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Contribution of Substance Use Disorders on HIV Treatment Outcomes and Antiretroviral Medication Adherence Among HIV-Infected Persons Entering Jail

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Abstract HIV and substance use are inextricably intertwined. One-sixth of people living with HIV/AIDS (PLWHA) transition through the correctional system annually. There is paucity of evidence on the impact of substance use disorders on HIV treatment engagement among jail detainees. We examined correlates of HIV treatment in the largest sample of PLWHA transitioning through jail in 10 US sites from 2007 to 2011. Cocaine, alcohol, cannabis, and heroin were the most commonly used substances. Drug use severity was negatively and independently correlated with three outcomes just before incarceration: (1) having an HIV care provider (AOR = 0.28; 95 % CI 0.09–0.89); (2) being prescribed antiretroviral therapy (AOR = 0.12; 95 % CI 0.04–0.35) and (3) high levels (>95 %) of antiretroviral medication adherence (AOR = 0.18; 95 % CI 0.05–0.62).

Demographic, medical and psychiatric comorbidity, and social factors also contributed to poor outcomes. Evidence-based drug treatments that include multi-faceted interventions, including medication-assisted therapies, are urgently needed to effectively engage this vulnerable population.

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Introduction

The interface between HIV and substance use is inextricably intertwined and is complicated by interactions with the criminal justice system (CJS) [1, 2]. Approximately one in six of the estimated 1.1 million HIV-infected individuals in the United States passes through the CJS annually. Most pass through jails where there is routine health assessment [3]. As such, jails represent an important opportunity not only to detect and treat HIV infection [4], but also to screen for and treat substance use disorders (SUDs). Evidence-based treatments are now routinely available for the treatment of both conditions [2], yet the availability of treatment for SUDs within criminal justice settings remains limited and the lack of treatment results in significant morbidity and mortality and recidivism to CJS [5–9].

The CJS bears a considerable burden of individuals with SUDs, with up to 65 % of prison inmates meeting DSM-IV criteria for drug or alcohol abuse or dependence [10, 11]. Drug use profiles by people entering prison have not appreciably changed since 1997 [11]. SUDs have a profoundly negative impact on the health of people living with HIV/AIDS (PLWHA) [2]. Not only are drug users less likely to be prescribed antiretroviral therapy (ART), but also, when they

are, they are more likely to do so with advanced HIV infection and achieve less favorable HIV treatment outcomes compared to non-drug users [12, 13].

In community settings, HIV-infected persons who actively use drugs and are not receiving evidence-based drug treatment have poor engagement in HIV care and adherence to ART [14], including released prisoners [7, 15]. Alcohol use disorders similarly are associated with poor HIV treatment outcomes [16] especially for those within the CJS [17]. Provision of evidence-based treatment for SUDs, however, markedly improves HIV treatment outcomes [18–20]. Less than one-fifth of all PLWHA in the US have achieved viral suppression, far lower than the estimated 60 % needed to reduce the ∼56,000 new HIV infections annually—a number that has not changed appreciably in the past 15 years [21]. Understanding the types and severity of SUDs among PLWHA who enter jails provides insight into developing necessary strategies in order to better improve access to HIV care, prescription of ART and improve ART adherence, all of which are prerequisite to achieving viral suppression.

We therefore examined the correlates of three major components of the HIV treatment engagement cascade that are requisite for achieving HIV viral suppression in the largest sample of recruited HIV-infected jail detainees: (1) having a HIV care provider; (2) receiving ART and (3) achieving high levels of ART adherence (≥95 %) among those prescribed it in the 30 days prior to incarceration. Moreover, because SUDs are chronic and relapsing conditions that figure prominently into comorbidity among jail detainees, we sought to describe the types of drugs used and their severity in order to provide insight into post-release interventions necessary for this population.

Methods

Data for this cross-sectional study is from the baseline assessment of the Enhance Link initiative that enrolled HIV-infected adults aged 18 or older from 10 diverse jail settings in the US.

Study Settings

The 10 study sites in 9 states (CT, GA, IL, MA, NY, OH, PA, RI, SC) and entry criteria for each site [22] as well as the post-release substance abuse treatment outcomes [23] have previously been described elsewhere. Subjects were enrolled if they were HIV-infected and provided written consent for study participation. Subjects in New York City (NYC) who received case management for a serious DSM-IV mental disorder were excluded and only women were recruited in Chicago. A total 1,270 baseline assessments resulted in 1,166 (91.8 %) subjects who knew their HIV diagnosis before incarceration and were included in the final analysis; 80 of the 1,270 total subjects who reported to be diagnosed with HIV during their index incarceration as well as 24 individuals with incomplete baseline data were excluded.

Dependent Variables

To assess the extent to which detainees were engaged in HIV care and treatment, we defined three dependent variables as the primary outcomes of interest: (1) Having an HIV care provider in the 30 days prior to incarceration; (2) Being prescribed ART in the 7 days prior to the index incarceration and (3) Being highly adherent (defined by self-report of having taken ≥95 % of prescribed ART) for the subset who received ART in the 7 days prior to incarceration.

Independent Variables and Behavioral Model for Vulnerable Populations

Independent variables were selected in accordance with the Behavioral Model for Vulnerable Populations. This model of health care utilization includes predisposing factors, enabling resources, and need factors as critical elements that influence health care utilization. In Fig. 1, we adapt this model for this population as has been previously described for vulnerable populations [24] and HIV-infected jail detainees [25].

According to the model, predisposing factors are the individuals' intrinsic characteristics that impact health care utilization. Represented in our study, they include age, gender, race, education, relationship status, sexual orientation, perception of health status, and the presence of a number of psychiatric and substance use disorders. Individuals' perception of their health status was dichotomized (good, very good, or excellent versus fair or poor). Enabling resources are those factors available to the individual by their community to facilitate access and health care utilization. These include having self-reported health insurance; food insecurity, defined as not having anything to eat for 2 days or more in the past 30 days and housing status with homelessness defined as self-identifying as homeless or having spent at least one night in public venues over the past month. Need factors assess the extent to which a person may need care and is often determined by the severity of the diseases, the individual's perception of their health and their priorities and needs for receiving care. These often include extent to which a person has multiple medical comorbidities, severity of drug or alcohol use, and severity of their psychiatric illnesses.

Types of drug use in the 30 days pre-incarceration was ascertained using the Addiction Severity Index (ASI) [26]

Fig. 1 Conceptual model of health behaviors among the HIV-infected persons during the pre-incarceration period—adapted from Chen et al. [25] with permission
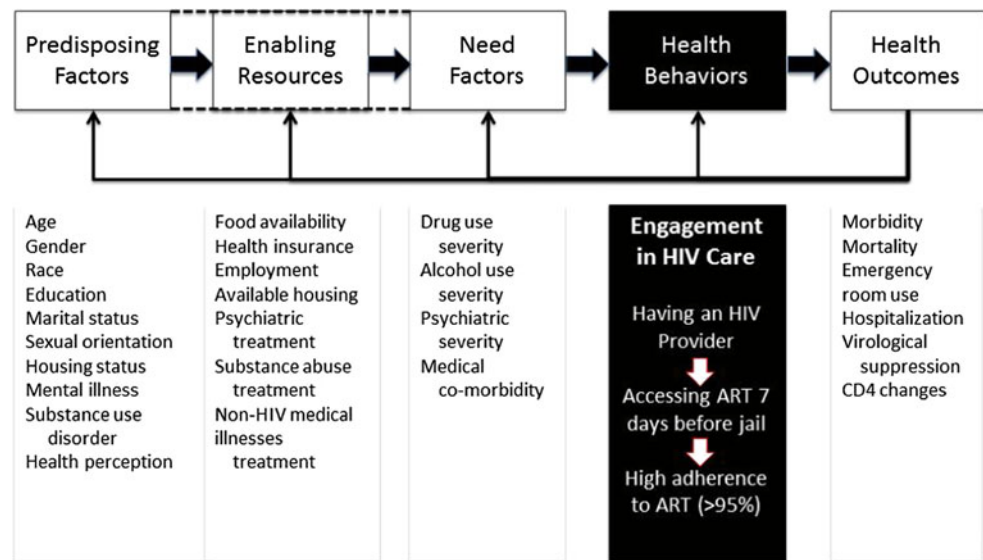
that includes opioids (heroin, other opioids/analgesics/painkillers), cocaine, cannabis, and amphetamines. Poly-substance use was defined as subjects using two or more substances per day (including alcohol). Pre-incarceration drug treatment was also reported from the ASI. Severity of substance use was determined by ASI Composite Scores [26]. The ASI composite scores were reported two ways: (1) continuous variables, ranging from 0 to 1 and (2) dichotomized composite scores using pre-specified cut-offs. Cut offs of 0.12, 0.15, and 0.22 for drug, alcohol, and psychiatric composite scores have been shown to confer high levels of sensitivity and specificity at (85 %, 86 %), (86 %, 80 %), and (90 %, 71 %), respectively, for DSM-IV diagnoses [25, 27].

Statistical Analysis

All independent variables that assessed predisposing factors, enabling resources, and need factors as described by the Behavioral Model for Vulnerable Populations were assessed and the association between recent drug use and the aforementioned variables were studied. For continuous variables, the difference between the means was tested using independent-sample t test. For the categorical variables, the Pearson's Chi square test was used. Significance level was defined at 0.05.

Also, we used regression models to examine the correlations between the three major outcomes and drug use. We fitted univariate and multivariate regression models with unadjusted and adjusted odds ratio as the measures of strength. Age, gender, race, and ASI composite scores for drug, alcohol, and psychiatric illnesses plus any variable significant at the $p \leq 0.10$ in the univariate assessment were then entered into the multivariate logistic regression

models to study their association with the three dependent outcomes while controlling for potential confounders. The significance of the overall model was evaluated using the log likelihood ratio test as well as Hosmer and Lemeshow goodness-of-fit test. Individual coefficients in the model were tested using Wald statistic for statistical significance. Multi-collinearity was evaluated between the covariates in the model using tolerance and Variance Inflation Factor (VIF). None of the covariates showed significant multi-collinearity. All the analyses were performed with SPSS statistical software V.16 (SPSS Inc., Chicago IL).

Results

Demographic and drug use characteristics of the sample are presented in Table 1. The mean age of the subjects was 42.8 years, mostly male (72.3 %), people of color (80.4 %) and heterosexual (78.0 %). Recent drug use over the 30-day pre-incarceration period was reported for cocaine (53 %), alcohol (51 %), cannabis (31.4 %), and heroin (26.8 %). Lifetime use of drug treatment was high with 70.6 % of all the detainees reported having received any treatment, while 55.7 % were treated by drug detoxification only. Of note, 19.6 % who received drug or alcohol treatment in the past 30 days reported concomitant recent substance use.

Using documented ASI composite score cutoffs for high levels of severity, 64.9, 36.9, and 52.3 % of subjects had ASI composite scores higher than the selected cut-offs for drug, alcohol, and psychiatric comorbidity respectively, indicating the group had the highest severity with underlying substance use and psychiatric illnesses.

The correlation between alcohol and drug use was examined using the corresponding ASI composite scores.

Table 1 Demographic characteristics, substance use pattern, substance use treatment history, and their associations with recent drug use—stratified based on any drug use in the 30 days pre-incarceration

	Total	Any drug use—30 days pre-incarceration[b]		p value
		User N = 841	Non-user N = 322	
Mean age, years (SD)	42.8 (8.8)	42.4 (8.8)	44.1 (8.7)	**0.004**
Gender				
Male	842 (72.3 %)	585 (69.6 %)	256 (30.4 %)	**0.008**
Female	322 (27.7 %)	249 (77.3 %)	73 (22.7 %)	
Race/ethnicity				
White	159 (13.9 %)	118 (74.2 %)	41 (25.8 %)	0.779
Hispanic	292 (25.5 %)	213 (72.9 %)	79 (27.1 %)	
Black	628 (54.9 %)	449 (71.6 %)	178 (28.4 %)	
Other	65 (5.7 %)	43 (66.2 %)	22 (33.8 %)	
Education				
<High school	586 (50.6 %)	433 (74.0 %)	152 (26.0 %)	0.107
≥High school diploma	572 (49.4 %)	399 (69.8 %)	173 (30.2 %)	
Relationship status				
Married or in a relationship	358 (30.7 %)	251 (70.3 %)	106 (29.7 %)	0.507
Not in relationship	807 (69.3 %)	582 (72.2 %)	224 (27.8 %)	
Sexual orientation				
Homo/bisexual	255 (22.0 %)	183 (71.3 %)	72 (28.2 %)	0.944
Heterosexual	904 (78.0 %)	646 (71.5 %)	257 (28.5 %)	
Patient's self-perception of his/her health status				
Good	634 (54.6 %)	439 (69.4 %)	194 (30.6 %)	0.056
Poor	528 (45.4 %)	393 (74.4 %)	135 (25.6 %)	
Health insurance				
Yes	911 (78.7 %)	649 (71.3 %)	261 (28.7 %)	0.630
No	247 (21.3 %)	180 (72.9 %)	67 (27.1 %)	
Food insecurity				
Yes	431 (37.2 %)	353 (81.9 %)	78 (18.1 %)	**<0.001**
No	727 (62.8 %)	473 (65.2 %)	252 (34.8 %)	
Homelessness				
Yes	454 (39.2 %)	361 (79.5 %)	93 (20.5 %)	**<0.001**
No	705 (60.8 %)	470 (66.9 %)	233 (33.1 %)	
Employment—past 3 years				
Employed	246 (21.3 %)	165 (67.1 %)	81 (32.9 %)	0.058
Unemployed	911 (78.7 %)	666 (79.6 %)	244 (26.8 %)	
Paid work—30 days pre-incarceration				
Yes	223 (19.6 %)	166 (74.4 %)	57 (25.6 %)	0.372
No	914 (80.4 %)	653 (71.4 %)	261 (28.6 %)	
Age at first arrest				
≤13 years	130 (11.6 %)	100 (76.9 %)	30 (23.1 %)	0.192
>13 years	988 (88.4 %)	706 (71.5 %)	282 (28.5 %)	
Mean age at first arrest, years (SD)	19.8 (7.1)	19.5 (6.8)	20.6 (7.7)	**0.035**
Medical illnesses & comorbidities				
Medical comorbidities				
Yes	875 (75.6 %)	632 (72.2 %)	243 (27.8 %)	0.303
No	282 (24.4 %)	194 (69.0 %)	87 (31.0 %)	

	Total	Any drug use—30 days pre-incarceration[b]		p value
		User N = 841	Non-user N = 322	
Receiving treatment for a medical illness other than HIV				
Yes	834 (72.5 %)	593 (71.1 %)	241 (28.9 %)	0.321
No	317 (27.5 %)	243 (74.1 %)	82 (25.9 %)	
Mean number of times treated for psychiatric illness (inpatient)	1.2	1.2	1.2	0.827
Mean number of times treated for psychiatric illness (outpatient)	1.3	1.5	1.2	0.186
Substance use disorders—last 30 days				
Alcohol				
Any use	51.0 %	59.5 %	29.0 %	**<0.001**
To intoxication	27.8 %	33.7 %	12.7 %	**<0.001**
Opioids				
Any opioid	31.8 %	44.1 %	–	–
Heroin	26.8 %	37.1 %	–	–
Other	9.2 %	12.7 %	–	–
Cocaine	53.0 %	73.5 %	–	–
Cannabis	31.4 %	43.7 %	–	–
Amphetamine	1.7 %	2.4 %	–	–
Polysubstance use[a]	56.4 %	73.9 %	–	–
Drug treatment				
Treated for "alcohol" or "drug" use –30 days pre-incarceration	19.9 %	19.6 %	20.7 %	0.691
Treated for alcohol use—lifetime	27.8 %	28.4 %	26.5 %	0.505
Treated for drug use—lifetime	70.6 %	76.4	55.4 %	**<0.001**
"Detox" only for alcohol—lifetime	22.1 %	23.6 %	18.0 %	0.052
"Detox" only for drug—lifetime	55.7 %	60 %	43.8 %	**<0.001**
Addiction severity index (ASI)—composite scores—continuous (mean + SD)				
Drugs	0.20 + 0.16	0.26 + 0.14	0.05 + 0.07	**<0.001**
Alcohol	0.18 + 0.25	0.22 + 0.27	0.10 + 0.19	**<0.001**
Psychiatric	0.28 + 0.26	0.29 + 0.26	0.25 + 0.25	**0.021**
Addiction severity index—composite scores—dichotomous (using standard cut offs)				
Drugs (score ≥ 0.12)	64.9 %	81.6 %	20.5 %	**<0.001**
Alcohol (score ≥ 0.15)	36.9 %	43.5 %	20.0 %	**<0.001**
Psychiatric (score ≥ 0.22)	52.3 %	54.2 %	47.5 %	**0.042**

Table 1 continued

ART antiretroviral therapy, *SD* standard deviation

Bold values denote $p < 0.05$ in the final model

[a] Defined as using more than one type of drug in the same day during the 30-day period prior to index incarceration

[b] Numbers may not add up exactly to 100 % due to missing data

ASI drug and ASI alcohol composite scores were significantly correlated ($p < 0.001$); however, the correlation was not strong (Pearson's correlation coefficient $r = 0.22$, and Spearman's correlation coefficient $r = 0.17$). Recent drug use was correlated with a number of demographic, social, and clinical factors. Independent correlates of recent drug use included being female ($p = 0.008$), experiencing recent food insecurity ($p < 0.001$), homelessness ($p < 0.001$) and lower mean age at the time of first arrest compared to non-users ($p = 0.004$).

Figure 2 examines the recent engagement in HIV care among pre-incarceration drug users and non-users. Though over 80 % of the sample had ever received ART, there was no significant difference between the two groups for this outcome. For the three primary outcomes of interest, pre-incarceration drug users were significantly less likely than non-users to have had a HIV doctor (74.0 vs. 81.0 %; $p = 0.011$), received ART (55.4 vs. 76.3 %; $p < 0.001$; N = 950) or been adherent to it (48.4 vs. 68.0 %; $p < 0.001$; N = 581) in the time immediately preceding incarceration.

After controlling for potential covariates, lower drug use severity remained significant for all three primary outcomes. Table 2 presents the univariate and multivariate regression for correlates of having an HIV care provider in
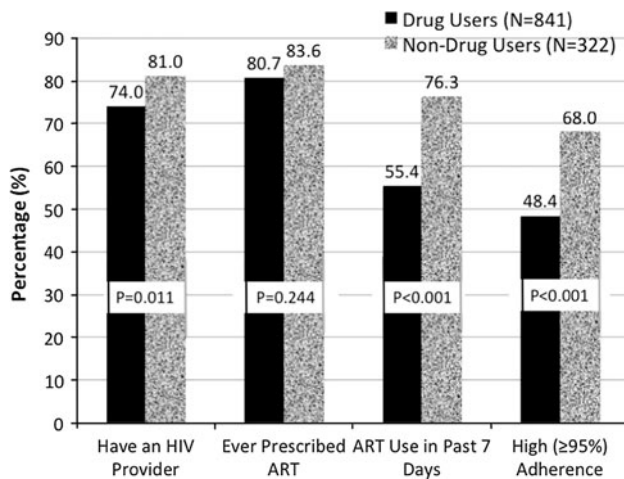
Fig. 2 Comparison of HIV treatment outcomes among HIV-infected drug users entering jail (N = 1,166)

the last 30 days. Having health insurance, increased psychiatric severity and being seen by a physician for a non-HIV related condition were independently correlated with having a HIV provider, while increasing drug addiction severity, being female, black, homeless and having a self-perception of poor overall health status were associated with not having a HIV physician.

With regard to the second outcome, receipt of ART just before incarceration (Table 3), having health insurance, receiving treatment for a condition not related to HIV, and increasing psychiatric severity portended a 3.67-, 2.98- and 2.65-fold increased likelihood of receiving ART, respectively, while being Black, female, being younger, experiencing food insecurity, having self-perception of poor health status and having increasing levels of drug addiction severity was negatively associated with this outcome.

Independent correlates for achieving optimal levels of ART adherence, however, yielded different results aside from increasing drug addiction severity being associated with an 82 % reduced likelihood of achieving optimal adherence. For this outcome, none of the demographic, social or health utilization factors for other conditions were significant. Being employed and paid for work was associated with a two-fold increased likelihood of optimal adherence (Table 4).

Discussion

Our findings illustrate that the prevalence of SUDs in the population of HIV-infected jail detainees is extremely high. Among all subjects, 72 % had used drugs in the 30 days before incarceration and is similar to findings from Arrestee Drug Abuse Monitoring (ADAM II) project, where 66 % reported any recent drug use, with the most commonly used substances being marijuana (35–58 %), cocaine (12–33 %), and heroin (3–22 %) [28, 29]. While most national surveys only measure recent use, our study extends this approach by also measuring addiction severity, which was particularly high within our sample with nearly two-thirds of subjects having scores exceeding the threshold for having DSM-IV criteria for SUDs. Moreover, 37 % and 52 % of inmates had composite scores above the cut-offs for alcohol dependence, and psychiatric illnesses, respectively. These figures document the syndemic nature of HIV, substance abuse, mental illness and its intersection with the criminal justice system.

Unlike the findings among arrestees from ADAM-II, HIV-infected jail detainees were more likely to use cocaine, heroin and alcohol, rather than marijuana. At least for those with opioid dependence and alcohol use disorders, there are a number of evidence-based treatments, primarily pharmacologically prescribed medication-assisted therapies, that would greatly benefit these individuals [2]. Specifically for opioid dependence, evidence-based treatments include methadone, buprenorphine and extended-release naltrexone (XR-NTX). In the case of alcohol dependence, naltrexone in either is oral or XR-NTX formulation is the preferred medication-assisted therapy, but acamprosate and disulfiram are also approved treatments [2]. In the case of cocaine abuse, some behavioral interventions, specifically cognitive behavioral therapy, have been shown to be effective, but there is no FDA-approved effective pharmacological therapy for cocaine use disorders [2, 17, 30].

Central to this study is the negative contribution of active drug use and the level of severity on each of the three designated HIV treatment outcomes. To our knowledge, this is the first time that drug use severity has been associated with all three negative health consequences along the HIV continuum of care cascade. It would be reasonable to extrapolate that the significantly lower rates of treatment engagement, and specifically suboptimal adherence, would result in lower levels of viral suppression as well. In the US, as few as 19 % of all PLWHA are currently virally suppressed [21]. With one-sixth of all PLWHA transitioning through the CJS annually, it stands to reason that this population needs significantly better interventions to keep them fully engaged in care. Moreover, PLWHA who transition through the CJS have been documented to have high rates of HIV risk behaviors upon release [31] and in the absence of effective HIV risk reduction strategies such as consistent evidence-based drug treatment, condom use or syringe exchange programs, interventions that target viral suppression would greatly contribute to reducing HIV transmission and ultimately lower the ~56,000 new infections that have remained unchanged for the past decade.

Our findings show that every 0.1 incremental increase in level of addiction severity translates into a 12 % reduction

Table 2 Significant correlates of having a HIV care provider within the 30-day period prior to incarceration

Variable	Unadjusted OR [95 % CI]	p value	Adjusted OR [95 % CI]	p value
Gender				
Male	Referent			
Female	0.61 [0.46–0.81]	**0.001**	0.54 [0.38–0.78]	**0.001**
Age, years—continuous	1.04 [1.03–1.06]	**<0.001**	1.02 [1.00–1.04]	0.091
Race/ethnicity				
White	Referent			
Black	0.58 [0.37–0.90]	**0.014**	0.48 [0.27–0.86]	**0.013**
Hispanic	1.03 [0.63–1.71]	0.898	0.65 [0.34–1.24]	0.190
Other	0.58 [0.29–1.31]	0.109	0.40 [0.17–0.94]	**0.035**
Food insecurity				
No	Referent			
Yes	0.60 [0.46–0.79]	**<0.001**	0.80 [0.53–1.21]	0.289
Homelessness				
No	Referent			
Yes	0.35 [0.27–0.46]	**<0.001**	0.61 [0.41–0.92]	**0.017**
Paid work in 30 days pre-incarceration				
No	Referent			
Yes	0.71 [0.51–0.99]	**0.043**	0.92 [0.60–1.40]	0.688
Health insurance				
No	Referent			
Yes	7.49 [5.48–10.23]	**<0.001**	5.26 [3.58–7.71]	**<0.001**
Medical comorbidities				
No	Referent			
Yes	1.96 [1.45–2.63]	**<0.001**	1.02 [0.66–1.52]	0.955
Receiving treatment for medical illnesses other than HIV				
No	Referent			
Yes	2.59 [1.94–3.45]	**<0.001**	2.28 [1.57–3.32]	**<0.001**
Patient's self-perception of his/her health				
Good	Referent			
Poor	0.73 [0.56–0.96]	**0.022**	0.67 [0.47–0.95]	**0.024**
Addiction severity—drug composite score (continuous)	0.34 [0.14–0.82]	**0.017**	0.28 [0.09–0.89]	**0.031**
Addiction severity—alcohol composite score (continuous)	0.51 [0.31–0.86]	**0.011**	0.67 [0.34–1.31]	0.238
Addiction severity—psychiatric composite score (continuous)	1.27 [0.75–2.15]	0.381	2.89 [1.36–6.13]	**0.006**

OR odds ratio, CI confidence interval

Bold values denote $p < 0.05$ in the final model

The following were not found to be significant correlates at $p < 0.10$ on bivariate analysis and not included in the final model: education, relationship status, sexual orientation, employment (last 3 years), age at first arrest

in likelihood of having a HIV provider, a 19 % reduction in likelihood of receiving ART, and a 16 % reduction in achieving optimal ART adherence. Alcohol use severity, on the other hand, did not correlate with these outcomes aside from trending towards significance for ART adherence, but alcohol use disorders (AUD), per se, have been associated with a number of poor HIV treatment outcomes [16], especially with CJS populations [17]. Unfortunately, only alcohol use severity and not the presence of an AUD

was assessed in this study, but future jail-release programs should systematically assess them among PLWHA and link them with evidence-based alcohol relapse prevention treatments in order to improve retention in care and adherence with ART [32].

Having health insurance was the strongest factor correlated with being engaged in HIV care and being prescribed ART. Similar findings have been found among the homeless [25]. Similarly, being female and black were

Table 3 Significant correlates of receiving antiretroviral therapy (ART) in 7 days prior to incarceration

Variable	Unadjusted OR [95 % CI]	p value	Adjusted OR [95 % CI]	p value
Gender				
Male	Referent			
Female	0.44 [0.33–0.59]	**<0.001**	0.46 [0.32–0.67]	**<0.001**
Age—continuous	1.04 [1.02–1.06]	**<0.001**	1.03 [1.01–1.05]	**0.003**
Education				
Less than High School Diploma	Referent			
High School diploma or higher	1.32 [1.02–1.72]	**0.038**	1.19 [0.86–1.65]	0.304
Race/ethnicity				
White	Referent			
Black	0.74 [0.50–1.11]	0.148	0.54 [0.32–0.91]	**0.021**
Hispanic	1.15 [0.74–1.80]	0.541	0.82 [0.46–1.46]	0.494
Other	0.78 [0.40–1.52]	0.468	0.49 [0.21–1.14]	0.097
Food insecurity				
No	Referent			
Yes	0.44 [0.34–0.58]	**<0.001**	0.58 [0.40–0.84]	**0.004**
Homelessness				
No	Referent			
Yes	0.43 [0.33–0.57]	**<0.001**	0.79 [0.55–1.13]	0.187
Health insurance				
No	Referent			
Yes	3.66 [2.57–5.19]	**<0.001**	2.58 [1.68–3.94]	**<0.001**
Medical comorbidities				
No	Referent			
Yes	1.40 [1.03–1.91]	**0.033**	1.03 [0.68–1.56]	0.902
Receiving treatment for medical illnesses other than HIV				
No	Referent			
Yes	2.69 [1.94–3.73]	**<0.001**	2.98 [2.00–4.44]	**<0.001**
Patient's self-perception of his/her health				
Good	Referent			
Poor	0.59 [0.45–0.77]	**<0.001**	0.55 [0.40–0.76]	**<0.001**
Addiction severity—drug composite score (continuous)	0.13 [0.05–0.31]	**<0.001**	0.12 [0.04–0.35]	**<0.001**
Addiction severity—alcohol composite score (continuous)	0.44 [0.26–0.75]	**0.003**	0.63 [0.33–1.22]	0.170
Psychiatric composite score (continuous)	0.73 [0.43–1.21]	0.218	2.65 [1.33–5.28]	**0.006**

OR odds ratio, *CI* confidence intervals

Bold values denote p < 0.05 in the final model

The following were not found to be significant correlates at p < 0.10 on bivariate analysis and not included in the final model: relationship status, sexual orientation, employment (last 3 years), paid work (30 days pre-incarceration), age at first arrest

independently and negatively associated with these two outcomes. Therefore interventions that focus on PLWHA transitioning from jail should be culturally and gender appropriate in order to reap the greatest benefits. Two comorbidities, individuals with high psychiatric severity and having been seen for a condition unrelated to HIV, were independently associated with having a HIV care provider and receiving ART. According to the Behavioral Model, these two factors would be consistent with need factors—having other conditions that require them to be engaged in care. Moreover, those with the highest

psychiatric severity would also gain access to health insurance due to it being a disability and perhaps serve as a conduit to simultaneous HIV treatment.

Although this is the largest study of its size, a few limitations exist. First, the study is cross-sectional and only associations rather than causality can be inferred. Second, most data are self-reported and may introduce information biases, including reporting and recall bias. Third, using the 30-day pre-incarceration period may introduce bias in two directions. Those whose lives have become more chaotic and result in incarceration may over-represent the drug use

Table 4 Significant correlates of high levels of adherence to antiretroviral therapy (≥95 %) among subjects who received antiretroviral therapy in the 7 days prior to incarceration

Variable	Unadjusted OR [95 % CI]	p value	Adjusted OR [95 % CI]	p value
Gender				
Male	Referent			
Female	1.04 [0.69–1.58]	0.847	0.96 [0.60–1.54]	0.861
Age—continuous	1.00 [0.98–1.02]	0.814	1.00 [0.98–1.02]	0.969
Race/ethnicity				
White	Referent			
Black	1.08 [0.66–1.76]	0.771	1.02 [0.59–1.76]	0.955
Hispanic	1.06 [0.62–1.80]	0.831	1.24 [0.68–2.26]	0.485
Other	0.86 [0.37–1.99]	0.731	0.83 [0.34–2.05]	0.686
Food insecurity				
No	Referent			
Yes	0.68 [0.47–0.98]	**0.039**	0.97 [0.62–1.54]	0.908
Homelessness				
No	Referent			
Yes	0.61 [0.42–0.87]	**0.007**	0.72 [0.47–1.10]	0.129
Paid work—30 days pre-incarceration				
No	Referent			
Yes	2.03 [1.27–3.24]	**0.003**	2.02 [1.21–3.36]	**0.007**
Patient's self-perception of his/her health				
Good	Referent			
Poor	0.68 [0.49–0.96]	**0.026**	0.70 [0.48–1.02]	0.062
Addiction severity—drug composite score (continuous)	0.14 [0.05–0.45]	**0.001**	0.18 [0.05–0.62]	**0.007**
Addiction severity—alcohol composite score (continuous)	0.41 [0.20–0.85]	**0.017**	0.49 [0.22–1.13]	0.094
Psychiatric composite score (continuous)	0.91 [0.47–1.76]	0.784	1.45 [0.64–3.29]	0.371

OR odds ratio, *CI* confidence interval

Bold values denote *p* < 0.05 in the final model

The following were not found to be significant correlates at *p* < 0.10 on bivariate analysis and not included in the final model: education, relationship status, sexual orientation, health insurance, age at first arrest, medical comorbidities, receiving treatment for medical illnesses other than HIV

information, while those who are on remand while on probation or awaiting trial may reduce their drug use behaviors while trying to avoid returning to jail. Moreover, though we used a number of psychometrically validated measures to assess the likelihood of being dependent on drugs or alcohol, we did not use standardized clinical screening measurements that would provide increased accuracy. Instead, we relied on measures of drug and alcohol use severity that have been strongly correlated with clinical diagnosis. Notwithstanding these limitations, this is the largest sample of PLWHA who interface with jails, and the findings provide valuable insight into the healthcare disparities facing this vulnerable population during the period just prior to incarceration and give some insight into post-release needs.

Conclusions

Recent active drug use and addiction severity is extremely high among PLWHA as they enter jail, and is associated with a number of demographic and social instability characteristics, suggesting the need for multidisciplinary and gender-specific interventions for PLWHA. Although HIV-infected jail detainees had a number of community-based interactions with drug treatment services, most of them had been "detox" and may not have included many evidence-based treatments. The findings of increased drug use severity markedly reducing the engagement of PLWHA in the HIV treatment continuum of care suggests that evidence-based drug treatment interventions are urgently needed for this vulnerable and "challenging" population.

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