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Substance use and HIV stage at entry into care among people with HIV

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Abstract: Background: Information regarding the impact of substance use on the timing of entry into HIV care is lacking. Better understanding of this relationship can help guide approaches and policies to improve HIV testing and linkage.

Methods: We examined the effect of specific substances on stage of HIV disease at entry into care in over 5000 persons with HIV (PWH) newly enrolling in care. Substance use was obtained from the AUDIT-C and ASSIST instruments. We examined the association between early entry into care and substance use (high-risk alcohol, methamphetamine, cocaine/crack, illicit opioids, marijuana) using logistic and relative risk regression models adjusting for demographic factors, mental health symptoms and diagnoses, and clinical site.

Results: We found that current methamphetamine use, past and current cocaine and marijuana use was associated with earlier entry into care compared with individuals who reported no use of these substances.

Conclusion: Early entry into care among those with substance use suggests that HIV testing may be differentially offered to people with known HIV risk factors, and that individuals with substances use disorders may be more likely to be tested and linked to care due to increased interactions with the healthcare system.

Keywords: Substance use, Early entry into care, Risk factors

Background

In the era of universal treatment for HIV, increasing attention has been focused on the HIV continuum of care from diagnosis to linkage and retention in care, initiation of antiretroviral therapy (ART), and achievement of HIV viral suppression [1, 2]. Timely diagnosis and engagement in care are key to maximizing the benefit of ART, minimizing the long-term negative consequences of HIV, and the success of a treatment as prevention approach [3–5]. In the United States (US), it is estimated that only 86% of people with HIV (PWH) have been diagnosed, and only 64% have been linked to care [6].

Although these proportions change over time, they are well below national and international HIV targets [2].

Traditional care models may pose challenges for PWH affected by factors that hinder the ability to engage in care on a routine basis [7–9]. Drug and alcohol use disorders often prevent PWH from reliably seeking follow-up care after HIV diagnosis or during the lifelong HIV treatment process [10–13]. In some regions, PWH who inject drugs represent a substantial portion of the HIV-infected population, which may explain ongoing HIV transmission and limited progress towards global HIV targets [2, 14, 15]. Research is needed to better define the challenges and optimal approaches to improve care delivery to individuals with co-occurring substance use.

Factors that have been associated with delayed HIV testing and linkage to care include younger age, Black or Hispanic race/ethnicity, lower socioeconomic status, and

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HIV testing without co-located HIV care services [3, 5, 16, 17]. However, these studies are somewhat dated as testing policies have continued to evolve, and the role of substance use has been less extensively examined [10, 18]. Little is known about the impact of specific substances or combinations of substances on the timing of linkage to care. Information regarding the relationship between substance use by substance type and the early stages of the HIV care continuum is limited. In this study, we used comprehensive clinical data from a geographically diverse cohort of PWH to characterize the effect of specific substances and multi-substance use on the timing of entry into HIV care.

We conducted this study to identify factors, particularly the impact of substance use, associated with differential engagement in early steps of the HIV care cascade among PWH in real-world settings. By examining when in their course of HIV disease PWH initiate care, we can better understand the impact of factors such as substance use on the initial HIV care cascade steps of testing and linkage. Additionally, care policies no longer target testing to high-risk groups but instead encourage HIV testing for everyone [19]. A better understanding of factors associated with entry into care, can help guide approaches and policies to improve HIV testing and linkage.

We examined the association between entry into care at earlier or later stages of HIV disease, defined by higher vs. lower CD4 counts (≥ 350 cells/mm^3 compared to < 350 cells/mm^3), and substance use and/or high-risk alcohol use. Substance use refers to use of illegal drugs, drugs taken for reasons or at amounts other than prescribed (e.g. illicit opioid use), drugs that may be federally banned, but permitted by certain states (marijuana) and alcohol. We further defined alcohol use here as "high-risk" alcohol use [20], as moderate or occasional alcohol consumption would not be expected to influence care seeking behaviors. We hypothesized that PWH reporting current substance use would be less likely to initiate care early (at higher CD4 counts) than PWH who do not use substances or high-risk alcohol. We further hypothesized that this relationship would vary depending on substance type and frequency of use, as well as different between sociodemographic sub-groups.

Methods
Data source
The Centers for AIDS Research (CFAR) Network of Integrated Clinical Systems (CNICS) cohort is a longitudinal observational study of adult PWH receiving care at eight clinical sites across the US from 1995 to the present [18, 21]. The CNICS cohort is geographically diverse with demographic and clinical characteristics similar to the overall population of PWH in the US [6].

Comprehensive clinical data collected through electronic data systems undergo rigorous quality assessment, are harmonized in a central repository, and are updated on a quarterly basis [21]. These data include demographic information, laboratory data, antiretroviral medication data, and diagnosis data including diabetes, hypertension, cardiovascular disease, mental illness, and substance use. Additionally, symptoms and behaviors are self-reported longitudinally by the CNICS clinical assessment of patient-reported measures and outcomes (PROs) using validated instruments including the PHQ-9 for depression [22], the AUDIT-C (Alcohol Use Disorders Identification Test) for alcohol use [23], and the ASSIST (modified Alcohol, Smoking, and Substance Involvement Screening Test) for substance use [24]. The CNICS clinical assessment of PROs are administered approximately every 6 months [25] via tablets as part of routine clinical care. CNICS data adheres to HIPAA, and was anonymized for the current study for the protection of the privacy of the subjects.

Study population
We examined all PWH newly enrolling in HIV care from January 1, 2010 to September 30, 2019. We included PWH enrolled in CNICS in or after 2010 in order to reflect current treatment and clinical care practices. PWH with evidence of previous HIV care prior to CNICS entry (e.g. historical ART or undetectable viral loads) were excluded. The analytic sample included PWH who completed the CNICS clinical assessment of PROs within the first 12 months of entry into care. Initiation of the clinical assessment varied across sites/institutions (site $N = 8$), so the study period start date also varied by site (median year of initiation 2011).

Statistical analysis
Study design and primary outcome
We conducted a cross-sectional analysis of HIV disease stage measured by CD4 count at the time of care initiation as the primary outcome of interest. Early entry into care was defined as starting clinical care for HIV with higher CD4 cell counts ≥ 350 cells/mm^3 compared to later entry into care defined by lower CD4 cell counts < 350; CD4 cut points were informed by previous research and clinical relevance [10, 26–29].

Primary predictor or exposure
Substance use, the primary predictor of interest, was obtained from PROs using the AUDIT-C [20, 23] and ASSIST [24] instruments. The first AUDIT-C and ASSIST completed within the first year of care was used as a proxy of substance and alcohol use at the time of entry into care. High-risk alcohol use was defined by AUDIT-C scores of greater than or equal to 4 for men and 3 for

women [20]. Methamphetamine, cocaine/crack, illicit opioid, and marijuana use were each categorized into three mutually exclusive categories: never used, past use, and current use. Illicit opioids includes all opioids that are prohibited by law or the use of prescription opioids not taken as prescribed.

Adjustment variables or covariates in the inferential analysis

Covariates of interest, including sex (assigned male or female at birth), age, race/ethnicity, mental health diagnoses, current depressive symptoms (measured by the PHQ-9), and CNICS site, were included in all statistical models as adjustment variables. There were a very small number of individuals recorded as transgender who were not included in the analysis due to sample size and protection of identify. For race/ethnicity, we constructed a four-category variable of: non-Hispanic White, non-Hispanic Black, Hispanic (of any race), and Other (any race, other than White or Black, who did not identify as Hispanic). For mental health diagnoses, we categorized PWH into one of three hierarchical groups [30]: 1) any psychotic disorder, bipolar disorder, and/or personality disorders with or without depression and/or anxiety, 2) depression and/or anxiety only, 3) no history of mental illness as documented within the first 6 months of entry into care.

The HIV acquisition risk factor was obtained directly from clinical records and noted as one of three categories: men who have sex with men (MSM), injection drug use (IDU), and heterosexual transmission. IDU was not included in the models due to collinearity with substances and difficulty of interpretation of substance coefficients in the presence of this variable. MSM was included as an HIV risk factor in the multiple substance model so that we could characterize the relationships of interest among two distinct male populations (MSM and non-MSM men) as substance use and HIV care seeking behaviors differ between these populations [31–33].

Additional variables included in sensitivity analyses were: year of entry into CNICS, enrollment in substance use treatment programs, hepatitis C virus coinfection, and comorbidities such as AIDS defining illnesses, diabetes, and hypertension. Year of entry was determined by the calendar year at which an individual first enrolled into the CNICS cohort. Enrollment in substance use treatment programs was a binary variable from responses in the PROs that signified if the individual had ever sought formal treatment of any substance use disorder. Hepatitis C and other comorbidities were indicators derived from diagnosis codes and/or condition specific medications for treatment as listed in the medical records.

Descriptive analysis

We compared the prevalence of use for each of the substances of interest at early or later initiation of care using chi square tests for categorical variables and t-tests for continuous variables.

Inferential analysis

We employed logistic regression models and relative risk regression models to determine factors associated with early entry into care compared to later entry into care; relative risk estimates from a generalized linear model with Poisson family and log link [34] were compared with the odds ratios obtained in the logistic regression models to aid in interpretability of associations since the outcome was common [35]. Only those with complete data were included in the regression models. All models used robust standard errors. Analyses were completed in Stata 14 (StataCorp 2015).

Inferential analysis: single substance models

Categorical parametrizations of substance use (never used, past use, current use) for methamphetamine, cocaine/crack, illicit opioid, and marijuana, and a binary parameterization of high-risk alcohol use (high-risk drinking vs. no high-risk drinking) were used to construct five separate, single-substance models. These models were designed to estimate the effect of *each* drug of interest and high-risk alcohol use separately. Additional analytic models included two-way multiplicative interaction terms for each substance of interest with age, sex, and race/ethnicity.

To address the impact of substance use frequency on the outcome, we included a second set of single substance models with measures of substance use frequency. These models included continuous variables for days of use in the last 30 days with adjustment for use of other substances (binary indicators of never/ever use for each substance).

Inferential analysis: multiple substance model

Finally, an analytic model including all reported substances and high-risk alcohol use was evaluated to assess the impact of *concurrent* use of substances on entry into care. In addition to adjusting for other current substance use, a multiple substance use indicator variable was included for any combination of substances or high-risk alcohol (not for specific combinations). Previous studies have suggested that multiple substance use is common among PWH [18]. An indicator for men who have sex with men (MSM) was also included in this model.

Sensitivity analyses

Sensitivity analyses were conducted with: 1.) other CD4 cut points (e.g. 500 cells/mm^3), 2.) adjustment for other

factors of interest that may potentially impact the relationship under examination such as year of entry into CNICS, enrollment in substance use treatment programs, hepatitis C virus coinfection, and other comorbidities (e.g. AIDS defining illnesses, diabetes, hypertension, etc.), 3.) linear regression models with continuous CD4 as the outcome, and 4.) models that varied the PRO window of eligibility. We also conducted a stratified analysis by HIV risk factors (i.e. MSM, IDU, heterosexual sex, or other/unknown; MSM who were also IDU were categorized into the MSM risk factor group) to assess the relationship between substance use and early entry into care for these specific populations.

Results

Among 5017 PWH who entered into care from January 2010 through September 2019, the majority were male (86%) with a mean age of 40 years (standard deviation (SD): 12 years). Mental health diagnoses and past or current substance use were more prevalent than reported within the general US population [36]. As shown in Table 1, demographic characteristics and substance use varied by early or later entry into care in unadjusted analyses. Less than 1% of the sample had any missing data for the sociodemographic variables; missingness for the primary predictors of substances and high-risk alcohol use ranged from 1.6% for high-risk alcohol use to 7.8% missingness for illicit opioids. There was complete ascertainment of the outcome variable.

In the single substance models, we found a significant association between current methamphetamine use (OR = 1.52, 95% Confidence Interval (CI): 1.23–1.88; RR = 1.14, 95% CI: 1.07–1.22), as well as past and current cocaine and past and current marijuana use (ORs = 1.20, 1.43, 1.19, 1.33, respectively; RRs = 1.07, 1.13, 1.07, 1.12) and increased likelihood of early entry into care (CD4 count $\geq$ 350 cells/mm^3) compared with PWH who reported no use of those substances. Associations between early initiation into care and past methamphetamine use, past and current illicit opioid use, and high-risk alcohol consumption were not statistically significant (Table 2).

None of the two-way interaction terms for each substance with age, sex, and race/ethnicity were statistically significant (data not shown), demonstrating no observed effect modification for any substance by demographic characteristics. In single substance models including measures of substance use frequency within the last 30 days, we found no statistically significant effects of greater frequency of substance use on early entry into care compared to lower frequency of use. There was not a strong dose response relationship between substance use and early care entry for any of the substances (Table 3).

In the model that included all substances, the relationships between early entry into care and current methamphetamine, cocaine/crack, and marijuana use remained statistically significant and the magnitude of the associations did not change. After accounting for use of other substances, current methamphetamine (OR = 1.52, 95% CI: 1.16–1.98; RR = 1.14, 95% CI: 1.05–1.23), cocaine/ crack (OR = 1.44, 95% CI: 1.07–1.93; RR = 1.12, 95% CI: 1.02–1.23), and marijuana (OR = 1.27, 95%CI: 1.04–1.53; RR = 1.09, 95% CI: 1.02–1.18) use were associated with earlier entry into care compared to PWH who did not use these substances in adjusted analyses. Past use of any of the substances was no longer associated with timing of care entry when controlling for use of the other substances and high-risk alcohol use (Table 4).

In the full model, we found a significant association between older age, being male with no reported sex with men, Black race, and Hispanic ethnicity and lower likelihood of early entry into care. Men who have sex with men were more likely to enter care with higher CD4 counts than men who did not report same-sex sexual relationships. Those with mental health diagnoses were more likely to enter care early than those without mental health diagnoses. Current depressive symptoms were not independently associated with early care initiation when controlling for the other covariates. (Table 5).

Sensitivity analyses using different specifications of the outcome variable and inclusion of additional comorbidity and adjustment covariates yielded similar results to the models described above (data not shown). Variation of the time window in which a PRO assessment was attributed to baseline substance use and alcohol consumption also did not affect the results. Patterns in the associations between substance use and early entry into care were also similar in analyses stratified by HIV risk factor (MSM, IDU, heterosexual sex).

Discussion

Contrary to our hypotheses, we found that PWH who reported current methamphetamine, cocaine/crack, or marijuana use were more likely to enter care at an earlier stage of HIV disease (as noted by CD4 counts $\geq$350 cells/mm^3) than those who did not report use of these substances. However, the magnitude of the observed effects was modest. We did not find an association between illicit opioid or high-risk alcohol use and stage of disease at entry into care. Reported associations between early entry into care and substance or high-risk alcohol use did not differ by demographic characteristics, including age, sex, and race/ethnicity, nor by HIV risk factor.

A possible explanation for our findings is that HIV testing continues to be targeted to persons at higher risk of HIV infection, such as those with certain substance use disorders [31, 37], and that recommendations for

Parrish *et al. Archives of Public Health*   (2021) 79:153

Page 5 of 9

Table 1 Demographic and clinical characteristics including substance use of PWH in this study categorized by CD4 count at enrollment in care

PWH Characteristics	Overall (N = 5017)	HIV Severity		
		CD4 < 350 cells/mm³ (N = 1945)	CD4 ≥ 350 cells/mm³ (N = 3072)	P-valueª
Age in years, mean (SD)	40.2 (11.9)	40.9 (11.7)	39.2 (12.1)	< 0.01
Male, N (%)	4333 (86.4)	1669 (85.8)	2664 (86.8)	0.35
Race/Ethnicity, N (%)				< 0.01
Non-Hispanic White	2149 (42.8)	378 (37.9)	1411 (45.9)	
Non-Hispanic Black	1670 (33.3)	748 (38.5)	922 (30.0)	
Hispanic	850 (16.9)	336 (17.3)	514 (16.7)	
Other	348 (6.9)	123 (6.3)	225 (7.3)	
Mental Health Diagnoses, N (%)				< 0.01
No mental health diagnoses	2747 (54.8)	1153 (59.3)	1594 (51.9)	
Depression and/or anxiety only	1801 (35.9)	634 (32.6)	1167 (38.0)	
Psychosis, bipolar, personality disorders (with or without depression and/or anxiety)	469 (9.4)	158 (8.1)	311 (10.1)	
Methamphetamines/crystal				< 0.01
Never used	3136 (64.6)	1299 (69.4)	1837 (61.6)	
Past use	1142 (23.5)	140 (21.9)	732 (24.6)	
Current use	576 (11.9)	164 (8.8)	412 (13.8)	
Cocaine/Crack				< 0.01
Never used	2678 (54.7)	1123 (59.3)	1555 (51.8)	
Past use	1809 (36.9)	639 (33.7)	1170 (39.0)	
Current use	410 (8.4)	133 (7.0)	277 (9.2)	
Marijuana				< 0.01
Never used	1461 (29.8)	645 (33.8)	816 (27.2)	
Past use	1666 (34.0)	637 (33.4)	1029 (34.4)	
Current use	1775 (36.2)	624 (32.7)	1151 (38.4)	
Illicit Opioids				0.02
Never used	3832 (82.8)	1477 (84.8)	2355 (81.7)	
Past use	645 (13.9)	217 (12.5)	428 (14.8)	
Current use	149 (3.2)	48 (2.8)	101 (3.5)	
High-risk Alcohol Consumption				0.01
High-risk drinking	3859 (78.1)	1530 (80.0)	2329 (77.0)	

Table 1 Demographic and clinical characteristics including substance use of PWH in this study categorized by CD4 count at enrollment in care *(Continued)*

PWH Characteristics	Overall (N = 5017)	HIV Severity		
		CD4 < 350 cells/mm³ (N = 1945)	CD4 ≥ 350 cells/ mm³ (N = 3072)	P-valueᵃ
No high-risk drinking	1080 (21.9)	383 (20.0)	697 (23.0)	
HIV Risk Factor				< 0.01
Men who have Sex with Men (MSM)	3222 (64.2)	1182 (60.8)	2040 (66.4)	
Injection Drug Use (IDU)	557 (11.1)	207 (10.6)	350 (11.4)	
Heterosexual	1008 (20.1)	465 (23.9)	543 (17.7)	
Unknown or Other	230 (4.6)	91 (4.7)	139 (4.5)	

ᵃComparing PWH populations with CD4 < 350 and CD4 ≥ 350 cells/mm³

universal testing for HIV have not been fully adopted in clinical practice [19]. People who report substance use may be more likely to be tested for HIV than those who do not report these behaviors [31, 38, 39], and more frequent testing can lead to earlier diagnosis of HIV and entry into care. This trend towards selective testing could be driven in part by self-selection by individuals with known HIV risk factors as education regarding high-risk behaviors can increase motivation for testing [31, 37, 40], and by clinicians who may be reluctant to routinely test all patients for HIV due to lack of awareness of newer testing guidelines or perceived limited capacity to integrate routine testing into practice [39].

In addition, substance use may increase engagement with the health care system due to exacerbation of underlying health conditions, overdose, injuries related to impairment [41–43], and/or substance use treatment, that provide more opportunities for testing and care initiation. Previous studies have found an association between physical health comorbidities and substance use [41, 43], which may prompt greater interaction with the health care system. While we controlled for hypertension, diabetes, and hepatitis C coinfection in sensitivity analyses, there may be additional health conditions that influence early entry into care in our study that we did not take into account. Additionally, clinical outreach

Table 2 Associations between substance use and early entry into careᵃ (individual models for each substance) in adjusted analysesᵇ

Substance	OR	P-value	95% CI	RR	P-value	95% CI
Methamphetamines (ref. Never used)						
Past use only	1.09	0.29	0.93–1.27	1.03	0.28	0.98–1.09
Current use	**1.52**	**< 0.01**	**1.23–1.88**	**1.14**	**< 0.01**	**1.07–1.22**
Cocaine/Crack (ref. Never used)						
Past use only	**1.20**	**0.01**	**1.05–1.37**	**1.07**	**0.01**	**1.02–1.12**
Current use	**1.43**	**< 0.01**	**1.14–1.79**	**1.13**	**< 0.01**	**1.05–1.22**
Marijuana (ref. Never used)						
Past use only	**1.19**	**0.02**	**1.03–1.38**	**1.07**	**0.02**	**1.01–1.14**
Current use	**1.33**	**< 0.01**	**1.14–1.55**	**1.12**	**< 0.01**	**1.05–1.19**
Illicit Opioids (ref. Never used)						
Past use only	1.12	0.22	0.93–1.34	1.03	0.22	0.98–1.10
Current use	1.22	0.28	0.85–1.74	1.07	0.25	0.95–1.20
High-risk Alcohol Consumption (ref. No high-risk drinking)						
High-risk drinking	1.12	0.11	0.97–1.30	1.04	0.12	0.99–1.10

ᵃ Early entry into care define as entering care with CD4 counts ≥ 350 cells/mm³
ᵇ All models adjusted for sex, age, race/ethnicity, current depressive symptoms, mental health diagnoses, and treatment site

Parrish *et al. Archives of Public Health*   (2021) 79:153

Page 7 of 9

Table 3 Single-substance models with frequency of use within the past 30 days and association with early entry into care[a,b]

Substance[c]	OR	*P*-value	95% CI	RR	P-value	95% CI
Methamphetamines	1.10	0.24	0.94–1.30	1.03	0.22	0.98–1.07
Cocaine/Crack	0.87	0.31	0.67–1.14	0.96	0.36	0.87–1.05
Marijuana	0.94	0.12	0.87–1.02	0.98	0.11	0.95–1.00
Illicit Opioids	0.80	0.16	0.58–1.10	0.93	0.19	0.83–1.04
Alcohol	1.00	0.80	0.97–1.02	1.00	0.82	0.99–1.00

[a] Early entry into care define as entering care with CD4 counts $\geq$ 350 cells/mm^{3}
[b] All models adjusted for sex, age, race/ethnicity, current depressive symptoms, mental health diagnoses, treatment site, and use of other substances
[c] Substances are measured by days of use within the past month (range 0–30)

programs targeting people who are homeless may bring certain subsets of people into clinical settings at earlier HIV disease stages, and the relationship between homelessness and substance use is well-established [44].

There are limitations of this study. We were interested in examining factors associated with entry into care and therefore excluded PWH with documented evidence of prior treatment. However, there is the possibility of misclassification if evidence of prior treatment was not well-documented. Second, detailed substance use information was obtained from the CNICS clinical assessment of PROs, and not all PWH have PRO assessments within the first year of care. This could result in potential for selection bias if those with substance use disorders and high-risk alcohol use and lower CD4 counts were less likely to receive PRO assessments systematically across CNICS clinics. However, sensitivity analyses using varying time windows for PRO completion, including 18 and 24 months, found similar results, reducing our concern about selection bias. Additionally, PROs are only available in English, Spanish, and Amharic, so not all PWH

may have been able to complete a PRO in their preferred language. Third, the timing of starting PRO assessment at sites varied so not all sites contributed participants throughout the entire study period. Fourth, the prevalence of illicit opioid use in the CNICS cohort is low, so non-significant results between illicit opioid use and stage of entry into care may be, in part, due to statistical power issues. Finally, findings may not generalize to other treatment contexts as a large proportion of PWH in the CNICS cohort live in urban and suburban settings.

This research has notable strengths too, including detailed substance use information using validated instruments collecting current and past substance use; demographic, clinical, and geographic diversity; and data reflecting clinical practice in the current treatment era.

Conclusions

This study provides insight as to the impact of specific substance use, as well as high-risk alcohol, on the HIV stage at which a person enters care for HIV. Early entry

Table 4 Associations between substance use and early entry into care[a] in adjusted analyses[b,c]

Substance	OR	P-value	95% CI	RR	P-value	95% CI
Methamphetamines (ref. Never used)						
Past use only	0.96	0.67	0.79–1.16	0.99	0.69	0.92–1.05
Current use	**1.52**	**0.00**	**1.16–1.98**	**1.14**	**< 0.01**	**1.05–1.23**
Cocaine (ref. Never used)						
Past use only	1.15	0.10	0.97–1.37	1.05	0.10	0.92–1.12
Current use	**1.44**	**0.02**	**1.07–1.93**	**1.12**	**0.01**	**1.02–1.23**
Marijuana (ref. Never used)						
Past use only	1.10	0.27	0.92–1.30	1.04	0.23	0.98–1.11
Current use	**1.27**	**0.02**	**1.04–1.53**	**1.09**	**0.01**	**1.02–1.18**
Illicit Opioids (ref. Never used)						
Past use only	1.04	0.73	0.85–1.27	1.01	0.79	0.94–1.08
Current use	1.02	0.94	0.68–1.53	1.00	0.95	0.89–1.14
High-risk Alcohol Consumption (ref. No high-risk drinking)						
High-risk drinking	1.17	0.12	0.96–1.42	1.05	0.12	0.99–1.23

[a] Early entry into care define as entering care with CD4 counts $\geq$ 350 cells/mm^{3}
[b] All substances included in the same analytic model
[c] All models adjusted for sex, age, race/ethnicity, MSM, current depressive symptoms, mental health diagnoses, and treatment site

Parrish *et al. Archives of Public Health*   (2021) 79:153

Page 8 of 9

Table 5 Associations[a] between PWH Characteristics and Early Entry into Care[b]

Substance	OR	P-value	95% CI	RR	P-value	95% CI
Male, Not MSM (ref. Female)	**0.68**	**< 0.01**	**0.54–0.85**	**0.86**	**0.01**	**0.79–0.94**
MSM	**1.33**	**< 0.01**	**1.14–1.56**	**1.12**	**< 0.01**	**1.05–1.19**
Age	**0.99**	**0.01**	**0.98–0.99**	**0.99**	**0.01**	**0.99–0.99**
Race/ethnicity (ref. Non-Hispanic White)						
Non-Hispanic Black	**0.80**	**0.01**	**0.67–0.94**	**0.92**	**0.01**	**0.86–0.98**
Hispanic	**0.79**	**0.01**	**0.66–0.95**	**0.92**	**0.02**	**0.86–0.98**
Current depressive symptoms (PHQ-9 Score)	0.96	0.11	0.90–1.01	0.98	0.12	0.97–1.0
Mental Health Diagnosis (ref. No Mental Health Diagnosis)						
Depression and/or Anxiety	**1.26**	**< 0.01**	**1.09–1.46**	**1.09**	**< 0.01**	**1.03–1.15**
Any psychotic, bipolar, or personality disorder	**1.42**	**0.01**	**1.10–1.82**	**1.13**	**< 0.01**	**1.04–1.22**

[a] Adjusted for all substances and treatment site
[b] Early entry into care define as entering care with CD4 counts $\geq$ 350 cells/mm^3

into care among PWH who use substances suggests that HIV testing may still be differentially offered to people with known HIV risk factors in routine care and in targeted outreach, and that individuals with substances use disorders may be more likely to be tested and linked to care due to increased interactions with the healthcare system. It is likely that a combination of factors is driving the associations we observed. Our findings also indicate that there is room for improvement in testing and linkage to care overall and in particular among those without documented risk factors for HIV.

Abbreviations
ART: Antiretroviral therapy; PHW: Persons with HIV; CNICS: The Centers for AIDS Research (CFAR) Network of Integrated Clinical Systems; PROs: Patient Reported Outcomes; AUDIT-C: Alcohol Use Disorders Identification Test; ASSIST: Alcohol, Smoking, and Substance Involvement Screening Test; IDU: Injection Drug Use; MSM: Mem who have Sex with Men

Declarations

Ethics approval and consent to participate
Institutional review boards at each site approved the study protocol. This specific research was reviewed and approved by the CNCIS review committee and was deemed as non-human research by the Institutional Review Board at the University of Washington as the authors received anonymized data for the current, secondary data analysis study.

Consent for publication
Not applicable.

Competing interests
The authors declare that they have no competing interests.

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