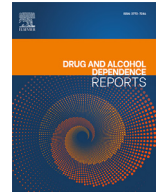




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Stressors experienced during the COVID-19 pandemic and substance use among US college students

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ABSTRACT

Background: The COVID-19 pandemic caused numerous stressors that may have been linked to substance use among college students.

Methods: We analyzed data from the Fall 2020 Healthy Minds Study ($N = 15,995$), a non-probability sample of students attending one of 28 universities, who completed an online survey during the COVID-19 pandemic (September – December 2020). Using multivariable logistic regression, we examined the associations between COVID-19 stressors (concern, racial/ethnic discrimination, financial distress, infection, illness of loved one, death of loved one, caregiving) and substance use (alcohol, cigarette, marijuana), adjusting for age, gender, race/ethnicity, and international student status. All COVID-19 stressors were included in the same weighted logistic regression models.

Results: About 46.89% of the sample reported drinking any alcohol (in the past 2 weeks), 7.38% used any cigarettes, and 16.87% used any marijuana over the past month. Multivariable logistic regression models showed that infection and caregiving were significantly associated with alcohol use; racial/ethnic discrimination and financial distress were associated with smoking cigarettes; and concern and infection were associated with marijuana use.

Conclusions: COVID-19 stressors were related to substance use, though the strength and significance of the associations varied depending on the stressors and the type of substance.

1. Introduction

Historically, substance use has increased during infectious disease outbreaks (P. Wu et al., 2008) and natural or man-made disasters (Hirst et al., 2018; Kanehara et al., 2016), presumably as a means of coping with distress (Rogers et al., 2020). In the COVID-19 pandemic, reports have been mixed, with some studies showing elevated rates of substance use in the general adult population (Czeisler et al., 2020)(Pollard et al., 2020). Prior studies have identified key stressors resulting from the pandemic, such as psychological distress, financial worries, racial tensions, personal or familial difficulties, social isolation and lack of social support (Capasso et al., 2021; Currie, 2021; Lechner et al., 2021; MacMillan et al., 2021; Rolland et al., 2020). Studies have suggested that people may have used substances to cope with these COVID-

19 stressors (Czeisler et al., 2020) and the mental health symptoms resulting from the stressors (Firkey et al., 2020; Horigian et al., 2020; Jones et al., 2021). However, few studies have cross-sectionally examined the wide range of COVID-19 stressors and how they are related to various substances.

Substance use among college students in the United States (U.S.) has been well documented (Schulenberg and Patrick, 2012), and research has begun to examine how the COVID-19 pandemic has affected this population. The pandemic caused unprecedented changes to the lives of students on college campuses, with major disruptions to social networks, housing and financial instability, and emotional distress (Jones et al., 2021), which studies have shown were significantly associated with substance use (e.g., alcohol consumption; Busse et al., 2021; Flaudias et al., 2021). However, studies examining the college population have been

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conducted on small or region-specific samples from single institutions. Thus, the aim of this study was to examine the associations between various stressors related to the COVID-19 pandemic and substance use in a large U.S. national sample of college students.

2. Methods

2.1. Sample

We analyzed data from the Fall semester cohort of the 2020 Healthy Minds Study (HMS), a cross-sectional, web-based survey examining mental health and related factors in undergraduate and graduate student populations. A total of 28 colleges opted to administer the COVID-19 module ($N = 15,995$). The response rate was 14% and sampling weights were used to adjust for non-response. The human subjects data collection procedures were approved by Advarra, and by the institutional review boards at each participating college. [See Supplemental Materials].

2.2. Measures

2.2.1. Substance use

Any alcohol use was measured using the binary (yes/no) item: “Over the past 2 weeks, did you drink any alcohol?”. Cigarette use was assessed using the ordinal item: “Over the past 30 days, about how many cigarettes did you smoke per day?” This variable was coded to reflect at least one cigarette over the past 30 days. Marijuana use was measured using the item that asked respondents (yes/no) whether they had used marijuana over the past 30 days.

2.2.2. COVID-19 stressors

We examined seven COVID-19 stressors, which were COVID-19 concern (scale between 10–50), Racial/ethnic discrimination (yes/no), Financial distress (ordinal variable, 0–4), Infection (yes/no), Infection of loved one (yes/no), Death of a loved one due to COVID-19, (yes/no), and Caregiving (yes/no). [See Supplemental Materials].

2.2.3. Sociodemographic covariates

Respondents self-reported sociodemographic characteristics, including gender (categorical - cis-gender man, cis-gender woman, transgender/nonbinary/other), race/ethnicity (categorical - White, Black, Asian American/Pacific Islander [AAPI], Latinx/Hispanic, Multiracial, Other), age (continuous), and international student status (yes/no).

2.3. Analysis

We used multivariable logistic regression analyses to test for associations between each COVID-19 stressor and each type of substance [Supplemental Materials]. We then included all seven COVID-19 stressors in the same models. All models were adjusted for sociodemographic characteristics and were run with and without survey weights. We present results as adjusted odds ratios with 95% confidence intervals. Missing data for individual variables was handled using listwise deletion, with <10% of data missing. For the purposes of this study, we focused on the weighted models that include all seven stressors simultaneously in the same models. Details about the data collection procedures, survey weighting, variables, descriptive statistics, and all analyses (weighted, unweighted, each stressor in its own model, all stressors included in the same model) can be found in the Supplemental Materials. All analyses were performed using StataSE 15.

3. Results

In the analytic sample of 15,995 college students, the average age of the weighted sample was between 24 and 25 years old, with 95% of

Table 1
Demographic characteristics ($N = 15,995$).

	N (weighted %)
Age*	24.73 (23.51 - 25.95)
Race/ Ethnicity	
White	10,567 (66.23%)
Asian American / Pacific Islander	1725 (5.92%)
Black	973 (8.06%)
Hispanic/Latinx	1080 (9.44%)
Multiracial	1411 (9.25%)
Other	186 (0.77%)
Missing/ unknown	49 (0.34%)
Gender	
Man	4477 (40.72%)
Woman	11,078 (56.72%)
Transgender/Non-binary/Other	399 (2.40%)
Missing/unknown	37 (0.17%)
International student	
No	15,172 (96.69%)
Yes	814 (3.31%)
COVID-19 Dimensions	
Concern (scale 10–50)*	32.23 (31.23 - 33.23)
Racial/ethnic discrimination (yes/no)	
No	14,847 (94.58%)
Yes	915 (5.42%)
Financial distress (ordinal, 0–4)*	2.85 (2.78 - 2.91)
Infection (yes/no)	
No	12,531 (77.95%)
Yes	3460 (22.05%)
Infected loved one (yes/no)	
No	10,916 (66.94%)
Yes	5054 (33.06%)
Death of loved one (yes/no)	
No	14,718 (90.99%)
Yes	1236 (9.01%)
Caregiving (yes/no)	
No	14,992 (93.32%)
Yes	972 (6.68%)
Substance use	
Any alcohol use	
No	8255 (53.11)
Yes	7736 (46.89)
Any cigarette use	
No	15,058 (92.61%)
Yes	878 (7.39%)
Any marijuana use	
No	13,266 (83.12%)
Yes	2725 (16.88%)
Any vaping	
No	13,925 (86.12%)
Yes	1988 (13.88%)

* Continuous - mean (95% Confidence Interval).

the sample being 40 years of age or younger. The sample was predominantly White (66.26%), majority women (69.37%), and mostly domestic students (94.96%) (Table 1). An estimated 46.89% of the sample had any alcohol over the past two weeks. In a model simultaneously including all COVID-19 stressors and adjusting for sociodemographic characteristics, COVID-19 infection (aOR: 1.42; 95% CI: 1.22–1.66), and caregiving (aOR: 1.51; 95% CI: 1.11–2.05) were associated with significantly greater odds of alcohol use. An estimated 7.38% of the sample had any cigarettes over the past 30 days. Racial/ethnic discrimination (aOR: 2.31; 95% CI: 1.37–3.92) and financial distress (aOR: 1.26; 95% CI: 1.06–1.49) were associated with significantly greater odds of smoking cigarettes. An estimated 16.87% of the sample used any marijuana over the past 30 days. A one-unit increase on the COVID-19 concern scale was associated with 3% increase in the odds of marijuana use (aOR: 1.03; 95% CI: 1.02–1.04), and COVID-19 infection was associated with significantly greater odds (aOR: 1.34; 95% CI: 1.08–1.66) (Table 2).

4. Discussion

4.1. Main findings

In a large sample of students from multiple colleges that specific stressors of the COVID-19 pandemic were related to substance use, with varying associations and significance depending on the stressor and the type of substance use. Explanations for the observed relations are only speculative at this stage. Notably, substance use (particularly in its most severe form) has been conceptualized as a ‘stress surfeit disorder’ (Koob et al., 2014) such that stressors play a key role in the initiation and maintenance of substance use, as well as relapses following a period of abstinence, through multiple mechanisms including dysregulation of the hypothalamic-pituitary-adrenal (HPA) axis and alterations in noradrenaline and γ -amino butyric acid (GABA) neurotransmission (Fronk et al., 2020). Our current study aligns with this neurobiological evidence, while echoing previous epidemiological findings that stress is related to substance use; specifically, caregiving is associated with greater odds of alcohol use (Rospenda et al., 2010); racial/ethnic discrimination and financial distress are linked to cigarette use (Borrell et al., 2010; Slopen et al., 2013) and that stress and anxiety are linked to marijuana use (Hyman and Sinha, 2009). Data were cross-sectional and did not allow for causal inferences, though it is plausible that the associations were bi-directional. For example, while pandemic-related financial stress may result in cigarette use as a means of coping, it is also possible that using cigarettes (the cost of purchasing cigarettes) can reduce available funds resulting in financial stress (Siahpush et al., 2003). Still, our overall findings align with prior studies that show that other stressors may have been linked to increased substance use (Gonzalez et al., 2021), but extends this literature by highlighting specific stressors that impact people during the pandemic.

Our findings raise the question of why certain stressors are related to substance use while other stressors are not. For example, a systematic review showed that discrimination was associated with drinking (Gilbert and Zemore, 2016) as well as alcohol use severity (Glass et al., 2020), but we did not find that COVID-19-related racial/ethnic discrimination was associated with any alcohol use over the past month when accounting for other COVID-19 stressors. We should note that the discrimination item did not specifically refer to Black Americans or AAPI, who were the most likely to experience discrimination during the pandemic (Chen et al., 2020; Ruiz et al., 2020; Wu et al., 2021). We also did not find evidence to suggest that COVID-19 concern was associated with alcohol use after accounting for the effects of other stressors, which differs from findings that show virus-related fears were linked to lower rates of risky drinking (Lechner et al., 2021). While COVID-19 concern has been linked to substance use in other studies (Rogers et al., 2020), we only found that it was associated with marijuana use over the past 30 days. Also, having a loved one become infected with or die from COVID-19 was also not associated with any substance use, despite being a highly stressful event. Along these lines, caregiving was only associated with alcohol use, but not any other substances. A key area for future research is to ascertain why only certain pandemic stressors are related to specific types of substance use.

Across the U.S., COVID-19 infection surged at different rates depending on the city and state throughout the period of data collection. Our study found that infection was associated with alcohol and marijuana use, net the effects of other stressors. The exact nature of how individuals became infected is unknown; however, there are several possibilities where substance use can lead to infection, and vice versa. For example, it is possible that one may become convivial (see Vanderbruggen et al., 2020) while using substances with others (Schmidt et al., 2021), sharing paraphernalia (noted by Van Laar et al., 2020), particularly while indoors in close-quarters. It is also possible that people may have attempted to use substances as pain relief/management from COVID-19 symptoms (see Khalsa et al., 2021). Also, it is possible that substance use can reduce immunity and increase vulnerability to viral and bac-

Table 2 Multivariable logistic regression models depicting associations between COVID-19 dimensions and substance use, Healthy Minds Study 2020, September – December 2020.

COVID-19 Dimensions	Any alcohol past 2 weeks			Any cigarettes past 30 days			Any marijuana past 30 days		
	Yes, n(%)	aOR	p-value	Yes, n(%)	aOR	p-value	Yes, n(%)	aOR	p-value
Concern (scale 10-50)	NA	1.01 [1.00, 1.02]	0.122	NA	1.00 [0.98, 1.01]	0.639	NA	1.03 [1.02, 1.04]	<0.001
Racial/ethnic discrimination (yes/no)	454 (5.25%)	1.00 [0.71, 1.42]	0.991	66 (8.89%)	2.31 [1.37, 3.92]	0.003	177 (6.55%)	1.36 [0.96, 1.92]	0.080
Financial distress (ordinal, 0-4)	NA	1.01 [0.90, 1.13]	0.875	NA	1.26 [1.06, 1.49]	0.011	NA	1.12 [1.00, 1.27]	0.051
Infection (yes/no)	1913 (25.64%)	1.42 [1.22, 1.66]	<0.001	241 (25.48%)	1.16 [0.89, 1.51]	0.262	767 (28.15%)	1.34 [1.08, 1.66]	0.009
Infected loved one (yes/no)	2552 (33.71%)	1.00 [0.88, 1.14]	0.976	321 (30.82%)	0.74 [0.46, 1.17]	0.185	959 (34.67%)	0.98 [0.81, 1.17]	0.804
Death of loved one (yes/no)	596 (9.00%)	0.92 [0.74, 1.15]	0.463	90 (12.83%)	1.61 [0.77, 3.35]	0.196	223 (8.11%)	0.83 [0.57, 1.19]	0.294
Caregiving (yes/no)	561 (7.99%)	1.51 [1.11, 2.05]	0.010	65 (6.51%)	0.98 [0.65, 1.49]	0.929	168 (6.14%)	0.95 [0.70, 1.29]	0.736
N		N=14,688			N=14,612			N=14,691	

All multivariable logistic regression models are adjusted for age, gender identity, race/ethnicity, and international student status
P<0.05 in bold

terial infections (Borgonhi et al., 2021). More research is needed with respect to acute COVID-19 infection and long-haul syndrome.

4.2. Limitations

First, data were cross-sectional and did not allow for us to ascertain the temporal order of events or make causal inferences. Second, the data were self-reported, and may have been vulnerable to recall and social desirability biases (e.g., reluctance to disclose COVID-19 infection status or history of substance use). Third, the sample consisted of college students, and it remains to be seen whether findings are generalizable to other populations. Fourth, the response rate was 14%, which raises concerns about sampling bias, though this response rate is comparable to surveys of this nature, and survey weights were used to adjust for non-response. Fifth, we did not have key measures (e.g., compliance with COVID-19 restrictions, measures of substance use prior to COVID-19, involvement in protesting racial injustice, state/region-level data, locations of college/universities) that could clarify our findings. Thus, our findings may have suffered from omitted variable bias. Sixth, due to small cell counts, we were unable to make meaningful ethno-racial comparisons. Certainly, racial disparities remain a central topic of concern when examining the health impact of COVID-19. Finally, the COVID-19 pandemic was not a static event, and the stressors we examined in the study may have varied over the course of the pandemic.

5. Conclusion

Despite these limitations, the current study provides findings from a large sample of students attending colleges across the U.S. and shows that different stressful aspects of the pandemic are related to certain types of substance use, though the strength and significance of the associations varied. Efforts to address substance use during and after the pandemic may target these specific stressors, such as initiating anti-racism campaigns on campuses (Ben et al., 2020), providing financial relief for students (see ideas on short-term and long-term measures to address food insecurity; Nazmi et al., 2019), organizing online support systems for informal caregivers (see interventions for caregivers for dementia; Etxeberria et al., 2020), and providing online/mobile Cognitive Behavioral Therapy and Mindfulness-based interventions to reduce COVID-19 concern (Heber et al., 2017; Howell and Passmore, 2019; Spijkerman et al., 2016). Future research can evaluate whether these efforts to alleviate pandemic-related stressors can curb substance use.

6. Contributors

Dr. Hans Oh conceived and designed the analysis and wrote the paper. Dr. Adam Leventhal, Dr. Christina Tam, Dr. Ravi Rajkumar, and Dr. John Clapp reviewed the manuscript and contributed to the writing. Dr. Sasha Zhou managed the data. Dr. Adam Leventhal's effort was partially supported by DA-K24048160.

Declaration of Competing Interest

Dr. Sasha Zhou is a co-investigator for the Healthy Minds Study. The authors have no other conflicts to disclose.

Author Disclosures

None.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.dadr.2021.100005](https://doi.org/10.1016/j.dadr.2021.100005).

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