Title

Health System-Based Unhealthy Alcohol Use Screening and Treatment Comparing Demographically Matched Participants With and Without HIV.

Journal

Alcoholism: Clinical and Experimental Research, 44(12)

Authors

Silverberg, Michael
Levine-Hall, Tory
Hood, Nicole
et al.

Publication Date

2020-12-01

DOI

10.1111/acer.14481

Peer reviewed

HHS Public Access

Author manuscript

Alcohol Clin Exp Res. Author manuscript; available in PMC 2021 December 01.

Published in final edited form as:

Alcohol Clin Exp Res. 2020 December ; 44(12): 2545–2554. doi:10.1111/acer.14481.

Health System-Based Unhealthy Alcohol Use Screening and Treatment Comparing Demographically-Matched Participants With and Without HIV

Michael J. Silverberg, PhD, MPH[1], **Tory Levine-Hall, BS**[1], **Nicole Hood, MPH**[1], **Alexandra N. Anderson, MPH**[1], **Stacey E. Alexeeff, PhD**[1], **Jennifer O. Lam, PhD**[1], **Sally B. Slome, MD**[2], **Jason A. Flamm, MD**[3], **C. Bradley Hare, MD**[4], **Thekla Ross, PsyD**[1], **Amy Justice, MD**[5,6], **Jonathan A.C. Sterne, PhD**[7], **Andrew Williams, PhD**[8], **Kendall J. Bryant, PhD**[9], **Constance M. Weisner, PhD**[1], **Michael A. Horberg, MD**[10], **Stacy A. Sterling, DrPH, MSW**[1], **Derek D. Satre, PhD**[1,11]

[1]Division of Research, Kaiser Permanente Northern California (KPNC), 2000 Broadway, Oakland CA, 94612, USA.

[2]Oakland Medical Center, KPNC, 3801 Howe Street, Oakland, CA 94611, USA.

[3]Sacramento Medical Center, KPNC, 2345 Fair Oaks Boulevard, Sacramento, CA 95825, USA.

[4]San Francisco Medical Center, KPNC, 2238 Geary Boulevard, San Francisco, CA 94115, USA.

[5]Yale School of Medicine, Yale University, 950 Campbell Avenue, West Haven, CT 06516, USA.

[6]VA Connecticut Healthcare System, 950 Campbell Avenue, West Haven, CT 06516, USA.

[7]Department of Population Health Sciences, Bristol Medical School, University of Bristol, Oakfield House, Oakfield Grove, Bristol BS8 2BN, UK

[8]Tufts Medical Center, 35 Kneeland Street, Boston MA 02111, USA.

[9]National Institute on Alcohol Abuse and Alcoholism, National Institutes of Health, 6700B Rockledge Drive, Bethesda, MD 20892-6902, USA.

[10]Mid-Atlantic Permanente Research Institute, Kaiser Permanente Mid-Atlantic States, 2101 East Jefferson Street, 3 West, Rockville, MD 20852, USA.

[11]Department of Psychiatry and Behavioral Sciences, Weill Institute for Neurosciences, University of California, San Francisco, 401 Parnassus Avenue, San Francisco, CA 94131, USA.

Abstract

Background.—Unhealthy alcohol use among persons living with HIV (PLWH) is linked to significant morbidity and use of alcohol services may differ by HIV status. Our objective was to compare unhealthy alcohol use screening and treatment by HIV status in primary care.

Methods.—Cohort study of adult (≥18 years) PLWH and HIV-uninfected participants frequency-matched 20:1 to PLWH by age, sex, and race/ethnicity who were enrolled in a large integrated

Corresponding Author: Michael J. Silverberg, PhD, Division of Research, Kaiser Permanente Northern California (KPNC), Oakland CA, USA, 2000 Broadway, Oakland CA 94612, Michael.J.Silverberg@kp.org, (510) 891-3801.

healthcare system in the United States, with information ascertained from an electronic health record. Outcomes included unhealthy alcohol screening, prevalence, provider-delivered brief interventions and addiction specialty care visits. Other predictors included age, sex, race/ethnicity, neighborhood deprivation index, depression, smoking, substance use disorders, Charlson comorbidity index, prior outpatient visits, insurance type, and medical facility. Cox proportional hazards models were used to compute hazard ratios (HR) for the outcomes of time to unhealthy alcohol use screening and time to first addiction specialty visit. Poisson regression with robust standard errors were used to compute prevalence ratios (HR) for other outcomes.

Results.—11,235 PLWH and 227,320 HIV-uninfected participants were included. By 4.5 years after baseline, most participants were screened for unhealthy alcohol use (85% of PLWH and 93% of HIV-uninfected), but with a lower rate among PLWH (adjusted hazard ratio [HR] 0.84, 95% CI 0.82–0.85). PLWH were less likely, compared with HIV-uninfected participants, to report unhealthy drinking among those screened (adjusted PR 0.74, 95% CI 0.69–0.79), and among those who screened positive, less likely to receive brief interventions (adjusted PR 0.82, 95% CI 0.75–0.90), but more likely (adjusted HR 1.7, 95% CI 1.2–2.4) to have an addiction specialty visit within one year.

Conclusions.—Unhealthy alcohol use was lower in PLWH, but the treatment approach by HIV status differed. PLWH reporting unhealthy alcohol use received less brief interventions and more addiction specialty care than HIV-uninfected participants.

Keywords

HIV; epidemiology; substance abuse; alcohol use; primary care

INTRODUCTION

Unhealthy drinking is common among persons living with HIV (PLWH) (Galvan et al., 2002), occurring in up to a quarter of HIV patients (Park et al., 2016), with prevalence of alcohol use disorders (AUDs) 2 to 4 times higher compared with those without HIV (Cook et al., 2001, Chander et al., 2008). Unhealthy drinking is associated with reduced antiretroviral therapy (ART) use and adherence (Chander et al., 2006, Matson et al., 2018), worse engagement and retention in care (Monroe et al., 2016, Matson et al., 2018), reduced HIV RNA suppression (Chander et al., 2006, Matson et al., 2018) and lower CD4 cell counts (Samet et al., 2007). Likewise, medical problems associated with unhealthy drinking have increasing prominence in the ART era, including cardiovascular disease (Freiberg et al., 2010), liver disease (Bonacini, 2011), liver cancer (Silverberg et al., 2011), cognitive deficits (Persidsky et al., 2011), and depression (Sullivan et al., 2011), and reduced life expectancy (DeLorenze et al., 2011, Marcus et al., 2016). Thus, it is essential for HIV care providers to be able to efficiently identify and address alcohol use issues in PLWH.

Unhealthy alcohol use, defined as ≥4 drinks in a day for women and men >65 years of age, and ≥5 drinks in a day for men 18–65 years, is not often addressed in healthcare settings (Hormes et al., 2012). Providers often fail to discuss alcohol use even when unhealthy use is identified (Straussner and Byrne, 2009), and PLWH with alcohol use disorders may be less likely than the general population to initiate specialty alcohol treatment (DeLorenze et al.,

2011, Weaver et al., 2008). PLWH may also be less likely to receive brief alcohol-related intervention following positive screens for unhealthy alcohol use, based on prior research in the United States Veterans Health Affairs (VA) system (Williams et al., 2017b). When PLWH do reduce unhealthy alcohol use, HIV clinical outcomes, including viral suppression and antiretroviral adherence are improved (Satre et al., 2020a). Greater alcohol use has also been shown to track closely with adverse changes in the VACS index score, a composite HIV severity and prognostic score (Williams et al., 2019). To avoid adverse consequences of unhealthy alcohol use, health systems are increasingly implementing routine screening and treatment (Mertens et al., 2015, Bradley et al., 2006), although studies evaluating the effectiveness of alcohol interventions among PLWH have mixed results (Samet and Walley, 2010, Williams et al., 2017a, Gause et al., 2018, Chander et al., 2015, Satre et al., 2019).

To better understand the key barriers faced by PLWH accessing alcohol-related care, we leveraged the rich electronic health record (EHR) data from Kaiser Permanente Northern California (KPNC), a large integrated healthcare system which implemented routine Screening, Brief Intervention and Referral to Treatment (SBIRT) in all adult primary care clinics (Mertens et al., 2015). We evaluated the prevalence of screening for unhealthy alcohol use among those screened, provider-delivered brief interventions and visits to addiction specialty care in PLWH and demographically-matched HIV-uninfected participants identified from the same health system. The integrated healthcare delivery model of KPNC provides a unique opportunity to study whether disparities exist in the delivery of alcohol-related care for PLWH compared with the general population, independent of the key barrier of differential access. We hypothesized that even in a setting of well-treated HIV among stably insured PLWH, we would still see disparities in alcohol-related care given the many competing demands in busy HIV primary care settings, such as the need for ongoing HIV disease management and monitoring of chronic conditions.

MATERIALS AND METHODS

Population and Study Design

The study population was a cohort of 11,235 PLWH and 227,320 HIV-uninfected adult (≥18 years of age) participants from KPNC—a large, private, non-profit integrated health system providing care to >4 million members. Most PLWH in KPNC are followed by HIV specialists in clinics within Departments of Adult and Family Medicine (referred to throughout as primary care), and therefore receive both HIV and general medical care from the same providers and clinics. These clinics may include a mix of patients with and without HIV. Another less common model of care involves PLWH receiving HIV care from HIV specialists within Infectious Disease clinics and their other general medical care from non-HIV primary care providers, in which case primary care providers are responsible for alcohol-related services. PLWH were identified from the KPNC HIV registry, which includes all known cases of HIV infection among KPNC members.

The eligible population included PLWH and HIV-uninfected adults who were active KPNC members at some point between July 1st, 2013 (rollout of routine unhealthy alcohol use screening in KPNC) and December 31st, 2017. The alcohol SBIRT workflow involves medical assistants administering National Institute on Alcohol Abuse and Alcoholism

(NIAAA)-based unhealthy alcohol screening questions which assess number of unhealthy drinking days (i.e., ≥4 drinks in a day for women ≥18 and men >65 years of age; ≥5 drinks in a day for men 18–65 years of age) over the prior 90 days, and average weekly quantity and frequency of alcohol use, at primary care visits. The screening is performed annually for those not reporting unhealthy alcohol use and at six months following all positive screens. It is then recommended that patients who screen positive for unhealthy drinking receive a brief intervention, as outlined in the NIAAA Clinician Guide (NIAAA, 2016, Willenbring et al., 2009). Specifically, providers were trained in brief motivational intervention techniques, and were encouraged to: 1) directly state concern that patient is drinking above low-risk limits (by how much per gender and age); 2) link drinking to presenting problem and/or ongoing medical concerns; and 3) recommend they cut back. Providers were trained to document the brief intervention in the medical record and encouraged to refer patients, as clinically appropriate, to Addiction Medicine for further assessment and treatment. The training was the same for all providers regardless of whether they had PLWH or not on their patient panels.

The final study population consisted of all eligible PLWH and a sample of HIV-uninfected participants, frequency matched 20:1 to PLWH by age (5-year categories), gender, race/ethnicity (White, Black, Hispanic, other, unknown), and observation start year (2013–2017). Start of follow-up was the latest of: KPNC member enrollment start date, 18th birthdate, first known to be HIV-infected (for PLWH), or July 1, 2013. Participants were followed until the earliest of: achieving outcome of interest, death date, lost-to-follow-up (i.e., >3 months continuous gap in health plan membership), or December 31, 2017 (i.e., administrative end of the study).

Measurements

Main outcomes of interest were unhealthy alcohol screening performed at a primary care visit and a positive unhealthy alcohol use screen, with data obtained from structured text fields populated by answers to standardized NIAAA-based unhealthy alcohol screening questions. A positive alcohol screen for men <66 years of age was defined as 5+ drinks in a day at least once (a “binge” drinking episode) and/or 15+ average weekly drinks in the last 90 days (NIAAA, 2016). For men ≥66 years of age and all women, a positive alcohol screen was defined as 4+ drinks in a day at least once and/or an average of 8+ average weekly drinks in the last 90 days. We further defined frequent unhealthy alcohol use as those with 5 or more days in past 90 days with a binge drinking episode (Saitz et al., 2014). We also evaluated follow-up after a positive screen including: (1) clinician-delivered brief interventions (International Classification of diseases, Revision 9 [ICD-9] V65.49, V65.42; ICD10 Z71.89, Z71.41) documented in the EHR within 60 days of a positive alcohol screen, and; (2) addiction medicine and recovery services department visit within 365 days of a positive screen (for consistency with prior studies (Williams et al., 2017b)).

The primary exposure of interest was HIV status. Additional key variables extracted from the EHR included sex, race/ethnicity (White, Black, Hispanic, other, unknown), neighborhood deprivation index (NDI) score (Messer et al., 2006, Stoddard et al., 2013) (categorized into quartiles), baseline depression, smoking status (current or non-current),

baseline alcohol use disorder diagnoses, other baseline substance use disorder diagnoses, modified Charlson comorbidity index score excluding AIDS for PLWH (categorized as 0, 1, 2+), number of outpatient care visits in prior year, insurance type (commercial, Medicare, Medicaid, other), KPNC facility (San Francisco which has largest HIV clinic vs. other clinics), HIV acquisition risk group (men who have sex with men [MSM], injection drug users [IDU], heterosexual sex, other, unknown), baseline $CD4^+$ T-cell counts (<350, 350 – 499, and 500+), baseline HIV RNA levels (<75 or 75+ copies/ml), prior clinical diagnosis of AIDS, and baseline prior antiretroviral therapy (ART) use.

Statistical Analysis

We first compared demographics and other potential confounders between all PLWH and HIV-uninfected participants using Pearson's chi-square test for categorical variables and t-tests for continuous variables. Using Kaplan-Meier estimates of the cumulative incidence curves, we compared the time to first unhealthy alcohol screen by HIV status. Hazard ratios (HR) by HIV status were obtained from Cox proportional hazards models. Adjusted models included terms for age (per 10 years), sex, race/ethnicity, neighborhood deprivation index, depression, smoking, alcohol use disorders, other substance use disorders, modified Charlson index, prior outpatient visits, insurance type, and KPNC facility.

Among those screened, we assessed the prevalence of any drinking, unhealthy drinking and frequent unhealthy drinking by HIV status. Crude and adjusted prevalence ratios (PR) by HIV status were obtained from Poisson regression models with robust standard errors (Zou, 2004) using Proc Genmod in SAS (Version 9.3, Cary, NC), with adjustment for same terms listed above. Among those who reported unhealthy alcohol use, we then reported the prevalence of clinician-delivered brief interventions within 60 days, with crude and adjusted PRs by HIV status. Among PLWH only, we then identified factors associated with brief interventions with additional consideration of HIV-specific factors (HIV transmission risk, CD4, HIV RNA levels, clinical AIDS and ART use). Adjusted models included all terms that were statistically significant ($P<0.05$) in univariate models. Similarly, we used Cox models to evaluate the association of HIV status and time to first addiction specialty visit within 365 days of a positive screen. We also identified factors associated with addiction specialty visits among PLWH.

Analyses were performed with SAS (Version 9.4; Cary, North Carolina, USA). All statistical tests are two-sided, and statistical significance was defined as $P<0.05$. The study was approved by the KPNC and University of California, San Francisco (UCSF) Institutional Review Boards and included waivers of written informed consent.

RESULTS

Baseline characteristics

The study population included 11,235 PLWH and 227,320 HIV-uninfected participants who both contributed a mean of 3 years of follow-up per subject, and were similar with respect to matching characteristics: mean age at baseline of 47 years; 91% men; 52% White race (Table 1). PLWH, compared with HIV-uninfected participants, had a higher percentage of

current smokers (16% vs. 11%), depression history (31% vs. 11%), alcohol use disorder history (11% vs. 7%), other substance use history (14% vs. 5%), Charlson comorbidity scores of 1 (10% vs. 8%) and 2+ (11% vs. 7%), more previous outpatient visits (mean 7.0 vs. 3.4), and a greater percentage receiving care at the San Francisco KPNC medical facility (36% vs. 9%). PLWH were predominantly MSM (70%), with 86% at baseline with prior ART, most (64%) with $CD4^+$ T cell counts ≥500+ cells/μL, and most (82%) with HIV RNA <75 copies/mL

Unhealthy alcohol use screening

As shown in Figure 1, there were small differences in the time to first unhealthy use screen by HIV status. By 4.5 years after baseline, 85% of PLWH and 93% of HIV-uninfected participants had been screened, with an adjusted HR of 0.84 (95% CI 0.82–0.85). The proportion reporting any alcohol use among those screened was 42% and 49% for PLWH and HIV-uninfected participants, respectively, with an adjusted PR of 0.91 (95% CI 0.89–0.94) (Table 2a). The proportion reporting unhealthy alcohol use among those screened was 10% and 13% for PLWH and HIV-uninfected participants, with an adjusted PR of 0.75 (95% CI 0.71–0.81) (Table 2b). Finally, the proportion reporting frequent unhealthy drinking among those screened was 3% and 4% for PLWH and HIV-uninfected participants, with an adjusted PR of 0.69 (95% CI 0.61–0.78) (Table 2c). Of note, of 854 PLWH and 24,174 HIV-uninfected participants who screened positive for unhealthy alcohol use, only 14% and 13%, respectively had a prior AUD history.

Alcohol treatment

Next, we evaluated receipt of alcohol interventions following a positive alcohol screen. Among those reporting unhealthy drinking, PLWH had a lower prevalence of receipt of brief interventions compared with HIV-uninfected participants (36% vs. 45%), with an adjusted PR of 0.82 (95% CI 0.75–0.90) (Table 2d). Similarly, among those who reported frequent unhealthy drinking, PLWH were less likely to receive brief interventions compared with HIV-uninfected participants (40% vs. 49%), with an adjusted PR of 0.84 (95% CI 0.72–0.98) (Table 2e). However, PLWH reporting unhealthy drinking were more likely to have an addiction specialty care visit within 365 days. As shown in Figure 2, by one year following a positive unhealthy alcohol use screen, 5% of PLWH had an addiction specialty care visit compared with 2% of HIV-uninfected participants, with an adjusted HR of 1.7 (95% CI 1.2–2.4). Among those reporting frequent unhealthy alcohol use, by 1 year, 9% and 3% of PLWH and HIV-uninfected participants, respectively, had an addiction specialty care visit, with an adjusted HR of 2.9 (95% CI 1.8–4.7).

As shown in Table 3, few factors were associated with receiving clinician-based brief interventions among PLWH who reported unhealthy drinking. In the adjusted model, factors associated with brief interventions included smoking (PR 1.25; 95% CI 1.04–1.50), San Francisco facility (PR 0.70; 95% CI 0.58–0.84), and CD4<350 vs ≥500 cells/μl (PR 1.29; 95% CI 1.01–1.65). Factors associated with an addiction specialty care visit among PLWH reporting unhealthy alcohol use (Table 4) included younger age (HR 0.75 per 10 years older; 95% CI 0.59–0.94), an alcohol use disorder (HR 3.44; 95% CI 1.60–7.39), more outpatient

visits (HR 1.03 per 1 visit; 95% CI 1.02–1.04), and an HIV transmission risk of injection drug use compared with men who have sex with men (HR 5.40; 95% CI 2.53–11.53).

DISCUSSION

In a large cohort study of PLWH and demographically matched HIV-uninfected participants with access to care, we found several differences in the delivery of alcohol-related services by HIV status. In the first five years following the implementation of routine health system-based alcohol screening and follow-up, PLWH had high screening rates (85% screened by five years), but overall coverage remained lower than that of HIV-uninfected participants (91%). Among those screened, PLWH had a modestly lower prevalence of self-reported unhealthy alcohol use compared with HIV-uninfected participants. Among those who screened positive for unhealthy alcohol use, we found that PLWH with positive screens were 18% *less* likely to have brief alcohol interventions (36% vs. 45%), but 70% *more* likely to have an addiction specialty care visit (5% vs. 2%) as compared with HIV-uninfected participants. Together these results have important implications for alcohol-related care in HIV primary care settings, which may have successfully addressed unhealthy alcohol use overall but are left with a greater burden of alcohol use disorders.

The high screening rate afforded by systematic screening in our study is encouraging given prior research on this topic. Metsch et al. (Metsch et al., 2008) studied 1225 PLWH in care in three large US cities, and noted only 35% of patients reported discussions of alcohol use with their providers. Factors associated with an increased likelihood of discussions included prior problem drinking, younger age, male sex, Hispanic ethnicity, poor health, and having a good relationship with their provider. Among PLWH in the VA, Conigliaro et al. (Conigliaro et al., 2003) noted that providers of healthier PLWH (i.e., who had high CD4, undetectable HIV RNA, or did not have Hepatitis) were more likely to be unaware of unhealthy alcohol use in their patients. Thus, systematic screening has great potential to overcome these and other screening disparities.

Here we observed lower unhealthy alcohol use rates in PLWH compared with HIV-uninfected participants with 42% and 49%, respectively, reporting any alcohol use and 10% and 13%, respectively, reporting unhealthy alcohol use. A study of 900 PLWH from the HIV Research Network that used the same definition of unhealthy alcohol use as we did in this study reported 40% with any alcohol use and 11% with unhealthy alcohol use (Chander et al., 2008), which were similar to rates among PLWH in our study. Crane et al. (Crane et al., 2017) studied >8000 PLWH in CFAR Network of Integrated Clinical Systems and reported a higher rate of any alcohol use (67%) and unhealthy alcohol use (27%) based on AUDIT-C scores. Our study is unique in that we compared unhealthy alcohol use rates among PLWH and HIV-uninfected participants identified from the same private health system and access to the same services. It is possible that the lower unhealthy alcohol use among PLWH in our study is due to more interactions with health care providers and the increased emphasis on healthy lifestyle behaviors, including drinking below low-risk limits, in HIV primary care clinics. This is in part supported by the higher rates of AUDs at baseline for PLWH compared with HIV-uninfected controls (11% vs. 7%), but lower current unhealthy drinking rates, consistent with successfully addressing past alcohol use problems. Despite these

encouraging findings, research suggests that for PLWH, adverse effects of alcohol use may be observed at lower drinking levels compared with the general population (Edelman et al., 2018).

Our finding of fewer brief interventions in PLWH is similar to that from another large study of PLWH and HIV-uninfected controls from the VA, which noted a 17% lower likelihood of brief interventions following a positive alcohol screen (Williams et al., 2017b). Of note, brief intervention rates overall were higher in the VA compared with KPNC with 57% and 74% of PLWH and HIV-uninfected controls in the VA with a brief intervention, compared with 42% and 49% for KPNC, respectively. This difference might be due to a more well-established screening program in the VA, which was initiated earlier than KPNC (2007 in the VA compared with 2013 in KPNC). However, the clinical significance of the observed disparity is unknown given prior research noting more limited long-term benefits of alcohol behavioral interventions in PLWH (Samet and Walley, 2010). In a VA study of 2101 PLWH, Williams et al. (Williams et al., 2017a) reported that 77% of patients with unhealthy alcohol use had alcohol brief interventions, but this did not result in reductions in alcohol use over time. More recent research shows promise (Gause et al., 2018, Chander et al., 2015), including our recent clinical trial (Satre et al., 2019) in KPNC demonstrating that motivational interviewing can improve drinking outcomes for PLWH in HIV primary care with low motivation at baseline to change drinking habits.

Despite the reduced likelihood of alcohol brief interventions, it should be noted that PLWH were more likely to have an addiction specialty care visit during follow-up. In adjusted models, we noted a 1.7-fold higher rate of addiction specialty care visits for those with an unhealthy alcohol screen and 2.9-fold higher rate among those with frequent unhealthy screens. These results are consistent with the premise that HIV providers at KPNC may be better able to triage more severe alcohol issues to alcohol specialty care. HIV providers may also have better access to addiction specialty care given the higher burden of substance use in this setting. This finding may also explain the reduced prevalence of brief interventions if HIV providers believed that unhealthy alcohol use would be more effectively treated along with other substance use in specialty clinics. Few others have evaluated alcohol specialty care initiation by HIV status. The VA study (Williams et al., 2017b) found that PLWH were more likely to have an inpatient or outpatient visit to specialty addiction care (28% vs. 11% for PLWH and HIV-uninfected controls, respectively) but there was no difference in adjusted models.

In our study, with routine screening and intervention, we did not observe disparities with respect to age, sex or race/ethnicity regarding receipt of alcohol brief interventions among PLWH reporting unhealthy alcohol use. Those with a smoking history were more likely to receive an intervention, which may reflect increased awareness of alcohol problems given the close link between smoking and alcohol use. We also noted a trend for more interventions for those with lower recent CD4 cell counts, which may reflect more opportunities for intervention for those with the greatest HIV clinical need. Similarly, few patient factors except for younger age, smoking and AUDs were associated with addiction specialty visits. It is possible that insurance coverage characteristics may also impact access, and in unadjusted results, we noted a trend for reduced access to addiction specialty care for

those with Medicaid or other publicly-subsidized insurance; however this represented only a small subset of our population. Our prior research has not found that other health insurance factors (e.g., deductibles or source of insurance) have influenced access to alcohol treatment services within KPNC (Satre et al., 2020b).

While it is encouraging that few measured patient-related factors were observed to be associated with alcohol treatment, it should be noted that treatments may be also driven by provider or health system characteristics. In a survey of 115 HIV providers in New York City, Strauss et al. (Strauss et al., 2009) noted that HIV providers were more likely to report routine screening and brief interventions if they had smaller caseloads, had more information on the harmful effects of alcohol on HIV outcomes, had greater years practice experience, and had greater self-efficacy to support alcohol reduction in their patients. In our study, we noted a lower likelihood of alcohol brief interventions for the San Francisco clinic, which may reflect competing clinical priorities in serving the largest HIV clinic population in KPNC. Further research is needed regarding provider and system-level factors that may impact delivery of alcohol-related care for PLWH, such as the integration of behavioral health specialists in HIV clinics, better access to alcohol specialty care as discussed above, and the HIV care model used. For example, most PLWH in KPNC are followed by HIV specialists within adult family medicine clinics, with HIV and general medical care provided by the same provider, while some PLWH are followed in infectious disease clinics, with general medical care provided by non-HIV PCPs.

Some limitations of the study should be noted. First, although the sample is comparable to insured PLWH (including patients with Medicaid, Medicare, and private insurance obtained via health exchanges), results may not be generalizable to women or to the uninsured. Similarly, the setting is a closed integrated healthcare system, and some features of SBIRT delivery may not be feasible in other settings (e.g., near universal delivery of alcohol screening to all members). Thus, while we anticipate excellent internal validity for study findings, caution is warranted regarding generalizability. However, findings may be generalizable to other integrated health care systems and to patient populations with access to robust alcohol screening and treatment programs. Second, alcohol and tobacco use may be underreported, and the level of detail recorded for EHR-derived risk factors only allowed for broad categorizations (e.g., current/former/never smoked). Although it is unknown whether differences in reporting of substance use exist by HIV status, it remains possible that the lower prevalence of unhealthy alcohol use for PLWH is explained by greater reluctance to disclose alcohol or other substance use than HIV-uninfected participants. It is conceivable, for example, that admitting alcohol use or other substance use may be seen as stigmatizing or embarrassing in the context of the generally strong relationship that PLWH have with their providers (Hormes et al., 2012). It is also possible that some clinicians did not document alcohol brief interventions during clinical encounters although it should be noted that all clinical encounters in the health system require clinicians to enter primary and often multiple secondary diagnostic codes. Clinicians were trained to enter these brief intervention diagnostic codes as part of the system-wide training for the alcohol screening initiative, and this training was the same for providers that do and do not care for PLWH. To further encourage guideline compliance, alcohol screening and brief intervention rates by clinic and provider are tracked regionally and performance feedback at the facility and

individual provider and medical assistant level disseminated and reviewed on a monthly basis.

An additional limitation was small sample size for some analyses. For example, evaluation of time to first addiction specialty visit is most relevant for those who reported frequent unhealthy drinking, but the small sample size precluded an analysis in the PLWH subset. We also do not know the specific reasons for addiction specialty care visits which may be for alcohol or other substance use issues. The major strength of our study is the use of a large, well characterized population of PLWH and matched HIV-uninfected participants from the same integrated healthcare system. Since KPNC implemented routine alcohol screening and treatment protocols for all members, regardless of HIV status, this study setting inherently controls for many ecologic, provider and system level factors. Another strength of the study is the availability of a comprehensive EHR, resulting in comprehensive ascertainment of study measures including alcohol screening and treatment outcomes.

In summary, we noted important differences in alcohol screening and treatment for PLWH and demographically-matched HIV-uninfected participants with access to care. First, we determined that the prevalence of unhealthy alcohol use was lower in PLWH, which may reflect greater prior attention to the health impacts of unhealthy alcohol use in this population. We also noted lower alcohol brief intervention rates but higher rates of addiction specialty care initiation for PLWH, which may reflect improved triage of more severe alcohol problems by HIV primary care providers. However, the lower alcohol brief intervention rates among PLWH suggest further research is needed regarding the integration of HIV and alcohol services in primary care, given the increasingly complex medical needs of an aging HIV patient population.

Funding:

Funding was provided by the National Institute on Alcohol Abuse and Alcoholism (U01AA026230 and K24AA025703).

REFERENCES

BONACINI M 2011 Alcohol use among patients with HIV infection. Ann Hepatol, 10, 502–7. [PubMed: 21911892]

BRADLEY KA, WILLIAMS EC, ACHTMEYER CE, VOLPP B, COLLINS BJ & KIVLAHAN DR 2006 Implementation of evidence-based alcohol screening in the Veterans Health Administration. Am J Manag Care, 12, 597–606. [PubMed: 17026414]

CHANDER G, HUTTON HE, LAU B, XU X & MCCAUL ME 2015 Brief Intervention Decreases Drinking Frequency in HIV-Infected, Heavy Drinking Women: Results of a Randomized Controlled Trial. J Acquir Immune Defic Syndr, 70, 137–45. [PubMed: 25967270]

CHANDER G, JOSEPHS J, FLEISHMAN JA, KORTHUIS PT, GAIST P, HELLINGER J & GEBO K 2008 Alcohol use among HIV-infected persons in care: results of a multi-site survey. HIV Med, 9, 196–202. [PubMed: 18366443]

CHANDER G, LAU B & MOORE RD 2006 Hazardous alcohol use: a risk factor for non-adherence and lack of suppression in HIV infection. J Acquir Immune Defic Syndr, 43, 411–7. [PubMed: 17099312]

CONIGLIARO J, GORDON AJ, MCGINNIS KA, RABENECK L & JUSTICE AC 2003 How harmful is hazardous alcohol use and abuse in HIV infection: do health care providers know who is at risk? J Acquir Immune Defic Syndr, 33, 521–5. [PubMed: 12869842]

COOK RL, SEREIKA SM, HUNT SC, WOODWARD WC, ERLEN JA & CONIGLIARO J 2001 Problem drinking and medication adherence among persons with HIV infection. J Gen Intern Med, 16, 83–8. [PubMed: 11251758]

CRANE HM, MCCAUL ME, CHANDER G, HUTTON H, NANCE RM, DELANEY JAC, MERRILL JO, LAU B, MAYER KH, MUGAVERO MJ, MIMIAGA M, WILLIG JH, BURKHOLDER GA, DROZD DR, FREDERICKSEN RJ, CROPSEY K, MOORE RD, SIMONI JM, CHRISTOPHER MATHEWS W, ERON JJ, NAPRAVNIK S, CHRISTOPOULOS K, GENG E, SAAG MS & KITAHATA MM 2017 Prevalence and Factors Associated with Hazardous Alcohol Use Among Persons Living with HIV Across the US in the Current Era of Antiretroviral Treatment. AIDS Behav, 21, 1914–1925. [PubMed: 28285434]

DELORENZE GN, WEISNER C, TSAI AL, SATRE DD & QUESENBERRY CP JR. 2011 Excess mortality among HIV-infected patients diagnosed with substance use dependence or abuse receiving care in a fully integrated medical care program. Alcohol Clin Exp Res, 35, 203–10. [PubMed: 21058961]

EDELMAN EJ, WILLIAMS EC & MARSHALL BDL 2018 Addressing unhealthy alcohol use among people living with HIV: recent advances and research directions. Curr Opin Infect Dis, 31, 1–7. [PubMed: 29176446]

FREIBERG MS, MCGINNIS KA, KRAEMER K, SAMET JH, CONIGLIARO J, CURTIS ELLISON R, BRYANT K, KULLER LH & JUSTICE AC 2010 The association between alcohol consumption and prevalent cardiovascular diseases among HIV-infected and HIV-uninfected men. J Acquir Immune Defic Syndr, 53, 247–53. [PubMed: 20009766]

GALVAN FH, BING EG, FLEISHMAN JA, LONDON AS, CAETANO R, BURNAM MA, LONGSHORE D, MORTON SC, ORLANDO M & SHAPIRO M 2002 The prevalence of alcohol consumption and heavy drinking among people with HIV in the United States: results from the HIV Cost and Services Utilization Study. J Stud Alcohol, 63, 179–86. [PubMed: 12033694]

GAUSE NK, ELLIOTT JC, DELKER E, STOHL M, HASIN D & AHARONOVICH E 2018 Association between change in self-efficacy to resist drinking and drinking behaviors among an HIV-infected sample: Results from a large randomized controlled trial. J Health Psychol, 23, 829–839. [PubMed: 27577039]

HORMES JM, GERHARDSTEIN KR & GRIFFIN PT 2012 Under-reporting of alcohol and substance use versus other psychiatric symptoms in individuals living with HIV. AIDS Care, 24, 420–3. [PubMed: 21942759]

MARCUS JL, CHAO CR, LEYDEN WA, XU L, QUESENBERRY CP JR., KLEIN DB, TOWNER WJ, HORBERG MA & SILVERBERG MJ 2016 Narrowing the Gap in Life Expectancy Between HIV-Infected and HIV-Uninfected Individuals With Access to Care. J Acquir Immune Defic Syndr, 73, 39–46. [PubMed: 27028501]

MATSON TE, MCGINNIS KA, RUBINSKY AD, FROST MC, CZARNOGORSKI M, BRYANT KJ, EDELMAN EJ, SATRE DD, CATZ SL, BENSLEY KM, FIELLIN DA, JUSTICE AC & WILLIAMS EC 2018 Gender and alcohol use: influences on HIV care continuum in a national cohort of patients with HIV. Aids, 32, 2247–2253. [PubMed: 30005010]

MERTENS JR, CHI FW, WEISNER CM, SATRE DD, ROSS TB, ALLEN S, PATING D, CAMPBELL CI, LU YW & STERLING SA 2015 Physician versus non-physician delivery of alcohol screening, brief intervention and referral to treatment in adult primary care: the ADVISe cluster randomized controlled implementation trial. Addict Sci Clin Pract, 10, 26. [PubMed: 26585638]

MESSER LC, LARAIA BA, KAUFMAN JS, EYSTER J, HOLZMAN C, CULHANE J, ELO I, BURKE JG & O'CAMPO P 2006 The development of a standardized neighborhood deprivation index. J Urban Health, 83, 1041–62. [PubMed: 17031568]

METSCH LR, PEREYRA M, COLFAX G, DAWSON-ROSE C, CARDENAS G, MCKIRNAN D & EROGLU D 2008 HIV-positive patients' discussion of alcohol use with their HIV primary care providers. Drug Alcohol Depend, 95, 37–44. [PubMed: 18243580]

MONROE AK, LAU B, MUGAVERO MJ, MATHEWS WC, MAYER KH, NAPRAVNIK S, HUTTON HE, KIM HS, JABOUR S, MOORE RD, MCCAUL ME, CHRISTOPOULOS KA, CRANE HC & CHANDER G 2016 Heavy Alcohol Use Is Associated With Worse Retention in HIV Care. J Acquir Immune Defic Syndr, 73, 419–425. [PubMed: 27243904]

NIAAA. Helping patients who drink too much: a clinician's guide, updated 2005 edition. Revised 2016 U.S. Department of Health and Human Services [NIH Publication No. 07–3769].. Available: https://pubs.niaaa.nih.gov/publications/practitioner/cliniciansguide2005/guide.pdf [Accessed October 6, 2020].

PARK LS, HERNANDEZ-RAMIREZ RU, SILVERBERG MJ, CROTHERS K & DUBROW R 2016 Prevalence of non-HIV cancer risk factors in persons living with HIV/AIDS: a meta-analysis. AIDS, 30, 273–91. [PubMed: 26691548]

PERSIDSKY Y, HO W, RAMIREZ SH, POTULA R, ABOOD ME, UNTERWALD E & TUMA R 2011 HIV-1 infection and alcohol abuse: neurocognitive impairment, mechanisms of neurodegeneration and therapeutic interventions. Brain Behav Immun, 25 Suppl 1, S61–70. [PubMed: 21397004]

SAITZ R, CHENG DM, ALLENSWORTH-DAVIES D, WINTER MR & SMITH PC 2014 The ability of single screening questions for unhealthy alcohol and other drug use to identify substance dependence in primary care. J Stud Alcohol Drugs, 75, 153–7. [PubMed: 24411807]

SAMET JH, CHENG DM, LIBMAN H, NUNES DP, ALPEREN JK & SAITZ R 2007 Alcohol consumption and HIV disease progression. J Acquir Immune Defic Syndr, 46, 194–9. [PubMed: 17667330]

SAMET JH & WALLEY AY 2010 Interventions targeting HIV-infected risky drinkers: drops in the bottle. Alcohol Res Health, 33, 267–79. [PubMed: 23584068]

SATRE DD, LEIBOWITZ AS, LEYDEN W, CATZ SL, HARE CB, JANG H, LAM JO, BRYANT KJ, WEISNER CM, STERLING SA, HORBERG M, VOLBERDING P & SILVERBERG MJ 2019 Interventions to Reduce Unhealthy Alcohol Use among Primary Care Patients with HIV: the Health and Motivation Randomized Clinical Trial. J Gen Intern Med, 34, 2054–2061. [PubMed: 31187344]

SATRE DD, SAROVAR V, LEYDEN W, HARE CB, CATZ SL, BRYANT KJ, WILLIAMS EC, HOJILLA JC, HORBERG MA & SILVERBERG MJ 2020a Changes in Days of Unhealthy Alcohol Use and Antiretroviral Therapy Adherence, HIV RNA Levels, and Condomless Sex: A Secondary Analysis of Clinical Trial Data. AIDS Behav, 24, 1784–1792. [PubMed: 31773444]

SATRE DD, WEISNER C, PALZES VA, YOUNG-WOLFF KC, PARTHASARATHY S, GUYDISH J & CAMPBELL CI 2020b Healthcare utilization of individuals with substance use disorders following Affordable Care Act implementation in a California healthcare system. J Subst Abuse Treat, 118, 1–9.

SILVERBERG MJ, CHAO C, LEYDEN WA, XU L, HORBERG MA, KLEIN D, TOWNER WJ, DUBROW R, QUESENBERRY CP JR., NEUGEBAUER RS & ABRAMS DI 2011 HIV infection, immunodeficiency, viral replication, and the risk of cancer. Cancer Epidemiol Biomarkers Prev, 20, 2551–9. [PubMed: 22109347]

STODDARD PJ, LARAIA BA, WARTON EM, MOFFET HH, ADLER NE, SCHILLINGER D & KARTER AJ 2013 Neighborhood deprivation and change in BMI among adults with type 2 diabetes: the Diabetes Study of Northern California (DISTANCE). Diabetes Care, 36, 1200–8. [PubMed: 23275367]

STRAUSS SM, TIBURCIO NJ, MUNOZ-PLAZA C, GWADZ M, LUNIEVICZ J, OSBORNE A, PADILLA D, MCCARTY-ARIAS M & NORMAN R 2009 HIV care providers' implementation of routine alcohol reduction support for their patients. AIDS Patient Care STDS, 23, 211–8. [PubMed: 19866539]

STRAUSSNER SL & BYRNE H 2009 Alcoholics Anonymous: Key research findings from 2002–2007. Alcoholism Treatment Quarterly, 27, 349–67.

SULLIVAN LE, GOULET JL, JUSTICE AC & FIELLIN DA 2011 Alcohol consumption and depressive symptoms over time: a longitudinal study of patients with and without HIV infection. Drug Alcohol Depend, 117, 158–63. [PubMed: 21345624]

WEAVER MR, CONOVER CJ, PROESCHOLDBELL RJ, ARNO PS, ANG A, ETTNER SL, COST SUBCOMMITTEE OF THE HIV/AIDS TREATMENT ADHERENCE, H. O. & COST STUDY, G. 2008 Utilization of mental health and substance abuse care for people living with HIV/AIDS, chronic mental illness, and substance abuse disorders. J Acquir Immune Defic Syndr, 47, 449–58. [PubMed: 18197121]

WILLENBRING ML, MASSEY SH & GARDNER MB 2009 Helping patients who drink too much: an evidence-based guide for primary care clinicians. Am Fam Physician, 80, 44–50. [PubMed: 19621845]

WILLIAMS EC, LAPHAM GT, BOBB JF, RUBINSKY AD, CATZ SL, SHORTREED SM, BENSLEY KM & BRADLEY KA 2017a Documented brief intervention not associated with resolution of unhealthy alcohol use one year later among VA patients living with HIV. J Subst Abuse Treat, 78, 8–14. [PubMed: 28554608]

WILLIAMS EC, LAPHAM GT, SHORTREED SM, RUBINSKY AD, BOBB JF, BENSLEY KM, CATZ SL, RICHARDS JE & BRADLEY KA 2017b Among patients with unhealthy alcohol use, those with HIV are less likely than those without to receive evidence-based alcohol-related care: A national VA study. Drug Alcohol Depend, 174, 113–120. [PubMed: 28324813]

WILLIAMS EC, MCGINNIS KA, TATE JP, MATSON TE, RUBINSKY AD, BOBB JF, LAPHAM GT, EDELMAN EJ, CATZ SL, SATRE DD, BRYANT KJ, MARSHALL BDL, KRAEMER KL, BENSLEY KM, RICHARDS JE, SKANDERSON M, JUSTICE AC, FIELLIN DA & BRADLEY KA 2019 HIV Disease Severity Is Sensitive to Temporal Changes in Alcohol Use: A National Study of VA Patients With HIV. J Acquir Immune Defic Syndr, 81, 448–455. [PubMed: 30973541]

ZOU G 2004 A modified poisson regression approach to prospective studies with binary data. Am J Epidemiol, 159, 702–6. [PubMed: 15033648]

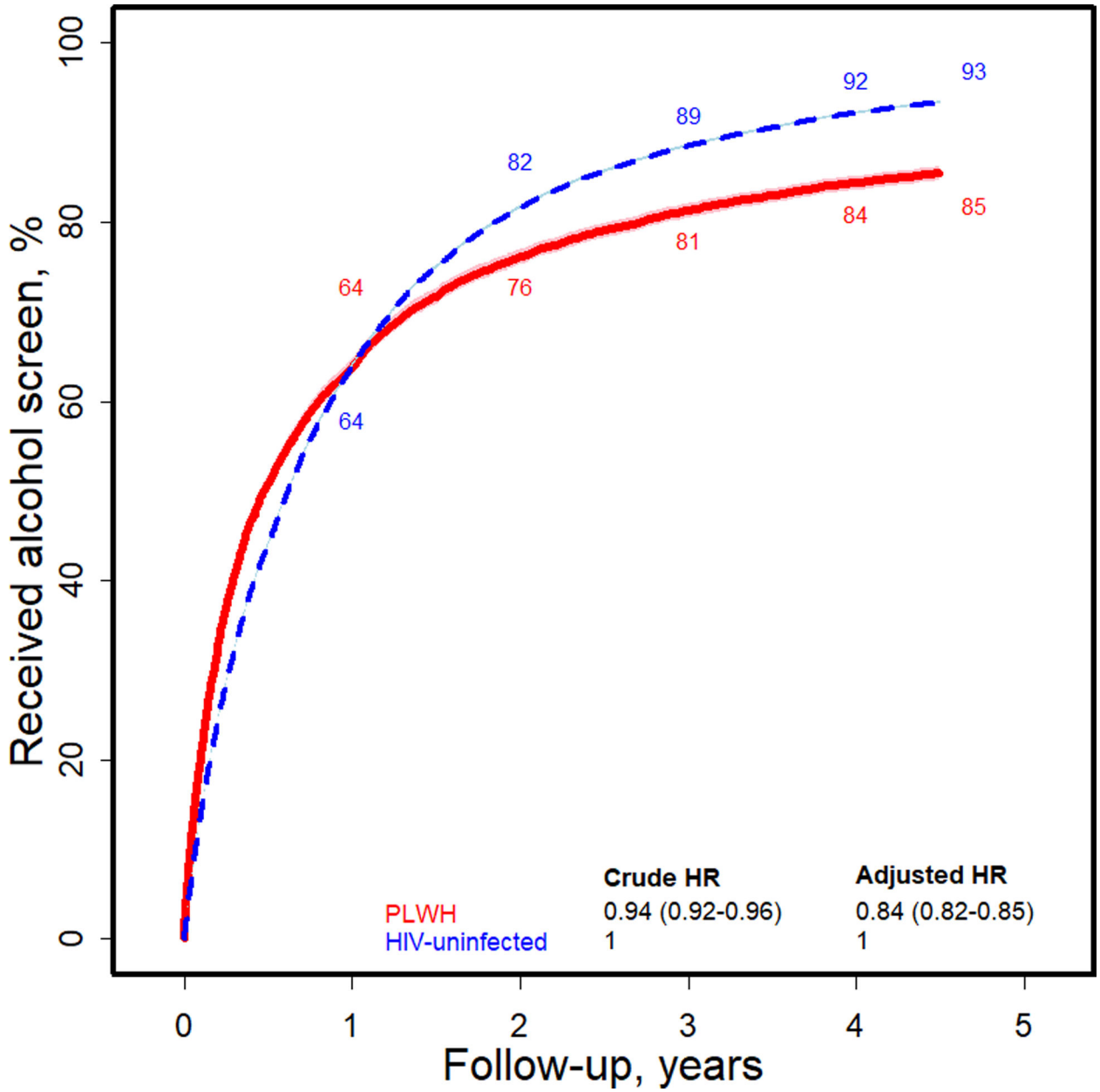

Figure 1. Time to primary-care based alcohol screening for persons living with HIV and HIV-uninfected participants.

Percentage screened for unhealthy alcohol use obtained from Kaplan-Meier curves and displayed with solid red line for persons living with HIV and dashed blue line for HIV-uninfected participants. Numbers adjacent to curves are the percentage screened at each year following baseline. Crude and adjusted hazard ratios (HR) from Cox Proportional Hazards models are also shown. Adjusted models include terms for age, sex, race/ethnicity (Black, White, Hispanic, Other/Unknown), modified Charlson index (excluding AIDS), prior outpatient visits, census-based SES, smoking, depression, alcohol specific substance use disorder, and insurance, and KPNC facility.

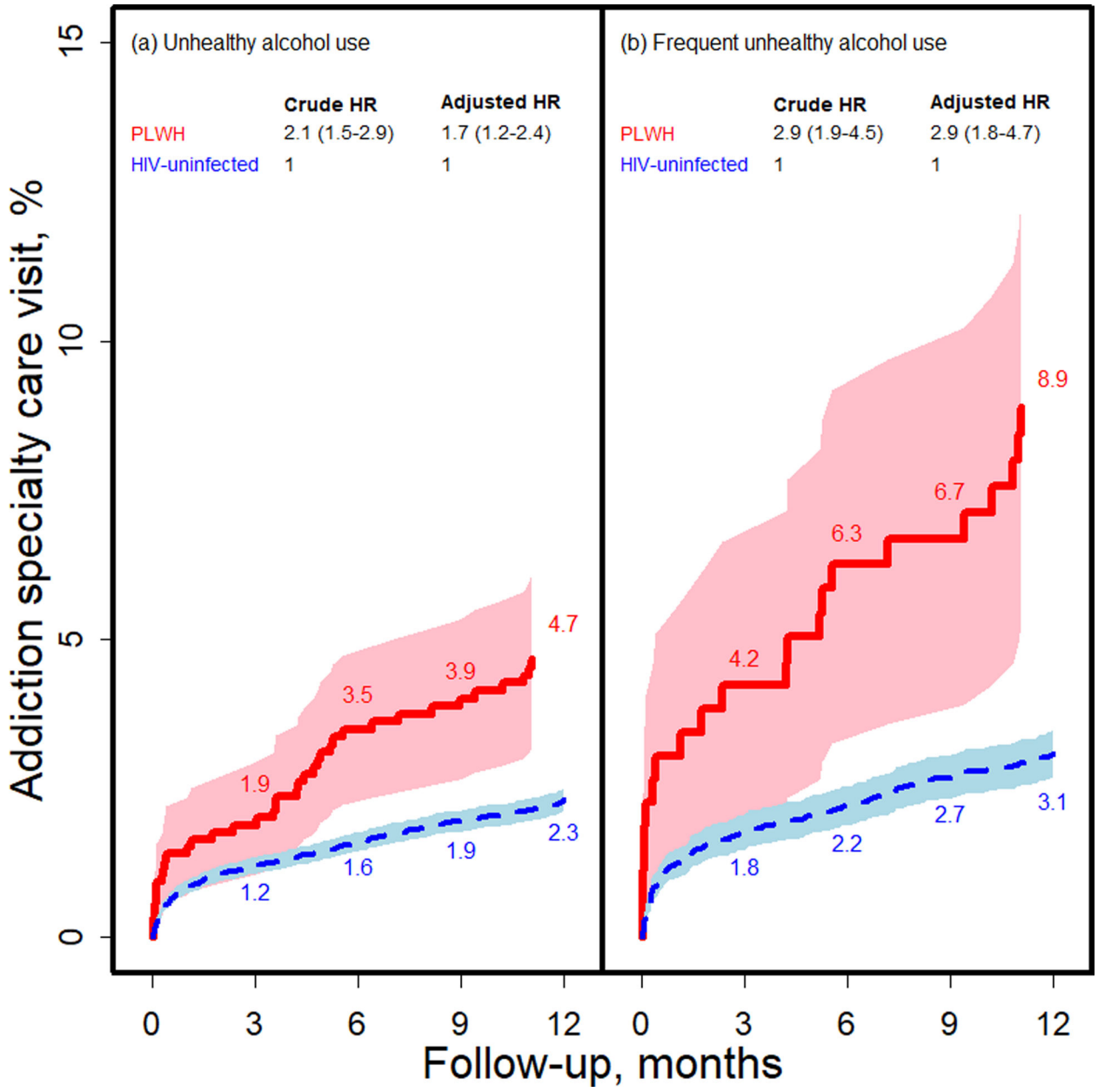

Figure 2. Time to first visit to addiction specialty care for persons living with HIV and HIV-uninfected participants reporting unhealthy drinking.

Results shown for (a) those reporting unhealthy alcohol use (4+/5+ drinks in a day at least once or average 8+/15+ drinks in a week for women/men); and (b) those reporting frequent unhealthy alcohol use (: 4+/5+ drinks in a day for 5 or more days in past 90 days. Percentage with an addiction specialty care visit obtained from Kaplan-Meier curves and displayed with solid red line for persons living with HIV and dashed blue line for HIV-uninfected participants. Numbers adjacent to curves are the percentage screened by one year. Crude and adjusted hazard ratios (HR) from Cox Proportional Hazards models are also shown.

Adjusted models include terms for age, sex, race/ethnicity (Black, White, Hispanic, Other/Unknown), neighborhood deprivation index, KPNC facility, and insurance type.

Table 1.

Baseline characteristics

Characteristic	PLWH n=11,235	HIV-uninfected n=227,320	P-value[1]
Mean years follow-up/subject (SD)	3.1 (1.6)	3.2 (1.6)	<0.001
Mean age, years (SD)	47.3 (12.3)	47.4 (14.0)	<0.001
Sex, %			0.887
Men	10,166 (90.5%)	205,782 (90.5%)	
Women	1,069 (9.5%)	21,538 (9.5%)	
Race/ethnicity, %			0.990
White	5,864 (52.2%)	118,116 (52.0%)	
Black	1,873 (16.7%)	38,181 (16.8%)	
Hispanic	1,993 (17.7%)	40,497 (17.8%)	
Other	1,055 (9.4%)	21,480 (9.5%)	
Unknown	450 (4.0%)	9,046 (4.0%)	
Neighborhood deprivation index[2], %			<0.001
Quartile 1 (least deprived)	3,112 (28.2%)	55,691 (24.8%)	
Quartile 2	2,362 (21.4%)	56,513 (25.2%)	
Quartile 3	2,605 (23.6%)	56,224 (25.1%)	
Quartile 4 (most deprived)	2,966 (26.9%)	56,013 (25.0%)	
History of depression, %	3,490 (31.1%)	25,614 (11.3%)	<0.001
Current smokers, %	1,766 (15.7%)	24,321 (10.7%)	<0.001
History of alcohol use disorder, %	1,184 (10.5%)	14,853 (6.5%)	<0.001
History of other substance use disorder, %	1,558 (13.9%)	10,524 (4.6%)	<0.001
Charlson comorbidity index, %			<0.001
0	8,892 (79.2%)	191,875 (84.4%)	
1	1,103 (9.8%)	19,043 (8.4%)	
2+	1,240 (11.0%)	16,402 (7.2%)	
Mean number outpatient visits (SD)	7.0 (13.7)	3.4 (7.8)	<0.001
Insurance Type, %			<0.001
Commercial	8,758 (78.0%)	192,757 (84.8%)	
Medicare	2,070 (18.4%)	27,857 (12.3%)	
Medicaid	228 (2.0%)	4,072 (1.8%)	
Other	179 (1.6%)	2,634 (1.2%)	
San Francisco KPNC Facility, %	4,084 (36.4%)	20,599 (9.1%)	<0.001

PLWH, persons living with HIV; SD, standard deviation

[1]Based on Pearson's chi-square test for categorical variables and t-test for continuous variables.

[2]Neighborhood Deprivation Index based on Messer et al.(Messer et al., 2006)

Table 2.

Alcohol screening and brief interventions results among persons living with HIV and HIV-uninfected participants

a. Any drinking			
HIV status	**%**	**Crude PR[3] (95% CI; P)**	**Adjusted PR[3] (95% CI; P)**
PLWH	3,610/8,650 (41.7%)	0.86 (0.83–0.88; <0.001)	0.91 (0.89–0.94; <0.001)
HIV-uninfected	91,239/186,987 (48.8%)	1 (reference)	1 (reference)
b. Any unhealthy drinking[1]			
HIV status	**%**	**Crude PR[3] (95% CI; P)**	**Adjusted PR[3] (95% CI; P)**
PLWH	854/8,650 (9.9%)	0.76 (0.72–0.81; <0.001)	0.75 (0.71–0.81; <0.001)
HIV-uninfected	24,174/186,987 (12.9%)	1 (reference)	1 (reference)
c. Frequent unhealthy drinking[2]			
HIV status	**%**	**Crude PR[3] (95% CI; P)**	**Adjusted PR[3] (95% CI; P)**
PLWH	263/8,650 (3.0%)	0.72 (0.64–0.81; <0.001)	0.69 (0.61–0.78; <0.001)
HIV-uninfected	7,874/186,987 (4.2%)	1 (reference)	1 (reference)
d. Brief interventions among those reporting unhealthy drinking[1]			
HIV status	**%**	**Crude PR[3] (95% CI; P)**	**Adjusted PR[3] (95% CI; P)**
PLWH	311/854 (36.4%)	0.82 (0.75–0.90; <0.001)	0.82 (0.75–0.90; <0.001)
HIV-uninfected	10,757/24,174 (44.5%)	1 (reference)	1 (reference)
e. Brief interventions among those reporting frequent unhealthy drinking[2]			
HIV status	**%**	**Crude PR[3] (95% CI; P)**	**Adjusted PR[3] (95% CI; P)**
PLWH	105/263 (39.9%)	0.82 (0.70–0.95; 0.008)	0.84 (0.72–0.98; 0.023)
HIV-uninfected	3,857/7,874 (49.0%)	1 (reference)	1 (reference)

PLWH, persons living with HIV; PR, prevalence ratio

[1]Unhealthy drinking: 4+/5+ drinks in a day at least once or average 8+/15+ drinks in a week for women/men

[2]Frequent unhealthy drinking: 4+/5+ drinks in a day for 5 or more days in past 90 days

[3]Prevalence ratio (PR) from Poisson regression with robust standard errors. Adjusted PR includes terms for age, sex, race/ethnicity, modified Charlson index (excluding AIDS), prior outpatient visits, neighborhood deprivation index, smoking, alcohol and other substance use disorders, depression, KPNC facility, and insurance type.

Table 3.

Characteristics associated with brief interventions among persons living with HIV (PLWH) who screened positive for unhealthy alcohol use

Characteristic	Unadjusted		Adjusted[2]	
	PR[1] (95% CI)	P	PR[1] (95% CI)	P
Age, years (per 10 years)	1.03 (0.96–1.10)	0.446		
Female sex	1.00 (0.67–1.49)	0.994		
Race/ethnicity				
White	1 (reference)			
Black	1.07 (0.81–1.42)	0.622		
Hispanic	1.12 (0.89–1.41)	0.320		
Other/Unknown	1.03 (0.79–1.36)	0.813		
Neighborhood deprivation index[3]				
Quartile 1 (least deprived)	1 (reference)			
Quartile 2	0.76 (0.58–1.00)	0.048	0.70 (0.54–0.92)	0.011
Quartile 3	0.90 (0.70–1.16)	0.420	0.78 (0.60–1.01)	0.058
Quartile 4 (most deprived)	1.11 (0.90–1.38)	0.331	0.96 (0.77–1.19)	0.697
Charlson comorbidity index				
0	1 (reference)		1 (reference)	
1	0.61 (0.38–0.98)	0.040	0.65 (0.41–1.04)	0.074
2+	0.97 (0.67–1.41)	0.889	1.03 (0.72–1.47)	0.865
Depression	0.94 (0.76–1.16)	0.561		
Current smokers	1.24 (1.03–1.49)	0.022	1.25 (1.04–1.50)	0.019
Alcohol use disorder	1.12 (0.89–1.41)	0.335		
Other substance use disorder	1.17 (0.93–1.48)	0.182		
Prior outpatient visits (per 1 visit)	0.98 (0.95–1.01)	0.254		
Insurance Type				
Commercial/Private	1 (reference)			
Medicare/Medicaid/Other	1.14 (0.89–1.46)	0.313		
San Francisco KPNC Facility	0.71 (0.60–0.85)	<0.001	0.70 (0.58–0.84)	<0.001
HIV transmission risk				
Men who have sex with men	1 (reference)			
Injection drug use	1.24 (0.91–1.71)	0.177		
Hetero/Other/Unknown	1.14 (0.91–1.43)	0.256		
CD4+ T-cells/μl				
<350	1.35 (1.05–1.72)	0.017	1.29 (1.01–1.65)	0.041
350–499	0.89 (0.67–1.19)	0.420	0.89 (0.67–1.18)	0.409
500+	1 (reference)		1 (reference)	
HIV RNA≥75 copies/ml	1.19 (0.94–1.51)	0.158		
Prior clinical AIDS	1.04 (0.87–1.25)	0.670		
Prior antiretroviral therapy use	0.93 (0.71–1.22)	0.600		

[1]Prevalence ratio (PR) from Poisson regression with robust standard errors.

[2]Adjusted model includes terms that reached statistical significance in unadjusted model.

[3]Neighborhood Deprivation Index based on Messer et al.(Messer et al., 2006)

Table 4.

Characteristics associated with addiction specialty care visits among persons living with HIV (PLWH) with unhealthy alcohol use

	Unadjusted[1]		Adjusted[1]	
Characteristic	**PR (95% CI)**	**P**	**PR (95% CI)**	**P**
Age, years (per 10 years)	0.76 (0.61–0.95)	0.017	0.75 (0.59–0.94)	0.014
Female sex	0.50 (0.07–3.54)	0.486		
Race/ethnicity				
White	1 (reference)			
Black	1.46 (0.65–3.28)	0.366		
Hispanic	0.39 (0.12–1.28)	0.119		
Other/Unknown	0.74 (0.26–2.09)	0.571		
Neighborhood deprivation index[2]				
Quartile 1 (least deprived)	1 (reference)			
Quartile 2	0.49 (0.18–1.31)	0.154		
Quartile 3	0.74 (0.31–1.75)	0.494		
Quartile 4 (most deprived)	0.72 (0.33–1.58)	0.407		
Charlson comorbidity index				
0	1 (reference)			
1	1.10 (0.35–3.50)	0.866		
2+	0.86 (0.21–3.50)	0.837		
Depression	1.56 (0.82–3.00)	0.178		
Current smokers	2.12 (1.14–3.95)	0.018	1.36 (0.74–2.51)	0.325
Alcohol use disorder	4.31 (2.34–7.95)	<0.001	3.44 (1.60–7.39)	0.002
Other substance use disorder	3.99 (2.14–7.42	<0.001	1.53 (0.67–3.50)	0.317
Prior outpatient visits (per 1 visit)	1.03 (1.02–1.04)	<0.001	1.03 (1.02–1.04)	<0.001
Insurance Type				
Commercial/Private	1 (reference)			
Medicare/Medicaid/Other	0.63 (0.20–2.00)	0.427		
San Francisco KPNC Facility	1.93 (0.97–3.84)	0.061		
HIV transmission risk				
Men who have sex with men	1 (reference)		1 (reference)	
Injection drug use	4.99 (2.52–9.90)	<0.001	5.40 (2.53–11.53)	<0.001
Hetero/Other/Unknown	0.78 (0.28–2.23)	0.648	0.90 (0.31–2.60)	0.850
CD4+ T-cells/μl				
<350	1.16 (0.45–2.99)	0.760		
350–499	0.90 (0.35–2.33)	0.829		
500+	1 (reference)			
HIV RNA≥75 copies/ml	1.59 (0.73–3.46)	0.243		
Prior clinical AIDS	0.67 (0.33–1.36)	0.267		
Prior antiretroviral therapy use	1.37 (0.43–4.38)	0.591		

[1]Prevalence ratio (PR) from Poisson regression with robust standard errors. Adjusted PR includes terms that reached statistical significance in unadjusted model.

[2]Neighborhood Deprivation Index based on Messer et al.(Messer et al., 2006)