ORIGINAL ARTICLE

Mental Health Risk Profiles and Related Substance Use During Coronavirus Pandemic Among College Students Who Use Substances

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Abstract

College students have shown elevated mental distress during the coronavirus disease of 2019 (COVID-19). The extent and persistence of mental distress as COVID-19 restrictions have continued is unclear. This study used latent profile analysis to identify student mental health risk subgroups and to evaluate subgroups in relation with substance use. A four-profile solution was supported with a sample of 930 college students (69.6% female, 58.1% White) from 11 US-based institutions. Students were characterized by *slight* mental health symptoms, *mild* mental health symptoms, *moderate-to-severe* mental health symptoms with mild psychosis/substance use, and *severe* mental health symptoms. The severe profile comprised more ethnoracial or sexual minorities and students impacted from COVID-19. Whereas the severe profile had more alcohol-related consequences, the slight profile had fewer cannabis-related consequences. COVID-19 has exacerbated college student risks for psychiatric disorders. Students of diverse backgrounds and more impacted by COVID-19 show disproportionately more mental distress and related substance use.

Keywords DSM-5 level 1 measure · Latent profile analysis · COVID-19 · Emerging adults · Multisite study · Cannabis use · Alcohol use

College students have been uniquely affected by the novel coronavirus disease pandemic of 2019 (COVID-19) given their almost universal transition to remote learning and limited social interactions. The stressors brought on by the pandemic appear to have impacted students' mental health and substance use. Before COVID-19, almost 20% of students met criteria for past-year mood or anxiety disorders (Auerbach et al., 2019), rates of substance misuse were highest among college students as compared to all other age groups (Substance Abuse and Mental Health Services Association [SAMHSA], 2019a), and rates have increased in substance use, anxiety, depression, anorexia nervosa, attention-deficit

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hyperactivity disorder, insomnia, obsessive–compulsive disorder, panic attacks, and phobias over the past decade (Oswalt et al., 2020; Welsh et al., 2019). Immediately following the outbreak of COVID-19, mental health symptoms appear to have worsened. One meta-analysis ($N = 90{,}879$ across 27 studies from 15 countries) from March to July 2020 found that 39% of students experienced anxiety, 31% depression, and 51% sleep impairment (Batra et al., 2021). Further, students who reported greater mood and anxiety symptoms also reported increases in substance use (Mohr et al., 2021; Papp & Kouros, 2021). However, it is unclear whether mental health symptoms have persisted as the pandemic continued and if there are subgroups of students with mental health symptoms beyond depression and anxiety symptoms.

Greater attention to the individual patterns of mental health symptoms can offer a more complete picture of student experiences during COVID-19. Extant work has primarily used variable-centered approaches (e.g., structural equation modeling) to examine the associations among mental health symptoms or to compare substance use rates between students with and without mental health symptoms (Mohr et al., 2021; Papp & Kouros, 2021). A limitation of variable-centered approaches is the assumption that samples are representative of a single homogenous population (L. M. Collins & Lanza, 2010). Person-centered approaches (e.g., profile or cluster analysis) overcome this limitation by identifying unobserved subpopulations based on a students' response patterns across mental health variables. This approach follows the assumption that identifying subgroups with similar attributes can help explain observed heterogeneity. Person-centered approaches have been previously used to identify subgroups of college students based on substance use (Pearson et al., 2017), mental health (Wu et al., 2017), and psychiatric comorbidity (Villarosa-Hurlocker & Madson, 2020).

To date, three studies have used person-centered analyses to examine mental health impacts during the early months of the pandemic (Browning et al., 2021; Fernández et al., 2020; Liu et al., 2021). Across studies, researchers found three unique profiles of mental health that differed based on symptom severity. Across studies, characteristics of individuals in the severe mental health profiles included younger age (18–29 years old), identifying as a woman, and endorsing more COVID-19 fears. A notable strength of these studies is the use of anxiety and depression indicators in their analyses, given the high prevalence of these disorders in adults. However, other common symptoms seen across psychiatric diagnoses were missing, and associations between mental health profiles and substance use were not examined.

Psychiatric comorbidity is prevalent (van Loo & Romeijn, 2015), including among college students who use substances (Sheidow et al., 2012), and much debate during the development of the *Diagnostic and Statistical Manual of Mental Health Disorders, 5th edition* (DSM-5) centered around viewing psychiatric disorders along a dimensional continuum rather than as distinct categories (Clarke & Kuhl, 2014). To address the high rates of symptom comorbidity, the DSM-5 Level 1 Cross-Cutting Symptom Measure (DSM-5 Level 1) (American Psychiatric Association [APA], 2013) was developed to assess presence and severity of 13 mental health domains that are common across disorders. Performing a person-centered analysis with these 13 mental health domains as indicators may better and more comprehensively differentiate students' mental health profiles. Examining the extent that COVID-19 experiences predict mental health profiles and how these profiles relate to substance use can help guide mental health treatment for college students.

Present Study

The present study sought to examine mental health symptom rates and identify different mental health profiles in a large high-risk sample of college students from 11 US-based institutions. Specifically, we recruited college students who endorsed past-month substance use given their heightened risk for mental health disorders (Sheidow et al., 2012), and that they have the highest rates of risky substance use, particularly alcohol and cannabis (SAMHSA, 2019b). Given the limited research on mental health rates as COVID-19 has continued, we first examined the rates of mental health symptoms and compared rates between the fall 2020 and spring 2021 semesters. We then used latent profile analysis (LPA) to identify subgroups of students based on the 13 mental health domains in the DSM-5 Level 1. Given that demographic characteristics (Browning et al., 2021) and COVID-19 experiences (Liu et al., 2021) have predicted student mental health during COVID-19, we examined several putative covariates (predictors) of latent profiles. Finally, to expand on current evidence that mental health symptoms are positively related to substance use (Patterson et al., 2021), we examined the associations between mental health profiles and substance-related variables.

Method

Participants and Procedures

College students were recruited from 12 universities in 12 states across the contiguous US (Arkansas, California, Colorado, Florida, Mississippi, Montana, New Mexico, Oklahoma, Pennsylvania, Texas, Wisconsin, Wyoming) from September 2020 to May 2021. Universities were selected for inclusion to represent the five major regions in the country. Study procedures were approved by the University of Southern Mississippi's institutional review board (IRB) using a single-site IRB policy. College students were eligible if they were 18 to 25 years old and endorsed any past-month substance use, determined via a single yes/no question (i.e., "Have you used any substances in the past month (e.g., alcohol, marijuana, tobacco, stimulants)?"). Eligible participants were directed to an electronic consent form, followed by an hour-long online survey, and received research credit in exchange for their participation. Study procedures were standardized across data collection sites by recruiting students from psychology participant pools and using the same Qualtrics survey administration software. We also minimized participant burden by employing a planned missingness design (Graham et al., 2006), such that all participants completed core measures on COVID-19 experiences and various substance use behaviors (e.g., typical and risky substance use patterns, substance-related consequences), and then completed a random set of 10 out of 36 additional measures of mental health, physical health, and personality traits. All study materials including survey instruments, data, and analyses are available at https://osf.io/ta25n/.

After removing ineligible or non-consenting individuals ($n = 1,687$), 3,681 participants completed the core measure battery, and each of the additional measures was completed by 920–940 participants (see Fig. 1). The final sample for the present analyses included 930 participants ($M_{age} = 19.39$, $SD = 1.41$) who completed the DSM-5 Level 1. Chi-square difference tests revealed no significant differences by study site, region of the USA, sex, race/
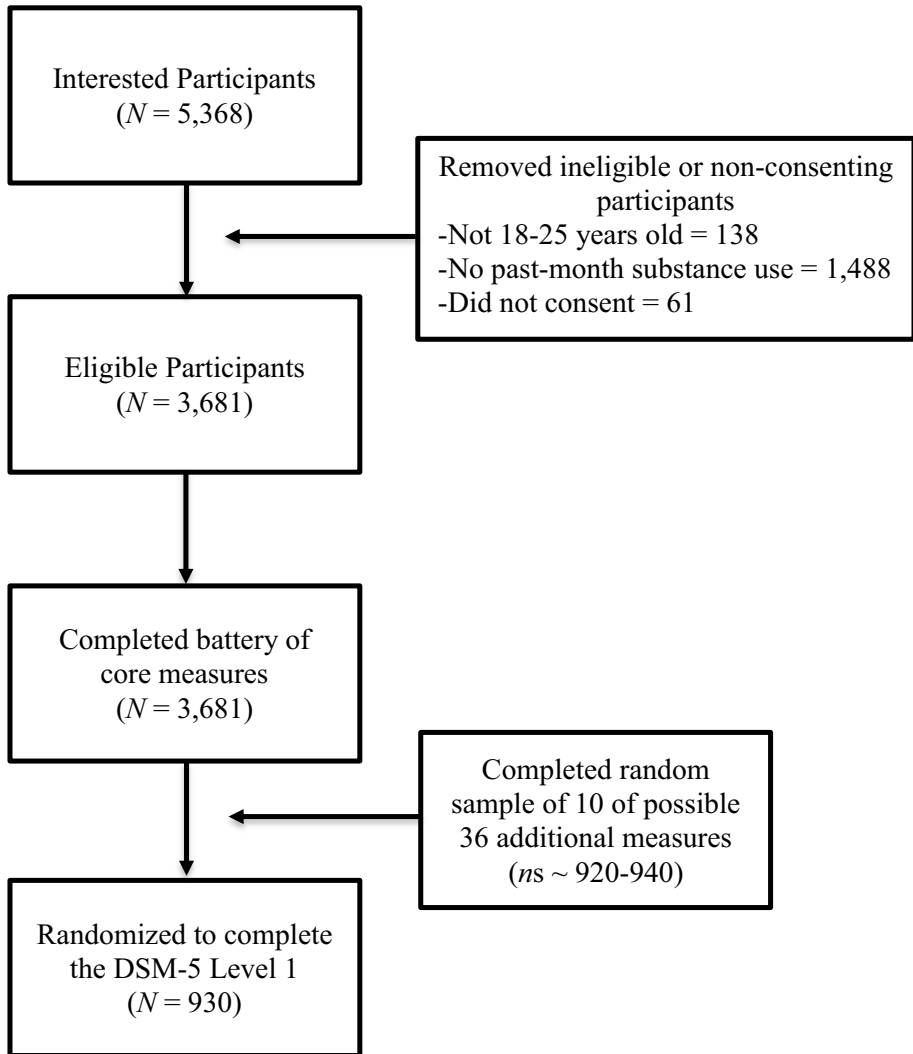
Fig. 1 Flow chart of participant inclusion

ethnicity, sexual orientation, academic class standing, housing status, or employment status between participants who completed (*n* = 930) or did not complete (*n* = 2,751) the DSM-5 Level 1. Study characteristics of the final sample are detailed in Table 1.

Measures

Mental Health Indicators

The DSM-5 Level 1(Narrow et al., 2013; APA, 2013) was used to assess the severity/frequency of psychiatric symptoms in the past two weeks using the response scale: 0 (*none:*

Table 1 Participant characteristics of final sample

	Total	MS	NM	MT	CA	PA	WI	FL	CO	TX	WY	AR	OK
N	930	65	36	107	33	37	33	46	206	113	113	105	36
Sex (%)													
Female	69.6	83.1	69.4	64.5	78.8	67.6	75.8	71.7	73.3	70.9	59.3	59.0	72.2
Male	30.2	16.9	30.6	35.5	21.2	32.4	24.2	28.3	26.7	28.9	40.7	40.0	27.8
Ethnoracial background (%)													
African American/Black	3.4	29.2	2.8	0.9	6.1	0	0	2.2	0.5	2.7	0	1.9	5.6
European American/White	58.1	40.0	22.2	69.2	0.0	62.2	66.7	43.5	63.6	61.9	71.7	67.6	38.9
Hispanic/Latinx	10.2	3.1	36.1	2.8	66.7	5.4	12.1	15.2	7.8	5.3	8.8	6.7	8.3
Asian/Asian American	2.3	0	2.8	3.7	3.0	8.1	3.0	0	1.5	4.4	2.7	0	0.0
American Indian/Alaska Native	0.4	0	2.8	0.9	0	0	0	0	0	0	0	1.0	2.8
Mixed	25.6	27.7	33.3	22.4	24.2	24.3	18.2	39.1	26.7	25.7	16.8	22.9	44.4
Sexual orientation (%)													
Completely heterosexual	68.5	61.5	55.6	67.3	72.7	70.3	57.6	60.9	62.4	81.4	73.5	71.4	80.6
Mostly heterosexual	16.6	12.3	30.6	18.7	12.1	24.3	12.1	17.4	18.0	10.6	15.0	17.1	16.7
Bisexual	10.7	15.4	5.6	11.2	12.1	2.7	24.2	13.0	15.1	5.3	9.7	7.6	0.0
Mostly homosexual	2.6	6.2	5.6	1.9	3.0	0.0	3.0	4.3	2.9	1.8	1.8	1.0	2.8
Completely homosexual	1.7	4.6	2.8	0.9	0.0	2.7	3.0	4.3	1.5	0.9	0	2.9	0.0
Class standing (%)													
Freshman	48.8	29.2	50.0	57.0	54.5	56.8	57.6	54.3	55.6	25.7	46.0	58.1	36.1
Sophomore	25.0	30.8	22.2	26.2	30.3	18.9	24.2	13.0	22.4	31.9	23.0	28.6	41.7
Junior	14.9	20.0	25.0	11.2	6.1	2.7	9.1	17.4	12.7	29.2	15.0	9.5	16.7
Senior	11.4	20.0	2.8	5.6	9.1	21.6	9.1	15.2	9.3	13.3	15.9	3.8	5.6
GPA (%)													
3.0–4+	80.6	76.9	77.8	79.5	57.6	97.3	81.8	97.8	76.5	87.6	77.0	82.9	77.8
2.0–2.99	18.3	21.5	19.5	18.6	39.4	2.7	18.2	2.2	22.5	11.5	31.2	16.2	22.3
1.0–1.99	1.1	1.5	2.8	1.8	3.0	0	0	0	1.0	0.9	1.8	1.0	0.0

Table 1 (continued)

	Total	MS	NM	MT	CA	PA	WI	FL	CO	TX	WY	AR	OK
Housing (%)													
On-campus	46.1	43.1	16.7	54.1	9.1	48.6	42.5	34.7	56.7	50.5	37.2	46.7	58.4
Off-campus	38.3	33.9	30.5	42.9	6.0	35.1	21.2	37.0	35.1	39.0	50.4	43.8	41.7
With parents	15.5	23.1	52.8	2.8	84.8	16.2	36.4	28.3	5.9	10.6	12.4	9.5	0.0
Employment (%)													
Unemployed	59.0	50.8	38.9	57.9	66.7	81.1	33.3	50.0	64.4	71.7	53.1	60.0	50.0
Employed	40.9	49.2	61.1	42.1	33.4	18.9	66.7	50.0	35.7	26.5	46.9	40.0	50.0

MS, Mississippi; NM, New Mexico; MT, Montana; CA, California; PA, Pennsylvania; WI, Wisconsin; FL, Florida; CO, Colorado; TX, Texas; WY, Wyoming; AR, Arkansas; OK, Oklahoma

not at all), 1 (*slight: rare, less than a day or two*), 2 (*mild: several days*), 3 (*moderate: more than half the days*), and 4 (*severe: nearly every day*). The DSM-5 Level 1 assesses 23 symptoms to capture 13 mental health domains: depression (2 items; $\alpha = 0.87$), anger (1 item), mania (2 items; $\alpha = 0.69$), anxiety (3 items; $\alpha = 0.85$), somatic distress (2 items; $\alpha = 0.72$), suicidal ideation (1 item), psychosis (2 items; $\alpha = 0.81$), sleep disturbance (1 item), memory problems (1 item), repetitive thoughts and behaviors (2 items; $\alpha = 0.80$), dissociation (1 item), impaired personality functioning (2 items; $\alpha = 0.82$), and substance use (3 items; $\alpha = 0.57$). For the domains with multiple items, a total score was created by summing items, and total scores on each domain were used for the LPA. We also used the DSM-5 Level 1 to evaluate rates of mental health symptoms given that the tool was designed to help clinicians determine which psychiatric diagnoses warrant further inquiry. Specifically, additional inquiry is recommended if individuals endorse a score of 1 or higher on suicidal ideation, psychosis, or substance use and 2 or higher on any item within the other domains. Prior work has demonstrated internal, convergent, and criterion-related validity of the DSM-5 Level 1 with college students (Bravo et al., 2018).

Covariates

A questionnaire was administered to assess several demographic covariates. The Perceived Coronavirus Threat Questionnaire (Conway, 2020) is a six-item measure of perceived fears of contracting COVID-19 (e.g., "I am worried that I or people I love will get sick from the coronavirus"). Participants indicated the extent they felt threatened about the coronavirus using a seven-point response scale: 0 (*not true of me at all*) to 7 (*very true of me*). Internal consistency was acceptable with the current sample ($\alpha = 0.73$). The abbreviated Coronavirus Impacts Questionnaire (Conway, 2020) is a nine-item measure of the impacts of the coronavirus across three domains: financial (e.g., "I have lost job-related income due to the coronavirus"), resource (e.g., "It has been difficult for me to get the things I need due to the coronavirus"), and psychological (e.g., "The coronavirus outbreak has impacted my psychological health"). Participants indicated the extent to which COVID-19 has impacted their lives using a seven-point response scale: 0 (*not true of me at all*) to 7 (*very true of me*). Internal consistency across the three subscales were adequate ($\alpha s = 0.78$ [financial], 0.76 [resource], 0.86 [psychological]).

Auxiliary Variables

Alcohol use was assessed using the Daily Drinking Questionnaire (DDQ; (R. L. Collins et al., 1985). Participants indicated the number of standard drinks they consumed each day in a typical week during the past month and drinks were summed to obtain the total number of drinks. Alcohol-related consequences were assessed using the 24-item Brief Young Adult Alcohol Consequences Questionnaire (BYAACQ; Kahler et al., 2005). Participants indicated whether they experienced consequences in the past month (e.g., "I have passed out from drinking")($\alpha = 0.90$). Cannabis use was assessed using the Marijuana Use Grid (MUG). Participants indicated the amount of marijuana they used in six 4-h time blocks (8am–12 pm, 12 pm–4 pm, etc.) each day of the week during the past month. Estimates were based on cannabis use method (i.e., joint, blunt, pipe, bong, edible, vaporize, dabbing). Cannabis-related consequences were assessed using the 21-item Brief Marijuana Consequences Questionnaire (B-MACQ; Simons et al., 2012). Participants indicated whether they experienced consequences in the past month (e.g., "I have been unhappy

because of my marijuana use")($\alpha = 0.88$). Past-month tobacco use was assessed using a modified version of the DDQ. Estimates were based on tobacco use method (i.e., cigarettes, e-cigarettes, hookah, smokeless tobacco, cigarillos, and cigars). Other substance use was assessed using an adapted version of the Alcohol, Smoking and Substance Involvement Screening Test (ASSIST; Ali et al., 2002). Participants indicated how many times they used each substance in the past month: stimulants, cocaine, methamphetamine, heroin, other opioids, and benzodiazepines.

Planned Analyses

Descriptive statistics were used to examine rates of mental health symptoms, and chi-square difference tests were conducted to compare rates between across semesters. An LPA was performed to examine distinct mental health profiles based on the total scores of the 13 DSM-5 Level 1 domains. Latent models with up to six profiles were fit to the data. We determined the optimal profile solution using two model fit indices: Bayesian Information Criterion (BIC) and Lo-Mendell-Rubin Adjusted Likelihood Ratio Test (LMRT). Lower values on the BIC indicate a better-fitting model and a statistically significant difference between class solutions (i.e., k vs. $k-1$) on the LMRT indicate that k class solution is a better fit than $k-1$ class solution (Nylund et al., 2007). Model entropy was evaluated to examine classification quality, with a score of 0.8 or higher indicative of adequate classification precision. Parameters of interest were latent prevalence and conditional response means for each profile.

After determining the optimal profile solution, we used a three-step maximum likelihood method to analyze predictors (i.e., hypothesized covariates) of latent profiles while accounting for classification error (Vermunt, 2010). Demographic covariates included: semester (fall vs spring), sex (male vs. female), race/ethnicity (White vs. person of color), sexual orientation (heterosexual vs. sexual minority), housing status (on-campus vs off-campus), and employment status (unemployed vs employed). The four indicators of COVID-19 impact (threats, financial, resource, and psychological) were also entered as covariates. Finally, we tested the equality of the means of auxiliary variables (i.e., substance use) across profiles using an adapted version of the Bolck, Croon, and Hagenaars method (BCH), which is the most robust approach to examine the relationships between means of continuous auxiliary variables and latent profiles, while taking into account classification error (Bakk & Vermunt, 2016).

Results

Rates of Mental Health Symptoms

Based on DSM-5 Level 1 scoring (APA, 2013), most participants endorsed depression (52%), anxiety (59%), or substance use (54%) symptoms. Over a third of the sample endorsed anger (39%), mania symptoms (39%), sleep problems (36%), and impaired personality functioning (42%). Based on DDQ scoring (Collins et al., 1985), 300 participants (32.5%) were light drinkers (< 4 drinks per week), 379 participants (41.1%) were moderate drinkers (4–11 drinks), and 243 participants (26.4%) were heavy drinkers (> 12 drinks).

Chi-square tests revealed no significant differences on mental health domains or drinking rates between fall and spring semester survey completers.

Profile Enumeration

The LMRT indicated a four-profile solution was the best fitting model with and without the covariates (see Table 2). Although the BIC value was lower in the five versus four profile solution, the LMRT was significant for the four-profile solution and nonsignificant for the five-profile solution, indicating a significantly better fit of the four-profile solution than the three-profile solution and no statistical improvement in fit for the five-profile solution. Also, the entropy value was 0.92, indicating adequate classification quality.

Figure 2 and Table 3 depict the estimated pattern of means on the 13 mental health domains across the four latent profiles. Based on latent profile prevalence, profile 1 comprised 45.4% of the sample ($n=423$) and was labeled the "slight mental health symptoms" group due to their low mean scores across domains ($-0.84 < zs < -0.35$). Profile 2 comprised 33.4% of the sample ($n=310$) and was labeled the "mild mental health symptoms" group due to their scores across domains within 0.5 standard deviations of the mean ($-0.14 < zs < 0.39$). Profile 3 comprised 13% of the sample ($n=121$) and was labeled the "moderate-to-severe mental health symptoms; mild psychosis and substance use" group due to scores across domains being between 0.5 and 1.5 standard deviations above the mean, except for psychosis ($z = -0.12$) and substance use ($z = 0.21$). Profile 4 comprised 8.1% of the sample ($n=75$) and was labeled the "severe mental health symptoms" group due to the high scores across domains ($0.82 < zs < 2.84$).

Table 2 Latent profile analyses for class solutions 1 through 6

Classes (k)	LMRT	BIC	Entropy
Profile model (no covariates)			
1		208,100.63	
2	2630.23***	205,561.93	.868
3	1538.71***	204,124.29	.819
4	725.87*	39,777.16	.921
5	642.28	39,223.86	.930
6	554.79	98,461.33	.544
Profile model (with covariates)			
2	4796.61***	40,516.99	.949
3	1552.19**	39,132.92	.936
4	759.89*	38,545.62	.925
5	657.04	38,061.76	.933
6	420.28	37,815.99	.928

LMRT, Lo-Mendell-Rubin adjusted likelihood ratio test; BIC, Bayesian information criterion
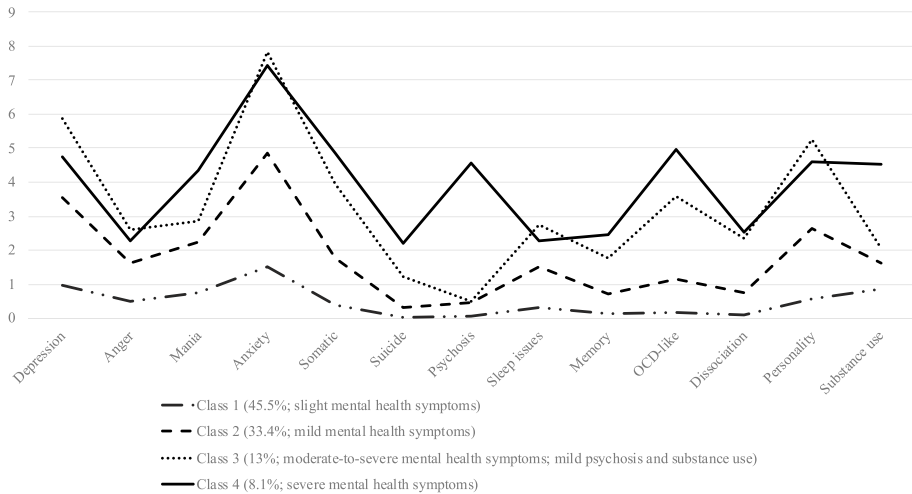
**p < .001, *p < .05

Fig. 2 Four latent profiles depicted by pattern of mean scores on the 13 mental health domains of the DSM-5 Level 1.

Predictors of Profile Membership

We examined the effects of covariates on profile membership with the severe mental health symptoms profile (profile 4) as the reference group. No differences emerged across profiles on semester, sex, academic class standing, housing or employment status, learning format, or COVID-19 threats or financial impacts. However, the severe profile was more likely to comprise ethnoracial minority students (63%; 37% White) relative to the slight (38%; 59% White), mild (39%; 61% White), and moderate-to-severe (41%; 59% White) profiles. The slight profile was less likely to comprise sexual minority students (8%; 92% heterosexual) relative to the severe (23%; 77% heterosexual) profile. Relative to the severe profile, the slight ($OR = 0.92$; $B = -0.08$, $p < 0.01$), mild ($OR = 0.91$; $B = -0.10$, $p < 0.01$), and moderate-to-severe ($OR = 0.93$; $B = -0.07$, $p < 0.05$) profiles had significantly less resource impacts from COVID-19. Relative to the severe profile, the slight profile ($OR = 0.89$; $B = -0.12$, $p < 0.001$) had significantly less, and the moderate-to-severe profile ($OR = 1.15$; $B = 0.14$, $p < 0.01$) had significantly more psychological impacts from COVID-19.

Equality of Means Among Latent Profiles

Few participants endorsed past-month use of heroin, methamphetamines, cocaine, benzodiazepines, or non-cigarette forms of tobacco only ($ns = 1$–23). Therefore, these substances were excluded from analyses. No differences across profiles emerged for cannabis use via bongs, edibles, dabs, and vapes, cigarettes, or stimulants (see Table 4). The slight profile had significantly more alcohol use than the

Table 3 Mean comparisons across latent classes on DSM-5 Level 1 mental health domains

	Profile 1 (slight mental health symptoms)	Class 2 (mild mental health symptoms)	Class 3 (moderate-to-severe mental health symptoms; mild psychosis and substance use)	Class 4 (severe mental health symptoms)
Depression	0.96_a	3.55_b	5.87_c	4.73_d
Anger	0.48_a	1.63_b	2.59_c	2.27_d
Mania	0.75_a	2.25_b	2.86_c	4.35_d
Anxiety	1.50_a	4.85_b	7.83_c	7.45_c
Somatic	0.40_a	1.76_b	3.95_c	4.84_d
Suicidal ideation	0.02_a	0.32_b	1.21_c	2.21_d
Psychosis	0.06_a	0.46_b	0.48_b	4.56_c
Sleep problems	0.33_a	1.53_b	2.76_c	2.29_d
Memory problems	0.12_a	0.70_b	1.75_c	2.46_d
Repetitive thoughts and behaviors	0.16_a	1.15_b	3.58_c	4.98_d
Dissociation	0.10_a	0.75_b	2.34_c	2.53_c
Personality functioning	0.56_a	2.64_b	5.25_c	4.59_d
Substance use	0.87_a	1.62_b	2.04_b	4.54_c

Means in a row that share a subscript indicate mean scores are not significantly different from each other

Table 4 Mean comparisons across latent mental health profiles on substance use auxiliary variables

	Profile 1 (slight mental health symptoms)	Profile 2 (mild mental health symptoms)	Profile 3 (moderate-to-severe mental health symptoms; mild psychosis/substance use)	Profile 4 (severe mental health symptoms)
DDQ	9.11_a	$7.90_{a,b}$	6.54_b	$8.09_{a,b}$
BYAACQ	4.78_a	5.66_b	$5.48_{a,b}$	8.57_c
MUG-joints	$.93_{a,b}$	$1.09_{a,b}$	$.71_a$	1.96_b
MUG-blunts	$.66_a$	$.79_a$	$.72_a$	2.17_b
MUG-pipe	$.75_a$	$.68_a$	$.97_a$	2.14_b
MUG-bong	1.49_a	1.79_a	1.07_a	2.30_a
MUG-edibles	1.15_a	1.65_a	1.48_a	2.30_a
MUG-vape	1.15_a	$.82_a$	$.93_a$	1.27_a
BMACQ	2.44_a	4.65_b	4.30_b	6.09_b
DUM-Cigarettes	1.43_a	$.74_a$	$.78_a$	2.07_a
DUM-Stimulants	1.33_a	1.86_a	1.53_a	2.26_a
DUM-Opioids	0.07_a	0.30_b	$0.22_{a,b}$	0.52_b

Means in a row that share a subscript indicate mean scores are not significantly different from each other. DDQ, Daily Drinking Questionnaire; BYAACQ, Brief Young Adult Alcohol Consequences Questionnaire; MUG, Marijuana Use Grid; BMACQ, Brief Marijuana Consequences Questionnaire; DUM, Drug Use Matrix

moderate-to-severe profile but not more than the other profiles. The severe profile had significantly more alcohol-related consequences than other profiles. The severe profile had significantly more cannabis blunt and pipe use than other profiles and significantly more cannabis joint use than the moderate-to-severe profile. The slight profile had significantly fewer cannabis-related consequences than other profiles. The slight profile had significantly less opioid use than the mild and severe profiles.

Discussion

The onset of the COVID-19 pandemic demonstrated greater mental health vulnerability among college students (Batra et al., 2021). Our findings suggest that mental health symptoms persisted in a high-risk sample of college students while COVID-19 policies continued from September 2020 to May 2021. Like findings of students in Fall 2020 (Coakley et al., 2021), the majority of the current sample endorsed elevated anxiety (59%) and depression (52%). Further, two of the profiles in this study represented students with moderate-to-severe anxiety and depression (21% of the sample). Thus, anxiety and depression levels appear to have persisted given similar rates of moderate-to-severe anxiety or depression found immediately following the COVID-19 outbreak (Kar et al., 2021; Woon et al., 2021). In fact, anxiety symptom severity was the highest of the mental health symptoms across profiles, which is concerning given that anxiety symptoms were the most prevalent mental health complaint of college students prior to COVID-19 (Auerbach et al., 2019). The elevated anxiety reported by the current sample may reflect an exacerbation of anxiety due to the stay-at-home order and social distancing policies (e.g., Son et al., 2020) and may be a factor driving in the elevated substance use among students in the moderate-to-severe and severe mental health profiles (Satre et al., 2020). The current sample also endorsed high rates of moderate-to-heavy drinking (67%), and anger, sleep and personality-related impairment, and mania symptoms (> 30%). The lack of differences in mental health rates among students in the Fall and Spring semesters suggest that psychiatric symptoms, broadly, have affected students alongside the continuation of COVID-19.

Current findings on mental health profiles are partially consistent with prior work (Browning et al., 2021; Fernández et al., 2020; Liu et al., 2021), in that profiles were largely distinguished by symptom severity. However, we found four unique profiles, and certain symptoms were more (depression, anger, anxiety, and sleep) or less (psychosis and substance use) commonly endorsed across profiles. These differences may be due to our use of a comprehensive measure of symptoms seen in comorbid psychiatric disorders beyond just mood and anxiety. Also contrary to these prior studies, COVID-19 fears and sex did not predict the likelihood of class membership. However, the severe profile was characterized by more ethnoracial and sexual minority students, which is consistent with findings that Asian American, Black, Latinx, and sexual minority students endorsed more psychological distress during the onset of COVID-19 (Charles et al., 2021; Salerno et al., 2021). Further, current findings align with prior reviews that students with certain socio-economic characteristics pre-pandemic (e.g., ethnoracial minority) may be more negatively affected by COVID-19 policies and, thus, experience more psychological distress (Chang et al., 2021; Kapilashrami & Bhui, 2020; Patterson et al., 2021).

Extending prior work, we found greater impacts of COVID-19 on student resources predicted membership to the severe profile. Though prior work is limited on how access to resources during COVID has affected students, one study found that Latinx students

endorsed more resource-related impacts from COVID-19 than White, non-Hispanic students (Trammell, et al., 2021). Given that the severe profile comprised more marginalized students, further investigation on the unique impacts of COVID-19 on specific ethnoracial/sexual minority groups is needed. We also found that the moderate-to-severe profile had greater psychological impacts of COVID-19 than the severe profile. Although somewhat surprising, a key distinction between these two profiles was the frequency of substance use, an unhealthy coping style that students often use to alleviate distress (Christie et al., 2021). Given that substance use often exacerbates mental health concerns, students who are experiencing mental distress but using fewer substances (i.e., moderate-to-severe profile) may be more aware of the psychological impacts from COVID-19 than students who may be using substances to cope with mental distress (i.e., severe profile).

Finally, we explored the relationships between profiles and substance use given the high comorbidity of these psychiatric conditions among students (Sheidow et al., 2012). The slight, mild, and severe profiles had high levels of alcohol and cannabis use, but only the severe profile had more alcohol-related problems, and the slight profile had the fewest cannabis consequences. These findings are consistent with prior findings that students experiencing more mental distress may not consume more substances than their less distressed counterparts, but they often experience more negative consequences (Buckner et al., 2010; Geisner et al., 2012).

Strengths and Limitations

There are several strengths of this study. This is the first study, to our knowledge, to explore the mental health symptoms potentially associated with COVID-19 across two semesters during the pandemic. The geographic generalizability is enhanced with at least one institution from each region of the country represented. Our use of the DSM-5 Level 1 measure to identify mental health profiles offers a more complete picture of mental health symptoms. Relatedly, our use of a person-centered approach clarifies the unique symptom presentations of college students while also attending to the known heterogeneity. Finally, our use of matrix sampling balanced participant burden while also increasing the reliability and validity of the data collected.

Several limitations also must be considered. These data are cross-sectional and limit the ability to make causal assertions. Longitudinal designs can clarify the temporal associations among substance use and other mental health symptoms. Also, the subsample of students who completed the DSM-5 Level 1 measure precluded us from distinguishing students by their specific racial/ethnic or sexual identity. Future multisite studies may consider additional stratified sampling procedures to enhance sample diversity. Our sample was also limited to students who were emerging adults and reported past-month substance use, excluding older students and those who abstain from such substances. Also, while we assessed quantity, frequency, and consequences of the two most commonly used substances (alcohol and cannabis), we only assessed frequency of past-month use of other substances. Future work would benefit from more comprehensive substance use assessment. Finally, many students opted to take a semester or year off from school during the pandemic, potentially limiting the generalizability of our findings.

Conclusion

Using latent profile analysis, we were able to identify distinct profiles of students based largely on severity of mental health symptoms. Although further validation is needed, the DSM-5 Level 1 may be an optimal tool to capture the symptoms seen across psychiatric disorders in students. Anxiety scores were highest of the mental health symptoms across profiles, signifying a need to better understand how anxiety develops among students and to offer interventions to help prevent emotional, social, and academic impairment due to anxiety (Liu et al., 2020). Further, mental health challenges may be more severe among ethnoracial or sexual minority students and those experiencing more impacts of COVID-19. The pandemic has made more visible the social and healthcare inequities and efforts to reach those students from historically marginalized groups is needed (Patterson et al., 2021). For example, universities may benefit from implementing mental health campaigns to combat the stigma associated with help-seeking. Finally, elevated mental health symptoms appear related to alcohol and cannabis consequences, though high rates of alcohol and cannabis use were also seen in those with minimal mental distress. These findings build on previous results by demonstrating the sustained role of COVID-19 on the mental health of US college students.

Declarations

Ethics Approval All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (i.e., institutional review boards) and with the Helsinki Declaration of 1975, as revised in 2000.

Consent to Participate Informed consent was obtained from all individual participants included in the study.

Consent to publish The authors affirm that human research participants provided informed consent for publication.

Conflict of Interest The authors declare no competing interests.

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