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Drug Use Among Adolescents and Young Adults with Unsuppressed HIV Who Use Alcohol: Identifying Patterns of Comorbid Drug Use and Associations with Mental Health

Tyrel J. Starks[1,2], **Karen Kolmodin MacDonell**[3], **Amy L. Pennar**[4], **Veronica Dinaj-Koci**[3], **Brett M. Millar**[1], **Sylvie Naar**[4]

[1]Department of Psychology, Hunter College of the City University of New York (CUNY), New York, NY, USA

[2]Health Psychology and Clinical Science Doctoral Program, Graduate Center of CUNY, New York, NY, USA

[3]Department of Family Medicine and Public Health Sciences, Wayne State University, Detroit, MI, USA.

[4]Florida State University College of Medicine, Center for Translational Behavioral Research, Tallahassee, FL, USA

Abstract

Youth living with HIV (YLWH; aged 16–24) are at elevated risk of alcohol and drug use. Studies in older populations have identified patterns or profiles of multiple substance use differentially associated with mental health and anti-retroviral therapy (ART) adherence. No studies of YLWH have yet examined such patterns. A sample of 179 YLWH, reporting ART non-adherence and alcohol use, were recruited at five Adolescent Trials Network clinics in urban areas of the US between November 2014 and August 2017. Participants completed the Alcohol Smoking and Substance Involvement Screening Test (ASSIST) to assess substance use involvement scores, and the Brief Symptom Inventory. Latent Profile Analysis identified three substance use patterns: minimal illicit drug use (15.1%), cannabis only (56.4%), and global polysubstance use (28.5%). Global polysubstance users experienced more mental health problems compared to the minimal illicit drug use group. The co-occurrence of drug use with alcohol was common among these YLWH – all of whom reported ART adherence problems – indicating the importance of interventions capable of addressing multiple substance use rather than alcohol alone.

Corresponding Author: Tyrel J. Starks, Associate Professor – Psychology, Hunter College, CUNY, 695 Park Ave., Room 611 Hunter North, New York, NY 10065, tstarks@hunter.cuny.edu, 212-206-7919.

Ethical Approval:
All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent:
Informed consent was obtained from all individual participants included in the study.

Conflict of interest:
The authors declare that they have no conflict of interest.

Keywords

HIV; alcohol use; drug use; medication adherence; youth

INTRODUCTION

HIV is a critical health issue for adolescents and young adults in the U.S. In 2015, youth aged 13-to-24 accounted for 21% of all new HIV infections in the U.S., representing the second highest infection rate of all age groups, behind only the 25-to-34 year old age range [1]. Indeed, more than 60,000 13-to-24 year olds in the U.S. are living with HIV. Further, it is estimated that this age group has the highest percentage of individuals currently unaware of their HIV-positive status [2].

Antiretroviral therapy (ART) is the single most important treatment for people living with HIV, optimizing viral suppression and slowing disease progression [3–6]. However, suboptimal adherence is pronounced among youth living with HIV (YLWH) [7,8]. Alarmingly, many YLWH are not receiving adequate medical care, with only 36% receiving some HIV medical care in 2015, only 27% being retained in ongoing care, and only 25% maintaining a suppressed viral load—which is the lowest rate of viral suppression of all age groups [2]. This is of high concern both for the health of the individual and of their sexual partners given advances such as treatment as prevention and the Undetectable = Untransmittable campaign. Accordingly, identifying and addressing risk factors which compromise adherence to ART among youth is of critical importance to the ongoing health of this population and to efforts to achieve 90% viral suppression as set by the United Nations Programme on HIV/AIDS's 90:90:90 goal [9].

As an additional health challenge for this vulnerable population, multiple studies have documented high rates of substance use among YLWH [10–13]. Among studies of adult-aged samples, substance use, abuse, and dependence have been associated with a number of negative health, social, and psychological consequences for people living with HIV [14]. Alcohol use, in particular, has been found to exacerbate health problems and accelerate HIV disease progression [3,15–18]. Substance use is also a major factor contributing to poor medication adherence, both in adults [3,19] and in YLWH [7].

People may use or abuse multiple substances and there is evidence that polysubstance use is commonplace among adolescents and young adults [20–22]. In a sample of adult men who have sex with men, the combination of polysubstance use and depressive symptoms, but not alcohol use alone, was linked to high-risk sexual behavior [23]. Among adults living with HIV, polysubstance use has been associated with poor coping skills and reduced quality of life [24–25]. Understanding patterns of polysubstance use among YLWH remains imperative for general health and ART adherence.

Several studies have assessed patterns of substance use and links to health outcomes among youth and adult populations living with HIV or at elevated risk for HIV. These studies utilized Latent Class or Latent Profile Analyses (LPA) to identify distinct patterns of substance use and assessed factors related to class identification. Connell et al. (2009)

assessed the association between patterns of substance use and risky sexual behavior in a nationally representative adolescent sample [26]. They identified four profiles of substance use: nonusers (27%), alcohol experimenters (38%), occasional polysubstance users (23%), and frequent polysubstance users (13%) and four profiles of sexual behavior: abstainers (53%), monogamous (15%), low-frequency multipartner (18%), and high-frequency multipartner (14%). Substance use class had a strong association with sexual behavior, particularly for females, such that those with more intense levels of substance use also reported greater sexual risk behavior. Mimiaga et al. (2008) investigated polysubstance use and sexual risk among adult-aged men who have sex with men utilizing mobile public health services (e.g., HIV, STI testing, vaccinations) [27]. In their sample, 11% reported polysubstance use during sex in the previous year, and the link between substance use and condomless anal sex was stronger among the younger men (aged 18–35) compared to those aged 36 or older.

Similarly, Parsons et al. (2014) explored patterns of substance use among older adults (aged 50 or older) living with HIV [28]. Latent Class Analysis identified four distinct patterns of substance use: exclusive alcohol use; alcohol and cannabis; alcohol and cocaine/crack; and multiple-substance use. There were differences across groups for level of reported impairment from substance use, with alcohol and cocaine/crack and multiple-substance use groups reporting the most impairment. Poorer adherence was reported by those using substances other than alcohol alone. Results of these studies suggest that polysubstance use is problematic and complex, and is associated with various negative outcomes; however, it needs to be further explored in YLWH.

Adolescence and emerging adulthood are the developmental periods when risky behaviors such as substance use typically peak [29]. This, alongside various other factors—e.g., not being able to afford health insurance, navigating typical psychosocial challenges central in this developmental period, rapid physical and psychological changes, making transitions in living arrangements, and experiencing social pressure in peer dynamics—draws attention to the importance and complexity of understanding substance use among YLWH. Further, efforts to address and support medication adherence for YLWH require consideration of substance use patterns.

The purpose of the current study was to explore patterns of comorbid substance use in a sample of YLWH who reported recent use of alcohol, utilizing their substance use involvement scores on the Alcohol, Smoking and Substance Involvement Screening Test (ASSIST) measure for each substance. Based on research with older populations [28], we hypothesized that LPA would yield groups characterized by alcohol use only (monosubstance use), comorbid cannabis use only, and polysubstance use. Where distinct patterns were observed, we sought to examine between-profile differences in demographics, mental health, and viral load. We also hypothesized that groups characterized by higher frequency use and/or polysubstance use would report more mental health symptoms and greater viral load compared to lower-frequency or monosubstance users.

METHODS

Participants and Procedures

Data were collected as part of *Healthy Choices* (Adolescent Trials Network study 129), a longitudinal randomized controlled trial of home- versus clinic-based Motivational Interviewing targeted towards alcohol use and viral suppression. Participants were recruited through Adolescent Trails Network sites in five cities: Los Angeles, Philadelphia, Chicago, Memphis, and Detroit. Potential participants were approached and screened for eligibility if interested. Eligibility criteria included: being HIV-positive youth (16–24 years of age), being able to understand and speak English, being currently prescribed ART medications, having an unsuppressed viral load, and self-reporting use of any alcohol in the past 12 weeks.

Data for the current analyses were drawn from the baseline assessment, which included an in-office survey, administered using a combination of a Qualtrics-administered survey assessment and other computer-assisted measures. Medical data such as viral load were collected using medical chart review. All study procedures were approved by the Institutional Review Boards of the relevant institutions.

Measures

Demographics.—Demographic items assessed age, race and ethnicity, gender and sexual identity, education, relationship status, and years of living with HIV.

Alcohol and Drug Use.—Alcohol and drug use were assessed using the ASSIST, a brief screening tool to assess levels of non-medical/non-prescription substance use and related problems [30]. For each substance--alcohol, tobacco, cannabis (marijuana, pot, grass, hash, etc.), cocaine/crack, amphetamines, inhalants, sedatives, hallucinogens, and opioids--the measure included items related to lifetime use, recent use, urges to use, and how often use has led to problems and failing to do what is normally expected. These items were rated on a 5-point Likert scale from “never” to “daily or almost daily.” Two other items, how often loved ones expressed concern and how often failed to control use, used three response scale (“never”, “yes, but not in the past 3 months,” and “Yes, in the past 3 months”). Items were recoded to have comparable scales and then summed.

Analyses utilized ASSIST scores for alcohol, cannabis, cocaine and amphetamines individually. All other drug categories were reported by fewer than 5% of youth. Therefore, scores for those drugs were summed together to create a composite score representing the total use (and associated problems) reported across all these drugs.

Mental Health Functioning.—Mental health functioning was assessed using the Brief Symptoms Inventory (BSI-18) [31]. The BSI-18 rates how much the participant feels distressed by a set of problems during the past seven days on a 5-point Likert scale (“not at all,” “a little bit,” “moderately,” “quite a bit,” and “extremely”). The BSI-18 contains three dimensions, somatization, anxiety, and depression, and these three subscales form the Global Severity Index (GSI). In the current sample, the GSI exhibited strong internal consistency (Cronbach’s $\alpha = .94$).

Viral Load.—Plasma HIV RNA assays were analyzed for viral load. Research assistants extracted viral load results from medical records. Results collected +/− four weeks from each data collection period were used. If a recent viral load result was not available for that period, the research assistant requested the clinic perform a more recent test. Results were recorded as copies per milliliter and here, were log-transformed.

Analytic Plan—We utilized a 3-step approach to LPA consistent with procedures outlined by Kamata et al. [32] LPA was utilized to identify patterns of substance use in the absence of any covariates using Mplus v8.2. All ASSIST variables were modeled as negative binomial distributions with free dispersion parameters to account for their skewed nature and the fact that ASSIST scores can only assume integer values. LPA solutions with one-to-four profiles were tested. Models were evaluated with respect to four criteria. The adjusted Lo-Mendell-Ruben Log-likelihood Ratio Test (LMR–LRT) was used to evaluate whether the addition of a profile significantly improved the fit of a model by comparing a model with k profiles to one with k^{-1} profiles [33]. AIC and sample-size adjusted BIC were examined across models to compare the amount of information lost when imposing the tested model on the data, where smaller AIC and BIC values indicate better fit. Finally, entropy values were used to assess the quality of profile assignment. That is, entropy reflects the ability of the included indictors to clearly delineate profiles, with higher values indicating profile solutions are more distinct from one another. Entropy values range between 0 and 1, with values closer to 1 indicating better discrimination between profiles [34]. After identifying a best-fitting model, we calculated an additional model in which profile membership was predicted by demographic variables of interest, including: age, male gender, and heterosexual orientation to examine the stability of profile assignment when accounting for covariates.

Finally, associations among profiles identified in LPA, mental health, and viral load were examined using linear regression analyses in Mplus. Two regression models were calculated: one predicted mental health (GSI scores) from latent profile membership, and another predicted viral load from mental health and profile membership. Both models adjusted for age, gender, and sexual orientation.

RESULTS

Baseline data was gathered for 183 participants, of whom 179 (97.8%) identified as a racial minority. Analyses excluded participants who identified as White (n = 3) and Asian American (n = 1) as these cell sizes precluded analyses where race/ethnicity could be entered as a covariate. Table 1 contains demographic data for the analytic sample of 179. The average age of participants was 21.38 years (SD = 1.87). The majority of this sample was Black (81.6%), identified as a sexual minority male (71.8%), had completed high school (72.1%), and were non-partnered (89.4%). Table 2 contains ASSIST data for the overall sample. The highest scores were observed for alcohol (M = 11.61, SD = 8.90) and cannabis (M = 13.97, SD = 10.55). The other substances, including cocaine (M = 1.47, SD = 4.37), amphetamine (M =1.36, SD = 4.55), and other drugs (M = 2.52, SD = 8.65), had relatively lower scores.

Latent Profile Analysis of Substance Use Patterns

Table 3 contains model fit statistics for LPA solutions. All fit indicators favored the 2-profile model over the single profile model. While entropy declined with the 3-profile model, all other fit indices improved relative to the 2-profile model. The inclusion of a 4th profile was associated with modest improvements in AIC and BIC, the solution was contra-indicated by the LMR-LRT (which was non-significant) and a further decline in entropy. Therefore, the 3-profile solution was retained in subsequent analyses. Finally, a model was run in which profile membership was predicted by age, male gender, and heterosexual orientation. These covariates exerted no influence on the solution. Profile membership was unchanged by covariate inclusion.

Between-profile differences on substance use frequency variables used in the LPA are provided in Table 2. These were examined to derive profile-labels based upon salient characteristics.

Profile 1 was characterized by the near-exclusive use of alcohol (n = 27, 15.1%). ASSIST scores for cannabis and cocaine were uniformly zero and scores for amphetamines and other drugs were very low (less than one, on average). Given the near total absence of comorbid drug use, the group was labeled *Minimal Illicit Drug Use*.

Profile 2 was characterized by the exclusive use of alcohol and cannabis. While this profile contained the greatest number of participants (n = 101, 56.4%), ASSIST scores for all other drugs were uniformly zero. The frequency of alcohol use did not differ significantly between Profile 1 and Profile 2. Given the uniform nature of their use, this group was labeled *Cannabis Use*.

Profile 3 (n = 51, 28.5%) was distinguished from other profiles by relatively higher ASSIST scores across a wide range of substances. Everyone with ASSIST scores greater than zero for cocaine in the sample was categorized into this group. This group also reported significantly higher ASSIST scores for alcohol, amphetamines, and other drugs compared to other profiles. Notably, the frequency of cannabis use did not differ significantly between Profile 3 and Profile 2. Given the range and frequency of drug use in this group, the pattern was termed *Global Polysubstance Use*.

Latent Profile Demographic Characteristics

Table 1 provides demographic data for each latent profile group. Tests of between-group differences suggested the groups were equivalent with respect to age, race and ethnicity, education, relationship status, and years since diagnosis. Sexual minority males were more likely to be classified into the comorbid Cannabis Use and Global Polysubstance use profiles. In contrast, the Minimal Illicit Drug Use profile contained a higher proportion of females compared to the other two groups.

Latent Profile Membership as a Predictor of Mental Health

Table 4 contains the results of the linear regression model predicting GSI scores. The model was significant (test of model fit for the baseline model $\chi^2(6) = 14.4$, $p = 0.026$) and accounted for 6% of the outcome variance. Examination of regression coefficients revealed

that the Global Polysubstance Use group had significantly higher GSI scores compared to the Minimal Illicit Drug Use group, but not the Cannabis Use group ($B = -4.28$, 95% CI −9.70, 1.15, $\beta = -0.15$, $p = 0.12$).

Latent Profile Membership and Mental Health as Predictors of Viral Load

The specified linear regression model predicting viral load (see Table 5) was not significant (test of model fit for the baseline model $\chi^2(6) = 10.12$; $p = 0.18$). Examination of regression coefficients revealed that only GSI scores had a statistically significant regression co-efficient. A subsequent model that omitted all non-significant covariates was statistically significant (test of model fit for the baseline model $\chi^2(1) = 5.83$; $p = 0.02$). GSI scores alone were positively associated with viral load ($B = 0.02$; 95% CI 0.003, 0.03; $\beta = 0.17$; $p = 0.012$).

DISCUSSION

These findings illustrate the scope of polysubstance use among YLWH who use alcohol. Generally consistent with hypothesized classifications, the three profiles observed were characterized by different patterns of substance use: Minimal Illicit Drug Use (15.1%), comorbid Cannabis Use only (56.4%), and Global Polysubstance Use (28.5%). These patterns mean that comorbid drug use was reported by the majority of the sample. While the combination of alcohol and cannabis was most frequently observed, youth with the Global Polysubstance Use pattern outnumbered those who were identified as using only alcohol primarily.

Moreover, this study is among the first to examine links between comorbid substance use classifications and both HIV-related and mental health outcomes in YLWH. Contrary to our hypotheses, viral load did not differ by profile membership. As expected, profile differences in mental health emerged, with Global Polysubstance Users experiencing more mental health problems. The association between substance use, particularly Global Polysubstance Use, and mental health highlights the need for assessing YLWH's substance use. In addition, it points to the potential utility of developing substance use interventions that are sufficiently flexible to address the comorbid use of drugs and alcohol, rather than narrower single-substance interventions.

In our sample, the majority of YLWH who consumed alcohol engaged in comorbid Cannabis use selectively, and avoided using other substances. These findings are comparable to Kedia et al. (2007) who documented that alcohol and cannabis were among the most commonly combined substances in nearly 70,000 adults admitted to treatment programs [35]. Rates of polysubstance use, defined as the use of three or more substances, were higher in the current study (28.5%) relative to some studies of adults living with HIV (10–11%) [27, 36], and consistent with others (28.2%) [28]. Excluding youth who abstain or do not frequently use alcohol, as occurred in this study, may have inflated the proportion of YLWH who engage in polysubstance use. Additional research is needed to identify patterns of substance use, including non-use, in a more representative sample of YLWH to determine prevalence of substance use classifications.

Youth in our sample generally reported high psychological distress on the GSI (M = 33.62, SD=14.52), being higher than a sample of non-patient youth [37], but consistent with rates of mental health problems documented among adults living with HIV [38–40]. In regression models examining mental health, Global Polysubstance Users reported significantly higher GSI scores relative to the Minimal Illicit Drug Use. This is generally consistent with Fernandez et al.'s (2015) study of more than 1,700 YLWH, in which youth with high-risk substance use had more severe mental health problems compared to youth with no/low-risk substance use [41]. However, the present study provides a more nuanced understanding of the association between substance use and mental health by considering characteristics of substance use rather than a none vs. any, or low vs. high approach. In this regard, our findings indicate substance users heterogeneous, and may benefit from targeted approaches for providing mental health services. YLWH reporting polysubstance use may be a particularly vulnerable sub-group warranting different approaches for treatment and intervention services.

Of concern, sexual minority males were over-represented in both the comorbid Cannabis Use profile and the Global Polysubstance Use profile. Conversely, female youth were significantly less likely to be classified into either of these groups and were instead over-represented in the Minimal Illicit Drug Use profile. These findings highlight the importance of addressing substance use, especially among the sexual minority males in our sample.

These findings also highlight the need to develop interventions to address the use of multiple substances. Interventions tailored to address factors restricted to a single drug category may be useful under some circumstances. For example, morphine replacement therapies have shown efficacy in the treatment of opioid addiction [42]. However, given the prevalence of multiple substance use, providers of substance use intervention services would benefit from some intervention options that are capable of flexibly addressing the use of a diverse range of substances and poly-substance use. Such interventions might focus on general motivational processes applicable across multiple substances [43]. One such example is Motivational Interviewing, which can be used to flexibly engage people in relation to a range of substance use behaviors. Motivational Interviewing has shown efficacy in a range of populations for the treatment of alcohol misuse, tobacco, and illicit drugs such as methamphetamines [44, 45].

Furthermore, efficacy has also been found for approaches that combine Motivational Interviewing and Cognitive Behavioral Therapy (CBT). At present, such interventions have shown efficacy in the treatment of methamphetamine use [46] and alcohol [47]. CBT interventions can readily incorporate emotion regulation skills that generalize across substances of abuse and are potentially efficacious in reducing anxiety and depression [48]. As such, the format has substantial potential to serve as a platform for interventions which address multiple substance use and comorbid mood and anxiety problems.

A number of limitations of the study should be noted. First, our study was part of a larger intervention targeting YLWH with alcohol use. As a result, the current sample did not include youth who abstain from or infrequently use substances. Profiles and associated HIV-related outcomes and mental health concerns may vary in a more representative sample

of YLWH or with larger samples allowing for more variability in co-occurring drug use. Furthermore, youth were recruited from HIV-care clinics and the sample may not include youth who are less engaged in care and/or have more problematic substance use, and did not include youth currently not receiving HIV-related medical care. Second, we relied on a self-report measure of substance use which may introduce social desirability bias in youths' reporting. Third, the current study did not measure concurrent use of multiple substances. Future studies may consider examining differences in profile identification based on both the frequency and quantity of substance use. Fourth, eligibility criteria required that participants be English speaking and all participants were recruited through ATN sites in urban areas. This limits generalizability, as risk factors and/or rates of substance use may differ for other populations of YLWH. Finally, LPA and the names ascribed to profiles are based on identifying common characteristics on a specific dimension and may not fully capture profile differences on other dimensions.

Conclusions

Our findings support three distinct patterns of substance use among YLWH who use alcohol. Youths' substance use and their associated mental health concerns highlight the need for tailoring prevention efforts. A one-size-fits-all approach to mental health and substance use may not be effective in this population, especially given findings from studies in the general population for how motivations for drinking, for example, vary across demographic groupings such as gender [49]. YLWH reporting polysubstance use may benefit from more comprehensive mental health services. Finally, the low rates of viral suppression we observed are a cause for concern. Implementing evidence-based adherence interventions which address substance use and mental health will be integral to achieving medication adherence and improved viral suppression. Future studies should examine typologies of substance use in samples that include youth not reporting the use of alcohol, and should consider long-term physical and mental health trajectories of youth by substance use classification.

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Table 1.

Demographic characteristics

	Substance use profile					
	Total	**Minimal illicit drug use**	**Cannabis use**	**Global polysubstance use**		
	***n* (%)**	***n* (%)**	***n* (%)**	***n* (%)**	**Test statistic**	***p* value**
	179 (100)	27 (15.1)	101 (56.4)	51 (28.5)		
Race						
Black	146 (81.6)	23 (85.2)	83 (82.2)	40 (78.4)	$\chi^2(4) = 2.94$	.57
Latino	21 (11.7)	4 (14.8)	11 (10.9)	6 (11.8)		
Multiracial	12 (6.7)	0 (0.0)	7 (6.9)	5 (9.8)		
Gender and sexual identity					†	
Sexual minority male	127 (71.8)	14 (51.9)[a]	77 (77.0)[b]	36 (72.0)[b]	.042	.04
Heterosexual male	12 (6.7)	2 (7.4)[a]	8 (8.0)[a]	2 (4.0)[a]	.708	.71
Female	25 (14.0)	9 (33.3)[a]	10 (10.0)[b]	6 (12.0)[b]	.013	.01
Transgender	13 (7.3)	2 (7.4)[a]	5 (5.0)[a]	6 (12.0)[a]	.314	.31
Education					$\chi^2(2) = 1.52$	.47
Less than HS degree	50 (27.9)	5 (18.5)	29 (28.7)	16 (31.4)		
Completed HS	129 (72.1)	22 (81.5)	72 (71.3)	35 (68.6)		
Relationship status					$\chi^2(2) = 2.12$	.35
Unpartnered	160 (89.4)	22 (81.5)	92 (91.1)	46 (90.2)		
Partnered	19 (10.6)	5 (18.5)	9 (8.9)	5 (9.8)		
	M (SD)	*M (SD)*	*M (SD)*	*M (SD)*		
Age	21.38 (1.87)	21.89 (1.69)	21.18 (2.00)	21.51 (1.64)	$F(2,176) = 1.73$	.18
Years HIV-positive	3.13 (4.50)	4.44 (4.13)	2.82 (4.69)	3.06 (4.26)	$F(2,176) = 1.40$	.25

HS High School. Subgroups with different superscripts differ at $p < .05$ by least significant difference post hoc.

†Due to a large number of cells with expected values less than zero, no χ^2 test of independence is reported. Fischer exact tests were calculated for each level of the demographic characteristic independently.

Table 2

Average ASSIST scores by latent profile category

		Latent profile membership				
	Total	**Minimal illicit drug use**	**Cannabis use**	**Global polysubstance use**		
n (%)	**179 (100)**	**27 (15.1)**	**101 (56.4)**	**51 (28.5)**	**Test statistic**	***p* value**
	M (SD)	***M (SE)***	***M (SE)***	***M (SE)***		
Alcohol	11.61 (8.90)	8.22 (1.26)[a]	11.20 (0.86)[a]	14.22 (1.51)[b]	$\chi^2(2) = 9.45^{**}$	*.009*
Cannabis	13.97 (10.55)	0.00 (0.00) †	15.35 (0.93)[a]	18.63(1.57)[a]	$\chi^2(1) = 3.24$	*.072*
Cocaine	1.47 (4.37)	0.00 (0.00) †	0.00 (0.00) †	5.16 (1.26)	†	
Amphetamine	1.36 (4.55)	0.11 (0.08)[a]	0.00 (0.00) †	4.73 (1.35)[b]	$\chi^2(1) = 11.63^{***}$	*<.001*
Other drugs	2.52 (8.65)	0.15 (0.10)[a]	0.00 (0.00) †	8.76 (2.68)[b]	$\chi^2(1) = 10.30^{***}$	*<.001*

Where omnibus tests of between group differences were significant, group-by-group comparisons were evaluated using the LSD post hoc test. Groups with different superscripts differ at $p < .05$. Groups which share a common superscript do not.

** $p<.01$,

*** $p<.001$

† Empty cell not included in follow-up chi-square analyses.

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Table 3

Latent class model fit statistics

	AIC	BIC	LMR LRT	*p*	Entropy
1 class	3630.7	3630.9			
2 class	3554.7	3555.0	85.27	<.01	.99
3 class	3511.5	3511.9	68.74	<.01	.84
4 class	3492.0	3492.6	30.31	.35	.81

Note. AIC Aikaike's information criterion, *BIC* Sample size adjusted Bayesian information criterion, *LMR LRT*: adjusted Lo-Mendell-Ruben Log-likelihood Ratio Test

p-value associated with the Lo-Mendel-Ruben Log-likelihood Ratio Test

Table 4

Regression of mental health on substance use profile membership

	GSI Score			
	R^2 = .06			
	B	**95% CI**	***β***	***p***
Intercept	18.01	--	--	
Age	0.51	(−0.59, 1.60)	.07	.39
Gender and sexual orientation (ref. = sexual minority male)				
Heterosexual male	−5.45	(−11.02, 0.13)	−.09	.21
Female	2.32	(−3.63, 8.27)	.06	.48
Transgender	−5.91	(−12.77, 0.95)	−.11	.16
Latent profile (ref. = minimal illicit drug use)				
Cannabis use	4.74	(−0.39, 9.87)	.16	.14
Global polysubstance use	9.02 **	(2.86, 15.71)	.28	.01

Note: GSI Brief Symptom Inventory Global Severity Index

** $p \leq .01$.

Table 5

Mental health and substance use profile as predictors of viral load

	Viral Load (log-transformed)			
	R^2 = .05			
	B	**95% CI**	***β***	***p***
Intercept	3.65	--	--	
Age	−0.01	(−0.11, 0.09)		.78
Gender and sexual orientation (ref. = sexual minority male)				
Heterosexual male	0.33	(−0.27, 0.92)	.07	.28
Female	−0.06	(−0.64, 0.52)	−.02	.85
Transgender	−0.30	(−0.78, 0.18)	−.06	.22
GSI Total Score	0.01*	(0.002, 0.03)	.17	.02
Latent profile (ref. = minimal illicit drug use)				
Cannabis use	−0.25	(−0.74, 0.23)	−.10	.30
Global polysubstance use	0.04	(−0.49, 0.58)	.02	.88

Note. GSI Brief Symptom Inventory Global Severity Index

* $p < .05$.