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Mental health and drinking to cope in the early COVID period: Data from the 2019–2020 US National Alcohol Survey

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ABSTRACT

Background: Studies show drinking to cope and mental health problems have increased during the COVID-19 pandemic, however, their samples have been limited by convenience sampling or lack of a pre-pandemic measure. We examined the early impact of the COVID-19 pandemic on mental health, drinking to cope and their association using a probability-based sample of the US adult population.

Methods: Data was drawn from the probability samples of the 2019–2020 National Alcohol Survey (N = 7,233) to examine differences in drinking to cope and symptoms of depression and anxiety. Analyses compared participants who responded to the survey just prior to the widespread onset of the pandemic to those who responded after March 2020, in the total sample and by sex.

Results: Respondents in the early- vs. pre-COVID-19 period had a 1.48 higher odds ($p = 0.03$) of higher agreement with drinking to forget one's worries and problems, with a significant association observed among women only. Respondents with symptoms of depression and anxiety had a 2.94 and 1.56 higher odds, respectively, of higher agreement with drinking to forget one's worries. We observed significant associations between early- vs. pre-COVID-19 period, depression and anxiety symptoms, and drinking to forget one's worries among women only; however, moderation by sex in the total sample was not statistically significant.

Conclusions: We observed higher prevalence of depression and anxiety symptoms and greater drinking to forget worries in the early months of COVID restrictions relative to the period just prior, with some effects more prominent among women. These observations call for sustained monitoring of and support for the mental health of the general population, and of women in particular during the course of the pandemic.

1. Introduction

The World Health Organization's declaration of COVID-19 as a global pandemic in early March 2020 prompted the initiation of measures to reduce the spread of the SARS-Cov-2 virus. These measures included physical distancing requirements and closures of schools, recreational facilities, and indoor dining and drinking establishments across much of the USA beginning in mid-March 2020. Simultaneously, the immediate economic fallout of such restrictions resulted in a sharp increase in US unemployment, with a peak overall unemployment rate of 14.8% in April 2020 (Falk, Romero, Carter, Nicchitta, & Nyhof, 2021). Such social restrictions and economic hardship are believed to have had profound implications for the general US population's mental health and use of alcohol.

US studies from the early pandemic period have reported increases in psychological distress, including symptoms of depression (Ettman et al., 2020; Kantor & Kantor, 2020; McGinty et al., 2020) and anxiety (Kantor & Kantor, 2020; Riehm et al., 2021; Veldhuis et al., 2021). A cross-sectional study of a nationally-representative sample found a higher prevalence of serious psychological distress in April 2020 compared to 2018 (12.6% vs. 3.9%) (McGinty et al., 2020), and a longitudinal study conducted between March and August 2020 noted that the odds of mental distress were 2 times higher in May compared to March 2020, but by August had declined to levels comparable to March (Riehm et al., 2021). The many studies that have been conducted on mental health in the early-COVID period observed high levels of depression and anxiety symptoms across a variety of populations, including college students (Lechner et al., 2021), a national sample of women (Lindau et al., 2021),

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older adults (Kobayashi et al., 2021), and racial/ethnic and sexual minorities (Veldhuis et al., 2021).

Similarly, self-reported increases in alcohol use were observed in the early months of the pandemic, with cross-sectional studies reporting increases in use ranging from 14% (Avery et al., 2020) to 29% (Capasso et al., 2021) to 60% (Grossman et al., 2020). A study using a probability-based web panel observed that participants reported consuming 29% more drinks per day in April compared to February 2020, as well as an increase of 21% in binge drinking during this period (Barbosa, Cowell, & Dowd, in press), and adults from a national, longitudinal survey of US households reported an increase in frequency of drinking from 1.3 to 1.7 days per week between March and June 2020 (McKetta et al., 2021). Notably, increases in drinking were observed in particular among women (Barbosa et al., in press; Pollard et al., 2020), parents (Wardell et al., 2020), and people with mental health problems (Capasso et al., 2021; Coakley et al., 2021).

The concurrent increases in depression and anxiety symptoms and alcohol use in the early pandemic period are consistent with epidemiologic observations of high co-morbidity between mental health problems and heavy alcohol use (Hasin & Grant, 2015; Hasin et al., 2007), and with the general understanding that relationships between heavy alcohol use and depression and anxiety are bidirectional in nature (Fergusson et al., 2009; Kushner et al., 2000). The Self-Medication Hypothesis suggests increases in drinking may be driven by increases in drinking to cope due to an external stressor (Hawn et al., 2020; Khantzian, 1997). In the context of the stresses of the COVID-19 pandemic, the potential for symptoms of depression and anxiety to trigger increases in drinking to cope is especially relevant (Brooks et al., 2020). Further, it is important to understand the correlates of coping-related drinking in particular, because it can increase the risk of developing alcohol-related problems over the long term (Cooper et al., 2016).

Studies provide evidence that drinking to cope increased in the US in the early pandemic period (Graupensperger et al., 2021), and was associated with increased alcohol use (Buckner et al., 2021; McPhee et al., 2020; Mohr et al., 2021; Prestigiacomo et al., 2021) and problems (Wardell et al., 2020). However, few studies have examined the relationship between symptoms of depression and anxiety and drinking to cope in a representative US population sample. One study using a convenience sample identified depressive symptoms as a predictor of coping motives in a sequential mediation model of alcohol quantity (McPhee et al., 2020), and another study of college students identified an association between symptoms of anxiety and drinking to cope (Buckner et al., 2021). These studies are important first steps in understanding mental health, drinking to cope motives, and alcohol use during the COVID-19 pandemic; however, they are limited to young adult (Graupensperger et al., 2021), college student (Mohr et al., 2021), and convenience samples (McPhee et al., 2020), using cross-sectional study designs with retrospective measures, and lack a pre-pandemic comparison. Thus, given the current literature, it is less well understood how drinking to cope may have changed in the general US population during the early pandemic period, and to what extent drinking to cope in the early pandemic period related to symptoms of depression and anxiety.

This work builds upon previous studies by examining the early impact of the COVID-19 pandemic on mental health and drinking to cope using a probability-based sample of the US non-institutionalized adult population. The aims of this study are to 1) describe differences in drinking to cope and symptoms of depression and anxiety in the general US population (overall and by sex) in the early pandemic period compared with the period just prior to the pandemic, and 2) examine the association between symptoms of depression and anxiety and drinking to cope overall and by sex, controlling for the early-COVID period. Analyses compare the mental health status and drinking to cope of participants in the 2019–2020 US National Alcohol Survey who responded to the survey just prior to the widespread onset of the pandemic to those who responded after March 2020.

2. Methods

2.1. National Alcohol Survey Data

Data are from the latest wave of the cross-sectional US National Alcohol Survey (NAS) conducted between September 2019 and April 2020 by the Public Health Institute's Alcohol Research Group's National Alcohol Research Center with funding from the National Institute of Alcohol Abuse and Alcoholism (NIAAA) (P50 AA005595). The NAS is a population-based survey of non-institutionalized adults ages 18 years or older, with a sampling frame representing 50 states and the District of Columbia, with targeted oversampling of Black/African American and Hispanic/Latinx respondents. The NAS used two probability samples: 1) a random digit dialing (RDD) cellular telephone sample, and 2) an address-based sample (ABS) that completed an online survey. These probability samples were supplemented with a non-probability sample drawn from an existing web panel, which was not included in this analysis (see "Analytic Sample" below for more detail). Interviews were conducted via telephone for the RDD sample and via a nearly-identical web survey for the ABS and panel samples. Interviews and questionnaires were available in English and Spanish. Telephone respondents received a \$15 (main sample) or \$25 (racial/ethnic oversample) gift code to a major online retailer for completing the interview, ABS respondents received a \$20 gift code, and panel respondents received a small proprietary incentive. The average interview duration was 40 min and 36 min for RDD and web survey respondents, respectively. All study protocols were approved by the Institutional Review Boards of the Public Health Institute (Oakland, CA) and the fieldwork organization, ICF, Inc. (Fairfax, VA).

The overall NAS RDD and ABS samples include 7,233 respondents, among whom 4,132 are non-Hispanic White, 1,293 non-Hispanic Black, 1,014 Hispanic/Latinx and 794 from other racial/ethnic groups. The American Association for Public Opinion Research (AAPOR) COOP4 cooperation rate (The American Association for Public Opinion Research, 2011) for the combined RDD and ABS samples was 42.2%.

2.2. Analytic sample

Data analyzed here include respondents from the probability samples (i.e., CATI and ABS) who were interviewed between February 1 and April 21, 2020. For this analysis, the non-probability web panel participants were not evenly distributed between the pre- and early-COVID samples and were thus excluded. We also excluded participants recruited prior to February to ensure more comparability of drinking measures reflecting the prior 12-month period, given likely increases in drinking during the holiday period (Cho et al., 2001) immediately prior to the COVID-19 pandemic onset that would not be captured similarly in earlier interviews. The analytic sample was divided into two periods (2/1/20 to 3/16/20 vs. 3/17/20 to 4/21/20) for comparison of pre- vs. early-COVID-19 pandemic periods, given that the US Centers for Disease Control and Prevention recommended no gatherings of more than 50 people on March 15th, and that the first state-wide stay-at-home order was issued on March 19th, quickly followed by other state lockdown orders. Based on these interview dates, the final analytic sample included 1,291 pre-COVID-19 respondents (82.9% from ABS sample), and 812 early-COVID-19 respondents (68.8% from ABS sample). We compared participants in the pre-COVID period sample with those in the early-COVID period sample and observed no statistically significant differences by sex, age, race/ethnicity, marital status, or level of education.

2.3. Measures

Two *drinking to cope* questions were included in the N14 survey and asked how much respondents agreed with the following: 1) "Drinking helps me to forget about my worries and my problems", and 2) "I drink

when I feel tense and nervous” (Cooper, 1994). The 4-point Likert-type response options ranged from “strongly agree” (4) to “strongly disagree” (1). These questions were asked of respondents who reported having at least one alcoholic beverage in the past 12 months. They were adapted from the Drinking Motives Questionnaire (DMQ) and include items with the highest factor loadings for the coping motives subscale (Cooper, 1994; Lac & Donaldson, 2017). Previous NAS studies have shown associations between these items and heavy drinking and alcohol dependence, where drinking to forget one’s worries had the highest loading (0.94) on a coping factor of reasons for drinking (Greenfield et al., 2009). Drinking to cope variables were treated as ordinal measures. We assessed the presence of *depression and anxiety symptoms* using the validated 4-item Patient Health Questionnaire (PHQ-4), with 2 items assessing each construct (Kroenke et al., 2009; Löwe et al., 2004). Respondents were asked how often during the past two weeks they had been bothered by: 1) “Feeling down, depressed, or hopeless”, and 2)

“Feeling little interest or pleasure in doing things” (depression); or 3) “Feeling nervous, anxious or on edge”, and 4) “Not being able to stop or control worrying” (anxiety). Response options ranged from “not at all” (0) to “nearly every day” (3). We summed the two items for each construct and applied standard cut-points to the sum score to define a 3-level variable for depression and (separately) anxiety: (1) No symptoms (score = 0), (2) Mild symptoms (score = 1 or 2), and (3) moderate/severe anxiety/depression (score = 3+). **Sociodemographic factors** were sex, age group (18–29, 30–39, 40–49, 50–59, 60+), race/ethnicity (mutually-exclusive indicators for non-Hispanic White, Black, Hispanic/Latinx, all other racial/ethnic groups combined), education (less than high school (HS), HS graduate, some college, college graduate), family income (\leq \$20,000, \$20,001–40,000, \$40,001–60,000, \$60,001–100,000, $>$ \$100,000), including an indicator for missing income to maximize included cases; only 10.1% of the sample was missing income data), marital status (married/cohabiting, never married, with

Table 1

Mental health and socio-demographic measures comparing the N14 respondents interviewed during 02/01–03/16/2020 (pre-COVID period) and during 03/17–04/21/2020 (early COVID period).

	Total			Women			Men		
	Pre-COVID (n = 1291)	Early COVID (n = 812)	p ¹	Pre-COVID (n = 786)	Early COVID (n = 509)	p ¹	Pre-COVID (n = 504)	Early COVID (n = 303)	p ¹
Drinking motives									
<i>Drinking helps forget worries²</i>									
Strongly agree	1.7%	2.3%	0.055	2.0%	2.3%	0.086	1.5%	2.3%	0.287
Agree	10.5%	14.0%		11.8%	13.3%		9.2%	14.7%	
Disagree	35.6%	40.7%		30.5%	39.7%		40.5%	41.8%	
Strongly disagree	52.2%	43.0%		55.7%	44.7%		48.8%	41.1%	
<i>Drink when nervous²</i>									
Strongly agree	1.6%	1.5%	0.248	1.6%	2.0%	0.239	1.6%	0.9%	0.646
Agree	13.2%	12.1%		12.3%	9.6%		14.1%	14.8%	
Disagree	34.6%	41.5%		33.5%	41.7%		35.7%	41.3%	
Strongly disagree	50.5%	44.9%		52.6%	46.7%		48.6%	43.0%	
Depression									
Moderate/severe symptoms	11.3%	13.3%	0.393	9.8%	14.8%	0.037	12.9%	11.6%	0.040
Mild symptoms	27.4%	29.2%		29.9%	23.6%		24.7%	35.5%	
No symptoms	61.3%	57.6%		60.3%	61.6%		62.4%	52.9%	
Anxiety									
Moderate/severe symptoms	10.5%	14.7%	0.026	10.9%	15.8%	0.072	10.1%	13.4%	0.276
Mild symptoms	28.6%	31.3%		31.1%	32.8%		25.8%	29.6%	
No symptoms	60.9%	54.0%		58.0%	51.4%		64.1%	57.0%	
Socio-demographics									
Sex male	48.0%	46.8%	0.659	–	–	–	–	–	–
<i>Age: 18–29</i>									
18–29	18.6%	19.7%	0.838	18.6%	19.0%	0.775	18.6%	20.5%	0.186
30–39	19.6%	20.1%		17.2%	18.8%		22.2%	21.6%	
40–49	15.3%	16.9%		17.5%	14.3%		12.9%	19.9%	
50–59	19.6%	18.0%		19.3%	20.6%		19.9%	15.0%	
60+	26.9%	25.3%		27.4%	27.4%		26.3%	23.0%	
<i>Race/ethnicity: White</i>									
White	64.5%	60.5%	0.164	66.3%	58.5%	0.072	62.6%	62.7%	0.630
Black	11.9%	16.0%		12.3%	17.0%		11.5%	14.8%	
Hispanics	15.7%	15.0%		14.5%	14.9%		17.1%	15.1%	
Others	7.8%	8.5%		6.9%	9.5%		8.8%	7.4%	
<i>Education: < HS grad</i>									
< HS grad	5.3%	5.0%	0.832	6.4%	4.9%	0.799	4.2%	5.1%	0.829
HS grad	25.8%	27.3%		25.4%	26.2%		26.3%	28.5%	
Some college	37.6%	38.6%		38.0%	39.7%		37.3%	37.4%	
College grad	31.2%	29.1%		30.3%	29.2%		32.2%	29.0%	
<i>Family income: \leq\$20,000</i>									
\leq \$20,000	17.3%	20.8%	0.641	20.2%	23.1%	0.796	14.1%	18.1%	0.524
\$20,001–40,000	19.2%	19.0%		21.2%	18.3%		17.0%	19.7%	
\$40,001–60,000	23.1%	21.7%		21.5%	22.6%		24.9%	20.6%	
\$60,001–100,000	19.5%	19.7%		19.7%	18.6%		19.3%	20.9%	
$>$ \$100,000	20.8%	18.9%		17.3%	17.5%		24.8%	20.7%	
<i>Marital status: married</i>									
married	57.4%	54.7%	0.611	57.2%	53.8%	0.600	57.6%	55.7%	0.916
Never married	21.9%	22.7%		17.9%	18.6%		26.2%	27.3%	
Others	20.7%	22.6%		24.9%	27.5%		16.2%	16.9%	
<i>Employment status: FT employed</i>									
FT employed	47.3%	45.8%	0.862	41.1%	38.7%	0.919	54.0%	53.7%	0.932
PT employed	11.3%	12.0%		13.9%	14.1%		8.4%	9.5%	
Unemployed	5.0%	5.9%		4.3%	5.3%		5.7%	6.5%	
Retired	16.9%	15.6%		16.9%	16.8%		16.8%	14.3%	
Others	19.6%	20.8%		23.8%	25.0%		15.1%	16.0%	
Having children age <18	29.2%	36.1%	0.012	33.1%	37.0%	0.253	25.0%	35.0%	0.020

¹ Chi-square test.

² Among current drinkers only.

separated, divorced and widowed combined), employment status (full-time, part-time, unemployed, retired, with student, homemaker, non-working disabled combined as “other”), and having children younger than 18 years old in the household.

2.4. Data weighting and analysis

Sampling weights for the full 2020 NAS sample were created to adjust for the disproportionate probability of selection caused by the number of telephones in a household (RDD), number of eligible adults in a household (RDD and ABS), and racial/ethnic oversampling (RDD and ABS) and were post-stratified to adjust for nonresponse and noncoverage. The combined weighted sample was aligned with the benchmark demographic distributions for the target adult US population using an iterative raking adjustment. The population targets were developed from the US Census Bureau’s latest American Community Surveys.

Bivariate F-tests or chi-square tests of independence compared pre- and early-COVID-19 respondents on drinking motives, mental health and sociodemographic characteristics. We used ordered logistic regression to predict each drinking-to-cope outcome with the pre- vs. early-COVID-19 indicator and the depression and anxiety measures as primary independent variables of interest, while controlling for socio-demographic factors, and ran these models stratified by sex. To formally test for a moderation effect by sex we included interaction terms in the model for the total sample for sex and early- vs. pre-COVID-19 period, sex and depression symptoms, and sex and anxiety symptoms. We also conducted a sensitivity analysis using linear regression to predict drinking to cope. All analyses were conducted in Stata version 16 (StataCorp, 2019) using SVY commands to accommodate the survey weights.

3. Results

Table 1 compares categories of drinking to cope measures, prevalence of depression and anxiety symptom categories, and sociodemographic characteristics between the pre-COVID and early-COVID samples for the overall analytic sample and separately by sex. For agreement with the “drinking helps me to forget my worries” item, the distribution of agreement categories between the pre- and early-COVID periods approached statistical significance in the total sample ($p = 0.06$) and among women ($p = 0.09$), and was not significantly different among men ($p = 0.29$). For agreement with the “drinking when I feel tense and nervous” item, we observed no statistically significant differences between the pre- and early-COVID periods in the overall sample ($p = 0.25$), among women ($p = 0.24$) or among men ($p = 0.65$). Given the lack of a significant difference between the pre- and early-COVID samples for the “drinking when I feel tense and nervous” item, we only examined the “drinking helps me to forget my worries” item in adjusted regression analyses.

The distribution of depression symptom categories was not significantly different between the pre- and early-COVID periods in the total sample ($p = 0.39$). But among women the overall test of differences across depression symptom categories was significantly different between the two COVID periods ($p = 0.04$) with a higher prevalence of moderate/severe depression symptoms in the early-(vs. pre-) COVID period (14.8% vs. 9.8%). Among men, the overall test of differences was also significant ($p = 0.04$), with a higher prevalence of mild depression symptoms in the early-(vs. pre-) COVID period (35.5% vs. 24.7%) but no difference in moderate/severe depression symptoms (12.9% vs. 11.6, pre- vs. early-COVID period, respectively). The distribution of anxiety symptom categories was statistically significant, with a higher prevalence of moderate/severe anxiety symptoms in the early-(vs. pre-) COVID period compared to the pre-COVID period among the total sample (14.7% vs. 10.5%, $p = 0.03$), and among women (15.8% vs. 10.9%, $p = 0.04$), but not among men (13.4% vs. 10.1%, $p = 0.28$). There were no statistically significant differences on other

sociodemographic characteristics between the early vs. pre-COVID samples, except for more reports of having a child under 18 in the home overall (36.1% vs 29.2%, $p = 0.01$) and among men (35.0% vs. 25.0%, $p = 0.02$).

Results in Table 2 show the relationship between early-COVID and mental health symptoms with drinking to forget worries. The odds of early-COVID period respondents reporting higher agreement with drinking to forget one’s worries was 1.48 (95% CI, 1.03–2.12) times that of respondents in the pre-COVID period in the total sample ($p = 0.03$), and 1.44 (95% 1.02–20.4) among women ($p = 0.04$). By contrast, no statistically significant association was observed among men ($p = 0.10$). However, the interaction term for COVID period and sex in the total sample was not statistically significant (OR = 0.95, $p = 0.89$, results not shown in table). Compared to respondents with no depressive symptoms, those with mild and moderate/severe depression symptoms had a 1.61 (95% CI, 1.01–2.57) and 2.94 (95% CI, 1.43–6.04) higher odds, respectively, of reporting greater agreement with drinking to forget one’s worries in the total sample ($p = 0.05$ and 0.003, respectively) and a 2.45 (95% CI, 1.20–4.99) times higher odds among women ($p = 0.01$). No statistically significant association between moderate/severe depression symptoms and drinking to forget one’s worries was observed among men ($p = 0.09$). Again, the interaction terms for depression symptoms and sex in the total sample were not statistically significant (OR = 0.71, $p = 0.33$ for mild symptoms and sex, OR = 0.58, $p = 0.36$ for moderate/severe symptoms and sex). Compared to respondents with no symptoms of anxiety, those with mild symptoms of anxiety had a 1.56 (95% CI, 0.98–2.47) higher odds of reporting agreement with drinking to forget one’s worries overall that approached statistical significance ($p = 0.06$), and a 1.62 (95% CI, 1.02–2.58) significantly higher odds among women ($p = 0.04$). No statistically significant association was observed between mild symptoms of anxiety and drinking to forget one’s worries among men ($p = 0.29$). However, the interaction term for anxiety symptoms and sex in the total sample was not statistically significant (OR = 0.81, $p = 0.53$ for mild symptoms and sex, OR = 1.2, $p = 0.74$ for moderate/severe symptoms and sex). Results from the sensitivity analysis using linear regression were generally consistent with the results from the ordered logistic regression models (data not shown).

In the sex-stratified models controlling for COVID period and demographics, the odds of reporting higher agreement with drinking to forget one’s worries was lower for Black women compared to White

Table 2

Adjusted ordered logistic regression estimates and 95% confidence intervals (CIs) predicting agreement with **drinking helps me to forget my worries** for the total sample and by sex, controlling for socio-demographic factors.

	Total		Women		Men	
	OR	95% CIs	OR	95% CIs	OR	95% CIs
Early COVID period (vs. pre-COVID)	1.48	(1.03, 2.12)*	1.44	(1.02, 2.04)*	1.49	(0.93, 2.38)†
Depression						
No symptoms	ref		ref		ref	
Mild symptoms	1.61	(1.01, 2.57)*	1.46	(0.92, 2.30)	1.21	(0.71, 2.07)
Moderate/severe symptoms	2.94	(1.43, 6.04)*	2.45	(1.20, 4.99)*	2.18	(0.88, 5.39)†
Anxiety						
No symptoms	ref		ref		ref	
Mild symptoms	1.56	(0.98, 2.47)†	1.62	(1.02, 2.58)*	1.32	(0.79, 2.23)
Moderate/severe symptoms	1.16	(0.59, 2.28)	1.27	(0.65, 2.48)	1.33	(0.43, 4.16)

Note: Models controlled for age, race/ethnicity, level of education, income, marital status, employment, having children under 18 in the household, and model for the total sample also included interactions for sex and each of the following: COVID period, depression symptoms and anxiety symptoms. ORs and CIs for the non-significant interaction terms are presented in the Results section. * $p < 0.05$, † $p < 0.1$.

women (aOR = 0.39, 95% CI 0.24–0.64, $p < 0.001$), and single women reported greater odds for higher agreement compared to married women (aOR = 1.78, 95% CI 1.11–2.86, $p = 0.02$) (results not shown in table). Hispanic/Latinx men had reduced odds (aOR = 0.44, 95% CI 0.23–0.82, $p = 0.01$) of reporting higher agreement with drinking to forget one's worries compared to White men, as did both single (aOR = 0.48, 95% CI 0.26–0.90, $p = 0.02$) and separated/divorced/widowed men (aOR = 0.50, 95% CI 0.25–0.97, $p = 0.04$) compared to married men (results not shown).

4. Discussion

In this study of mental health and drinking to cope among the general US population in the pre- and early-pandemic periods, findings addressing our first aim show a higher prevalence of depression and anxiety symptoms and greater drinking to forget one's worries in the early months of COVID restrictions relative to the period just prior, with effects more prominent among women. Interestingly, while we observed a higher agreement with the motive to drink to help forget one's worries in the early-COVID period compared to the pre-COVID period, we did not observe any difference in agreement with the motive to drink because one feels nervous or tense. Findings from sex-stratified, multi-variable models addressing our second aim show significant associations of depression and anxiety symptoms with drinking to forget one's worries, controlling for the early-COVID period. Although significant associations were observed among women and not men, we observed no significant moderation by sex in the model with the total sample. This suggests that the effect of depression and anxiety symptoms on drinking to forget one's worries was not stronger among women compared to men, which may partially be explained by the smaller sample size for men relative to women in this sample ($n = 807$ vs. 1,295, respectively).

To the best of our knowledge no other studies have reported on distinctions between specific drinking motive items in the early-COVID period. That we observed no differences in the endorsement of drinking because one feels nervous and tense between respondents in the pre- vs. early-COVID periods suggests feelings of nervousness and tension were not a salient driver of drinking behavior in the early-COVID period, and is in contrast to the higher endorsement of drinking to forget one's worries and problems in the early- vs. pre-COVID sample. It is important to recall that respondents in the early-COVID period were interviewed between 3/17/21 and 4/21/21, which was very early in the pandemic when uncertainty about the pandemic was high and unemployment was already on the rise. It may be that drinking during this period was motivated more by experiences, such as job loss or furlough, that caused one worries and problems than by a response to a negative mood state (which also may be more acute), such as feeling nervous and tense. Relatedly, "drinking because one feels nervous and tense" connotes somatic experiences (Brodbeck et al., 2014) whereas "drinking to forget one's worries and problems" reflects cognitive ones, and rumination may have been more prevalent in the very early stages of the pandemic than attention to physical symptoms. Still, based on the highest loading coping item "drinking to forget one's worries and problems" (Greenfield et al., 2009), our findings are consistent with studies reporting higher levels of drinking to cope in the early pandemic period compared to prior to the pandemic (Graupensperger et al., 2021; McPhee et al., 2020; Prestigiacomo et al., 2021), and with some studies showing higher levels of drinking to cope in the early pandemic period among women compared to men (McPhee et al., 2020; Rodriguez, Litt, & Stewart, 2021). For example, in a US study of couple dynamics related to pandemic stress, drinking to cope motives were higher among women than men (Rodriguez, Litt, & Stewart, 2021). These findings are consistent with studies showing that coping motives are a more salient drinking motive for women than men (Kuntsche & Kuntsche, 2009). On the other hand, a study of Canadian adults (The American Association for Public Opinion Research, 2011) and a study of US college students observed no differences in coping motives by sex in the early-COVID

period (Mohr et al., 2021). Differences in drinking motive measurement, sampling, and populations under study may explain these divergent reports of sex differences in drinking to cope in the early pandemic period. Specifically, the aforementioned studies were conducted in different countries, among adult drinkers recruited from an online crowdsourcing platform for workers or college students recruited as a convenience sample, and although both used the Drinking Motives Questionnaire 3-item coping scale, they had different frequency response options. Further research is needed to more fully understand the impact of the COVID pandemic on sex differences in drinking to cope.

It is also important to note that in sex-stratified models we observed a lower odds of agreement with drinking to forget one's worries and problems among Black women compared to White women and Hispanic/Latino men compared to White men, and a higher odds among single women compared to married women, and single or divorced men compared to married men. To be clear, these models show the association between these respondent characteristics and drinking to forget one's worries, controlling for the pre- and early-COVID periods and accounting for depression and anxiety symptoms. Others studies have shown that loneliness and isolation were associated with drinking to cope (Mohr et al., 2021), and solitary drinking (Wardell et al., 2020) in the early part of the pandemic, which is consistent with our finding. However, studies have noted sizable increases in psychological and pandemic-related distress among the Black and Latinx communities (Palsson & Gray, 2020; Veldhuis et al., 2021), although there are mixed findings on the increases in alcohol use among Black and Latinx groups in the early-COVID period compared to Whites (Barbosa et al., in press; Nordeck et al., 2021). It is possible that the stresses of the COVID-19 pandemic in Black and Latinx communities early in the pandemic did not necessarily translate into increases in drinking to cope. Black, Latinx, and other hard-hit communities are more likely to have had higher levels of stressors than other groups before the COVID-19 pandemic (Caetano et al., 1998; Mulia et al., 2008), potentially resulting in a less dramatic change in the relationship between mental health and drinking to cope compared to groups that experienced a marked increase in stressors via exposure to COVID-19-related hardships. More in-depth, longitudinal research is required to comprehensively understand the early and long-term impact of the pandemic on drinking to cope and mental health problems among Black and Latinx individuals.

The observation of higher depressive symptoms among both women and men in the early-COVID period compared to the pre-COVID period, but no difference in the total sample, is likely because moderate/severe depression symptoms were higher among women whereas mild symptoms were higher among men. Thus, the shift in the overall distribution of symptom categories between the pre- and early-COVID periods in the total sample was minimized. These findings are nonetheless consistent with the many observational studies of the mental health effects of the COVID-19 pandemic in the US, both in that there were higher levels of symptoms of depression and anxiety in the early-COVID period compared to before (Marroquín et al., 2020), and that symptom severity was greater among women than among men (Kantor & Kantor, 2020; Riehm et al., 2021). These findings are also consistent with the broader literature showing that affective disorders are more common among women than men (Faravelli et al., 2013; Kessler, 2003; McLean et al., 2011), and with recent work suggesting the COVID-19 pandemic may be disproportionately impacting the mental health of women relative to men (Brooks et al., 2020; Palsson & Gray, 2020; Taylor, 2019). It is encouraging that a longitudinal study from March through August of 2020 noted a return of symptoms of depression and anxiety to levels seen in early March (Riehm et al., 2021), although this work also noted a greater relative increase in mental distress among women and a slower decrease thereafter compared to men. Together, these observations call for sustained monitoring of and support for the mental health of the general population, and of women in particular during the course of the pandemic.

Our findings that moderate/severe depression symptoms and mild anxiety symptoms were associated with drinking to forget one's worries controlling for the effects of the early-COVID period contributes to the limited literature on the relationship between symptoms of depression and anxiety and drinking to cope in the early stages of the pandemic. Our observation is consistent with a study by Carbia et al. among Irish adults and a study by Wardell et al. among Canadian adults, where both studies observed significant associations between depression and coping motives during the pandemic (Carbia et al., 2021; Wardell et al., 2020). Our finding that sex did not moderate the associations of depression and anxiety symptoms with drinking to forget one's worries is also consistent with the Wardell et al. study, which did not observe any sex differences in the relationship between mental distress and drinking to cope. However, unlike our findings, a US study using a web panel sample observed a significant moderation effect of sex where the association between COVID-19 related psychological distress and the quantity of alcohol consumed was significant among women only (Rodríguez, Litt, & Stewart, 2020). While it did not include measures of drinking to cope per se, it is consistent with evidence suggesting that psychological distress due to COVID was associated with increased drinking in the early months of the pandemic, potentially to mitigate these feelings, and that this association was particularly salient for women.

This study has limitations that must be considered. First, the cross-sectional nature of the data precludes examination of temporal changes in depression and anxiety symptoms and drinking to cope due to the COVID-19 pandemic and of the causal relationships between changes in these constructs. Second, the self-report alcohol measurement is subject to social desirability and recall biases, which could result in underreporting of alcohol use (Stockwell et al., 2004). Third, the measurement of drinking to cope was limited to two items, and this limits examination of the breadth of drinking to cope motives that were likely playing a role in people's drinking in the early months of the pandemic. Indeed, while these items were derived from the validated Drinking Motives Questionnaire (DMQ) (Grant et al., 2007), other studies that have examined drinking to cope in the early pandemic period often utilized the Drinking Motives Revised Short-form 3-item (Kuntsche & Kuntsche, 2009) scale to produce a score as a measurement of drinking of cope (Buckner et al., 2021; Mohr et al., 2021) vs. single items. However, by examining individual items we were able to observe precisely which drinking-to-cope motives were or were not impacted by the COVID-19 pandemic. Fourth, the DMQ does not apply a timeframe to the assessment of drinking motives, while the PHQ-4 measure of symptoms of depression and anxiety has a past 2-week time frame; this difference may have limited the ability to detect an association between these mental health symptoms and drinking because one feels tense and nervous. Finally, we did not have power to examine if the effect of depression and anxiety symptoms was stronger on drinking to forget one's worries in the early-COVID period compared to the pre-COVID period due to a limited sample size, and we note that this is an important area for further study.

Despite these limitations, our findings improve the collective understanding of the impact of the COVID-19 pandemic on symptoms of depression and anxiety and drinking to cope in the general US population, and highlight the impact of the pandemic on symptoms of depression and anxiety among women and drinking to cope, and their association with one another. Such knowledge can inform public health and clinical initiatives to screen for and support those struggling with the mental health impacts of the COVID-19 pandemic. Moreover, coping motives may be a salient intervention point to mitigate the impact of the pandemic on alcohol use and related-problems, especially in light of the predicted long-term harms from increased alcohol use during the pandemic (Rehm et al., 2020). Longitudinal investigations utilizing rigorous measures will be necessary for estimating and understanding the impact of the COVID-19 pandemic on the mental health, drinking to cope, and alcohol use among men and women in the general US population over the course of the pandemic, and for determining the

longevity of the pandemic's effect on mental health and drinking to cope.

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CRedit authorship contribution statement

Priscilla Martinez: Conceptualization, Writing – original draft, Writing – review & editing. **Katherine J. Karriker-Jaffe:** Conceptualization, Investigation, Methodology, Writing – review & editing. **Yu Ye:** Software, Formal analysis. **Deidre Patterson:** Investigation, Data curation. **Thomas K. Greenfield:** Conceptualization, Writing – review & editing. **Nina Mulia:** Conceptualization, Writing – review & editing. **William C. Kerr:** Conceptualization, Writing – review & editing, Funding acquisition.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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