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Alcohol misuse among youth living with and at high risk for acquiring HIV during the COVID-19 stay-at-home orders: a study in Los Angeles and New Orleans

Roxana Rezai [1,2,*], Panteha Hayati Rezvan[1], Warren Scott Comulada[1], Sung-Jae Lee[2,3],
Manuel A. Ocasio[4], Dallas Swendeman[1], Maria Isabel Fernández[5], the Adolescent Trials Network
(ATN) CARES Team

[1]Center for Community Health, Department of Psychiatry and Biobehavioral Sciences, University of California, Los Angeles, CA 90024, USA
[2]Department of Epidemiology, Fielding School of Public Health, University of California, Los Angeles, CA 90095, USA
[3]UCLA Nathanson Family Resilience Center, Department of Psychiatry and Biobehavioral Sciences, University of California, Los Angeles, CA 90095, USA
[4]Department of Pediatrics/Adolescent Medicine, Tulane University School of Medicine, New Orleans, LA 70112, USA
[5]College of Osteopathic Medicine, Nova Southeastern University, Miami, FL 33328, USA

*Corresponding author: The University of California, Center for Community Health, 10920 Wilshire Blvd., Suite 350, Los Angeles, CA 90024, USA.
Tel.: 310-794-2715; Fax: 310-794-8297; E-mail: RRezai@mednet.ucla.edu

Abstract

Background: To slow the spread of the COVID-19 virus, governments across the globe instituted stay-at-home orders leading to increased stress and social isolation. Not surprisingly, alcohol sales increased during this period. While most studies primarily focused on alcohol consumption among college students or adults, this study investigates alcohol misuse among marginalized youth in the USA. We examined risk factors associated with hazardous alcohol use and binge drinking including risk behaviors, life stressors and demographic characteristics. **Methods:** In October 2020, youth living with or at high risk for acquiring human immunodeficiency virus (HIV), participating in community-based research to improve HIV prevention and care, were invited to complete an online survey to assess the impact of the stay-at-home orders on multiple aspects of their daily life. **Results:** Respondents ($n = 478$) were on average 23 years old; cisgender (84%), not-heterosexual (86.6%), Latino or Black/African American (73%) and assigned male at birth (83%); 52% reported being employed and 14% reported living with HIV. White participants and those who use drugs had higher odds of hazardous alcohol use and binge drinking, compared with other race categories and non-drug users, respectively. **Conclusion:** Contrary to findings from adult studies, we did not observe an increase in hazardous or binge drinking among youth at risk for HIV. Hazardous alcohol use and binge drinking was more likely among White participants, those who use drugs and those who were hazardous/binge drinkers prior to the COVID-19 lockdown, which points to the importance of identifying and treating youth who misuse alcohol early to prevent future alcohol misuse.

Introduction

The COVID-19 pandemic has upended daily life creating upheavals around the world. There is evidence from prior epidemics that the stay-at-home orders issued to mitigate the spread of the virus could have negative mental health consequences such as increases in anxiety, depression, alcohol and other substance use (Brooks *et al.*, 2020; Clay and Parker, 2020; Rajkumar, 2020). Given the stress, social isolation and boredom from lockdown, it is not surprising that among US adults 18 or older alcohol sales and use have risen dramatically since the COVID-19 stay-at-home orders were instituted (i.e. from March 2020 to October 2020; Boschuetz *et al.*, 2020, NIAAA, 2021a). Studies with adult samples have reported more frequent, higher quantities and more harmful levels of alcohol use than before the pandemic (Boschuetz *et al.*, 2020; Sharma *et al.*, 2020). There is growing concern that compared with adults, adolescents and young adults (AYA) may experience more persistent and lifelong concerns from the pandemic including alcohol use and abuse

(Sarvey and Welsh, 2021). Recent studies have shown that young adults between the age of 18 and 30 years had the highest levels of depression, anxiety and uncertainly during the COVID-19 stay-at-home orders compared with other age groups (Glowacz and Schmits, 2020).

Alcohol use and misuse among AYA has long been a public health concern. Despite the higher legal drinking age in the USA, alcohol is often accessible, with >7 million AYA between the age of 12 and 20 years reporting alcohol consumption (SAMHSA, 2020). Drinking patterns vary by race/ethnicity with White AYA reporting higher prevalence rates for harmful alcohol use (e.g. 5+ or 10+ drinks consumed per occasion) in their lifetime, the past 12 months and the past 2 weeks than non-White AYA (Terry-McElrath and Patrick, 2020).

Marginalized subgroups such as sexual and gender minorities, AYA living with human immunodeficiency virus (HIV), AYA with a history of incarceration and homeless AYA are particularly susceptible to alcohol use and misuse (Talley *et al.*, 2019). There is evidence that experiences of discrimination,

victimization and trauma contribute to the development of negative coping strategies including alcohol use and misuse (Feinstein and Newcomb, 2016). For instance, transgender AYA have a higher prevalence and frequency of alcohol consumption, and initiate drinking at earlier ages than cisgender AYA (Day *et al.*, 2017). Studies of homeless AYA report that 57–75% use alcohol with 60% meeting diagnostic criteria for substance abuse disorders (Wenzel *et al.*, 2010; Walls and Bell, 2011). Alcohol use is highly correlated to risky sexual behaviors such as intention and engagement in condomless sex, which significantly increases HIV risk (Dir *et al.*, 2018). Given that the highest rates of new HIV infection occur among gender and sexual minority youth, the high rates of alcohol use in this population are particularly concerning (Guilam-o-Ramos *et al.*, 2019). Clearly, the stress of the pandemic and the sequela of the stay-at-home orders may increase alcohol use and misuse among AYA, especially those from marginalized subgroups.

Despite the interest in alcohol research during the pandemic, the majority of studies have recruited adult samples. A survey of gender and sexual minority young adults reported a 43–67% increase in alcohol and marijuana use during the COVID-19 pandemic (Dyar *et al.*, 2021). The few studies on young people have primarily focused on college or secondary school students (Bollen *et al.*, 2021; Clare *et al.*, 2021). Contrary to findings from older samples, the COVID-19 stay-at-home orders have been found to have little effect on alcohol consumption in young people. For instance, evidence from ongoing national and international studies of students suggests that alcohol use either stayed the same or declined slightly post-stay-at-home orders (Clare *et al.*, 2021; Thorisdottir *et al.*, 2021). Similar patterns were reported for college students (Bollen *et al.*, 2021). A study of 312 US college students reported a reduction in the amount of alcohol consumed post-COVID-19 related university closures (White *et al.*, 2020). There are limited studies examining alcohol use among AYA whose life experiences and marginalized identities place them at high risk of increased alcohol use or misuse during the stay-at-home period.

Another concern with studies of pandemic-related alcohol use is their focus on general alcohol consumption, rather than more serious types of alcohol misuse (e.g. hazardous alcohol use and binge drinking; Capasso *et al.*, 2021, Opara *et al.*, 2021). Hazardous alcohol use refers to patterns of alcohol consumption that increases risk for adverse health effects such as alcohol poisoning, injuries and weaking of the immune system (Avery *et al.*, 2020; CDC, 2021; Opara *et al.*, 2021). Binge drinking, which has similar negative health consequences (CDC, 2021), refers to ingesting a large quantity of alcohol in a relative short period resulting in a blood alcohol concentration of 0.08% or greater. Binge drinking is common among AYA; ~43% of people who binge drink in the USA are under the age of 24 years (CDC, 2021). Given the higher risk for alcohol misuse among marginalized AYA, understanding hazardous and binge drinking during COVID-19 stay-at-home orders and identifying potential risk factors, as we do in this study, are public health imperatives.

This study examines important factors linked to alcohol misuse during COVID-19 stay-at-home orders in a sample of marginalized AYA at risk or living with HIV in Los Angeles, CA and New Orleans, LA. Specifically, we examine connections among descriptive characteristics of the sample (demographics, assessment site, HIV status), COVID-19 related changes (number of paid work hours, living situation, mental health, illicit drug use), and hazardous alcohol use and binge drinking during the stay-at-home period.

Methods

Participants and procedures
During October 2020, 478 AYA completed an online survey to assess the impact of the COVID-19 stay-at-home orders on multiple aspects of daily life including risk behaviors and life stressors. Survey respondents had been recruited from homeless shelters, Lesbian, Gay, Bisexual, Transgender, and Queer (LGBTQ) organizations, community health centers and youth-serving agencies in high HIV prevalence neighborhoods in Los Angeles and New Orleans to participants in three HIV related intervention protocols supported by the Adolescent Medicine Trials Network (ATN). Every 4 months for 2 years, participants completed a psychosocial interview and were tested for sexually transmitted infections (STI) and substance use. Thus, we had data on their alcohol and drug use prior to the start of the COVID stay at home orders. The COVID survey took 15–20 min and participants were compensated $25. Study procedures were approved by the institutional review boards (IRB) at participating universities.

Primary outcomes
We utilized the three-item AUDIT-C (Bohn *et al.*, 1995) to measure self-reported hazardous alcohol use and binge drinking since the beginning of the stay-at-home orders. The AUDIT-C score was computed by summing all the responses on a 0–4 Likert scale, ranging from 0 to 12, where 0 reflects no alcohol use. In line with previous recommendations (Reinert and Allen, 2007), an AUDIT-C score of ≥ 3 for individuals assigned female at birth and a score of ≥ 4 for individuals assigned male at birth to indicate hazardous alcohol use. We operationalized binge drinking as drinking 6+ drinks on one occasion using the third question of the AUDIT-C. Participants who responded '*Never*' to this question were classified as non-binge drinkers.

Covariates
Descriptive characteristics
Participants reported their age, sex assigned at birth, gender and sexual identity (Gay/Lesbian, Bisexual and Other), race/ethnicity (Black/African American, Latino, White and Asian/HPI/NA/AN/Other) and employment status. We used biological tests to determine HIV status and computed a dichotomous indicator of intervention assignment (coaching vs. automated messaging and monitoring (AMM)/peer support) to account for intervention.

Changes during the COVID-19 stay-at-home orders
Participants reported changes in their living arrangements during the stay-at-home period (e.g. if they moved in with family members due to school closing or going virtual or moved in with family members or friends due to being unable to pay housing costs).

They also reported on their mental health, life stressors (i.e. levels of anxiety/worry, depression/sadness and overall quality of life/sleep) and paid hours worked. Responses included '*Highly decreased*', '*Somewhat decreased*', '*No change*', '*Somewhat increased*' and '*Highly increased*', respectively. We created a dichotomous variable to indicate an 'unfavorable outcome' if any of the responses for the anxiety/worry and depression/sadness were '*Somewhat increased*' or '*Highly*

increased'. For indicators of paid hours worked and general quality of life/sleep, we determined 'unfavorable outcome' if the responses were '*Highly decreased*' or '*Somewhat decreased*'.

Participants rated the overall impact of the pandemic on their day-to-day life, where responses were '*Not at all*', '*A little*', '*Some*' and '*A lot*'. We dichotomized this variable as high impact ('*A lot*' = 1) or some to no impact ('*Not at all*', '*A little*' or '*Some*' = 0). Participants were asked to rate—on a scale of 1 to 10—their worry about the pandemic, where 1 refers to being '*Not worried at all*' and 10 refers to '*Being extremely worried*'.

Drug use during the COVID-19 stay-at-home orders

Participants reported their use of methamphetamines, cocaine or crack, heroin, ecstasy, prescription painkillers (opioids) and other prescription drugs (e.g. Xanax or Benzos) not used as prescribed, and hallucinogens, since the start of the stay-at-home orders. Using these responses, we created a dichotomous variable indicating any illicit drug use during this period.

Statistical analysis

We compared the proportions of hazardous alcohol use and binge drinking along with the AUDIT-C scores measured during the stay-at-home orders with those proportions and scores measured prior to the stay-at-home period using McNemar and Wilcoxon matched-pairs signed-rank tests, respectively. We examined differences in AUDIT-C scores by sex assigned at birth via Mann–Whitney U test. We used chi-square tests to examine differences between participants reporting hazardous alcohol use and those who do not and repeated the analyses to compare binge drinkers and non-binge drinkers. To control for familywise error rates when performing multiple comparison tests, we used Holm–Bonferroni correction (Holm, 1979).

We considered all descriptive characteristics as well as any factor measured during the stay-at-home period that, for substantive reasons, might be expected to be important in predicting hazardous alcohol use or binge drinking. We entered these variables into three separate logistic regression models for each outcome with progressive inclusion of covariates to get a sense of uncertainties in parameter estimates by examining the standard errors. Model A included demographic variables as well as HIV status and the coaching intervention that were considered important variables given our study sample; model B further accounted for variables measured during the stay-at-home orders and model C further included past hazardous alcohol use or binge drinking.

In total, 78% and 80% of participants had complete data on the variables required for the hazardous alcohol use and binge drinking analysis models, respectively (missing data ranged from 0 to 17%; Table S1). Since there were meaningful differences between participants with complete and incomplete data, we utilized multiple imputation (MI) (Rubin, 2009) under missing at random for regression analyses to reduce bias. MI analyses via fully conditional specification (van Buuren, 2018) applied to the variables in the models. Imputation models included four auxiliary variables (<2% missing data; Table S1) that were associated with missingness among analysis variables. Twenty datasets were imputed via Stata's *mi impute chained* command, where the results were combined using Rubin's rules. All statistical analyses were conducted in Stata SE version-16 (StataCorp., 2019).

Results

Sample characteristics

The average age was 23.4 years (standard deviation [SD] = 2.2, range [15–27]). In total, ~69% were recruited from Los Angeles; 37% were Latino and 36% Black/African American. A total of >80% were assigned male at birth, and 16% identified as transgender/gender diverse. Most participants were gay/lesbian (53%) or bisexual (21%). Roughly, 52% were employed during the stay-at-home orders and 17% were students. In total, ~60% reported decreases in paid hours worked; almost 46% moved to another place to live during the stay-at-home period. Roughly, 77% reported increases in anxiety/worry or depression/sadness. A similar proportion reported decreases in quality of life/sleep. In total, ~14% were living with HIV. Roughly 32% reported illicit drug use since the beginning of the stay-at-home orders.

The median AUDIT-C score measured during the stay-at-home period (median: 2, interquartile range (IQR): [1, 4]) was lower ($P < 0.001$) than the median score prior to the stay-at-home period (3, [1, 5]). Participants assigned male at birth (2, [1, 5]) had higher median score ($P = 0.005$) than those assigned female at birth (1, [0, 3]). Almost one-third ($n = 142$) reported hazardous alcohol use and 43% ($n = 187$) binge drinking during the stay-at-home period (see Table S2).

Hazardous alcohol use
Differences in demographic characteristics

As shown in Table 1, participants reporting hazardous alcohol use were more likely to be White AYA compared with those who did not ($\chi^2_{(3)} = 16.8$, $P = 0.001$). In particular, Black/African American (odds ratio [OR]: 0.37, 95% confidence interval [CI]: [0.21, 0.67]), Latino (0.50, [0.29, 0.88]) and Asian/HPI/NA/AN/Other (0.22, [0.09, 0.53]) have lower odds of hazardous alcohol use compared with Whites (Table S3).

Comparison of characteristics measured prior and during the stay-at-home period

Participants reporting hazardous alcohol use during the stay-at-home period were more likely to report marijuana use ($\chi^2_{(1)} = 14.7$, $P < 0.001$), other illicit drug use ($\chi^2_{(1)} = 19.6$, $P < 0.001$), and participation in substance abuse treatment programs ($\chi^2_{(1)} = 4.5$, $P = 0.033$), and less likely to report consistent condom use in sexual intercourse ($\chi^2_{(1)} = 8.3$, $P = 0.004$) prior to the start of the stay-at-home period than participants not reporting hazardous alcohol use. In total, 71% of the 142 participants reported hazardous alcohol use during the stay-at-home orders met criteria for prior hazardous alcohol use ($\chi^2_{(1)} = 60.3$, $P < 0.001$). There was sufficient evidence of difference in proportions between participants reporting hazardous alcohol use prior (43.5%) and during (33.3%) the stay-at-home period ($P < 0.001$). Participants who reported hazardous alcohol use during the stay-at-home period were more likely to report decreases in paid hours worked ($\chi^2_{(1)} = 4.4$, $P = 0.037$). They were also more likely to report illicit drug use since the beginning of the stay-at-home orders ($\chi^2_{(1)} = 41.5$, $P < 0.001$) compared with those who did not report hazardous alcohol use (Table 1).

Table 2 shows the results from multivariable logistic regressions for hazardous alcohol use using MI. Higher odds of hazardous alcohol use during the stay-at-home order were observed for those with prior hazardous alcohol use compared with those without prior hazardous alcohol use (aOR: 4.39,

Table 1. Characteristics of participants who responded to the COVID-19 survey by hazardous alcohol use

Characteristics	Hazardous alcohol use (n = 142, 33.3%)		Non-Hazardous alcohol use (n = 258, 66.7%)		Total (n = 427)[a]	
	n	%	n	%	n	%
Descriptive characteristics						
Age, mean (SD)	23.6	2.1	23.4	2.3	23.4	2.2
Age categories						
15–20 years	17	12	51	17.9	68	15.9
21–27 years	125	88	234	82.1	359	84.1
Sex assigned at birth						
Female	23	16.2	48	16.8	71	16.6
Male	119	83.8	237	83.2	356	83.4
Gender identity						
Cisgender	124	87.3	234	82.1	358	83.8
Transgender/Gender diverse	18	12.7	51	17.9	69	16.2
Sexual identity						
Heterosexual	16	11.3	39	13.8	55	13
Gay/Lesbian	79	56	150	53	229	54
Bisexual	29	20.6	58	20.5	87	20.5
Other sexual identity	17	12.1	36	12.7	53	12.5
Race & Ethnicity***						
Black/African American	39	27.5	102	35.8	141	33
Latino	57	40.1	110	38.6	167	39.1
White	38	26.8	37	13	75	17.6
Asian/HPI/NA/AN/Other[b]	8	5.6	36	12.6	44	10.3
Employment						
Employed	81	57.9	142	51.3	223	53.5
Student	19	13.6	54	19.5	73	17.5
Unemployed	40	28.6	81	29.2	121	29
Assessment site						
Los Angeles	100	70.4	192	67.4	292	68.4
New Orleans	42	29.6	93	32.6	135	31.6
Coaching intervention	50	35.2	112	39.3	162	37.9
Living with HIV	14	9.9	44	15.4	58	13.6
Changes during the COVID-19 stay-at-home orders[c]						
Moved to another place to live*	75	52.8	121	43.2	196	46.5
Number of paid work hours decreased**	88	67.7	144	56.7	232	60.4
General quality of life or sleep decreased	113	82.5	203	76.0	316	78.2
Levels of anxiety, worry, depression or sadness increased*	111	82.8	198	74.4	309	77.3
Overall impact of COVID-19 on day-to-day life (A lot vs. Not at all/some)	85	60.3	141	51.8	1226	54.7
Levels of worry about the COVID-19 pandemic[d], mean (SD)	6.5	2.5	6.6	2.5	6.5	2.5
Illicit drug use[e]	76	53.5	64	22.5	140	32.8

When we adjusted for the familywise error rate for multiple comparisons, all the comparisons reported above remained significant except for 'number of paid work hours decreased'. *$0.05 \leq P < 0.1$. **$0.001 \leq P < 0.05$. ***$P < 0.001$. [a]Hazardous alcohol use variable was missing for 51 participants (10.7%). [b]Asian/Hawaiian or Pacific Islander/Native American/Alaska Native/other. [c]Lockdown period from 20 March 2020, to late October 2020. [d]Self-rated question—1 referred to as being not worried at all, and 10 referred to as being extremely worried. [e]Illicit drugs measured since the beginning of the COVID-19 lockdown period include methamphetamines, cocaine or crack, heroin, ecstasy, prescription painkillers (opioids) not used as prescribed, hallucinogens and other pre-scription drugs not used as prescribed (e.g. Xanax or Benzos).

95% CI: [2.68, 7.19]). We did not find sufficient evidence indicating that individuals who reported decreased in paid hours worked had higher odds hazardous alcohol use during the stay-at-home period (1.28, [0.75, 2.16]). Higher odds of hazardous alcohol use was observed for participants who reported illicit drug use since the beginning of the stay-at-home period compared with those not reporting illicit drug use (4.31, [2.70, 6.89]). Although the estimated OR was attenuated, it remained significant after including hazardous alcohol use prior to the stay-at-home period (3.56, [2.16, 5.88]).

Binge drinking
Differences in demographic characteristics
As shown in Table 3, participants reporting binge drinking were more likely to be in 21–27 years age group ($\chi^2_{(1)} = 6.0$,

$P = 0.015$) and to be White AYA ($\chi^2_{(3)} = 23.9$, $P < 0.001$), compared with participants who did not report binge drinking. In particular, 21–27 years old participants had higher odds of binge drinking than 15–20 years old participants (OR: 2.25, 95% CI: [1.16, 4.38]). The odds of binge drinking were lower among Blacks/African Americans (0.30, [0.17, 0.53]), Latinos (0.55, [0.32, 0.96]) and Asians/HPI/NA/AN/Other (0.22, [0.10, 0.50]) relative to Whites (Table S3).

Comparison of characteristics measured prior and during the stay-at-home period
Participants who reported binge drinking during the stay-at-home orders were also more likely to report marijuana use ($\chi^2_{(1)} = 19.4$, $P < 0.001$) and other illicit drug use ($\chi^2_{(1)} = 16.8$, $P < 0.001$), and less likely to report consistent condom use in

Table 2. Estimated ORs with 95% CI from MI[a] for the analysis of the association between hazardous alcohol use and potential covariates

Characteristics	Model A: Demographics		Model B: Demographics & COVID-19 measurements		Model C: Demographics & COVID-19 measurements & Prior hazardous alcohol use	
	aOR	(95% CI)	aOR	(95% CI)	aOR	(95% CI)
Descriptive characteristics						
Age						
15–20 years						
21–27 years	1.59	(0.76, 3.31)	1.37	(0.63, 3.01)	1.18	(0.51, 2.72)
Sex assigned at birth						
Female	1.20	(0.60, 2.40)	1.24	(0.62, 2.48)	1.07	(0.52, 2.21)
Male						
Gender identity						
Cisgender						
Transgender/Gender diverse	0.63	(0.32, 1.24)	*0.47**	*(0.22, 1.01)*	0.55	(0.25, 1.21)
Sexual identity						
Heterosexual						
Gay/Lesbian	1.39	(0.65, 2.97)	1.29	(0.61, 2.72)	1.31	(0.56, 3.07)
Bisexual	1.12	(0.51, 2.50)	0.98	(0.43, 2.22)	0.96	(0.40, 2.33)
Other sexual identity	1.31	(0.53, 3.21)	1.05	(0.41, 2.70)	1.09	(0.39, 3.03)
Race & Ethnicity						
Black/African American	**0.38***	**(0.21, 0.69)**	**0.41**	**(0.21, 0.78)**	0.62	(0.31, 1.23)
Latino	**0.54**	**(0.31, 0.95)**	**0.49**	**(0.27, 0.90)**	0.61	(0.33, 1.16)
White						
Asian/HPI/NA/AN/Other	**0.22***	**(0.09, 0.54)**	**0.24***	**(0.09, 0.63)**	**0.36**	**(0.13, 0.96)**
Coaching intervention	0.82	(0.53, 1.28)	0.81	(0.51, 1.30)	0.83	(0.50, 1.38)
Living with HIV	*0.52**	*(0.26, 1.02)*	*0.46**	*(0.23, 0.94)*	*0.47**	*(0.22, 0.99)*
Measures prior to the COVID-19 stay-at-home orders						
Hazardous alcohol use					**4.39***	**(2.68, 7.19)**
Changes during the COVID-19 stay-at-home orders[b]						
Moved to another place to live			1.38	(0.87, 2.17)	1.21	(0.75, 1.95)
Number of paid work hours decreased			1.28	(0.75, 2.16)	1.48	(0.87, 2.52)
Levels of anxiety, worry, depression or sadness increased			1.18	(0.65, 2.15)	1.32	(0.73, 2.39)
Illicit drug use[c]			**4.31***	**(2.70, 6.89)**	**3.56***	**(2.16, 5.88)**

*$0.05 \leq P < 0.1$ (italic font). **$0.001 \leq P < 0.05$ (bold font). ***$P < 0.001$ (bold font). [a]Missing values were imputed using MI via fully conditional specification. Incomplete binary variables were imputed using logistic regression and incomplete ordinal/nominal variables were imputed using predictive mean matching (PMM; using a linear prediction model to obtain predicted values and $k = 10$ for randomly drawing from the kth nearest observed values to the predicted value). The imputed AUDIT-C items were then used to calculate the AUDIT-C scores where the scores were dichotomized to represent participants who reported hazardous alcohol use and those who do not. Note, due to convergence issues the AUDIT-C score items in Model A were imputed using PMM rather than ordinal logistic model. MI was carried out using 20 imputations with a burn-in of 100 iterations via Stata's *mi impute chained* command. The imputation model included all the analysis variables and the outcome variable of interest, as well as auxiliary variables summarized in Table S1 (imputation models for Model A and Model B included measures prior to stay-at-home period such as AUDIT-C score items, marijuana use, illicit drug use (excluding marijuana) and involvement in substance abuse treatment programs, and imputation model for Model C included support or social services prior to stay-at-home orders and current employment status in addition to the auxiliary variables included in Model A and Model B). [b]Lockdown period from 20 March 2020 to late October 2020. [c]Illicit drugs measured since the beginning of the COVID-19 lockdown period include methamphetamines, cocaine or crack, heroin, ecstasy, prescription painkillers (opioids) not used as prescribed, hallucinogens and other pre-scription drugs not used as prescribed (e.g. Xanax or Benzos).

sexual intercourse ($\chi^2_{(1)} = 5.3$, $P = 0.02$) prior to the stay-at-home period than those who did not binge drink. Additionally, they were more likely to report sex exchange for money, food, drugs, etc. ($\chi^2_{(1)} = 6.6$, $P = 0.01$), to be employed ($\chi^2_{(1)} = 10.0$, $P = 0.007$), and to have a recent admission to emergency room or urgent care ($\chi^2_{(1)} = 6.6$, $P = 0.01$) prior to the stay-at-home period than those who did not binge drink. Almost 65% of the 187 participants reported binge drinking during the stay-at-home orders met criteria for prior binge drinking ($\chi^2_{(1)} = 60.6$, $P < 0.001$). No evidence of difference in proportions was observed between participants reporting binge drinking prior (43.1%) and during (42.8%) the stay-at-home period. Participants who reported binge drinking during the state-at-home order were more likely to report decreases in their quality of life/sleep ($\chi^2_{(1)} = 4.2$, $P = 0.04$) and increases in levels of anxiety, worry, depression or sadness ($\chi^2_{(1)} = 9.4$, $P = 0.002$) compared with those who did not binge drink. Illicit drug use since the beginning of the stay-at-home period

($\chi^2_{(1)} = 44.2$, $P < 0.001$) was higher among participants who reported binge drinking compared with non-binge drinkers (Table 3).

According to Table 4, which summarizes the results from multivariable logistic regressions for binge drinking using MI, participants who reported binge drinking prior to the stay-at-home period had higher odds of binge drinking during this period relative to those without a prior history of binge drinking (aOR: 3.69, 95% CI: [2.33, 5.85]). We did not find sufficient evidence indicating that participants who reported increases in levels of anxiety, worry, depression or sadness had higher odds of binge drinking during the stay-at-home period (1.65, [0.93, 2.93]). Results also demonstrates higher odds of binge drinking for participants who reported illicit drug use during stay-at-home orders relative those who did not report illicit drug use (4.10, [2.55, 6.59]). The association remains significant after further inclusion of binge drinking prior to the stay-at-home period (3.43, [2.10, 5.61]).

Table 3. Characteristics of participants who responded to the COVID-19 survey by binge drinking

Characteristics	Binge drinking ($n = 187$, 42.8%)		No binge drinking ($n = 250$, 57.2%)		Total ($n = 437$)[a]	
	n	%	*n*	%	*n*	%
Demographic						
Age, mean (SD)*	23.6	2.1	23.3	2.4	23.4	2.3
Age categories**						
15–20 years	13	6.9	36	14.4	49	11.2
21–27 years	174	93.1	214	85.6	388	88.8
Sex assigned at birth						
Female	27	14.4	46	18.4	73	16.7
Male	160	85.6	204	81.6	364	83.3
Gender identity						
Cisgender	162	86.6	206	82.4	368	84.2
Transgender/Gender diverse	25	13.4	44	17.6	69	15.8
Sexual identity						
Heterosexual	20	10.7	36	14.5	56	12.9
Gay/Lesbian	99	53.2	134	54.0	233	53.7
Bisexual	43	23.1	48	19.3	91	21
Other sexual identity	24	12.9	30	12.1	54	12.4
Race & Ethnicity***						
Black/African American	47	25.1	98	39.2	145	33.2
Latino	81	43.3	90	36.0	171	39.1
White	47	25.1	29	11.6	76	17.4
Asian/HPI/NA/AN/Other[b]	12	6.4	33	13.2	45	10.3
Employment						
Employed	108	58.7	120	49.4	228	53.4
Student	28	15.2	48	19.7	76	17.8
Unemployed	48	26.1	75	30.9	123	28.8
Assessment site*						
Los Angeles	137	73.3	163	65.2	300	68.6
New Orleans	50	26.7	87	34.8	137	31.4
Coaching intervention	67	35.8	98	39.2	165	37.8
Living with HIV	22	11.8	37	14.8	59	13.5
Changes during the COVID-19 stay-at-home orders[c]						
Moved to another place to live*	97	51.9	104	42.5	201	46.5
Number of paid work hours decreased	111	64.2	124	56.1	235	59.6
General quality of life or sleep decreased**	149	82.3	172	73.8	321	77.5
Levels of anxiety, worry, depression or sadness increased**	150	84.3	165	71.4	315	77.0
Overall impact of COVID-19 on day-to-day life (A lot vs. Not at all/some)	102	56.7	128	53.8	230	55.0
Levels of worry about the COVID-19 pandemic[d], mean (SD)	6.4	2.5	6.6	2.5	6.5	2.5
Illicit drug use[e] ***	92	49.2	48	19.2	140	32.0

*$0.05 \leq P < 0.1$. **$0.001 \leq P < 0.05$. ***$P < 0.001$. When we adjusted for the familywise error rate for multiple comparisons, all the comparisons reported above remained significant except for 'Age' and 'General quality of life or sleep decreased'. [a]Binge drinking variable was missing for 41 participants (8.6%). [b]Asian/Hawaiian or Pacific Islander/Native American/Alaska Native/other. [c]Lockdown period from 20 March 2020, to late October 2020. [d]Self-rated question—1 referred to as being not worried at all, and 10 referred to as being extremely worried. [e]Illicit drugs measured since the beginning of the COVID-19 lockdown period include methamphetamines, cocaine or crack, heroin, ecstasy, prescription painkillers (opioids) not used as prescribed, hallucinogens and other pre-scription drugs not used as prescribed (e.g. Xanax or Benzos).

Discussion

This is one of the first papers to examine alcohol misuse during the COVID-19 stay-at- home period among a sample of highly marginalized AYA whose life circumstances place them at increased risk for negative outcomes and make them particularly susceptible to alcohol use and misuse. Our study is significant in that it reports the more serious alcohol misuse behaviors, hazardous alcohol use and binge drinking, rather than general alcohol consumption as has been done by others. It is important to note that our analysis focused on a marginalized sample allowing for more nuanced interpretation since all participants had similar vulnerabilities due to the strict inclusion criteria.

Participants who reported hazardous alcohol use or binge drinking during lockdown were more likely to report prior alcohol misuse and illicit drug use compared with those who did not. This suggests that prior behaviors, rather than the stay-at-home orders per se, impacted alcohol misuse among our participants. This finding once again demonstrates that past behavior is one of the best predictors of future behavior and points to the importance of prevention and early intervention. In fact, almost two thirds (65%) of AYA reported binge drinking during the stay-at-home orders met criteria for binge drinking prior to the stay-at-home period. In addition, prior to the COVID-19 pandemic, those reporting binge drinking were more likely to report marijuana use and other illicit drug use and less likely to report consistent condom use in sexual intercourse, compared with those who did not binge drink. Similar results have been demonstrated in studies of adults at risk for HIV during the pandemic with a 3-fold increase in the prevalence of hazardous alcohol use among individuals who reported substance use (Pytell *et al.*, 2022). Although not the focus of this paper, we also note that hazardous alcohol users and binge drinkers were less likely to report consistent

Table 4. Estimated ORs with 95% CI from MI[a] for the analysis of the association between binge drinking and potential covariates

Characteristics	Model A: Demographics		Model B: Demographics & COVID-19 measurements		Model C: Demographics & COVID-19 measurements & Priorbinge drinking	
	aOR	(95% CI)	aOR	(95% CI)	aOR	(95% CI)
Descriptive characteristics						
Age						
15–20 years						
21–27 years	**2.16****	**(1.08, 4.32)**	1.93	(0.92, 4.09)	1.82	(0.82, 4.01)
Sex assigned at birth						
Female	0.91	(0.50, 1.65)	0.84	(0.44, 1.62)	0.79	(0.40, 1.57)
Male						
Gender identity						
Cisgender						
Transgender/Gender diverse	0.62	(0.32, 1.19)	**0.48****	**(0.23, 0.96)**	*0.54**	*(0.26, 1.13)*
Sexual identity						
Heterosexual						
Gay/Lesbian	1.25	(0.64, 2.42)	1.02	(0.49, 2.09)	1.00	(0.47, 2.12)
Bisexual	1.47	(0.72, 3.00)	1.22	(0.56, 2.64)	1.16	(0.52, 2.62)
Other sexual identity	1.42	(0.62, 3.27)	1.15	(0.48, 2.79)	1.09	(0.43, 2.75)
Race & Ethnicity						
Black/African American	**0.33*****	**(0.18, 0.60)**	**0.36****	**(0.19, 0.69)**	*0.54**	*(0.27, 1.08)*
Latino	0.64	(0.37, 1.13)	*0.60**	*(0.33, 1.09)*	0.78	(0.41, 1.47)
White						
Asian/HPI/NA/AN/Other	**0.25*****	**(0.11, 0.57)**	**0.26*****	**(0.11, 0.62)**	**0.34****	**(0.13, 0.84)**
Coaching intervention	0.80	(0.52, 1.23)	0.76	(0.48, 1.21)	0.69	(0.48, 1.24)
Living with HIV	0.71	(0.39, 1.28)	0.65	(0.34, 1.26)	0.66	(0.33, 1.30)
Measures prior to the COVID-19 stay-at-home orders						
Binge drinking					**3.69*****	**(2.33, 5.85)**
Changes during the COVID-19 stay-at-home orders[b]						
Moved to another place to live			1.43	(0.93, 2.19)	1.33	(0.85, 2.08)
Number of paid work hours decreased			1.02	(0.62, 1.67)	1.13	(0.68, 1.88)
Levels of anxiety, worry, depression or sadness increased			*1.65**	*(0.93, 2.93)*	1.65	(0.91, 2.99)
Illicit drug use[c]			**4.10*****	**(2.55, 6.59)**	**3.43*****	**(2.10, 5.61)**

*0.05 ≤ P < 0.1 (italic font). **0.001 ≤ P < 0.05 (bold font). ***P < 0.001 (bold font). [a]Missing values were imputed using MI via fully conditional specification. Incomplete binary variables were imputed using logistic regression, incomplete nominal variables were imputed using predictive mean matching (via a linear prediction model to obtain predicted values and $k = 10$ for randomly drawing from the kth nearest observed values to the predicted value), and incomplete ordinal variables (third item of AUDIT-C screening) were imputed using ordinal logistic model. The imputed AUDIT-C item values were then dichotomized to represent binge drinkers versus non-binge drinkers. MI was carried out using 20 imputations with a burn-in of 100 iterations via Stata's *mi impute chained* command. The imputation model included all the analysis variables and the outcome variable of interest as well as auxiliary variables summarized in Table S1 (imputation models for Model A and Model B included measures prior to the stay-at-home period such as binge drinking (third item of AUDIT-C screening), marijuana use, illicit drug use (excluding marijuana) and involvement in substance abuse treatment programs, and imputation model for Model C included support or social services prior to the stay-at-home orders and current employment status in addition to the auxiliary variables included in Model A and B). [b]Lockdown period from 20 March 2020, to late October 2020. [c]Illicit drugs measured since the beginning of the COVID-19 lockdown period include methamphetamines, cocaine or crack, heroin, ecstasy, prescription painkillers (opioids) not used as prescribed, hallucinogens and other pre-scription drugs not used as prescribed (e.g. Xanax or Benzos).

condom use in sexual intercourse and more sex partners during the stay-at-home orders than those who were not hazardous alcohol or binge drinkers. Increased number of sex partners has been associated with higher risk of acquiring of sexually transmitted infections including HIV (Marcus *et al.*, 2015). Establishing patterns of hazardous alcohol use or binge drinking early in life may lead to lifelong trajectory of alcohol misuse and increased risk of HIV infection, both of which impact morbidity and mortality, and overall quality of life.

Given that we selected participants with history of homelessness, incarceration, AYA who were sexual and gender minorities, and those at risk for or with HIV, predisposing factors for alcohol misuse, we were surprised that changes in paid hours worked, living situation and mental health during the stay-at-home orders were not associated with increases in hazardous alcohol use or binge drinking for most participants. Our findings are in line with studies of college students indicating that alcohol use either stayed the same or slightly decreased during the lockdown period (White *et al.*, 2020;

Schepis *et al.*, 2021). It could be that despite their vulnerabilities, many of our participants are resilient and have well-developed internal resources and protective coping mechanisms. It could also be that AYA tend to use alcohol in social settings and the restrictions in social interactions and virtual school resulted in fewer opportunities to drink. Future studies could examine this phenomenon.

It was interesting, but not surprising given our vulnerable and diverse sample, that we found few associations between demographic characteristics and alcohol misuse. Although we did not find any bivariate associations between the outcomes of interest and sex, gender or sexual identity (Table S3), to address the potential problem of multicollinearity among these variables that may mask significance of some associations, we conducted tests for multicollinearity levels and did not find unreasonably high levels of collinearity. Those that emerged mirror non-COVID-19 related studies of alcohol and drug use behaviors among young adults. For instance, participants who reported hazardous alcohol use or binge

drinking were more likely to be White and use illicit drugs than those who did not (Grigsby *et al.*, 2016). The association between binge drinking and anxiety/depression is also supported in the literature, with some studies reporting that 60% of youth in substance use treatment programs also meet the diagnostic criteria for a mental health disorder (Hser *et al.*, 2001, Stapinski *et al.*, 2016, Torikka *et al.*, 2017). Given that the levels of anxiety/depression during the stay-at-home orders were higher among those who reported binge drinking, it is conceivable that some participants turned to alcohol as a coping strategy, for example, to alleviate feeling lonely, stressed or anxious. Use of alcohol as self-medication or to relieve negative emotion has long been established (Stapinski *et al.*, 2016; Anthenien *et al.*, 2017).

Notwithstanding the significance of this study, our findings should be interpreted with caution because it is a cross-sectional survey conducted in Los Angeles and New Orleans, both HIV epicenters. Similar to many other studies of alcohol use during the stay-at-home orders, we recruited a convenience sample, which limits generalizability. Yet, the risk profiles of youth in this study are comparable to the population of youth living with and at high risk for acquiring HIV. Thus, our timely study provides a unique snapshot of COVID-19 related factors obtained from a marginalized sample of AYA in the midst of the stay-at-home period.

Considering that at the time of data collection standardized and validated measures of COVID-19 related changes in quality of life indicators and daily activities were not available, it could be that measurement error impacted our findings. However, this limitation applies to many other COVID-19 studies. Similar to other COVID-19 studies, data were collected via self-report using Qualtrics and are subject to the limitations associated with self-report. Our sample is comprised of marginalized AYA who met strict eligibility criteria; thus, our results do not generalize to the broader population. In spite of this, our findings regarding alcohol misuse during the stay-at-home order reflect the findings of other studies of general sample of secondary school and college students.

Conclusions

Contrary to many other studies of alcohol use during the pandemic, we did not observe any increase in hazardous alcohol use or binge drinking during the stay-at-home period compared with the period prior to the lockdown. Even though our participants had life circumstances and experiences predisposing them to alcohol misuse, our findings are in line with COVID-19 alcohol studies focused on younger samples. We found few relations between demographic characteristics and alcohol misuse; those that emerged mirror non-COVID-19 related studies of alcohol use among young adults. Given that pre-pandemic alcohol misuse appears to be a driver of use during the stay-at-home orders, our findings point to the importance of identifying youth and treating youth who misuse alcohol early to prevent future alcohol misuse.

Supplementary material

Supplementary material is available at *Alcohol and Alcoholism* online.

Conflict of interest statement

None declared.

Data availability

All data are incorporated into the article and its online supplementary material.

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