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# Coping with A Year of Online Education in Lock-Down: Impact of Prolonged COVID-19 Stressors On Problematic Drinking in College Students

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## Abstract

The COVID-19 pandemic brought about unprecedented stressors for college students. Early reports found the immediate onset of these stressors led to increased problematic drinking and psychological distress in university students. However, it has remained unclear what lasting effects the pandemic will have on drinking and coping mechanisms. The current study examined the impact of prolonged COVID-19 stressors on the drinking behavior of college students a year into the pandemic. College students (N = 377) completed an online survey in the spring of 2021 that assessed their drinking during the pandemic, coping styles, and level of stress on 8 COVID-19 specific stressors developed by the research team. Our results showed a large percentage of college students continued to report problematic and increased drinking a year into the pandemic. Stress concerning online education was the strongest predictor of increased drinking, problematic drinking, and using substances to cope. These results suggest that students may be sensitive to abrupt changes in learning modality, and many may turn to negative coping mechanisms. This is an important consideration for educators when making changes to their instructional plans and suggests helping students regain an internal locus of control concerning their academics could be beneficial.

## Introduction

In March 2020, the novel coronavirus (COVID-19) pandemic necessitated the closure of most university campuses and campus housing in the United States (US). This action brought about unprecedented stressors for college students including an abrupt pivot to online instruction, potential housing loss, potential wage and/or job loss, social isolation, and general concerns about health and safety. With the immediate onset of these extreme stressors, there was concern that alcohol misuse would spike as people sought ways to cope (Clay & Parker, 2020; Ramalho, 2020). Given the propensity of college students to engage in problematic drinking under normal circumstances, there was specific concern that college students would increase their alcohol use as a way to cope with pandemic stressors (Bollen et al., 2021; Charles et al., 2021; Lechner et al., 2020).

Reports from early in the pandemic (Spring 2020) showed increased alcohol drinking for college students (Bertrand et al., 2021; Charles et al., 2021; Lechner et al., 2020) and adults (Jacob et al., 2021; Vanderbruggen et

al., 2020; Weerakoon et al., 2021). Notably, increased psychological distress had a positive association with increased alcohol drinking (Jacob et al., 2021; Lechner et al., 2020; Rodriguez et al., 2020; Weerakoon et al., 2021). However, Charles et al. (2021) found that by Fall 2020 many of the psychological distress symptoms had returned to pre-pandemic levels for college students. At that time, the stay-at-home orders were still in place for most of the US and a majority of universities were still fully virtual. Therefore, a reduction in psychological distress concerning COVID-19 by Fall 2020 may indicate college students were beginning to acclimate to the pandemic-related stressors. However, the long-term impact of COVID-19 related stressors on drinking behavior remains unknown.

The current study sought to investigate the long-term impact of COVID-19 related stressors experienced by college students on alcohol drinking behavior a year after the initial university closures in the US. Specific stressors expected to impact college students were isolation due to quarantine and lock-down orders in most US cities, academic stress due to the abrupt switch to online-only education many universities implemented, living situation stress due to potential change in housing arrangements, and financial stress due to potential loss of wages or jobs during the pandemic.

Given that isolation and solitary drinking, financial stress, and academics have been shown to impact drinking behavior (Brown & Richman, 2012; de Goeij et al., 2015; Keough et al., 2015; Singleton, 2007; Wormington et al., 2011); we hypothesized stressors related to isolation, the COVID-19 virus, academics, living situation, and finances would increase drinking in college students. We also examined sex differences in pandemic-related stress and drinking behavior due to evidence suggesting females are more likely to drink to cope with stress compared to males (Peltier et al., 2019). For our analyses, we focused on biological sex instead of gender identity due to biological systems potentially contributing to differences in stress-related drinking (Peltier et al., 2019).

## Method

### Participants

Participants were recruited through email and course announcements at the researchers' university (St. Edward's University, located in Austin, TX), as well as ads and posts on social media platforms including Facebook, Instagram, Reddit, SurveyCircle, and College Promise Network. Data were collected using Qualtrics from February 4 - April 25, 2021. At this time period, a majority of universities were still operating virtually, and COVID-19 vaccine availability to the general population was limited in the US. A total of 876 individuals consented to participate. Responses were excluded for indicating they were not an undergraduate student ($n$ = 31), completing less than 91% of the survey ($n$ = 167), or for being flagged by the researchers as bots before a captcha was added to the survey ($n$ = 301). These exclusions resulted in a final sample size of 377 participants (320 females; 49 males; 8 not disclosed).

### Procedure

This study was part of a larger online survey investigating alcohol use and sexual desire among college students

during the COVID-19 pandemic (for the sexual desire component see Goldey et al., 2022). The anonymous Qualtrics survey included a measure of COVID-19 stress created by the research team, as well as previously validated measures evaluating alcohol use, coping mechanisms, and perceived stress. Unrelated to this study, participants were also asked to complete a measure assessing dyadic and solitary sexual desire. Participants provided consent prior to initiation of the survey and were debriefed and referred to support services for mental health and substance use following completion of the survey. All procedures were approved by the university's IRB.

**Measures**

To examine the multifaceted nature of COVID-19 related stressors and their impact on college students, the research team developed a questionnaire containing items specific to stressors faced by college students during the pandemic. This included items addressing stress related to academics, finances, living situation, isolation, and concern about the health of one's own self as well as family members and friends. The final questionnaire included 38 items; 29 original items created by the researcher team and 9 items adapted from existing measures (Barzilay et al., 2020; Ellis et al., 2020; Huth-Bocks, 2020; McLean & Cloitre, 2020; Russell et al., 1978). Items were presented in randomized order on a 7-point Likert scale ("0" = not at all to "6" = very much so) asking participants the extent to which the statement described their feelings over the past month. In addition to the COVID-19 stress measure designed for this study, the researchers also included the validated Perceived Stress Scale (PSS) as a general measurement of overall stress (Cohen, 1988). This 10-item scale measures perceived stress over the last month using a 5-point Likert scale ("0" = never to "4" = very often). The Alcohol Use Disorders Identification Test-Concise (AUDIT-C) was used to measure and categorize drinking behavior (Bush et al., 1998). It is a 3-item measure with a scale of 0-12. For each question, the answer choices range from 0 to 4 points. A score of 3 or more in females or 4 or more in males is considered to be hazardous or risky drinking. Finally, the abbreviated Coping Orientation to Problems Experienced (Brief-COPE) was used to measure coping mechanisms used during the pandemic (Carver, 1997). It is a 28-item measurement that uses a 4-point Likert scale ("1" = I haven't been doing this at all" to "4" = "I've been doing this a lot"). This measurement reduces into 14 subscales that measure specific types of coping mechanisms, including the use of substances to cope.

**Statistical Analyses**

Data were analyzed using SPSS 27.0. A principal components analysis (PCA) was used to segment out the specific factors contributing to overall COVID-19 stress. Sex differences were analyzed using independent samples t-tests for AUDIT-C, the PSS, and the COVID-19 stress measures (continuous variables) and chi-square test of independence for change in drinking (categorical variable). One-way ANOVAs were used to test for differences in reported COVID-19 stress factors based on whether drinking changed during the pandemic. Post hoc Tukey HSD pairwise comparisons were used when appropriate. To investigate whether the hypothesized COVID-19 stress factors predicted AUDIT-C score or scores for the substance use subscale of the Brief-COPE, multiple linear regressions were used. The controls of age and biological sex were included in the first step, main effects were in the second step, and sex interactions were in the final step. Additionally, a multinomial logistic regression

was used to test whether COVID-19 stress factors predicted whether an individual increased their drinking, decreased their drinking, or kept their drinking the same during the pandemic. For all analyses, $p < .05$ was deemed significant.

## Results

### Demographics and Drinking Behavior

On average, the participants were 21 years old (SD = 2.83), 85% female, 59% Caucasian/White, and 73% were living with family during the pandemic. Additionally, 64% of the participants indicated that they drink alcoholic beverages ($n$ = 240). The average score on the AUDIT-C was 3.5 ($SD$ = 1.99), with 61% of those who drink qualifying for risky or problematic drinking based on their AUDIT-C score and biological sex. Of those who drink, 75% report drinking primarily with others instead of alone. When asked if their drinking changed since the start of the pandemic, 41% reported drinking more, 31% reported drinking less, and 28% reported no change in their drinking. Additionally, 62% indicated they would drink more if they were going out to bars and events, and 64% indicated financial concerns did not impact how much they drank (see Table 1).

Table 1. Demographics (N = 377)

| **Characteristic** | ***n* (%)** |
|---|---|
| **Biological Sex** | |
| Female | 320 (84.9%) |
| Male | 49 (13%) |
| Intersex | 1 (0.3%) |
| Prefer not to say | 7 (1.9%) |
| **Gender Identity** | |
| Woman | 270 (71.6%) |
| Man | 58 (15.4%) |
| Nonbinary or genderqueer | 41 (10.9%) |
| Other | 5 (1.3%) |
| Prefer not to say | 3 (0.8%) |
| **Age** | |
| 18-19 | 125 (33.2%) |
| 20-22 | 200 (53.1%) |
| 23-25 | 42 (11.1%) |
| 26-30 | 6 (1.6%) |
| 31+ | 4 (1.1%) |
| **Race/Ethnicity** [a] | |
| Asian | 55 (14.6%) |
| Black/African American | 24 (6.4%) |
| Caucasian/White | 224 (59.4%) |
| Hispanic/Latinx | 95 (25.2%) |

| Characteristic | *n* (%) |
|---|---|
| Native American | 12 (3.2%) |
| Pacific Islander | 2 (0.5%) |
| Other | 5 (1.3%) |
| Prefer not to say | 4 (1.1%) |
| **Living Situation for Majority of Pandemic** [a] | |
| Alone | 35 (9.3%) |
| With roommate(s) | 104 (27.6%) |
| With romantic partner | 42 (11.1%) |
| With children | 6 (1.6%) |
| With family | 274 (72.7%) |

[a] Percentages do not equal 100 due to participants selecting all options that applied

**COVID-19 Stress Measure Principal Component Analysis**

The COVID-19 Stress measure created by the researchers had high internal consistency ($\alpha = 0.93$). However, this measurement was designed to assess multiple domains of pandemic-related stress. Therefore, a PCA was performed to analyze the individual components of pandemic-related stress (for in-depth analysis see Goldey et al., 2022). Bartletts' test of sphericity was significant ($\chi^2 = (703) = 6023.49$, $p < .001$), and the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy indicated underlying factors were producing variance in the measure (KMO= .92). Together these tests suggest a PCA was appropriate. Eight components with eigenvalues > 1 were extruded using the PCA. These components included: 1) Isolation Stress, 2) Virus Stress, 3) Academic Stress, 4) Living Situation Stress, 5) Financial Stress, 6) Concerns about Racism and Prejudice, 7) Family and Caregiving Stress, and 8) Concerns about Healthcare Access. The specific items, component loadings, communalities, and eigenvalues are provided in Table 2.

Table 2. Items, Eigenvalues, Component Loadings, and Communalities for COVID Stress Measure

| Component (Eigenvalue) | Item | Component Loading | Communality |
|---|---|---|---|
| **Isolation and Mental Health** (11.27) | I feel that social isolation has harmed my mental health. | .732 | .641 |
| | I am worried about the difficulty of making new friends or finding a romantic partner during the pandemic. | .700 | .530 |
| | I feel isolated from others. | .692 | .680 |
| | I feel less connected to friends because of social distancing. | .690 | .569 |
| | I feel bored. | .674 | .511 |
| | I feel as if I am losing creativity since the pandemic began. | .623 | .523 |

| **Component** (Eigenvalue) | **Item** | **Component Loading** | **Communality** |
|---|---|---|---|
| | I feel limited in the recreational or leisure activities that are available to me during the pandemic. | .606 | .552 |
| | I feel that I spend too much time on social media due to the pandemic. | .537 | .486 |
| | I feel that I don't have anyone to turn to with problems or concerns. | .506 | .464 |
| | I fear that life will never go back to "normal". | .386 | .462 |
| **Virus** (2.93) | I am worried about becoming ill from possible or certain exposure to the coronavirus. | .772 | .750 |
| | I am worried about the possibility that I will unknowingly infect someone else with COVID. | .760 | .681 |
| | I am worried about the possibility of a family member or other loved one getting COVID. | .729 | .654 |
| | I am worried that if I catch the coronavirus I will have long-term health problems as a result. | .637 | .572 |
| | I feel uncertain about when the pandemic will end or how it will end. | .488 | .600 |
| | I am worried that the government is not doing enough to protect or support us during the pandemic. | .484 | .564 |
| | I am worried because my job requires possible exposure to coronavirus. | .407 | .378 |
| **Academic** (2.23) | I am worried about the impact of online learning on my grades. | .765 | .747 |
| | I am worried about keeping up with assignments and/or taking exams online. | .719 | .708 |
| | I am concerned with the decrease in motivation for studying I've had since classes went remote. | .700 | .748 |
| | I am worried about the impact COVID-19 has on graduate or professional school applications. | .496 | .495 |
| **Living Situation** (1.61) | I am spending so much time with my household members that they are getting on my nerves. | .791 | .728 |
| | I feel tension or conflict between my household members. | .747 | .685 |
| | In my current living situation, I have too little freedom or privacy. | .636 | .594 |
| | I feel that I do not have an adequate living space to thrive in academics or social connection. | .456 | .538 |
| **Financial** | I am worried that I won't have enough money to pay | .775 | .725 |

| Component (Eigenvalue) | Item | Component Loading | Communality |
|---|---|---|---|
| (1.42) | for food, rent, or other necessities. | | |
| | I am worried that my or my family's income will decrease due to the economic impact of the pandemic. | .704 | .663 |
| | I am worried about finding and/or keeping a job during the pandemic. | .539 | .450 |
| **Concerns about Racism and Prejudice** (1.19) | I have conflicting feelings because I want to attend protests for racial justice but COVID is still at large. | .791 | .750 |
| | I am concerned that the pandemic has made racism and anti-immigrant prejudice worse. | .646 | .616 |
| | I feel impacted by events of racial injustice towards myself or others. | .606 | .555 |
| **Family and Caregiving** (1.09) | I have been feeling stressed about helping my younger siblings with online school or homework. | .699 | .576 |
| | I have been feeling stressed about taking care of family members (children, siblings, grandparents, etc.). | .665 | .650 |
| | I am concerned for myself and/or my family because my racial/ethnic group has been disproportionately harmed by COVID. | .554 | .600 |
| | I have been feeling stressed due to taking on more family chores (cooking dinner, cleaning house, etc.) while in school. | .521 | .540 |
| **Healthcare Access** (1.06) | I am worried about being more susceptible to the coronavirus because of a medical condition. | .715 | .635 |
| | I am worried that it will be difficult for me to get medication, important medical procedures, or other health necessities due to the coronavirus pandemic. | .608 | .592 |
| | I fear being denied medical treatment because of discrimination. | .577 | .588 |

**Sex Differences in Drinking Behavior and COVID-19 Stress**

An independent samples t-test was conducted to evaluate sex differences in overall drinking using AUDIT-C score. Males had significantly higher scores on the AUDIT-C ($M$ = 4.32, $SD$ = 2.63) compared to females ($M$ = 3.35, $SD$ = 1.82), $t(44.02) = -2.17$ $p = .036$, suggesting the males in this sample were drinking more and engaging in more risky drinking behavior. However, a chi-square test of independence found no significant relationship between sex and change in drinking during the pandemic (no change, decreased drinking, or increased drinking), $\chi^2$ (2, $N$ = 235) = 0.31, $p = .857$. Therefore, although males were engaging in more problematic drinking compared

to females, there was not an overall sex difference in either increased or decreased drinking due to the pandemic. Additional independent samples t-tests were performed to assess sex differences in total COVID-19 stress and the eight individual COVID-19 stress factors (see Figure 1A). Females reported significantly more total COVID-19 stress ($M$ = 3.52, $SD$ = 1.04) compared to males ($M$ = 2.98, $SD$ = 1.28), $t(365) = 3.31$ $p = .001$, as well as increased Isolation Stress ($t(56.59) = 2.34$ $p = .023$), Virus Stress ($t(366) = 4.284$ $p < .001$), Academic Stress ($t(366) = 1.42$ $p = .021$), Racism and Prejudice Concern ($t(58.42) = 3.44$ $p = .001$), and Healthcare Access Concern ($t(366) = 2.159$ $p = .031$). In addition to COVID-19 stress, females also exhibited higher overall stress on the PSS ($M$ = 2.57, $SD$ = 0.66) compared to males ($M$ = 2.14, $SD$ = 0.68, $t(326) = 3.88$, $p < .001$).

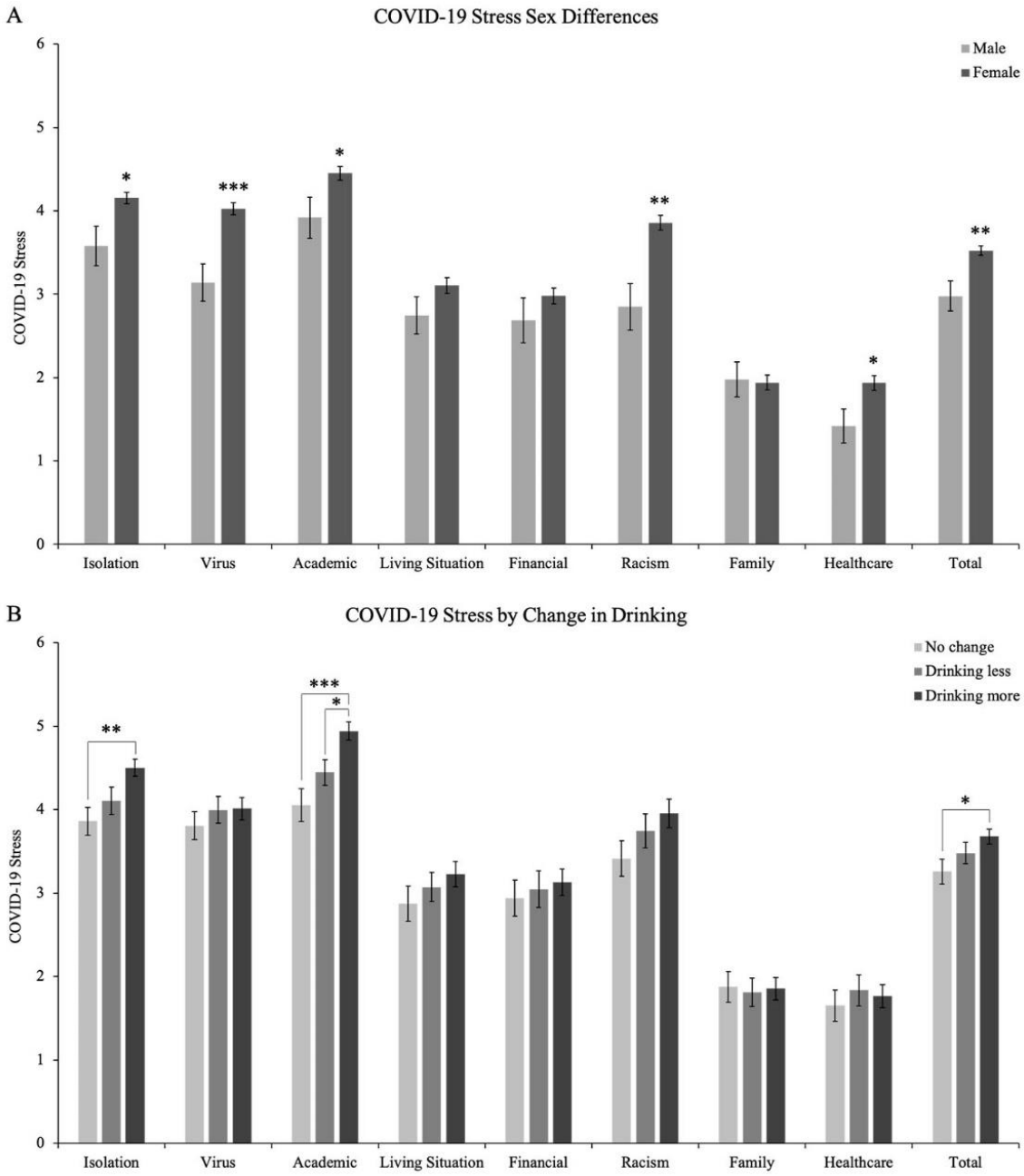


Figure 1. Differences in COVID-19 related Stress by Sex (A) and Change in Drinking during the Pandemic (B). COVID-19 stress = scores on the COVID-19 stress measurement developed by the research team. $^{+}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

**Differences in COVID-19 Stress by Change in Drinking**

One-way ANOVAs were conducted to compare the effects of Change in Drinking during the pandemic (no change, decreased drinking, or increased drinking) on the eight COVID-19 stress factors and the total combined COVID-19 stress (see Figure 1B). These analyses revealed significant effects for Isolation Stress ($F(2,236) = 5.49$, $p = .005$), Academic Stress ($F(2,236) = 9.46$, $p < .001$), and Total COVID-19 Stress ($F(2,235) = 3.50$, $p = .039$). Post hoc comparisons using Tukey HSD indicated that those whose drinking increased during the pandemic had higher isolation stress ($M = 4.50$, $SD = 1.02$) compared to those whose drinking had not changed ($M = 3.87$, $SD = 1.37$, $p = .004$). Those whose drinking increased during the pandemic also reported more academic stress ($M = 4.94$, $SD = 1.05$) compared to those whose drinking did not change ($M = 4.05$, $SD = 1.60$, $p < .001$), as well as those whose drinking decreased ($M = 4.45$, $SD = 1.33$, $p = .039$). Lastly, those who reported increased drinking had overall higher COVID-19 stress ($M = 3.68$, $SD = 0.86$) compared to those whose drinking did not change ($M = 3.26$, $SD = 1.19$, $p = .030$). A factorial ANOVA was also performed to test for an interaction between Change in Drinking and Sex, however there were no significant interactions for Total COVID-19 Stress or any of the individual stress factors.

**Relationship Between AUDIT-C Scores, COVID-19 Stress Factors, and Demographic Covariates**

To test our hypothesis that Isolation Stress, Virus Stress, Academic Stress, Living Situation Stress, and Financial Stress will impact drinking behavior, we conducted a multiple linear regression predicting AUDIT-C score from the above COVID-19 stress factors, Age, Biological Sex, Drinking Alone (vs with others), and Biological Sex x COVID-19 stress factor interactions (see Table 3). Our model controlled for age and biological sex as those variables have been shown to impact overall drinking behavior (Erol & Karpyak, 2015; Moore et al., 2005). Additionally, our model included sex interactions with the COVID-19 stress factors due to evidence suggesting males and females differ in their motives for drinking as well as the stressors they use alcohol as a coping mechanism for (Kuntsche et al., 2015; Peltier et al., 2019; Wardell et al., 2020). This analysis showed a negative relationship between Age and AUDIT-C, indicating older participants were more likely to have lower scores on the AUDIT-C.

Additionally, being male was a significant predictor for scoring higher on the AUDIT-C, compared to being female. The only significant COVID-19 stress factors were Isolation Stress and Academic Stress. Interestingly, Isolation Stress had a negative relationship with AUDIT-C, suggesting those experiencing more isolation and mental health stress were more likely to drink less and have a lower score on the AUDIT-C. However, Academic Stress had a positive relationship with AUDIT-C, suggesting those experiencing higher stress about online learning and academics were more likely to score higher on the AUDIT-C. In addition to these main effects, Isolation Stress, Virus Stress, and Drinking Alone had significant interactions with biological sex. Both Isolation Stress and Drinking Alone increased AUDIT-C scores to the level of risky drinking for males, but lowered AUDIT-C scores for females. Lower levels of Virus Stress, however, correlated with higher AUDIT-C scores for males, whereas virus stress was not associated with AUDIT-C scores for females (see Figure 2). This pattern may suggest males not concerned about the virus were continuing to engage in risky drinking.

Table 3. Regression Analyses Predicting AUDIT-C Score and COPE: Substance Use Score

| | AUDIT-C ($n$ = 236) | | | COPE: Substance Use ($n$ = 338) | | |
|---|---|---|---|---|---|---|
| | *B* | (*SE*) | $\Delta R^2$ | *B* | (*SE*) | $\Delta R^2$ |
| Step 1: Controls | | | $.069^{***}$ | | | $.031^{+}$ |
| Age | -0.14 | $0.06^{**}$ | | -0.15 | $0.06^{*}$ | |
| Biological Sex | 1.25 | $0.38^{***}$ | | -0.18 | 0.45 | |
| Step 2: Main effects | | | $.113^{*}$ | | | $.114^{***}$ |
| Age | -0.17 | $0.06^{**}$ | | -0.11 | $0.06^{+}$ | |
| Biological Sex | 1.08 | $0.39^{**}$ | | -0.19 | 0.45 | |
| Isolation Stress | -0.49 | $0.16^{**}$ | | -0.10 | 0.17 | |
| Virus Stress | -0.15 | 0.12 | | -0.12 | 0.14 | |
| Academic Stress | 0.36 | $0.13^{**}$ | | 0.33 | $0.15^{*}$ | |
| Living Situation Stress | 0.13 | 0.11 | | 0.08 | 0.12 | |
| Financial Stress | 0.05 | 0.10 | | 0.15 | 0.11 | |
| Drink Alone | -0.24 | 0.45 | | 1.54 | $0.51^{**}$ | |
| Step 3: Interactions | | | $.205^{***}$ | | | .027 |
| Age | -0.14 | $0.06^{**}$ | | -0.11 | $0.06^{+}$ | |
| Biological Sex | 0.39 | 0.42 | | -0.70 | 0.55 | |
| Isolation Stress | -0.60 | $0.16^{***}$ | | -0.18 | 0.19 | |
| Virus Stress | -0.03 | 0.13 | | -0.001 | 0.15 | |
| Academic Stress | 0.39 | $0.14^{**}$ | | 0.29 | $0.17^{+}$ | |
| Living Situation Stress | 0.17 | 0.11 | | 0.10 | 0.13 | |
| Financial Stress | 0.03 | 0.10 | | 0.14 | 0.11 | |
| Drink Alone | -0.79 | 0.48 | | 1.82 | $0.57^{**}$ | |
| Sex x Isolation Stress | 1.09 | $0.40^{**}$ | | 0.49 | 0.46 | |
| Sex x Virus Stress | -1.33 | $0.36^{***}$ | | -0.87 | $0.42^{*}$ | |
| Sex x Academic Stress | 0.22 | 0.35 | | -0.10 | 0.46 | |
| Sex x Living Situation Stress | -0.03 | 0.30 | | -0.14 | 0.36 | |
| Sex x Financial Stress | 0.19 | 0.27 | | 0.23 | 0.33 | |
| Sex x Drink Alone | 4.65 | $1.20^{***}$ | | -1.68 | 1.81 | |

*Note.* Biological sex: 1= male, 0 = female. Drink alone: 1 = predominantly drinks alone, 0 = predominantly drinks with others. AUDIT-C = Alcohol Use Disorders Identification Test-Concise; higher scores indicate increased and riskier drinking. COPE: Substance Use = substance use subscale of the Coping Orientation to Problems Experienced; higher scores indicate more substance use as a coping mechanism. *B* = unstandardized beta. $^{+}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

**Relationship between Coping with Substances, COVID-19 Stress Factors, and Demographic Covariates**

Although AUDIT-C scores can indicate problematic drinking, they do not specifically measure the use of alcohol

to cope. Therefore, we ran a separate model with the same predictors above but with scores from the Substance Use subscale from the Brief-COPE as the dependent variable (see Table 3). Age again showed a negative relationship with using substances to cope, suggesting older participants were less likely to engage in this type of coping behavior. Academic Stress also had a significant positive relationship, suggesting increased scores on the AUDIT-C seen in the previous model may be due to using substances to cope with increased stress about online learning and academics. Additionally, Drinking Alone had a positive relationship with COPE: Substance Use, suggesting those who predominantly drink alone are more likely to use substances to cope compared to those who predominantly drink with others. Although adding in the sex interactions did not produce a significant change to the $R^2$ ($p$ = .485), there was one significant interaction between Sex and Virus Stress. As shown in Figure 2, males with high Virus Stress were far less likely to use substances to cope, however there was no change for females.

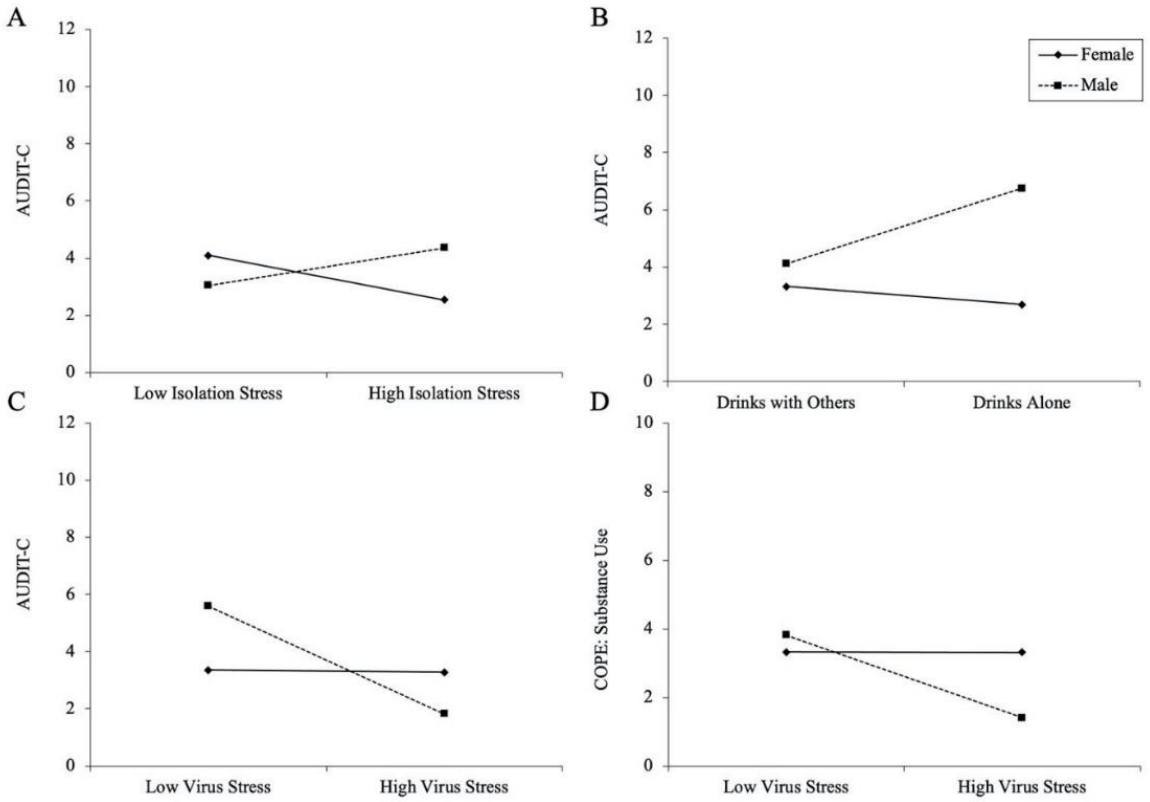


Figure 2. Interactive effects due to sex on isolation stress and problematic drinking (A), drinking with others or alone and problematic drinking (B), and concern about the virus on problematic drinking (C) and using substances to cope (D). AUDIT-C = Alcohol Use Disorders Identification Test-Concise; COPE: Substance Use = substance use subscale of the abbreviated Coping Orientation to Problems Experienced.

**Change in Drinking Based on COVID-19 Stress and Drinking Behavior**

To specifically analyze the impact of COVID-19 stress on self-reported changes in drinking during the pandemic, we conducted a multinomial logistic regression to examine the odds of belonging to each level of drinking change (increased drinking, decreased drinking, and no change in drinking) based on COVID-19 stress factors, biological sex, age, and drinking alone or with others. No change in drinking during the pandemic was used as the reference

group. Addition of the predictors significantly improved the model fit compared to the null model, $\chi^2(18, N = 197) = 42.88$, Nagelkerke $R^2 = .22$, $p = .001$. As shown in Table 4, Academic Stress and Drinking Alone were the significant unique contributors.

Table 4. Predicting Drinking Change during the Pandemic (N = 197)

| Predictor | $\chi^2$ | *df* | *p* |
|---|---|---|---|
| Age | 4.99 | 2 | .082$^{+}$ |
| Biological Sex | 1.90 | 2 | .387 |
| Isolation Stress | 0.82 | 2 | .663 |
| Virus Stress | 2.10 | 2 | .350 |
| Academic Stress | 12.15 | 2 | .002$^{**}$ |
| Living Situation Stress | 0.45 | 2 | .797 |
| Financial Stress | 1.51 | 2 | .471 |
| Drink Alone | 8.37 | 2 | .015$^{*}$ |

*Note.* Biological sex: 1= male, 0 = female. Drink alone: 1 = predominantly drinks alone, 0 = predominantly drinks with others. $\chi^2$ = difference in -2 log likelihoods between the final model and a reduced model. $^{+}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

As shown in Table 5, Age is the only significant predictor when comparing no change in drinking to decreased drinking, with increases in age increasing the odds of reducing drinking during the pandemic. Additionally, Academic Stress is the only significant predictor when comparing no change in drinking to increased drinking, with increases in academic stress increasing the odds of drinking more during the pandemic. Although not significant, tending to drink with others instead of alone showed a trend towards predicting both increased and decreased drinking during the pandemic. This result may be due to both living situation (alone, with peers, with family, etc.) and the acceptability of drinking in that living situation.

Table 5. Parameter Estimates Contrasting No Change versus Change in Drinking (N = 197)

| Predictor | No Change in Drinking vs. | *B* | *OR* | *p* |
|---|---|---|---|---|
| Age | Decreased | 0.22 | 1.24 | .039$^{*}$ |
| | Increased | 0.15 | 1.16 | .143 |
| Female | Decreased | -0.82 | 0.44 | .200 |
| | Increased | -0.69 | 0.50 | .273 |
| Isolation Stress | Decreased | -0.05 | 0.96 | .842 |
| | Increased | 0.13 | 1.14 | .546 |
| Virus Stress | Decreased | 0.01 | 1.01 | .941 |
| | Increased | -0.20 | 0.82 | .270 |
| Academic Stress | Decreased | 0.31 | 1.37 | .110 |
| | Increased | 0.69 | 1.99 | .001$^{**}$ |
| Living Situation Stress | Decreased | 0.07 | 1.07 | .680 |
| | Increased | 0.10 | 1.11 | .500 |

| Predictor | No Change in Drinking vs. | *B* | *OR* | *p* |
|---|---|---|---|---|
| Financial Stress | Decreased | -0.10 | 0.90 | .470 |
| | Increased | -0.17 | 0.84 | .223 |
| Drinks with Others | Decreased | 1.11 | 3.04 | .066$^{+}$ |
| | Increased | 0.99 | 2.69 | .098$^{+}$ |
| Drinks Alone | Decreased | -1.27 | 0.28 | .280 |
| | Increased | 0.71 | 2.03 | .346 |

*Note.* No change is drinking is the reference category. *OR* = odds ratio associated with the effect of one standard deviation increase in the predictor. $^{+}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

## Discussion

In the early stages of the pandemic, a concerning pattern of increased alcohol use was seen among college students (Bertrand et al., 2021; Charles et al., 2021; Lechner et al., 2020). However, as the pandemic persisted and pandemic-related stress became chronic, it was unknown how this behavior would change. The goal of this study was to assess the impact of this prolonged COVID-19 stress on college student drinking after almost a year of pandemic restrictions. In our sample, we found that over half of the college students who drank met the qualifications for problematic drinking based on the AUDIT-C. Additionally, 41% of the drinkers reported increasing their drinking during the pandemic, although 31% did report decreasing their drinking. We predicted stress related to isolation, the virus, academics, living situation, and finances would increase drinking in college students. However, our analyses indicated the strongest predictor for increased drinking, increased AUDIT-C score, and increased use of substances to cope was only stress specifically concerning online learning and academic performance. In addition, age was the largest determinant for decreased drinking, lower AUDIT-C scores, and decreased likelihood of using substances to cope. These findings regarding age are consistent with previous research (Moore et al., 2005); however, our findings regarding academic stress may be unique to COVID-19 and the changes in learning modalities it necessitated.

### Impact of Online Education Stress on Drinking

Previous findings concerning the impact of academic stress on drinking to cope in college students are mixed, with some showing a positive relationship (Singleton, 2007; Wormington et al., 2011), and others finding either no direct relationship or a negative relationship (Butler et al., 2011; Grimaldi et al., 2016; Woolman et al., 2015). In this sample, however, academic stress was one of the strongest predictors of increased drinking during the pandemic, increased problematic drinking, and increased use of substances to cope. These results may differ from prior reports due to the unprecedented changes to academic instruction during the pandemic, as well as how academic stress was assessed in our sample. In our Academic Stress measure, the items involve concern over the impact of online learning on grades, completing assignments and exams online, continuing to be motivated despite the online modality, and the impact of COVID-19 on graduate and professional school applications.

Therefore, students were reporting stress regarding how the online modality would impact their academic abilities

and performance. The external and uncontrollable nature of this stressor (i.e., students being worried about their grades because of the course being online instead of their own learning abilities) may account for the positive relationship between academic stress and drinking, as see in Wormington et al. (2011) with external regulation of academic motivation positively correlating with drinking in high school students. This finding is of importance to educators as it suggests abrupt changes in teaching and learning modalities may have adverse consequences on the coping behaviors of students in response to their perceived academic performance. Should online and hybrid education models persist in universities and colleges that traditionally did not adopt them, educators should work toward shifting students' perceptions concerning online education performance to alleviate concern and negative coping behaviors.

**Sex Differences in Drinking due to COVID-19 Stressors**

The secondary goal of this study was to investigate potential sex differences in drinking to cope with COVID-19 stress. Previous research shows that females are more likely to use alcohol as a way to cope with stressors (Kuntsche et al., 2015; Peltier et al., 2019), and an early report found more pronounced effects of women drinking to cope with pandemic stressors compared to men (Rodriguez et al., 2020). In the current study, we found that females reported increased pandemic-related stress overall, as well as increases in stress concerning isolation, the virus, academics, racism and prejudice, and access to healthcare compared to men (Figure 1A). Interestingly, we did not find sex differences in drinking change during the pandemic, although males did have higher scores on the AUDIT-C compared to females. These results suggest that although males were engaging in more problematic drinking, there were not sex differences in terms of drinking more or less during the pandemic. However, in investigating the interactive effects of sex and our hypothesized COVID-19 stressors, we found sex differences pertaining to isolation stress, drinking alone, and virus stress (Figure 2). Higher isolation stress was predictive of lower AUDIT-C scores for females, but higher AUDIT-C scores for males. Given that our sample was predominantly female, this interaction may help to explain the negative relationship between isolation stress and AUDIT-C that was contrary to our hypothesis. Additionally, drinking alone predicted much higher AUDIT-C scores, well above the problematic drinking cutoff, in males but not females. Given the relationship between depressive symptoms and solitary drinking (Keough et al., 2015), it is possible that these individuals were experiencing heightened depressive symptoms and were using alcohol as a coping mechanism. Moreover, the hesitancy of some men to seek out social support for mental health problems (McKenzie et al., 2018; Staiger et al., 2020) may have made them more susceptible to the isolation stress and more likely to use alcohol as a coping mechanism for being alone.

Stress about the virus also had an interesting effect on males in terms of their AUDIT-C scores and use of substances to cope, but no effect on females (Figure 2). Males with high virus stress had much lower scores on both the AUDIT-C and COPE: Substance Use subscale. Additionally, males with low virus stress were more likely to have very high AUDIT-C scores, well above the problematic drinking cut-off. It appears that for males specifically, having very little stress about the virus correlated with much more problematic drinking. It is possible that these individuals were not concerned about the virus, so they were continuing to engage in risky drinking behaviors, whereas those who were concerned about the virus changed their drinking behaviors. Due to this being

self-report data, another possibility is some of the males in the sample may have skewed their answers either intentionally or inadvertently. College aged males may be less likely to report high levels of stress and more likely to report high levels of drinking. Additionally, a limitation of this study is the relevantly small number of male participants compared to female participants. This was the result of using a convenience sample, and future studies could examine these potential sex differences in samples with a more even split between the sexes.

## Implications

Overall, our findings indicate stress concerning online education was the leading predictor of increased and problematic drinking in college students late into the pandemic. The strength of this finding may be due to the immediacy of the switch to a novel learning modality coupled with the externalized nature of the stressor. Given the possibility of continued changes to learning modalities as COVID-19 variants arise, it is important for educators to work with students to mitigate their concerns over the impact of online education on their learning and grades to reduce problematic drinking. Additionally, changes to instruction occurring during a semester that are unrelated to a global pandemic could also contribute to unhealthy coping behavior in students. Therefore, educators should consider how to outline expectations of course progress during times of change to help alleviate concern over external stressors.

Our results also indicate that isolation stress had a more detrimental impact on male students compared to female students, potentially contributing to increased solitary problematic drinking. Previous research suggests that although men are more reluctant to seek help and social support, their attitudes can change following treatment for mental health and involvement in support groups (Staiger et al., 2020). Therefore, colleges and universities may want to consider developing social support groups for students during times of distress to help ease feelings of isolation and provide alternative coping avenues beyond alcohol. Although vaccines against the COVID-19 virus are now readily available in the US, the effects of the pandemic are far from over. Additionally, new variants threaten the possibility of additional school closures and changes to education models. As educators, we need to be aware of the impact of these, or other potential, changes on our students during the semester and develop ways to support them through times of distress and uncertainty.

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