*p*
	N = 114 (8.53%)	N = 141 (10.55%)	N = 146 (10.93%)	N = 935 (69.99%)	N = 1336		
	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)		
Age						37.06 (3)	< **.001**
18–25	37 (32.46)	16 (11.35)	31 (21.23)	118 (12.62)	202 (15.12)		
>25	77 (67.54)	125 (88.65)	115 (78.77)	817 (87.38)	1134 (84.88)		
Gender						2.51 (6)	.87
Male	31 (27.19)	37 (26.24)	49 (33.56)	273 (29.20)	390 (29.19)		
Female	81 (71.05)	102 (72.34)	95 (65.07)	644 (68.88)	922 (69.01)		
Gender minority	2 (1.75)	2 (1.42)	2 (1.37)	18 (1.93)	24 (1.79)		
Household income						19.91 (6)	**.004**
<$20,000	16 (14.04)	21 (14.89)	15 (10.27)	102 (10.91)	154 (11.53)		
$20,000-$50,000	21 (18.42)	52 (36.88)	37 (25.34)	223 (23.85)	333 (24.93)		
>50,000	77 (67.54)	68 (48.23)	94 (64.38)	610 (65.24)	849 (63.55)		
Education						37.23 (9)	< **.001**
High school or technical/vocational school or less	4 (3.51)	20 (14.18)	12 (8.22)	91 (9.73)	127 (9.51)		
Some college	12 (10.53)	45 (31.91)	45 (30.82)	223 (23.85)	325 (24.33)		
Bachelor's degree	65 (57.02)	47 (33.33)	47 (32.19)	374 (40.00)	533 (39.90)		
Graduate degree	33 (28.95)	29 (20.57)	42 (28.77)	247 (26.42)	351 (26.27)		
COVID-19 health risk							
Obesity	9 (7.89)	39 (27.66)	34 (23.29)	209 (22.35)	291 (21.78)	16.13 (3)	**.001**
High blood pressure	9 (7.89)	35 (24.82)	18 (12.33)	157 (16.79)	219 (16.39)	15.19 (3)	**.002**
Lung disease	3 (2.63)	12 (8.51)	8 (5.48)	106 (11.34)	129 (9.66)	12.61 (3)	**.006**
Diabetes	6 (5.26)	7 (4.96)	5 (3.42)	53 (5.67)	71 (5.31)	1.30 (3)	.73
Heart or artery diseases	4 (3.51)	2 (1.42)	1 (0.68)	22 (2.35)	29 (2.17)	3.00 (3)	.39
Cancer	2 (1.75)	2 (1.42)	1 (0.68)	37 (3.96)	42 (3.14)	7.03 (3)	.071
HIV or AIDS	0 (0.00)	2 (1.42)	1 (0.68)	5 (.53)	8 (.60)	2.36 (3)	.5
At least one of the above medical problems	21 (18.42)	66 (46.81)	50 (34.25)	376 (40.21)	513 (38.40)	25.82 (3)	< **.001**
Employment changes due to pandemic	85 (74.56)	96 (68.09)	106 (72.60)	598 (63.96)	885 (66.24)	8.57 (3)	**.036**
Housing changes due to pandemic	29 (25.44)	46 (32.62)	54 (36.99)	222 (23.74)	351 (26.27)	14.71 (3)	< **.001**
Alcohol Use Disorder						4.23 (6)	.64
Moderate risk	66 (57.89)	84 (59.57)	87 (59.59)	581 (62.14)	818 (61.23)		
High risk	4 (3.51)	10 (7.09)	9 (6.16)	63 (6.74)	86 (6.44)		
Tobacco Use Disorder						14.29 (6)	**.027**
Moderate risk	14 (12.28)	25 (17.73)	16 (10.96)	134 (14.33)	189 (14.15)		
High risk	1 (0.88)	8 (5.67)	7 (4.79)	78 (8.34)	94 (7.04)		
Cannabis Use Disorder						5.89 (6)	.43
Moderate risk	22 (19.30)	39 (27.66)	28 (19.18)	207 (22.14)	296 (22.16)		
High risk	2 (1.75)	5 (3.55)	4 (2.74)	18 (1.93)	29 (2.17)		
Other Substance Use Disorders							
Cocaine						6.43 (6)	.37
Moderate risk	2 (1.75)	5 (3.55)	3 (2.05)	40 (4.28)	50 (3.74)		
High risk	0 (0.00)	0 (0.00)	1 (0.68)	1 (0.11)	2 (0.15)		
Prescription stimulants						1.55 (6)	.95
Moderate risk	4 (3.51)	6 (4.26)	7 (4.79)	40 (4.28)	57 (4.27)		
High risk	0 (0.00)	0 (0.00)	0 (0.00)	3 (0.32)	3 (0.22)		
Methamphetamine						8.83 (6)	.18
Moderate risk	3 (2.63)	3 (2.13)	3 (2.05)	26 (2.78)	35 (2.62)		
High risk	0 (0.00)	1 (0.71)	0 (0.00)	0 (0.00)	1 (0.07)		
Inhalants						1.11 (3)	.78
Moderate risk	2 (1.75)	3 (2.13)	1 (0.68)	17 (1.82)	23 (1.72)		
High risk	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)		
Sedatives or sleeping pills						14.82 (6)	.023
Moderate risk	8 (7.02)	7 (4.96)	16 (10.96)	105 (11.23)	136 (10.18)		
High risk	0 (0.00)	2 (1.42)	1 (0.68)	1 (0.11)	4 (0.30)		
Hallucinogens						.61 (3)	.90
Moderate risk	1 (.88)	2 (1.42)	14 (1.50)	3 (2.05)	20 (1.50)		
High risk	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)		
Street opioids						1.36 (3)	.72
Moderate risk	1 (.88)	4 (2.84)	21 (2.25)	4 (2.74)	30 (2.25)		

(*continued on next page*)

Table 1 (*continued*)

	Non-Hispanic Asian	Non-Hispanic Black	Hispanic/Latino	Non-Hispanic White	Total	χ^2 (df)	*p*
	N = 114 (8.53%)	N = 141 (10.55%)	N = 146 (10.93%)	N = 935 (69.99%)	N = 1336		
	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)		
High risk	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)		
Prescription opioids						5.11 (3)	.16
Moderate risk	1 (.88)	3 (2.13)	35 (3.74)	2 (1.37)	41 (3.07)		
High risk	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)		
Other						3.47 (6)	75
Moderate risk	6 (5.26)	9 (6.38)	7 (4.79)	73 (7.81)	95 (7.11)		
High risk	0 (0.00)	0 (0.00)	0 (0.00)	2 (0.21)	2 (0.15)		
At least one type of Other Substance Use Disorders						11.75 (6)	.068
Moderate risk	16 (14.04)	21 (14.89)	31 (21.23)	200 (21.39)	268 (20.06)		
High risk	0 (0.00)	3 (2.13)	2 (1.37)	5 (0.53)	10 (0.75)		
More than one type of SUDs (Polysubstance use disorder)						7.41 (6)	.28
Moderate risk	33 (28.95)	51 (36.17)	47 (32.19)	339 (36.26)	470 (35.18)		
High risk	1 (0.88)	7 (4.96)	4 (2.74)	29 (3.10)	41 (3.07)		

2.5. Data analysis plan

All analyses were conducted with SPSS (IBM Corp, 2020). We first calculated the descriptive statistics for demographic variables and employment and housing disruptions, coronavirus victimization distress, racial bias, and risk for SUDs for all and each racial/ethnic group; and then examined racial/ethnic differences on all these variables through Chi-square analyses and analysis of variance (ANOVA) tests with Bonferroni post hoc comparison. Spearman's rank correlations were conducted to examine the bivariate associations between employment and housing disruption, coronavirus victimization, and racial bias and risk for SUDs across all racial/ethnic groups. A binary logistic regression was then used to predict risk for SUDs based on significant results of tests. To further examine the risk for SUDs in each racial/ethnic group, four separate binary logistic regressions were conducted for Asian, Black, Hispanic/Latino, and non-Hispanic White adults. For logistic regression power analysis, we adopted the events per variable (EPV, i.e., the number of events divided by the number of degrees of freedom required to represent all the variables in the model) > 20 standard as suggested by Austin and Steyerberg (2017). Since our research questions included potential 7–14 predictors in the final model, the minimum sample size requirement for participants who were at risk for a specific type of SUD ranged from 140 to 280. Asian, Black, and Latinx groups had an overall sample size less of than $N = 140$, thus the results of separate binary logistic regressions for each racial/ethnic group should be interpreted with caution.

3. Results

3.1. Demographics and pre-existing socioeconomic and health disadvantages

Demographic data and Chi-Square analyses by racial/ethnic group and the total sample are provided in Table 1. Most respondents were female. More than half reported household income greater than $50,000 per year, and 11.53% reported below $20,000. The sample was highly educated, with over 90% of respondents reporting at least some college and 66.17% having completed college. Thirty-eight percent of respondents had at least 1 COVID-19 health risk listed by the CDC (2021a). ANOVA test yielded significant age differences across race/ethnicity, $F(3, 1332) = 21.56$, $p < .001$. A Bonferroni post-hoc comparison indicated that Asians were significantly younger than Black ($p = .002$) and non-Hispanic White ($p < .001$) groups and Hispanic/Latino were significantly younger than non-Hispanic Whites ($p < .001$). Chi-square tests indicated that Black respondents reported lower income and education levels than other racial/ethnic groups. Asians were significantly less likely to report at least one COVID-19 health risk.

3.2. COVID-19 related employment and housing disruption

As shown in Table 1, 66.24% of participants reported employment changes due to the pandemic, and 51.95% reported being at least slightly troubled by employment disruption (score ≥ 2; $M = 1.77$, $SD = 1.64$). Twenty-six percent of participants reported housing disruptions due to the pandemic. Results of Chi-square tests show that Asian and non-Hispanic White adults were less likely to report pandemic-related employment or housing disruptions. However, there were no racial/ethnic differences in employment disruption distress.

3.3. Coronavirus victimization distress (CVD) and coronavirus racial bias (CRB)

Frequencies, percentages, and χ^2 statistics across racial/ethnic groups are provided in Table 2. Black and non-Hispanic White participants were least likely to experience coronavirus victimization (9.93% and 9.51%, respectively) compared with Hispanic/Latino (14.38%) and Asian respondents. Asian respondents (19.30%) were significantly more likely to experience distress in response to these experiences than other groups (2–8%, $p < .001$). Most BIPOC respondents reported at least one coronavirus racial bias belief, compared to approximately one-third of non-Hispanic Whites.

3.4. Risk for substance use disorders

Table 1 presents levels of substance use disorder risks across racial/ethnic groups. More than half of respondents were at moderate risk for alcohol use disorder and 6% were at high risk, about a quarter were at moderate risk and 7% were at high risk for tobacco use disorder, 22% at moderate risk and 2% at high risk for cannabis use disorder. Around 10% reported moderate to high risk of sedatives or sleeping pill use disorder, and 2–7% of participants were at moderate or high risk for all other drug types. Due to the small sample sizes in these substance use disorders, they were combined as "at least one type of other substance use disorder (hereafter other substance use disorder)" in further analyses. Approximately 20% were at moderate risk for at least one other substance use disorders, and less than 1% were at high risk. For polysubstance use, around 35% were at moderate risk for at least two substances, and 3% were at high risk. Since less than 140 participants were

Table 2
Frequencies, percentages, means (SDs), and bivariate test results for coronavirus victimization distress (CVD) and coronavirus racial bias beliefs (CRB) by race/ethnicity.

	Asian	Black	Hispanic/Latino	Non-Hispanic White	Total		
	N = 114 (8.53%)	N = 141 (10.55%)	N = 146 (10.93%)	N = 935 (69.99%)	N = 1336		
	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	Chi-square (df)	*p*
At least one coronavirus victimization experience	31 (27.19)	14 (9.93)	21 (14.38)	61 (6.52)	127 (9.51)	55.19 (3)	< **.001**
Reported CVD (at least one item score >2)	22 (19.30)	11 (7.80)	8 (5.48)	24 (2.57)	65 (4.87)	64.72 (3)	< **.001**
Endorsed at least one CRB	100 (87.72)	130 (92.20)	123 (84.25)	295 (31.55)	648 (48.50)	360.22 (3)	< **.001**
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	*F* (df1, df2)	*p*
CVD	1.32 (.78)	1.11 (.48)	1.14 (.54)	1.04 (.25)	1.08 (.40)	18.34 (3, 1332)	< **.001**
CRB	2.48 (.70)	2.28 (.63)	2.14 (.62)	1.35 (.47)	1.63 (.69)	300.42 (3, 1332)	< **.001**

at high risk for any SUDs, moderate to high risk were combined in further analyses. Black and non-Hispanic White adults reported significantly higher risk for tobacco and non-Cannabis substances compared to Asian and Hispanic/Latino respondents.

3.5. Associations among stressors and SUD risk across race/ethnicity

Spearman's rank correlations among studied variables and demographics are illustrated in Table 3. CVD and CRB were positively associated with each other ($r = 0.25$, $p < .001$). Risk for tobacco, cannabis, and other SUDs ($rs = 0.078$, $p < .001$) was positively associated with CVD. None of the SUD risks were related to CRB after the Bonferroni adjustment of p values. Age was negatively associated with alcohol, cannabis, and other SUD risk. Household income and education level were positively correlated with alcohol risk and negatively correlated with risk of other SUDs and polysubstance use disorder and individuals with at least one COVID-19 health risk were significantly at greater risk for disorders related to tobacco and other substances. Employment and housing disruptions were significantly correlated with risk for cannabis and other substances, and polysubstance use disorders, while employment disruption was associated with alcohol disorder risk and disruption in housing with tobacco risk.

A binary logistic regression was then conducted to examine low-risk versus moderate/high-risk SUD based on COVID-19-related employment and housing disruptions, CVD, and CRB controlling for race/ethnicity, age, and pre-existing socioeconomic and health disadvantages (i.e., education and household income level and at least one COVID-19 health risk) across racial/ethnic groups (See Table 4). Results indicated that coronavirus victimization distress was only associated with higher odds of tobacco use risk (AOR = 1.36, 95% CI [1.01, 1.81]) and polysubstance use risk (AOR = 1.87, 95% CI [1.14, 3.06]). CRB was unrelated to risk of any SUDs. Employment disruption distress was associated with higher odds of alcohol (AOR = 1.26, 95% CI [1.16, 1.37]), cannabis (AOR = 1.10, 95% CI [1.02, 1.20]), other drug (AOR = 1.15, 95% CI [1.05, 1.25]) use risk, and polysubstance use risk (AOR = 1.34, 95% CI [1.10, 1.63]). Housing disruption due to the pandemic was associated with higher odds of tobacco (AOR = 1.50, 95% CI [1.11, 2.01]), other substance (AOR = 1.71, 95% CI [1.25, 2.34]), and polysubstance (AOR = 2.19, 95% CI [1.07, 4.48]) use risk.

3.6. Associations for each racial/ethnic group

To further evaluate the relationship of race/ethnicity to the relationship between different SUDs and stressors, we conducted logistic regressions for each racial/ethnic group (See Table 5). Due to small sample sizes of individuals with moderate to high risk of polysubstance use disorder in each racial/ethnic group, only alcohol, tobacco, cannabis, and other substance use disorders were examined. For Black individuals, coronavirus racial bias belief was associated with higher odds of alcohol use risk (AOR = 1.94, 95% CI [1.01, 3.71]), employment

Table 3
Spearman's correlations between CVD, CRB, SUDs, demographics, and COVID-19 related employment and housing disruptions across race/ethnicity.

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. CVD	1												
2. CRB	.25***	1											
3. Alcohol use disorder	.012	.005	1										
4. Tobacco use disorder	.078**	.034	.24***	1									
5. Cannabis use disorder	.078**	.048	.25***	.64***	1.								
6. Other substance use disorder	.078**	.044	.09 ***	.26 ***	.23 ***	1							
7. Polysubstance use disorder	.05	.045	.10***	.29***	.19 ***	.16***	1						
8. Age	−.088**	−.101**	−.075**	.051	−.13***	−.079*	0.016	1					
9. Household income	−.048	−.076**	.10**	−.16***	−.11**	−.075 *	−.055*	.13***	1				
10. Education level	−.028	−.085**	.15***	−.19***	−.074*	−.067 *	−.067*	.033	.33***	1			
11. At least one COVID-19 health risk	−.015	−.010	−.028	.11**	.023	.13 **	.038	.31***	−.068*	−.12***	1		
12. Employment disruption distress	.11***	.11***	.21***	.066	.11***	.10***	.12**	−.14***	−.065	.077*	−.058*	1	
13. Housing disruption	.10***	.11***	.052	.14***	.12***	.15 ***	.12**	−.08**	−.22***	−.10***	.078**	.32***	1

Note. *$p < .05$, **$p < .01$, ***$p < .001$.

Table 4
Association between coronavirus victimization distress (CVD), coronavirus racial bias (CRB) and risk for SUDs.

	Alcohol use disorder risk		Tobacco use disorder risk		Cannabis use disorder risk		Other substance use disorder risk		Polysubstance use disorder risk	
	AOR	95% CI	AOR	95% CI	AOR	95% CI	AOR	95% CI	AOR	95% CI
CVD	0.97	(0.71,1.32)	**1.37**	**(1.01,1.87)**	**1.18**	**(0.86,1.61)**	1.15	(0.84,1.95)	**1.87**	**(1.14,3.06)**
CRB	1.02	(0.81,1.29)	1.11	(0.87,1.43)	1.14	(0.89,1.47)	1.28	(0.98,1.67)	1.25	(.69,2.29)
Race										
Asian (Reference)										
Black	**1.8**	**(1.04,3.1)**	**1.89**	**(1,3.55)**	1.8	(0.98,3.31)	0.97	(0.46,2.1)	5.34	(.59,48.72)
Hispanic/Latino	1.45	(0.85,2.49)	1.14	(0.59,2.19)	1.1	(0.58,2.05)	1.55	(0.78,3.12)	5.80	(.64,52.54)
Non-Hispanic White	**1.89**	**(1.15,3.11)**	1.92	(1.05,3.52)	1.68	(0.94,3.01)	**1.99**	**(1.03,3.85)**	2.67	(.27,26.32)
At least one COVID-19 health risk	1.01	(0.78,1.32)	**1.45**	**(1.11,1.89)**	1.28	(0.97,1.7)	**1.69**	**(1.26,2.26)**	1.35	(.68,2.70)
Age	0.99	(0.98,1)	**1.01**	**(1,1.02)**	0.98	(0.97,0.99)	1.01	(0.99,1.02)	1.00	(.98,1.03)
Household income										
<$20,000 (Reference)										
$20,000-$50,000	0.84	(0.55,1.28)	1.14	(0.75,1.73)	1.03	(0.67,1.59)	0.81	(0.51,1.28)	0.98	(.37,2.63)
>50,000	1.22	(0.81,1.82)	0.78	(0.52,1.18)	0.82	(0.54,1.25)	0.75	(0.45,1.17)	0.88	(.33,2.36)
Education level										
High school or technical/vocational school or less (Reference)										
Some college	1.11	(0.72,1.7)	0.95	(0.62,1.47)	0.94	(0.59,1.51)	0.86	(0.57,1.14)	1.46	(.46,4.63)
Bachelor's degree	**1.68**	**(1.1,2.57)**	0.61	(0.4,0.95)	0.86	(0.54,1.37)	0.67	(0.49,1.17)	0.84	(.25,2.81)
Graduate degree	**1.87**	**(1.19,2.95)**	0.42	(0.26,0.67)	0.7	(0.42,1.17)	0.75	(0.3,0.88)	0.61	(.16,2.39)
Employment disruption distress	**1.26**	**(1.16,1.37)**	1.06	(0.97,1.14)	**1.1**	**(1.02,1.2)**	**1.15**	**(1.05,1.25)**	**1.33**	**(1.10,1.63)**
Housing disruption	0.79	(0.59,1.07)	**1.5**	**(1.11,2.01)**	1.28	(0.95,1.74)	**1.71**	**(1.25,2.34)**	**2.19**	**(1.07,4.48)**

Note. Significant findings at $p < .05$ are in bold.

Table 5
Association between selected stressors and SUD risk adjusted for variables for each race/ethnicity.

		Alcohol use disorder risk		Tobacco use disorder risk		Cannabis use disorder risk		Other drug use disorder risk	
		AOR	95% CI	AOR	95% CI	AOR	95% CI	AOR	95% CI
Asian	CVD	0.75	(0.4,1.4)	0.99	(0.41,2.36)	1.04	(0.68,3.55)	1.16	(.53,2.58)
	CRB	0.74	(0.36,1.5)	0.6	(0.24,1.48)	1.48	(0.42,4.02)	1.47	(.49,4.36)
	Employment disruption distress	1.35	(0.97,1.88)	1.15	(0.75,1.75)	1.14	(0.69,1.89)	**2.14**	(1.23,3.75)
	Housing disruption	0.32	(0.11,0.93)	0.28	(0.05,1.53)	0.37	(0.09,3.11)	1.44	(.37,5.65)
Black	CVD	2.92	(0.26,33.42)	1.76	(0.72,4.3)	1.64	(0.63,3.62)	.47	(.10,2.23)
	CRB	**1.94**	(1.01,3.71)	0.5	(0.24,1.03)	1.17	(0.3,1.39)	2.41	(.97,5.99)
	Employment disruption distress	1.16	(0.88,1.53)	1.27	(0.96,1.68)	1.44	(0.9,1.63)	**1.43**	(1.01,2.01)
	Housing disruption	0.94	(0.37,2.43)	2.41	(0.95,6.09)	**1.28**	(1.37,9.96)	1.53	(.50,4.69)
Hispanic/Latino	CVD	1.06	(0.5,2.23)	**2.59**	(1.07,6.25)	1.8	(0.44,2.34)	1.06	(.48,2.34)
	CRB	0.8	(0.41,1.54)	1.12	(0.52,2.41)	0.76	(0.64,3.29)	1.25	(.57,2.70)
	Employment disruption distress	**1.43**	(1.1,1.86)	1.12	(0.85,1.48)	1.15	(0.68,1.23)	1.26	(.95,1.67)
	Housing disruption	0.6	(0.25,1.44)	1.65	(0.66,4.13)	0.7	(0.53,3.86)	2.02	(.80,5.13)
Non-Hispanic White	CVD	1.01	(0.55,1.86)	1.43	(0.82,2.48)	1.09	(0.93,2.88)	**1.84**	(1.05,3.24)
	CRB	0.94	(0.68,1.29)	**1.36**	(1,1.86)	**1.12**	(1.05,2.04)	1.10	(.78,1.55)
	Employment disruption distress	**1.24**	(1.13,1.37)	1.02	(0.93,1.12)	**1.08**	(1.03,1.26)	1.09	(.99,1.21)
	Housing disruption	0.89	(0.62,1.29)	**1.64**	(1.14,2.34)	1.66	(0.91,1.97)	**1.80**	(1.23,2.64)

Note. Significant findings at $p < .05$ are in bold.

disruption distress was associated with higher odds of cannabis use risk (AOR = 1.44, 95% CI [1.06, 1.95]) and other substance use risk (AOR = 1.43, 95% CI [1.01, 2.01]) For Hispanic/Latino, higher levels of coronavirus victimization distress were associated with higher odds of tobacco use risk (AOR = 2.59, 95% CI [1.07, 6.25]), and employment disruption distress was associated with higher odds of alcohol use risk (AOR = 1.43, 95% CI [1.10, 1.86]). For non-Hispanic White adults, higher levels of coronavirus victimization distress were associated with higher odds of other substance use risk (AOR = 1.84, 95% CI [1.05, 3.24]), coronavirus racial bias beliefs were associated with higher odds of tobacco use risk (AOR = 1.36, 95% CI [1.00, 1.86]). Moreover, employment disruption distress was associated with higher odds of alcohol (AOR = 1.24, 95% CI [1.13, 1.37]), while housing disruption was associated with higher odds of tobacco (AOR = 1.64, 95% CI [1.14, 2.34]), cannabis (AOR = 1.66, 95% CI [1.15, 2.39]), and other substance (AOR = 1.80, 95% CI [1.23, 2.64]) use risk. Despite the highest levels of coronavirus victimization distress and racial bias among Asians, CVD and CRB were unrelated to their SUD risk, and employment disruption distress was related to higher odds of at least one type of other substance use risk (AOR = 2.14, 95% CI [1.23, 3.75]).

4. Discussion

In addition to increases in susceptibility to infection and hospitalization, the COVID-19 pandemic has led to employment and housing disruptions and exacerbated racial/ethnic discrimination in the U.S. This study examined the association of specific COVID-19-related employment, housing, and discrimination stressors with SUD risks among a large national sample of Asian, Black, Hispanic/Latino, and non-Hispanic White adults aged 18–78 years old. Different stressors emerged as risk factors for substance use disorders across racial/ethnic groups. Results add to the growing body of research on coronavirus-related stressors and associated health and mental) health problems among U.S. racial/ethnic groups (Fisher et al., 2022; Rodriguez et al., 2020)

Pre-existing health and socioeconomic disadvantages were found among BIPOC adults. Black adults reported the highest rates of COVID-19 health risks and lowest education and income levels. Although Asians had the highest education levels and the lowest rates of COVID-19 health risk, they were more likely to have an annual income of less than $20,000. Consistent with past research, health and socioeconomic

disadvantages were both associated with higher SUD risk, except that higher education levels were associated with higher risk for alcohol use disorder (Luther et al., 2020; Wu et al., 2018; Rodriguez et al., 2020). Our results expanded the prior research by identifying significant associations between employment and housing disruptions related distress with higher SUD risk across different racial/ethnic groups. More than half of our sample reported employment and housing disruptions during the pandemic, and consistent with previous research, BIPOC adults were significantly more likely to report such disruptions (Di Gessa et al., 2021). Despite no significant racial/ethnic differences in employment disruption distress, we found differential associations between such distress and SUDs across racial/ethnic groups. Distress from employment disruption was associated with other substance use risk among Asian and Black samples, alcohol use risk among Hispanic/Latino samples, and alcohol and cannabis use risk among non-Hispanic White samples. Likewise, housing disruption was associated with cannabis use risk only among Black individuals, and tobacco and other substance use risk among non-Hispanic White individuals. Such differential associations may speak to diverse substance preferences as coping strategies for distress for different racial/ethnic groups that future research should focus on.

BIPOC adults overall reported significantly higher levels of CVD and CRB than non-Hispanic Whites, which parallels their disproportionately higher rates of coronavirus infection and mortality (CDC, 2021b; Chae et al., 2021; Di Gessa et al., 2021; Posel et al., 2021). Asians reported the highest levels of distress and racial bias beliefs than all other groups. This finding is consistent with reports on the spike in racial discrimination against Asians during the pandemic motivated by racism, xenophobia, and the presumptive origin of COVID-19 (Croucher et al., 2020; Wu et al., 2021). Racial/ethnic differences were found in the association between CVD and CRB with different types of substance use risk, highlighting the significance of examining culturally specific stressors experienced by BIPOC populations. Coronavirus racial bias belief, but not individually targeted victimization distress, was associated with higher odds of alcohol use risk only among Black adults, indicating that the perception of long-standing societal racism experienced by the Black population in the US has more detrimental effects than individual discrimination exposure against an infectious disease identity (Tao et al., 2022). In contrast, although coronavirus racial bias beliefs were not associated with substance use risk among Hispanic/Latino, coronavirus victimization distress was associated with their tobacco use risk, which is consistent with their higher rates of COVID-19 infections and being employed in essential industries during the pandemic (Blau et al., 2020; CDC, 2021b). Results also suggest that mental health providers should attend to not only direct experiences with racial bias during pandemics, but also a social climate that increasingly stigmatizes BIPOC populations (Pew Research Center, 2020). For example, they should be aware of the impact of historical trauma and long-term social oppression experienced by the Black population on their internalized beliefs about racial bias related to new infectious diseases, and provide culturally adaptive treatment that addresses their internalized racism beliefs.

Although CVD and CRB were not associated with substance use risk among Asians, the pandemic has significantly elevated their risk of substance use. Prior data suggested that Asians had the lowest risk for all types of substance use in 2019 (SAMSHA, 2020). The current study found Asian reports of SUDs to be similar to those of Hispanic/Latino participants. Moreover, similar at-risk rates of cannabis use were found between Asians and all other racial/ethnic groups after adjusting for CVD, CRB, and demographics. Such high substance use risk during the pandemic may be related to a sense of insecurity experienced by all Asians due to housing and employment disruptions and the increase in pandemic-related anti-Asian sentiment in the U.S.

One-third of non-Hispanic White adults endorsed at least one item reflecting a belief that bias (CRB) against their race/ethnicity had increased since the pandemic. Contrary to our hypothesis, higher levels of CRB were associated with this population's tobacco and other SUD risk. This highlights the importance of not limiting studies on the impact of perceived racial bias to groups identified as BIPOC in the U.S. For example, media attention to resistance to masking and other COVID-19 safety procedures in some majority non-Hispanic White regions (e.g., Steineck, 2021), may have been perceived as racial discrimination and placed these populations at SUD risk.

4.1. Strength, limitations, and future directions

Identifying the associations between pandemic-related stressors and risk for substance use disorders across different racial/ethnic groups supports the importance of research that can inform culturally tailored prevention and intervention approaches to reduce SUD during national emergencies. One major limitation of the current study is that participants were asked to complete Q3-7 of the NIDA-ASSIST 30 days after their last substance use-focused EMA, thus the substance use risk score may not reflect the actual substance use in a 30-day range. Future studies should use time-consistent measures of substance use risks. Meanwhile, the separate logistic regression results for each racial/ethnic group should be interpreted with caution due to the small sample sizes in each BIPOC group. Also, recruitment was addressed to Facebook users, limiting the generalization of results to other social media users or people who do not use social media platforms. Individuals who did not have access to the internet were unable to take the survey, yet they may be at higher risk of SUD due to disadvantaged socioeconomic backgrounds (NIDA, 2020). We also noted that our sample has a higher percentage of females and more educated individuals, which are sample characteristics that are frequently seen in online survey recruitment (Weinberg et al., 2014). This may further prevent us from generalizing our findings to broader populations. In addition, we only used single items to measure participants' disruptions in employment and housing, limiting our abilities to conduct in-depth investigations of these two important topics. Future studies should include more comprehensive assessments to fully capture the variances in employment and housing disruptions. Finally, the current study found differential patterns of relationship between stressors and different types of SUD risk across racial/ethnic groups (e.g., substance use was not associated with either CVD or CRB in the Asian group, while CRB was associated with alcohol use risk among Black and non-Hispanic White groups). This finding highlights the significance of future research as well as clinical efforts on identifying and addressing culturally-specific risk factors for different substance uses across race/ethnicity."

5. Conclusions

Substance use risk has significantly increased in the U.S. during the COVID-19 pandemic (Czeisler et al., 2020). The current study adds to a small but growing body of research on COVID-19-specific employment and housing disruptions and racial/ethnic discrimination on substance use risk across diverse racial/ethnic adults. Results indicate that although Asian, Black and Hispanic/Latino adults were more likely to experience pre-existing health and socioeconomic disadvantages, employment and housing disruptions, and coronavirus victimization distress and racial bias, coronavirus-related perceptions of increased racial bias also affected non-Hispanic Whites with consequences for SUD risk. The findings underscore the importance of examining how the current pandemic has exacerbated racial/ethnic systemic inequalities and contributed to racial bias anxieties among majority of adults and implications for culturally tailored interventions for the current and future national health emergencies.

Credit author statement

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Data availability

The data that has been used is confidential.

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References

Acuff, S.F., Strickland, J.C., Tucker, J.A., Murphy, J.G., 2021. Changes in alcohol use during COVID-19 and associations with contextual and individual difference variables: a systematic review and meta-analysis. Psychol. Addict. Behav. https://doi.org/10.1037/adb0000796. Advance online publication.

American Psychiatric Association, 2017. Mental Health Disparities: Diverse Populations. Retrieved 2021 from. https://www.psychiatry.org/psychiatrists/cultural-competency/education/mental-health-facts.

American Psychological Association, 2020. Stress in American 2020. Retrieved Oct. 3rd from. https://www.apa.org/news/press/releases/stress/2020/report-october.

Austin, P.C., Steyerberg, E.W., 2017. Events per variable (EPV) and the relative performance of different strategies for estimating the out-of-sample validity of logistic regression models. Stat. Methods Med. Res. 26 (2), 796–808. https://doi.org/10.1177/0962280214558972.

Blau, F., Koebe, J., Meyerhofer, P., 2020. Who Are the Essential and Frontline Workers? https://doi.org/10.3386/w27791.

Camplain, R., Camplain, C., Trotter, R.T., Pro, G., Sabo, S., Eaves, E., et al., 2020. Racial/ethnic differences in drug-and alcohol-related arrest outcomes in a southwest county from 2009 to 2018. AJPH (Am. J. Public Health) 110 (S1), S85–S92. https://doi.org/10.2105/AJPH.2019.305409.

CDC, 2021a. People with certain medical conditions. Retrieved Feb. 22, 2021 from. https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/people-with-medical-conditions.html.

CDC, 2021b. June 17, 2021). *Risk For COVID-19 Infection, Hospitalization, and Death by Race/Ethnicity*. Retrieved July 5 from. https://www.cdc.gov/coronavirus/2019-ncov/covid-data/investigations-discovery/hospitalization-death-by-race-ethnicity.html.

Chae, D.H., Yip, T., Martz, C.D., Chung, K., Richeson, J.A., Hajat, A., Curtis, D.S., Rogers, L.O., LaVeist, T.A., 2021. Vicarious Racism and Vigilance during the CoViD-19 Pandemic: Mental Health Implications Among Asian and Black Americans. Public Health Reports, 00333549211018675.

Croucher, S.M., Nguyen, T., Rahmani, D., 2020. Prejudice toward asian Americans in the covid-19 pandemic: the effects of social media use in the United States. Frontiers in Communication 5, 39.

Czeisler, M.É., Lane, R.I., Petrosky, E., Wiley, J.F., Christensen, A., Njai, R., Weaver, M. D., Robbins, R., Facer-Childs, E.R., Barger, L.K., 2020. Mental health, substance use, and suicidal ideation during the COVID-19 pandemic—United States, June 24–30, 2020. MMWR (Morb. Mortal. Wkly. Rep.) 69 (32), 1049.

Di Gessa, G., Maddock, J., Green, M.J., Thompson, E.J., McElroy, E., Davies, H.L., Mundy, J., Stevenson, A.J., Kwong, A.S., Griffith, G.J., 2021. Mental health inequalities in healthcare, economic, and housing disruption during COVID-19: an investigation in 12 UK longitudinal studies. medRxiv, 21254765. https://doi.org/10.1101/2021.04.01.21254765.

Emery, R.L., Johnson, S.T., Simone, M., Loth, K.A., Berge, J.M., Neumark-Sztainer, D., 2021. Understanding the impact of the COVID-19 pandemic on stress, mood, and substance use among young adults in the greater Minneapolis-St. Paul area: findings from project EAT. Soc. Sci. Med. 276, 113826.

Fisher, C.B., Tao, X., Yip, T., 2022. The Effects of COVID-19 Victimization Distress and Racial Bias on Mental Health Among AIAN, Asian, Black, and Latinx Young Adults. Cultur Divers Ethnic Minor Psychol. https://doi.org/10.1037/cdp0000539.

Fisher, C.B., Yip, T., 2020a. The Coronavirus Victimization Distress Scale (CVDS). https://www.fordham.edu/download/downloads/id/15376/Coronavirus_Victimization_Distress_Scale_CVDS_.pdf.

Fisher, C.B., Yip, T., 2020b. The Coronavirus Racial Bias Scale (CRBS). https://www.phenxtoolkit.org/toolkit_content/PDF/Fordham_CRBS.pdf.

Fisher, C.B., Tao, X., Liu, T., Giorgi, S., Curtis, B., 2021. COVID-related victimization, racial bias and employment and housing disruption increase mental health risk among U.S. Asian, black and Latinx adults. Front. Public Health 9, 772236. https://doi.org/10.3389/fpubh.2021.772236.

IBM Corp, 2020. IBM SPSS Statistics for Windows. IBM Corp. Version 27.0.

Khantzian, E.J., 1997. The self-medication hypothesis of substance use disorders: a reconsideration and recent applications. Harv. Rev. Psychiatr. 4 (5), 231–244.

Koob, G., Kreek, M.J., 2007. Stress, dysregulation of drug reward pathways, and the transition to drug dependence. Am. J. Psychiatr. 164 (8), 1149–1159.

Luther, A.W.M., Reaume, S.V., Qadeer, R.A., Thompson, K., Ferro, M.A., 2020. Substance use disorders among youth with chronic physical illness. Addict. Behav. 110, 106517 https://doi.org/10.1016/j.addbeh.2020.106517.

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. Morbidity and mortality weekly report 70 (5), 162–166. https://doi.org/10.15585/mmwr.mm7005a3.

NIDA, 2012. Smoking, and Substance Involvement Screening Test: NM-ASSIST. https://www.drugabuse.gov/sites/default/files/pdf/nmassist.pdf.

NIDA, 2020. What Are Risk Factors and Protective Factors? Retrieved from. https://www.drugabuse.gov/publications/preventing-drug-use-among-children-adolescents/chapter-1-risk-factors-protective-factors/what-are-risk-factors on 2021. October 21.

Nyman, A.L., Spears, C.A., Churchill, V., Do, V.V., Henderson, K.C., Massey, Z.B., et al., 2021. Associations between COVID-19 risk perceptions and smoking and quitting behavior among US adults. Addictive Behaviors Reports, 100394. https://doi.org/10.1016/j.abrep.2021.100394.

Pew Research Center, 2020. Many Black and Asian Americans Say They Have Experienced Discrimination amid the COVID-19 Outbreak. Retrieved August 12 from. https://www.pewsocialtrends.org/2020/07/01/many-black-and-asian-americans-say-they-have-experienced-discrimination-amid-the-covid-19-outbreak/.

Posel, D., Oyenubi, A., Kollamparambil, U., 2021. Job loss and mental health during the COVID-19 lockdown: evidence from South Africa. PLoS One 16 (3), e0249352. https://doi.org/10.1371/journal.pone.0249352.

Rodriguez, L.M., Litt, D.M., Stewart, S.H., 2020. Drinking to cope with the pandemic: the unique associations of COVID-19-related perceived threat and psychological distress to drinking behaviors in American men and women. Addict. Behav. 110, 106532 https://doi.org/10.1016/j.addbeh.2020.106532.

Samsha, 2020. 2019 NSDUH Detailed Tables. https://www.samhsa.gov/data/report/2019-nsduh-detailed-tables.

Shiffman, S., 1982. Relapse following smoking cessation: a situational analysis. J. Consult. Clin. Psychol. 50 (1), 71.

Sinha, R., 2001. How does stress increase risk of drug abuse and relapse? Psychopharmacology 158 (4), 343–359. https://doi.org/10.1007/s002130100917.

Steineck, L., 2021. Parents protest Lake Schools mandate, cheer unmasked students at high school. The Repository. https://www.cantonrep.com/story/news/2021/09/27/parents-lake-local-schools-ohio-protest-covid-mask-mandate/5881523001/.

Tao, X., Yip, T., Fisher, C.B., 2022. Employment, coronavirus victimization distress, and substance use disorders among black and non-Hispanic White young adults during the COVID-19 pandemic. Journal of Ethnicity in Substance Abuse, Advanced online publication 1–20.

Taylor, S., Paluszek, M.M., Rachor, G.S., McKay, D., Asmundson, G.J., 2021. Substance use and abuse, COVID-19-related distress, and disregard for social distancing: a network analysis. Addict. Behav. 114, 106754.

Webb Hooper, M., Nápoles, A.M., Pérez-Stable, E.J., 2020. COVID-19 and racial/ethnic disparities. JAMA 323 (24), 2466–2467. https://doi.org/10.1001/jama.2020.8598.

Weinberg, J.D., Freese, J., McElhattan, D., 2014. Comparing data characteristics and results of an online factorial survey between a population-based and a crowdsource-recruited sample. Sociological Science 1.

Wu, L.-T., Zhu, H., Ghitza, U.E., 2018. Multicomorbidity of chronic diseases and substance use disorders and their association with hospitalization: results from electronic health records data. Drug Alcohol Depend. 192, 316–323. https://doi.org/10.1016/j.drugalcdep.2018.08.013.

Wu, C., Qian, Y., Wilkes, R., 2021. Anti-Asian discrimination and the Asian-white mental health gap during COVID-19. Ethn. Racial Stud. 44 (5), 819–835.