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Drug and alcohol use among people living with HIV in care in the United States by geographic region

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Abstract

Substance use in the U.S. varies by geographic region. Opioid prescribing practices and marijuana, heroin, and methamphetamine availability are evolving differently across regions. We examined self-reported substance use among people living with HIV (PLWH) in care at seven sites from 2017-2019 to understand current regional substance use patterns. We calculated the percentage and standardized percentage of PLWH reporting current drug use and at-risk and binge alcohol use by U.S. Census Bureau geographic region and examined associations in adjusted logistic regression analyses. Among 7,686 PLWH, marijuana use was the most prevalent drug (30%),

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followed by methamphetamine/crystal (8%), cocaine/crack (7%), and illicit opioids (3%). One-third reported binge alcohol use (32%). Differences in percent of current use by region were seen for marijuana (24-41%) and methamphetamine/crystal (2-15%), with more use in the West and Northeast, and binge alcohol use (26-40%). In adjusted analyses, PLWH in the Midwest were significantly less likely to use methamphetamine/crystal (aOR: 0.13;0.06-0.25) or illicit opioids (aOR:0.16;0.05-0.53), and PLWH in the Northeast were more likely to use cocaine/crack (aOR:1.59;1.16-2.17), compared to PLWH in the West. Understanding differences in substance use patterns in the current era, as policies continue to evolve, will enable more targeted interventions in clinical settings among PLWH.

Keywords

drug use; alcohol use; marijuana; methamphetamine; HIV

Introduction

Substance use patterns, including injection drug use (IDU) and opioid misuse, have varied by geographic region in the general population(Schieber et al., 2019; Substance Abuse and Mental Health Services Administration Office of Applied Studies; Weiss et al., 2006; Zerzan et al., 2006). For example, methamphetamines have been more prevalent in the Western United States (U.S.) compared to the Northeast(Substance Abuse and Mental Health Services Administration Office of Applied Studies). While some information is available about geographic patterns of substance use among people living with HIV (PLWH), much of the information is from before or early in the antiretroviral therapy (ART) treatment era or is limited to men who have sex with men (MSM)[(Sullivan et al., 1998)]. In recent years, policies have evolved regarding opioid prescribing practices and the legality/availability of marijuana and have differed by region. Additionally, the availability of methamphetamine has changed substantially. Substance use can impact HIV transmission though IDU, sexual risk behaviors, adherence to ART, likelihood of viremia, and other health impacts(Bedoya et al., 2012; Colfax et al., 2004; Dirks et al., 2012; Hatfield et al., 2009; Mimiaga et al., 2013; Nance et al., 2019). Understanding substance use patterns among PLWH across the U.S. in the current treatment era could help target prevention and treatment programs. We therefore examined substance use among PLWH in care at seven clinics across the U.S. from 2017-2019.

Methods

Setting:

We conducted this study among PLWH in the Centers for AIDS Research Network of Integrated Clinical Systems (CNICS) cohort. CNICS is a longitudinal observational study of PLWH enrolled in care at eight clinical sites from January 1995 to the present(Kitahata et al., 2008).

Participants:

All PLWH ≥18 years of age who completed a clinical assessment of patient reported measures and outcomes (PROs) from 2017-2019 (end date varied slightly by site, median end date 7/1/19) at seven CNICS sites with applicable data available at time of analyses were included. Patients complete PRO assessments every ~4-6 months as part of routine care visits; for those who completed multiple assessments, the most recent assessment was used. Patients who appear intoxicated or medically unstable at the time of a clinic visit, have a cognitive impairment, or do not speak English, Spanish, or Amharic are not asked to complete PRO assessments. CNICS participation has been approved by Institutional Review Boards at each site.

Data Sources:

The CNICS data repository captures longitudinal data on the CNICS cohort(Kitahata et al., 2008). It integrates comprehensive clinical data from outpatient and inpatient encounters, including standardized HIV-related information collected at enrollment (initial clinic visit), demographic, clinical, medication, laboratory, and sociodemographic data obtained from each site's electronic health record and other institutional data sources. Data from PRO assessments are also integrated into the data repository. PLWH use touchscreen tablets to complete the assessment using web-based survey software developed for collecting PROs, found to be well-tolerated, with high completion rates and potentially higher accuracy than other approaches(Crane, Crane, et al., 2017; Crane et al., 2007; Fredericksen et al., 2012; Kozak et al., 2012; Lawrence et al., 2010). The assessment measures drug use with the modified Alcohol, Smoking, Substance Involvement Screening Test (ASSIST)(Newcombe et al., 2005; 2002) and alcohol use with the three-item Alcohol Use Disorders Identification Test consumption questions (AUDIT-C)(Bradley et al., 2003; Bush et al., 1998).

Instrument scoring:

There are several ways of scoring the ASSIST(Newcombe et al., 2005; 2002). We were interested in current drug use (within 3 months) by class (illicit opioids, cocaine/crack, methamphetamine/crystal, and marijuana), as well as current IDU. Illicit opioids include both heroin and prescription opioids for non-medical reasons. We also examined moderate-to-high risk drug use by class defined as an ASSIST score ≥4(Humeniuk et al., 2005). At-risk alcohol use in the prior year was defined as an AUDIT-C score of ≥5 for men and ≥4 for women(Crane, McCaul, et al., 2017; Gual et al., 2002). We examined two binge drinking definitions: any binge drinking, including binge drinking at any frequency (less than monthly, monthly, weekly, daily, or almost daily), and frequent binge drinking, defined as binge drinking at least weekly. An episode of binge drinking was defined as ≥5 drinks on one occasion for men and ≥4 drinks for women(National Institute on Alcohol Abuse and Alcoholism, 2005, Revised July 2016).

Regions:

We used U.S. Census Bureau definitions for geographic region and included PLWH in care at clinics in the Northeast (Boston), Midwest (Cleveland), South (Chapel Hill, Birmingham, Baltimore), and West (Seattle, San Diego)(United States Bureau of the Census, 2011).

Analyses:

We compared demographic characteristics of PLWH in care at each site who completed PRO assessments to those who did not using chi-square and t-tests. We calculated the percentages of PLWH reporting current use for each drug, as well as current IDU, at-risk alcohol use, and binge drinking, overall and by region. We repeated these analyses among MSM only and showing each of the three southern clinics and two western clinics separately. We used chi-square tests to compare percentages by region overall and within MSM. We repeated analyses using percentages standardized to demographic characteristics of those in the West, standardizing on age (< or ≥50; the median age), sex, race/ethnicity (white, black, Hispanic, other), and MSM (yes/no). We selected West as the region for standardization as the West had the highest mean number of participating PLWH per clinic making for a large and stable reference category.

We conducted logistic regression analyses to determine associations between regions and current drug and alcohol use adjusted for demographic and clinical characteristics. The purpose of these analyses was to evaluate if regional differences seen in the unadjusted analyses were just due to differences in demographic and clinical characteristics across sites, including age, race/ethnicity, sex, and MSM as the HIV acquisition risk factor. As odds ratios from logistic regression analyses for common outcomes such as marijuana use can be different from underlying prevalence ratios, specifically skewing away from the null, we conducted sensitivity analyses using generalized linear models with relative risks rather than odds ratios. We conducted sensitivity analyses using moderate-to-high risk current drug use as the outcome, as well as analyses that additionally adjusted for years in care, nadir CD4 count, and current CD4 count, as a way to identify other important factors in the association between regions and drug and alcohol use.

Results

The PRO assessment was completed by 7,686 PLWH between 2017-2019 at seven CNICS sites across the US. Demographic and clinical characteristics categorized by current recreational drug and at-risk alcohol use are shown in Table 1. Median age of PLWH was 50 years, 1507 (20%) women, and 5079 (67%) with a current CD4 cell count ≥500 cells/mm^3. IDU was the HIV acquisition risk factor in 903 (12%) with the most common HIV acquisition risk factor MSM (58%). Demographic characteristics of PLWH who completed the assessment were similar to the 1,070 PLWH (12%) who did not have a complete assessment during the study period (data not shown).

Overall, almost one-third of PLWH reported current marijuana use (30%), the highest percent of all drugs, followed by methamphetamine/crystal (8%) and cocaine/crack use (7%). The percentage of PLWH reporting current illicit opioid use and reporting current IDU were low (3% each) (Table 2; Appendix Figure 1a). In addition, one-third of PLWH reported binge alcohol use (32%), the highest of all substances, followed by at-risk alcohol use (16%) and frequent binge drinking (5%).

Significant differences in the percentage of all PLWH reporting marijuana (24-41%), methamphetamine/crystal (2-15%), at-risk alcohol use (13-21%), and any binge drinking

(26-40%) were seen by geographic region. At-risk alcohol use or any binge drinking was highest in the Northeast and Midwest, methamphetamine use was highest in the West and Northeast, and marijuana and alcohol use were lowest in the South (Table 2). Statistically significant but small differences were seen by geographic region in the percentage of PLWH reporting illicit opioid use (1-3%), IDU (1-5%), and frequent binge drinking (4-6%). In analyses standardized to the population in the West, similar patterns were observed (Table 2). In analyses limited to MSM, a generally similar pattern of substance use by region was seen (Appendix Table 1; Appendix Figure 1b). Finally, in analyses that separated each of the southern and western clinics (Appendix Table 2), similar patterns of substance use across the southern sites were seen for most substances, however the exceptions were lower rates of alcohol use and higher rates of illicit opioid use at southern clinic 1 (Baltimore) compared with the other southern clinics. Substance use was similar across the Western clinics with the exception of more binge drinking and marijuana use at Western clinic 2.

Adjusted analyses

In analyses adjusted for age, sex, race, and MSM, we found differences in drug use by region (Table 3). Compared to PLWH in care in the West, those in the Midwest were significantly less likely to use methamphetamine/crystal (adjusted odds ratio (aOR) 0.13;0.06-0.25), illicit opioids (aOR:0.16;0.05-0.53), or report IDU (aOR:0.18;0.07-0.52). Compared to PLWH in the West, PLWH in the Northeast were more likely to use cocaine/crack (aOR:1.59;1.16-2.17). PLWH in the South were significantly less likely to use every drug, except illicit opioids, compared to PLWH in the West.

There were also differences in alcohol use by region in adjusted analyses. Compared to PLWH in the West, at-risk alcohol use was significantly more likely in the Midwest (aOR:1.39;1.09-1.78) and Northeast (aOR:1.30;1.05-1.60), and less likely in the South (aOR:0.78;0.67-0.92). A similar pattern was seen for any binge drinking. Frequent binge drinking was also less likely in the South compared to the West in adjusted analyses (Table 3). In addition, we repeated adjusted analyses using relative risk rather than odds ratios and found similar findings (Appendix Table 3). We conducted sensitivity analyses examining moderate-to-high risk current drug use. Overall findings were generally similar to the main analyses, except for cocaine (Appendix Table 4). For example, PLWH in the Midwest were significantly more likely to report moderate-to-high risk cocaine/crack than those in the West in adjusted analyses (aOR:1.79;1.11-2.88). Sensitivity analyses that additionally adjusted for nadir CD4 count, current CD4 count, and years in care did not result in different findings with the exception of binge drinking in the West vs. Northeast region. Specifically, the adjusted odds ratios for PLWH in the West vs. Northeast were consistent across sensitivity analyses, ranging from 1.18-1.20, with p values around 0.05 (ranging from 0.045-0.07).

Discussion

Differences in the percentage of PLWH in clinical care from 2017-2019 who use drugs and alcohol exist by geographic region. These differences range in size from mostly modest differences for many drugs to the many fold differences in use for drugs such as

methamphetamine/crystal in the West vs. South. The largest differences in drug use were for methamphetamine/crystal and marijuana use, with the most methamphetamine/crystal use in the West and least marijuana use in the South. At-risk alcohol use, as well as any binge drinking, was more common in the Midwest and Northeast and less common in the South, and these patterns persisted in adjusted analyses.

Several predominantly older studies examined regional differences in substance use among MSM with or without HIV(Hirshfield et al., 2004; Sullivan et al., 1998; Thiede et al., 2003). While somewhat dated, a study among MSM with HIV demonstrated geographic differences in substance use, with higher rates of heroin in the Northeast, higher rates of amphetamine use in the West, and more at-risk drinking in the West compared to the Eastern U.S.(Sullivan et al., 1998) Substance use among MSM is arguably influenced by local social norms due to use for social integration(Kelly et al., 2012), suggesting the potential for geographic variability in the U.S. because of social influences(Feinstein et al., 2018).

We found similar patterns among the subset of MSM, which was not surprising given the large proportion of MSM in CNICS overall. Our findings are similar to a study from the 1990s of young MSM (not necessarily with HIV) from urban areas, which noted higher amphetamine rates in the West versus South(Thiede et al., 2003). Our findings differ from an older study which found the highest methamphetamine rates in South central regions (29%), although this study was internet-based and did not target PLWH(Hirshfield et al., 2004). Furthermore, the study's Pacific region, which most closely matches the West region in our study, also had high rates of methamphetamine use (24%), which was higher than the other regions examined(Hirshfield et al., 2004). Our findings indicated the highest prevalence of methamphetamine use was still in the West, where it has been most prevalent historically, particularly among MSM(Hirshfield et al., 2004; Sullivan et al., 1998; Thiede et al., 2003) however rates were similar in the Northeast, confirming growing concern that methamphetamine use is on the rise in the Northeast(Hirshfield et al., 2004).

While our primary focus was to evaluate substance use across regions, we examined differences within regions for the Western and Southern clinics to ensure they did not differ dramatically. We found that among clinics in the South and in the West most patterns of drugs and alcohol use looked similar within these regions although there were exceptions. For example, we found different rates of illicit opioid use across the three southern clinics and of marijuana use across the two western clinics highlighting that variations in some drug patterns may be at a more local level. This may not be entirely surprisingly given that marijuana was legal during the entire study period for Western clinic 2 (Seattle) and became legal mid-study for Western clinic 1 (San Diego). These findings support our approach of looking at regional differences but also serve as a reminder of the importance of more local impacts.

Strengths of this study include demographic, clinical, and geographic diversity including regions with (West) and without marijuana legalization and the large sample size. This addresses limitations of prior studies which have often lacked racial/ethnic diversity(Hirshfield et al., 2004). We include all PLWH who completed the PRO assessment (the assessment is not done if PLWH are medically unstable, intoxicated, do not speak

English/Spanish/Amharic). This allowed inclusion of 88% of all PLWH seen during the time period suggesting there is unlikely to be selection bias due to missing outcome data influencing inferences. We focus on PLWH in care after 1/2017, allowing findings to be relevant to current patterns of use, which is particularly important given recent, ongoing changes in availability of methamphetamine, marijuana, and opioids and we use standardized substance use assessments.

There are several limitations to this study. Our findings represent PLWH in care at only seven clinics and, therefore, may be affected by sampling bias as these clinics may not generalize to all clinics in each region. While it is reassuring that we found similar patterns for most drugs across the three clinics in the South and the two clinics in the West, it does not mean that these clinics represent all of these regions or that patterns of use might not be very different among PLWH in other areas of the regions that are not represented. Similarly, substance use patterns in Boston may differ from other areas of the Northeast. More clinics per region would strengthen findings. Nor does it address the possibility that there may be cultural differences among PLWH across regions that may impact their reporting of substance use. We use self-reported substance use collected on touch-screen tablets as part of a broader clinical assessment which may undercapture substance use but is likely more accurate than medical records and results in more complete capture of substance use than interview-based approaches(Jensen et al., 2015; Kozak et al., 2012). We only include PLWH in care, so our results may not generalize to those not yet diagnosed or in HIV care; our results may underestimate substance use rates if PLWH not yet diagnosed or in care have higher rates.

Conclusions

This study demonstrates the ongoing high prevalence of drug and alcohol use among PLWH in care in the current era and highlights the importance and unmet need for additional successful approaches to intervene and address these deleterious risk behaviors. Differences in drug use exist by geographic region among PLWH in clinical care for some (e.g., marijuana and methamphetamines), but not all drugs and range in size from modest to substantial differences. These results do not replace the need for local monitoring as there can always be specific geographic locales with high prevalence rates, however, they may be helpful at both the clinic and regional level in providing data to inform and understand the impact of policies and laws as policies continue to evolve. Understanding the magnitude and differences in drug use patterns in the current era will enable more targeted interventions that are specific to PLWH.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1.

Clinical and demographic characteristics by recreational drug and alcohol use among 7686 people living with HIV in clinical care at 7 CNICS sites across the U.S. in 2017-2019

	Everyone		No current recreational drug use		Recreational drug use		P value	No at-risk alcohol use		At-risk alcohol use		P value
	N=7686		N=4891		N=2795			N=6448		N=1238		
	N 100%		N 64%		N 36%			N 84%		N 16%		
Sex												
Male	6179	80%	3747	77%	2432	87%		5170	80%	1009	82%	
Female	1507	20%	1144	23%	363	13%	<0.001	1278	20%	229	19%	0.3
Age (years)												
<30	558	7%	236	5%	322	12%		416	6%	142	11%	
30-39	1399	18%	764	16%	635	23%		1098	17%	301	24%	
40-49	1702	22%	1090	22%	612	22%		1424	22%	278	22%	
≥50	4027	52%	2801	57%	1226	44%	<0.001	3510	54%	517	42%	<0.001
Race/ethnicity												
White	3051	40%	1786	37%	1265	45%		2559	40%	492	40%	
Black	3221	42%	2160	44%	1061	38%		2765	43%	456	37%	
Hispanic	970	13%	666	14%	304	11%		760	12%	210	17%	
Other	444	6%	279	6%	165	6%	<0.001	364	6%	80	6%	<0.001
HIV acquisition risk factor												
MSM	4464	58%	2661	54%	1803	65%		3706	57%	758	61%	
IDU *	903	12%	515	11%	388	14%		790	12%	113	9%	
Heterosexual	2005	26%	1503	31%	502	18%		1686	26%	319	26%	
Other	314	4%	212	4%	102	4%	<0.001	266	4%	48	4%	0.01
CD4+ cell count (nadir) ** cells/mm^3												
≤350	5125	68%	3370	70%	1755	64%		4372	69%	753	62%	
351-500	1197	16%	715	15%	482	18%		981	15%	216	18%	
≥500	1252	17%	751	16%	501	18%	<0.001	1010	16%	242	20%	<0.001
CD4+ cell count (current) cells/mm^3												
≤350	1249	16%	791	16%	458	17%		1079	17%	170	14%	

	Everyone		No current recreational drug use		Recreational drug use		P value	No at-risk alcohol use		At-risk alcohol use		P value
	N=7686		N=4891		N=2795			N=6448		N=1238		
	N 100%		N 64%		N 36%			N 84%		N 16%		
351-500	1246	16%	795	16%	451	16%		1038	16%	208	17%	
≥500	5079	67%	3250	67%	1829	67%	0.9	4246	67%	833	69%	0.04
Currently receiving ART												
No	509	7%	303	6%	206	7%		419	7%	90	7%	
Yes	7177	93%	4588	94%	2589	93%	0.046	6029	94%	1148	93%	0.3
Current viral load **												
Detectable	616	8%	321	7%	295	11%		519	8%	97	8%	
Undetectable	6921	92%	4490	93%	2431	89%	<0.001	5816	92%	1105	92%	0.9
Hepatitis C virus												
No	6482	84%	4177	85%	2305	82%		5383	83%	1099	89%	
Yes	1204	16%	714	15%	490	18%	0.001	1065	17%	139	11%	<0.001
Region												
Northeast	746	10%	377	8%	369	13%		586	9%	160	13%	
Midwest	560	7%	351	7%	209	7%		443	7%	117	9%	
South	3747	49%	2650	54%	1097	39%		3257	51%	490	40%	
West	2633	34%	1513	31%	1120	40%	<0.001	2162	34%	471	38%	<0.001

IDU: injection drug use: MSM: men who have sex with men; ART: antiretroviral therapy

* PLWH who report both MSM and IDU as HIV acquisition risk factors are included with IDU

** 1% of individuals were missing nadir CD4 count values, 2% of individuals were missing current viral load values

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Table 2.

Number, percentage, and standardized percentage of current users by individual substance and by region among people living with HIV in clinical care at CNICS sites in 2017-2019

	Number of individuals by region					
	West N, (%, st%*)	**Northeast N, (%, st%*)**	**Midwest N, (%, st%*)**	**South N, (%, st%*)**	**Everyone N, (%)**	**P value**
	2633	746	560	3747	7686	
Marijuana	912 (34.6, Ref)	304 (40.8, 37.1)	188 (33.6, 30.1)	915 (24.4, 21.4)	2319 (30.2)	<0.001
Methamphetamines/crystal	386 (14.7, Ref)	104 (13.9, 12.1)	9 (1.6, 1.9)	75 (2.0, 3.9)	574 (7.5)	<0.001
Cocaine/crack	164 (6.2, Ref)	63 (8.4, 10.7)	43 (7.7, 7.2)	230 (6.1, 4.0)	500 (6.5)	0.07
Illicit Opioids	83 (3.2, Ref)	13 (1.7, 1.5)	3 (0.5, 1.0)	112 (3.0, 2.7)	211 (2.7)	0.001
IDU	122 (4.6, Ref)	34 (4.6, 4.2)	4 (0.7, 0.7)	49 (1.3, 1.3)	209 (2.7)	<0.001
At-risk alcohol use	471 (17.9, Ref)	160 (21.4, 21.1)	117 (20.9, 24.7)	490 (13.1, 12.4)	1238 (16.1)	<0.001
Binge drinking (any)	929 (35.3, Ref)	298 (39.9, 39.5)	209 (37.3, 43.0)	987 (26.3, 30.8)	2423 (31.5)	<0.001
Binge drinking (frequent)	143 (5.4, Ref)	44 (5.9, 6.7)	28 (5.0, 5.6)	136 (3.6, 3.6)	351 (4.6)	0.002

*standardized percentage to West region based on age, sex, race/ethnicity and MSM.

IDU: injection drug use; MSM: men who have sex with men

Table 3.

Associations between regions and drug and alcohol use in adjusted analyses* among people living with HIV in clinical care at CNICS sites in 2017-2019

	West	Midwest	South	Northeast
		OR, 95% CI, p-value	**OR, 95% CI, p-value**	**OR, 95% CI, p-value**
Marijuana	Ref	0.86 (0.69,1.05), 0.1	0.54 (0.47,0.61), <0.001	1.15 (0.96,1.37), 0.1
Methamphetamines/crystal	Ref	0.13 (0.06,0.25), <0.001	0.16 (0.12,0.21), <0.001	0.85 (0.67,1.09), 0.2
Cocaine/crack	Ref	1.02 (0.71,1.47), 0.9	0.75 (0.60,0.94), 0.01	1.59 (1.16,2.17), 0.004
Illicit opioids	Ref	0.16 (0.05,0.53), 0.003	0.87 (0.63,1.19), 0.4	0.80 (0.43,1.47), 0.5
IDU	Ref	0.18 (0.07,0.52), 0.001	0.32 (0.23,0.47), <0.001	1.07 (0.71,1.60), 0.8
At-risk alcohol	Ref	1.39 (1.09,1.78), 0.008	0.78 (0.67,0.92), 0.003	1.30 (1.05,1.60), 0.01
Binge drinking (any)	Ref	1.33 (1.08,1.64), 0.007	0.77 (0.68,0.88), <0.001	1.20 (1.00,1.43), 0.045
Binge drinking (frequent)	Ref	1.05 (0.67,1.63), 0.8	0.72 (0.55,0.95), 0.02	1.20 (0.83,1.72), 0.3

* Logistic regression models adjusted for age, sex, race, and MSM

CI: confidence interval; IDU: injection drug use; MSM: men who have sex with men; OR: odds ratio