IJADR International Journal of Alcohol and Drug Research

The Official Journal of the Kettil Bruun Society for Social and Epidemiological Research on Alcohol

https://doi.org/10.7895/ijadr.629 IJADR, 2026, 14 ISSN: 1925-7066

Association of binge drinking with the COVID-19 pandemic

Oluwabunmi Dada[1], David Adzrago[2], Emmanuel Odame[3], Elizabeth Obekpa[2], Hadii M. Mamudu[4,5], Manik Ahuja[4,5], Matt Asare[6], David W. Stewart[4,7], Johnny Wilkerson[2], Prasun Bhattacharjee[4,8] and Timir K. Paul[4,9]

[1] Department of Occupational Safety and Health, Murray State University, Murray, KY
[2] School of Public Health, The University of Texas Health Science Center at Houston, Houston, TX
[3] Department of Environmental Health Sciences, University of Alabama at Birmingham, Birmingham
[4] Center for Cardiovascular Risk Research, East Tennessee State University, Johnson City, TN 37614
[5] College of Public Health, East Tennessee State University, Johnson City, TN 37614
[6] Department of Public Health, Baylor University, Waco, TX 76706
[7] Bill Gatton College of Pharmacy, East Tennessee State University, Johnson City, TN 37614
[8] College of Business and Technology, East Tennessee State University, Johnson City, TN 37614
[9] Department of Cardiovascular Sciences, Ascension St. Thomas Hospital West, University of Tennessee Health Science Center at Nashville, Nashville, TN 37203

Abstract

Aim: This study examined changes in binge drinking prevalence and odds before and after the 2020 COVID-19 pandemic declaration in the United States (US) among individuals with prior history of alcohol use, and explores the interaction effects of sociodemographic, behavioral, and health-related factors on the association.

Methods: A cross-sectional analysis was conducted using data from the Health Information National Trends Survey (HINTS) collected between February and June 2020 from adults reporting alcohol use in the past 30 days (n = 1,948). The primary outcome was binge drinking, defined as consuming five or more drinks (men), or four or more drinks (women) on one occasion in the past month. Weighted multivariable logistic regression models estimated adjusted odds ratios (AORs) and 95% confidence intervals (CIs) for binge drinking after the pandemic declaration, versus before the declaration, adjusting for sociodemographic, behavioral, and health-related factors.

Results: Binge drinking prevalence was similar before (44.39%) and after (44.13%) the declaration, with no significant overall difference (AOR = 0.77; 95% CI [0.54–1.10]). Cardiometabolic outcomes significantly moderated the association (p = .022), with lower probabilities among those with cardiometabolic conditions and higher probabilities among those without. Increased odds of binge drinking were observed among Hispanic adults (AOR = 2.10; 95% CI [1.08, 4.07]), lesbian/gay or bisexual individuals (AOR = 2.89; 95% CI [1.11, 7.54]), and former (AOR = 1.78; 95% CI [1.15, 2.76]) or current (AOR = 3.45, 95% CI [1.71, 6.98]) smokers.

Conclusions: While overall binge drinking remained stable, disparities emerged across subpopulations. These findings underscore the need for targeted interventions addressing alcohol use among vulnerable groups during public health emergencies.

Introduction

The severe acute respiratory syndrome coronavirus 2 (COVID-19) has unprecedentedly disrupted every aspect of life (Calina et al., 2021). Since COVID-19 emerged in 2019 and became a global pandemic in 2020, people have continued to experience illnesses and deaths from the virus, segregation, social isolation, and physical and financial constraints (Calina et al., 2021; Yazdi et al., 2020). In the United States (US), COVID-19 was the third leading cause of morbidity and mortality from March 2020 to October 2021 (Shiels et al., 2022). Additionally, significant changes in social behaviors, mental health, and substance use have been reported since then (Chacon et al., 2021). Evidence showing that COVID-19-related stressors have increased substance use, such as alcohol consumption, continues to emerge (Brooks et al., 2020; Da et al., 2020; Pollard et al., 2020). A major development observed during the peak of COVID-19 was a significant increase in the prevalence of binge drinking, defined as the consumption of alcohol within two hours, usually five or more drinks for men and four or more drinks for women (National Institute on Alcohol Abuse and Alcoholism [NIAAA], 2024). Binge drinking is associated with adverse health outcomes such as liver and

Correspondence: Oluwabunmi Dada, 157 Industry and Technology Center Department of Occupational Safety and Health, Murray State University, Murray, KY. Email odada1@murraystate.edu.
Financial support: this research received no specific funding.
Declaration of interest: None
Keywords: binge drinking, alcohol use, alcohol dependence, COVID-19 pandemic, sociodemographic.

other chronic diseases, including the risks of different types of cancer (NIAAA, 2024). This evidence serves as the impetus for this study.

Before the COVID-19 pandemic, research consistently demonstrated that binge drinking patterns varied significantly across sociodemographic groups, reflecting deep-rooted health disparities (Clay & Parker, 2020; Clay et al., 2023; Pollard et al., 2020; Rehm et al., 2020). Young adults aged 18-25 years consistently showed the highest prevalence of binge drinking, with rates exceeding 35% in national surveys (Grucza et al., 2018; Naimi et al., 2003). Sex differences were well-documented, with men traditionally exhibiting higher rates than women, although this gap has been narrowing in recent decades (Curtis et al., 2024). Racial and ethnic disparities revealed complex patterns (Bryant & Kim, 2012; Witbrodt et al., 2014), with non-Hispanic whites generally showing higher overall prevalence (Bryant & Kim, 2012); however, Hispanic and Native American populations continue to face disproportionate burden and alcohol-related harms (Chartier et al., 2014). Sexual and gender minorities (SGM) experienced elevated binge drinking rates compared to their heterosexual and cisgender counterparts, primarily attributed to minority stress, discrimination, and limited social support systems (Akré et al., 2021; Mereish, 2024). Educational and socioeconomic factors also played crucial roles, with college students and lower-educated adults showing high rates of binge drinking (Casswell et al., 2003), and the latter facing greater long-term risks and consequences (Herttua et al., 2015). Additionally, individuals who smoked tobacco or had lower levels of physical activity demonstrated higher propensities for binge drinking, suggesting clustering of risk behaviors (Meader et al., 2016). These established disparities reflected underlying structural inequalities, differential stress exposure, and varying access to protective resources and healthy coping mechanisms.

While these baseline sociodemographic disparities in binge drinking are well-documented, significant gaps remain in understanding how public health crises like pandemics may exacerbate, alter, or create new patterns of such variations in consumption. The COVID-19 pandemic presented a unique natural experiment where entire populations simultaneously experienced unprecedented stressors (Dada & Ogunyiola, 2021; Hale et al., 2020). Importantly, these pandemic-related stressors did not affect all groups equally; young adults faced educational disruptions and altered social environments (Hale et al., 2020), racial and ethnic minorities experienced disproportionate COVID-19 health impacts and economic losses (Tai et al., 2020), SGM individuals encountered reduced access to community support systems (Akré et al., 2021; Mereish, 2024; Moore et al., 2021), and individuals with lower socioeconomic status (SES) faced greater job insecurity and housing instability (Perry et al., 2021). These differential exposures to pandemic stressors suggest that pre-existing binge drinking disparities may have been significantly altered during the crisis period. However, no studies have systematically examined whether established sociodemographic disparities in binge drinking were maintained, amplified, or shifted during COVID-19 among individuals with prior history of alcohol use. This paucity of information represents a critical knowledge gap because understanding crisis-specific patterns of binge drinking disparities is essential for developing targeted interventions and policies during future public health emergencies, when resources are limited and must be strategically allocated to protect the most vulnerable populations.

Investigating the impact of a pandemic on binge drinking is important because the misuse of alcohol is problematic and significantly adds to the global burden of the disease, as well as to societal harms, including violence and economic burden (Acuff et al., 2022; Clay & Parker, 2020; Sohi et al., 2022). Binge drinking during crises such as the COVID-19 pandemic could transcend individual health risks to include behavioral shifts that could yield a cascade of societal issues, including a surge in domestic violence incidents, amplified pressure on healthcare systems already strained by the pandemic, and substantial economic repercussions (Acuff et al., 2022; Clay & Parker, 2020). Furthermore, if pandemic conditions differentially affected binge drinking patterns across sociodemographic groups, this could exacerbate existing health inequities and create new disparities that persist beyond the immediate crisis period, potentially requiring long-term targeted interventions and policy responses.

This study examines changes in binge drinking prevalence and odds before and after the 2020 COVID-19 pandemic declaration in the US among individuals with a prior history of alcohol use, and explores its associations with sociodemographic, behavioral, and health-related factors. Additionally, this study examines whether sociodemographic factors moderate the association between the COVID-19 pandemic declaration and binge drinking behavior. By focusing specifically on individuals with established history of alcohol use and examining before-and-after changes across multiple sociodemographic dimensions simultaneously, this study addresses a critical gap in understanding how public health crises may reshape existing patterns of health disparities. Findings from this study will contribute to the understanding of the differential impacts of the COVID-19 pandemic on binge drinking behaviors across vulnerable subpopulations and inform the development of targeted policies and programmatic initiatives for future pandemics and other public health emergencies.

Methods

Study population and design

This study employed a cross-sectional analytical design using secondary data from the Health Information National Trends Survey (HINTS) 5, Cycle 4, conducted from February through June 2020. The survey is a cross-sectional, nationally representative survey of the noninstitutionalized US adult population aged 18 years and older, and uses a two-stage stratified random sampling design with oversampling of racial/ethnic minorities. The sampling design, methods, and survey materials have been described extensively elsewhere (Finney Rutten et al., 2020; Nelson et al., 2004).

The analytical sample for this study was restricted to current drinkers, defined as survey respondents who reported having at least one drink of any alcoholic beverage on at least one day during the past 30 days (n = 1,948 out of 3,865 total

HINTS respondents), representing a weighted population of approximately 130 million adults in the US. This restriction was applied because the study's primary outcome (binge drinking) could only be assessed among individuals with recent alcohol consumption, and the research questions specifically focused on understanding how pandemic-related stressors affected drinking patterns among those already consuming alcohol. There was a total of 534 (27.41%) missing observations out of the total sample of 1,948; therefore, we performed multiple imputation by chained equations (MICE), an iterative statistical method for handling missing data. We used 20 imputations to impute missing values and retain the complete data on adults who are current drinkers (Austin et al., 2021; Azur et al., 2011).

The study design leveraged the unique timing of HINTS 5, Cycle 4 data collection, which spanned the World Health Organization's (WHO) COVID-19 pandemic declaration on March 11, 2020. Survey responses collected before March 11, 2020 (February 1 to March 11) were classified as *before pandemic declaration* (n = 752 current drinkers), while responses collected after March 11, 2020 (March 12 to June 30) were classified as *after pandemic declaration* (n = 1,196 current drinkers). This natural division allowed for examination of changes in binge drinking prevalence in relation to the pandemic declaration among current alcohol drinkers.

Survey measures

Dependent variable

The primary outcome was past 30-day binge drinking among current drinkers, derived from gender-specific survey questions consistent with The National Institute on Alcohol Abuse and Alcoholism (NIAAA) definitions (NIAAA, 2024). Male participants were asked: "During the past 30 days, how many times did you have five or more alcoholic drinks on one occasion?" Female participants were asked: "During the past 30 days, how many times did you have four or more alcoholic drinks on one occasion?" The original five-category responses were: *never*, *1-2 times*, *3-5 times*, *6-10 times*, and *11 or more times*. Binge drinking was dichotomized as *yes* (any frequency greater than one time) versus *no* (never) to reflect our study's aim of assessing binge drinking behavior among the population of people with prior history of alcohol use. This dichotomization is based on the primary research question that focuses on the presence versus absence of binge drinking behavior rather than frequency gradations, which is consistent with earlier national studies on binge drinking (Adzrago et al., 2023; Ayyala-Somayajula et al., 2025; Barbosa et al., 2023).

Independent variables

The COVID-19 pandemic declaration status was the primary exposure variable, operationalized as survey response timing before (February 1 to March 11, 2020) versus after (March 12 to June 30, 2020) the pandemic declaration, using March 11, 2020 (WHO pandemic declaration date; HINTS 5 Cycle 4, 2020) as the cut point. This variable is available in the HINTS 5, Cycle 4 dataset.

Based on existing national studies on binge drinking (Adzrago et al., 2023; Ayyala-Somayajula et al., 2025; Barbosa et al., 2023; Clay et al., 2023), we included the sociodemographic, behavioral, and health-related factors as covariates rather than primary exposures because our study's main objective was to assess the association between pandemic declaration and binge drinking. Demographic variables included age (categorized as 18–25, 26–34, 35–49, 50–65, or 65 years and older), sex (male or female), race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic, non-Hispanic Asian, or non-Hispanic other), and Rural-Urban Commuting Areas framework (metropolitan, micropolitan, or rural). Sexual orientation was categorized as heterosexual/straight or sexual minority, which included lesbian, gay, or bisexual individuals. Socioeconomic characteristics included highest level of education attained (less than high school, high school graduate, some college, or college graduate/higher), annual household income (ranging from less than $20,000 to $75,000 or more), employment status (employed or unemployed), and marital status (single/never married, married/living as married, divorced/separated, or widowed).

The behavioral and health-related variables included substance use, physical activity, mental health, cardiometabolic conditions, respiratory outcomes, and perceived health risks associated with consumption. Substance use measures included smoking status (never smoker, former smoker, or current smoker) and e-cigarette use (never user, former user, or current user). Physical and mental health measures included engagement in moderate physical activity at least one day per week (versus none) and anxiety or depression symptoms assessed using the four-item patient health questionnaire for anxiety and depression (PHQ-4), categorized as none or mild/moderate/severe. Cardiometabolic conditions were based on self-reported diagnoses of diabetes, hypertension, heart conditions, or obesity. Respiratory conditions were identified from self-reported diagnoses of chronic lung disease, asthma, emphysema, or chronic bronchitis. Health risk perceptions captured participants' beliefs regarding the health risks of alcohol consumption. Attitudes toward anti-alcohol policies included support for measures such as restrictions on alcohol advertising, requirements for health warnings on containers, and inclusion of recommended drinking guidelines.

Statistical analyses

The analytical approach was designed to examine the association between the COVID-19 pandemic declaration and binge drinking among current users of alcohol while controlling for potential confounding by sociodemographic factors. All analyses incorporated HINTS sampling weights and design effects (clustering and stratification) to produce nationally representative estimates and appropriate standard errors.

All analyses accounted for the complex survey design of the HINTS by incorporating the final sampling weights to produce nationally representative estimates, and the clustering and stratification variables were also included to calculate appropriate standard errors and account for design effects (Finney Rutten et al., 2020; HINTS 5 Cycle 4, 2020). A Taylor series linearization approach for variance estimation method was applied as the analytical strategy to appropriately reflect factors such as the selection of the sample, differential sampling rates to subsample a subpopulation, and nonresponse adjustments in estimating sampling error of survey statistics.

The primary analysis used pooled data from both time periods (n = 1,948 current drinkers) with pandemic declaration status as the main exposure variable. We first calculated differences in the binge drinking prevalence across the independent variables, using the Rao-Scott chi-square test, which is a complex sample survey data version of the Pearson chi-square test used to account for survey designs. Next, we examined the subgroup differences in the binge drinking prevalence across the independent variables, stratified by pandemic declaration status. Results were reported as unweighted frequencies and weighted percentages.

We examined the unadjusted association between binge drinking and pandemic declaration status, along with the covariates, using logistic regression analysis. Next, we used multivariable logistic regression analysis to examine the association between binge drinking and pandemic declaration status, adjusting for the covariates. In individual models, we further assessed the interaction between each covariate (adjusting for the remaining covariates) and the pandemic declaration status on binge drinking to determine whether the association between pandemic declaration status and binge drinking varied by the covariates. Statistically significant interactions ($p < .05$) were further examined through marginal effect analysis using Stata's margins command to estimate average predicted probabilities, and presented the results in graphs with Stata's margins plots. Marginal effect analyses were used to estimate adjusted average predicted probabilities of binge drinking across subgroups of the two interacting variables, holding other covariates constant (Norton et al., 2019). This approach facilitates the interpretation of interaction effects in logistic regression models by providing average predicted probabilities of binge drinking for each category of the two interacting variables (Norton et al., 2019).

In a secondary analysis, we stratified the adjusted multivariable logistic regression model by pandemic declaration status to evaluate the association between binge drinking and the sociodemographic and health-related factors to provide estimates for within-group differences.

The primary measure of association was the adjusted odds ratio (AOR) with the corresponding 95% confidence interval comparing the odds of binge drinking by the pandemic declaration and covariates among current drinkers. We assessed multicollinearity between the independent variables and found a mean variance inflation factor (VIF) of 1.21, which is less than 5 or 10 thresholds to suggest multicollinearity between the independent variables (Salmerón-Gómez et al., 2025; Vatcheva et al., 2016). All analyses were performed in Stata/SE 16.1. Statistical significance was set at $p < .05$ using two-tailed tests.

Research ethics approval statement

As is consistent with the guidelines of the Institutional Review Board (IRB), ethical review was not required for this study because it relied exclusively on publicly available, de-identified secondary data. Such analyses are consistent with institutional and federal guidelines indicating that publicly available, non-identifiable data do not constitute human subjects research and, therefore, do not require IRB oversight.

Results

Prevalence of binge drinking among current drinkers

Overall, the prevalence of binge drinking among current users of alcohol was 44.22% and did not significantly differ by the pandemic declaration (Table 1). Across sociodemographic subgroups and health-related factors (Table 1), the prevalence of binge drinking was significantly higher among individuals who were aged 18 to 25 years (61.31%), males (48.55%), lesbian/gay or bisexual (67.49%), single/never married (53.09%), completed high school education (57.12%), had total annual family income of $20,000-$34,999 (56.34%), current cigarette smokers (62.68%), current e-cigarette users (71.21%), had symptoms of anxiety or depression (52.96%), and opposed or strongly opposed anti-alcohol messages (54.78%). Regarding the frequency of binge drinking in the past 30 days, Figure 1 shows that past 30-day binge drinking frequency was higher after the pandemic declaration (6 to 10 times = 4.29% and 11 or more times = 3.09%) than before the declaration (6 to 10 times = 3.12% and 11 or more times = 2.99%).

When the prevalence was stratified by pandemic declaration (Table 1), the prevalence across sociodemographic subgroups and health-related factors before the pandemic declaration was significantly higher among individuals who were aged 18 to 25 years (60.03%), lesbian/gay or bisexual (70.80%), completed less than high school education (65.65%), had fair/poor general health (60.45%), current cigarette smokers (58.64%), current e-cigarette users (77.10%), and had symptoms of anxiety or depression (54.57%). After the pandemic declaration, the prevalence was significantly higher among individuals who were aged 18 to 25 years (61.69%), males (49.18%), lesbian/gay or bisexual (66.14%), completed high school education (61.61%), current cigarette smokers (65.24%), current e-cigarette users (69.67%), had symptoms of anxiety or depression (52.18%), and opposed or strongly opposed anti-alcohol messages (61.43%).

Association between binge drinking, pandemic declaration, and sociodemographic characteristics

The unadjusted and adjusted logistic regression analysis results showed that the association between binge drinking and the pandemic declaration was not statistically significant among current drinkers (Table 2). In the adjusted model (Table 2), the odds of binge drinking were lower among individuals aged 65 years or more (AOR = 0.15, 95% CI [0.06, 0.39]) compared to those aged 18 to 25 years. The odds were higher among males (AOR= 1.39, 95% CI [1.01, 1.91]) compared to females, lesbian/gay or bisexual (AOR = 2.42, 95% CI [1.21, 4.83]) compared to heterosexual, former (AOR = 1.66, 95% CI [1.15, 2.41]) and current (AOR = 2.33, 95% CI [1.32, 4.09]) smokers compared to nonsmokers, and current e-cigarette users (AOR = 2.27, 95% CI [1.07, 4.83]) compared to non-users.

Table 1

Sociodemographic characteristics and past 30-day binge drinking among adult current drinkers in the United States (n = 3,865)

	Before and after COVID-19 pandemic declaration			Before COVID-19 pandemic declaration			After COVID-19 pandemic declaration		
	Total *n* (%)	Binge drinking *n* (%)	*p*-value	Total *n*(%)	Binge drinking *n(%)*	*p*-value	Total *n (%)*	Binge drinking	*p*-value
Characteristics	1,948 (100)	747 (44.22)		(*n* = 752)	267 (44.39)		(*n* = 1,196)	480 (44.13)	
COVID-19 pandemic declaration			.950	-	-	-	-	-	-
Before COVID-19 declaration	752 (36.23)	267 (44.39)		-	-		-	-	
After COVID-19 declaration	1,196 (63.77)	480 (44.13)		-	-		-	-	
Age			<.001			.009			<.001
18–25	71 (9.33)	38 (61.31)		17(5.92)	10(60.03)		54 (11.26)	28 (61.69)	
26–34	218 (14.43)	113 (56.44)		71(9.98)	37(56.88)		147 (16.95)	76 (56.29)	
35–49	393 (26.96)	173 (45.47)		126 (24.58)	55(47.01)		267 (28.31)	118 (44.72)	
50–64	636 (31.77)	282 (44.97)		245 (38.15)	103(49.22)		391 (28.14)	179 (41.70)	
≥65	630 (17.52)	141 (21.81)		293 (21.36)	62 (22.60)		337 (15.33)	79 (21.17)	
Sex			.016			.322			.029
Female	1051 (48.82)	372 (39.69)		399 (47.77)	130 (41.03)		652 (49.42)	242 (38.96)	
Male	897 (51.18)	375 (48.55)		353 (52.23)	137 (47.47)		544 (50.58)	238 (49.18)	
Race/ethnicity			.723			.786			.815
Non-Hispanic White	1281 (69.51)	483 (42.96)		549 (76.75)	190 (43.21)		732 (65.39)	293 (42.79)	
Non-Hispanic Black	238 (9.50)	88 (44.31)		67 (6.87)	25 (51.56)		171 (10.99)	63 (41.72)	
Hispanic	292 (13.51)	132 (56.90)		85 (8.79)	35 (51.39)		207 (16.18)	97 (58.60)	
Non-Hispanic Asian	74 (4.22)	23 (28.63)		23 (3.56)	9 (42.71)		51 (4.60)	14 (22.43)	
Non-Hispanic other	63 (3.27)	21 (38.64)		28 (4.03)	8 (40.66)		35 (2.84)	13 (36.87)	
Sexual orientation			.003			.022			.029
Heterosexual	1834 (93.01)	689 (42.48)		714 (94.37)	250 (42.81)		1120 (92.24)	439 (42.28)	
Lesbian/Gay or Bisexual	114 (6.99)	58 (67.49)		38 (5.63)	17 (70.80)		76 (7.76)	41 (66.14)	
Marital status			.022			.065			.137
Single/never married	353 (27.69)	157 (53.09)		117 (22.11)	51 (57.10)		236 (30.85)	106 (51.46)	
Married/living as married	1074 (58.57)	401 (40.53)		424 (63.07)	143 (41.19)		650 (56.02)	258 (40.11)	
Divorced/separated	340 (9.85)	133 (45.87)		130 (9.98)	46 (40.89)		210 (9.78)	87 (48.76)	
Widowed	181 (3.89)	56 (32.61)		81 (4.84)	27 (35.27)		100 (3.34)	29 (30.40)	

Table 1 (continued)

	Before and after COVID-19 pandemic declaration			Before COVID-19 pandemic declaration			After COVID-19 pandemic declaration		
	Total *n* (%)	Binge drinking *n* (%)	*p*-value	Total *n*(%)	Binge drinking *n(%)*	*p*-value	Total *n (%)*	Binge drinking	*p*-value
Level of education completed			<.001			.021			.010
Less than High School	97 (5.17)	40 (53.66)		33 (5.51)	13 (65.65)		64 (4.97)	27 (46.25)	
High School graduate	311 (20.40)	151 (57.12)		118 (17.71)	52 (47.35)		193 (21.93)	99 (61.61)	
Some college	537 (37.47)	199 (42.08)		207 (38.09)	71 (47.63)		330 (37.12)	128 (38.84)	
College graduate/higher	1003 (36.96)	357 (37.97)		394 (38.69)	131 (36.85)		609 (35.98)	226 (38.65)	
Total annual family income			.021			.077			.109
<$20,000	287 (11.73)	126 (51.32)		99 (12.02)	42 (55.63)		188 (11.56)	84 (48.80)	
$20,000–$34,999	181 (7.36)	85 (56.34)		75 (7.07)	34 (54.25)		106 (7.53)	51 (57.44)	
$35,000–$49,999	232 (11.22)	76 (45.84)		87 (12.98)	24 (51.97)		145 (10.22)	52 (41.46)	
$50,000–$74,999	314 (17.03)	111 (43.69)		129 (15.67)	37 (32.41)		185 (17.80)	74 (49.34)	
≥$75,000	934 (52.67)	349 (40.80)		362 (52.26)	130 (42.21)		572 (52.90)	219 (40.00)	
Employment status			.542			.179			.831
Unemployed	850 (32.49)	266 (42.57)		369 (34.84)	102 (38.89)		481 (31.16)	164 (44.90)	
Employed	1098 (67.51)	481 (45.02)		383 (65.16)	165 (47.33)		715 (68.84)	316 (43.78)	
General health status			.676			.041			.556
Excellent/very good/good	1700 (88.81)	636 (43.94)		665 (90.12)	229 (42.64)		1035 (88.07)	407 (44.69)	
Fair/poor	248 (11.19)	111 (46.49)		87 (9.88)	38 (60.45)		161 (11.93)	73 (39.93)	
Rural-Urban Commuting Areas			.709			.821			.751
Metropolitan	1750 (87.66)	671 (43.92)		648 (85.65)	229 (44.15)		1102 (88.80)	442 (43.80)	
Micropolitan/small town/rural	198 (12.34)	76 (46.37)		104 (14.35)	38 (45.83)		94 (11.20)	38 (46.78)	
Moderate physical activity intensity			.994			.061			.197
None	419 (21.41)	167 (44.25)		152 (22.09)	61 (55.82)		267 (21.02)	106 (37.36)	
At least one day per week	1529 (78.59)	580 (44.21)		600 (77.91)	206 (41.15)		929 (78.98)	374 (45.93)	
Cigarette smoking status			<.001			.016			<.001
Never	1193 (58.45)	383 (38.02)		460 (54.97)	140 (37.52)		733 (60.42)	243 (38.28)	
Former smoker	507 (25.73)	207 (46.95)		205 (28.00)	75 (49.18)		302 (24.44)	132 (45.49)	
Current smoker	248 (15.83)	157 (62.68)		87 (17.03)	52 (58.64)		161 (15.14)	105 (65.24)	

Table 1 (continued)

	Before and after COVID-19 pandemic declaration			Before COVID-19 pandemic declaration			After COVID-19 pandemic declaration		
	Total *n* (%)	Binge drinking *n* (%)	*p*-value	Total *n*(%)	Binge drinking *n(%)*	*p*-value	Total *n (%)*	Binge drinking	*p*-value
E-cigarette use status			<.001			.002			.001
Never	1639 (75.73)	565 (39.15)		647 (79.95)	201 (39.03)		992 (73.33)	364 (39.23)	
Former user	241 (16.29)	136 (54.59)		81 (15.45)	48 (62.42)		160 (16.77)	88 (50.49)	
Current user	68 (7.98)	46 (71.21)		24 (4.60)	18 (77.10)		44 (9.90)	28 (69.67)	
Anxiety/depression symptoms			.005			.032			.040
None	1411 (69.30)	488 (40.35)		548 (72.46)	171 (40.51)		863 (67.51)	317 (40.25)	
Mild/moderate/ severe	537 (30.70)	259 (52.96)		204 (27.54)	96 (54.57)		333 (32.49)	163 (52.18)	
Cardiometabolic outcomes			.950			.086			.343
No	820 (45.55)	328 (44.10)		304 (44.94)	114 (39.38)		516 (45.90)	214 (46.72)	
Yes	1128 (54.45)	419 (44.33)		448 (55.06)	153 (48.48)		680 (54.10)	266 (41.93)	
Respiratory outcomes			.995			.397			.691
No	1713 (89.54)	664 (44.23)		671 (91.87)	245 (45.00)		1042 (88.22)	419(43.77)	
Yes	235 (10.46)	83 (44.19)		81 (8.13)	22 (37.46)		154 (11.78)	61 (46.83)	
Anti-alcohol messages			.010			.710			.005
Strongly oppose/Oppose	140 (7.32)	73 (54.78)		59 (7.91)	25 (44.45)		81 (6.98)	48 (61.43)	
Neither support nor oppose	440 (25.17)	190 (50.00)		160 (24.20)	59 (46.89)		280 (25.73)	131 (51.66)	
Strongly support/ Support	1368 (67.51)	484 (40.93)		533 (67.89)	183 (43.49)		835 (67.29)	301 (39.46)	
Perceived health risks of drinking alcohol			.878			.983			.837
Decreased risk or no effect	246 (12.41)	93 (40.53)		95 (13.17)	36 (42.34)		151 (11.98)	57 (39.40)	
Increased risk	610 (32.16)	261 (47.71)		246 (32.83)	94 (45.91)		364 (31.79)	167 (48.77)	
Uncertain or don't know	1092 (55.42)	393 (43.02)		411 (54.00)	137 (43.97)		681 (56.23)	256 (42.51)	

Notes: Data are from the 2020 Health Information National Trends Survey (HINTS) 5, Cycle 4 (February–June 2020). The analytic sample includes US adult current drinkers (unweighted n = 1,948; weighted n = 130,037,260). Responses collected before March 11, 2020, are classified as before the COVID-19 pandemic declaration, and responses collected on or after March 11, 2020, are classified as after the declaration. Frequencies are unweighted and percentages are weighted to account for the complex survey design. Differences in category totals may reflect missing data.

Table 2

Association between past 30-day binge drinking and COVID-19 pandemic declaration, sociodemographic characteristics, and health behaviors among adults in the United States (n = 3,865)

		Unadjusted		Adjusted	
		OR	95% CI[a]	AOR[b]	95% CI
COVID-19 pandemic declaration	Before declaration	Ref[c]	-	Ref	-
	After declaration	0.99	[0.71, 1.38]	0.77	[0.54, 1.10]
Age	18–25	Ref	-	-	Ref
	26–34	0.82	[0.37, 1.83]	1.12	[0.50, 2.48]
	35–49	0.53	[0.24, 1.13]	0.63	[0.28, 1.43]
	50–64	0.52	[0.26, 1.04]	0.56	[0.26 1.21]
	≥65	0.18***	[0.08, 0.39]	0.15***	[0.06, 0.39]
Sex	Female	Ref	-	Ref	Ref
	Male	1.43*	[1.07, 1.92]	1.39*	[1.01, 1.91]
Race/ethnicity	Non-Hispanic White	Ref	-	Ref	Ref
	Non-Hispanic Black	1.06	[0.64, 1.74]	1.02	[0.63, 1.66]
	Hispanic	1.75*	[1.10, 2.80]	1.63	[0.93, 2.87]
	Non-Hispanic Asian	0.53	[0.22, 1.30]	0.64	[0.27, 1.54]
	Non-Hispanic other	0.83	[0.31, 2.23]	0.42	[0.14, 1.26]
Sexual orientation	Heterosexual	Ref	-	Ref	-
	Lesbian/Gay or Bisexual	2.82**	[1.44, 5.52]	2.42*	[1.21, 4.83]
Marital status	Single/never married	Ref		Ref	
	Married/living as married	0.60*	[0.40, 0.90]	1.00	[0.62, 1.62]
	Divorced/separated	0.75	[0.43, 1.30]	1.12	[0.62, 2.03]
	Widowed	0.43**	[0.24, 0.77]	1.20	[0.57, 2.54]
Level of education completed	Less than High School	Ref	-	Ref	-
	High School graduate	1.15	[0.49, 2.72]	1.47	[0.62, 3.46]
	Some college	0.63	[0.27, 1.46]	0.81	[0.36, 1.82]
	College graduate/higher	0.53	[0.24, 1.16]	0.81	[0.35, 1.85]
Total family annual income	<$20,000	Ref	-	Ref	-
	$20,000 to < $35,000	1.22	[0.63, 2.38]	1.52	[0.77, 3.00]
	$35,000 to < $50,000	0.80	[0.42, 1.52]	0.80	[0.40, 1.61]
	$50,000 to < $75,000	0.74	[0.43, 1.25]	0.92	[0.48, 1.75]
	≥$75,000	0.65	[0.40, 1.06]	0.90	[0.47, 1.75]
Employment status	Unemployed	Ref	-	Ref	-
	Employed	1.11	[0.80, 1.53]	0.77	[0.50, 1.19]
General health status	Excellent/very good/good	Ref	-	Ref	-
	Fair/poor	1.11	[0.68, 1.80]	1.12	[0.62, 2.01]
Rural-urban commuting areas	Metropolitan	Ref	-	Ref	-
	Micropolitan/Small town/rural	1.10	[0.65, 1.87]	1.02	[0.63, 1.65]
Moderate physical activity intensity	None	Ref	-	Ref	-
	At least one day per week	1.00	[0.67, 1.48]	1.20	[0.79, 1.82]
Cigarette smoking status	Never	Ref	-	Ref	-
	Former smoker	1.44*	[1.07, 1.95]	1.66**	[1.15, 2.41]
	Current smoker	2.74***	[1.67, 4.50]	2.33**	[1.32, 4.09]
E-cigarette use status	Never	Ref	-	Ref	-
	Former user	1.87**	[1.21, 2.89]	1.00	[0.60, 1.67]
	Current user	3.85***	[1.89, 7.84]	2.27*	[1.07, 4.83]
Anxiety/depression symptoms	None	Ref	-	Ref	-
	Mild/moderate/severe	1.66**	[1.17, 2.36]	1.14	[0.79, 1.65]
Cardiometabolic outcomes	No	Ref	-	Ref	-
	Yes	1.01	[0.75, 1.36]	1.19	[0.85, 1.69]
Respiratory outcomes	No	Ref	-	Ref	-
	Yes	1.00	[0.63, 1.59]	1.02	[0.62, 1.68]
Anti-alcohol messages	Strongly oppose/oppose	Ref	-	Ref	-
	Neither support nor oppose	0.83	[0.45, 1.52]	0.88	[0.44, 1.76]
	Strongly support/support	0.57*	[0.34, 0.97]	0.60	[0.32, 1.12]
Perceived health risks of drinking alcohol	Decreased risk or no effect	Ref	-	Ref	-
	Increased risk	1.34	[0.81, 2.21]	1.37	[0.80, 2.38]
	Uncertain or don't know	1.11	[0.67, 1.85]	1.07	[0.64, 1.78]

Notes:

Data source: 2020 Health Information National Trends Surveys, HINTS 5 Cycle 4.Before the COVID-19 pandemic declaration data were collected before March 11, 2020, and after COVID-19 pandemic declaration data were collected on and after March 11, 2020.

[a]95% CI = 95% confidence interval. [b]AOR = Adjusted odds ratio. [c]Ref = Reference group. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Figure 1

Prevalence of frequency of past 30-day binge drinking before and after the COVID-19 pandemic declaration among adults who drink (n = 3,865)

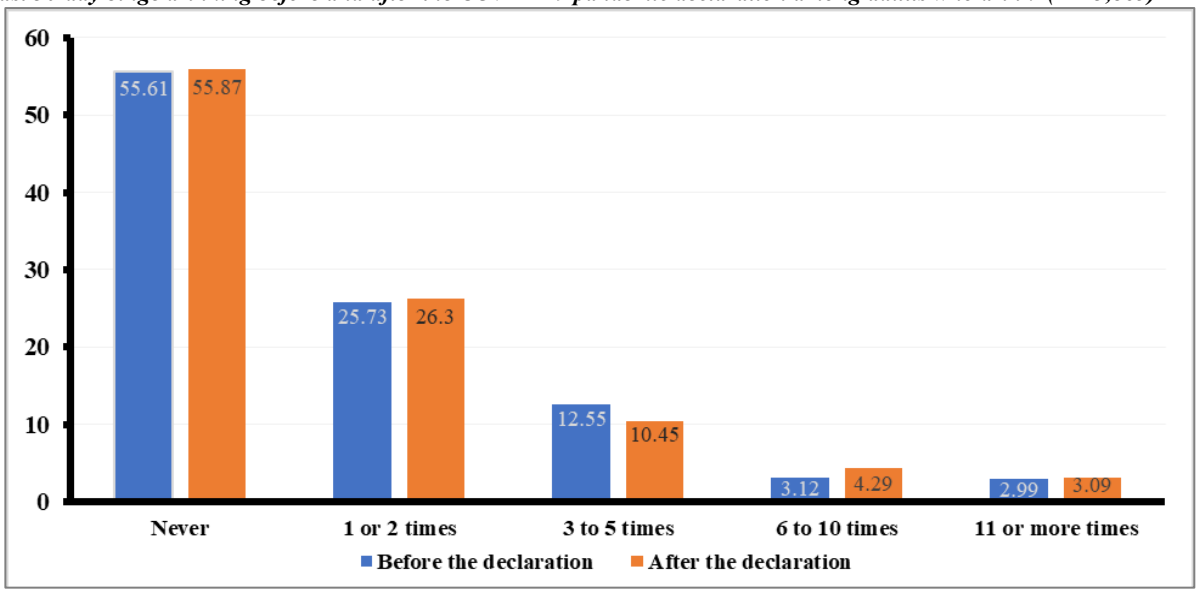


Table 3

The odds of past 30-day binge drinking among adults in the United States before and after the COVID-19 pandemic declaration (n = 3,865)

		Before COVID-19 declaration (Model 1)		After COVID-19 declaration (Model 2)	
		AOR[a]	95% CI[b]	AOR	95% CI
Age	18–25	Ref[c]	-		Ref
	26–34	1.27	[0.23, 7.00]	1.05	[0.38, 2.85]
	35–49	0.53	[0.09, 3.01]	0.63	[0.24, 1.66]
	50–64	0.53	[0.11, 2.58]	0.55	[0.21, 1.45]
	≥65	0.15*	[0.02, 0.92]	0.15**	[0.05, 0.45]
Sex	Female	Ref	-		Ref
	Male	1.62	[0.93, 2.81]	1.39	[0.90, 2.12]
Race/ethnicity	Non-Hispanic White	Ref	-		Ref
	Non-Hispanic Black	0.78	[0.29, 2.13]	0.98	[0.54, 1.76]
	Hispanic	1.09	[0.40, 2.93]	2.10*	[1.08, 4.07]
	Non-Hispanic Asian	0.54	[0.14, 2.04]	0.60	[0.18, 1.97]
	Non-Hispanic other	0.17*	[0.03, 0.91]	0.53	[0.13, 2.09]
Sexual orientation	Heterosexual	Ref	-		Ref
	Lesbian/Gay or Bisexual	2.11	[0.60, 7.43]	2.89*	[1.11, 7.54]

Table 3 (continued)

		Before COVID-19 declaration (Model 1)		After COVID-19 declaration (Model 2)	
		AOR[a]	95% CI[b]	AOR	95% CI
Marital status	Single/never married	Ref	-	Ref	
	Married/living as married	0.72	[0.34, 1.54]	1.11	[0.63, 1.93]
	Divorced/separated	0.65	[0.19, 2.24]	1.45	[0.75, 2.79]
	Widowed	0.88	[0.25, 3.13]	1.49	[0.56, 3.98]
Level of education completed	Less than High School	Ref	-	Ref	-
	High School graduate	0.58	[0.16, 2.14]	2.12	[0.70, 6.44]
	Some college	0.57	[0.15, 2.15]	0.83	[0.27, 2.51]
	College graduate/higher	0.36	[0.10, 1.27]	1.14	[0.35, 3.68]
Total family annual income	<$20,000	Ref		Ref	-
	$20,000 to < $35,000	1.79	[0.59, 5.41]	1.68	[0.61, 4.60]
	$35,000 to < $50,000	1.11	[0.39, 3.11]	0.72	[0.28, 1.82]
	$50,000 to < $75,000	0.64	[0.24, 1.74]	1.24	[0.56, 2.76]
	≥$75,000	1.27	[0.45, 3.55]	0.98	[0.41, 2.35]
Employment status	Unemployed	Ref	-	Ref	-
	Employed	1.01	[0.52, 1.97]	0.67	[0.38, 1.19]
General health status	Excellent/very good/good	Ref	-	Ref	-
	Fair/poor	1.05	[0.92, 4.58]	0.79	[0.36, 1.75]
Rural-Urban Commuting Areas	Metropolitan	Ref	-	Ref	-
	Micropolitan/Small town/rural	0.96	[0.48, 1.93]	0.97	[0.45, 2.10]
Moderate physical activity intensity	None	Ref	-	Ref	-
	At least one day per week	0.70	[0.37, 1.36]	1.50	[0.86, 2.60]
Cigarette smoking status	Never	Ref	-	Ref	-
	Former smoker	1.63	[0.86, 3.11]	1.78*	[1.15, 2.76]
	Current smoker	1.58	[0.65, 3.86]	3.45**	[1.71, 6.98]
E-cigarette use status	Never	Ref	-	Ref	-
	Former user	1.81	[0.79, 4.14]	0.71	[0.36, 1.41]
	Current user	4.66**	[1.49, 14.50]	1.72	[0.70, 4.25]
Anxiety/depression symptoms	None	Ref	-	Ref	-
	Mild/moderate/severe	1.23	[0.69, 2.19]	1.17	[0.72, 1.91]
Cardiometabolic outcomes	No	Ref	-	Ref	-
	Yes	1.72*	[1.05, 2.81]	0.98	[0.65, 1.49]
Respiratory outcomes	No	Ref	-	Ref	-
	Yes	0.68	[0.32, 1.42]	1.28	[0.68, 2.41]
Anti-alcohol messages	Strongly oppose/oppose	Ref	-	Ref	-
	Neither support nor oppose	0.95	[0.35, 2.56]	0.85	[0.37, 1.95]
	Strongly support/support	1.07	[0.46, 2.45]	0.48	[0.22, 1.06]
Perceived health risks of drinking alcohol	Decreased risk or no effect	Ref	-	Ref	-
	Increased risk	1.42	[0.60, 3.38]	1.60	[0.82, 3.11]
	Uncertain or don't know	1.15	[0.53, 2.49]	1.17	[0.60, 2.27]

Notes:

Data source: 2020 Health Information National Trends Surveys, HINTS 5 Cycle 4. Before the COVID-19 pandemic declaration data were collected before March 11, 2020, and after COVID-19 pandemic declaration data were collected on and after March 11, 2020.

[a]AOR = Adjusted odds ratio. [b]95% CI = 95% confidence interval. [c]Ref = Reference group. *$p \leq 0.05$, **$p \leq 0.01$, ***$p \leq 0.001$.

Interaction between sociodemographic characteristics and pandemic declaration on binge drinking

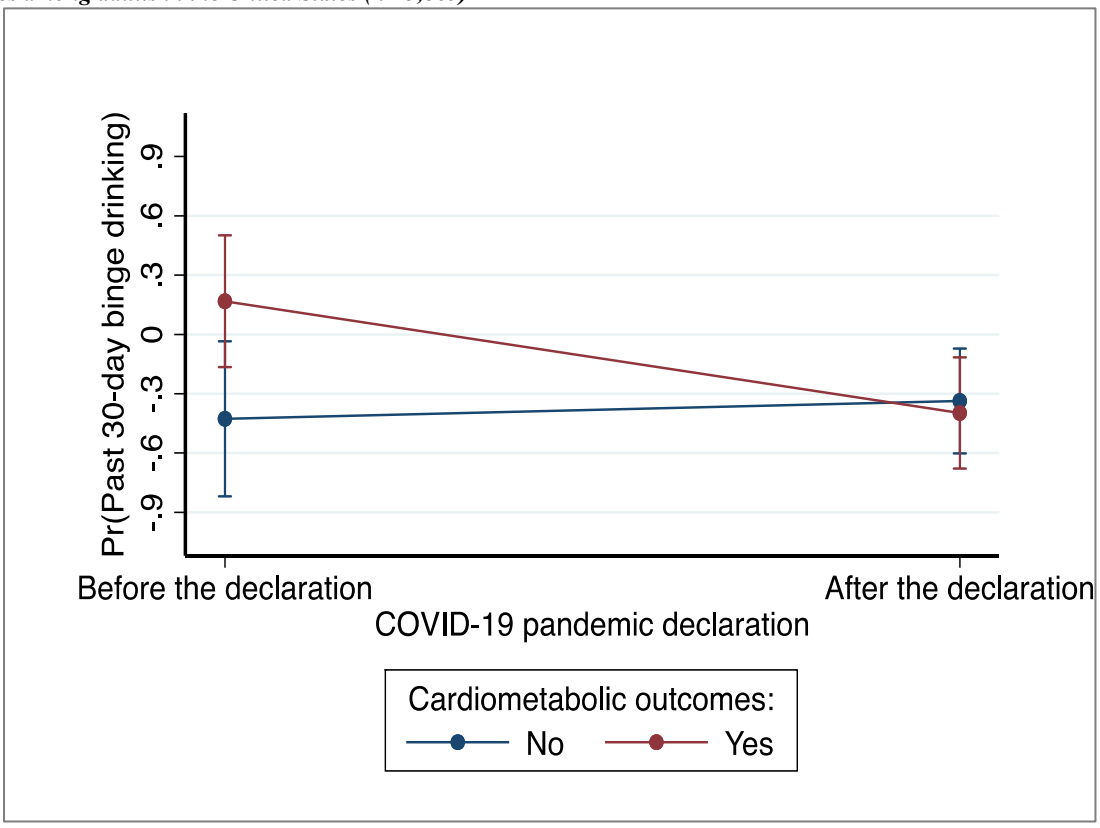
Among all the sociodemographic characteristics and health-related factors, only cardiometabolic outcomes significantly moderated the association between binge drinking and pandemic declaration (p = .022). During the pandemic, the lower probability of binge drinking was observed among people with cardiometabolic outcomes (Margin = -0.40, 95% CI [-0.68, -0.12], p = .006) compared to those without cardiometabolic outcomes (Margin = -0.34, 95% CI [-0.60, -0.07], p = .014; Figure 2). Before the pandemic, the probability was higher for people with cardiometabolic outcomes (margin = 0.17, 95% CI [-0.17, 0.50], p = .319) compared to those without cardiometabolic outcomes (margin = -0.43, 95% CI [-0.82, -0.03], p = .033; Figure 2). The probability in general decreased for people with cardiometabolic outcomes but increased for people without cardiometabolic outcomes (Figure 2).

Association between binge drinking and sociodemographic characteristics, stratified by pandemic declaration

We stratified the logistic regression analysis of the association between binge drinking and sociodemographic characteristics among current users of alcohol to determine within-group differences (Table 3). Individuals aged 65 years or more (compared to 18 to 25 years) had lower odds of binge drinking before (AOR = 0.15, 95% CI [0.02, 0.92]) and during (AOR = 0.15, 95% CI [0.05, 0.45]) the pandemic. Compared to non-Hispanic White people, non-Hispanic others (AOR = 0.17, 95% CI [0.03, 0.91]) had lower odds of binge drinking before the pandemic, while the odds were higher for Hispanic people during the pandemic (AOR = 2.10, 95% CI [1.08, 4.07]). Sexual and gender minorities had higher odds of binge drinking (AOR = 2.89, 95% CI [1.11, 7.54]) compared to heterosexual individuals during the pandemic. The odds were higher during the pandemic for former (AOR = 1.78, 95% CI = 1.15, 2.76) and current (AOR = 3.45, 95% CI = 1.71, 6.98) smokers compared to nonsmokers. The odds were higher for current e-cigarette users (AOR= 4.66, 95% CI= 1.49, 14.50) compared to non-users, and people with cardiometabolic outcomes (AOR= 1.72, 95% CI= 1.05, 2.81) compared to those without cardiometabolic outcomes.

Figure 2

Differences in past 30-day binge drinking between and within COVID-19 pandemic declaration and cardiometabolic outcomes among adults in the United States (n =3,865)



Discussion

Binge drinking of alcohol is a major public health issue, with disparities across subpopulations. While studies on binge drinking of alcohol exist (Adzrago et al., 2023; Bryant & Kim, 2012; Grucza et al., 2018; Naimi et al., 2003), to the best knowledge of the authors there have been no studies on binge drinking among people with prior history of alcohol use in the US during the COVID-19 pandemic. Therefore, this study examined changes in binge drinking behavior among current users of alcohol before and after the COVID-19 pandemic declaration in March 2020 using nationally

representative data from the HINTS 5, Cycle 4. We found that approximately two in five people (44.22%) with a prior history of alcohol use indulged in binge drinking, with disparities across subpopulations; however, there was no statistically significant difference in the prevalence before versus after the pandemic declaration. These findings reveal that while population-level binge drinking remained unchanged, specific vulnerable populations experienced disproportionate risks, suggesting the need for a targeted approach to addressing binge drinking of alcohol during public health emergencies.

Early studies reported widespread increases in alcohol misuse among the general US population during the COVID-19 pandemic (Grossman et al., 2020; Nordeck et al., 2022; Pollard et al., 2020; Weerakoon et al., 2021). In contrast, our study focused on current drinkers, including individuals with a prior history of alcohol use, and found no significant difference in binge drinking prevalence before and after the pandemic declaration. This distinction is important, as individuals who were already drinking before the pandemic may have maintained their established patterns of use despite the social disruptions. The insignificant difference in binge drinking may also reflect competing influences: while pandemic-related stress, isolation, and economic uncertainty could have encouraged heavier drinking (Grossman et al., 2020; The Lancet Gastroenterology & Hepatology, 2020; Weerakoon et al., 2021), lockdown measures simultaneously reduced social or binge drinking opportunities such as such as bars, parties, and gatherings (Mangot-Sala et al., 2022). These counterbalancing forces may explain the observed stability in binge drinking behaviors among this subgroup during the early pandemic period.

Sexual minority individuals (lesbian, gay, and bisexual adults) exhibited significantly higher odds of binge drinking during the pandemic period compared to heterosexual adults. This finding aligns with minority stress theory and previous research documenting elevated substance use among sexual minorities during crises (Akré et al., 2021; Fish et al., 2021; Hughes et al., 2016). The pandemic likely exacerbated existing stressors for this population, including social isolation from chosen families, discrimination in healthcare settings, and economic vulnerabilities (DiPlacido et al., 2023; Stewart et al., 2024). These results underscore the critical need for culturally competent mental health and substance use services that address the unique experiences of sexual minority populations during public health emergencies.

The significant racial/ethnic disparities observed in this study revealed that Hispanic adults had higher odds of binge drinking during the pandemic. This pattern is consistent with previous research showing that Hispanic populations faced disproportionate exposure to pandemic-related stressors such as essential worker employment, higher infection rates, and economic hardship (Garcini et al., 2022; Ormiston et al., 2023). These structural inequities may have contributed to increased alcohol misuse as a coping response. Addressing these disparities requires interventions that integrate social determinants of health and strengthen support systems for communities most affected by public health crises.

As in prior studies, tobacco use was strongly associated with binge drinking (Gubner et al., 2016; Jiang et al., 2014; McKee & Weinberger, 2013; Vanderbruggen et al., 2020; Wang, 2020). Alcohol and tobacco use are highly correlated across levels of use and diagnostic categories (McKee et al., 2007; McKee & Weinberger, 2013). Our results showed that current smokers had over three times greater odds of binge drinking than nonsmokers, while former smokers had approximately 1.6 times higher odds. Similarly, e-cigarette users were more than twice as likely to binge drink compared to non-users. These findings reaffirm the clustering of risk behaviors and the shared neurobehavioral pathways underlying alcohol and tobacco co-use (Harrison & McKee, 2011; McKee et al., 2007). During the pandemic, individuals with pre-existing substance use patterns may have been particularly vulnerable to increased consumption as a coping mechanism. Public health interventions targeting alcohol misuse should therefore integrate screening and prevention efforts for concurrent substance use.

An additional finding from this study was that individuals with cardiometabolic outcomes exhibited lower probabilities of binge drinking during the pandemic than those without such conditions. The observed interaction may suggest that individuals with chronic health conditions were somewhat more cautious, perhaps reducing binge drinking in response to perceived medical vulnerability amid the pandemic. While direct evidence is scarce, alcohol consumption surveys have documented heterogeneous responses to COVID-19 lockdowns, including reductions in drinking among some groups (Kim et al., 2020). This observation highlights a significant moderating role of health status in behavioral adaptation to stress, warranting further exploration in longitudinal studies.

This study found that individuals who engaged in moderate physical activity were more likely to report binge drinking compared to those with no physical activity. Similar associations have been observed in previous studies linking higher physical activity with increased alcohol consumption, possibly reflecting lifestyle-related leisure patterns, greater socialization, or compensatory behaviors (Grossman et al., 2020; Mitchell et al., 2022). This relationship underscores the need for nuanced health messaging that addresses both the benefits of physical activity and the potential risks of concurrent substance use.

Study limitations

While this study benefits from the use of a large, nationally representative dataset (Finney Rutten et al., 2020), application of complex survey weights, and multiple imputation for missing data (Austin et al., 2021), several limitations should be considered when interpreting the findings. The cross-sectional design precludes causal inference, and self-reported alcohol use may be influenced by recall and social desirability biases, potentially leading to underreporting of binge drinking. The data capture only the early phase following the COVID-19 pandemic declaration (through June 2020), which limits generalizability to longer-term behavioral trends as restrictions and social contexts evolved. Additionally, potential seasonal variations in drinking patterns and regional differences in pandemic restrictions were not accounted for, which could have

influenced alcohol consumption behaviors. Despite these limitations, the findings provide valuable insight into subgroup disparities in binge drinking behavior during the early pandemic period.

Implications for future research

Several research priorities emerge from these findings. First, longitudinal studies are needed to examine causal relationships between pandemic-related stressors and drinking behaviors over extended periods. Such designs would provide insight into how acute crisis-driven changes in alcohol use evolve into long-term patterns, which is essential for developing effective interventions. Previous longitudinal studies using objective measures like smart-breathalyzer data have demonstrated the utility of tracking alcohol use changes over time during the pandemic (Aschbacher et al., 2021; Houston et al., 2024), and national longitudinal surveys have revealed important patterns in how drinking behaviors evolved from pre-pandemic to pandemic periods (Kerr et al., 2022; Pollard et al., 2020).

Second, mechanistic research should focus on identifying the specific pathways through which pandemic stressors affect drinking behavior across different demographic groups. This includes examining the roles of social isolation, economic hardship, healthcare access barriers, and discrimination in driving disparities. Understanding these mechanisms could help design targeted prevention strategies that address the root causes of problematic drinking in vulnerable populations. Research has shown that individual characteristics, contextual factors, and mental health variables significantly influence alcohol consumption during lockdown conditions (Acuff et al., 2022; Schmits & Glowacz, 2022), and studies have identified specific mechanisms like anxiety and depression that mediate increased alcohol use during the pandemic (Akré et al., 2021; Calina et al., 2021).

Third, there is a need for intervention research aimed at developing and testing culturally tailored approaches for high-risk groups during public health emergencies. Potential strategies include telehealth-delivered interventions, community-based peer support programs, and integrated substance use and mental health services tailored for sexual minorities and racial/ethnic minority populations. The rapid transition to telehealth during COVID-19 demonstrated both opportunities and challenges for reaching underserved populations, particularly younger adults who historically underutilize alcohol treatment services, while specialized telehealth approaches for substance use disorders showed promise during the pandemic era (Oesterle et al., 2020; Palzes et al., 2022).

Fourth, technology and innovation should be leveraged to enable real-time monitoring of substance use patterns during crises. Approaches such as smartphone-based ecological momentary assessment and machine learning algorithms could help identify individuals at the highest risk for problematic drinking and facilitate timely interventions. Mobile phone-based ecological momentary interventions have shown efficacy in reducing young adults' alcohol use through real-time assessment and brief interventions delivered during drinking events (Dulin & Gonzalez, 2017; Wright et al., 2018), and smartphone-based momentary interventions targeting alcohol cravings demonstrate the potential to deliver needed intervention to large numbers of individuals not receiving traditional treatment (Dulin & Gonzalez, 2017; Wright et al., 2018).

Finally, policy research should investigate the impact of different public health and economic policy responses, such as alcohol outlet restrictions, telehealth expansion, and economic support programs on substance use outcomes during emergencies. The results could inform future preparedness and response planning to minimize the negative consequences of public health crises on alcohol use. Systematic reviews of alcohol and substance use during COVID-19 highlight the need for comprehensive policy approaches (Roberts et al., 2021), while analysis of mental health and substance use innovations during the pandemic provides insights into effective service delivery models (Panchal et al., 2020).

Conclusions

Binge drinking of alcohol among people with prior history of alcohol use in the US remained high during the COVID-19 pandemic (two in five people), with significant disparities across demographic groups. Hispanic adults and sexual minorities experienced disproportionate increases in binge drinking risk, highlighting how public health crises can exacerbate existing health inequities. These findings underscore the importance of equity-centered approaches to emergency preparedness that anticipate and address differential impacts across vulnerable populations. Future public health emergency responses should include targeted surveillance, culturally tailored interventions, and policies that address structural factors contributing to substance use disparities during public health emergencies.

References

Acuff, S. F., Strickland, J. C., Tucker, J. A., & Murphy, J. G. (2022). Changes in alcohol use during COVID-19 and associations with contextual and individual difference variables: A systematic review and meta-analysis. *Psychology of Addictive Behaviors*, *36*(1), 1–19. https://doi.org/10.1037/adb0000796

Adzrago, D., Wong, S.-W., & Wilkerson, J. M. (2023). Effect modification of illicit drug use on symptoms of a major depressive episode to better understand binge drinking by adolescents and adults in the United States. *Interntional Journal of Mental Healklth and Addiction*, *21*(5), 2999–3016. https://doi.org/10.1007/s11469-022-00770-9

Akré, E. R., Anderson, A., Stojanovski, K., Chung, K. W., VanKim, N. A., & Chae, D. H. (2021). Depression, anxiety, and alcohol use among LGBTQ+ people during the COVID-19 pandemic. *American Journal of Public Health*, *111*(9), 1610–1619. https://doi.org/10.2105/ajph.2021.306394

Aschbacher, K., Hendershot, C. S., Tison, G., Hahn, J. A., Avram, R., Olgin, J. E., & Marcus, G. M. (2021). Machine learning prediction of blood alcohol concentration: a digital signature of smart-breathalyzer behavior. *NPJ Digital Medicine*, *4*(1), 74. https://doi.org/10.1038/s41746-021-00441-4

Austin, P. C., White, I. R., Lee, D. S., & van Buuren, S. (2021). Missing data in clinical research: A tutorial on multiple imputation. *Canadian Journal of Cardiology*, *37*(9), 1322–1331. https://doi.org/10.1016/j.cjca.2020.11.010

Ayyala-Somayajula, D., Dodge, J. L., Leventhal, A. M., Terrault, N. A., & Lee, B. P. (2025). Trends in alcohol use after the COVID-19 pandemic: A national cross-sectional study. *Annals of Internal Medicine*, *178*(1), 139–142. https://doi.org/10.7326/annals-24-02157

Azur, M. J., Stuart, E. A., Frangakis, C., & Leaf, P. J. (2011). Multiple imputation by chained equations: What is it and how does it work? *International Journal of Methods in Psychiatric Research*, *20*(1), 40–49. https://doi.org/10.1002/mpr.329

Barbosa, C., Dowd, W. N., Barnosky, A., & Karriker-Jaffe, K. J. (2023). Alcohol consumption during the first year of the COVID-19 pandemic in the United States: Results from a nationally representative longitudinal survey. *Journal of Addiction Medicine*, *17*(1), e11–e17. https://doi.org/10.1097/adm.0000000000001018

Brooks, S. K., Webster, R. K., Smith, L. E., Woodland, L., Wessely, S., Greenberg, N., & Rubin, G. J. (2020). The psychological impact of quarantine and how to reduce it: Rapid review of the evidence. *The Lancet*, *395*(10227), 912–920. https://doi.org/10.1016/S0140-6736(20)30460-8

Bryant, A. N., & Kim, G. (2012). Racial/ethnic differences in prevalence and correlates of binge drinking among older adults. *Aging & Mental Health*, *16*(2), 208–217. https://doi.org/10.1080/13607863.2011.615735

Calina, Hartung, T., Mardare, I., Mitroi, M., Poulas, K., Tsatsakis, A., A., Rogoveanu, I., &Docea, A. O. (2021). COVID-19 pandemic and alcohol consumption: Impacts and interconnections. *Toxicology reports*, *8*, 529–535. https://doi.org/10.1016/j.toxrep.2021.03.005

Casswell, S., Pledger, M., & Hooper, R. (2003). Socioeconomic status and drinking patterns in young adults. *Addiction*, *98*(5), 601–610. https://doi.org/https://doi.org/10.1046/j.1360-0443.2003.00331.x

Chacon, N. C., Walia, N., Allen, A., Sciancalepore, A., Tiong, J., Quick, R., Mada S., Diaz M.A. & Rodriguez, I. (2021). Substance use during COVID-19 pandemic: Impact on the underserved communities. *Discoveries (Craiova)*, *9*(4), e141. https://doi.org/10.15190/d.2021.20

Chartier, K. G., Vaeth, P. A., & Caetano, R. (2014). Focus on: ethnicity and the social and health harms from drinking. *Alcohol Research: Current Reviews*, *35*(2), 229. https://doi.org/10.35946/arcr.v35.2.13

Clay, J. M., & Parker, M. O. (2020). Alcohol use and misuse during the COVID-19 pandemic: A potential public health crisis? *Lancet Public Health*, *5*(5), e259. https://doi.org/10.1016/s2468-2667(20)30088-8

Clay, J. M., Stafford, L. D., & Parker, M. O. (2023). Associations between self-reported inhibitory control, stress, and alcohol (mis)use during the first wave of the COVID-19 pandemic in the UK: A national cross-sectional study utilising data from four birth cohorts. *International Journal of Mental Health and Addiction*, *21*(1), 350–371. https://doi.org/10.1007/s11469-021-00599-8

Curtis, A. F., Miller, M. B., Costa, A. N., Musich, M., & McCrae, C. S. (2024). An overview of sex and gender considerations in sleep and alcohol use. *Current Addiction Reports*, *11*(2), 316–326. https://doi.org/10.1007/s40429-023-00539-7

Da, B. L., Im, G. Y., & Schiano, T. D. (2020). Coronavirus disease 2019 hangover: A rising tide of alcohol use disorder and alcohol-associated liver disease. *Hepatology*, *72*(3), 1102–1108. https://doi.org/10.1002/hep.31307

Dada, O., & Ogunyiola, A. (2021). A preliminary impact assessment of social distancing on food systems and greenhouse gas emissions. *Journal of Human Behavior in the Social Environment*, *31*(1-4), 254–261. https://doi.org/10.1080/10911359.2020.1816242

DiPlacido, J., Fallahi, C. R., & Daigle, C. D. (2023). Minority stress and substance use: The role of anxiety/depression and PTSD symptoms in response to the COVID-19 pandemic. *Cogent Psychology*, *10*(1), 2218258. https://doi.org/10.1080/23311908.2023.2218258

Dulin, P. L., & Gonzalez, V. M. (2017). Smartphone-based, momentary intervention for alcohol cravings amongst individuals with an alcohol use disorder. *Psychology of Addictive Behaviors*, *31*(5), 601. https://doi.org/10.1037/adb0000292

Finney Rutten, L. J., Blake, K. D., Skolnick, V. G., Davis, T., Moser, R. P., & Hesse, B. W. (2020). Data resource profile: The national cancer institute's health information national trends survey (HINTS). *International Journal of Epidemiology*, *49*(1), 17–17j. https://doi.org/10.1093/ije/dyz083

Fish, J. N., Salerno, J., Williams, N. D., Rinderknecht, R. G., Drotning, K. J., Sayer, L., & Doan, L. (2021). Sexual minority disparities in health and well-being as a consequence of the COVID-19 pandemic differ by sexual identity. *LGBT Health*, *8*(4), 263–272. https://doi.org/10.1089/lgbt.2020.0489

Garcini, L. M., Rosenfeld, J., Kneese, G., Bondurant, R. G., & Kanzler, K. E. (2022). Dealing with distress from the COVID-19 pandemic: Mental health stressors and coping strategies in vulnerable latinx communities. *Health & Social Care in the Community*, *30*(1), 284–294. https://doi.org/https://doi.org/10.1111/hsc.13402

Grossman, E. R., Benjamin-Neelon, S. E., & Sonnenschein, S. (2020). Alcohol consumption during the COVID-19 pandemic: A cross-sectional survey of US adults. *International Journal of Environmental Research and Public Health*, *17*(24). https://doi.org/10.3390/ijerph17249189

Grucza, R. A., Sher, K. J., Kerr, W. C., Krauss, M. J., Lui, C. K., McDowell, Y. E., Hartz, S., Virdi, G. & Bierut, L. J. (2018). Trends in adult alcohol use and binge drinking in the early 21st-century United States: A meta-analysis of 6 national survey series. *Alcoholism: Clinical and Experimental Research*, *42*(10), 1939–1950. https://doi.org/https://doi.org/10.1111/acer.13859

Hale, T., Angrist, N., Kira, B., Petherick, A., Phillips, T., & Webster, S. (2020). Variation in government responses to COVID-19. Retrieved August 15, 2025 from www.bsg.ox.ac.uk/sites/default/files/2020-12/BSG-WP-2020-032-v10.pdf

Herttua, K., Mäkelä, P., & Martikainen, P. (2015). Educational inequalities in hospitalization attributable to

alcohol: A population-based longitudinal study of changes during the period 2000–07. *Addiction*, *110*(7), 1092–1100. https://doi.org/https://doi.org/10.1111/add.12933

HINTS 5 Cycle 4. (2020). *Health Information National Trends Survey 5 (HINTS 5) Cycle 4*. Retrieved April 1, 2021 from https://hints.cancer.gov/docs/methodologyreports/HINTS5_Cycle4_MethodologyReport.pdf

Houston, P., Vittinghoff, E., & Marcus, G. (2024). Changes in alcohol consumption during the COVID-19 pandemic: A longitudinal cohort study using smart-breathalyzer data. *Scientific Reports*, *14*. https://doi.org/10.1038/s41598-024-53757-y

Hughes, T. L., Wilsnack, S. C., & Kantor, L. W. (2016). The influence of gender and sexual orientation on alcohol use and alcohol-related problems: Toward a global perspective. *Alcohol Research : Current Reviews*, *38*(1), 121–132. https://pubmed.ncbi.nlm.nih.gov/27159819

Kerr, W. C., Ye, Y., Martinez, P., Karriker-Jaffe, K. J., Patterson, D., Greenfield, T. K., & Mulia, N. (2022). Longitudinal assessment of drinking changes during the pandemic: The 2021 COVID-19 follow-up study to the 2019 to 2020 National Alcohol Survey. *Alcoholism: Clinical and Experimental Research*, *46*(6), 1050–1061. https://doi.org/https://doi.org/10.1111/acer.14839

Kim, J. U., Majid, A., Judge, R., Crook, P., Nathwani, R., Selvapatt, N., Lovendoski, J., Manousou, P., Thursz, M., Dhar, A., Lewis, H., Vergis, N., & Lemoine, M. (2020). Effect of COVID-19 lockdown on alcohol consumption in patients with pre-existing alcohol use disorder. *The Lancet Gastroenterology & Hepatology*, *5*(10), 886–887. https://doi.org/10.1016/s2468-1253(20)30251-x

Mangot-Sala, L., Tran, K. A., Smidt, N., & Liefbroer, A. C. (2022). The impact of the COVID lockdown on alcohol consumption in the Netherlands. The role of living arrangements and social isolation. *Drug and Alcohol Dependence*, *233*, 109349. https://doi.org/10.1016/j.drugalcdep.2022.109349

Meader, N., King, K., Moe-Byrne, T., Wright, K., Graham, H., Petticrew, M., Power, C., White, M., &Sowden, A. J. (2016). A systematic review on the clustering and co-occurrence of multiple risk behaviours. *BMC Public Health*, *16*(1), 657. https://doi.org/10.1186/s12889-016-3373-6

Mereish, E. H. (2024). Oppression-based stress and alcohol inequities among sexual and gender minority people: An intersectional multilevel framework. *Alcohol Research: Current Reviews*, *44*(1), 05. https://doi.org/10.35946/arcr.v44.1.05

Moore, S. E., Wierenga, K. L., Prince, D. M., Gillani, B., & Mintz, L. J. (2021). Disproportionate impact of the COVID-19 pandemic on perceived social support, mental health and somatic symptoms in sexual and gender minority populations. *Journal of Homosexuality*, *68*(4), 577–591. https://doi.org/10.1080/00918369.2020.1868184

Naimi, T. S., Brewer, R. D., Mokdad, A., Denny, C., Serdula, M. K., & Marks, J. S. (2003). Binge drinking among US adults. *JAMA*, *289*(1), 70–75. https://doi.org/10.1001/jama.289.1.70

National Institute on Alcohol Abuse and Alcoholism (NIAAA). (2024). *Drinking Levels and Patterns Defined | National Institute on Alcohol Abuse and Alcoholism (NIAAA)*. https://www.ncbi.nlm.nih.gov/pubmed/

Nelson, D., Kreps, G., Hesse, B., Croyle, R., Willis, G., Arora, N., Rimer, B., Vish Viswanath, K., Weinstein, N., &Alden, S. (2004). The Health Information National Trends Survey (HINTS): Development, design, and dissemination. *Journal of Health Communication*, *9*(5), 443–460. https://doi.org/10.1080/10810730490504233

Nordeck, C. D., Riehm, K. E., Smail, E. J., Holingue, C., Kane, J. C., Johnson, R. M., Veldhuis, C. B., Kalb, L. G., Stuart, E. A., Kreuter, F., &Thrul, J. (2022). Changes in drinking days among United States adults during the COVID-19 pandemic. *Addiction*, *117*(2), 331–340. https://doi.org/https://doi.org/10.1111/add.15622

Norton, E. C., Dowd, B. E., & Maciejewski, M. L. (2019). Marginal effects—Quantifying the effect of changes in risk factors in logistic regression models. *JAMA*, *321*(13), 1304–1305. https://doi.org/10.1001/jama.2019.1954

Oesterle, T. S., Kolla, B., Risma, C. J., Breitinger, S. A., Rakocevic, D. B., Loukianova, L. L., Hall-Flavin, D. K., Gentry, M. T., Rummans, T. A., Chauhan, M., & Chauhan, M. (2020). Substance use disorders and telehealth in the COVID-19 pandemic era: a new outlook. *Mayo Clinic Proceedings*, *95*(12), 2709–2718. https://doi.org/10.1016/j.mayocp.2020.10.011

Ormiston, C. K., Chiangong, J., & Williams, F. (2023). The COVID-19 pandemic and Hispanic/Latina/o immigrant mental health: Why more needs to be done. *Health Equity,* *7*(1), 3–8. https://doi.org/10.1089/heq.2022.0041Palzes, V. A., Chi, F. W., Metz, V. E., Campbell, C., Corriveau, C., & Sterling, S. (2022). COVID-19 pandemic-related changes in utilization of telehealth and treatment overall for alcohol use problems. *Alcoholism: Clinical and Experimental Research*, *46*(12), 2280–2291. https://doi.org/10.1111/acer.14961

Panchal, N., Kamal, R., Orgera, K., Cox, C., Garfield, R., Hamel, L., & Chidambaram, P. (2020). The implications of COVID-19 for mental health and substance use. *Kaiser Family Foundation*, *21*, 1–16. Retrieved on August 15, 2025 from https://abtcounseling.com/wp-content/uploads/2020/09/The-Implications-of-COVID-19-for-Mental-Health-and-Substance-Use-_-KFF.pdf

Perry, B. L., Aronson, B., & Pescosolido, B. A. (2021). Pandemic precarity: COVID-19 is exposing and exacerbating inequalities in the American heartland. *Proceedings of the National Academy of Sciences*, *118*(8), e2020685118. https://doi.org/10.1073/pnas.2020685118

Pollard, M. S., Tucker, J. S., & Green, H. D., Jr. (2020). Changes in adult alcohol use and consequences during the COVID-19 pandemic in the US. *JAMA Network Open*, *3*(9), e2022942-e2022942. https://doi.org/10.1001/jamanetworkopen.2020.22942

Rehm, J., Kilian, C., Ferreira-Borges, C., Jernigan, D., Monteiro, M., Parry, C. D. H., Sanchez, Z. M., &Manthey, J. (2020). Alcohol use in times of the COVID 19: Implications for monitoring and policy. *Drug and Alcohol Review*, *39*(4), 301–304. https://doi.org/10.1111/dar.13074

Roberts, A., Rogers, J., Mason, R., Siriwardena, A. N., Hogue, T., Whitley, G. A., & Law, G. R. (2021). Alcohol and other substance use during the COVID-19

pandemic: A systematic review. *Drug and Alcohol Dependence*, *229*, 109150. https://doi.org/10.1016/j.drugalcdep.2021.109150

Salmerón-Gómez, R., García-García, C. B., & Rodríguez-Sánchez, A. (2025). Enlarging of the sample to address multicollinearity. *Computational Economics*. https://doi.org/10.1007/s10614-025-10920-5

Schmits, E., & Glowacz, F. (2022). Changes in alcohol use during the COVID-19 pandemic: Impact of the lockdown conditions and mental health factors. *International journal of mental health and addiction*, *20*(2), 1147–1158. https://doi.org/10.1007/s11469-020-00432-8

Shiels, M. S., Haque, A. T., Berrington de González, A., & Freedman, N. D. (2022). Leading causes of death in the US during the COVID-19 pandemic, March 2020 to October 2021. *JAMA Internal Medicine*, *182*(8), 883–886. https://doi.org/10.1001/jamainternmed.2022.2476

Sohi, I., Chrystoja, B. R., Rehm, J., Wells, S., Monteiro, M., Ali, S., & Shield, K. D. (2022). Changes in alcohol use during the COVID-19 pandemic and previous pandemics: A systematic review. *Alcoholism: Clinical and Experimental Research*, *46*(4), 498–513. https://doi.org/10.1111/acer.14792

Stewart, S. D., Manning, W. D., Gustafson, K. E., & Kamp Dush, C. (2024). Sexual and gender identities and alcohol use during the COVID-19 pandemic. *PLoS One*, *19*(9), e0308925. https://doi.org/10.1371/journal.pone.0308925

Tai, D. B. G., Shah, A., Doubeni, C. A., Sia, I. G., & Wieland, M. L. (2020). The disproportionate impact of COVID-19 on racial and ethnic minorities in the United States. *Clinical Infectious Diseases*, *72*(4), 703–706. https://doi.org/10.1093/cid/ciaa815

The Lancet Gastroenterology & Hepatology (2020). Drinking alone: COVID-19, lockdown, and alcohol-related harm. *The Lancet Gastroenterology & Hepatology*, *5*(7), 625. https://doi.org/10.1016/S2468-1253(20)30159-X

Vatcheva, K. P., Lee, M., McCormick, J. B., & Rahbar, M. H. (2016). Multicollinearity in regression analyses conducted in epidemiologic studies. *Epidemiology*, *6*(2). Retrieved day, month, year, from https://pmc.ncbi.nlm.nih.gov/articles/PMC4888898/

Weerakoon, S. M., Jetelina, K. K., & Knell, G. (2021). Longer time spent at home during COVID-19 pandemic is associated with binge drinking among US adults. *American Journal of Drug and Alcohol Abuse*, *47*(1), 98–106. https://doi.org/10.1080/00952990.2020.1832508

Witbrodt, J., Mulia, N., Zemore, S. E., & Kerr, W. C. (2014). Racial/ethnic disparities in alcohol-related problems: Differences by gender and level of heavy drinking. *Alcoholism: Clinical and Experimental Research*, *38*(6), 1662–1670. https://doi.org/10.1111/acer.12398

Wright, C., Dietze, P. M., Agius, P. A., Kuntsche, E., Livingston, M., Black, O. C., Room, R., Hellard, M., & Lim, M. S. (2018). Mobile phone-based ecological momentary intervention to reduce young adults' alcohol use in the event: A three-armed randomized controlled trial. *JMIR mHealth and uHealth*, *6*(7), e9324. https://doi.org/10.2196/mhealth.9324

Yazdi, K., Fuchs-Leitner, I., Rosenleitner, J., & Gerstgrasser, N. W. (2020). Impact of the COVID-19 pandemic on patients with alcohol use disorder and associated risk factors for relapse [Original Research]. *Frontiers in Psychiatry*, *11*. https://doi.org/10.3389/fpsyt.2020.620612