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Authors
Hojilla, J Carlo
Marcus, Julia
Volk, Jonathan E
et al.

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Alcohol and drug use, partner PrEP use, and STI prevalence among people with HIV

J. Carlo Hojilla[a,b], **Julia L. Marcus**[c], **Jonathan E. Volk**[d], **Wendy Leyden**[b], **C. Bradley Hare**[d], **Rulin C. Hechter**[f], **E. Jennifer Edelman**[g], **Michael J. Silverberg**[b,*], **Derek D. Satre**[a,b,*]

[a]Department of Psychiatry, Weill Institute for Neurosciences, University of California, San Francisco, CA, United States

[b]Division of Research, Kaiser Permanente Northern California, Oakland, CA, United States

[c]Department of Population Medicine, Harvard Medical School and Harvard Pilgrim Health Care Institute, Boston, MA, United States

[d]Department of Adult and Family Medicine, Kaiser Permanente San Francisco Medical Center, San Francisco, CA, United States

[f]Department of Research and Evaluation, Kaiser Permanente Southern California, Pasadena, CA, United States

[g]Department of Medicine, Yale School of Medicine, New Haven, CT, United States

Abstract

Objectives—People with HIV (PWH) have a high burden of bacterial sexually transmitted infections (STIs). We examined the relationship of alcohol and drug use and partner pre-exposure prophylaxis (PrEP) use to STI prevalence in a cohort of PWH with a history of unhealthy alcohol use.

Methods—We analysed data from a primary care-based alcohol intervention study at Kaiser Permanente Northern California (KPNC). Participants were recruited between April 2013 and May 2015 and were followed for up to 24 months. We linked participant responses to questions from the 24-month follow-up interview, including alcohol and drug use and partner PrEP use, with STI test results (i.e., syphilis, chlamydia, gonorrhoea) in the KPNC electronic health record. Prevalence ratios (PR) were estimated using Poisson models fitted with robust variance estimators to evaluate the association of substance use and partner use of PrEP with STIs.

Results—In the analytic sample (n=465), the median age was 52 years (interquartile range 45–59); 67% were white; 95% were men who have sex with men. Thirty-two percent of participants

Corresponding author: J. Carlo Hojilla, RN, PhD, Division of Research, Kaiser Permanente Northern California, 2000 Broadway, Oakland, CA 94612, carlo.hojilla@ucsf.edu, Phone: +1(510) 891-3631.

*Authors contributed equally

AUTHOR CONTRIBUTIONS

Study concept and design: J.C.H., M.J.S., and D.D.S. Data retrieval, analysis, and interpretation: J.C.H., J.E.V., J.L.M., W.L., D.D.S., and M.J.S. Manuscript preparation: J.C.H. with support from the other authors. All authors provided critical review and edits. The final manuscript was approved by all authors.

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All other authors have no conflicts of interest to disclose.

had HIV-positive partners only; 31% had HIV-negative partners with at least one on PrEP in the previous year; and 37% had HIV-negative partners without any on PrEP. Twenty-three percent reported alcohol and drug use prior to sex in the last six months. Eight percent of participants had an STI. Partner PrEP use (adjusted PR [aPR] 2.99 [95% confidence interval 1.11–8.08]) was independently associated with higher STI prevalence. Participants who reported use of alcohol (aPR 1.53 [0.61–3.83]), drugs (aPR 1.97 [0.71–5.51]), or both (aPR 1.93 [0.75–4.97]) prior to sex had a higher STI prevalence.

Conclusions—The higher prevalence of STIs among PWH with unhealthy alcohol use who have partners on PrEP suggests that this subgroup may be a high-yield focus for targeted outreach, STI screening, and sexual health counselling.

BACKGROUND

There were over 2 million incident cases of bacterial sexually transmitted infections (STIs) in the United States in 2017.[1] Surveillance data suggest dramatic increases in the incidence of syphilis, chlamydia, and gonorrhoea despite overall declining rates of new HIV infections.[2] Preliminary estimates comparing new STI diagnoses between 2013 and 2017 indicate a 76% increase in syphilis, a 67% increase in gonorrhoea, and a 21% increase in chlamydia.[1,3] These substantial increases have raised concerns about the spread of treatment-resistant gonorrhoea, increased morbidity from untreated infections, and other serious public health consequences (e.g., infertility, perinatal complications, further stigmatisation of subgroups). There is also uncertainty regarding whether the high incidence of STIs will compromise the long-term success of antiretroviral therapy (ART)-based prevention strategies such as pre-exposure prophylaxis (PrEP) and treatment as prevention (TasP).[4] Although ART-based prevention will likely remain effective even in the presence of STIs,[5,6] available data are not sufficient to rule out the possibility that STI-induced genital inflammation can facilitate local shedding of HIV despite systemic control.[4,7,8]

People with HIV (PWH), particularly men who have sex with men (MSM), are among the most severely impacted by the STI epidemic. For example, county surveillance data from San Francisco, California, indicate that between 2011 and 2014, the number of new STI cases among PWH increased by over 38% from 992 to 1372.[9] Unhealthy alcohol use and drug use are prevalent among PWH, and place individuals at even greater risk for STIs as these have been associated with risk-taking behaviours and worse health outcomes.[10–13] Unhealthy alcohol use refers to a range of drinking behaviors that increase the risk of negative health consequences.[14] Previous studies have found that unhealthy alcohol use and drug use are associated with condomless sex and poor medication adherence and retention in care.[12,15–17]

Given the burden of STIs in this medically vulnerable population, it is critical to identify subgroups of PWH at greatest STI risk to target resources and optimize screening and early treatment. In this study, we examined the prevalence of bacterial STIs (syphilis, chlamydia, and gonorrhoea) and associated correlates, including alcohol and drug use and partner PrEP use, among a primary care-based cohort of PWH with unhealthy alcohol use in an integrated healthcare system.

METHODS

Study Design

This study examined data collected in the Health and Motivation Study, described in detail elsewhere.[18] Briefly, the study was a randomized clinical trial of primary care-based behavioural interventions to reduce unhealthy alcohol use among 614 PWH in Kaiser Permanente Northern California (KPNC). Participants were eligible if they reported any occasions of consuming ≥3 drinks in a day for women and ≥4 drinks in a day for men within the previous year. Participants were recruited between April 2013 and May 2015, and were followed for up to 24 months. For this study, we analysed data from those who completed the 24-month follow-up telephone interview and provided partner information.

Variables

During the 24-month follow-up interview, participants were asked whether any of their partners in the last year used PrEP ("In the past 12 months, have any of your HIV-negative sexual partners been prescribed PrEP medication?"). Participants could respond with either "Yes," "No," "All my partners have been HIV-positive," or "Don't know/refuse." Those who had no partners in the previous year were automatically marked as "Don't know/refuse." Participant responses were categorized by partner HIV status and PrEP use into mutually exclusive categories: HIV-positive partners only (those who reported only having HIV-positive partners); HIV-negative partners with at least one on PrEP; and HIV-negative none on PrEP (those who had HIV-negative partners but none of whom used PrEP). Participants with responses coded as "Don't know/refuse" were excluded from our analyses to avoid misclassification as this group potentially included individuals who were not sexually active in the previous year.

Participants were also asked about condom use during anal and/or vaginal sex and total number of partners in the last six months. Additional data collected included stimulant use (amphetamines, misuse of prescription stimulants, cocaine), opiate use (misuse of prescription opioids, heroin), cannabis use, and use of other drugs (hallucinogens, MDMA) in the last year, as well as any alcohol and/or drug use (including cannabis) before sex in the last six months. Drug and alcohol use were assessed using an interviewer-administered questionnaire (e.g., "When was the last time you used amphetamines/speed?"). Severity of alcohol use was measured using the Alcohol Use Disorder Identification Test (AUDIT).[19,20] AUDIT scores were interpreted based on standard cut-offs: <7 indicated low risk for alcohol use disorder; 8–15 indicated hazardous use; 16–19 suggested high risk for alcohol use disorder; and scores 20 or greater suggested a likelihood for alcohol use disorder.[20] Interview responses were combined with laboratory data regarding most recent HIV viral load and positive STI tests in the prior year from the KPNC electronic health record. HIV viral suppression was defined as most recent viral load <75 copies/mL.

Our outcome of interest was prevalence of any laboratory-confirmed bacterial STI in the year prior to the 24-month follow-up interview. STI testing was completed as part of routine clinical care. Extragenital testing (i.e., rectal and pharyngeal sites) was based on patient and provider discretion, and results were included in our analysis if tests returned positive.

Gonorrhoea and chlamydia were tested using nucleic acid amplification tests. Syphilis was tested using a rapid plasma reagin (RPR) and a treponemal IgG and IgM antibody test. Syphilis infections that occurred within the study period were identified based on a 4-fold increase in RPR titers.[21] Those who had no positive results were assumed not to have an STI because PWH are screened for those STIs frequently in our healthcare delivery system, with quarterly testing recommended for most of those who are sexually active.

Analysis

Participant characteristics, including viral load, were summarized using descriptive statistics. The Kruskal-Wallis test was used to evaluate differences in median number of sex partners between PWH who had HIV-positive partners only, those who had at least one partner on PrEP, and those who did not report any partner PrEP use. Differences in condom use across partner groups were evaluated using chi-square tests. We estimated prevalence ratios (PR) to evaluate the association between alcohol and drug use and partner PrEP use with STIs using Poisson regression models fitted with robust variance estimators. Covariates were selected *a priori* using clinical judgment and all variables in the unadjusted models were used in the final adjusted model. Variance inflation factor (VIF) was used to test for collinearity between all of the predictor variables. Analyses were completed using Stata 14 (College Station, TX). This study was approved by the Institutional Review Boards at KPNC (IRB# 1272606–18) and at the University of California, San Francisco (IRB # 12–09657).

RESULTS

Of the 614 PWH in the parent study, 553 participants completed 24-month interviews; of those, 88 did not provide partner information and were excluded from this analysis. Participant characteristics are summarized in Table 1. Of the 465 PWH in this analysis, median age was 52 years (interquartile range [IQR] 45–59). Most were white (307/465), college educated (274/465), and MSM (441/465).

Thirty-two percent (147/465) of participants had HIV-positive partners only, 31% (145/465) had at least one HIV-negative partner in the previous year who took PrEP, and 37% (173/465) had HIV-negative partners without reported PrEP use. Approximately 94% (437/465) of all participants were virologically suppressed. Of the 318 PWH with HIV-negative partners, most (97%; 307/318) were either suppressed (94%; 300/318) or reported partner PrEP use (46%; 145/318) in the prior year.

The majority of participants (76%; 355/465) had low risk alcohol use. However, self-reported drug use in the past year was common. Approximately 23% (107/465) reported using alcohol and drugs prior to sex in the last six months. Participants who had a partner on PrEP reported a higher number of sex partners in the last six months (Median=4 [IQR 2–10]) compared to those with only HIV-positive partners (Median=1 [IQR 0–2]) and those with HIV-negative partners not on PrEP (Median=1 [IQR 0–2], $p<0.001$). However, condomless sex did not statistically differ across the three partner groups, with a prevalence of condomless sex in the last six months of 13% (19/143) among PWH who had a partner on PrEP, 19% (28/146) among those with only HIV-positive partners, and 16% (28/173) among PWH without PrEP partners ($p=0.4$).

Period prevalence of any bacterial STI in the prior year was 8% (36/465). Of the individuals who had an STI, 47% (17/36) had syphilis, 44% (16/36) had chlamydia, 31% (11/36) had gonorrhoea, and 14% (5/36) had multiple STIs. Of those who had multiple STIs, two participants had two STIs and three had three STIs in the prior year. All infections occurred among MSM. STI prevalence was highest among college-educated men between 40 and 59 years of age, those who had a partner on PrEP in the previous year, and those who reported using either drugs or a combination of alcohol and drugs prior to sex in the last six months.

In the multivariable model (Table 2), the adjusted prevalence of STIs was higher among participants who had at least one partner on PrEP compared with those who had HIV-negative partners not taking PrEP (adjusted PR [aPR] 2.99 [95% confidence interval 1.11–8.08]). Participants who reported using alcohol (aPR 1.53 [0.61–3.83]), drugs (aPR 1.97 [0.71–5.51]), or both (aPR 1.93 [0.75–4.97]) prior to sex also had a higher prevalence of STIs. However, these associations did not reach statistical significance.

DISCUSSION

This study examined the association of alcohol and drug use and partner use of PrEP with STI risk among PWH with a history of unhealthy drinking. Results indicated that, although PWH in this cohort have reduced HIV transmission risk based on their viral suppression and/or the use of PrEP by partners, the risk of STI transmission remained a concern. We found that participants who had a partner on PrEP had nearly three times the prevalence of STIs compared with those who had HIV-negative partners not taking PrEP.

Approximately 8% of the participants in our study had a positive STI test result during the study period. The prevalence we observed was slightly lower compared to recent estimates in the STD Surveillance Network. However, Lucar et al.[22] found similar STI rates in their clinic-based cohort of PWH across multiple sites in the Washington DC metropolitan area. These findings should be interpreted with the context that overall STI incidence among MSM has been steadily increasing over the last two decades. In one study at a community health centre in Boston, incidence of STIs among MSM increased from 4.6 to 26.8 per 100 person-years between 2005 and 2015.[23] This trend is likely multifactorial and partly due to a decline in condom use, enhanced STI testing, and broader perception of HIV as a manageable illness.[24] Some have proposed that the roll-out of PrEP has contributed to increases in condomless sex, thus driving incident STIs among MSM.[25,26] However, surveillance data have noted increases in STI prevalence in the general MSM population well before the widespread use of PrEP.[27,28] In our analysis, we found no statistically significant differences in condom use among PWH who had a partner on PrEP and those who did not, suggesting the potential role of other behavioural factors, such as number of partners and alcohol and drug use.

Sexual network characteristics may account for the associations we observed. PWH who had a partner on PrEP had four times the median number of sex partners in the last six months compared to others, suggesting a higher probability of STI exposure. Other network characteristics such as background STI prevalence, rate of partner exchange, concurrency of sex partners, and network density or how interconnected individuals are in a sexual network

might have also influenced STI risk.[29–30, w1] As PWH who had a partner on PrEP were more sexually active than others in our cohort, they may also have been screened for STIs more frequently, leading to increased detection of asymptomatic infections.

We also found that PWH who used alcohol and drugs prior to sex had a higher STI prevalence, although estimates were not statistically significant. Chemsex, or the use of sex-enhancing drugs such as amphetamines during sex, has become increasingly popular among MSM in industrialized countries, and is a well-known driver of sexual risk-taking.[16] The associations we observed were attenuated in adjusted analyses but the direction of each association was consistent with findings from previous reports. For example, alcohol and drug use have been associated with condomless sex, impaired sexual decision-making, and having higher numbers of sexual partners.[12,15,17,w2–w5]

The results of our analysis underscore the importance of frequent STI screening among PWH. Our findings also support the need for ongoing discussions around sexual risk behaviours (e.g., alcohol and drug use) and STI risk reduction (e.g., condom use) during routine clinic visits. Given the cross-sectional design of our study, we cannot conclude that partner PrEP use is causally associated with STIs in PWH. However, this study has important implications for public health efforts. The prevalence of STIs among PWH who have partners on PrEP suggests that this subgroup may be a high-yield focus for targeted interventions. Along with efforts to increase STI screening, enhanced outreach that integrate HIV and STI care coordination, and novel strategies, such as STI post-exposure prophylaxis, are needed.

A key strength of our analysis is the use of a primary care-based cohort in an integrated healthcare system, which allowed us to link interview data with laboratory-confirmed STI test results. However, we acknowledge some important limitations. We were limited in our ability to characterize participants' sexual networks and assess temporality of exposure and outcome. It is conceivable that participants acquired an STI before any encounter with a partner on PrEP or acquired the infection from others in their sexual network. It is also possible that participants may not have accurately reported their partner's PrEP use or their condom use behaviours due to recall bias, social desirability, and/or misinformation. Some in our sample may also have received STI testing outside of the KPNC healthcare system, results of which would not be captured in the electronic health record. All participants had a history of unhealthy alcohol use in the prior year, so findings may not be reflective of the experiences of other PWH. However, the prevalence of hazardous alcohol use in our cohort based on AUDIT scores was similar to other studies involving general PWH populations.[w6,w7] Lastly, the majority of the participants in our study were MSM and all of them were insured; therefore findings may not be generalizable to the broader population of PWH, particularly cisgender women, transgender people, and those without health insurance coverage.

Despite these limitations, this study provides important insights that can inform efforts to address the STI epidemic. However, prospective studies are needed to more clearly understand the relationship between partner PrEP use and STI incidence among PWH.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Key Messages

- In this clinic-based sample of PWH with a history of unhealthy alcohol use, overall prevalence of bacterial STI (i.e., syphilis, chlamydia, gonorrhoea) was 8% (36/465).
- PWH who had a partner on PrEP were more likely to have an STI compared to those who had HIV-negative partners not taking PrEP.
- Findings underscore the importance of STI screening and discussions around STI risk reduction among PWH.
- PWH with partners on PrEP and have a history of unhealthy alcohol use may benefit from enhanced outreach, targeted screening, and sexual health counselling.

Table 1.

Characteristics of participants with HIV at the 24-month follow-up interview (N=465)

		n	(%)
Gender/sexual orientation	MSM	441	(95)
	Male, non-MSM	7	(2)
	Female	14	(3)
	Transgender	3	(<1)
Age	< 40	67	(14)
	40–59	285	(61)
	≥ 60	113	(24)
Race/ethnicity	White	307	(66)
	Hispanic or Latino/a	72	(16)
	African-American	50	(11)
	Other	36	(8)
Education	Completed high school/GED or less	115	(25)
	Some college	76	(16)
	College or graduate school	274	(59)
HIV viral load	≥ 75 copies/mL	28	(6)
	< 75 copies/mL	434	(94)
AUDIT score	No alcohol use in the last year	14	(3)
	0–7 (Low risk for alcohol use disorder)	355	(76)
	8–15 (Hazardous use)	73	(16)
	16–19 (High risk use)	14	(3)
	≥20 (Alcohol use disorder likely)	9	(2)
Drug use in the last year	Amphetamines	61	(13)
	Misuse of prescription stimulants	14	(3)
	Cocaine	56	(12)
	Misuse of prescription opioids	36	(8)
	Heroin	2	(<1)
	Cannabis	273	(59)
	Hallucinogens	18	(4)
	MDMA	43	(9)
	> 1 drug reported	121	(26)
Alcohol/drug use before sex in the last 6 months	None	219	(47)
	Alcohol & drugs	107	(23)
	Alcohol only	99	(21)
	Drugs only	40	(9)
Partners in last 6 months, median (IQR)		1	(1–3)

		n	(%)
Any condomless sex in last 6 months		75	(16)
STI in the last year		36	(8)
Partner status and PrEP use	HIV-positive partners only	147	(32)
	HIV-negative on PrEP	145	(31)
	HIV-negative not on PrEP	173	(37)

MSM = men who have sex with men; AUDIT = Alcohol Use Disorders Identification Test; Stimulants = amphetamines, misuse of prescription stimulants, cocaine; Opioids = misuse of prescription opioids, heroin; Other = hallucinogens, MDMA; IQR = interquartile range

Table 2.

Prevalence of bacterial sexually transmitted infections in the previous year among people living with HIV (N=465)

		STI Prevalence		Crude PR	(95% CI)	Adjusted PR	(95% CI)
		n/N	(%)				
Age	< 40	3/66	(5)	Ref		Ref	
	40–59	31/283	(11)	2.41	(0.76 – 7.65)	2.77	(0.88 – 8.72)
	≥ 60	2/113	(2)	0.39	(0.07 – 2.27)	0.57	(0.10 – 3.29)
Race/ethnicity	White	26/305	(9)	Ref		Ref	
	Hispanic or Latino/a	5/72	(7)	0.81	(0.32 – 2.05)	0.96	(0.40 – 2.32)
	African-American	2/49	(4)	0.48	(0.12 – 1.96)	0.66	(0.16 – 2.72)
	Other	3/36	(8)	0.98	(0.31 – 3.07)	0.89	(0.29 – 2.70)
Education	High school/GED or less	4/114	(4)	Ref		Ref	
	Some college	7/75	(9)	2.66	(0.81 – 8.78)	2.58	(0.83 – 8.00)
	College or graduate school	25/273	(9)	2.61	(0.93 – 7.34)	2.20	(0.79 – 6.13)
Alcohol/drug use before sex in the last 6 months	None	10/217	(5)	Ref		Ref	
	Alcohol & drugs	13/106	(12)	2.66	(1.21 – 5.87)	1.93	(0.75 – 4.97)
	Alcohol only	8/99	(8)	1.75	(0.71 – 4.31)	1.53	(0.61 – 3.83)
	Drugs only	5/40	(13)	2.71	(0.98 – 7.52)	1.97	(0.71 – 5.51)
Number of partners in last 6 months				1.01	(1.00 – 1.03)	1.00	(0.99 – 1.01)
Condomless sex in last 6 months		7/75	(9)	1.26	(0.57 – 2.76)	1.16	(0.54 – 2.52)
Partner status and PrEP use	HIV-negative not on PrEP	6/173	(3)	Ref		Ref	
	HIV-negative on PrEP	22/143	(15)	4.44	(1.85 – 10.65)	2.99	(1.11 – 8.08)
	HIV-positive partners only	8/146	(5)	1.58	(0.56 – 4.45)	1.51	(0.50 – 4.56)

STI = sexually transmitted infections; MSM = men who have sex with men; PR = prevalence ratio; PrEP = preexposure prophylaxis. Models were limited to MSM as all STI infections were in MSM. Adjusted model includes terms for all variables in table.