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Authors

Pytell, Jarratt D

Shen, Nicola M

Keruly, Jeanne C

et al.

Publication Date

2022-12-01

DOI

10.1016/j.drugalcdep.2022.109382

Peer reviewed

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Drug and Alcohol Dependence xxx (xxxx) xxx

Contents lists available at ScienceDirect

Drug and Alcohol Dependence

journal homepage: www.elsevier.com/locate/drugalcdep

The relationship of alcohol and other drug use during the COVID-19 pandemic among people with or at risk of HIV; A cross-sectional survey of people enrolled in Collaborating Consortium of Cohorts Producing NIDA Opportunities (C3PNO) cohorts

Jarratt D. Pytell [a,*], Nicola M. Shen [b], Jeanne C. Keruly [c], Catherine R. Lesko [b], Bryan Lau [b], Anthony T. Fojo [a], Marianna K. Baum [d], Pamina M. Gorbach [e], Marjan Javanbakht [e], Michele Kipke [f], Gregory D. Kirk [b], Brian Mustanski [g], Steven Shoptaw [h], Susanne Siminski [i], Richard D. Moore [a], Geetanjali Chander [a]

[a] Department of Medicine, Johns Hopkins School of Medicine, 600 N. Wolfe St., Baltimore, MD 21287, USA
[b] Department of Epidemiology, Johns Hopkins Bloomberg School of Public Health, 615 N. Wolfe St., Baltimore, MD 21205, USA
[c] Division of Infectious Diseases, Johns Hopkins School of Medicine, 600 N. Wolfe St., Baltimore, MD 21287, USA
[d] Department of Dietetics and Nutrition, Robert Stempel College of Public Health, Florida International University, 11200 SW 8 Street, AHC-5, 326, Miami, FL 33199, USA
[e] Department of Epidemiology, Fielding School of Public Health, University of California Los Angeles, Box 951772, CHS 41-295, Los Angeles, CA 90095-1772, USA
[f] University of Southern California, Children's Hospital Los Angeles, CHL 4650 W. Sunset Blvd., Los Angeles, CA 90027, USA
[g] Institute for Sexual and Gender Minority Health and Wellbeing and Department of Medical Social Sciences, Northwestern University, Chicago, IL, USA
[h] Department of Family Medicine, University of California Los Angeles, 10880 Wilshire Boulevard, Los Angeles, CA 90024, USA
[i] Frontier Science Foundation, 4033 Maple Road, Amherst, NY 14226, USA

ARTICLE INFO

Keywords:
Alcohol use
Stimulant use
Opioid use
Multiple substance use
HIV

ABSTRACT

Background: Alcohol use during the COVID-19 pandemic increased. People living with HIV or at risk for HIV acquisition often have psycho-social and structural barriers or co-occurring substance use making them vulnerable to the adverse effects of alcohol. We describe factors associated with alcohol use during the COVID-19 pandemic in this group.

Methods: From May 2020 to February 2021, 1984 people enrolled in 6 existing cohort studies completed surveys about alcohol and other drug use during the COVID-19 pandemic. We describe the past-month prevalence of no alcohol use, low-risk use, and hazardous use. We use multinomial regression to describe factors associated with low-risk or hazardous alcohol use relative to no alcohol use.

Results: Forty-five percent of participants reported no alcohol use, 33% low-risk use, and 22% hazardous use in the past 30 days. Cannabis and stimulant use were associated with a higher prevalence of low-risk use relative to no use. Tobacco, stimulant, cannabis use and recent overdose were associated with a higher prevalence of hazardous use relative to no use. Substance use treatment and living with HIV were associated with a lower prevalence of low-risk or hazardous use relative to no use.

Conclusions: Stimulant use was strongly associated with a higher prevalence of hazardous alcohol use while engagement in substance use treatment or living with HIV was associated with a lower prevalence. Ascertaining hazardous alcohol and other drug use, particularly stimulants, in clinical care could identify people at higher risk for adverse outcome and harm reduction counseling.

* Correspondence to: Department of Medicine, Johns Hopkins School of Medicine, 5200 Eastern Avenue, Baltimore, MD 21224, USA.
E-mail address: jpytell1@jhmi.edu (J.D. Pytell).

https://doi.org/10.1016/j.drugalcdep.2022.109382
Received 16 August 2021; Received in revised form 15 February 2022; Accepted 26 February 2022
Available online 3 March 2022

1. Introduction

People with HIV or at risk for HIV are potentially more susceptible to the adverse effects of alcohol due to high prevalence of mental health disorders, poor physical health and chronic conditions, and risk-taking behaviors (Hutton et al., 2019; Korthuis et al., 2008; LeGrand et al., 2015). Epidemiological evidence consistently shows the relationship between hazardous alcohol use and emergency department visits, increased sexual transmission risk behavior, and worse HIV related outcomes in this population (Hendershot et al., 2009; Hutton et al., 2019; Monroe et al., 2016; Shuper et al., 2009). A cross-sectional survey of people with HIV/hepatitis C virus (HCV) co-infection after the start of the COVID-19 pandemic showed 26% of respondents used both alcohol and other drugs (Sims et al., 2020). Sanchez et al. (2020) surveyed men who have sex with men (MSM) and found the prevalence of drug use increased 10% and alcohol use increased 25% among respondents compared to prior to COVID-19.

People often consume higher levels of alcohol during times of stress, and alcohol use often stays elevated after the stressful event has resolved (Moise and Ruiz, 2016; Welch et al., 2014). Alcohol consumption during the COVID-19 pandemic has increased in the general population and resulted in a rise of hospitalizations related to withdrawal management and alcohol-related conditions (Pollard et al., 2020, Stockwell et al., 2021; Grossman et al., 2020; Sharma et al., 2021). Among the population of people with HIV and those at risk of HIV, hazardous alcohol use during this period may compound the existing burden of health and social vulnerabilities leading to worse health outcomes. At the same time the drug supply has become increasingly saturated with illicitly manufactured fentanyl directly contributing to 100,000 drug overdoses in 12-month period in the U.S. (Ahmad et al., 2021). Yet less is known about the intersection of alcohol and drug use among people with HIV or at risk for HIV during the COVID-19 pandemic.

Given the high burden of alcohol and other drug use among people with HIV or at risk for HIV, there is an urgent need to identify the patterns of multiple substance use to initiate harm reduction and treatment strategies and direct future research. Lesko and Bengtson (2021) highlighted the relationship of alcohol and drug use consequences among vulnerable populations like those people with HIV or at risk for HIV. However, studies thus far are either limited to a single geographic area or the methods (i.e., online surveys) limit the generalizability (Sanchez et al., 2020; Sims et al., 2020). The Collaborating Consortium of Cohorts Producing NIDA Opportunities (C3PNO) organized surveys which provided a new opportunity to understand alcohol and other drug use in a diverse population of people with or at risk for HIV during the COVID-19 pandemic. Herein, we report the results from the initial surveys describing the 1) prevalence of low-risk and hazardous alcohol use and 2) exploring the association of other drug use and psycho-social factors with alcohol use among a population of people with HIV or at risk for HIV enrolled in diverse cohorts.

2. Methods

2.1. Study sample

The Collaborating Consortium of Cohorts Producing NIDA Opportunities (C3PNO) was established in 2017 by the National Institute on Drug Abuse (NIDA) to enhance data sharing opportunities and mechanisms to facilitate collaborative research efforts among NIDA-supported cohorts that examine HIV/AIDS in the context of substance use. Details of the participating cohorts and other methodology have been previously described (Gorbach et al., 2021), but briefly, the C3PNO Consortium is comprised of nine NIDA cohorts located in major cities in the United States and Canada (Baltimore, Chicago, Los Angeles, Miami, and Vancouver, Canada) with a combined sample size of up to 12,000 active participants. Between May 2020 and February 2021, a subset of participants in each cohort was recruited to respond to a survey about their experiences during the COVID-19 pandemic. Of the nine C3PNO cohorts, six reported information on participant alcohol use: The AIDS Linked to the Intravenous Experience (ALIVE, Baltimore, Maryland, PWID); the Healthy Young Men's Study (HYM, Los Angeles, California, young men who have sex with men); the Johns Hopkins HIV Clinical Cohort (JHHCC, Baltimore, Maryland, PWH); the Miami Adult Studies on HIV (MASH, Miami, Florida, focused on cocaine use, HIV, and HCV); mSTUDY (Los Angeles, California, Black or Hispanic MSM); and the Multilevel Influences on HIV and Substance Use in YMSM Cohort (RADAR, Chicago, Illinois, young MSM). Two waves of surveys were administered at varying times by each cohort between May 11th, 2020 and February 15th 2021. Given our objective to explore associations of alcohol and other drug use, we conducted a cross-sectional analysis of survey respondents who had complete information on alcohol use and the covariates of interest. If people responded to more than one wave of the survey, we used their first survey. We explored incorporating alcohol consumption prior to the start of the COVID-19 pandemic but 75% of the respondents were missing this information which limited this analysis.

2.2. Outcomes

The primary outcome was alcohol use, categorized into three groups based on participant responses to the United States Alcohol Use Disorders Identification Test – Consumption questions (USAUDIT-C), modified to ask about drinking in the past 30 days rather than past year (Higgins-Biddle and Babor, 2018). We denote the three groups as; no alcohol use (abstinent), low-risk alcohol use, and hazardous alcohol use based on terminology best practices (Miller et al., 2019, chap. 2). Average drinks per week was calculated using the first two USAUDIT-C questions (average drinking days and average drinks per drinking day). The third question asks about heavy episodic drinking (also known as binge drinking). Heavy episodic drinking was defined as reporting drinking $\geq$ 4 drinks for women or $\geq$ 5 drinks for men in a single occasion (National Institute on Alcohol Abuse and Alcoholism (NIAAA), 2016). Hazardous alcohol use was defined as averaging $\geq$ 7 drinks per week for females and males $\geq$ 65 years of age, $\geq$ 14 drinks per week for males $<$ 65 years of age or reporting heavy episodic drinking on any occasion in the past month. Low risk alcohol use was defined as reporting any alcohol use below the thresholds for hazardous use. No alcohol use was defined as reporting no alcohol use in the past 30 days.

2.3. Covariates

Demographic covariates included age, sex assigned at birth (male or female), and self-reported race/ethnicity. We also included two indicators of socio-economic status: employment status and current food insecurity. Respondents were classified as employed if they endorsed being employed full time, employed but with a reduction in hours, furloughed, or working "without formal employment" (e.g. freelance or contract work). Current food insecurity was defined as endorsing either not having enough money for food, or rationing food. Mental health variables considered were anxiety measured on the Generalized Anxiety Disorder-7 (GAD-7) categorized as none-low anxiety (0–or moderate-to-severe anxiety (10–21)(Spitzer et al., 2006), resilience as classified by the Brief Resiliency Scale categorized as low (average score between 1 and 2.99), normal (3.00–4.31), or high (>4.31) resiliency (Smith et al., 2008), self-reported disruptions to mental health care during the pandemic, and level of worry about the pandemic. Patients reported their level of worry about COVID-19 on a scale of 1–10, and patients who reported a level of $\geq$ 5 were classified as having substantial worry. HIV status was self-reported at the time of the survey. Current drug use was ascertained using the second question of the Alcohol, Smoking and Substance Involvement Screening Test (ASSIST) modified to ask about the past-month frequency of use (WHO ASSIST Working Group, 2002). ASSIST provides 5 levels of frequency of use (daily, weekly, less than weekly but more than once, once, or never) and participants were

categorized as self-reported past month use (or not) for each of the following substances: tobacco, stimulant (cocaine or methamphetamine), non-prescribed opioid (heroin, fentanyl, or prescription opioids), and cannabis. Participants also reported whether they were currently receiving any substance use disorder treatment (the survey question did not specify if this treatment was pharmacological, group-based, or therapy-based in nature or for what substance use disorder was being treated). Participants who reported being in substance use disorder treatment also reported whether there had been any disruptions to their treatment which could include missed in-person or telemedicine visits with clinicians or disruption in medications. Overdose was defined as self-reporting an overdose event in the past 30 days at the time of the survey. Lastly, because of broad differences in the six cohorts' geographic and social profiles due to different study goals, cohort was included as an adjustment variable, as was survey wave (wave 1 or wave 2). We did not adjust for calendar month in which the survey was completed due to high collinearity with cohort.

2.4. Statistical analysis

We determined the proportion of individuals who reported no alcohol use, low-risk use, and hazardous use in the past 30 days. We examined associations between the covariates listed above with low-risk alcohol use and with hazardous alcohol use using multinomial logistic regression, with no alcohol use as the reference category. Age was included as a linear covariate in the model. On visual inspection of the relationship of age and prevalence of hazardous or low-risk alcohol use relative to no alcohol use, the rate of prevalence decrease for each increasing year of age was different for those ages < 50 and ≥ 50. We accounted for this by adding a knot at age 50 which allows for separate slopes to be calculated for ages < 50 and ≥ 50. We report the results of both crude (adjusted only for cohort) and fully adjusted models (adjusted for all covariates in a single model). A post-hoc secondary analysis was conducted to measure the association between opioid and stimulant use patterns (none, opioids only, stimulants only, or both) and alcohol use.

3. Results

3.1. Study sample

A total of 2121 participants completed a survey. Of these, 14 participants (1%) were excluded due to missing alcohol use information on their survey. We excluded 123 participants (6%) that were missing information on any covariates of interest. Table 1 provides the study population characteristics. The median age of the study sample was 42 years, and a majority were male (79%) and non-Hispanic Black (56%). Current employment was reported by 43% of participants and 28% reported some limitations to their access to food. At the time of the survey, 42% reported having HIV.

Overall, 45% of the sample reported no alcohol use in the past 30 days, 33% reported low-risk alcohol use, and 22% reported hazardous alcohol use. Current tobacco use (43%) and cannabis use (39%) were relatively common and there was substantial use of stimulants (13%) and opioids (6%) as well. Of 351 participants who used either opioid or stimulants, 224 (64%) used stimulants only, 77 (22%) used opioids only, and 50 (14%) used both opioids and stimulants. Of the 17% of participants who were receiving substance use disorder treatment, 69% (or 12% of the total population) experienced disruptions to their treatment. Ten (0.5%) participants reported recent overdose.

Table 2 shows the proportion of participants who reported current drug use and recent overdose by alcohol use category. Compared to participants with no alcohol use, participants with low-risk alcohol use had higher prevalence of stimulant use (13%) and cannabis use (53%) and similar levels of tobacco use (39%), opioid use (5%), and recent overdose (0.3%). Among participants with hazardous alcohol use, there was a higher prevalence of tobacco (53%), stimulant (24%), opioid (7%), cannabis use (64%) and overdose (1.2%) compared to participants with no alcohol use.

Table 1
Characteristics of 1984 participants enrolled in a NIDA-funded cohort who completed at least one survey about their experiences during the COVID-19 pandemic between 11 May 2020 and 15 February 2021.

	Participants (N = 1984)
Age, in years[a]	42 (26, 57)
Male sex	1567 (79%)
Race/ethnicity	
Black, non-Hispanic	1112 (56%)
White, non-Hispanic	258 (13%)
Hispanic	489 (25%)
Other, non-Hispanic	125 (6%)
Employed	853 (43%)
Food insecure	558 (28%)
Moderate-to-severe anxiety	463 (23%)
Brief Resiliency Scale	
Low resilience	350 (18%)
Normal resilience	1338 (67%)
High resilience	296 (15%)
Disruptions to mental health care	959 (48%)
Substantial worry due to the pandemic	1269 (64%)
HIV+	841 (42%)
Alcohol Use	
No use	899 (45%)
Moderate alcohol use	658 (33%)
Heavy alcohol use	427 (22%)
Current tobacco use	857 (43%)
Current stimulant use (cocaine or methamphetamines)	255 (13%)
Current opioid use (heroin, prescription, fentanyl)	113 (6%)
Current marijuana use	787 (39%)
Current substance use treatment	331 (17%)
Disruption to substance use treatment	229 (12%)
Cohort	
ALIVE	470 (24%)
HYM	304 (15%)
JHHCC	227 (11%)
MASH	330 (17%)
RADAR	342 (17%)
mSTUDY	311 (16%)
Surveys included by wave	
Wave 1	1913 (96%)
Wave 2	71 (4%)

[a] Median (Q1, Q3).

Table 2
Proportion of participants reporting current tobacco, stimulant, opioid or cannabis use and overdose in past 30 days by alcohol use level among 1984 participants.

	No Alcohol Use (N = 899)	Low-Risk Alcohol Use (N = 658)	Hazardous Alcohol use (N = 427)
Tobacco	357 (40%)	255 (39%)	227 (53%)
Stimulant	66 (7%)	85 (13%)	104 (24%)
Opioid	47 (5%)	36 (5%)	30 (7%)
Cannabis	167 (19%)	348 (53%)	272 (64%)
Recent overdose	3 (0.3%)	2 (0.3%)	5 (1.2%)

3.2. Low-risk alcohol use

Multinomial logistic regression estimates a ratio of prevalence ratios (RPR) (Table 3). In the crude analyses adjusted only for cohort, the prevalence of low-risk alcohol use relative to no alcohol use decreased with each year of age before the age of 50 (RPR: 0.93, 95% CI 0.91, 0.96) and also after the age of 50 (RPR: 0.95, 95% CI: 0.92, 0.98). The prevalence of low-risk alcohol use relative to no use was statistically higher

Table 3
Participant characteristics and their associations with the relative prevalence of moderate and heavy alcohol use, compared with the prevalence of abstinent alcohol use, among 1984 participants who were enrolled in a NIDA-funded cohort and completed at least one survey during the COVID-19 pandemic between 11 May 2020–15 February 2021. Both crude (adjusted only for cohort) and fully adjusted relative prevalence ratio estimates are presented.[a]

	Low-Risk Alcohol Use (vs. No Use)		Hazardous Alcohol Use (vs. No Use)	
	Crude RPR (95% CI)	Adjusted RPR (95% CI)	Crude RPR (95% CI)	Adjusted RPR (95% CI)
Age, 1-year increment (<50 years of age)	0.93 (0.91, 0.96)	0.95 (0.92, 0.98)	0.96 (0.93, 0.98)	0.98 (0.94, 1.01)
Age, 1-year increment (≥50 years of age)	0.95 (0.92, 0.98)	1.02 (0.99, 1.05)	0.92 (0.88, 0.95)	0.97 (0.93, 1.01)
Male sex	1.51 (1.11, 2.06)	1.48 (1.06, 2.05)	2.01 (1.35, 2.99)	2.13 (1.39, 3.27)
Race/ethnicity				
Black, non-Hispanic	REF	REF	REF	REF
White, non-Hispanic	0.79 (0.55, 1.12)	0.66 (0.44, 0.97)	1.26 (0.85, 1.85)	1.01 (0.65, 1.57)
Hispanic	0.93 (0.67, 1.29)	0.77 (0.54, 1.10)	1.02 (0.72, 1.45)	0.81 (0.54, 1.20)
Other, non-Hispanic	0.84 (0.51, 1.38)	0.67 (0.40, 1.14)	0.88 (0.50, 1.53)	0.64 (0.35, 1.18)
Employed	1.49 (1.17, 1.89)	1.57 (1.19, 2.06)	1.61 (1.23, 2.12)	1.88 (1.37, 2.58)
Food insecure	1.03 (0.81, 1.31)	0.94 (0.73, 1.23)	1.12 (0.85, 1.46)	0.93 (0.69, 1.26)
Moderate-to-severe anxiety	1.13 (0.87, 1.47)	0.95 (0.70, 1.29)	1.44 (1.09, 1.91)	1.05 (0.75, 1.48)
Brief Resiliency Scale				
Low resilience	REF	REF	REF	REF
Normal resilience	0.97 (0.73, 1.30)	1.03 (0.75, 1.42)	0.86 (0.63, 1.18)	0.96 (0.67, 1.38)
High resilience	0.81 (0.55, 1.17)	0.93 (0.61, 1.42)	0.71 (0.46, 1.10)	0.90 (0.55, 1.48)
Interruptions to mental health care	1.16 (0.93, 1.44)	1.18 (0.93, 1.51)	1.09 (0.83, 1.37)	1.01 (0.76, 1.34)
Substantial worry due to the pandemic	1.15 (0.92, 1.44)	1.16 (0.91, 1.48)	1.18 (0.91, 1.52)	1.15 (0.86, 1.53)
HIV+	0.60 (0.47, 0.79)	0.64 (0.48, 0.84)	0.55 (0.41, 0.73)	0.53 (0.38, 0.74)
Current tobacco use	1.48 (1.17, 1.87)	1.25 (0.97, 1.62)	3.05 (2.33, 3.99)	2.20 (1.63, 2.97)
Current stimulant use	1.76 (1.22, 2.54)	1.66 (1.10, 2.49)	3.74 (2.59, 5.38)	2.84 (1.87, 4.33)
Current opioid use	1.69 (1.06, 2.69)	1.47 (0.87, 2.47)	2.39 (1.44, 3.95)	1.36 (0.76, 2.43)
Current cannabis use	3.61 (2.84, 4.59)	3.16 (2.45, 4.07)	5.70 (4.34, 7.49)	4.20 (3.13, 5.62)
Current substance use treatment	0.56 (0.41, 0.77)	0.59 (0.42, 0.82)	0.58 (0.40, 0.84)	0.53 (0.35, 0.80)
Disruptions to substance use treatment (among those on substance use treatment n = 327)	1.66 (0.88, 3.15)	1.42 (0.69, 2.93)	1.87 (0.82, 4.23)	1.58 (0.58, 4.28)
Recent Overdose	1.32 (0.21, 8.14)	0.92 (0.13, 6.35)	5.24 (1.17, 23.48)	3.02 (0.55, 16.66)
Survey Wave 2	1.39 (0.76, 2.52)	1.17 (0.61, 2.24)	0.98 (0.49, 1.93)	0.91 (0.43, 1.92)

[a] The multinomial regression returns coefficients that after exponentiation can be interpreted as a ratio of prevalence ratios (RPR). For example, in the crude analysis adjusted for cohort only, the RPR for tobacco use vs no tobacco use is 3.05 (95% 2.33, 3.99) for participants with heavy alcohol use compared to participants with no use. Put differently, the prevalence of tobacco use among participants with heavy alcohol use is 3.05 (95% CI 2.33, 3.99) times higher the prevalence of tobacco use among participants with no alcohol use.

among males (RPR: 1.51, 95% CI: 1.11, 2.06) and among employed participants (RPR: 1.49, 95% CI: 1.17, 1.89), and lower among participants with HIV (RPR: 0.60, 95% CI: 0.47, 0.79). With respect to drug use, cannabis had the largest association with low-risk alcohol use relative to no alcohol use (RPR: 3.61, 95% CI: 2.84, 4.59), but any drug use was associated with a higher prevalence of low-risk versus no use: tobacco (RPR: 1.48 95% CI: 1.17, 1.87), stimulants (RPR: 1.76, 95% CI: 1.22, 2.54), and opioids (1.69, 95% CI: 1.06, 2.69). Participants receiving substance use treatment had a lower prevalence of low-risk alcohol use relative to no use (RPR: 0.56, 95% CI: 0.41, 0.77). Among those in substance use treatment, there was a non-significant increase in the relative prevalence of low-risk alcohol use among those whose treatment was interrupted (RPR: 1.66, 95% CI: 0.88, 3.15). Participants with recent overdose had a non-significant increased prevalence of low-risk alcohol use relative to no use (RPR: 1.32, 95% CI 0.21, 8.14). Self-reported race, food insecurity, and survey round were not significantly associated with the prevalence of low-risk relative to no alcohol use, nor were the mental health indicators of low-risk-to-severe anxiety, resilience, interruptions to mental healthcare, or worry about the pandemic.

In the fully adjusted model (Table 3), the prevalence of low-risk alcohol use relative to no use decreased with each year of age before 50 (RPR: 0.95, 95% CI: 0.92, 0.98) but not after 50 (RPR: 1.02, 95% CI: 0.99, 1.05). The prevalence of low-risk alcohol use relative to no use remained higher among males (RPR: 1.48, 95% CI: 1.06, 2.05) and employed participants (RPR: 1.57, 95% CI: 1.19, 2.06), and remained lower among participants with HIV (RPR: 0.64, 95% CI: 0.48, 0.84). White participants had a lower prevalence of low-risk alcohol use relative to no use (RPR: 0.66, 95% CI: 0.44, 0.97) compared to non-Hispanic, Black participants. After adjustment, opioid use and tobacco use were no longer significantly associated with higher prevalence of low-risk alcohol use relative to no use (RPR: 1.46, 95% CI: 0.88, 2.44 and RPR: 1.25, 95% CI: 0.96, 1.61, respectively), but cannabis maintained the strongest association (RPR: 3.16, 95% CI: 2.45, 4.07) followed by stimulants (RPR: 1.66, 95% CI: 1.11, 2.50). Receiving substance use treatment was still associated with a lower prevalence of low-risk alcohol use compared to no use (RPR: 0.58, 95% CI: 0.42, 0.82).

3.3. Hazardous alcohol use

In crude analyses adjusted only for cohort (Table 3), year of age was associated with a lower prevalence of hazardous alcohol use relative to no use both before (RPR: 0.96, 95% CI: 0.93, 0.98) and after age 50 (RPR: 0.92, 95% CI 0.88, 0.95). A higher prevalence of hazardous alcohol use relative to no use was seen among males (RPR: 2.01, 95% CI: 1.35, 2.99) and employed persons (RPR: 1.61, 95% CI: 1.23, 2.12), and a lower prevalence was seen among people with HIV (RPR: 0.55, 95% CI, 0.41, 0.73). Drug use was strongly associated with the prevalence of hazardous alcohol use relative to no use: tobacco (RPR: 3.05, 95% CI: 2.33, 3.99), stimulants (RPR: 3.74, 95% CI: 2.59, 5.38), opioids (RPR:

2.39, 95% CI: 1.44, 3.95), and cannabis (RPR: 5.70, 95% CI: 4.34, 7.49). Substance use treatment was associated with a lower prevalence of hazardous alcohol use relative to no use (RPR: 0.58, 95% CI: 0.40, 0.84). Among those in substance use treatment, there was a non-significant increase in the relative prevalence of hazardous alcohol use among those whose treatment was interrupted (RPR: 1.87, 95% CI: 0.82, 4.23). Participants with recent overdose had a higher prevalence of hazardous alcohol use relative to no use (RPR: 5.24, 95% CI 1.17, 23.48).

In the fully adjusted model (Table 3), age was no longer associated with a lower prevalence of hazardous alcohol use relative to no use. A higher prevalence of hazardous alcohol use relative to no use was still observed among males (RPR: 2.13, 95% CI: 1.39, 2.37) and among employed persons (RPR: 1.88, 95% CI: 1.37, 2.58), and a lower prevalence was still observed among participants with HIV (RPR: 0.53, 95% CI: 0.38, 0.74). As was observed with the prevalence of low-risk alcohol use relative to no use, after adjustment, opioid use was no longer significantly associated with an increased prevalence of hazardous alcohol use relative to no use (RPR: 1.36, 95% CI: 0.76, 2.43). Other drug use remained associated with a higher prevalence: tobacco (RPR: 2.20, 95% CI: 1.63, 2.97), stimulants (RPR: 2.84, 95% CI: 1.87, 4.33), and cannabis (RPR: 4.20, 95% CI: 3.13, 5.62). Participants receiving substance use treatment had a lower prevalence for hazardous alcohol use relative to no use (RPR: 0.53, 95% CI: 0.35, 0.80). Among those in substance use treatment, there was a non-significant increase in the relative prevalence of hazardous alcohol use among those whose treatment was interrupted (RPR: 1.58, 95% CI: 0.58, 4.28). Participants with recent overdose had a higher prevalence of hazardous alcohol use relative to no use (RPR: 3.02, 95% CI 0.55, 16.66). No other variables were significantly associated with the prevalence of hazardous alcohol use in the fully adjusted model.

3.4. Secondary analysis

In the crude analysis, an increased prevalence of low-risk alcohol use was observed relative to no use for participants who only used opioids (RPR: 1.93, 95% CI: 1.11, 3.36), participants who only used stimulant (RPR: 1.86, 95% CI: 1.25, 2.77) and participants who used both (RPR: 1.55, 95% CI: 0.68, 3.52) (Table 4). After adjustment, the same pattern held: opioids only (RPR: 1.85, 95% CI 1.01, 3.38), stimulants only (RPR: 1.88, 95% CI: 1.20, 2.88), both (RPR: 1.50, 95% CI: 0.62, 3.63). In the crude analysis, all three were associated with an increased prevalence of hazardous alcohol use relative to no use: only opioid use (RPR: 2.24, 95% CI: 1.15, 4.35), only stimulant use (RPR: 3.87, 95% CI: 2.60, 5.75), and both (RPR: 3.79, 95% CI: 1.74, 8.28). After adjustment, opioid use was no longer significantly associated with the increased prevalence of hazardous alcohol relative to no use (RPR: 1.61, 95% CI 0.78, 3.36); stimulant use was associated with a higher prevalence (RPR: 3.11, 95% CI: 1.98, 4.88) as was the use of both (RPR: 2.17, 95% CI: 1.14, 6.48).

Table 4
The association of opioid and stimulant use, considered together, with moderate alcohol use, and with heavy alcohol use. Both crude (adjusted only for cohort) and fully adjusted relative prevalence ratio estimates are presented. The fully adjusted model included all adjustment variables as in Table 3.

	Low-Risk Alcohol Use (vs. No Use)		Hazardous Alcohol Use (vs. No Use)	
	Crude RPR[a] (95% CI)	Adjusted RPR[a] (95% CI)	Crude RPR[a] (95% CI)	Adjusted RPR[a] (95% CI)
Opioid and Stimulant Use				
Neither	REF	REF	REF	REF
Opioids only	1.93 (1.11, 3.36)	1.85 (1.01, 3.38)	2.24 (1.15, 4.35)	1.61 (0.78, 3.36)
Stimulants only	1.86 (1.25, 2.77)	1.88 (1.20, 2.88)	3.87 (2.60, 5.75)	3.11 (1.98, 4.88)
Both	1.55 (0.68, 3.52)	1.50 (0.62, 3.63)	3.79 (1.74, 8.28)	2.71 (1.14, 6.48)

[a] The crude analysis adjusts for cohort only and the adjusted analysis included all covariates listed in Table 3.

4. Discussion

In our multi-cohort study of people with and at risk for HIV with high prevalence of drug use, we found that nearly a quarter of participants reported drinking above recommended levels set by NIAAA. As expected (by design), drug use (tobacco, cannabis, opioid, and stimulant) was relatively common and higher compared to the general population (Substance Abuse and Mental Health Services Administration, 2020). However, the significant relationship between hazardous alcohol use and stimulant use is notable. Stimulant use in the last month was reported by 13% of all participants, while one-in-four participants with hazardous alcohol use reported stimulant use; when compared to people who did not report stimulant use, stimulant use was associated with a nearly 3-fold increase in prevalence of hazardous alcohol use compared to no use. Overdose deaths involving stimulants is rising (Ahmad et al., 2021) and recognizing the strong relationship of hazardous alcohol use with stimulants should lead clinicians to screen for both alcohol and stimulant use when patients report using one those substances. Additional studies examining the temporal relationship of alcohol and stimulant use are needed to understand this relationship.

Alcohol sales surged at the start of the COVID-19 pandemic with a 54% increase in sales in March 2020 (The Nielsen Company, 2020). Multiple nationally representative surveys showed that alcohol spending and consumption increased (Anderson et al., 2020; Barbosa et al., 2021; Lee et al., 2021). The prevalence of hazardous alcohol use in our study is comparable to U.S. general public which potentially suggests that, when considering alcohol use alone, these cohorts are similar to the broader community (Substance Abuse and Mental Health Services Administration, 2020). However, we believe this finding should be a cause for specific concern for the End the HIV Epidemic plan (Fauci et al., 2019). Alcohol use is associated with behaviors which increase the risk of HIV transmission, less adherence to anti-retroviral treatment, and lower retention of care among people with HIV which could hinder the national goal of stopping the HIV epidemic (Hendershot et al., 2009; Hutton et al., 2019; Monroe et al., 2016).

At the same time that alcohol use is increasing, surveillance data shows that drug overdoses are now at the highest levels ever recorded (Ahmad et al., 2021). In both US and Canada, most overdose deaths involve heroin tainted by illicitly manufactured fentanyl and represent a continuation and worsening of the opioid overdose epidemic. However, stimulant use, including cocaine and methamphetamines, was rising prior to the COVID-19 pandemic, and stimulants are now involved in nearly half of overdose deaths (Collins, 2021). In our study, stimulant use was strongly associated with both low-risk and hazardous alcohol use. Understanding the context and patterns of people's use of alcohol and stimulants could inform harm reduction approaches as simulant use becomes more widespread.

Other drug use including tobacco, cannabis, stimulants, and opioids was associated with increased prevalence of low-risk or hazardous alcohol use relative to no use. This result is consistent with previous studies demonstrating an association between hazardous alcohol use and other drug use (Fairbairn et al., 2016; Newcomb et al., 2014). The drug most strongly associated with low-risk or hazardous alcohol use was cannabis, indicating the rarity of cannabis use in the absence of alcohol use. Opioid use alone (in the absence of stimulant use) was only weakly and not statistically significantly associated with hazardous alcohol use; the association between opioid use and stimulant use together (as opposed to either drug alone) and low-risk alcohol use was weaker and not statistically significant. People often mix opioids and stimulants, specifically cocaine, and combining both drugs could be a marker of more intense drug use and thus also more intense (heavy) alcohol use. The co-use of opioids and alcohol raises the risk of overdose

(White and Irvine, 1999); one-in-seven opioid overdose deaths involved alcohol (Tori et al., 2020). Given the association between these three substances in our study, further public health surveillance of hazardous alcohol use and its identification and treatment when caring for people who use opioids and stimulants could inform harm reduction approaches as simulant use becomes more widespread.

For participants who had current substance use treatment and for those who have HIV, there was a lower prevalence of hazardous alcohol use. Given the cross-sectional nature of the study, we consider several potential explanations. For participants undergoing substance use treatment, they could be more motivated to not drink just as they are motivated to engage in substance use treatment (i.e., confounding by a common factor, motivation). Alternatively, it may be that during the COVID-19 pandemic and the resulting social distancing and isolation, engaging with people including clinicians, counselors, and peers during substance use treatment respondents could have relatively higher social connection which may have served as a protective factor (i.e., substance use treatment is protective) (Dobkin et al., 2002; Kahle et al., 2020; Volkow, 2020). Finally, it may be that people whose drinking was well-controlled were more likely to be able to remain engaged in substance use treatment (i.e., reverse causation). Similar factors of engaging in HIV care where people are more likely asked about alcohol use and being advised to reduce or abstain from alcohol based given the known poor HIV outcomes with alcohol use may be contributing to the lower alcohol use in these persons.

A limitation of this study is the varying time at which the participants completed the survey. The cohorts vary geographically and in the timing of the survey waves. The rapidly changing circumstances of each location in-terms of COVID-19 transmission and mitigation burden likely varied between cohorts. Participants completing surveys early in the pandemic might be systematically different compared to participants completing surveys later. While we controlled for cohort and survey wave, our estimates may skew towards less alcohol use because early participants had yet to experience the burden of COVID-19 and subsequently increased alcohol consumption. Alternatively, people who could be reached to respond to a survey during the pandemic might have had a lower prevalence of alcohol use than all people eligible to complete such a survey. As the cohorts complete new survey waves there will be opportunities to see how alcohol and other drug use changed over time. We did not have measurements of depression or depressive symptoms, which we would expect to also be associated with alcohol consumption and which may have provided a richer picture of alcohol consumption in this population during the COVID-19 pandemic (Boden and Fergusson, 2011; Saatcioglu et al., 2008). Finally, when compared to our cross-sectional design, longitudinal data would improve the understanding of how alcohol use and its risk factors have changed during the COVID-19 pandemic.

5. Conclusion

We found that among people with HIV or at risk of HIV hazardous alcohol use was common and associated with increased stimulant use after the start of the COVID-19 pandemic. Numerous evidence-based treatments and harm-reduction approaches exist which reduce the adverse effects and healthcare burdens of alcohol and drug use (Bramson et al., 2015; Muckle et al., 2012). The significant and strong association of hazardous alcohol use with other drug use, particularly stimulant use, implies that future studies evaluating alcohol and other drug use should measure and account for all types of substances used to fully explain the relationship of multiple substance use and its impact on health outcomes. For clinicians who care for people with HIV or at risk of HIV, when hazardous alcohol is identified, screening for other substance use might increase the identification of other substance use and create an opportunity for harm-reduction or the diagnosis and treatment of a substance use disorder.

Funding

This work was supported by grants from the National Institutes of Health (T32 HP10025; K01 AA028193; K08 MH113094; K24 AA027483; K24 AI118591; U24 DA044554; U01 DA036935; U01 AI069918; U01 DA021525; P30 AI094189; U01 DA036297; U01 DA040325; U01 DA036926; U01 DA040381; U01 DA036267; U01 DA036939; U01 DA038886).

CRediT authorship contribution statement

NSM conducted all data analyses and JDP drafted the manuscript. CRL, JCK, RDM, ATF, MK, MKB, SS, PMG, MJ, SS, GDK, and GC provided input on the data collection instrument. JCK, RDM, MK, MKB, SS, PMG, MJ, SS, GDK, and GC oversaw and coordinated data collection. All authors listed have made a substantial intellectual contribution to this manuscript and approved it for publication.

Conflict of interest

The study authors have no conflicts of interest to declare.

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