



# Stress and Substance Use During the COVID-19 Pandemic Lockdown among College Students in the United States

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### Abstract

The high prevalence of substance use among U.S. college students has been a long-term health problem that was likely intensified by the COVID-19 pandemic. In this study, we investigated the associations between pandemic-specific stress and current use of alcohol, (non-medical) cannabis, and tobacco, and estimated the unique impact of pandemic-specific stress on substance use while controlling for general stress. Current substance use was defined as daily or occasional use in the past three months. Data were collected online at one large, southeastern university in March of 2021 as part of the American College Health Association—National College Health Assessment III. Results indicated that while the two pandemic-specific stress measures were highly interrelated, stress due to a worsened financial situation (as a result of the COVID-19 pandemic) was more strongly associated with current use of alcohol and cannabis than was pandemic-specific overall stress. After controlling for students' sociodemographic characteristics, college-related factors, and an indicator of whether the student ever had COVID-19, the odds of reporting current use of alcohol and cannabis were significantly higher among students who reported that the pandemic made their financial situation a lot more stressful relative to students who reported otherwise. The latter finding was also observed after controlling for the level of overall stress, pointing to a unique impact of pandemic-specific stress on substance use. The study documents a robust association between pandemic-specific stress and college students' substance use and underscores the importance of providing wellness programs to help students deal with pandemic-specific and general stressors. Moreover, the study highlights the need for future research addressing the impact of pandemic-specific stress on substance use on other U.S. college campuses.

### Keywords

Alcohol use; Non-medical marijuana use; Smoking; Tobacco use; Teenagers; Young adults

## Introduction

Since Spring 2020, the COVID-19 pandemic and campus-wide

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lockdowns have become a considerable source of stress among the U.S. college students [1-3]. For example, college students reported considerably lower levels of psychological well-being in Spring 2020 relative to Fall 2019 [1]. To better evaluate the extent of the COVID-19 pandemic impact on college students' mental health, several professional societies and organizations developed innovative assessment tools to gather pandemic-specific information on the mental health of college students. For example, the American College Health Association partnered with the Healthy Minds Network to develop a survey component specific to COVID-19. This innovative component has been administered as part of the National College Health Assessment III since Fall 2020 [4]. Overall results from the Fall 2020 Assessment showed that "financial stress, a known predictor of student mental health, has been significantly affected by the pandemic" [1]. However, to our knowledge no study has examined relations between the pandemic-specific stress measures and college students' substance use.

According to decades of both theory and research, students who experience stress may deal with stress using various different coping strategies. Some students engage in positive coping strategies, e.g., seeking social support from family and friends, openly communicating with healthcare professionals, or meditating [5-8]. However, some students choose maladaptive coping strategies, such as substance use, physical and emotional distancing, and avoidance [7-12]. Moreover, stress and engaging in health-destructive behaviors have a reinforcing nature [13]. Similar to the relationship between stress and cigarette smoking stress and use of other substances could exacerbate the other [12]. For example, a student may engage in alcohol use to experience temporary stress reduction. However, because drinking alcohol does not address the initial cause of the stress (e.g., stress due to financial burden), the student experiences amplified stress when he/she abstains from drinking, which triggers further alcohol use in an attempt to reduce stress levels. The reinforcing nature of substance use as a coping strategy complicates cessation of substance use, making cessation especially challenging for students who experience chronic stress. Overall, prior literature points to a strong association between general stress and substance use but has not yet examined the role of pandemic-specific stress [14,15]. It is important to determine whether pandemic-specific stress simply adds to general stress levels or makes a unique contribution to substance use. If there is a unique contribution, additional resources or programs may be needed to help students cope with pandemic-specific stress.

In addition to stress, determinants of substance use include sociodemographic characteristics. Specifically, sexual and gender minority youth and young adults (including college students) have been shown to be at greater risk for use of alcohol, non-medical cannabis, and tobacco [16-18]. Moreover, there are disparities among specific sexual and gender minority groups, e.g., the prevalence of use of alcohol and tobacco (and other drugs) is higher among bisexual college students relative to heterosexual and gay/lesbian students [17]. In addition, there are disparities in substance use associated with race/ethnicity and other sociodemographic characteristics, e.g., relationship status [5,19-21]. While White college students are more likely to engage in substance use (including cigarette smoking, alcohol, and cannabis use) relative to racial and ethnic minorities,

there are significant disparities among the racial and ethnic minority groups. For example, the prevalence of cannabis use is highest among Hispanic students, followed by Asian and Black/African American students, and the prevalence of heavy alcohol drinking is higher among Hispanic relative to Black/African American students [20]. Therefore, it is important to consider students' sociodemographic characteristics when examining the association between stress and substance use.

We hypothesized that pandemic-specific stress would be associated with increased substance use, including current use of alcohol, non-medical cannabis, and tobacco. Goal 1 was to identify pandemic-specific stress measures that were associated with students' use of alcohol, non-medical cannabis, and tobacco during the pandemic lockdown (without controls). Goal 2 was to determine whether pandemic-specific stress was associated with substance use after controlling for students' characteristics (i.e., sociodemographic and college-related factors) and an indicator of whether a student has had COVID-19. Goal 3 was to determine whether pandemic-specific stress makes a unique contribution as a predictor of substance use after controlling for the level of the overall stress as well as students' characteristics.

## Material and Methods

### Data source and measures

The data source was the 2021 Spring American College Health Association-National College Health Assessment III. The online survey was administered to students at one large (total enrollment >25,000 students) southeastern university during the first two weeks of March 2021, that is, during the pandemic lockdown. The surveys were administered to a random sample (drawn from all students enrolled in the university) which was selected using simple random sampling. To address the study goals, we limited the dataset to reports with complete information on all measures (n=644, 94% of the total number of cases reported by the American College Health Association).

The two pandemic-specific stress measures included the level of overall stress due to the COVID-19 pandemic and the stress due to a (substantially) worsened financial situation as a result of the COVID-19 pandemic. Overall (pandemic-specific) stress was defined using responses to the survey question, "How has the COVID-19 pandemic impacted your overall level of stress?" [4]. Responses to this question were used to group students into three categories, based on whether the impact of COVID-19 on their overall level of stress was significant, moderate, or other (i.e., the COVID-19 pandemic had no effect or was associated with a decrease in the overall level of stress). Stress due to a worsened financial situation was measured using the question, "How has your financial situation been affected by the COVID-19 pandemic?" [4]. The response to this question was used to differentiate among students who reported that the impact of COVID-19 on their financial situation was "a lot more stressful", "somewhat more stressful", and other ("no significant change", "somewhat less stressful" and "a lot less stressful"). Both pandemic-specific stress measures were used as independent variables to address Goal 1. Moreover, stress due to a worsened financial situation was used as an independent variable to address Goals 2 and 3.

The level of overall stress was defined using the survey question "Within the last 30 days, how would you rate the overall level of stress you have experienced?" [4]. The responses were "high", "moderate",

"low", and "no stress". A binary overall stress measure differentiated between two levels of student's overall stress: high and not high (including moderate, low and no stress). The overall stress measure was used as an independent variable to address Goal 3.

The substance use measures were binary (yes, no) and included the students' current use (in the past three months) of alcohol, (non-medical) cannabis, and tobacco. The measures were constructed via pooling responses to questions regarding ever-use (i.e., lifetime use) and use in the past three months ("never", "once or twice", "monthly", "weekly", "daily or almost daily"). Each substance use measure differentiated between current users (i.e., occasional and daily users) and non-users (i.e., never and former users). The substance-use measures were included as the dependent variables to address all study goals.

The secondary measures included: (1) demographic characteristics such as age, race/ethnicity, gender identity, sexual orientation, and relationship status, (2) college-related factors such as program type (undergraduate, graduate), enrollment type (part-time, full-time), and the student's overall GPA (A, B, C/below C), and (3) an indicator of ever having (or never having) a COVID-19 diagnosis or symptoms. The indicator differentiated between students who reported ever having either a positive COVID-19 test or symptoms consistent with COVID-19 and those students who reported having neither a diagnosis nor symptoms. The secondary measures were included as independent variables to address Goals 2 and 3.

### Sample description in terms of secondary characteristic and overall level of stress

The sample (n=644) included students who were 18-20 years old (41%), 21-24 years old (43%) and 25-32 years old (17%). The sample included Hispanic (27%), Non-Hispanic (NH) Black/African American (BAA, 8%), NH White (49%), and other non-Hispanic students (that is, Non-Hispanic students other than NH BAA and NH White students, 16%). About 67% of students self-identified as cisgender women, 28% as cisgender men and 5% as transgender/gender non-binary; 5% identified as gay/lesbian, 13% as bisexual, 10% as other sexual minority (e.g., queer), and 73% as heterosexual. About 46% of students reported being in a relationship (including married/partnered or being in a relationship but not married/partnered) and 54% of students reported not being in a relationship. The sample included undergraduate (82%) and graduate (18%) students, who were enrolled either full-time (87%) or part-time (13%). Reported GPA was A (65%), B (29%) and C/below C (7%). About 22% of students reported (ever) having COVID-19 diagnosis or symptoms and 78% of students reported having neither a COVID-19 diagnosis nor the symptoms. In addition, 32% of students reported a high level of overall stress in the past 30 days, whereas 52% reported moderate, 16% reported low and 1% reported no stress.

### Statistical analysis

The categorical measures with more than two categories were used for descriptive purposes only, while the binary measures were used in the statistical analysis. Goal 1 was addressed using chi-square tests. Goal 2 (and Goal 3) was addressed with three multiple logistic regression models, one model for each substance use measure. For Goal 2, the independent variables in the models included pandemic-specific stress due to a worsened financial situation along with all secondary measures. For Goal 3, the overall level of stress was

included as an independent variable in the model in addition to all independent variables used in the Goal 2 model.

Analyses for each goal were conducted at the 5% significance level. However, we used the estimated percentages and odds ratios with the corresponding confidence intervals, in addition to the p-values, when determining significance of each effect, as is recommended by the American Statistical Association [22]. The SAS® 9.4 software package was used to perform the analysis [23].

## Results

### Goal 1: Identifying the pandemic-specific stress measures associated with substance use

About 44% of students reported that the COVID-19 pandemic had significantly increased their overall level of stress and 30% reported that the COVID-19 pandemic made their financial situation a lot more stressful. There was a significant association between the two pandemic-specific stress measures (Chi-Square=78.28, df=1, p<0.001). Specifically, the percentage of students who reported that COVID-19 significantly increased their overall level of stress was considerably higher among students who reported that the COVID-19 pandemic had made their financial situation a lot more stressful (71%) relative to students who reported that COVID-19 had not made their financial situation a lot more stressful (33%).

About 63% of students reported current use of alcohol. Figure 1 illustrates the significant associations between pandemic-specific overall stress and current alcohol use (Chi-Square=3.95, df=1, p=0.047), and between pandemic-specific financial stress and current alcohol use (Chi-Square=9.02, df=1, p=0.003). Because the latter association was more pronounced, it appears that stress due to a worsened financial situation as a result of the pandemic was more strongly associated with current alcohol use than was overall stress due to the pandemic.

About 22% of students reported current use of (non-medical) cannabis. Figure 1 illustrates the significant association between pandemic-specific financial stress and current use of cannabis (Chi-Square=12.73, df=1, p<0.001). The association between pandemic-specific overall stress and current use of cannabis was not significant.

About 14% of students reported current use of tobacco. However, current use of tobacco was not significantly associated with either of the pandemic-specific stress measures.

Based on the results presented in this Section, the final set of analyses for addressing Goals 2 and 3 focused on pandemic-specific stress due to a worsened financial situation.

### Goal 2: Estimating the impact of increased financial stress on substance use while controlling for other factors

Table 1 presents the model-assisted estimates for each substance use measure. Consistent with Goal 1 findings, the odds of current alcohol and cannabis use were higher among students who reported that COVID-19 made their financial situation a lot more stressful than among other students. However, the odds of current tobacco use did not differ between students who reported that COVID-19 made their financial situation a lot more stressful and students who reported otherwise.

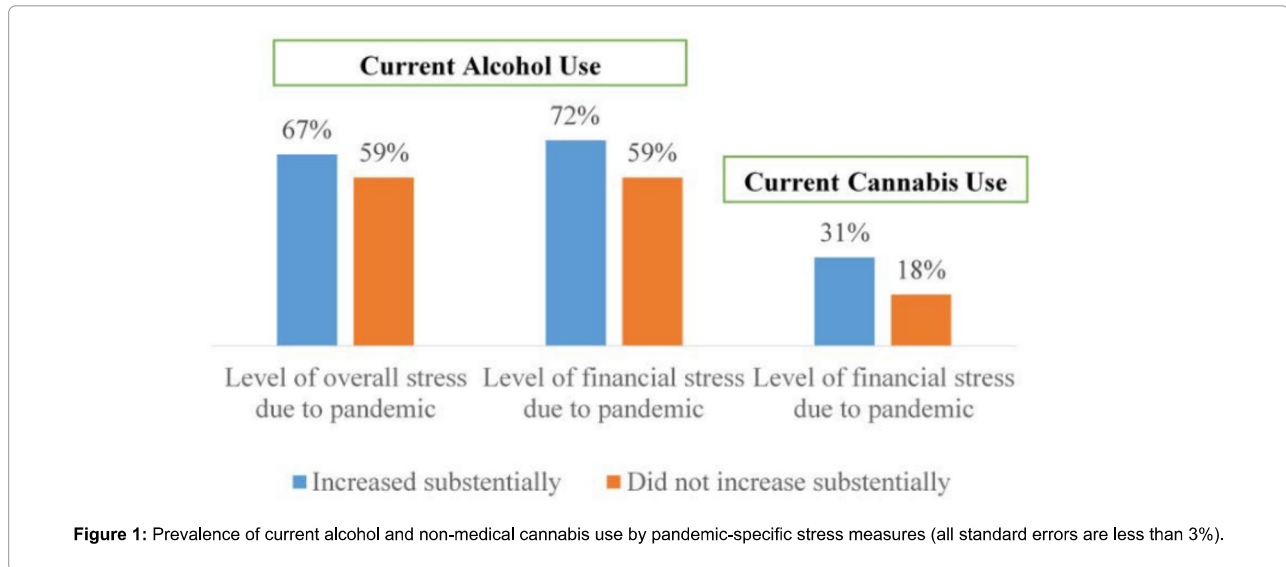
Additional results (summarized in Table 1) pointed to some common findings across the substance use measures. Specifically, the odds of current alcohol, cannabis, and tobacco use were all significantly higher among students who were in a relationship relative to students who were not in a relationship. Moreover, the odds of current use of

cannabis and tobacco were significantly higher among students who reported having had a COVID-19 diagnosis or symptoms compared to students who reported neither diagnosis nor symptoms. Finally, the odds of current use of alcohol and cannabis were significantly higher for NH Other students (i.e., NH students who were neither NH BAA nor NH White) relative to NH White students, and for bisexual students relative to heterosexual students.

**Table 1:** Results of three multiple logistic regression models predicting current substance use (the data source is the 2021 spring american college health association-national college health assessment iii, march of 2021, USA)

Comparison vs. a Reference Group (RF)	Odds Ratio	95% Simultaneous Confidence Bands <sup>a</sup>
<b>Current Alcohol Use<sup>b</sup></b>		
COVID-19 made the financial situation a lot more stressful (p=0.039): yes vs. no	<b>1.54</b>	<b>1.02:2.31</b>
Age group (p<0.001), RF is "25-32 years old"		
18-20 years old	<b>0.36</b>	<b>0.17:0.76</b>
21-24 years old	1.40	0.70:2.78
Race/ethnicity (p=0.031), RF is "NH White"		
NH BAA	0.54	0.24:1.20
NH Other	<b>0.51</b>	<b>0.27:0.95</b>
Hispanic	0.91	0.53:1.54
Gender identity (p=0.047), RF is "Cisgender man"		
Cisgender woman	1.14	0.72:1.82
Transgender/gender non-binary	0.38	0.13:1.10
Sexual orientation (p=0.015), RF is "Heterosexual"		
Gay/lesbian	1.42	0.48:4.19
Bisexual	<b>2.90</b>	<b>1.30:6.48</b>
Other sexual minority	1.05	0.49:2.24
Relationship status (p=0.002): in a relationship vs. not in a relationship	<b>1.81</b>	<b>1.25:2.60</b>
<b>Current Non-Medical Cannabis Use<sup>c</sup></b>		
COVID-19 made the financial situation a lot more stressful (p=0.009): yes vs. no	<b>1.76</b>	<b>1.15:2.68</b>
Race/ethnicity (p=0.029), RF is "NH White"		
NH BAA	0.70	0.25:1.92
NH Other	<b>0.37</b>	<b>0.15:0.94</b>
Hispanic	1.19	0.68:2.09
Sexual orientation (p=0.002), RF is "Heterosexual"		
Gay/lesbian	2.15	0.74:6.23
Bisexual	<b>2.76</b>	<b>1.39:5.50</b>
Other sexual minority	1.87	0.82:4.27
Relationship status (p=0.004): in a relationship vs. not in a relationship	<b>1.85</b>	<b>1.22:2.80</b>
Having COVID-19 diagnosis or symptoms (p=0.013): yes vs. no	<b>1.77</b>	<b>1.13:2.79</b>
<b>Current Tobacco Use<sup>d</sup></b>		
Relationship status (p=0.025): in a relationship vs. not in a relationship	<b>1.72</b>	<b>1.07:2.77</b>
Having COVID-19 diagnosis or symptoms (p=0.009): yes vs. no	<b>1.95</b>	<b>1.18:3.22</b>

<sup>a</sup>: The simultaneous confidence bands are computed using Bonferroni method, odds ratios significantly different from 1.0 are bold.  
<sup>b</sup>: The model for the current use of alcohol was significant (Likelihood Ratio Chi-Square=117.85, df=17, p<0.001); college-related factors and an indicator of having (or not having) a COVID-19 diagnosis or symptoms were not significant at 5% level (results are not presented).  
<sup>c</sup>: The model for the current use of cannabis was significant (Likelihood Ratio Chi-Square=63.77, df=17, p<0.001); age, gender identity, and college-related factors were not significant at 5% level (results are not presented).  
<sup>d</sup>: The model for the current use of tobacco was significant (Likelihood Ratio Chi-Square=27.90, df=17, p=0.046); pandemic-specific stress due to a worsened financial situation, age, race/ethnicity, gender identity, sexual orientation and college-related factors were not significant at 5% level (results are not presented).



### Goal 3: Identifying the contribution of pandemic-specific stress to substance use after controlling for the overall level of stress and other factors

The three multiple logistic regression models for predicting current alcohol use (Likelihood Ratio Chi-Square=120.18, df=18,  $p < 0.001$ ), cannabis use (Likelihood Ratio Chi-Square=64.05, df=18,  $p < 0.001$ ), and tobacco use (Likelihood Ratio Chi-Square=31.19, df=18,  $p = 0.027$ ) remained significant after imposing the additional control for overall stress. The results based on these models were similar to the ones depicted in Table 1. (The one exception was that after controlling for the level of the overall stress, gender identity was a significant predictor of current use of alcohol at the 10% level only). The level of overall stress was not significantly associated with either current alcohol use or current cannabis use, but it appeared to be associated with current tobacco use (but the association was significant at 10% level). The effect of pandemic-specific financial stress on current alcohol and cannabis use was consistent with the one observed in Goal 2. Indeed, the odds of current alcohol use were significantly higher among students who reported the pandemic made their financial situation a lot more stressful than among students who reported otherwise (Odds Ratio= 1.64, 95% Confidence Interval =1.08:2.50,  $p = 0.020$ ). Similarly, the odds of current cannabis use were significantly higher among students who reported that the pandemic made their financial situation a lot more stressful (Odds Ratio= 1.71, 95% Confidence Interval =1.11:2.64,  $p = 0.015$ ). In contrast, pandemic-specific financial stress was not significantly related to current tobacco use. The odds of current tobacco use were similar for students who reported that the pandemic made their financial situation a lot more stressful and students who reported otherwise.

## Discussion

### Discussion of the key findings

The current study was designed to examine the associations between pandemic-specific stress and substance use, as well as whether pandemic-specific stress makes a unique contribution to substance use after controlling for the overall level of stress. Our hypothesis that pandemic-specific stress is associated with increased substance use,

including current use of alcohol, non-medical cannabis and tobacco, was partially supported. While the associations were significant with respect to current use of alcohol and non-medical cannabis, there was no association with respect to current tobacco use. Moreover, between the two pandemic-specific stress measures, stress due to a worsened financial situation (as a result of the pandemic) appeared to be the stronger predictor of current use of alcohol and non-medical cannabis.

The findings linking pandemic-specific financial stress and alcohol and cannabis use are highly important, because they point to an effect of pandemic-specific stress on substance use. The high rate of substance use among college students is of concern due to its potential negative health consequences. Furthermore, substance use has been directly linked to poorer mental health outcomes, some of which (e.g., depression) are associated with poorer academic performance and decisions to leave college [24-26]. Past research (pre-Covid-19) has also shown that self-reported stress is associated with anxiety, depression, substance use, poorer quality of life and well-being [27,28]. Thus, in addition to influencing substance use, pandemic-specific stress could affect other health-risk behaviors and mental health outcomes and could potentially (directly or indirectly through mental health) lead to dropping out of college, which has implications for future employment, earnings, health, and psychological well-being. Moreover, substance use and associated mental health outcomes during adolescence and early adulthood can continue through the transition to adulthood, further affecting well-being and health [29].

The study also indicated that pandemic-specific financial stress was more important for predicting current use of alcohol and non-medical cannabis than was the overall level of stress during the past 30 days. Furthermore, pandemic-specific financial stress made a unique contribution to substance use with overall stress controlled. This unique effect of pandemic-stress suggests that programs and policies to address pandemic-specific financial stress such as the programs supported through the Higher Education Emergency Relief Fund may be beneficial. It also shows that general stress and pandemic-specific stress are distinct constructs, and that pandemic-specific stress may not be adequately captured by a general measure of overall stress [30].

## Discussion of the secondary findings

While the study is not suitable for estimating prevalence rates (see study limitations below), the study findings pointed to relatively high percentages of students who reported a significant increase in overall stress due to the pandemic (43%) and stress due to a substantially worsened financial situation as a result of the pandemic (30%), as well as high levels of the overall stress (32%). Although, we are not aware of other studies estimating these percentages in Spring 2021, analysis of data collected for seven U.S. colleges in Spring 2020 pointed to a similar percentage (26%) of students who reported that the pandemic has made their financial situation a lot more stressful [1]. The observed high percentages for stress measures are consistent with reduced access to mental healthcare services due to the pandemic. Indeed, among students who attempted to seek mental healthcare during the pandemic, 60% of students reported that it was more difficult to access the health care during the pandemic, in comparison to pre-pandemic [1].

In addition, the study indicated that the prevalence of current use of alcohol and cannabis was higher among bisexual students relative to heterosexual students, which is consistent with the broader literature on sexual orientation and substance use among college students [17,31]. However, we could not find prior studies showing that current alcohol use is more prevalent among older students (25-32 years old) relative to younger students (18-20 years old) or that current use of alcohol, cannabis, and tobacco is more common among students who are in a relationship relative to those who are not in a relationship. The latter finding does not agree with the notion [32] that being in a romantic relationship protects individuals from engaging in health-risk behaviors. It may be that some couples share substance use preferences and support each other's use.

Additional findings highlighted existing disparities in substance use associated with whether (or not) students had COVID-19 diagnosis or symptoms. The current use of alcohol (and cannabis) was positively associated with ever having COVID-19 diagnosis or symptoms. This association could be explained as follows. First, having COVID-19 diagnosis or symptoms may be perceived as an additional stressor among students who were substance users prior to the disease, complicating substance-use cessation efforts (especially for students with a substance use disorder) and leading to continued use of substances after having COVID-19. Second, there is a negative association between substance use and immune system response, and, correspondingly, a positive association between the substance use and contracting respiratory infections, such as COVID-19 [33]. Future studies incorporating the time of contracting COVID-19 and initiation of substance use are needed to explore the impact of alcohol, cannabis and tobacco use as risk factors for contracting COVID-19, and whether substance-use cessation behaviors are influenced by the COVID-19 infection.

Our study has several noteworthy limitations. First, the response rate was very low for the Spring 2021 Assessment, such that the American College Health Association computed the response rate at 11%. However, this low response rate is consistent with prior administrations, e.g., the overall response rate computed over seven colleges was about 9% in 2020 Spring Assessment [1]. Second, there were relatively small samples for some specific cross-groups, e.g., there were only four students who reported being a current tobacco user and self-identified as transgender/gender non-binary, potentially affecting the statistical power. Perhaps as a result of this limitation,

our study did not show consistent disparities across the substance use measures associated with gender identity and sexual minority status [16-18]. Specifically, in our study the current use of tobacco was not associated with either gender identity or sexual orientation (after controlling for other factors). Third, it should be noted that our measure of overall stress asked for a global rating of stress without giving examples of particular stressors and thus, may underestimate the actual level of overall stress experienced. Another limitation is that the sampling strategy was based on a simple random sample. Thus, the prevalence estimates reported in this paper should not be assumed valid for the population of all U.S. college students (or the population of all students enrolled in the university from which the sample was drawn).

Future investigations should include measures of other kinds of stress in research on college student substance use during the pandemic. For example, academic-related stress has been linked to increased substance use pre-pandemic but its impact on substance use or other aspects of well-being (e.g., mental health) during the COVID-19 pandemic has not been addressed [27]. The results will advance our understanding of whether the effects of education and academic performance which were significant sources of stress before the pandemic are surpassed by effects of pandemic-specific stressors [27]. In addition, future studies should examine how pandemic-specific stress measures are related to conventional measures of general stress and distress. This knowledge will help determine if pandemic-specific stress is distinct from other kinds of stress.

## Conclusion

The study highlights the urgent need for programs and policies to help college students address pandemic-caused financial hardship. "Coronavirus Aid, Relief, and Economic Security Act" has enabled distributing financial aid to postsecondary-institution students in need through the Higher Education Emergency Relief Fund [30,34]. Despite importance of the program, Schmidt & Weissman (2021) identified some limitations of how these aids have been distributed and offered several recommendations to help improve the implemented procedures at U.S. Institutions of Higher Education, e.g., to inform students about aid availability and requirements using multiple channels, such as social media and college websites [34].

In addition to financial support, it is important to provide students with access to wellness programs both on campus and remotely to help them cope with stress and avoid substance use. An example of such a program might be the University of Vermont's Wellness Environment program which was found to promote healthy behaviors (e.g., a substance-free lifestyle) during the campus lockdown [3]. Such wellness programs should incorporate health-promoting coping strategies to help students deal with pandemic-specific and general stressors (e.g., academic-related stressors), yet be tailored to students, e.g., incorporate an individualized intervention delivered to a student via cell phone text messaging, [35]. Moreover, the associations between pandemic-specific stress and substance use documented in the present study indicate that campus-wide programs and campaigns to reduce stress and improve coping skills might help prevent increases in substance use.

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